Chapter I

Origins, War, and Linguistics, 1930-1960

(Part I)

A. Academic and Wartime Origins of the Founders

Academic computer science resulted when academics went to war. The war put them into practical jobs, with practical problems to solve, and at one level, they became as practical as any engineer. However, this was a matter of consciously choosing to be practical when the situation called for it. This was quite different from the engineer’s unconscious practicality. When the academics eventually returned to their campuses, they took with them this capacity for controlled practicality.

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, doctor, minister, etc.). They tended to have degrees in liberal arts, instead of engineering. Two examples were Arthur Burks, the eventual founder of the Computer Science department at Michigan, and George Forsythe, the eventual founder of the Computer Science department at Stanford. 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.[1] Robert Emmett McDonald’s father was a mining engineer.[2] William W. Butler’s father was a lawyer in a a small town.[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.[4]

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

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1. (Babbage) OH 107, Gene M. Amdahl, pp. 3-6.

2. (Babbage) OH 45, Robert Emmett McDonald, p. 4.

3. (Babbage) OH 92, William W. Butler, p. 3.

4. (Babbage) OH 113, H. Dick Clover, p. 3.

with the faculty, did not do research, or anything like that.[1] 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.[2] After the war, he decided to get a master's degree because he had become typed as a maintenance engineer. He chose California Institute of Technology 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.[3] Butler eventually got a job at Engineering Research Associates because his wife know William Norris's wife.[4] 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

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1. (Babbage) OH 92, William W. Butler, pp. 6-10.
2. ibid pp. 12-18.
3. ibid pp. 18-22.
4. ibid, p. 29.

passed along the news that Engineering Research Associates was hiring. He went there, and was hired.[1] 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.[2] 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

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1. (Babbage) OH 120, Dean Babcock, pp. 3-7.

2. (Babbage) OH 45, Robert Emmett McDonald, pp. 6-12.

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.[1]

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.[2] Arthur Burks, as we shall see, was in the process of going off to Michigan. Among other people, Von Neumann recruited Willis Ware, who had spent the war working on radar, or more precisely, "Identification-Friend- or- Foe" (IFF).[3] 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

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1. (Babbage) OH 113, H. Dick Clover, pp. 4-21, 25-27.

2. (Babbage) OH 37, Willis H. Ware, p. 13.

3. ibid, p. 6.

> 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.[1]

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.[2]

When he had his degree, he found an industrial job, and left, without even waiting to see the IAS machine to completion.[3]

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

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1. ibid, p. 7.

2. ibid, p. 10-11.

3. ibid p. 39-42.

this, and promptly recruited Amdahl, simply on his potential.[1]

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

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1. (Babbage) OH 107, Gene M. Amdahl, pp. 27-40.

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.[1]

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."[2] In 1941, He got his Ph.D. in mathematics at Brown University, where the emphasis was on pure mathematics rather than applied.[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

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1. (Babbage) OH 75, Arthur W., and Alice R. Burks, pp. 3-6, 8.

2. (Babbage) OH 17, Alexandra Forsythe, pp. 3, 9.

3. (Babbage) OH 21, John Herriot, p. 3.

his hero, Bertrand Russell.[1]

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. They might never have gotten involved in computing if it had not been for the Second World War.

The Second World War, by actual or de-facto conscription, drew vast number of academics into much more practical concerns. The emergent computer scientists were not particularly unique in this regard; they were not even very exotic compared to the anthropologists who became OSS officers.

However, vast numbers of academics became involved in engineering, of which the engineering of computers and software was only one instance. They became accustomed to the idea of spending comparatively vast sums of money, and building elaborate apparatus. However, if they changed their occupation, they preserved much of their academic orientation.[2]

It was quite possible to penetrate into the very depths of engineering without losing one's liberal arts orientation. Arthur Burks was a mathematician and physicist before he was a philosopher. When he got his Ph.D. in Philosophy, in 1941, no employment was in immediate sight, and the Second World War was

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1. (Babbage) OH 90, Marvin Stein, p. 12.

