

What is a Computer? (And, what isn't?)

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Hand out a series of cards to the groups, each group gets eight to ten cards (some overlap between groups is fine and even desirable). Each card has the name of a “device” and a brief description of the device on it. The groups are asked to look over the cards and decide, as a group, which of the devices are computers, which are not, and why. To make this more fun, you might consider giving each group at least one of the more amusing cards like “domesticated cat” or “human brain.” The groups’ specific assignment is to create two piles of cards, one containing things that are computers and one containing things that aren’t and to be able to justify that division.

When they’re done, bring them back together and discuss people’s categorizations and why they made their decisions. Try to come to consensus on a few interesting cards. The class should, of course, be free to construct a division according to their own collective understanding of what a computer is. However, it’s important that an understanding of computers as *devices that follow instructions* comes out of this exercise. The moderator should ensure that the idea of following instructions enters the discussion before the end of the exercise. A second, less important note, might be to introduce some discussion about whether some of these listed items *are* computers or *contain* computers.

By the way, here’s an excellent quote from *Computers, the Internet and Criminal Justice: Literacy and Beyond* by Cecil Greek describing the line between calculating devices and computers: “[Babbage’s analytical] engine could choose to perform the next operation depending on how the previous operations turned out, and was not limited to sequential calculations producing static tables. Real computers allow symbolic manipulation, not just numeric operations.”

Some notes on interesting comparisons/contrasts below. The abacus, arithometer, and analytical engines are all early computing devices (with very different definitions of early). Of these, I believe the analytical engine is a computer. The ENIAC, Pentium II microprocessor, iMac, and Xbox are all things that are recognized today as computers (well, the PII is at least a part of a computer). I no longer believe the ENIAC is a true computer. It had no stored program capability and, more importantly, no conditional execution. The Xbox seems to have knocked off HAL’s trademark “eye.” (Compare the two pictures on the cards!) The AmigoBot, marionette, toaster, and VCR are all “direct control” types of devices. It might be fun to pair one of the two more “computerish” ones with one of the two less computerish ones. I tend not to believe

that any of these things are, in fact, computers. Finally, a fairly strong argument can be made to disqualify the VCR and AmigoBot and (much less so) the Xbox from being computers because they are not *general purpose* computing devices.

Cards:

- Abacus

Developed ca. 3000 B.C. in Asia Minor.

A device consisting of rows of beads mounted on rods. The beads can slide along the rods, and different bead positions represent different numerical values. The operator of an abacus can follow certain well-defined procedures to perform calculations surprisingly quickly.

In the mid-20th century, an abacus outperformed an electric calculator in exciting, head-to-head, calculating competition.

[Jones Telecommunications & Multimedia Encyclopedia:

http://www.digitalcentury.com/encyclo/update/comp_hd.html]

- Arithometer

Invented in 1820 by Charles Xavier Thomas de Colmar

A mechanical device capable of adding, subtracting, multiplying, and dividing. The arithometer was popular as late as World War I.

As with a calculator, the user of the arithometer can command it to perform a calculation (by pushing buttons and moving levers), but the arithometer cannot use the results of its calculations to decide what calculations to perform next.

[Jones Telecommunications & Multimedia Encyclopedia:

http://www.digitalcentury.com/encyclo/update/comp_hd.html]

- ENIAC

Developed in 1944 by Mauchly, Eckert, and other scientists at U. Penn.

An electronic device that used vacuum tubes, electrical relays, and other components to perform calculations.

Operators wired together some of ENIAC's electrical devices to represent the commands it should execute. It then executed those commands, performing literally thousands of additions in a single second. It could not decide what commands to execute next based on the results of previous calculations.

ENIAC was over 150 feet in width and took up a large room.

[UPenn Almanac article: <http://www.upenn.edu/almanac/v42/n18/eniac.html>]

- Analytical Engine

Designed (but never built) ca. 1832 by Charles Babbage in collaboration with Ada Lovelace (Augusta Ada King, Countess of Lovelace).

A machine that would have received instructions from punch-cards — pieces of paper with holes punched in them in patterns with meaning to the machine.

The machine would perform the calculations described on the cards using steam power and a complex system of gears and cogs. As it proceeded, the results of previous calculations could be used to control what calculations it performed next. Finally, it would print its results.

[Jones Telecommunications & Multimedia Encyclopedia:
http://www.digitalcentury.com/encyclo/update/comp_hd.html]

- Pentium II Microprocessor

Developed ca. 1997 by Intel Corp.

A tiny, square wafer of silicon that has been printed — through “etch lithography” and “doping” processes — with millions of transistors. Each transistor is capable of blocking or passing a signal based on a second signal that controls it. The pattern printed on the Pentium II allows it to perform millions of computations per second based on commands supplied electrically from pins — small metal prongs that attach to the chip. It provides the results of these calculations as well as requesting new commands or data electrically through other pins. The Pentium II is capable of storing its commands electronically and choosing which commands to execute based on previous calculations. The Pentium II takes up a few square millimeters on a wafer-thin chip.

[Intel Microprocessor Hall of Fame: http://www.intel.com/intel/intelismuseum/exhibit/hist_micro/hof/hof_main.htm]

- iMac

Developed in 1997 by Apple Corp.

