W1: THE HUMAN THE COMPUTER THE INTERFACE

EARLY BEGINNINGS

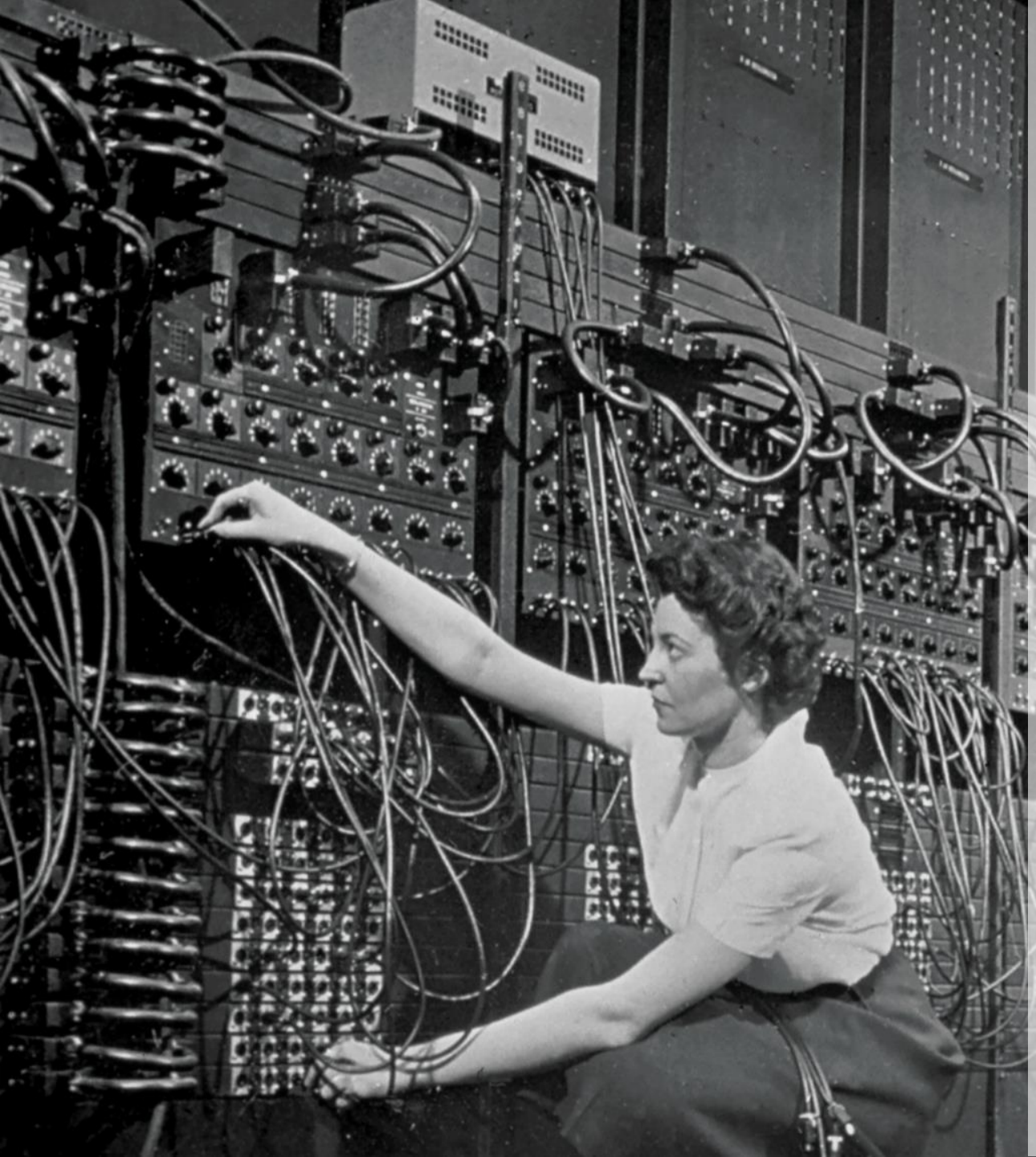
COMPUTING IN 1945

HARVARD MARK 1

The Harvard Mark I was a large computer designed to assist in differential equation numerical computation. It was developed at Harvard University by Howard Aiken and was funded and installed by IBM. The computer (or the IBM Automatic Sequence Controlled Calculator (ASCC)) was known as the Harvard Mark I.

The Harvard Mark 1 is a room-sized, relay-based calculator. The machine had a fifty-five feet long, eight feet in high and 5 tons in weight.

Bellis, Mary. “Who Invented the Mark I Computer?” ThoughtCo, www.thoughtco.com/howard-aiken-and-grace-hopper-4078389.



E. N. I. A. C.

An all-electronic calculating machine was proposed by physicist John Mauchly in 1942. Meanwhile, the U.S. Army needed complicated wartime ballistics tables to be measured.

ENIAC (Electronic Numerical Integrator And Computer), designed between 1943 and 1945, was the first large-scale computer to operate without being slowed by any mechanical components at electronic level.

"r/OldSchoolCool - ENIAC, the First Electronic General-Purpose Computer That Was Turing-Complete Was a 30-Ton Behemoth Covering 1,800 Sq Ft, Used 20,000 Vacuum Tubes, 70,000 Resistors, 10,000 Capacitors, 1,500 Relays, 6,000 Manual Switches, Consumed 150 KW of Electricity, and Required Six Women Programmers (c. 1940s)." Reddit, www.reddit.com/r/OldSchoolCool/comments/iotlf3/eniac_the_first_electronic_generalpurpose/.

P.D.P -1

The PDP-1 (Programmed Data Processor-1) computer build in 1959.
It was the first consumer computer that concentrated on user interaction instead of the productive use of computer process.

The first computer game is generally assumed to be the game Spacewar!, developed in 1962 at MIT (Stephen Russell a.o.). Spacewar originally ran on a PDP-1 computer the size of a large car.

"Alan Kotok, Steve Russell, Martin 'Shag' Graetz Play Spacewar! at the Computer Museum, Boston." Alan Kotok, Steve Russell, Martin "Shag" Graetz Play Spacewar! at the Computer Museum, Boston | PDP-1 Restoration Project | Computer History Museum, www.computerhistory.org/pdp-1/6a210c1a96e2ed4f4ffa5492d5128d83/.

GRACE MURRAY HOPPER

The American computer scientist and rear admiral of the United States Navy was Grace Brewster Murray Hopper.

She was one of the first Harvard Mark I computer programmers and a computer programming pioneer who invented one of the first links.

Jasper, Marykate, and By. “Google Is Working on a Movie About Grace Hopper.” The Mary Sue, 28 Feb. 2018, www.themarysue.com/google-is-working-on-a-movie-about-grace-hopper/.

