Computer Oral History Collection, 1969-1973, 1977

Interviewee: Paul Rosenthal
Interviewer: Henry S. Tropp
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TROPP:

[This is] a short bull session with Mr. Paul Rosenthal and it's May the sixteenth 1973 and, why don't we start, Paul, why don't you pull that chair over here so you can relax. Why don't you just start off with your early days and let's talk about people.

ROSENTHAL:

Okay. I got interested, or first heard about, computers in a course on theory of relativity at Temple University. I remember that two engineers, who were taking the course as part of their math requirements, for Master's in physics at Temple, sat behind me and brought in some logic diagrams of computers. And we spent several late afternoons going over them and they tried to explain to everybody as mathematicians, what a computer was. Finally at the time I said, "Hey, is there any jobs there?" They said, "sure, they want a couple of programmers." I said, "what's a programmer?"

TROPP:

[Chuckle].

ROSENTHAL:

They tried very carefully to explain what a programmer was, and finally I said, "well, what does it pay?" At that time it paid $3000 a year to start and at that time the Philadelphia School System was paying $2400 a year.

TROPP:

This is l95l?

ROSENTHAL:

l95l. I was a trained math teacher and I decided, "heck, for $600 a year I'll go into computers." [LAUGH]. So I called up Herb Mitchell, got an appointment to see him after school because I was substitute teaching in the Philadelphia School System and taking my Master's in math at night. I saw Herb at 3:30 p.m. and was interviewed by him

and by Al Toner [?] and Grace Hopper, Hildegard [?] and some of these other people; and by 5:30 p.m. I was hired. That following Monday I started at Eckert-Mauchly Computer Corporation, February l5th, l97l, the same day that Mary Hass [?] started.

TROPP:

'51, you mean.

ROSENTHAL:

'5l, '5l. Mary Haas was one of the original people on the Codasyl Committee. And that's how I got started in computers. Stayed in it, I guess, for the next twenty-three years, or twenty-two years.

TROPP:

Was the SORT program your first attempt to do it? You might tell that story again, you told me at lunch time.

ROSENTHAL:

Okay. The first job I was assigned after I was trained, and the training took about four weeks, and involved a couple of hours for a couple of weeks every day on logic design of computers. Plus programming, plus practice programs, but it was about four weeks. They assigned me SORT routine to do. And they gave me a book about half an inch thick that had been written by a couple of the gals.

TROPP:

This was Betty Holberton?

ROSENTHAL:

Betty Holberton and Hildegarde, and somebody else had worked on it, but I don't remember who it was. It was the gals' job, there were three of them. There was theory in there for doing two-way sorting, three-way sorting and four-way sorting and estimates of the optimum ways of doing it. I looked at it and studied it and started coding it and decided it was all much too complicated. Decided that there was a much simpler programming way to do it that was about ninety-five percent efficient. So I wrote the program, a two-way sort and then a three-way sort and then a four-way sort for ten, twenty and four word items, etcetera. A whole group of programs and got them out and got them running through most of l95l and '52. I was sort of the sorting man until I left for New York in '53, when I turned it over to the sorting specialist and I can't remember his name who became the very famous generator of the polyphase sort.

TROPP:

I don't know the name either.

ROSENTHAL:

I can't remember the name. But the technique I used was not the one in the book, it was much simpler, and no one ever realized it until about twenty years later when I sat in a Chicago meeting of the twenty-fifth anniversary of computers and sat down with, I think, Betty. We were talking about the old days, I mentioned to her the method I used for the sorting. She was horrified. All these years she had thought that her technique for sorting was the method that was implemented back in the original stuff, and actually what I did was, I implemented a combination of two sample techniques that they had put in the introduction as training. Two different trivial methods of doing sorting as sort of an introduction of what sorting was. Those techniques were very simple, very straightforward, and I combined the two of them and just programmed them. I was a beginner, I couldn't do that complicated stuff.

ROSENTHAL & TROPP:

[LAUGHTER].

TROPP:

You told me another marvelous story about UNIVAC that I would like you to put on this tape, and that has to do with that weekend that you worked on the machine. [LAUGHTER].

