15 July 1966, Volume 153, Number 3733

SCIENCE

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. ADVERTISING CORRESPONDENCE: Rm. 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE 6-1858.

The Human Use of Computing Machines

The relation of man and computers has entered a new era, in which interaction is becoming quick and simple. A decade ago, use of computers seemed impractical for most scientists. Those conversant with the machines talked of the frustrating hours spent in programming, compiling, and debugging. There were long delays between concept and fruition, as users awaited their turn. Usually the computations merely took advantage of the fact that the new devices were much faster than desk calculators.

In this last decade the speed and memory of computers has been improved. Present-day models calculate 10^7 to 10^8 times as fast as a man does. These developments, however, are not so important as those which make for greater ease of using the machines. A sizable group of very competent men have created libraries of programs and subroutines. Some of them have turned their attention to other quick means of communicating with computers and to the complementary problem of obtaining information from the machine in a much more usable form.

An impressive sample of this progress was presented on 20 and 21 June at a symposium at the Bell Telephone Laboratories, Murray Hill, New Jersey. The audience numbered about 200 and included representatives from more than a hundred universities throughout the country. The group was truly interdisciplinary; it included substantial representation from the humanities, the social sciences, biology and medicine, the physical sciences, and, of course, mathematics and engineering.

At the Bell Laboratories some 1400 men spend at least half their time working with computers, of which 40 are available. These include special-purpose computers for on-line problem solving, a console for handling pictorial input and output, and a computer which takes graphic or symbolic input and delivers auditory output. Under design is a system in which a central machine will serve 200 to 300 typewriter consoles and contain an elaborate program library.

Today, instructions to a computer can often be conveyed by typing simple English or abbreviations. Another means of easy access to the computer is through a console that employs something similar to an oscilloscope screen and a light pen. The computer converts a rough sketch into a finished drawing. Block circuit drawings can be quickly assembled through a series of instructions mediated by a light pen.

The computer can communicate with the user in new, simple forms. To the scientist, perhaps the most impressive development is the graphic presentation of data. Earlier, the output from the machine usually took the form of almost indigestible quantities of printed results. Today a glance at a curve on a screen or the plot of a thousand points can provide an almost instant summation of the same output. Another impressive development is that of teaching a computer to talk. Through manipulation of controls, the investigator can change the character and emphasis of the speech. This work seems to be speeding the day when it will become possible to speak to a computer and to obtain quickly a spoken as well as a visible output.

Improvements in computers and in the ease of using them portend a further great expansion in their use in all the sciences and in many of the humanities. "After growing wildly for years the field of computing now appears to be approaching its infancy."—PHILIP H. ABELSON