Future of pointing devices

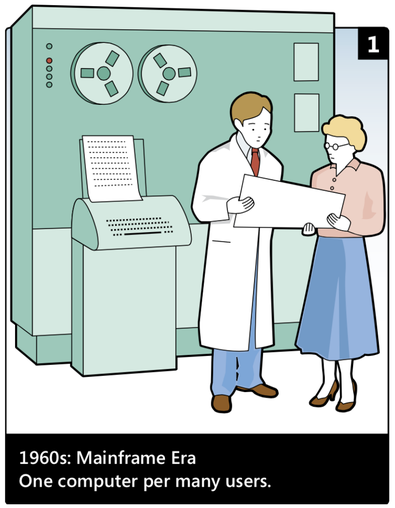
Bhaumik | Marathon | Tinjo

DDE-’13

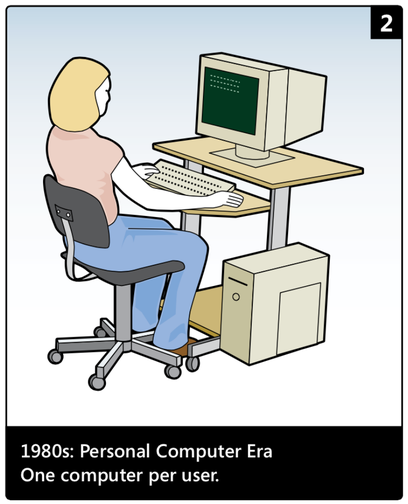
The Fact

The human hand is incredible, yet we boil this input down to 2-D location on today's touch devices.

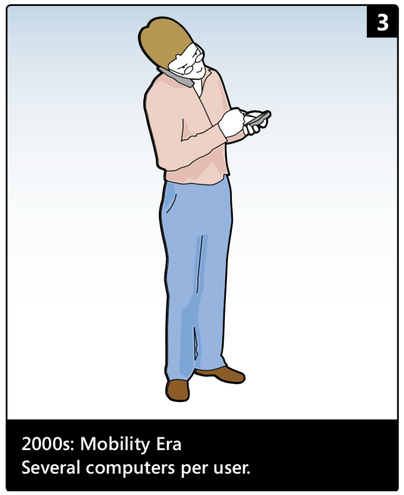
Multi-touch	number of fingers on the screen
Rich-touch	Digitize the complex dimensions of input our fingers and hands can express—things like **sheer force**, **pressure**, **grasp pose**, **part of finger** and so on.



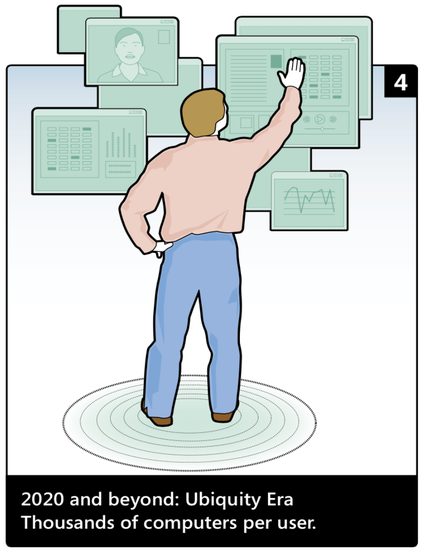
1960s: Mainframe Era
One computer per many users.



1980s: Personal Computer Era
One computer per user.