ROSENTHAL:

Okay. As part of the sort routine, which didn't run, as the computer wasn't capable of doing it, I got involved in the systems test routine for UNIVAC and programmed it and checked it out, and then started working with the engineers. Got involved really in computer check-out as well as in preparation of proposals and sample runs. And I would work, since I was single at the time, and on the clock and interested in lots of money--I had a car I had to pay for--I worked midnight to eight Monday through Friday and all weekend on certain applications projects and that kind of thing. We worked all through l95l in to January '52, and one Friday night we came in to try and run, I think it was the Ford Motor demonstrations, involved sorting some six or seven big tapes. This was about three or four hours worth of sorting, and we had been trying for about three or four months to get this done unsuccessfully.

We came in and the engineers told us "you won't get any work done this weekend, because we have just gone through and taken all the different engineering changes that we have been testing for the last six months and taken what we think were the best ones and put them in through the whole machine, so that the machine now has ten tape units

that are all the same; all four of the adders are all the same for the first time." So we got there, and sure enough it didn't work, but we had a very good technician and I telephoned one of the engineers. We worked all Friday night and into about 8 o'clock Saturday, when all of a sudden the machine started working. It worked perfectly from 8:30 Saturday until 8 o'clock Monday morning. We got all the work done we had to get done, plus a lot of backlog. The engineers came in Monday morning and said, "gee, did it work at all?" We said, "it worked perfectly." We showed them the log and all the production we had got and how beautiful the system was. They looked at it and they broke the machine down and shipped it to Army Map Service.

TROPP:

[LAUGH]. That was the second machine that was shipped there?

ROSENTHAL:

That was the first machine that was shipped. The Serial l was still in the factory

TROPP:

Oh, I see.

ROSENTHAL:

being used by Bureau of Census on the factory site.

TROPP:

Oh, I see, it had not been shipped.

ROSENTHAL:

It had not been shipped. What they were doing is, they were using serial number 2 and serial number 3. Serial 3 had just about come up then as the test set for finding out the problems that were in number l. When they got something proven on 2, they put it in Number l. So actually, Serial 2 was the first machine shipped. I think that was Army Map or Air Controller.

TROPP:

I think Army Map is right.

ROSENTHAL:

I don't remember which was 2 and which was 3. One went into the basement of the Pentagon and the other went into the Army Map Service out here in, I guess west, west of

us.

TROPP:

The other problem that you told me about on UNIVAC was the atomic test problem in terms of the number of hours it took to run one of the parameters and that's worth repeating.

ROSENTHAL:

Well, all the production computing for the two H Bombs that were tested in l953, in the spring, was done on the UNIVAC is either at Army Map at the Air Controller basement or in Philadelphia. A run of parameters took sixty hours. A single set of parameters. We ran dozens and dozens and dozens of these trying to evaluate different approaches and different sizes. The final runs were done based on the actual bombs that were constructed. The two that were going to be shot, and they were run, I think vaguely, in February, if I remember correctly, of l953, if I remember correctly. We actually tore off the sheet that had the yield number that was one half of the actual yield of the H bomb. The one that blew out all the test equipment and rained debris and radioactivity on some of the Japanese fishermen. A very famous case.

TROPP:

This went twice beyond expectation.

ROSENTHAL:

Twice beyond expectation, that's right. We had just left out one specific physical phenomenon, the Taylor instability, which has to do with turbulence.

TROPP:

About which there is still only limited—

ROSENTHAL:

Only limited knowledge, but nobody had really realized that at that temperature and pressure, that metals, you know, had turbulent flow and this increased the pressure and compression in certain areas of the bomb enough to increase the yield tremendously. The theory of turbulence was not done in there, and, therefore, the yield was completely wrong.

TROPP:

In our limited time, I would like to spend it on what we were talking about just a few minutes ago, and that's people. People that you didn't know and that you felt made

significant contributions. The world's greatest programmer…

ROSENTHAL & TROPP:

[LAUGHTER].

ROSENTHAL:

I still feel that the world's greatest programmer is Steve Wright, who I met in '5l, who really is the father of systems programming. He did the loaders and the, I guess, the first exec, and it was under his specific direction that I did the first of the trace routines that was ever done. He, also, set up a lot of the theory on how the systems test routine, which also I guess, would be the first of systems programming, was done. I did the first of the sort routines. He did the first thinking on assemblers and compilers and interested Grace Hopper in staying in Philadelphia and getting into, quote, "Compiler Business," in those days symbolic assemblers, that's about as far as we were really thinking. He now works for ADR, he still does. He has one proviso that he will only do systems analysis and programming. He doesn't want to be a manager, he doesn't want to be a salesman, he doesn't want to make a lot of money in that sense. He just enjoys programming and systems analysis. I still consider him, and people who do know him, consider him the world's best programmer. He can--you can talk to some of the ADR people, but I've heard recent stories of taking projects that were in trouble, that a dozen people had worked on for six months and didn't work and was too slow and ineffective, and sitting down and looking at it and redesigning the programs in a period of ten or fifteen days by himself producing an enormous system that met the productivity and speed and all the other requirements.