WHAT INTERACTION DID YOU SEE

- MECHANICAL
- POOR FEEDBACK
- SPECIALIST USE
- PROCESS CONTROL
- CALCULATIONS
- NO INTENTION TO ADDRESS THE MASS MARKET

DEVELOPMENT

- EXTREMELY DIFFICULT TO USE
- LARGE AND EXPENSIVE
- “PEOPLE TIME” (LABOUR)
- USED BY SPECIALISTS
- NO KNOWLEDGE ABOUT HOW TO MAKE USE EASIER

WHAT IS HCI

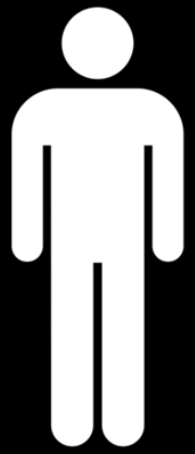
Human-computer interaction (HCI) is a collaborative area of research that focuses on computer technology development and, in particular, human (user) interaction with computers.

HCI has since grown to include almost all aspects of information technology design, although it was originally concerned with computers.

beginnings
Computing in 1945

HUMAN COMPUTER INTERACTION -DEFINITION

COGNITION



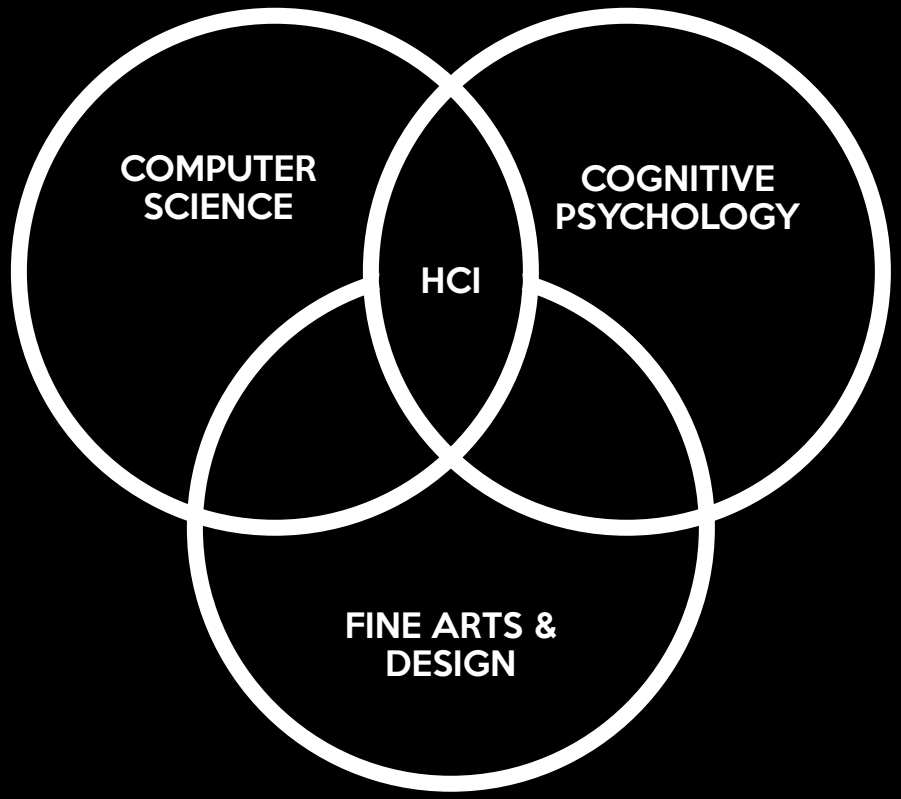
PROCESSING

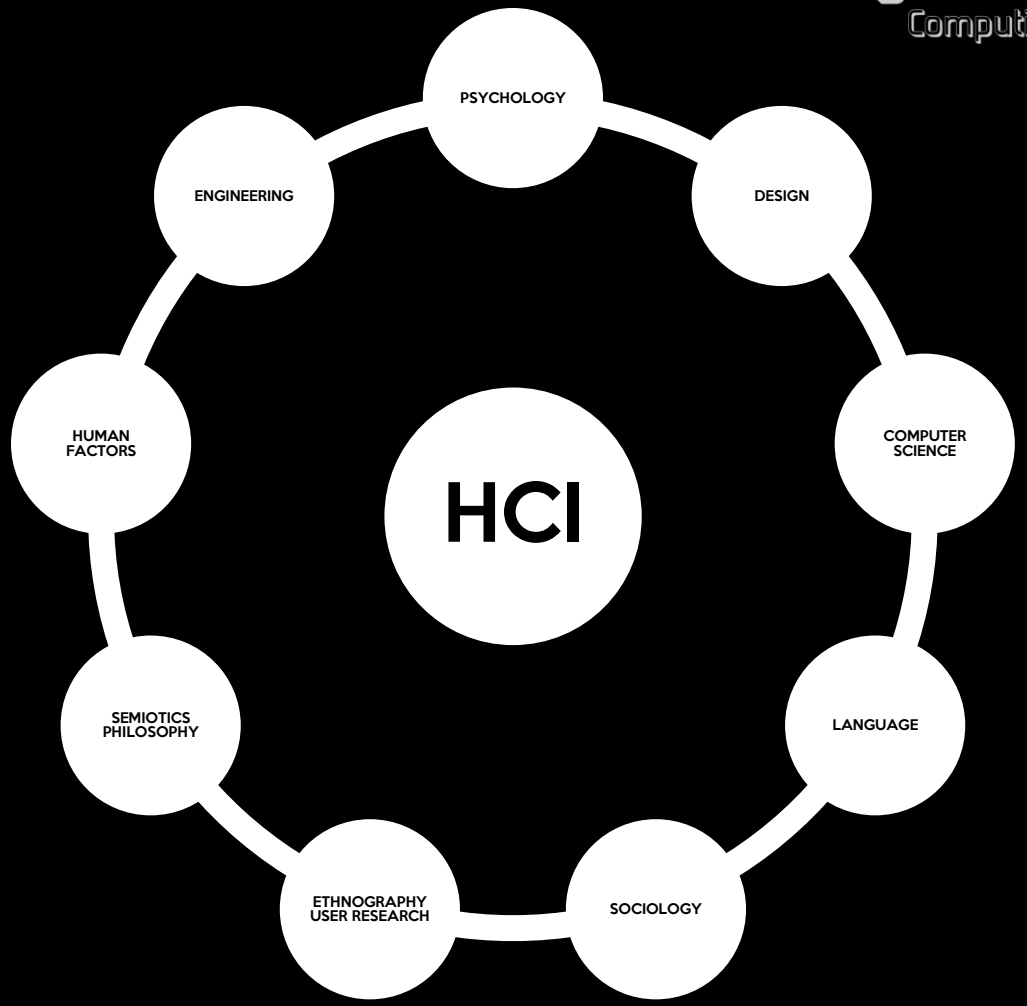
ANALOG I/O

INTERFACE

DIGITAL I/O

HUMAN **INTERACTION** **COMPUTER**





DISCIPLINES-CONTRIBUTING TO HCI

PRINCIPLE OF HCI (USABILITY)

USEFUL

- Accomplish what is required (functional, does things)

USABLE

- Do it easily and naturally without error (does the right things)

USED

- Make people want to use it (be attractive, acceptable to org.)