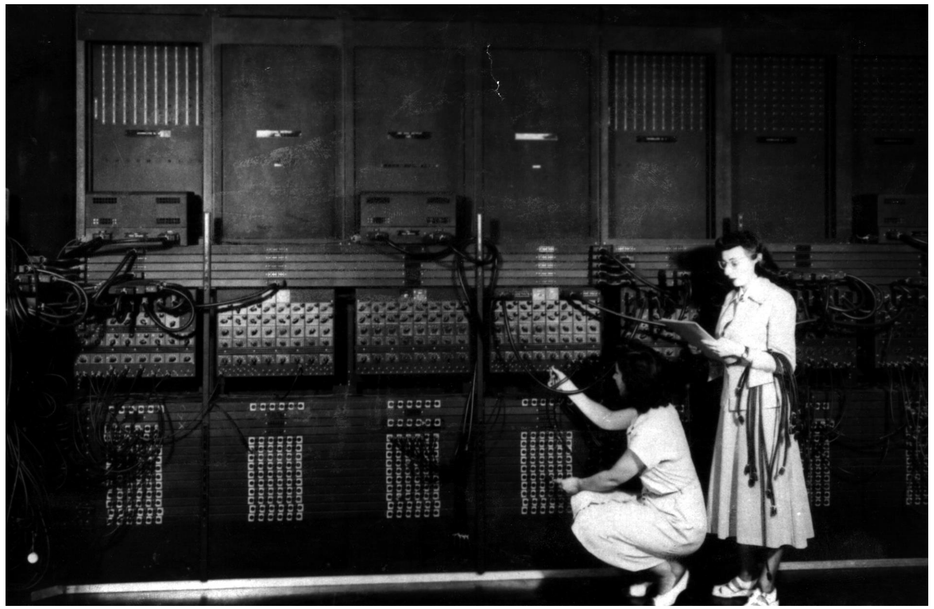


2000s: Mobility Era
Several computers per user.



2020 and beyond: Ubiquity Era
Thousands of computers per user.

History of Interaction

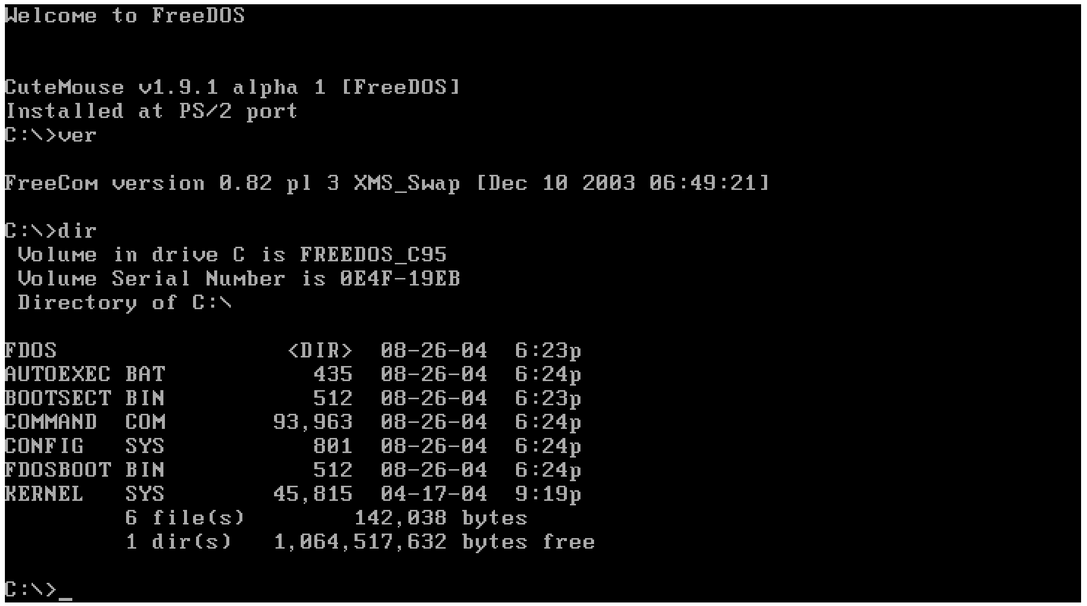


Computer Interfaces (CI)

The first computers were **not interactive**.