TROPP:

That's fantastic.

ROSENTHAL:

Just fantastic, fantastic programmer. One of the few people I have ever met who could keep an entire, like a FORTRAN compiler, of that complexity in his head. The whole thing and just as he worked on pieces, he knew all the intricacies. But he also believed the way I believed that complexity for its own sake is no use. So he didn't do tricks, unless there was an actual objective, an economic objective or a space limitation or something else was involved. He is somebody you should interview.

TROPP:

Who are some of the other people?

ROSENTHAL:

The other, I think, person who is most important that I know of in those early days was

Herb Mitchell, who was the boss of the Software Group, Applications and Systems Software at Eckert-Mauchly. Through '50 and '5l he was Grace Hopper's boss, my boss and everybody else. He eventually moved to the West Coast, but he got the first Ph.D. computer-linked in his matrix analysis work under Aiken at Harvard. He was, I think, a key person in deciding who, who to hire, who to use. He liked interesting people. There is also an interesting story on him. When I interviewed for a job with Herb, he asked me how good a student I was, because if I had a math degree, it was important that you be a good student and intelligent. And, of course, frankly, I was a fairly lousy student, because I was an athlete, I earned my living through swimming. Loved to run around with women, liked to go out drinking with my friends, none of whom were going to college, were businessmen and had the money and all that kind of thing. So I got reasonable grades, but not according to Herb. So I said, "well, I went through college on a scholarship," and he said, "ah, well that's good enough."

ROSENTHAL & TROPP:

[LAUGHTER].

ROSENTHAL:

I neglected to tell him for fifteen years that it was an athletic scholarship.

ROSENTHAL & TROPP:

[LAUGHTER].

ROSENTHAL:

That's how I was hired.

TROPP:

How did he react when you told him fifteen years later?

ROSENTHAL:

He says, well, he still made a good choice. ? You proved yourself.

ROSENTHAL:

I proved myself. He liked me. A human being, I guess.

TROPP:

You moved out to the West Coast in '55?

ROSENTHAL:

In '55, in May of '55. The primary reason I moved out was because I got into a violent argument with Grace Hopper over the A2 compiler. I was the technical head of the New York Service Bureau of UNIVAC, and she finished the A2 compiler, which was an interpretive three-address mathematical system, I guess very much like, I'm trying to remember, IT, I guess, which was the forerunner of the intermediate of FORTRAN. It was very like that. You know, "add A, B, C; cosine A, B." She got it finished and running and sent it up to the New York Service Bureau with this great big advance publicity on how it was going to cut our programming by about eighty percent. I wrote an evaluation of the system and I took a sample, I believe, of five jobs that we had done over the last year and showed the applicability of A2 to each of these jobs. Now some of these jobs would today be called data processing rather than scientific calculating. There was a statistical survey for AT&T of their personnel, a personnel survey that we processed, and there were a couple of other jobs, and I showed that on one of the five jobs you got eighty percent, you really did, it was a mathematical job. It was beautiful. I think three of them it was totally in[applic]able; and the other one it didn't save a thing, but maybe it was nice. She got so upset by that, that through the grape vine I heard that she was going to get me fired.

TROPP:

[LAUGH].

ROSENTHAL:

It was at that point I decided, well, now, valor and tactics, and I went down to my boss and said, "well, what do I do? Do I resign or what." It was then Herb Mitchell, who had moved in to New York. He said, "well, Erwin Tomash has just been appointed Regional Manager of Computers for Remington-Rand"-- although it may have been Sperry, I guess it was Sperry--"of Los Angeles, and he needs a Philadelphia-trained,"-- and in those days that was the UNIVAC thing rather than ERA trained, which he was--"person to come out there to be the expert on computers who's marketing oriented and can write proposals and that kind of thing." So he said, "why don't you go down and talk to him." So I went down and I talked to Erwin, who happened to be in, and he hired me, and I moved to the West Coast.

TROPP:

This may not be a very fair question, but that doesn't stop me. How would you characterize the difference in the environments from the East Coast to the West Coast, as you saw them in '55?

