History

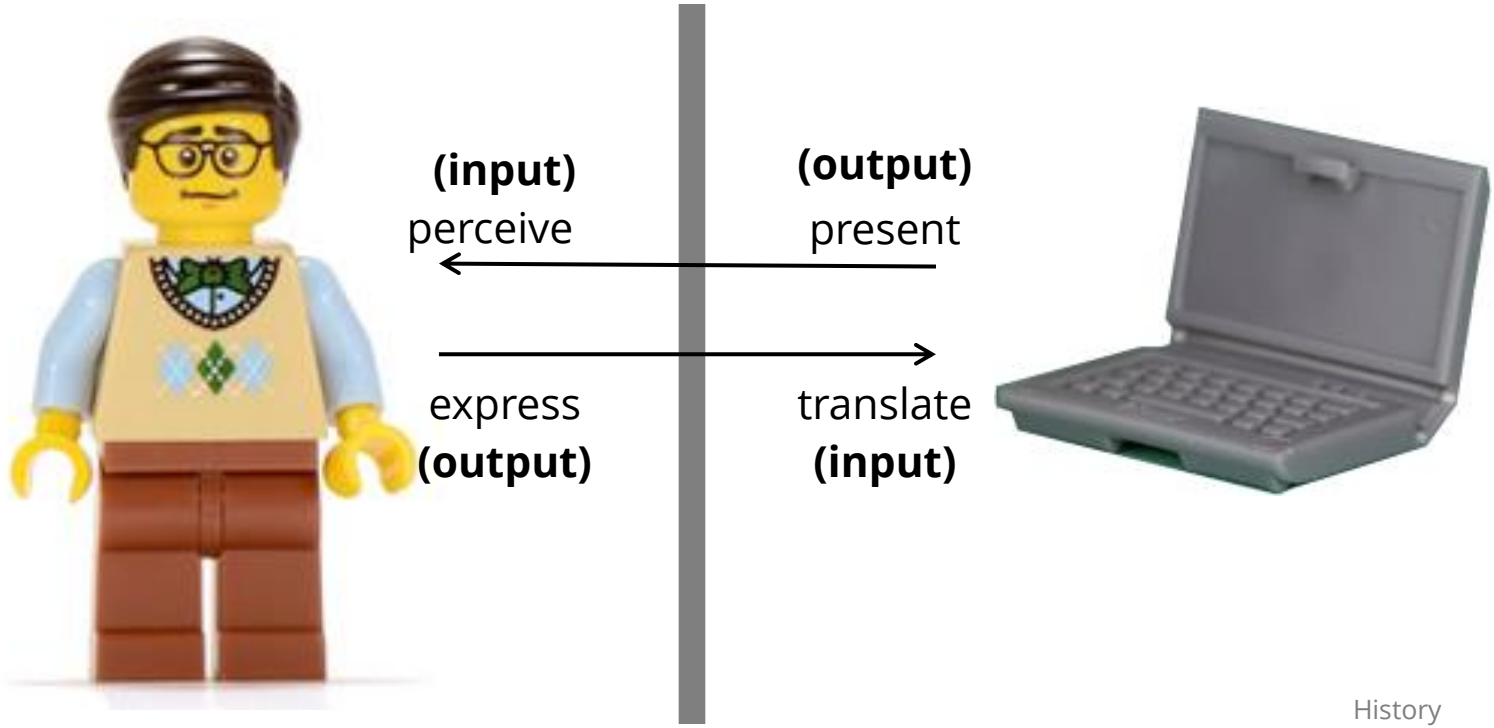
A (brief) history of interaction

Outline

- Major paradigms of interaction
  - Batch interfaces
  - Conversational interfaces
  - Graphical interfaces
  - Ubiquitous Computing
  - Spatial Computing
- Visionaries who inspired advances
  - Vannevar Bush
  - Douglas Engelbart
  - Ivan Sutherland
  - Alan Kay
- The current and future of interaction

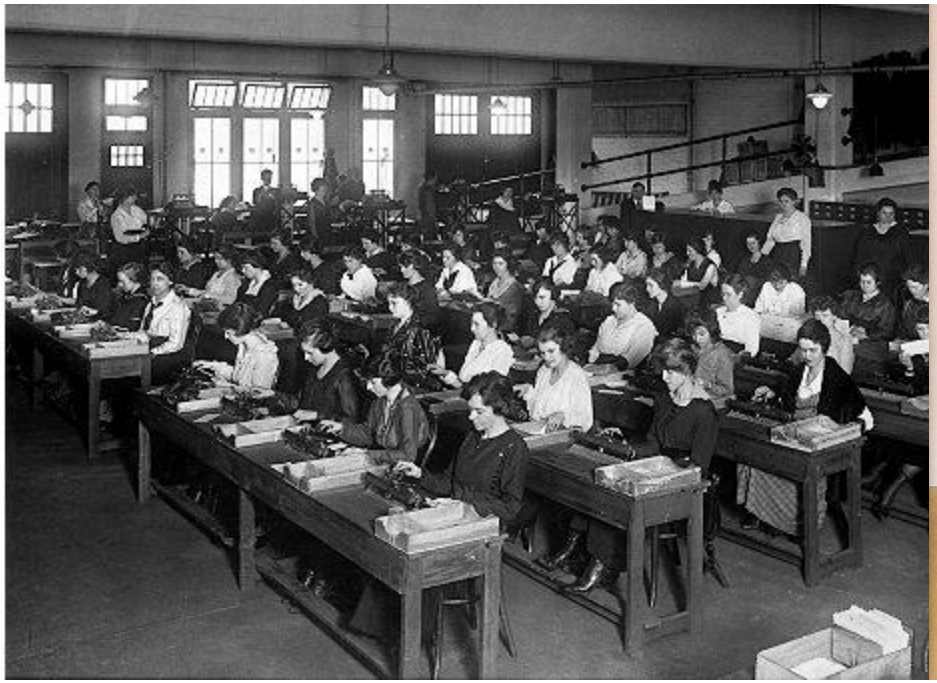
The History of Interaction

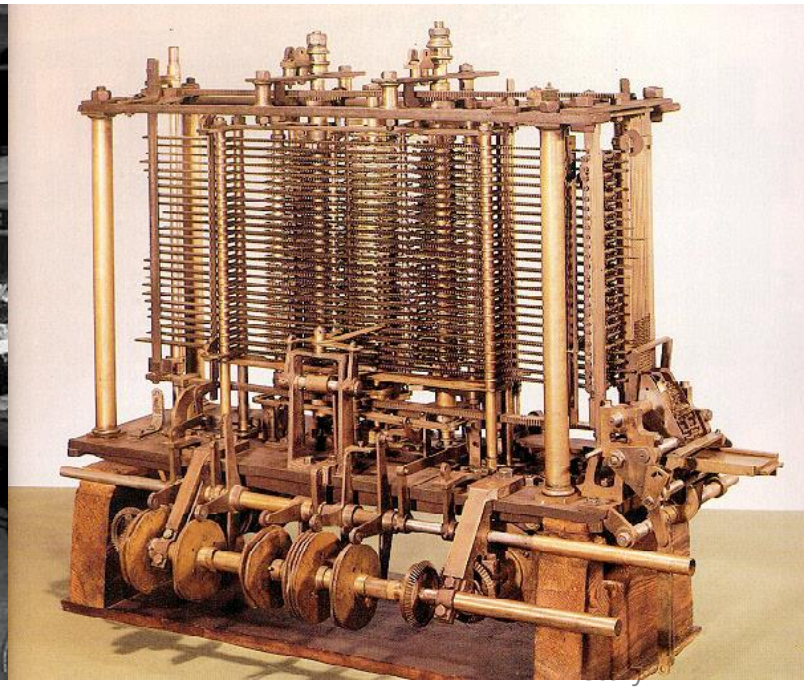
- History of interaction is the history of making the input and output languages of the machine closer to the input and output language of the user and their tasks
- Interaction has evolved from forms that favoured the machine (when its time was more valuable) to those that favour the user



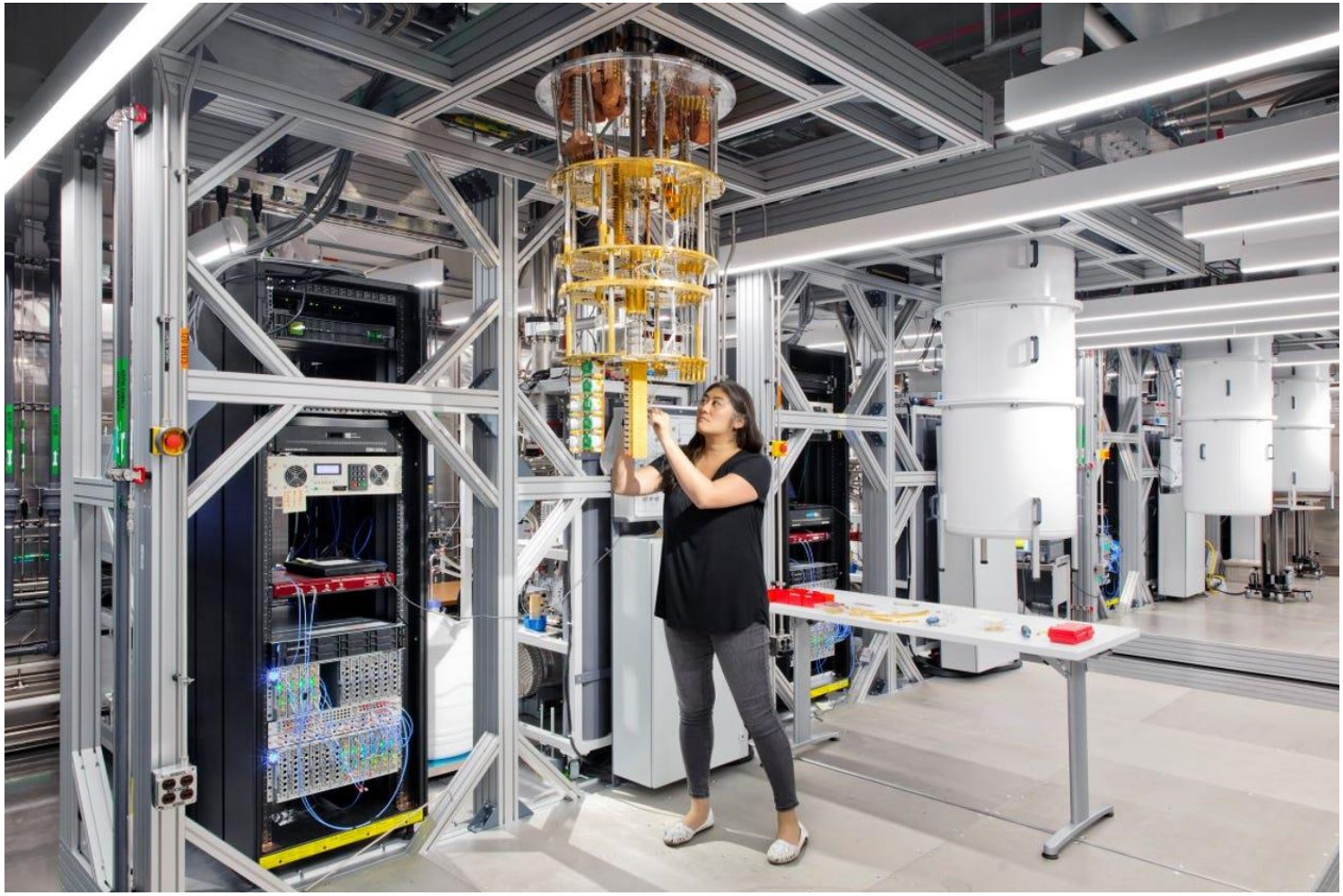
Earliest “Computers”