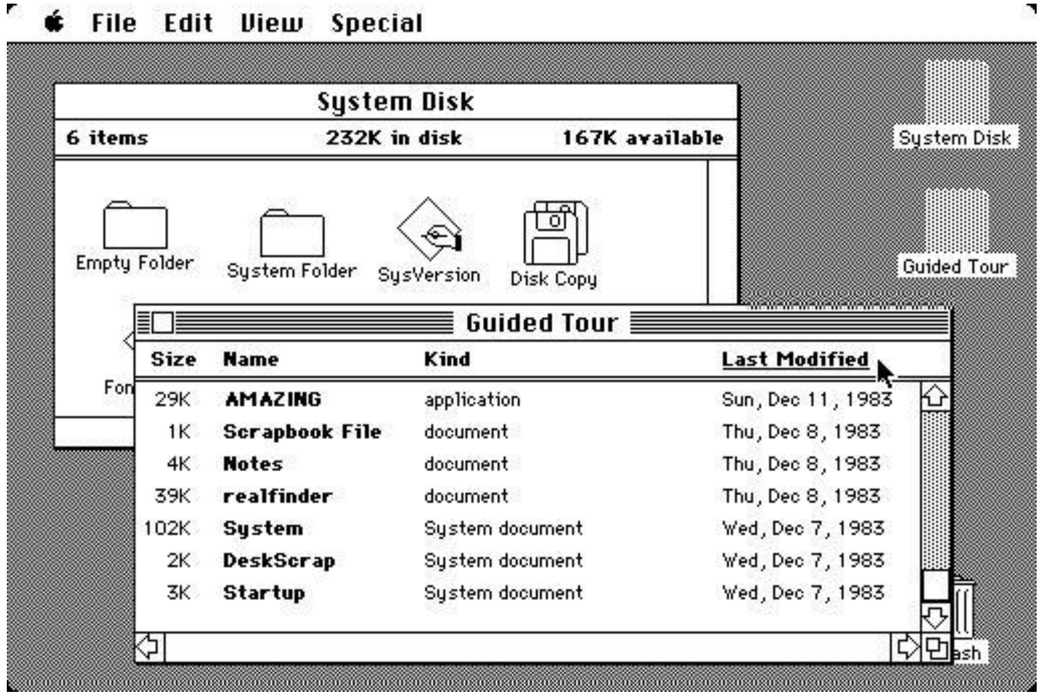
The result of the logical operation, the output, came usually in **print**.

The whole **interaction could last from hours to days**, thus it was **not real time.**



Command Line Interfaces (CLI)

A Command Line Interface accepts written **text** as input for the application running on the computer.



Graphical User Interfaces (GUI)

A GUI makes use of **visual elements to provoke behavior** from the user, respond to that behavior and provide information.

Touch User Interfaces (TUI)

A TUI has as a main purpose to facilitate the **usage of a touch screen** by supporting a **model of interaction** based on the **fingers** and the **hand**.

Touch interfaces support actions like **tapping**, **double tapping**, **swiping**, **tap** and **hold**, **multi-touching** and depending on the specifications of a particular device, more interactions like tilting and rotating. All of the above are based on direct manipulation of objects.

Natural User Interfaces (NUI)

The NUI is based on design of interactions that **feel natural to the human.** The aim of such a design model is to make the interface behave in a way that **feels real** and **not iconic**. The most notable feature of a NUI is the **support of gestures.**

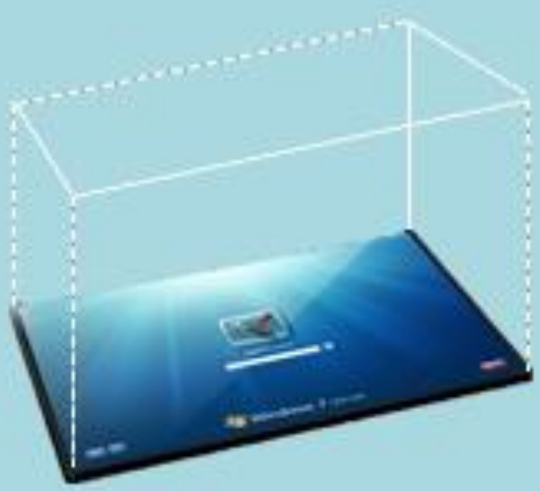
Another important aspect of natural interfaces is the ability to understand **speech**. Like with gestures, a word, phrase or dictation can be identified and invoke a response from the application.

Context- awareness refers to the **ability of the interface** to adapt to different environmental conditions or to the subtext of communication received by the user.

But Still there is a downside

Drawbacks to gesture controls is the learning curve.
Because there is so much potential and room for interpretation, **gestures can be confusing**, especially when **users switch between devices with contrasting controls**.

Fact : The more we rely on gestures over visible buttons, the greater the possibility for confusion.



Concept – Continuous Interaction Space

Observations

Most interactions fall into one of two modalities:

1) direct touch and multi-touch (by hand and by tangibles) **directly on the surface**, and

2) hand gestures above the surface.

