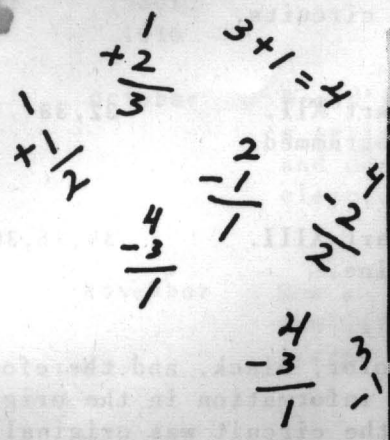
World's Smallest Electric Brain



E. C. Berkeley explains how Simon gets instructions from a piece of punched tape.

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Part I of a series of articles outlining principles and describing construction of electric and electronic computing devices

ON THE COVER of this issue of RADIO-ELECTRONICS is a picture of the smallest existing, complete electric brain. This midget electric brain is named Simon, in honor of Simple Simon of Mother Goose fame. He can be called electric or mechanical for he uses relays; but not electronic, for he does not use a single electron tube. Nevertheless he illustrates in solid hardware the principles of all the giant artificial brains, electronic, electric, or mechanical. He is perhaps the only electric brain small enough to be understood completely by one man.

Simon is about 24 inches long, 15 inches wide, and 6 inches high. He weighs (not counting his power supply) about 39 pounds. He runs on 24 volts d.c., drawing at most about 5 amperes. And in number mentality, Simon at present compares with a child of two years, for he knows only four numbers, 0, 1, 2, and 3.

Simon is slow. He performs each operation in about ⅔ second—unlike the electronic brain finished in 1949 called Binac, which adds at the rate of 3,500 additions per second. And yet Simon is a true mechanical brain, for he has the two essential properties that define a mechanical brain: he can transfer information automatically from any one of his 16 registers to any other, and he can perform endlessly long sequences of reasoning operations.

What is the purpose of this little idiot of an electric brain—or should he be looked on rather as a baby, with capacity to grow? Why was it worth while to build him?

The purpose of Simon

An editorial entitled "Simple Simon" in the *Wall Street Journal* for May 22, 1950, expressed in part the purpose of Simon: it said, "The world may admire a genius but it loves a moron." The same may perhaps be true of the crew of men who want to know how electric brains work, what they are all about, and how to construct them. It may be rather easier to understand the working of a little moron of an electric brain, that a student can easily feel superior to, than it is to understand the working of a giant electric brain, that a student can easily feel inferior to.

Simon was designed and built to exhibit in simple understandable form the essential principles of any artificial brain. He will be useful in lecturing, educating, training, and entertaining—just as a spinning toy gyroscope is both entertaining and instructive. For it is certainly true that the demand for computer-trained electronics engineers, operators, maintenance men, mathematicians, etc., is steadily growing in the new field of automatic computing machinery.

There are now more than a dozen kinds or species of these giant artificial brains. Most are represented by just one example, such as the rather old—but still spry—Harvard IBM automatic sequence-controlled calculator, finished in 1944. This machine handles numbers of 23 decimal digits and can remember 72 of them at one time. There are now in use more than 20 machines of the type known as the International Business Machines card-programmed calculator, and more than 80 of the type known as the Reeves electronic analogue computer.

Digital and analogue computers

These artificial brains are of two main types: *digital* and *analogue*. A digital machine expresses information by the positioning of devices in any one of a small number of exact positions. For example, a human hand with fingers up or down may express 0, 1, 2, 3, 4, 5; or a counter wheel can stop at any one of the spots 0 to 9; or a light can be on or off, 2 positions; or a relay may be energized or not energized; or an electron tube may be conducting or not. All these devices are *digital*.

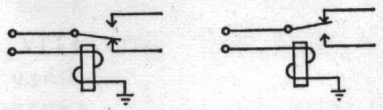

Fig. 1—Diagram showing a register of Simon expressing the information "1,0".

An analogue machine, on the other hand, expresses information as the measurement of a physical quantity, such as distance moved, or amount of rotation, or electric potential, etc. The

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