THE HUMAN

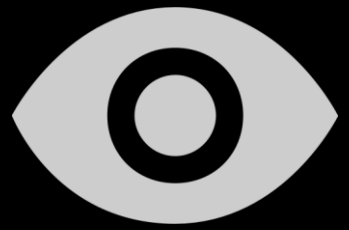
A person's interaction with the outside world occurs through information being received and sent: input and output.

In an interaction with a computer the user receives information that is output by the computer, and responds by providing input to the computer – the user's output becomes the computer's input and vice versa.

WHY DO WE NEED TO UNDERSTAND HUMAN IN HCI

- Humans are limited in their capacity to process information.
- This has important implications for design.
- Interacting with technology is cognitive
- Human Information Processing is referred to as cognition

INPUT—OUTPUT CHANNELS



Human vision is a highly complex activity with a range of physical and perceptual limitations, yet it is the primary source of information for the average person.

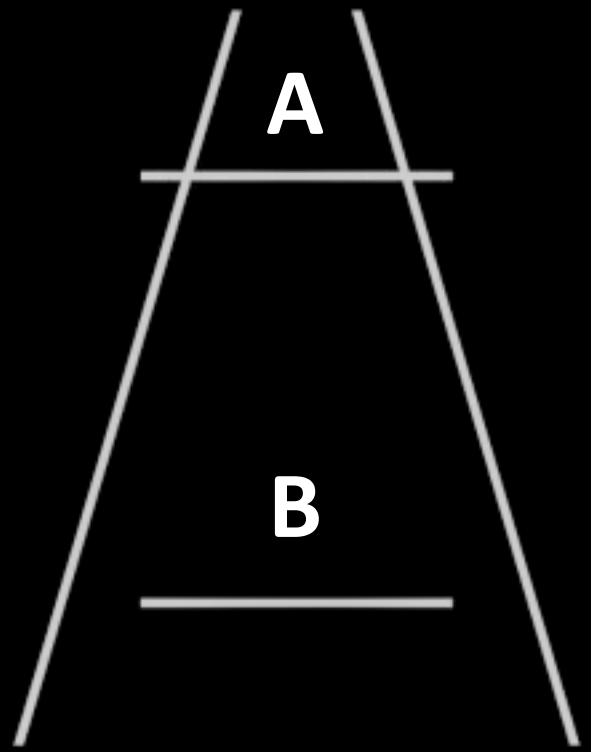
The third and last of the senses that we will consider is touch or haptic perception. Although this sense is often viewed as less important than sight or hearing, imagine life without it.

The sense of hearing is often considered secondary to sight, but we tend to underestimate the amount of information that we receive through our ears.

Before leaving this section on the human's input–output channels, we need to consider motor control and how the way we move affects our interaction with computers.

VISION · HEARING · TOUCH · MOVEMENT

WHAT DO YOU SEE?

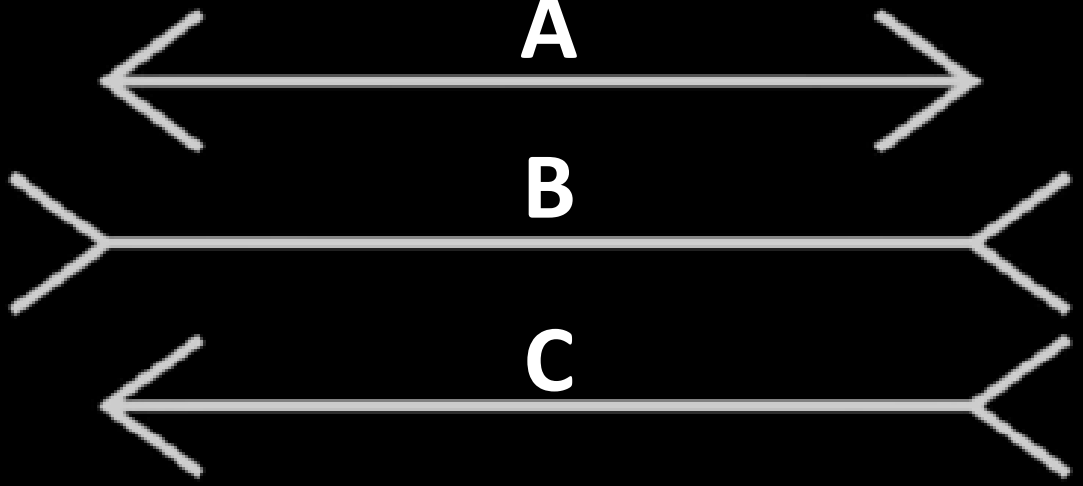


The Ponzo illusion is an optical illusion that was first demonstrated by the Italian psychologist Mario Ponzo (1882-1960) in 1913.

He suggested that the human mind judges an object's size based on its background.
He showed this by drawing two identical lines across a pair of converging lines, similar to railway tracks.

https://psychology.wikia.org/

WHAT DO YOU SEE?



The Muller-Lyer illusion is a well-known optical illusion in which two lines of the same length appear to be of different lengths. The illusion was first created by a German psychologist named Franz Carl Muller-Lyer in 1889.

Muller-Lyer illusion is that our brains perceive the depths of the two shafts based upon depth cues. When the fins are pointing in toward the shaft of the line, we perceive it as sloping away much like the corner of a building.

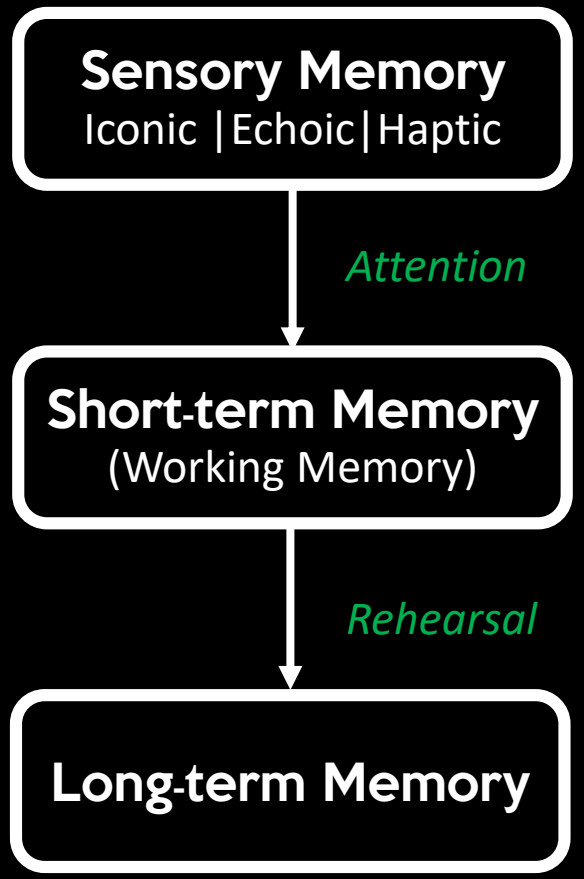
https://www.verywellmind.com/

WHAT IS HUMAN MEMORY?