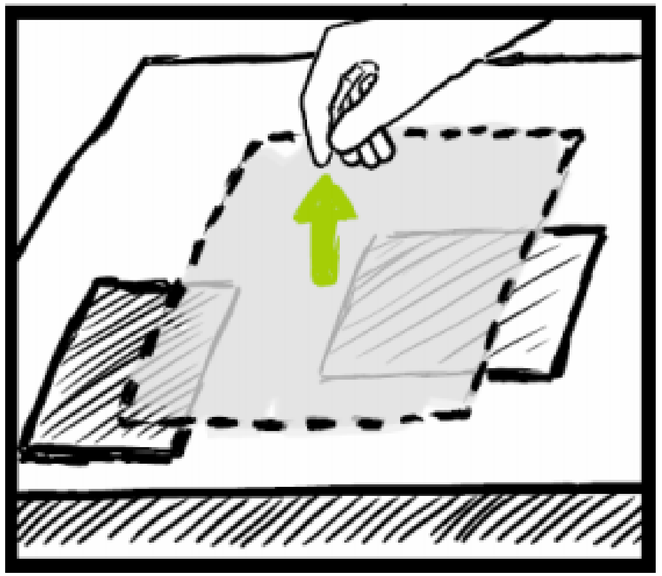
The limitation is that these two modalities ignore the rich interaction space between them.

“ We wanted to move beyond this limitation, contribute a unification of these discrete interaction modalities called the continuous interaction space. ”

Interactions

Lifting Gestures to Reveal Objects

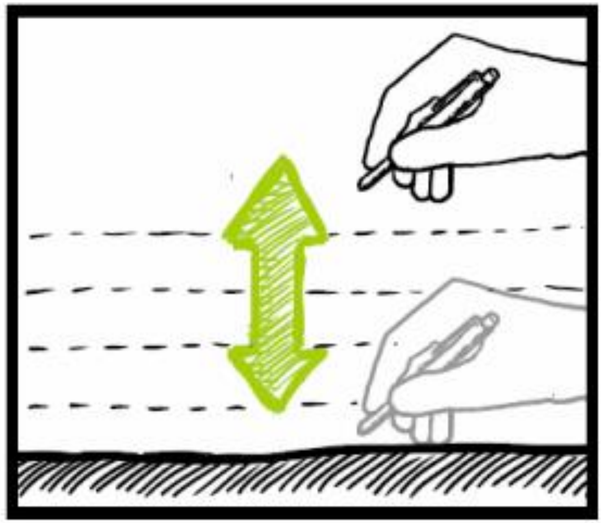
The lifting gesture allows one to **virtually lift up** digital content, primarily to **reveal other content lying underneath**.
. To reveal content that is currently occluded by overlapping documents, the person can move their fingers together into a ‘**pick**’ posture, and then lift their fingers off the surface into a ‘pick-up’ gesture.



Discrete Layers and Stacks of Digital Objects

the space above the tabletop surface can be divided into discrete interaction layers. In our adoption of this idea, the space above the surface is divided into **multiple parallel planes**, each corresponding to a layer.

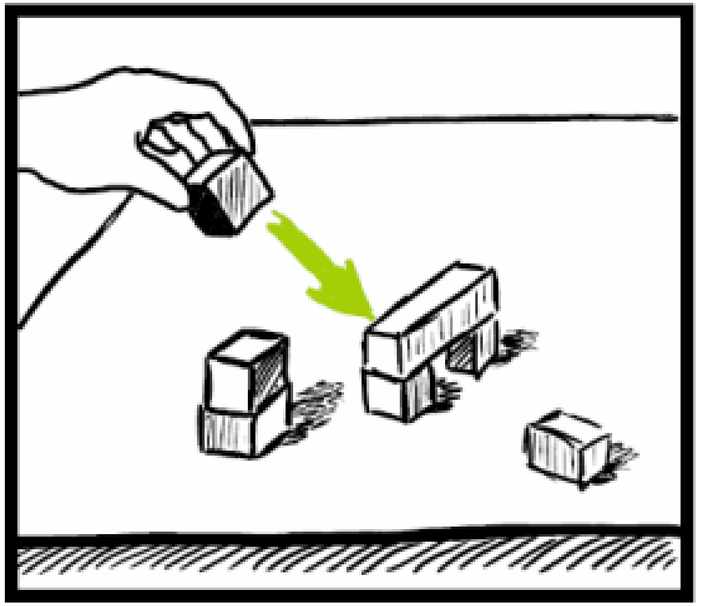
Each of these layers can then **correspond to layers** of visual content in the tabletop application, or even to different interpretations of gestures within a layer (e.g., an annotation layer, an editing layer, a movement layer, etc.).



