Letters

The Missing LINC

I keep seeing the "personal computer era" referred to as having begun in the mid-1970s, as if it required the microchip to make it possible to design hardware and software for a single-user computer. But there are important antecedents to this, dating back twenty years, and they were not hand-held calculators so much as proper computers with analog interfaces and mass storage—namely, lab computers.

In 1962, at MIT's Lincoln Labs, Wesley Clark and Charles Molnar designed the LINC (Laboratory INstrument Computer), to be used in a research lab in a manner analogous to an oscilloscope. It wasn't merely its display and analog-to-digital converters (hence joysticks and Spacewar) which made it unique: its software was designed to enable the scientist-user to program without a professional programming staff. Much of the design rationale was process-control oriented (hence interrupts) so that online data analysis could be performed during an experiment, allowing modification to the experimental protocol. But having such a friendly computer in the room, shared only with the other users of the same lab, created the atmosphere of "personal computing" a decade before mass-market economics extended it.

The first 24 LINCs (with their small memories and dual small-reel magnetic tapes—so-called LINCtapes—which were the forerunners of the floppies) were built under a government research grant and distributed around the country in 1963 to various physics, chemistry, and life sciences labs (they were especially important in my own field of neurobiology). With the plans in the public domain, several computer manufacturers began selling them (Digital Equipment Corporation's version cost $54,000—and in 1966 dollars, at that) and improving on the design (DEC's LINC-8 and PDP-12 were the major extensions). In essence, thousands of users experienced the personal computer revolution in the 1960s and helped shape its present philosophy.

It is curious how this heritage has been forgotten in the great expansion. One consequence is an excessive amount of reinventing the wheel. The interactive software packages developed by LINC users (especially at Washington University and the University of Wisconsin) were excellent—I have yet to see a statistics-and-plotting package for microcomputers which equals LINDSY for the LINC, and the LINC's text editor and operating system (LAP) puts CP/M to shame. And—another forerunner of the present microcomputer situation—the really good general-purpose software came from small groups, not manufacturers.

Most people tend to compare new microcomputer software to fancier mainframe versions, but it is often more appropriate to compare it to the lab computer antecedents, which shared a similar philosophy. It is the design philosophy for microcomputers that so sets them apart from the staffed mini- and main-frame computers, and it is that single-user-as-master philosophy that was so extensively developed by the LINC users.

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Computer Scrabble*

We were pleased to see an article discussing the feasibility of a computer opponent for Selchow & Righter's popular Scrabble word game (see "Computer Scrabble," December 1981 BYTE, page 320). Others who are intrigued by this concept will appreciate knowing that the state of the art in microcomputer Scrabble has made a great leap forward. It is far beyond the boundaries that Mr. Roehrig tells us will not be broken by anything less than a new, superior generation of microcomputers.

"Monty plays the Scrabble Brand Crossword Game" (a computer-opponent program available on disk for the Apple II and TRS-80 Models I and III from Ritam Corporation for $39.95) demonstrates both speed and ability, within the constraints of today's microcomputers.

Monty spends an average of only 4½ minutes per move at the highest skill level, and yet it uses an extensive word list (over 50,000), based in part on the *Official Scrabble Players Dictionary*.

As for memory, the program requires no more than 48K bytes for Apple and 32K bytes for TRS-80 versions, much of which is devoted to machine-language graphics, music, and other user-interface requirements. The dictionary is accessed from disk and is stored in an average of only two bytes per word (with an average length of 6 or 7 letters) by use of advanced compression techniques. In addition, Monty is capable of challenging other players' words, based on linguistic analysis, without accessing the disk.

To give Mr. Roehrig's efforts due credit, the "game's complexities" do offer a challenge! It took us several major design breakthroughs, over four man-years of programming (for three different computers), and a lot of determination to develop "Monty plays Scrabble" without conceding to "certain constraints" on word length, search, and placement.

Although his conclusion that "improved computerized Scrabble will require a faster host computer with more memory capacity" has been disproved by example, we thank Mr. Roehrig for his article. It makes our endeavor seem quite worthwhile when we learn that we've achieved the impossible!

By the way, Mr. Roehrig neglected to properly acknowledge that Scrabble is a trademark of the Selchow & Righter Company, and to disclaim, as does Ritam, any sponsorship or endorsement by Selchow & Righter.

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More Commbat

I would like to thank George Stewart for his excellent and perceptive review, "Commbat: A Tele-Game for Two," in the December 1981 BYTE (page 100). He captured my motivation for creating Commbat in the first paragraph.

The problems he mentioned of synchronizing both systems upon initial start-up