Memory refers to the processes that are used to acquire, store, retain, and later retrieve information.

Information is stored in memory:

- Sensory Memory
- Short-term (Working) Memory
- Long-term Memory.



INFORMATION IS STORED IN MEMORY

SENSORY MEMORY

The sensory memories act as buffers for stimuli received through the senses.

A sensory memory exists for each sensory channel: *iconic* memory for visual stimuli, *echoic* memory for aural stimuli and *haptic* memory for touch.

These memories are constantly overwritten by new information coming in on these channels.

SHORT-TERM MEMORY

Short-term memory or working memory acts as a *'scratch-pad'* for temporary recall of information. It is used to store information which is only required fleetingly.

Short-term memory can be accessed rapidly, in the order of 70 ms. However, it also decays rapidly, meaning that information can only be held there temporarily, in the order of 200 ms.

LONG-TERM MEMORY

If short-term memory is our working memory or 'scratch-pad', long-term memory is our *main resource*.

Here we store factual information, experiential knowledge, procedural rules of behavior – in fact, everything that we 'know'.

Unlike working memory there is little decay: long-term recall after minutes is the same as that after hours or days.

Attention is the concentration of the mind on one out of a number of competing stimuli or thoughts. It is clear that we are able to focus our attention selectively, choosing to attend to one thing rather than another. This is due to the limited capacity sensory and mental processes

A rehearsal strategy uses repeated practice of information to learn it. When a student is presented with specific information to be learned, such as a list, often he will attempt to memorize the information by repeating it over and over.

THE COMPUTER

In order to understand how humans interact with computers, we need to have an understanding of both parties in the interaction. The previous chapter explored aspects of human capabilities and behavior of which we need to be aware in the context of human–computer interaction;

This chapter considers the computer and associated input–output devices and investigates how the technology influences the nature of the interaction and style of the interface.

A COMPUTER SYSTEM COMPRISES VARIOUS ELEMENTS, EACH OF WHICH AFFECTS THE USER OF THE SYSTEM.

INPUT/OUTPUT · INTERACTION · VIRTUAL REALITY · MEMORY · PROCESSOR

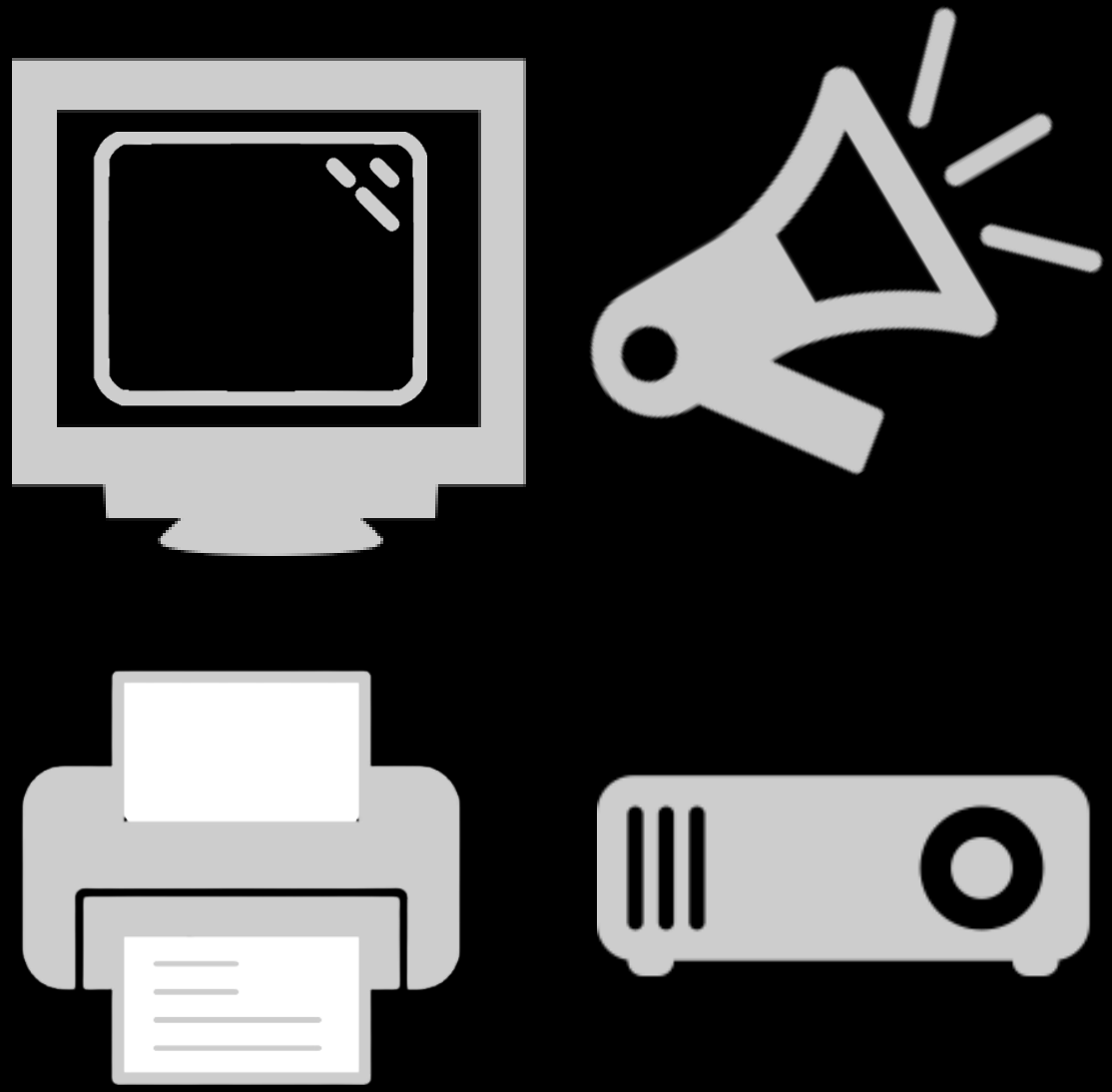
INPUT DEVICE

Input devices are the hardware devices which take information from user of the computer system, convert it into electrical signals and transmit it to the processor.