2. See Hodges, Alan Turing..., p. 210-17, 231-33, for the comparable British example of Bletchley Park.

obviously about to begin. So, reverting back to his undergraduate credentials, he applied to a summer training program at the Moore School of the University of Pennsylvania. As he explained afterwards:

> "The war, of course, was raging in Europe and so I thought that I would be better able to contribute to the war effort by getting this training in engineering. The idea of that course was that it would take a person who had a bachelor's degree in physics and math and make that person into somewhat of a engineer."[1]

This course, and additional night schools during the war years, made him into an electrical engineer. In the fall, they had him teaching quiz sections of similar courses.[2]

In December 1941, he moved into his first actual engineering project. The navy was developing a coil which could be mounted in an airplane to trigger German magnetic mines. Burks and John Mauchley, were assigned to do a series of mathematical calculations of the coil's power. When that project finished up, he worked on radio antennas.[3]

In 1943, he was assigned to work on ENIAC. Now, he worked, in effect, as one of J. Presper Eckert's apprentices, being trained on the job as an electronic circuit designer.[4] In the process, he became one of the few computer experts in circulation.

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1. (Babbage) OH 75, Arthur W., and Alice R. Burks, p.8.

2. ibid, p. 11.

3. ibid, pp. 12, 15-16.

4. ibid, p. 27-34.

During his extended residence in Philadelphia, Arthur Burks had become acquainted with the University of Pennsylvania philosopher Glen Morrow, and they talked about Plato at lunch, off and on. Morrow was a specialist in Plato [verify this], apparently in the economic dimensions.[1]

At the end of the war Aberdeen Proving Ground offered Burks a job, and the Moore school matched the offer on the spot. When Burks expressed a desired to get back into philosophy, Dean Pender of the Moore school negotiated with Glen Morrow, and Morrow attempted to set up a joint appointment, This came to nothing, however. Even though Morrow was the dean of the liberal arts college, the rest of the Philosophy department would not agree. Burks then did an aggressive job search, that is, sending out query letters to strangers in the modern fashion, instead of relying on friendly connections, as was the norm then. He sent out fifty queries, covering practically all possibilities. He got job offers at Swarthmore (where he already had a part-time "visitor" teaching job) and at Michigan (where he had gotten his Ph.D.). He accepted the offer at Michigan, beginning in fall, 1946[2]

The computer people did not take this as the last word, however. Von Neumann and Goldstine got him an offer of a permanent position at Princeton, however, this was not a joint appointment. Given the politics that was obviously impossible.

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1. ibid, p. 66.

2. ibid, p.66-67, 75;
"A Philosophical Computer Man," <u>Datamation</u>, Dec. 1977, p. 32.

Eckert and Mauchley also made an offer of a job in their new company. The emerging computer establishment simply did not have any philosophy positions in its gift, and even though it was quite willing to allow Burks time to work on philosophy, the computer establishment could not come up with philosophical colleagues. However, the computer establishment did the next best thing. In 1948, Burks was offered a consulting contract with Burroughs, on a one-day-a-week basis, as well as summers. Burroughs was in Detroit then, so Burks could commute from Ann Arbor by bus.[1]

The end of the war left Burks back where he had started, in the philosophy department at Michigan. However, he now had engineering skills and industrial connections. Admittedly, Burks was a somewhat exceptional case, but similar things were commonly happening to mathematicians.

Mathematicians commonly went into industrial calculation of one kind or another. George Forsythe did meteorology in the military, and Alexandra Forsythe worked at Douglass Aircraft doing aerodynamic calculation.[2] Their classmate and eventual colleague, John Herriot, was at Ames Aeronautical Laboratory, as he put it, "doing sort of applied research in theoretical aerodynamics."[3] The people doing this kind of work might have a business tabulator machine if they were lucky, and a bunch of

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1. (Babbage) OH 75, Arthur W., and Alice R. Burks, pp. 89-90, 102-104.