ROSENTHAL:

It was really a different world. By the time I got to the West Coast in '55, I was already an outsider. There was an in-group of people from Lockheed and Douglas and North American,

TROPP:

Northrop, RAND.

ROSENTHAL:

and Northrop, RAND especially, who--SDC, in fact, who I am currently with, had been, was just being set up, had spun off, and they considered the work that they were doing was far away in the forefront of computing theory of applications, and if you hadn't been working there for many years, then you were a nobody. Actually, it was in a sense, the freezing out, and the atmosphere there, the ingrown-ness, that got me interested, I had gotten a little bit interested in commercial data processing then and I was doing quite a bit of work on it, when I finally decided, "ah, the heck with it," you know. The people that I met in commercial data processing, some of the people at Pacific Mutual..., were open, they were interesting; they were also making more money than the scientific people, and this is for the birds. So I guess, in September, after about four months there, I went out to UCLA and signed up for the MBA and it took me about five years part-time to get it, but I eventually got an MBA and switched completely into commercial data processing.

TROPP:

Well, the reason I asked the question is because of this well known clash between these two environments. Looking back at their self estimate, would you agree or disagree with them violently?

ROSENTHAL:

I think the West Coast people did some very fine work. They did the first good FORTRAN compiler. The one that was good. They worried a lot about efficiency. They worried a lot about doing applications well. But I think the raw ideas came out of the East. I think the West Coast, I guess, in the old days of engineering and math, they used to say that the United States was the engineer and Europe was the mathematician, the theoretician. I would compare the United States in that role as the engineer, I think, to the West Coast, and the East Coast to the Europe in those days. Definitely. The real ideas came out of the East Coast. Some people at IBM, people like Eckert, Mauchly, a couple, very few, because there was very little software and math stuff done at ERA, University of Pennsylvania.

TROPP:

You have to include Harvard and MIT.

ROSENTHAL:

Harvard, NYU. After the AEC moved the machine and Richmyer and some of the other people into the AEC Computing Facility at NYU.

TROPP:

Was Courant involved?

ROSENTHAL:

Courant was there. I would say that the real numerical analysis, the real basic numerical analysis then came out of NYU.

TROPP:

Rather than out of the Institute in Los Angeles? You see that was already dismantled or nonexistent by the time you got there.

ROSENTHAL:

Let's put it this way, I worked in shock hydrodynamics in '52 and '53 on the computer, scientific work. Some of the most advanced and probably the biggest mathematical calculations that were done. The theory, the stability equations, the equations of state, the concepts of centering of numerical meshes, all came out of Courant at NYU, through the AEC and through the various people that--The people in the West Coast advertised it and used it, but when I needed something new, I went up to the Institute of Advanced Study, and talked to Courant and—

TROPP:

You mean the Institute or NYU?

ROSENTHAL:

No, no, at Princeton.

TROPP:

Was Courant at Princeton then?

ROSENTHAL:

No, not Courant, Von Neumann was at--I'm sorry, Von Neumann was at Princeton and

Von Neumann talked to Courant and talked to some of the other people and about a week later Richmyer, who was the Technical Director of Los Alamos, and son of the very famous Richmyer who wrote the mathematical physics text book.

TROPP:

There was a Richmyer at the Institute of Numerical Analysis. Now I don't know which of the two.

ROSENTHAL:

It was this one, it was the son.

TROPP:

The son.

ROSENTHAL:

The son went up there in '53 or '54. He called me up and gave me the solution. So I think the theory came out of there. Most of the numerical analysis, the good numerical analysis was done for the H bomb work in '5l and '52. Then it was spread and used for missile trajectory and other work in stress analysis and that kind of thing in '53, '54, and '55.

TROPP:

Some of that is even earlier. I think you can find some early work by people out of Los Alamos coming to the East Coast in '46, '47, '48.

ROSENTHAL:

That's right, but remember the numerical analysis that, other than the AEC work that I knew of in '52--and I think in '52 I knew about all the numerical analysis work that was around, it was my area--it was trajectory work, which was done at the University of Pennsylvania and Harvard.

TROPP:

Did you have contact with Alston Householder at Oak Ridge?

ROSENTHAL:

Yeah, yeah. I met Householder several times.

TROPP:

How about Szasz [?]?

ROSENTHAL:

No, I didn't know him. I have an interesting story on Teller though.

TROPP:

Oh, great.