OUTPUT DEVICE

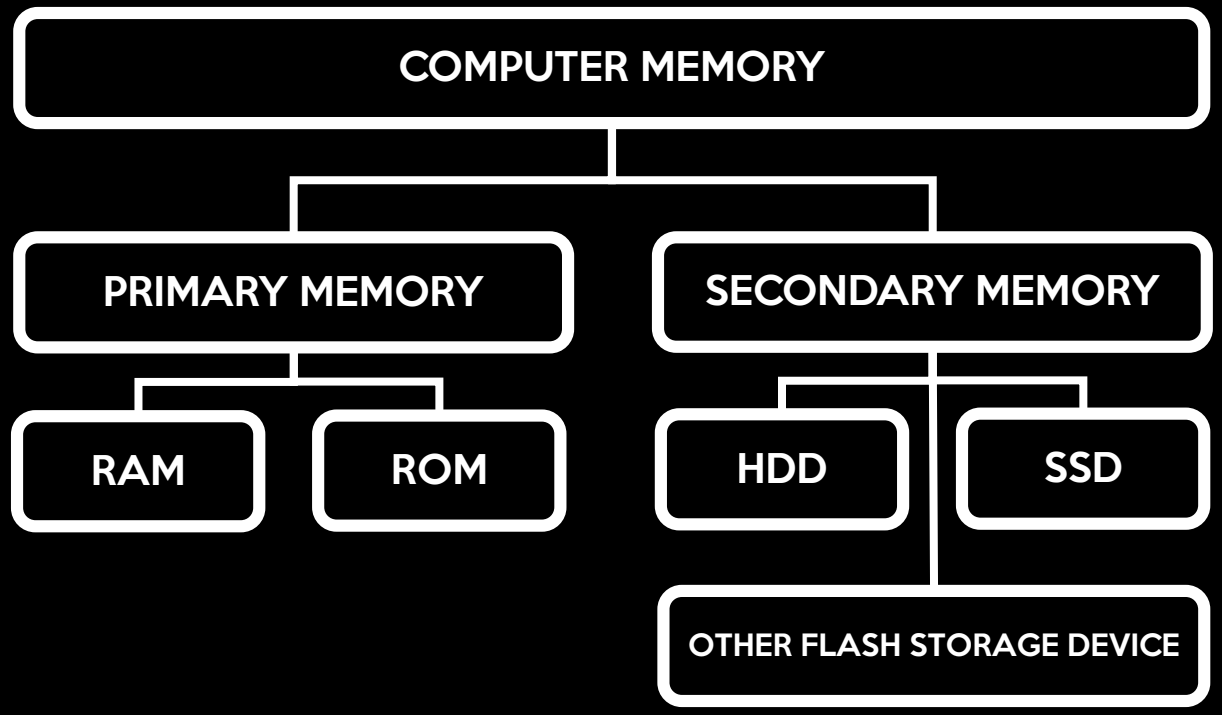
It is used to present information to the user from a computer.

Output devices take data from the computer system and convert it to a form that can be read by humans.



COMPUTER MEMORY

Computer memory is a generic term for all of the different types of data storage technology that a computer may use, including RAM, ROM, and flash memory.



SHORT TERM MEMORY

RANDOM ACCESS MEMORY

Random Access Memory is your system's short-term data storage; it stores the information your computer is actively using so that it can be accessed quickly.

The more programs your system is running, the more memory you'll need.

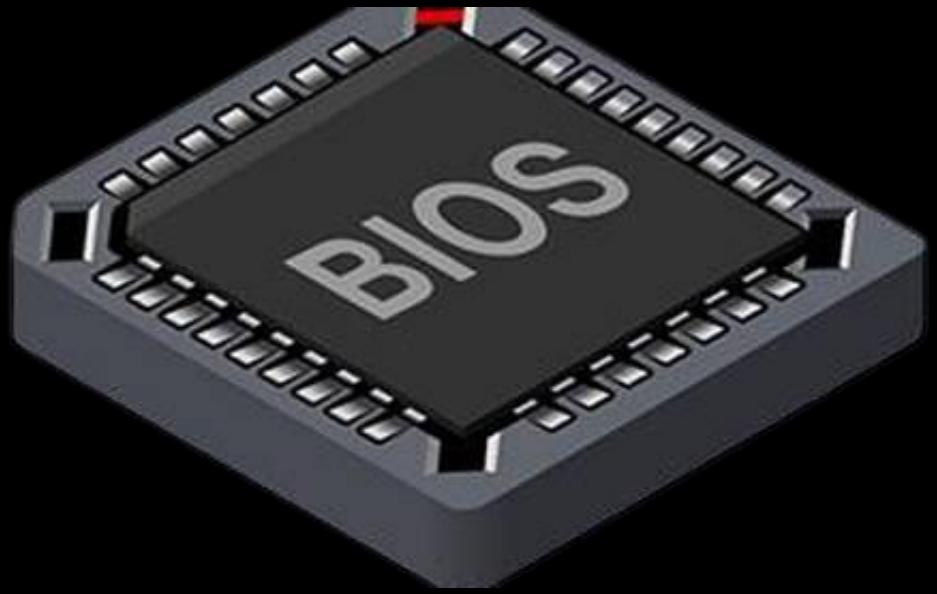
LONG TERM MEMORY

ROM (READ-ONLY MEMORY).

It refers to computer memory chips containing permanent or semi-permanent data.

Used to store the start-up instructions for a computer, also known as the firmware.

ROM is non-volatile; even after you turn off your computer, the contents of ROM will remain. ROM is mostly used for firmware updates.



LONG TERM MEMORY

HARD DISK DRIVE (HDD)

Hard disk drive, is a magnetic storage device that is installed inside the computer.

SOLID-STATE DRIVE (SSD)

Uses integrated circuit assemblies to store data persistently, typically using flash memory,

OPTICAL DRIVE

is a storage device that uses lasers to read data on the optical media.

READ ONLY MEMORY (ROM)

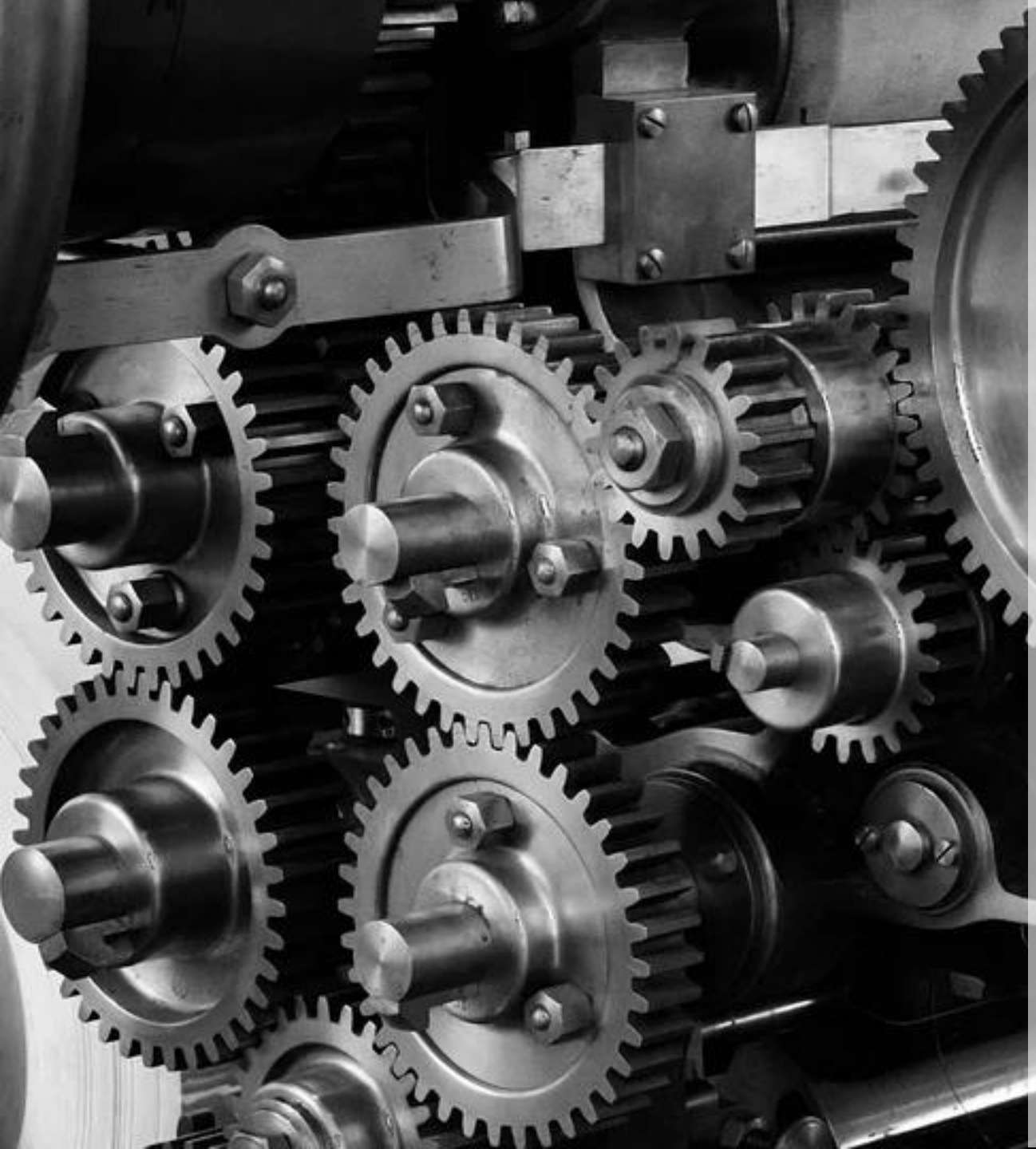
Read only memory media that is pre-recorded.

