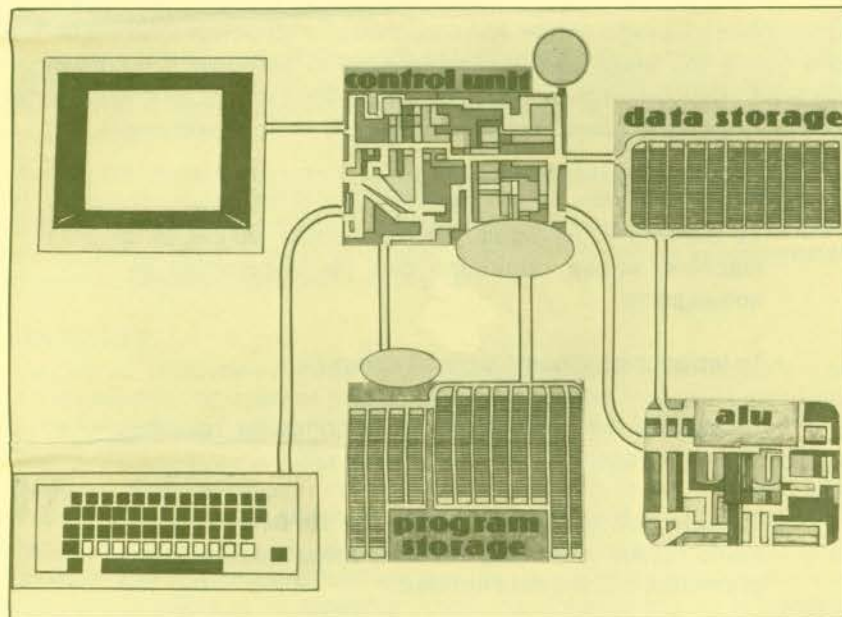


COMPUTERS: THE INSIDE STORY

A 16mm Film / Videocassette



A DISCUSSION LEADER'S GUIDE

*Audiences: Business, Industry, College,
High School*

Film length: 21 minutes, Color

CHURCHILL FILMS

662 North Robertson Boulevard, Los Angeles, California 90069-9990

CONTENT

By following program steps through a computer, viewers begin to understand the structure and principles of computers, and the automatic and physical way they work.

A prospective purchaser types her name in a computer which responds, "Hi, Ann, glad to meet you." Via animation and models, we go inside the computer to see how the parts interact to receive Ann's name, store it, and display it in a message. When Ann then makes a choice in a simulation, we again follow the steps inside the machine to see how it automatically switches to the correct response. She inputs the value of an inventory item which allows an explanation of how the computer does arithmetic.

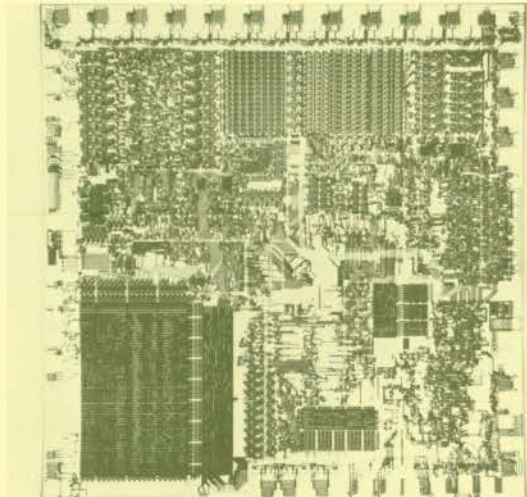
OBJECTIVES

- To demystify the computer, and show that it is a machine whose principles can be understood by non-experts;
- To introduce the basic parts of computers;
- To explain the steps by which a computer receives input, processes it, and outputs a result;
- To show how computer "decisions" are actually automatic results of the way the machine is built and programmed, and the data entered.

OUTLINE

MICRO-CHIPS

Inside the computer are micro-chips. Some are "memory" chips which store programs and data. All the chips are coordinated by the micro-processor.



Intel Corporation

- When the user inputs the value of an item in an inventory, the number is routed to the ALU. There it appears in binary numbers which are added to a previous total and routed to the display.

SUGGESTED DISCUSSION

BEFORE THE FILM

Tell the group that the film they are about to see explains the steps by which a computer receives input, processes it and outputs a result. Ask why it might be useful or important for a non-expert to have some understanding of how a computer functions, rather than relinquishing all control of computers to computer professionals.