ROSENTHAL:

This happened in, I guess, the fall of l952. We had a program for one of the AEC programs; I don't know if it's classified, so I won't tell you what it is; but it wasn't working. We had every mathematician and physicist from Los Alamos from Livermore and from Oak Ridge there looking and trying to find out what was wrong. We couldn't find out. And finally, in desperation, they called Teller. I drove down to the airport and picked Teller up, checked him into the hotel. I guess it was a Friday night or something like that. I was the coordinator, a UNIVAC coordinator to AEC Facilities, you might say, south of Philadelphia. There was another coordinator who handled the AEC Facilities north of Philadelphia, which was Harvard and Princeton and the other thing. So I had to pick up the people and deliver them and operate the computer at times, and we got Teller in, and he checked in. He napped a while, because he had been on the plane. He showed up, finally, Saturday morning and worked all day Saturday on this thing. I left about 4 o'clock on Saturday, just about when Teller was getting on the computer, and assigned our best operator to that shift, and the next shift, Hal Sweeney; about 11 o'clock that night I got a phone call in the middle of a party, which I'd had in my house and was the reason I left, saying "I'm leaving, I refuse to operate one more minute for that son of a bitch, Teller. He makes me nervous.

TROPP:

[Laughter].

ROSENTHAL:

He leans over my shoulder, he presses the buttons, he knows how to run the machine already, he insults me, he's obnoxious. He's got all the people here terrorized. They are all afraid of him, ?:[Laugh]

ROSENTHAL:

even Richmyer," you know, who was T Director, Assistant Director of T Division. I said, I'll be right in [?]. So I left the party going at my house all by itself, which was a very big risk, and went in and took over the operation of the computer about ll o'clock.

By about l2:30, I had the shakes. Finally, I got so annoyed, he made me make a mistake which made us lose about ten or fifteen minutes of computer time, and I backed up and I turned around and I yelled and I said, "God damn it, I'm running this computer, and I know how to do that better than you do. You stick to the God dam physics." He said, "fine."

ROSENTHAL & TROPP:

[LAUGHTER].

ROSENTHAL:

We worked, and about l:30 or 2 in the morning, I remember it very vividly, he looked over at a number that was coming out of the console, and he said, "that's wrong," in his deep German accent. The other guys looked over and said, "well, what's the matter with it, why is it wrong?" He says, "I don't know. It just is wrong." Now here was a guy looking at temperature and pressure numbers and flux density numbers in the middle of a hydrogen bomb. ?:[Chuckle].

ROSENTHAL:

You know, that was half-way to explosion, and he said "that's wrong." So we went in and we changed the console type-outs to give more detail of the number that he said was wrong. We sat there and we ran and just watched it and everybody else had the Grantham numbers. He sat there and he just watched the numbers typing out. He watched and he watched and in about half an hour or forty-five minutes he said, "that number is wrong." Again, he couldn't explain why, but this time he did say that-- I think it was either too high or too--I forget exactly, but he gave some sort of explanation how it was behaving incorrectly. So we went back in further, and he looked at it, and he then--we traced through the calculation that was wrong, and he showed us what numbers he felt were wrong, and we looked at it and discovered that we were basically subtracting two large numbers from each other and then dividing by something else. We were losing all accuracy.

TROPP:

The significant digits were vanishing.

ROSENTHAL:

The significant digits were just vanishing, and it was simply a matter of rewriting the equation. So we rewrote the equation, it took about a minute, and I programmed the change, which took all of about five minutes. That's checking it five or six times and typing it into the console, right into the memory and backed up to where the thing had started to go bad and reran it. We ran for about fifteen or twenty minutes and Von

Neumann sat there and looked at it, this was about three—

TROPP:

You mean Teller.

ROSENTHAL:

Teller, Teller sat and looked at it, he looked at it and said, "it's right there." And he got up and he said, "drive me to the airport."

TROPP:

[LAUGHTER].

ROSENTHAL:

"What?" He says, "yes, there's a plane that leaves for such and such at 5 o'clock in the morning." He had the whole, the entire country's airline schedule memorized. He said, "the plane leaves, and it goes here, and I'll get breakfast here, and I'll be where I want to be at 9 or l0 o'clock." "Yes, sir."

ROSENTHAL & TROPP:

[Laugh].

ROSENTHAL:

I put him in the car, and I drove him to the airport, and I went back to my house, and the party was still going on.

TROPP:

[LAUGHTER].

[End of Interview]