RECORDABLE (R)

Recordable media that can be recorded once.

REWRITABLE (RW)

Rewritable media that can be recorded, erased, and recorded



THE INTERACTION

Interaction models help us to understand what is going on in the interaction between user and system.

They address the translations between what the user wants and what the system does.

INTERACTION PARADIGMS

1950'S	BATCH PROCESSING
1960'S	TIMESHARING
1970'S	NETWORKING (1972 1ST EMAIL)
1980'S	GRAPHICAL DISPLAY
	MICROPROCESSOR
1990'S	WWW
1995'S	GRID/CLOUDS COMPUTING
THIS ERA ...	HUMAN ROBOT INTERACTION
	TABLET/TABLE TOP COMPUTING

TYPES OF USER INTERFACES

COMMAND LINE INTERFACE

- Expressing instructions to the computer directly
- Use function keys, single characters, short abbreviations, whole words, or a combination

- Suitable for repetitive tasks
- Better for expert users than novices
- Offers direct access to system functionality
- Command abbreviations should be meaningful!

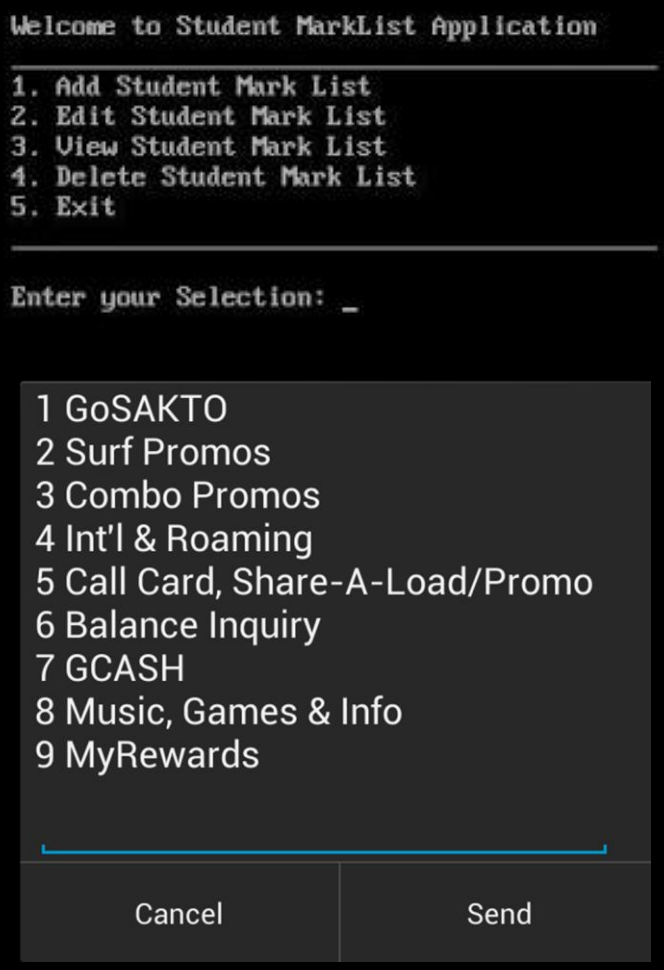
```
[root@localhost ~]# ping -q fa.wikipedia.org
PING text.pmtpa.wikimedia.org (208.80.152.2) 56(84) bytes of data.
^C
--- text.pmtpa.wikimedia.org ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 540.528/540.528/540.528/0.000 ms
[root@localhost ~]# pwd
/root
[root@localhost ~]# cd /var
[root@localhost var]# ls -la
total 72
drwxr-xr-x. 18 root root 4096 Jul 30 22:43 .
drwxr-xr-x. 23 root root 4096 Sep 14 20:42 ..
drwxr-xr-x.  2 root root 4096 May 14 00:15 account
drwxr-xr-x. 11 root root 4096 Jul 31 22:26 cache
drwxr-xr-x.  3 root root 4096 May 18 16:03 db
drwxr-xr-x.  3 root root 4096 May 18 16:03 empty
drwxr-xr-x.  2 root root 4096 May 18 16:03 games
drwxrwx--T.  2 root gdm  4096 Jun  2 18:39 gdm
drwxr-xr-x. 38 root root 4096 May 18 16:03 lib
drwxr-xr-x.  2 root root 4096 May 18 16:03 local
lrwxrwxrwx.  1 root root   11 May 14 00:12 lock -> ../run/lock
drwxr-xr-x. 14 root root 4096 Sep 14 20:42 log
lrwxrwxrwx.  1 root root   10 Jul 30 22:43 mail -> spool/mail
drwxr-xr-x.  2 root root 4096 May 18 16:03 nis
drwxr-xr-x.  2 root root 4096 May 18 16:03 opt
drwxr-xr-x.  2 root root 4096 May 18 16:03 preserve
drwxr-xr-x.  2 root root 4096 Jul  1 22:11 report
lrwxrwxrwx.  1 root root    6 May 14 00:12 run -> ../run
drwxr-xr-x. 14 root root 4096 May 18 16:03 spool
drwxrwxrwt.  4 root root 4096 Sep 12 23:50 tmp
drwxr-xr-x.  2 root root 4096 May 18 16:03 yp
[root@localhost var]# yum search wiki
Loaded plugins: langpacks, presto, refresh-packagekit, remove-with-leaves
rpmfusion-free-updates                                                  | 2.7 kB     00:00
rpmfusion-free-updates/primary_db                                       | 206 kB     00:04
rpmfusion-nonfree-updates                                               | 2.7 kB     00:00
updates/metalink                                                        | 5.9 kB     00:00
updates                                                                 | 4.7 kB     00:00
updates/primary_db                      73% [=====================        ]  62 kB/s | 2.6 MB     00:15 ETA
```