- Human computers (up to 1940s)
- Babbage’s Analytical Engine (designed mid 1800s)
  - First general-purpose computing device
  - Calculate mathematical formulas
  - Promised to do the work of (human) computers much more quickly and accurately

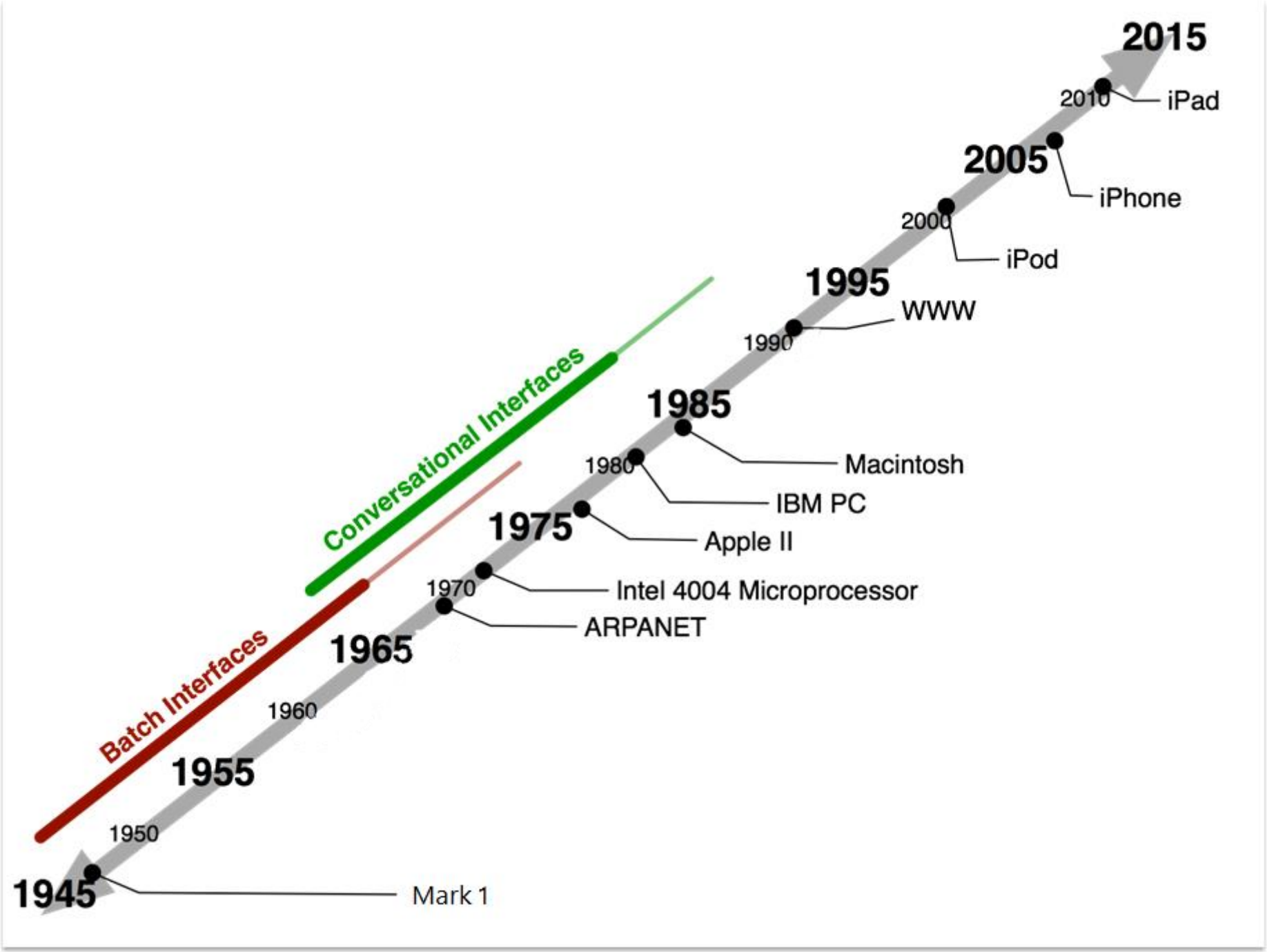




Equivalent of Babbage's machine



IBM's Quantum Computer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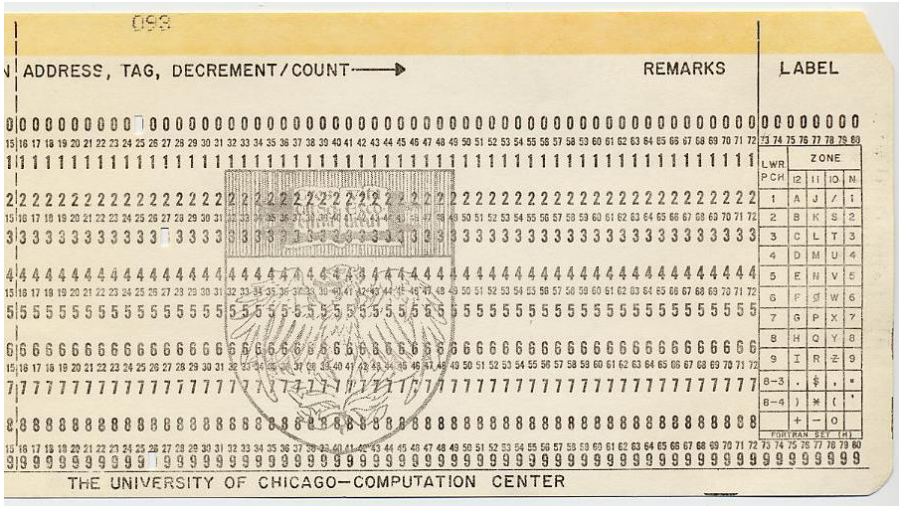
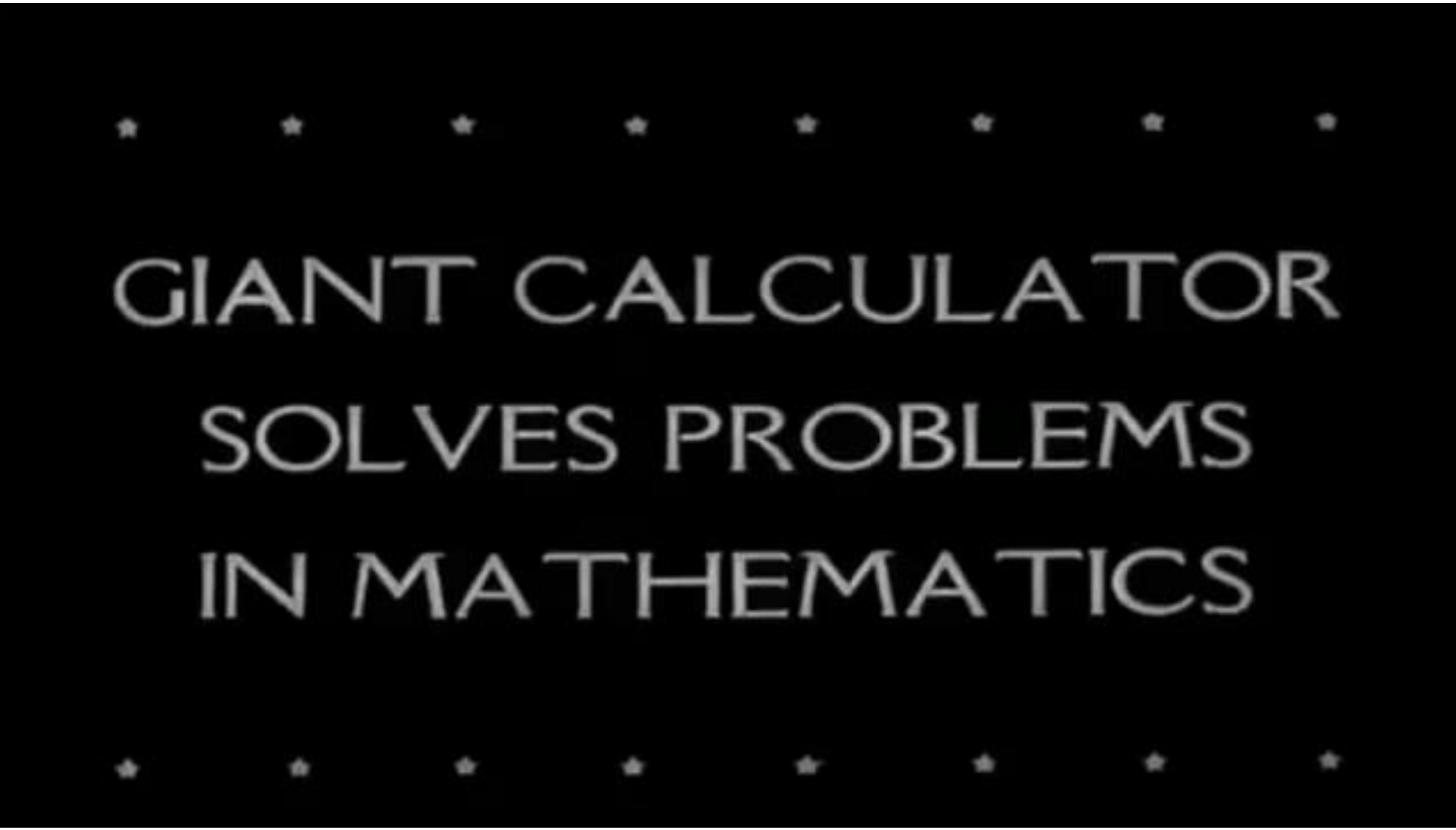
Mark 1
Conversational Interfaces
Batch Interfaces

Batch Interface (1945-1965)

