

## A. Academic Origins of the Founders

In the 1930's, most of the future computer scientists were originally academics, rather than corporate engineers. Even apart from their qualifications, their background was disproportionately academic. They were not all "university brats," of course, but their fathers tended to be in cognate occupations (schoolteacher, minister, etc.). They tended to have degrees in liberal arts, instead of engineering. Some examples were Arthur Burks, George Forsythe, and Donald Knuth (at a later date). In the period before the war, academic science was much less well-funded than it would later become, and this tended to screen out the highly entrepreneurial technology manager.

Most of the people who got involved in computers at an early date, and stayed involved, were not destined to become academic computer scientists. They were destined to become corporate computer engineers, instead.

The future corporate computer engineers tended to have fathers who were engineers, or lawyers, or businessmen. Gene M. Amdahl grew up on a farm (BAB OH 107, P. 3-6). Robert Emmett McDonald's father was a mining engineer (BAB OH45, p. 4). William W. Butler's father was a lawyer in a small town (BAB OH 92, p. 3). H. Dick Clover's father was a South Dakota farmer, until he failed in the depression, and then he went to Council Bluffs, Iowa, and worked for the streetcar system (BAB OH 113, p. 3).

The future corporate computer engineers attended college only so long as was necessary to get a suitable first job, and expected thereafter to develop their skills on the job.

The most usual procedure was for an aspiring engineer to get an undergraduate degree, and then find an employer which would offer further training. William W. Butler had gotten his undergraduate engineering degree at Iowa State. He belonged to a fraternity, and did not have any kind of mentoring relationship with the faculty, did not do research, or anything like that (BAB OH 92, p. 6-10). He spent the war working as a field engineer for RCA, having to do with radar, and practically attached to the navy, much of the time at sea and in the south pacific (ibid p. 12-18). After the war, he decided to get a master's degree because he had become typed as a maintenance engineer. He chose CalTech more or less by chance, and went through a course which essentially represented the difference between an early twentieth-century undergraduate engineering degree and a late twentieth century undergraduate engineering degree. A classmate got him a job at Douglas Aircraft (ibid p.18-22). Butler eventually got a job at Engineering Research Associates because his wife knew William Norris's wife (ibid p. 29). College was a method of getting a job, and not necessarily the best method.

Sometimes college enrollment was not even for academic purposes. Dean Babcock, a wartime graduate of the University of Minnesota in Electrical Engineering, had missed a few courses as a result of the accelerated program. When he was demobilized from the navy in April 1946, he went back to the University the next day, nominally to finish up these loose ends. His actual purpose was to plug into the old-boy-network, hanging out on the

engineering school steps. Within a month or so, the old-boy-net passed along the news that Engineering Research Associates was hiring. He went there, and was hired (BAB OH 120, p. 3-7). Nowadays, universities have professional placement bureaus for the same purpose.

Then there were the career changers. Before the war, Robert Emmett McDonald had been in the process of becoming an electric utility company executive. He had taken both electrical engineering and business administration in college, and had taken additional graduate work in business while employed by Commonwealth Edison. In 1943, the war intervened, and the navy made him into a radar officer. After the war, he would up working for airlines in connection with the new electronics which were suddenly filling airplanes. In 1953, his employer, Braniff Airlines, consolidated its operations to Texas. McDonald did not like the idea of going to Texas, and looked for a new job. He found one at Engineering Research Associates (BAB OH45, p. 6-12). Except for the war, McDonald's career was a normal example of upgrading skills on the job.

It was not always necessary to have any kind of academic credential to get a job in the emerging computer industry. It was sometimes just a matter of being in the right place at the right time. H. Dick Clover completed high school, graduating in 1939. He took a "commercial course," stressing things like accounting. His hobbies were golf and fishing, ie. he was not a radio ham. Clover got a job with the Social Security (Bureau of Old Age and Survivor's Insurance), marking time until the war which he imminently expected. This involved working with punched card tabulators. After Pearl Harbor, when Clover was about to join the navy, his supervisor intervened to find him appropriate work. This turned out to be Naval Intelligence, and specifically, cryptanalysis, the American equivalent of Bletchley Park. When the war ended, he continued the same work as a civilian employee of the Navy. Engineering Research Associates was effectively a spin-off of the naval operation, and Clover went with it, as a matter of course, and in the company of large numbers of his colleagues (BAB OH 92, pp. 4-21, 25-27).

