

EDUCOM Boston Oct. 31, 1984

Thanks for the Honors, I appreciate it from EDUCOM. I just came from an honor event in Omaha; Cecil Johnson, a friend and self styled advocate of mine, organized that meeting and His Excellency Swedish Ambassador Wachmeister, Dr. McCredie formerly president of EDUCOM, and Dr. Mackintosh, a distinguished physicist from Denmark, spoke words that made my fingers tingle and feel that life is worthwhile. And you have heard what was said today. In response I want to tell you a little of my beginnings in the computer field.

1. My history goes back well before 1930. Logs, bases, Mon.
2. What life was like in the 1930's
3. PhD in 1930, Grad Students in 32, Major students in 33.
4. Several students interested in partial diff. eqns.
5. We developed approx. methods for solution.
6. We needed computer for solution of lin. alg. equations.
7. I study what calculaters were available.

Analog vs digital

IBM tabulator

Monroes and Marchants etc.

Nothing that would do our work.

I was faced with building a new computer.

8. I started to study the possible structure of such a mach.

The medium of such a machine.

The base for such a machine.

Memory and jogging, regeneration, refreshing.

Enumeration vs logic

Serial methods

9. In spite of these preliminary efforts, I could not get the system to work, even ^{in my mind} mentally. I remember the winter of 1937-38 was a desperate one for me because I had this problem of the computer. After many months of hard work, I was still in the mental part of the problem. I had mentally assembled a collection of parts which could possibly be used for my purpose but the system would not jell. One evening, after an early supper, I went to my office in 52 Physics intending to spend the evening working on computers but I was not optimistic. To begin with, I was still uncertain as to the medium of the machine, that is, what stuff the machine would use in its computations. Since this was the most elementary problem, every other part seemed impossible, and I was left with an extreme sense of failure.

I then did something I had done in a very few cases, I went to my automobile and started to drive over the good roads of Iowa. I drove at a high rate of speed to cause my attention to be given to driving and to mitigate the unhappiness which I felt. The paving was clear of snow altho the temperature was -20 F. and the car was heated with a Southwind heater made by Stewart Warner of Chicago. I drove for several hours, at times slowing up and then driving faster to cover my anguish. At last I said to myself, "This has got to stop," and I looked out and I was crossing the Mississippi near Rock Island at a place about 189 miles from my desk.

Some one has denegated this episode by saying I was looking for a drink. Well, I am here to tell you that this idea did not enter my mind until I was entering Illinois. In those days Iowa did not allow liquid refreshments by the drink but Illinois did and in less than a mile I turned in and stopped at a road house. I hung up my heavy coat, ordered a drink and looked around. There were few people there and in a moment I settled down to think. Amazingly, my thought process was working extremely well. There was only one thing to think about. I may have had two drinks all evening. Counsel asked me if I used any paper. I do not remember any, but it does not matter, my thoughts were forever carved in memory. When I had finished thinking, I got up, put on my heavy coat and drove home at a much slower rate and went to bed.

Four thoughts came from Illinois. They involved matters I had thought of before but they were so sharp and clear that I knew I was on my way. My training caused me to go over them carefully but I did not change anything. Here they are:

I would use electricity and electronics for the medium of the of the computer

In spite of custom, I would use base-2 numbers in my computer.

I would use capacitors for memory, but jog to avoid lapses.

I would compute by direct logic action, not by enumeration.

There are several things I would like to say about these four decisions. Although they were all fixed in my mind, cautious me, went over each with a fine toothed comb, but as I have said I did not change anything. However these decisions were rough concepts, and I did not know the details of how to do some things. The first of them looks too commonplace today to be a great invention. However, this was not true in the winter of 1937-38; perhaps the world was not inured to doing everything electrically and although I was well trained in this field I was uncertain. I received a letter from an executive in a company ~~that~~ you all know which said "we will not build computers electrically." Every one of these decisions required detailed planning. I had the idea of regeneration or jogging, as I called it then, in my mind but I did not know how to implement it. This was even more true of the last decision; neither I nor others knew how to do it. Completing the details of them took more than a year.

I am now amazed and pleased to find that all of my four decisions relate to structures that are found in modern computers. Almost every computer today uses all four of my Illinois decisions. All computing is now done by electrical and electronic means. I do not know of any serious machines which do not use the base-2 and logical deductions. It is true that I did not invent the present dynamical memory, but it uses capacitive memory as I did, and its refreshing circuits derive directly from my jogging or regenerative methods.

10. At the end of about a year I had completed plans for putting the four decisions of Illinois into practice. This resulted in a paper plan for the computer in which no experimental work had been done. ~~However~~ the patent office would accept such a plan as a basis for a patent. But we did not wish such a patent, we wished a completed computer, and although I had completed the basic elements of a computer from a mental point of view, I knew that it was time for experimental work. I obtained a man, Clifford Berry by name, a man of great merit, to help with the rest of the machine.

We began experimental work in September of 1939. This preliminary work moved very fast and by the end of the year a new computer was completed and demonstrated. The four elements obtained from Illinois had been proven correct.