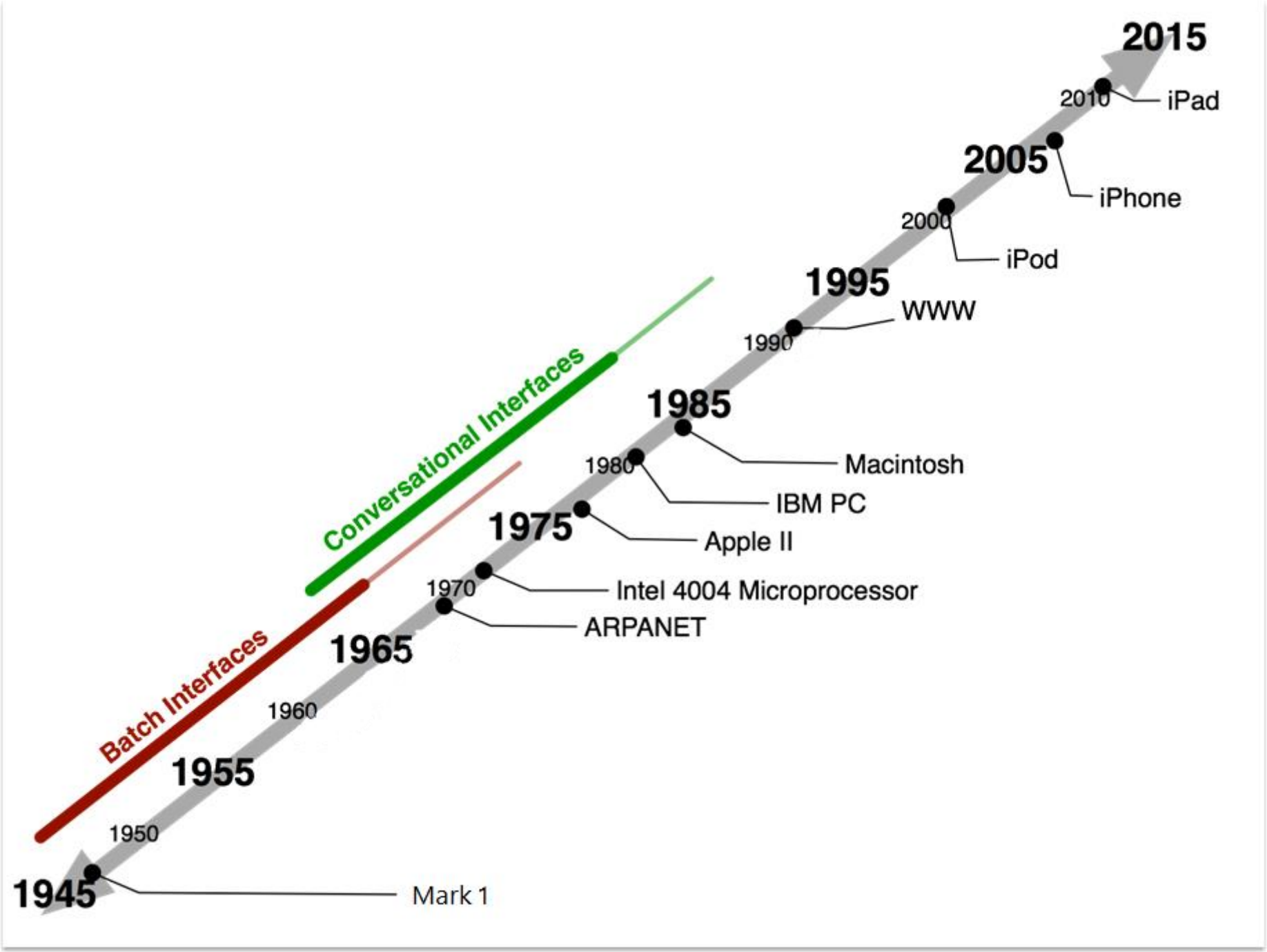
- Interaction style
  - Set of instructions prepared a priori
  - Input fed to computer via punch cards, paper tape, magnetic tape
  - Output - typically received via paper printout
  - No real interaction possible as system executes instructions
  - Responses received in hours, days
- Users
  - Only used by highly trained individuals



Dials, Knobs, Lights and punch cards (1940s)



Howard Aiken, IBM ASCC / Harvard Mark I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Conversational Interface (1965 – 1985+)

- Interaction style
  - User issues a command, waits for response
  - Feedback can be given during execution
  - Commands need to be learned
  - Commands are hard to discover
- Users
  - trained experts

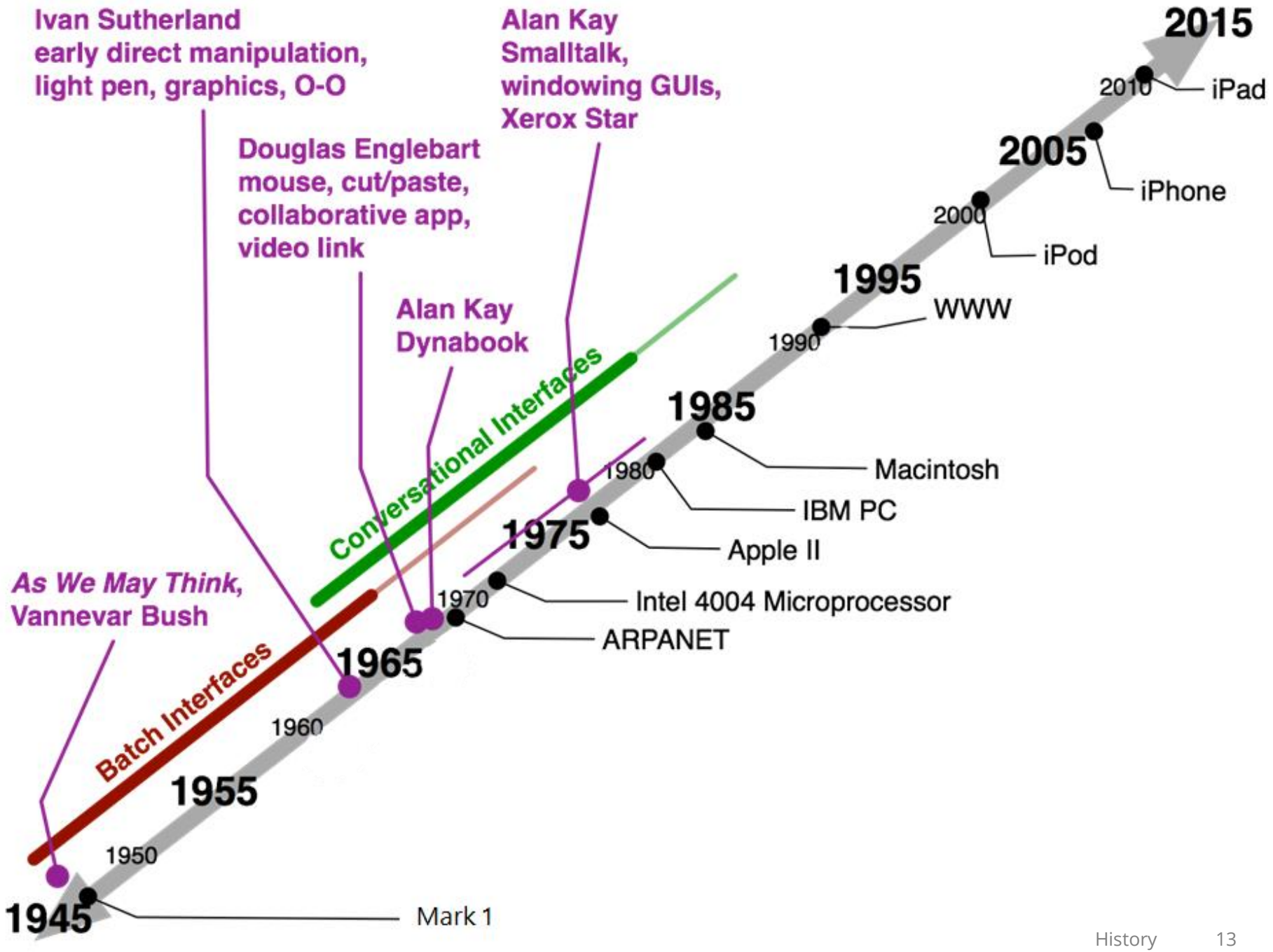
```
[mkyong@localhost _node]$ du -lsh pattern_final
2.4G    pattern_final
[mkyong@localhost _node]$ du -lsh pattern3
726M    pattern3
[mkyong@localhost _node]$
```

Command-Line Interface

- Advantages
  - Fast and highly flexible: can combine commands to create sophisticated sets of operations
- Disadvantages
  - Users need to understand the computer
  - I/O is in system language, not task language
  - Requires “Recall” rather than “Recognition”

Recognizing User Needs

- Batch and command line interfaces require interaction language closer to the system than task
- These interfaces were common at a time when the computer's time was more expensive than a person's time
- Some visionaries imagined a different form of interaction.


Ivan Sutherland
early direct manipulation,
light pen, graphics, O-O
Alan Kay
Smalltalk,
windowing GUIs,
Xerox Star
Douglas Englebart
mouse, cut/paste,
collaborative app,
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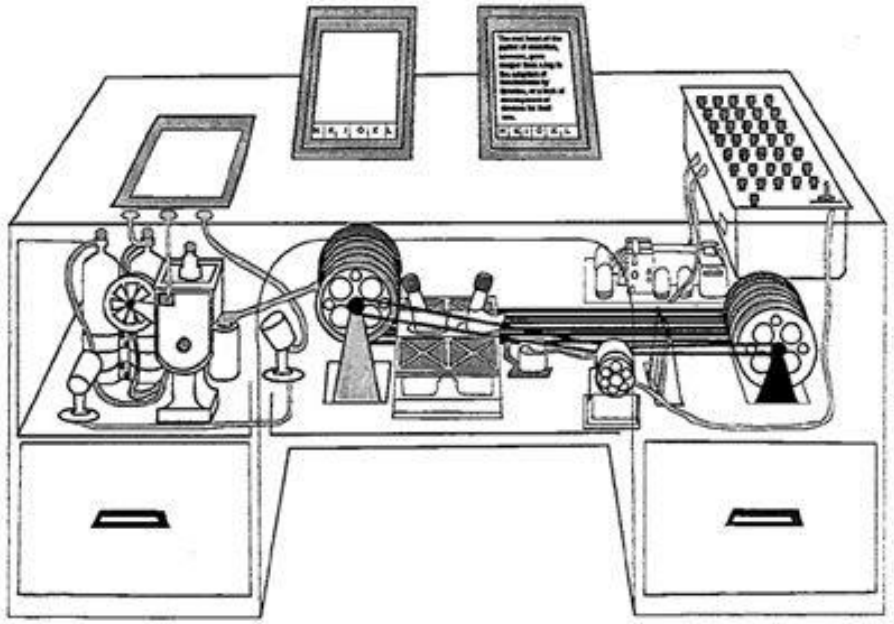
Vannevar Bush