TYPES OF USER INTERFACES

MENU INTERFACE

- Set of options displayed on the screen
  - less recall - easier to use
  - rely on recognition so names should be meaningful

- Selection by:
  - numbers, letters, arrow keys, mouse combination
- Often (frequent) options hierarchically grouped
- Restricted form of full WIMP system



TYPES OF USER INTERFACES

NATURAL LANGUAGE

- Familiar to user
- Speech recognition or typed natural language

- Problems
  - vague · ambiguous · hard to do well!
- Solutions
  - try to understand a subset
  - pick on key words

SIRI 2011 · CORTANA & ALEXA 2014 · GOOGLE 2016 · BIXBY 2017

TYPES OF USER INTERFACES

QUERY INTERFACES

- Question/answer interfaces
  - user led through interaction via series of questions
  - suitable for novice users but restricted functionality
  - often used in information systems
- Query languages (e.g. SQL)
  - used to retrieve information from database
  - requires understanding of database structure and language
  - syntax, hence requires some expertise

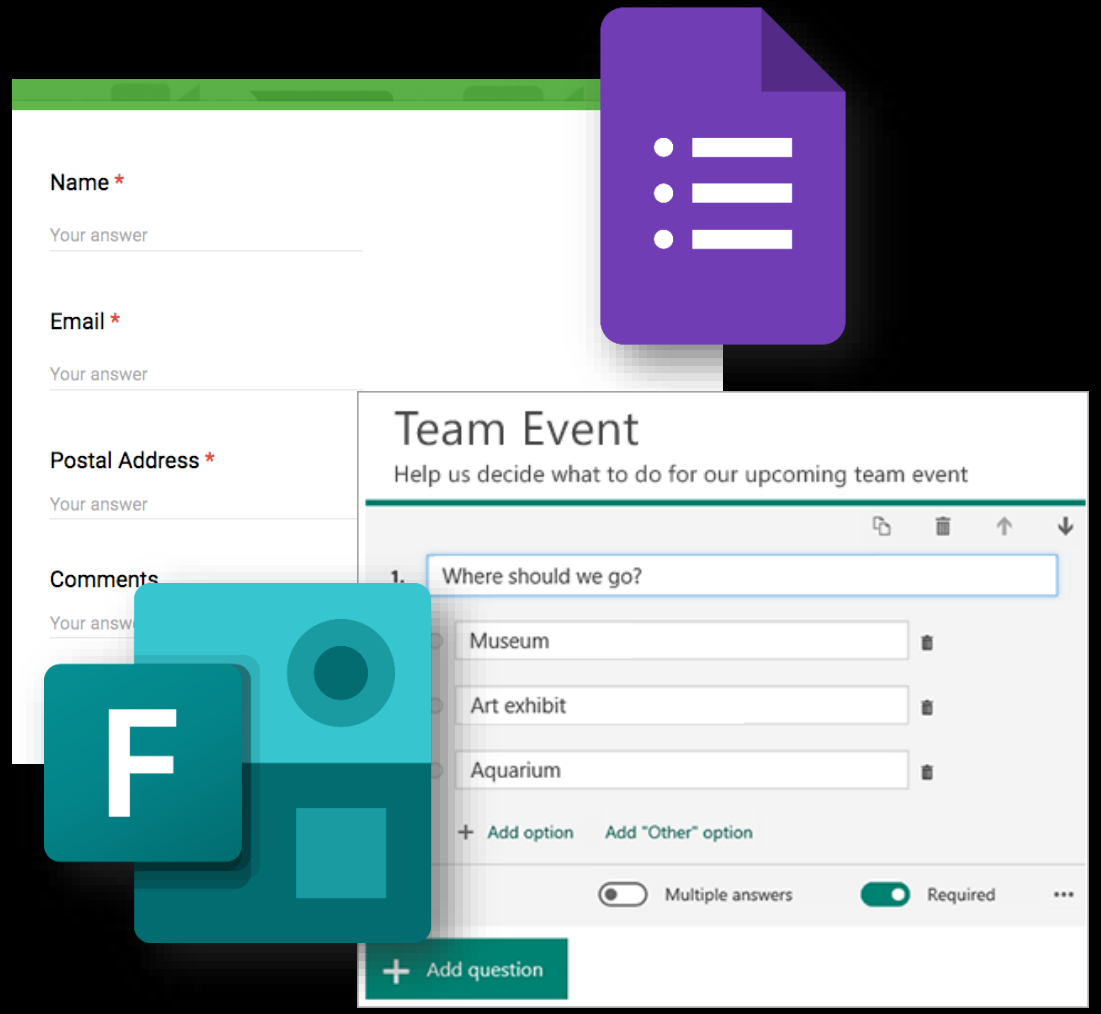
simple_offset_filter.sql - not connected

```
1  USE [AdventureWorks2012]
2  GO
3  SELECT
4      [SalesOrderID]
5      ,[SalesOrderDetailID]
6      ,[OrderQty]
7      ,[ProductID]
8      ,[UnitPrice]
9      ,[LineTotal]
10     ,[rowguid]
11     ,[ModifiedDate]
12 FROM [Sales].[SalesOrderDetail]
13 ORDER BY
14     [SalesOrderDetailID] DESC
15 OFFSET 0 ROWS FETCH NEXT 10 ROWS ONLY;
16 GO
```

TYPES OF USER INTERFACES

FORM-FILLS INTERFACE

- Primarily for data entry or data retrieval
- Screen like paper form.
- Data put in relevant place
- Requires
  - good design
  - obvious correction facilities