2. (Babbage) OH 17, Alexandra Forsythe, p. 4-8.

3. (Babbage) OH 21, John Herriot, pp. 3-4.

ordinary clerks operating adding machines if they were not. In either case, the mathematical calculations had to be translated into simply arithmetic which the people or the machines could handle. This necessary translation bordered on being computer programming.

When the war ended, George Forsythe had offers from Brown University, where he had gotten his Ph.D., and Boeing. A major reason for choosing Boeing was that his wife had been the victim of sex-discrimination on the part of Brown's dean, and was unhappy about the idea of going back to Brown. So they went to Seattle instead. It took about a year or two for Forsythe to become homesick for academia. In 1947, he moved to UCLA, where he had done some of his wartime work.[1]

Once he was at UCLA, Forsythe became involved with the SWAC computer which the Bureau of Standards was building on the UCLA campus. He remained there for ten years, until the Bureau of Standards got itself into political difficulties and had to retrench. At that point, in 1957, he moved on to Stanford.[2]

If Forsythe was not back where he had started, he was back where he had been in 1941, on his first teaching job. The difference was that he was now an applied mathematician instead of a pure mathematician. He joined his old friend John Herriot, who had, since 1952, been dusting off his wartime computing

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1. (Babbage) OH 17, Alexandra Forsythe, p. 9.

2. ibid, pp. 10-14.

skills.[1]

Burks, and Forsythe, and Herriot had all moved in the same direction, but they were all about the same age-- just old enough to have Ph.D.'s on the eve of war. The effect on a younger man was more drastic.

Marvin Stein, the UCLA freshman, was in the army at the end of 1942. He was assigned to the signal corps, and the signal corps was using tabulators for storekeeping. Stein was sent to the local IBM office to be trained as a keypunch operator (really, a kind of typist). He talked his way into a more advanced course which was being offered, and had become the instructor's ad hoc teaching assistant within the week. When Stein got back to the army, his colonel, a reserve officer, allowed him to run the installation on the basis of sheer ability, even though he was a mere private-first-class. The NCO's had apparently not done very well in the school they had been sent to (Stein does not say what kinds of NCO's they were).[2]

At the end of the war, Stein went back to UCLA, completed his undergraduate degree in 1947, and entered graduate school with a teaching assistantship. When the National Bureau of Standards SWAC center started up, Stein was given a fellowship associated with it, and became involved in numerical analysis, or applied mathematics. After he had gotten his Ph.D., the university, unable to pay him a living wage, found him a job at Convair.

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1. (Babbage) OH 21, John Herriot, pp. 4-6.

2. (Babbage) OH 90, Marvin Stein, p. 13.

Convair bought a powerful new computer from Engineering Research Associates (Univac), and the machine’s teething troubles brought Stein into contact with the ERA engineering staff, based in Minneapolis. They gave and/or got him consulting work. In 1955, Univac decided to make the University of Minnesota a present of a block of computer time, 400 hours (annually?), and introduced Stein as a suitable person to take charge of this allocation, run programming courses, etc.[1]

Stein had been looking for an academic position while he was at Convair. As he later explained it:

> It was probably psychological. In those days, I believe, the professors used to brainwash the students. They said the good students will become the professors and the ordinary students will be out there working in industry. Consequently, when I found myself working in industry, I had in my mind the stigma of being an ordinary student. When an opportunity came for an academic position, I said, this is what I was educated for and I can always return to industry; so I will try it to see what I can make of it.[2]

As we have seen, archetypal corporate engineers were impervious to this kind of brainwashing, if that is what it was. However, archetypal corporate engineers did not usually take Bertrand Russell as their hero in their freshman year of college. Academics, on the other hand, might very well do so.

The emergent academic computer scientists had approached the war effort out of a sensibility distinctly different than

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1. ibid, pp. 13-16.

2. ibid, p. 16.

corporate engineers. They had learned what skills they needed to function efficiently. But, they did not become corporate engineers in the spirit. When the time came, they reverted to their original selves, while retaining a new potentiality.