- Headed Office of Scientific Research and Development
  - Manhattan project, other WWII science efforts
- 1945 article, “As We May Think” in The Atlantic
  - http://www.theatlantic.com/doc/194507/bush
  - inspires computer scientists to present day
- Goal was to augment human intellect

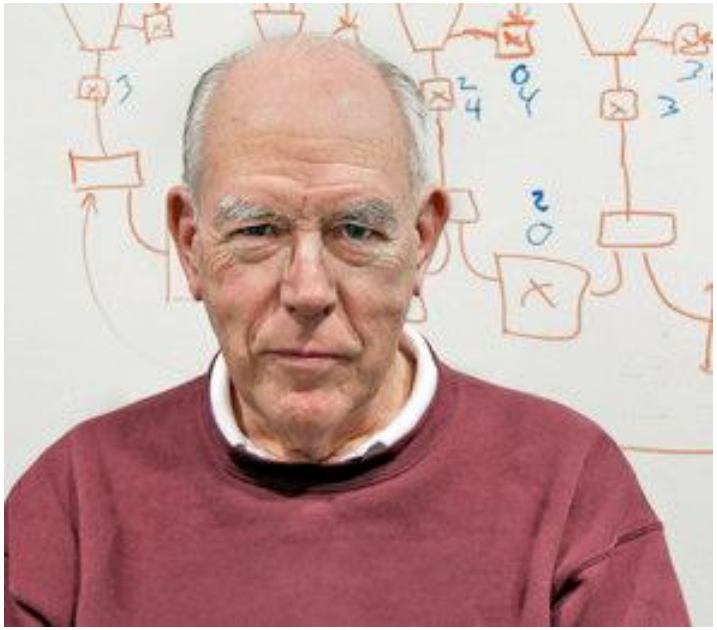
Bush's "Memex"

- "A memex is a device in which an individual stores all his books, records, and communications. It is an enlarged intimate supplement to his memory."
- Proposes associative links between content (hyperlinks)
- Dual display setup
- Direct annotation of stored content
- Indexing for easy access
- But hardware a long way off



Ivan Sutherland

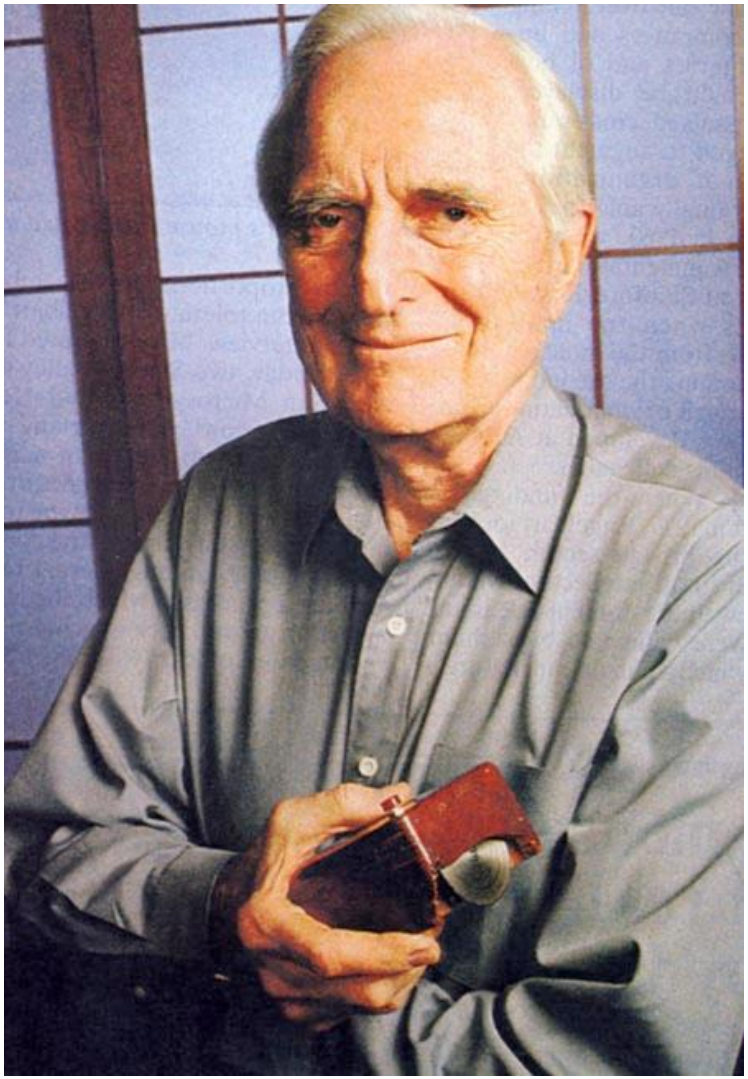
- Sketchpad (~1963)
  - Light pen
  - Direct manipulation
  - Early graphical interface
  - https://www.youtube.com/watch?v=FuKREmsiD9o
  - Expands computer domain to include artists, draftsmen, …
- Language of interface moves substantially closer to task domains



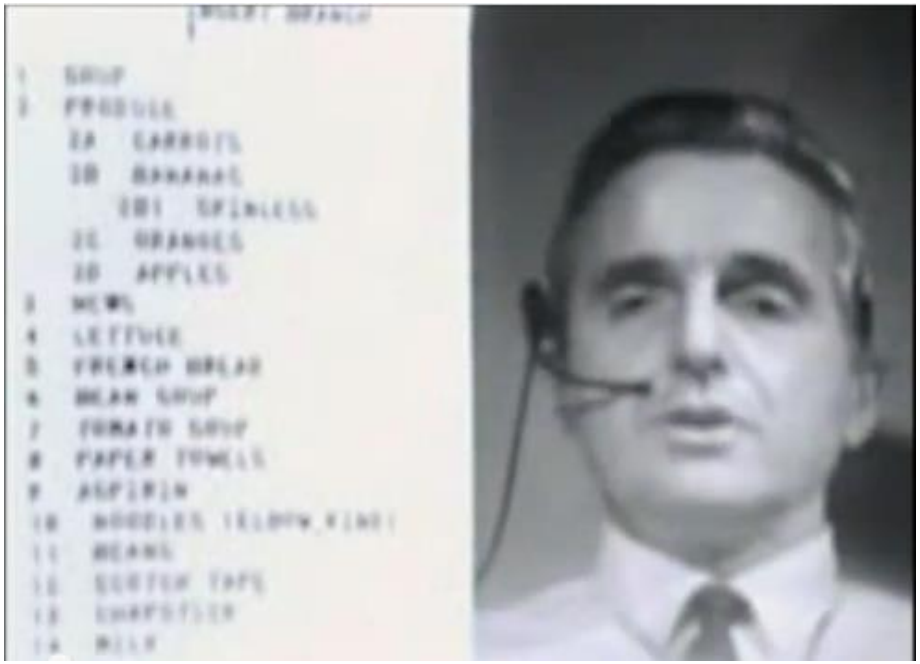
INK

Douglas Engelbart

- Led team at Stanford Research Institute (SRI) created On-Line System (NLS) (~1968)
  - invented the mouse
  - implemented hypertext
  - introduced copy/paste
  - vision of computer-supported collaborative work



The NLS “Mother of all Demos” (1968)

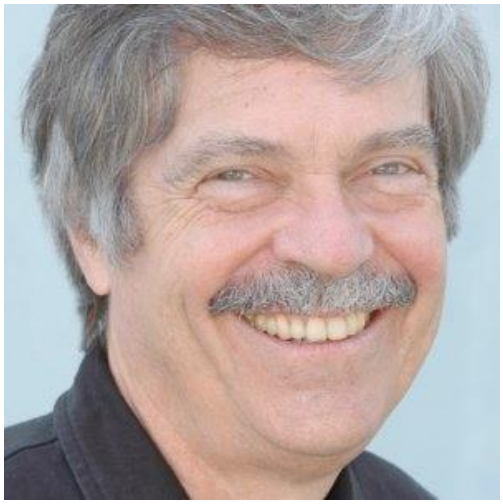


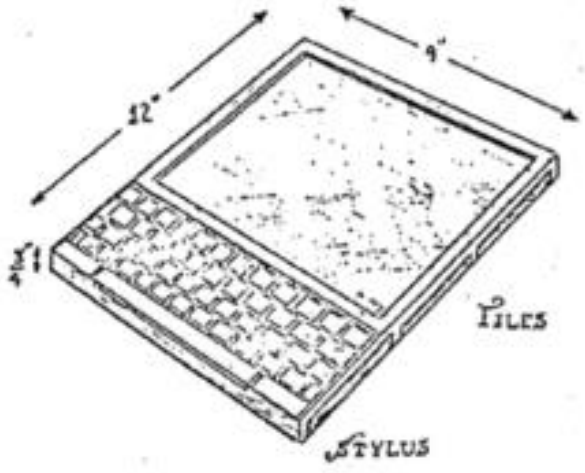
https://youtu.be/yJDv-zdhzMY?t=90 (intro, text editing, copy & paste)
https://youtu.be/yJDv-zdhzMY?t=1857 (mouse, chorded keyboard)

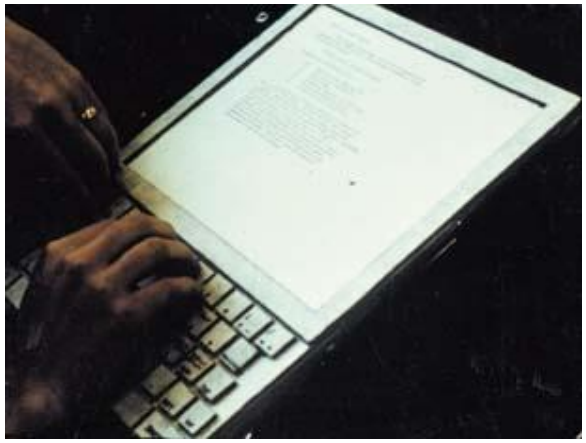
Talked about hardware, hypertext documentation, collaboration, mentions that Arpanet is coming)