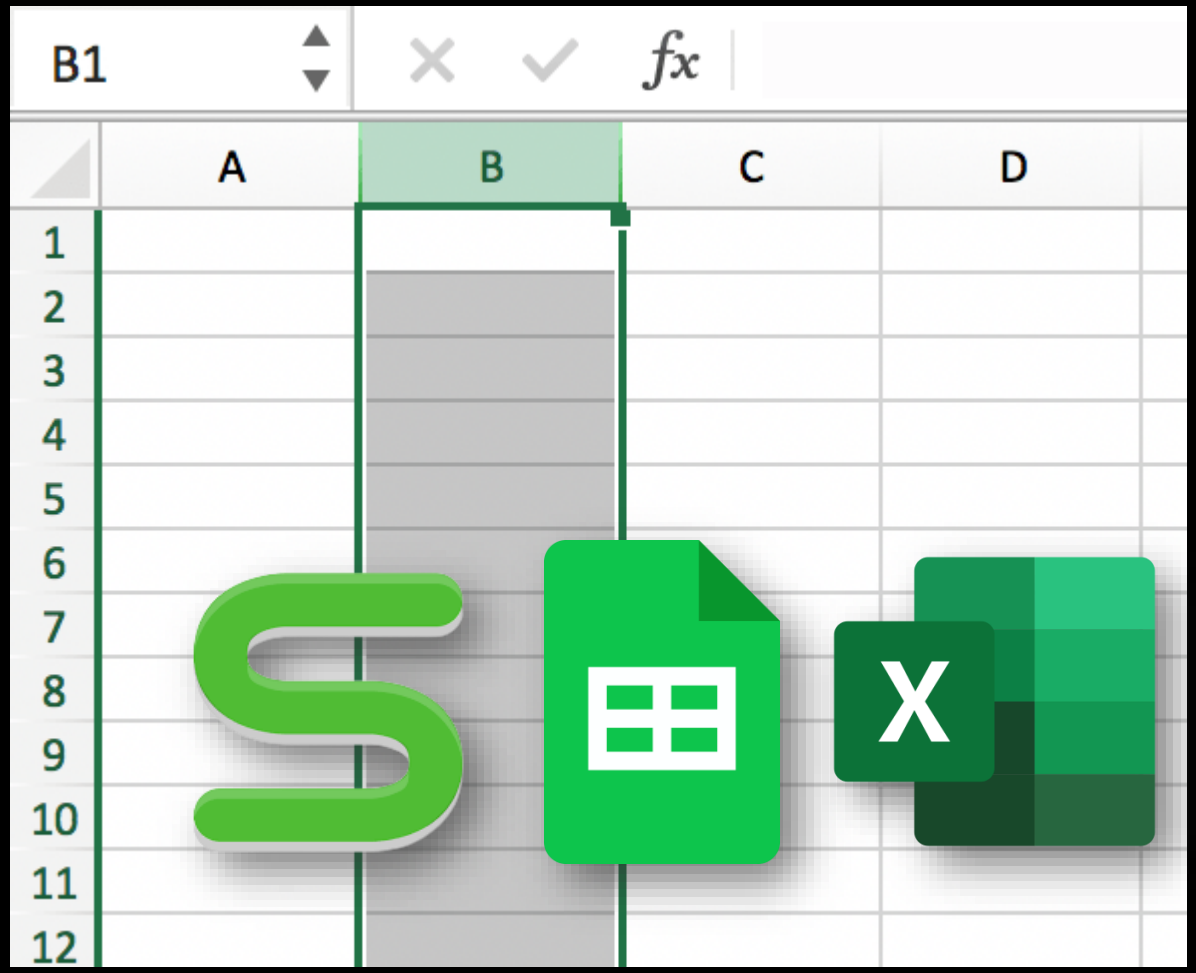


TYPES OF USER INTERFACES

SPREADSHEETS INTERFACE

- First spreadsheet VISICALC,
- followed by Lotus 1-2-3

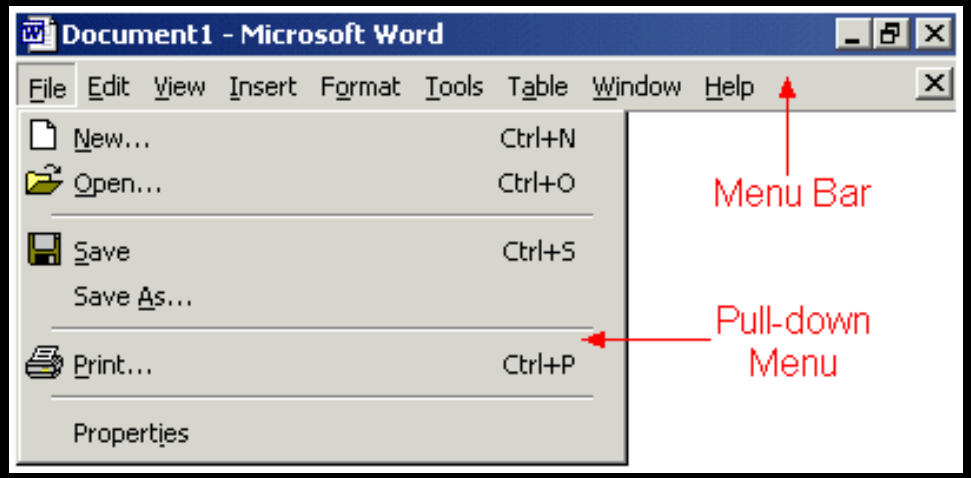
- MS Excel most common today
- Sophisticated variation of form-filling.
  - grid of cells contain a value or a formula
  - formula can involve values of other cells
    - e.g. sum of all cells in this column
  - user can enter and alter data
  - spreadsheet maintains consistency



TYPES OF USER INTERFACES

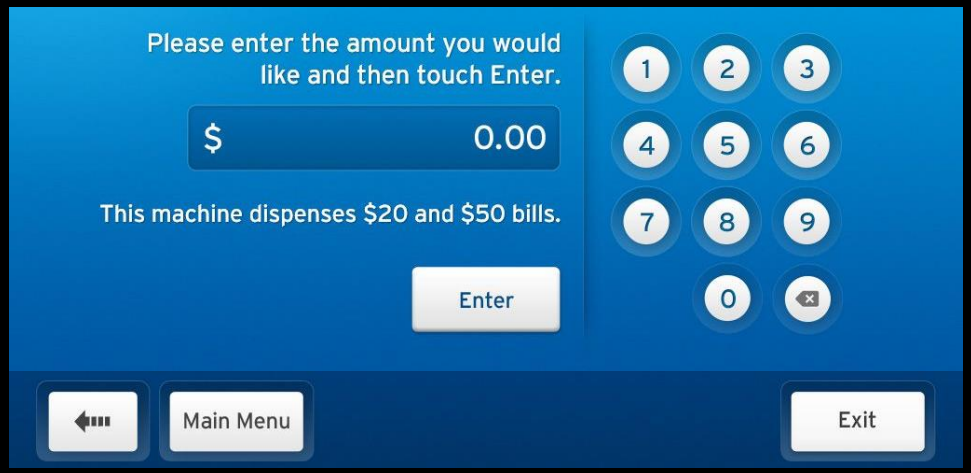
WIMP INTERFACE

- Windows, Icon, Mice, and Pointer
- or windows, icons, mice, and pull-down menus!
- default style for majority of interactive computer systems, especially PCs and desktop machines



POINT AND CLICK INTERFACE

- Used in ..
  - Multimedia, web browsers and hypertext
  - Minimal typing
  - Use in ATM's



TYPES OF USER INTERFACES

THREE DIMENSIONAL INTERFACES

- Virtual reality
- ‘ordinary’ window systems
  - highlighting visual
- 3D workspaces
  - use for extra virtual space
  - light and occlusion give depth
  - distance effects