Meanwhile, better computers were being developed in industry. There was no compelling need for the universities to become involved in computing. There was no compelling social or economic pressure for universities to develop computer expertise paralleling that of great corporations. There was no compelling pressure growing out of personal needs of individual faculty members. Nor was there a truly enduring need arising out of the utilitarian aspects of academic disciplines.

In the first place, there was no public need for academic research and education. The numbers of computer scientists and computer engineers were still very small-- some fraction of the 13,000 computer specialists as late as 1960. Those of the high level experts who were not employed in academia all worked in a handful of laboratories, for a handful of big organizations, most of which were computer manufacturers ("IBM and the seven dwarves"). Such firms could reasonably train their own long-term employees, and would have an advantage in being able to disclose proprietary information. By analogy, the design of telephone systems was not considered a appropriate academic engineering field-- such expertise was concentrated at Bell Labs and Western Electric.

IBM was much the same kind of firm. Apart from doing its own research, it not only trained its own employees, but trained its customers’ employees, and provided former IBM’ers for jobs which required more extended training and experience. In short, the company behaved very much like a national public utility of computing-- or an extension of the federal civil service.

Such monopolistic or semimonopolistic firms were willing to sponsor almost any reasonable type of research, without much worry about immediate results. The same applied for government laboratories. Braun and McDonald (Revolution in Miniature), point out that this was not a carte blanche. However, that applied when large sums of money were at issue. Bell Labs had no difficult in employing theorists such as Claude Shannon and the mathematician R. W. Hamming.

Computer manufacturers had their internal pure research programs at an early date. These were not funded on the same scale as industrial research, of course, but they were sufficiently well funded as to compare favorably with all but a handful of academic situations.

Artificial intelligence is something like a litmus test of willingness to conduct pure research. It is notoriously expensive, on account of the sheer power of the computers required. At the same time, results from artificial intelligence are notoriously problematic.

IBM was doing actual research with artificial intelligence at a very early date. In 1952 or thereabouts, Nathaniel Rochester, Gene Amdahl’s boss at IBM, was supporting work which was thirty or forty years ahead of its time in terms of commercial prospects. This meant things like neural nets and character recognition.

They wrote a program to simulate a neural net, of a size feasible for the then-computers. This meant only 1000 neurons on an IBM 701 (presumably neurons with an unrealistically low number of connections). The performance was uninspiring. Interestingly, this surfaced what must be a very early example of the hard AI/soft AI dispute. Gene Amdahl wanted to try altering the software around, but Rochester took the view that the network was simply much too small.[1]

Rochester and his associates also did character recognition, using theoretically sophisticated methods, but the results were not remotely good enough to be commercially viable.[2]

However, this sort of pure research was the spare-time diversion of a group whose main business was to design computers.

Similarly, IBM supported Arthur Samuel’s checker-playing program. Samuel had moved to IBM when he found that a university did not offer sufficient scope to his interest in computers.[3]

Of course IBM did not fund these projects on the scale that the military would have. As John McCarthy commented: "They tended to be two or three people projects, and without dedicated computers."[4] While artificial intelligence per se at IBM came to a halt in 1959, after adverse publicity (ibid), IBM went on to

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1. (Babbage) OH 107, Gene M. Amdahl, p. 40.

2. ibid p. 41.

3. Pamela McCorduck, <u>Machines Who Think</u>, 1979, pp. 148-53.

4. (Babbage) OH 156, John McCarthy, p. 10.

do other kinds of impractically exotic research. In 1968-70, IBM Research was doing an early form of personal computer graphics with a machine costing $700,000 which could only serve one terminal (An IBM 1130 computer with an IBM 2250 graphics terminal attached). This was only about twenty years in advance of its time.[1]

All of these pieces of research had very little in the way of rational expectation of profit. However, IBM dominated its market sufficiently that it could behave more or less like AT&T, and fund research over the long term.

Universities were not under an obligation to get involved in computing as a matter of meeting social or economic needs. If they had felt like doing so, they could perfectly well have left the whole business to IBM and the federal government.