Alan Kay

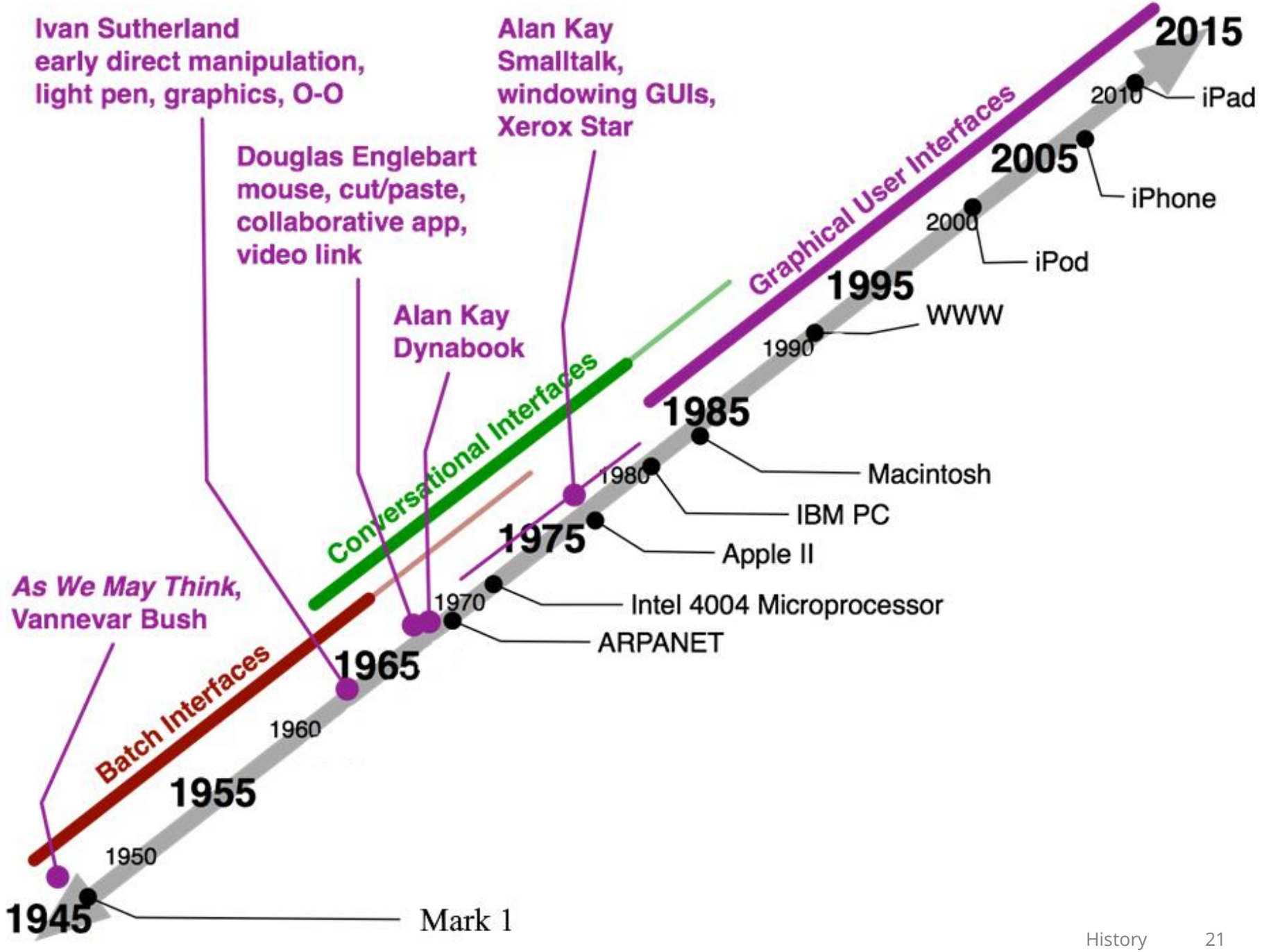
- Pioneering work on
  - object-oriented programming (Smalltalk)
  - Xerox Star: graphical user interface
  - Dynabook: conceptual basis for laptops and tablet computers
- Quote: “The best way to predict the future is to invent it.”







Dynabook (~1972)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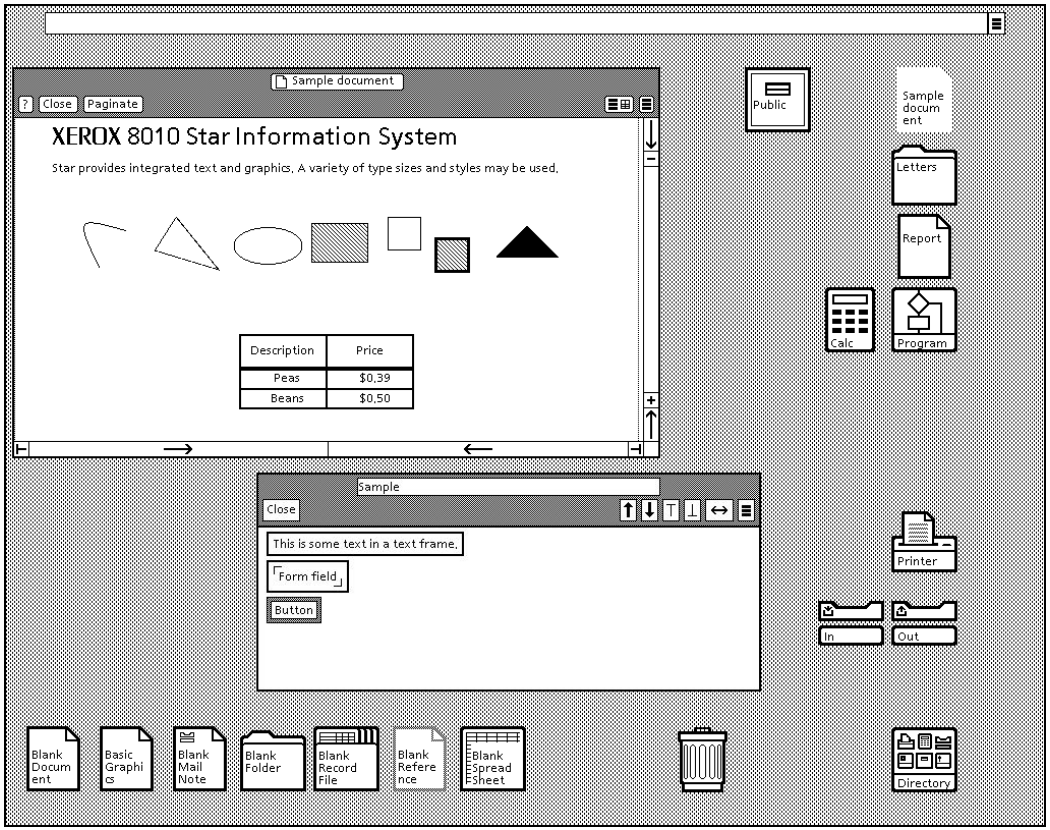
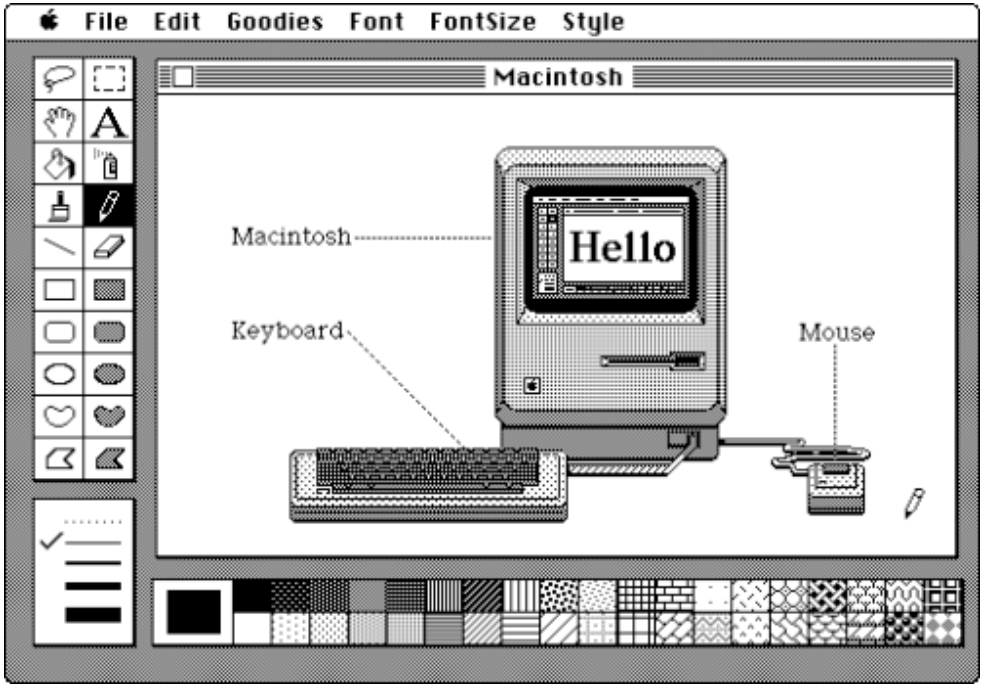
Xerox Star Information System (~1981)

- First commercial computer with GUI
  - windows, icons, folders, mouse, (and Ethernet, file/print servers, email)
  - based on Xerox Alto research ~1974

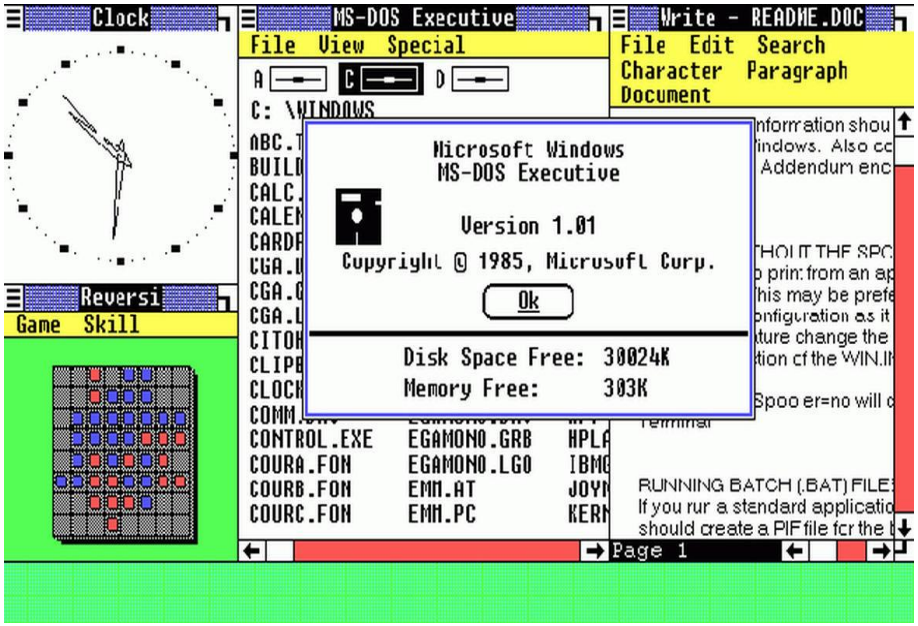


Graphical User Interfaces (1984 – present)