Physical Objects

People can **stack tangible objects** on a tabletop, where the surface application **reacts** to the stacks built on the table.

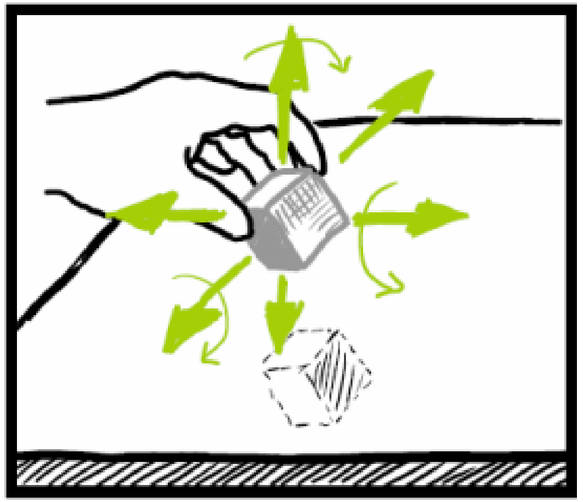
Overall, these approaches allow a person to **create physical stacks** and structures on top of the **usually flat tabletop surface**.



6-DOF Manipulation

The free movement of people's hands in the space above the surface can be leveraged to allow **full 6 degree of freedom (DOF)** interaction with digital content. These dimensions are movement along and rotation around the three axes.

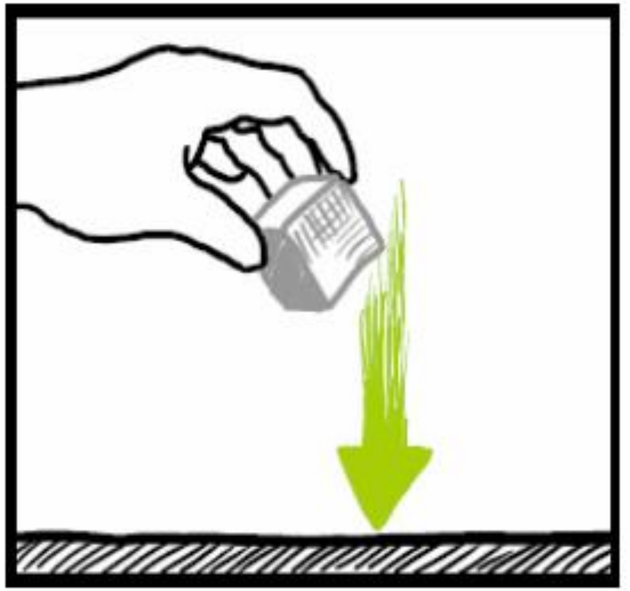
The image displays a digital object (a 3D cube) that can be picked up; the cube's position and orientation are then directly mapped to the position of the person's hand (**3D location: yaw, pitch, roll**).



Picking and Dropping

The **continuous interaction space** is picking and dropping of digital objects, where those objects react according to a physical simulation imitating real-world behaviour. This is also called **physics-based interaction.**

The virtual objects displayed on the screen behave according to a **simulated physical model and gravity**; for example, they fall back to the ‘ground’, push other objects away, or stop when bouncing against ‘walls’.



Feedback

Feedback of Possible Actions by **Hovering**
Related to the technique above is feedback about what actions are possible as a person moves and hovers above objects. For example, by **sensing the position of people's hands** above the surface interface, widgets on the touch screen (such as buttons, sliders) can give people **visual or audible feedback** about possible actions.

Similar to the way GUI buttons often change their color when the mouse cursor hovers over the button, the interactive elements of our **tabletop application interface could change their visual appearance** (e.g., glowing border, different background
color) once a person's hand approaches the widget.