Sometimes a corporate engineer would get a Ph.D., due to circumstances. After the ENIAC team split up, the leader of the Princeton (Institute for Advanced Study) faction, John Von Neumann, had to get replacements for Presper Eckert in order to build the IAS computer. Eckert, the ENIAC team's circuit designer, had gone with the other side. (BAB OH 37, p. 13) Among other people, Von Neumann recruited Willis Ware, who had spent the war working on radar, or more precisely, "Identification-Friend- or- Foe" (IFF) (ibid, p. 6). As Ware put it:

In all honesty... I went to Princeton because it was an almost-free Ph.D. The deal was, we could work for Johnny von Neumann during the day and get paid as an engineer, and take whatever time off that we needed to go off to campus and work the degree. But I was the only one who did that, as it turned out. It was a deal you couldn't say "no" to. (ibid, p. 7)

On closer examination, however, not all that glittered turned out to be gold. Ware goes on:

...it became clear that we were sort of fifth class citizens around there... they stuck us in the second basement. And when you go to the social events... you would go to the social gatherings, and they's say "Well, I'm in mathematics" or "I'm in physics," or "I'm in --" -- "What are you in?" And then when one answered, it became clear that you were a social outcast... I think most of us thought at the time that it was professional snobbery (ibid, p. 10-11).

When he had his degree, he found an industrial job, and left, without waiting to see the IAS machine to completion (ibid p. 39-42).

Gene Amdahl presents an even more interesting case. In 1949-50, he was a graduate student in physics at Wisconsin, and in an effort to find a better way to do his calculations, he formulated some ideas about automatic computing. His academic superiors responded by changing his thesis topic and sending him off to Aberdeen for the summer to learn more about computers. He returned with fully developed ideas about better computers, and built a small computer (within Wisconsin's modest means, sans government support, using war-surplus tubes). IBM came to hear of this, and promptly recruited Amdahl, simply on his potential (BAB OH 107, pp. 27-40).

What runs through these cases is the extremely utilitarian attitude that engineers took towards universities. They asked about pay, about skill upgrades, and about the chance to do interesting and original work, in no particular order. The answers tended to come out in favor of the giant corporation doing government-contract work, or acting as a public utility.

Academic computer science was founded by men who really wanted to be in universities, whose values were profoundly academic. That was why they returned to universities in the face of all kinds of practical reasons not to. These kinds of values were commonly inculcated at an early age, to the point that in later life, they were simply not open to discussion.

Arthur Burks, the first Chairman of the Computer Science Department at Michigan, was born in 1915, in Duluth, Minnesota. His father was a city school teacher (first in Duluth, then in Chicago). His mother was a substitute teacher, probably about the most substantial employment that a married woman could have maintained at the time. Burks' father taught mathematics, but was interested in history. Both of Arthur Burks' brothers became historians (one at Wayne State, the other at Hunter College). In a very real sense, one can say that Burks was "to the schoolhouse born." Arthur Burks attended DePauw as an undergraduate, from 1932-36. He majored in mathematics, and minored in physics, but he also took excursions into philosophy, and became certified as a school teacher. Graduating into the depths of the depression, he could not get a teaching job, unsurprisingly. He therefore went to the University of Michigan for a masters degree in philosophy. In choosing to go to Michigan, he passed up an offer

of a fellowship in statistics at Iowa State, even though it was the only one he had received. He spent a year teaching high school after getting his masters, and then returned to Michigan for a Ph.D. in philosophy, doing his dissertation on Charles S. Peirce (BAB OH 75, pp. 3-6, 8).

George Forsythe, the founder of the Computer Science department at Stanford University, had a lifelong connection with academia. As his wife put it: "George's father was a doctor; he ran a health service at the University of Michigan... George had grown up in Ann Arbor." (BAB OH 17, pp. 3, 9). In 1941, He got his Ph.D. in mathematics at Brown University, where the emphasis was on pure mathematics rather than applied, (John Herriot, BAB OH 21, p. 3).

Marvin Stein, the founder of the Computer Science department at Minnesota, was a freshman at UCLA in 1941, intending to study philosophy of science. However, he was becoming aware that one could not study philosophy of science very well without knowing science, and that, to understand science, one needed to know mathematics. So he switched to mathematics, the aptly named "queen of the sciences," in conscious or unconscious imitation of his hero, Bertrand Russell (BAB OH 90, p. 12).

The founders set the pattern for later recruits-- they recruited people rather like themselves. An example would be Donald Knuth, whose father was a Lutheran church organist and a schoolteacher (BAB OH 332).

Academic computer science was founded by people who were profoundly academic. Their values, their ways of life, their work habits, their recreations, were all geared to the university, and this academic orientation was essentially impervious to any subsequent experiences they might have.