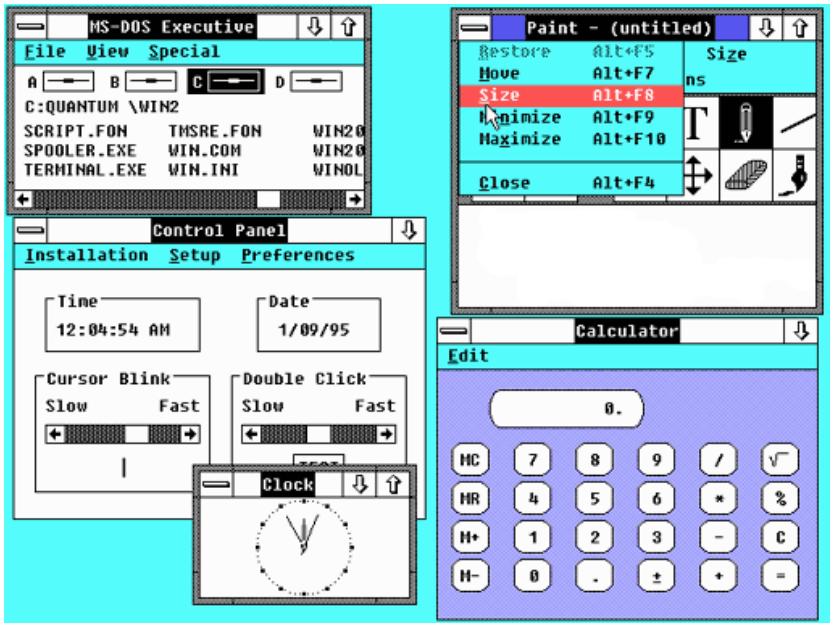
- The early 1980s, Apple became the world's most popular computer
- IBM enters the personal computer market in 1981 with the IBM PC
- Apple's Macintosh (Jan 1984), brings the GUI to the masses



Graphical User Interfaces (1984+)



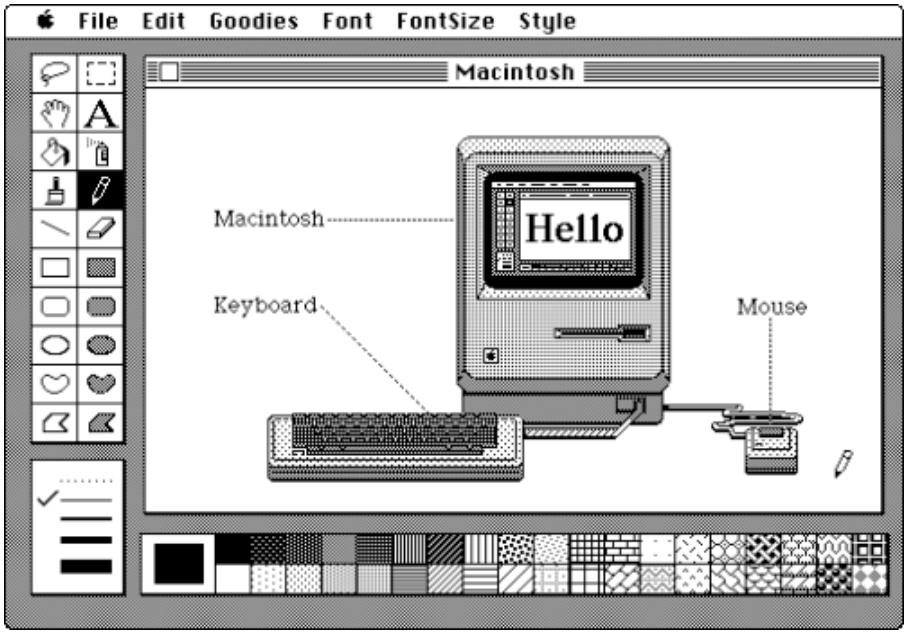
Microsoft Windows 1.0 (1985)



Microsoft Windows 2.0 (1987)

Graphical User Interface (GUI)

- WIMP interface
  - Windows, Icons, Menus, and Pointer
- Hardware interface
  - Keyboard
  - Pointing device (e.g., mouse)
  - High resolution, high refresh graphics display



GUI Interaction style

- User in control
  - system waits for input, then responds
- **Recognition** over **Recall**
  - enables discovery of options and experimentation
- Metaphors
  - make Interaction language closer to users' own language, closer to task domain
  - e.g. "desktop", "folder", "drag-and-drop",...
- GUI interaction opens interface up to broader audience

Modern and Future Interaction

- Where can we go from here?
- What other paradigms are possible?

Voice interface

- Voice also started to become a form of interaction with the 1997 introduction of Dragon NaturallySpeaking
  - sold several million copies of its voice interaction software
- Google Home
  - https://www.youtube.com/watch?v=r0iLfAV0pIg
- Amazon Echo
  - https://www.youtube.com/watch?v=zmhcPKKt7gw

Touch interfaces

- The latter part of the 2000s witnessed a big leap forward in UI design
- FingerWorks, a gesture recognition company, produced multi-touch products in 1998
  - The company was acquired by Apple in 2005.
- Touch interfaces took off dramatically with the introduction of the iPhone in 2007 and the iPad in 2010
  - Multipoint capacity touch enabled users to interact with digital content in new ways

Gesture interface

"Kinect" (2010) https://www.youtube.com/watch?v=pzfpXAbQ61U

"MYO armband" (2013)

https://youtu.be/jOEcsNmTk7g?t=157

"Leap Motion" (2012) https://www.youtube.com/watch?v=_d6KuiuteIA

Mark Weiser

- "**The most profound technologies are those that disappear**. They weave themselves into the fabric of everyday life until they are indistinguishable from it." (*Scientific American*, 1991)

- Computing should fade into the environment

  - examples?


38°c

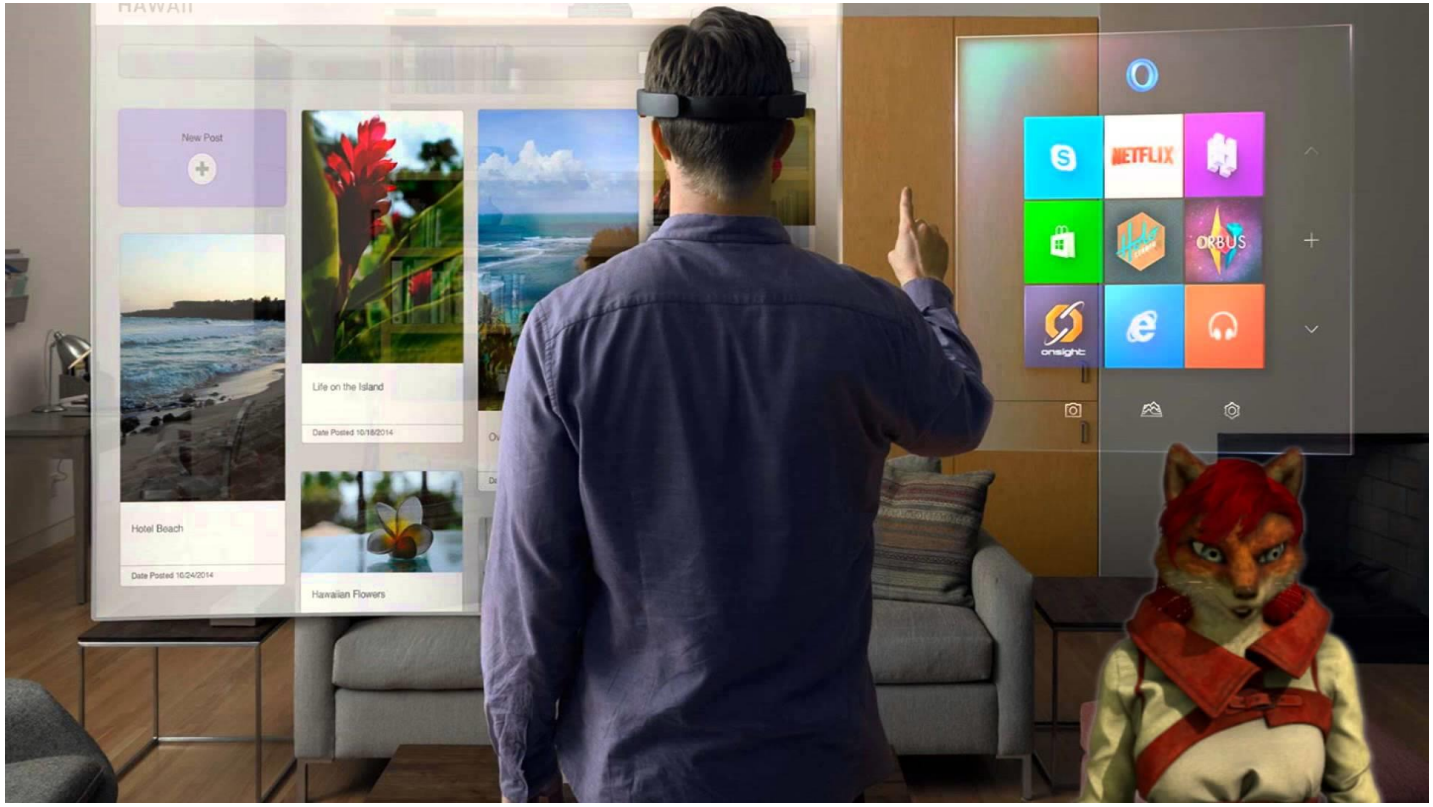

Take out the garbage tonight
Do your homework

Ubiquitous Computing

- A Day Made of Glass... Made possible by Corning. (2011)
- https://www.youtube.com/watch?v=6Cf7IL_eZ38

