

A Bit of Background 1938-1978

I was born in 1938 to a working class Pittsburgh family. No one on either side attended college, but there was a family myth of descent from great rabbis and scholars. My father was drafted for WWII when I was five and my brother David was one. The story is that I was designated as “the man of the house” and that seems consistent with my memory.

A few years later, we moved from Pittsburgh to Ford City, a nearby Appalachian mill town. This allowed my father to pursue his dream of owning a (wholesale) business to pass on to his sons. The town and the high school were not a good fit. Until college, I had literally never met an engineer, much less a scientist or academic. There is evidence that I was also a problem for the school – they offered to pay for me to transfer to a private boarding school.

I entered the U. of Rochester as a physics major on a Naval ROTC scholarship without understanding anything about either. Physics went OK until junior year E&M class when I wanted know what an electron actually was. The answer (still popular) was “shut up and calculate”. This led to my switching focus to Math. ONR was also a bad fit and was dropped. Still clueless, I signed up for Neal Rothman’s Math course on computing, but did not get hooked. At Rochester, I also formed my continuing belief in the Existentialist assertion that there are no higher truths and that each of us is responsible for his own authenticity. This still seems true, but it did not .do well for the Existentialists and provides no guidance.

On graduation, I applied to both Math grad schools and companies, ending up back in Pittsburgh at Westinghouse. They brought in some 200 new grads for orientation and testing. I did well enough to be assigned to an in-house program leading to a MS at Pitt with some courses at (then) Carnegie Tech. My main work assignment was with the research unit developing a computer using internal technology, which was even to me, hopeless.

I was admitted to the Math PhD program at Carnegie and started a routine path. By a stroke of good luck, the chair of the Math department was Al Perlis, even then a giant of computing and the first winner of the Turing Award. One day he said to me “You seem like a fairly bright kid, but people have been doing Math for centuries and you are unlikely to make a difference, but in this new field, nothing is known”.

There was no graduate program in Computer Science, but the distinguished scientists Alan Newell and Herb Simon had produced strong AI students through the management school, including Ed Feigenbaum and (bizarrely) Julian Feldman who jointly edited the famous early AI book. I worked with both groups on separate AI and Systems thesis topics, both of which are still active personal research areas.

Upon finishing, I chose a job at MIT Lincoln Lab over a faculty position, probably without a clear analysis. There were no mentors at Lincoln, only a unique computer capability and contemporaries like Larry Roberts and Bert and Ivan Sutherland who did seminal

work in graphics, computer vision, networks and more. We all were brash and organized a research show, inviting many top researchers, including Bill Miller from SLAC at Stanford. After my two years at Lincoln, I took a junior faculty job at Stanford over a research position at RAND, which was also doing advanced work.

The Stanford story has many twists, starting with my cousin Gary who had finished at MIT and was a student in the Stanford AI project. After my recruiting visit, Gary suggested that many AI students would leave the demigod John McCarthy to work with me. I have never asked Gary if he believed that, but it worked. We will hear a lot more about Stanford, but there were other formative events in that period. One was a sabbatical in Jerusalem with no scientific, but deep personal impact. Another was helping to establish the computing effort at IIASA in Vienna and interacting with Howard Raiffa a master of decision theory, which became a core technology for me.

With no obvious qualifications, I was put on an NIH study section covering all aspects of computation and medicine. This was early days, much of the work was crude and the trips were mostly boring. The biologist David Zipser and I formed a mutual education bond sharing the basics with each other. On one site visit (Abib at U Mass) I had the most abrupt Eureka moment. Arbib was discussing perception and action in the Frog. We were building hand-eye robots at Stanford and I kept wondering where the Frog's memory and reasoning was done. Of course, there is none, but that blew my AI mind, years before any serious work on connectionist computation.

After Stanford, I accepted an offer from President Sproull to start a new Computer Science Department back at Rochester. It was decades later that it occurred to me that starting a department was living out my father's life goal of starting his own business. The new department was developed in close cooperation with Xerox PARC, which gave us the first Altos outside the company. The department was fairly successful and I also solved institutional problems as Vice Provost for Computing.

Fortieth birthday crises were popular at the time and I spent considerable effort planning a future. My incredible good fortune of getting in at the start of the computing revolution opened many opportunities, but my decision was to choose a scientific question that would not be solved in my lifetime. My original label was human memory but it was really the computational analysis of the mind/body/world problem.

In pursuit of this goal, my next step was to take a sabbatical back at Stanford, auditing courses in biology, neuroscience and Karl Pribram's course in psychology. Operationally, I studied all the proposed theories of human memory and proved that all but one of them was computationally falsifiable. Meanwhile, Geoff Hinton joined Jay McClelland and Dave Rumelhart on a post doc at UCSD and they sent an email suggesting a workshop on radical approaches to brain computation. Dave had taken my class at Stanford and was surprised but happy that I was doing related work. That workshop and others over the next few years are generally considered the foundation of the Connectionist program for neural computation.

The 40-year period 1978-2018 story will continue after the presentations and discussions.