The iMac is a single system comprised of a monitor, hard drive, CD drive, memory, a PowerPC G3 processor, and the Macintosh (OS X) operating system. An iMac can receive commands from several of its own components, from the internet, or from a keyboard, mouse, or other control device. It can be used to play games, edit documents, and a variety of other tasks. It also comes in quite a few oddly named colors like “Snow,” “Indigo,” or “Graphite.”

[Apple: <http://www.apple.com/imac/g3/>]

- HAL9000

Developed ca. 1991 (sort of) by Arthur C. Clarke (sort of)

An advanced device capable of performing a variety of tasks and interacting with its human users (companions?). The HAL9000 communicates by voice and can control a auxiliary devices such as the pod bay doors on a spaceship. It (he?) has an unfortunate tendency towards obsessing over minor details or inconsistencies in the instructions given it, however. In the events described in Arthur C. Clarke’s “2001: A Space Odyssey,” HAL’s tendency toward obsessive literalism led to the unfortunate death of most of its spaceship’s human crew (oops).

- Microsoft Xbox

Developed in 2001 by Microsoft Corp.

The Xbox is a gaming system: it reads commands from a DVD and executes the commands along with responding to input from control devices to display games on an attached monitor. The Xbox can be connected to the internet through an Ethernet port, contains a hard drive to store information, and runs on a 733MHz Intel processor. The Xbox, however, has never controlled a mission to space.

[Microsoft: <http://www.microsoft.com/xbox/>]

- AmigoBot

Developed late 20th century by ActivMedia Robotics.

The AmigoBot is a small, wireless, mobile robot. It weighs about 10 pounds (with batteries) and can run for approximately 2 hours before charging. It is equipped with 10 sonar sensors (devices that send out a sound signal and then time how long it takes the signal to return) and sensors that measure the movement of its wheels. It can also be equipped with a “hand” to manipulate objects in the world. It receives commands directly from a joystick, wirelessly from a computer, or from a computer resting on top of the robot wired in directly.

[ActivMedia Robotics: <http://www.amigobot.com/amigo/techspecs.html>]

- Marionette

Popularized mid-19th century by Thomas Holden.

A marionette is a puppet controlled from above by a set of strings. A single, basic marionette has about nine strings, but more complex puppets can have dozens. Each string controls the position of some part of the puppet, and coordinated movement of the strings (by tilting a fixed framework) can elicit a variety of compelling motions. “Plucking” individual strings can create other complex movements. Marionettes range widely in size (see *Being John Malkovich*).

[Encyclopedia Britannica: <http://www.britannica.com/eb/article?query=marionette&eu=117364&tocid=28722\#28722.toc>]

- Timed Pop-up Toaster

Developed in 1919 by Charles Strite

Using a system of springs, heating element, and timer, the pop-up toaster can toast bread — caramelizing surface sugars to a golden-brown, crunchy consistency — without the need for human supervision.

[Toaster Museum: <http://www.toaster.org/museumintro.html>]

- VCR

First commercialized for home use by Sony in 1969.

A VCR (Video Cassette Recorder) is a device that transcribes video signals (such as television) onto a magnetic tape. The video signal can then be replayed from the tape. Some modern VCRs can quickly advance or rewind their tapes, leave marks on the tapes to which they can return, automatically scan past commercials

in recorded television broadcasts, or automatically record television broadcasts at preset times and dates.

[Encyclopedia Britannica: <http://www.britannica.com/eb/article?eu=77264&tocid=0&query=vcr>]

- Domestic Cat

Domesticated ca. 2000 B.C. in Egypt.

A four-legged creature with a tail, covered in fur and possessed of retractable claws. Cats pretty much do whatever they want. Physically, the domestic cat weighs between about 5 and 20 pounds.

[Natural History Museum of LA County: <http://www.lam.mus.ca.us/cats/home.html>]

- The human brain

Year of development in dispute (ca. 100,000 - 200,000 B.C. according to “Out of Africa” evolutionary theory). Developer also in dispute.

The human brain is a large organ, one of which is situated within the skull of each modern human. Capable of a wide range of tasks from mathematical calculations to identifying Jelly Bean flavors, the human brain coordinates most functions of its associated human. The human brain receives sensory information from a variety of devices (eyes, ears, toes, etc.) and also controls a variety of devices capable of acting in the world (hands, voice box, toes, etc.). The structure of the human brain consists of a massive network of interconnected neurons, a specialized kind of cell, interacting through chemical and electric processes. The human brain receives power from edible objects in the world around it like Jelly Beans. Physically, the human brain weighs in at about three pounds.

- Microsoft Windows

Developed ca. 1985 by Microsoft Corp.

Software that regulates the control of a computing device by programs. Windows handles the operation of the machine’s physical devices, presents an interface for the user to the machine’s storage devices, supports other programs’ interfaces, and a wide variety of other functions.

- Digital watch

First developed in 1973 by Seiko.

A digital watch is a timekeeping device. Unlike an analog watch, the digital watch has no hands. Instead, it uses an LCD (Liquid Crystal Display) to display the time as numerical digits. Each watch has one or more microchips inside to control the LCD. Some can tell time in many different time zones or record “lap times.” The ever-fashionable “calculator watch” can also perform basic calculations. A few can even record calendar appointments and give reminders at appropriate times, store phone numbers, etc.