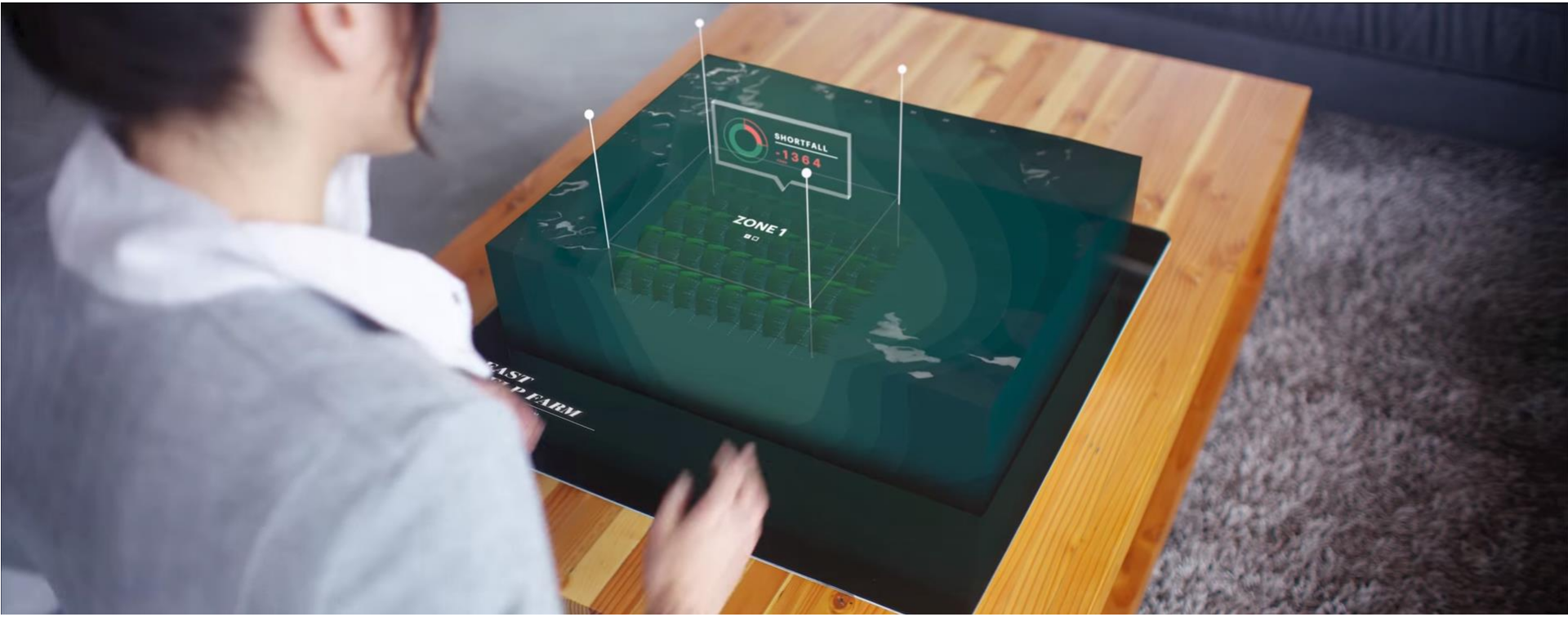
Spatial Computing

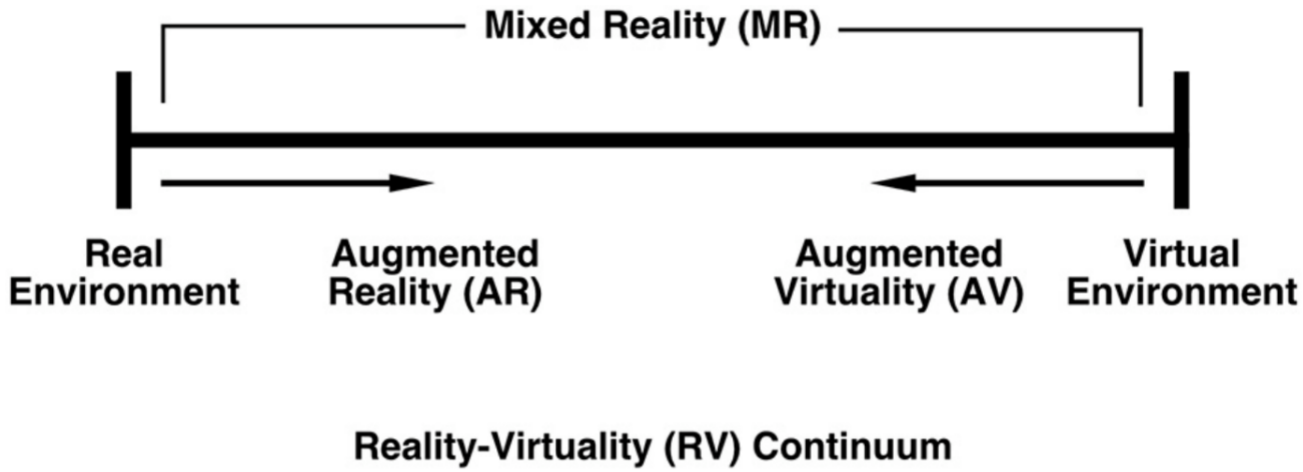
- HoloLens 2 AR Headset (2016)
  https://www.youtube.com/watch?v=uIHPPtPBgHk



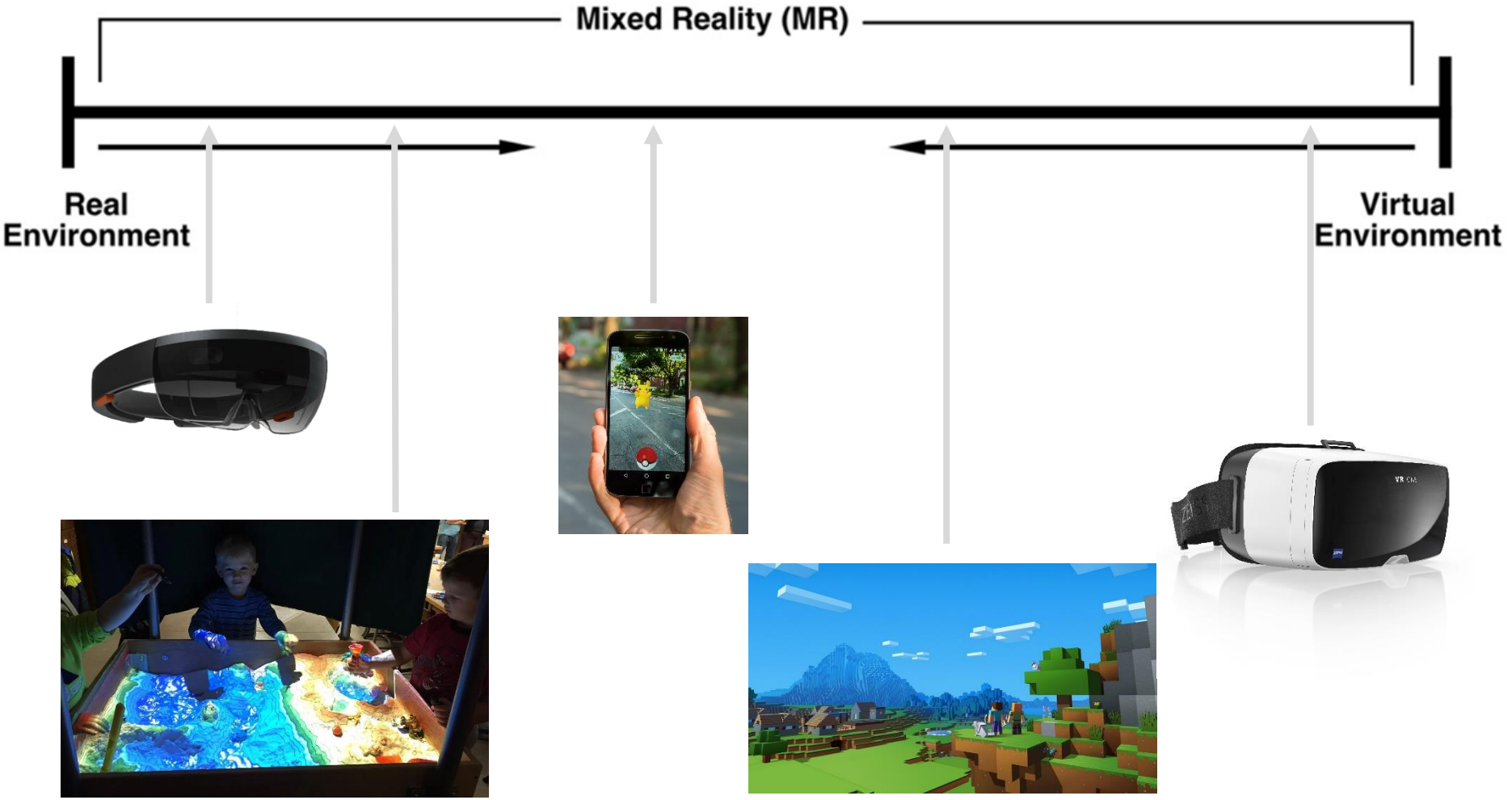
Microsoft Vision (2015)