Individual professors might have personal needs leading to involvement in computing. This, too, does not constitute an adequate explanation. Someone like Arthur Samuel, who wanted to do expensive research, could always switch to a corporation. Personal, idiosyncratic interests did not translate into introducing the computer on campus. There were a number of well established mechanisms for coping with odd personal interests, eg. summer vacations, sabbaticals, permitted industrial consulting, salary buyout grants. Computers only needed to be brought on campus if they were to be integrated into one or more recognized academic disciplines.

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1. (Babbage) OH 352, Laszlo A. Belady, p. 13-15.

Even then, it was not self-evident that a whole discipline should grow up to deal with computers. Applied mathematicians displayed an early interest in computers-- as tools, not subjects. However, on the basis of this limited interest, the role of computers on campus ought to have been self-limiting, as computers got better, and required less special attention. The presence of a music school on campus does not imply the need to develop an expertise in musical instrument design and manufacturing. Similarly, there were not departments of "typewriter-ology," at least, not at the senior college or graduate school level.

The precondition for a growing and expanding collective collegiate interest in computers was that computer must either be a purpose in their own right, or an integral part of a larger purpose. Now, as we have seen, the original computer scientists were disinclined to go in for computer engineering for its own sake. If that was what they had wanted to do, they could have done it even better in a corporation or a government laboratory. Computer science was only going to come into existence if it engaged, or was thought to engage, important questions in the social sciences or humanities.

The incipient computer scientists had learned the requisite technical skills during their wartime employments. However, they had returned to academia, and stayed there, despite all temptations. By now, they were substantially involved in academic concerns. Still, they kept a weather eye open on industrial developments, regarding them with an eye which was not that of a layman. And then, the saw something which interested them, which seemed relevant to what they were doing in the university.

Synopsis of part II:

C. The Growth of Complexity, late 1950’s

Once the stored-program computer was in place, and furnished with increasing amounts of storage, people began using it for bigger and more involved problems. Programming became more complex.

People were first working problems out in conventional languages, such as mathematics and accounting, and then translating their solutions into machine language.

When programmers wrote chunks of machine language to implement the conventional vocabulary, they often chose to reuse these chunks, modifying them to fit into new programs. The reusable chunks began to accumulate.

D. The Parsing Compiler, late 1950’s

Eventually, compiler programs were introduced to unify and regularize these bits of software. A compiler program read in a stream of text, and translated it, according to general open-ended rules, into machine language. The significance was in the open-endedness of the rules, and the fact that, like tinker-toys or Lego blocks, more or less infinitely complex structures could be built up out of them.

The parsing compiler was, ipso facto, a generalized language machine. Take ALGOL and LISP as the point of departure, with their more generalized grammars and free format, compared to FORTRAN and COBOL.

E. A Meeting with Linguistics

As it happened, this development intersected with something which had been happening in the "human sciences" (psychology, linguistics, etc.). It had come to be accepted that language and mind were very much the same thing. This conception dated back to the writings of Edward Sapir, inter alia (I think De Sassure as well), but it found its fullest expression in the work of Noam Chomsky.

Paul Edwards has argued that the language-mind linkage presupposed a mechanistic-rational view of intelligence, but this is arguable. On the contrary, people were doing linguistics of mysticism (Victor Turner, Mircea Eliade, etc.). Language was the pre-eminent aspect of mind which resisted the simplicities of someone like Adam Smith or Sigmund Freud. Mind-as-language implied that emotions had meanings and contexts, the same as words.

A machine which translated languages was presumptively a model of human intelligence. The compiler authors were thus poised for the ultimate scholarly quest. Try to look at Chomsky as a product of certain trends, not as a solitary genius.

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An extremely partisan account by a quasi-participant, arguing in favor of artificial intelligence. She used to be Edward Feigenbaum’s secretary, and co-authored some of his polemics, was married to Joseph Traub (of whom, more later in Ch. 2).

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