Among the reasons: they are less dependent upon experts, and can work with them more comfortably; they can understand both the possibilities and limitations of computers; they can more quickly learn to use computers and computer programs; and, they have access to ideas which are increasingly important in understanding social organization and systems in nature.

AFTER THE FILM

Discuss the computer's need for instructions (a program) to accomplish any task and the necessity for a person to design, write, and enter that set of instructions into the computer.

Review the sequence of "Ann" being entered and then displayed, perhaps after copying the computer-system chart on a display board. Point out how the Program Counter increments by one after each instruction is executed.

Review the sequence of selecting the letter "C", and the way the computer switches to the proper instructions. Point out that the unique feature of computers, and the key to their power, is the capability of testing and then switching, or branching. In the machine, this is done by altering the Program Counter.

Review the way a circuit can be set up to control another circuit. Point out that, in principle, a computer is made from two sets of circuits. One set, shown in the film, receives input. The other set, shown in blue, responds automatically with the correct output. In a computer, the output circuits include some which are built in (hardware) and some which are set by the programmer (software).

Review the binary numbering system, and how adder circuits do arithmetic.

TECHNICAL ADVISORS

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RELATED CHURCHILL TITLE

Computers: Tools for People, I, JH, SH, A, 24 minutes - a companion film

CHURCHILL FILMS

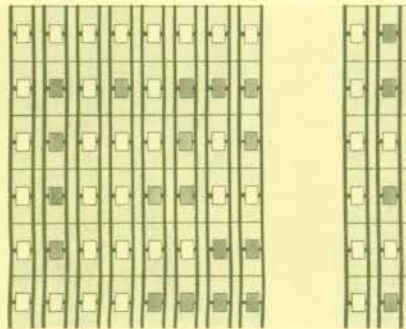
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CONTROL UNIT
(Central Processing Unit)

All the chips are controlled by a microprocessor, the Control Unit.

- While the instruction is in the Instruction Register, the Control Unit sends an impulse through it. The coded instruction routes the impulse to the location of the next byte of data and to its destination, setting up a path from one to the other.
- Finally, the Control Unit sends an impulse through the source byte to the destination byte, and the operation is performed. The Program Counter increments by one and the cycle starts over.



DATA AND PROGRAM STORAGE

Inside Data Storage, letters and numbers are stored, each in a group of cells, usually eight to a group. Each cell is called a "bit"; the group of bits which holds a character is called a "byte".

A bit can be turned on or off. In computer talk, each can store a One (when on) or a Zero (when off).

A pattern of eight 1's and 0's is used to store a letter or a number, following a standard code.

A computer has thousands of bytes of data and program storage. Each byte has its own address.

BASIC CYCLE

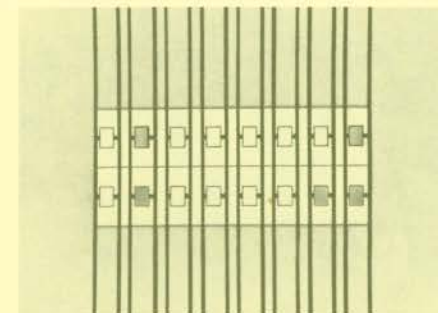
The parts of a computer work in a cycle which repeats with incredible speed, perhaps millions of times each second. Each cycle includes several steps whose starts and stops are regulated by a timer.

- The Control Unit sends an electrical impulse to the Program Counter, which routes the impulse to the bytes in Program Storage where an instruction is stored.
- The instruction is copied to a part of the Control Unit called the Instruction Register. A typical instruction has three parts: the operation to be done (such as Copy a piece of data), the address where the data is coming from, and the address where it will go.

COMPUTER "DECISIONS"

When a computer user is offered several choices and selects one, the computer must respond automatically by switching to the correct path.

- To understand automatic switching, an electrical model is used wherein a master circuit controls a slave circuit by turning it on and off with a relay. This demonstrates that output circuits can be set up to do logical tasks such as testing whether the two inputs match, or are different.



- Inside the computer, such comparing is done in the Arithmetic Logic Unit, the ALU.

- When a user chooses from a list such as A, B, C, or D, the letter selected is routed to a register in the ALU. There it is compared to a letter previously stored by the programmer. If they do not match, the program sends in another letter, testing each until a match occurs. When it does, a signal passes from the ALU, through Control, to the Program Counter. The Counter is changed so that it receives the address of the instruction for the correct response.