- https://www.youtube.com/watch?v=cEeht3nyhec





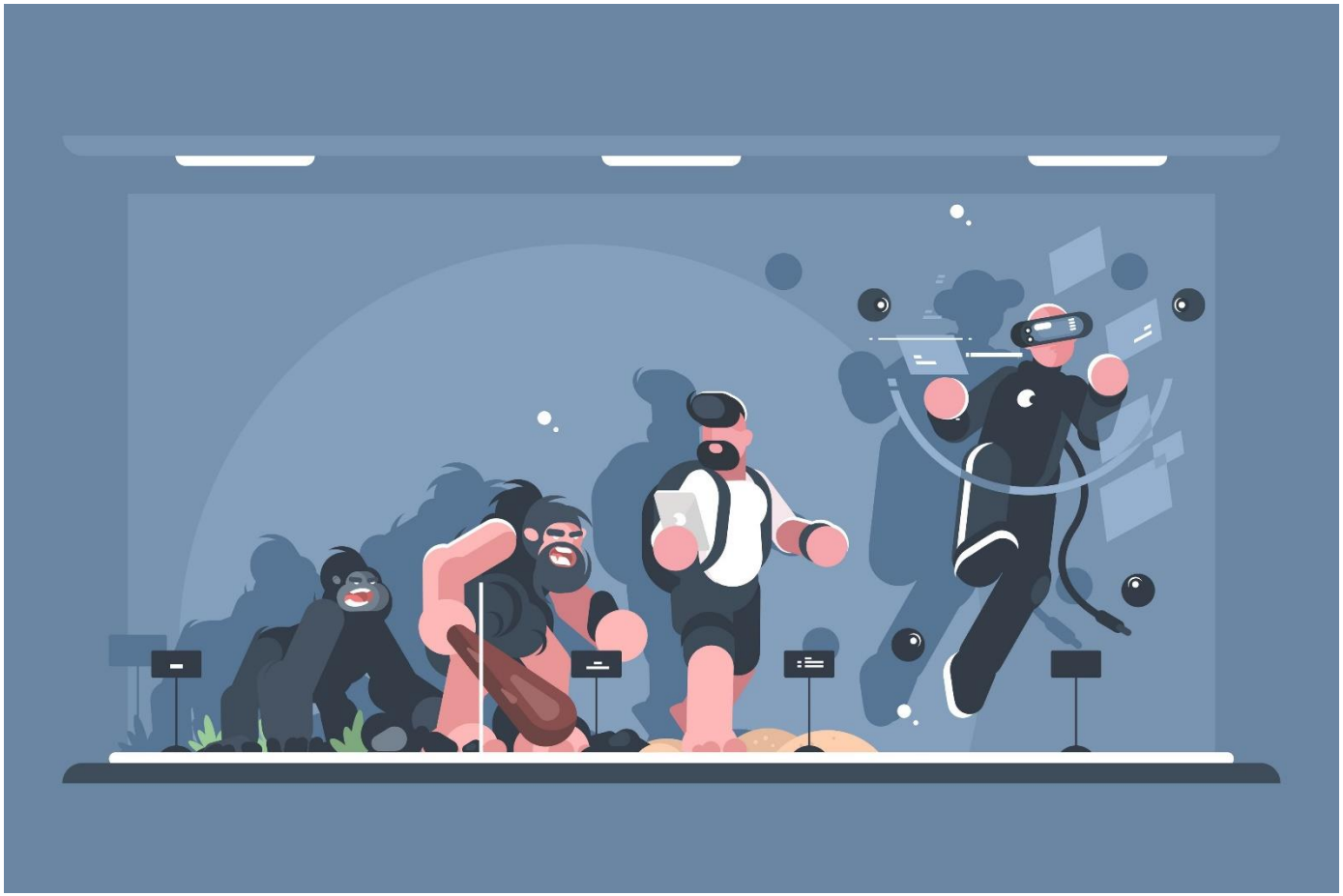
- Milgram and Kishino, 1994


Mixed Reality (MR)
Real Environment
Virtual Environment

Virtual Reality

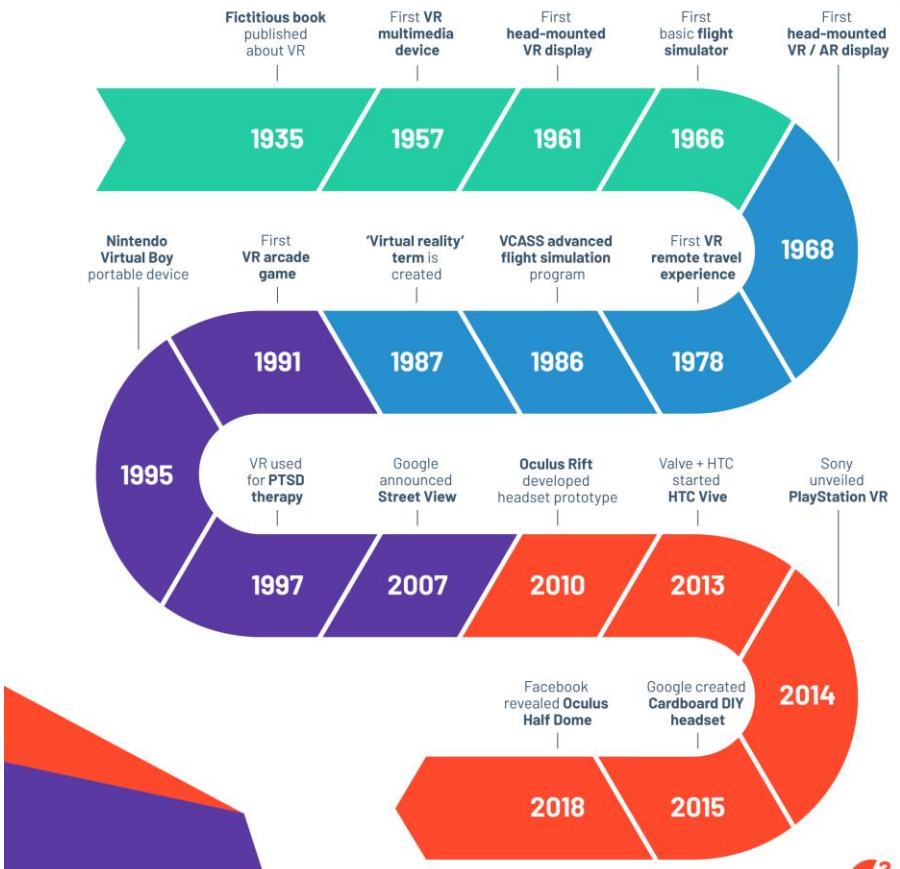
- Oculus Quest 2 (Meta Quest Pro – latest release)
- https://www.youtube.com/watch?v=60yP8f5E-B4
- Apple Pro Vision:
- https://www.youtube.com/watch?v=Btf4mN37OsU

History of Immersive Technology



https://www.g2.com/articles/history-of-virtual-reality

History of **Virtual Reality**



PYGMALION'S SPECTACLES

By STANLEY G. WEINBAUM

Author of "The Black Flame," "A Martian Odyssey," etc.

Unbelieving, still gripping the arms of that unseen chair, Dan was staring at a forest

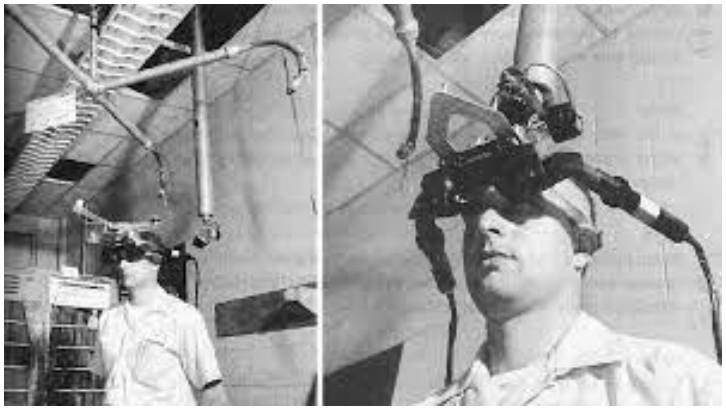
The main character meets a professor who invents a pair of goggles that allowed him to view a movie with sight, sound, taste, smell, and touch

History of Immersive Technology

- Sensorama, 1956
- Prototype built in 1962
- By Morton Heilig

History of Immersive Technology

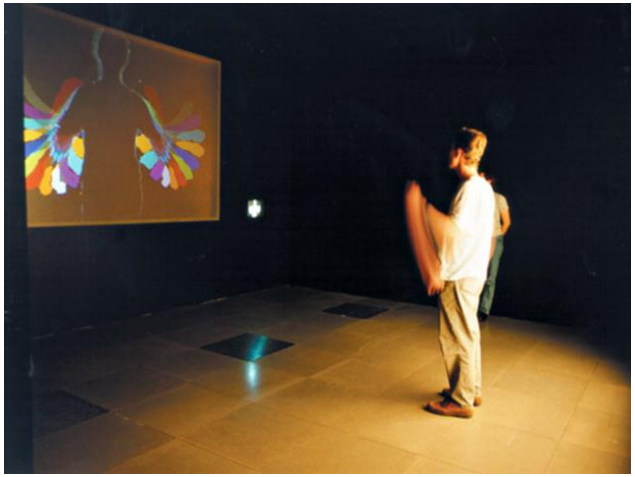
- Ivan Sutherland's The Sword of Damocles (1965)
- Based on his idea of "Ultimate display"
- Widely considered first HMD



https://www.youtube.com/watch?v=NtwZXGprxag

History of Immersive Technology

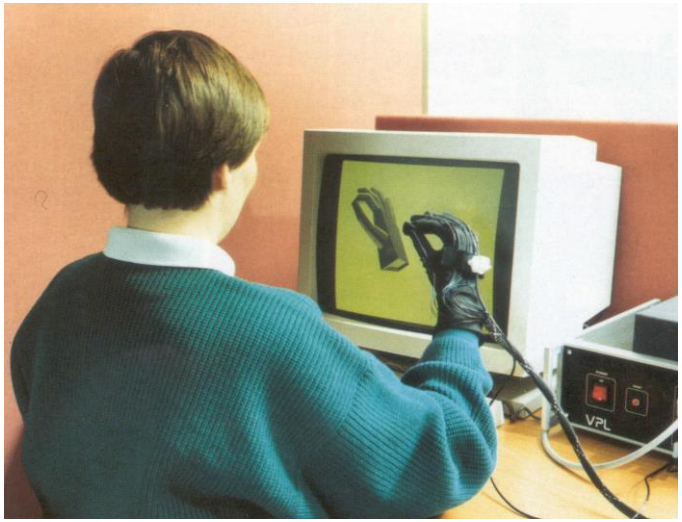
- Videoplace, by Myron Krueger , 1975



https://www.youtube.com/watch?v=dqZyZrN3Pl0

History of Immersive Technology

- VPL Research, founded in 1984
- First commercial VR devices
- DataGlove, EyePhone, DataSuite



History of Immersive Technology

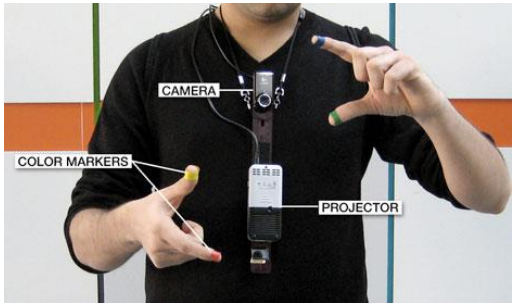
- The Virtual Interface Environment Workstation (VIEW), 1990
- NASA project to develop VR training simulator for astronauts
- Partnered with VPL research
- Real-time binaural 3D audio processing

History of Immersive Technology

- Virtuality gaming machines, 1991

History of Immersive Technology

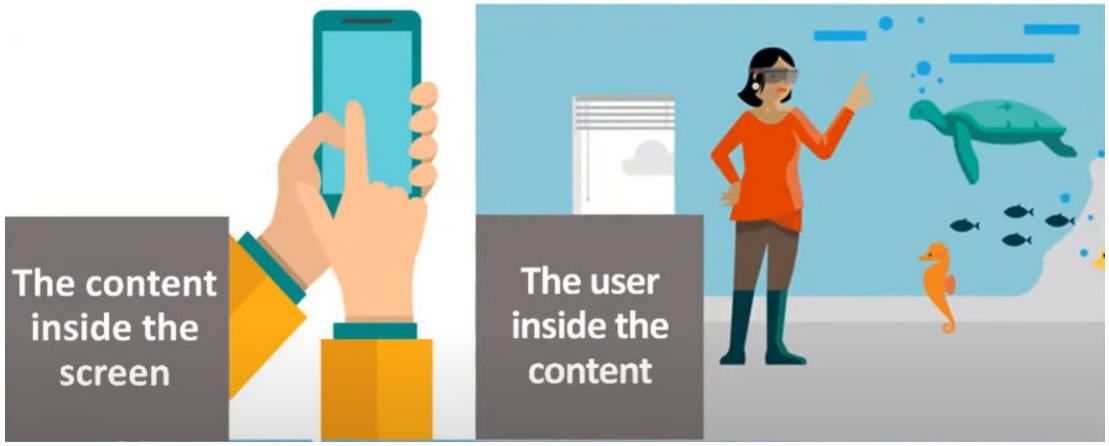
- Sixth-sense (2009)



https://www.pranavmistry.com/archived/projects/sixthsense/

Metaverse

- Network of virtual worlds for social interactions.
- Cross-device and cross-content interaction rolled into one.
- Eg:
  - SecondLife (2003)
  - Horizon Worlds (~~facebook~~ Meta)
  - AltspaceVR (Microsoft)



Mar Gonzalez Franco, ISMAR keynote, 2021

Hyper Reality by Keiichi Matsuda

Summary

- History of HCI

	Input	Output
Early Days	Connecting wires Paper tape & punch Card Keyboard	Lights on display Paper
Yesterday	Keyboard Mouse Microphone Cameras	High-res screen Audio Head mounted displays
Today	Mobiles, Wearables, Computer Jewelry	Ubiquitous computing Multimedia
Soon?	Data gloves + suites Computer jewelry	Spatial Computing

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