CS 349
10 Some History

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Slides mostly by Michael Terry

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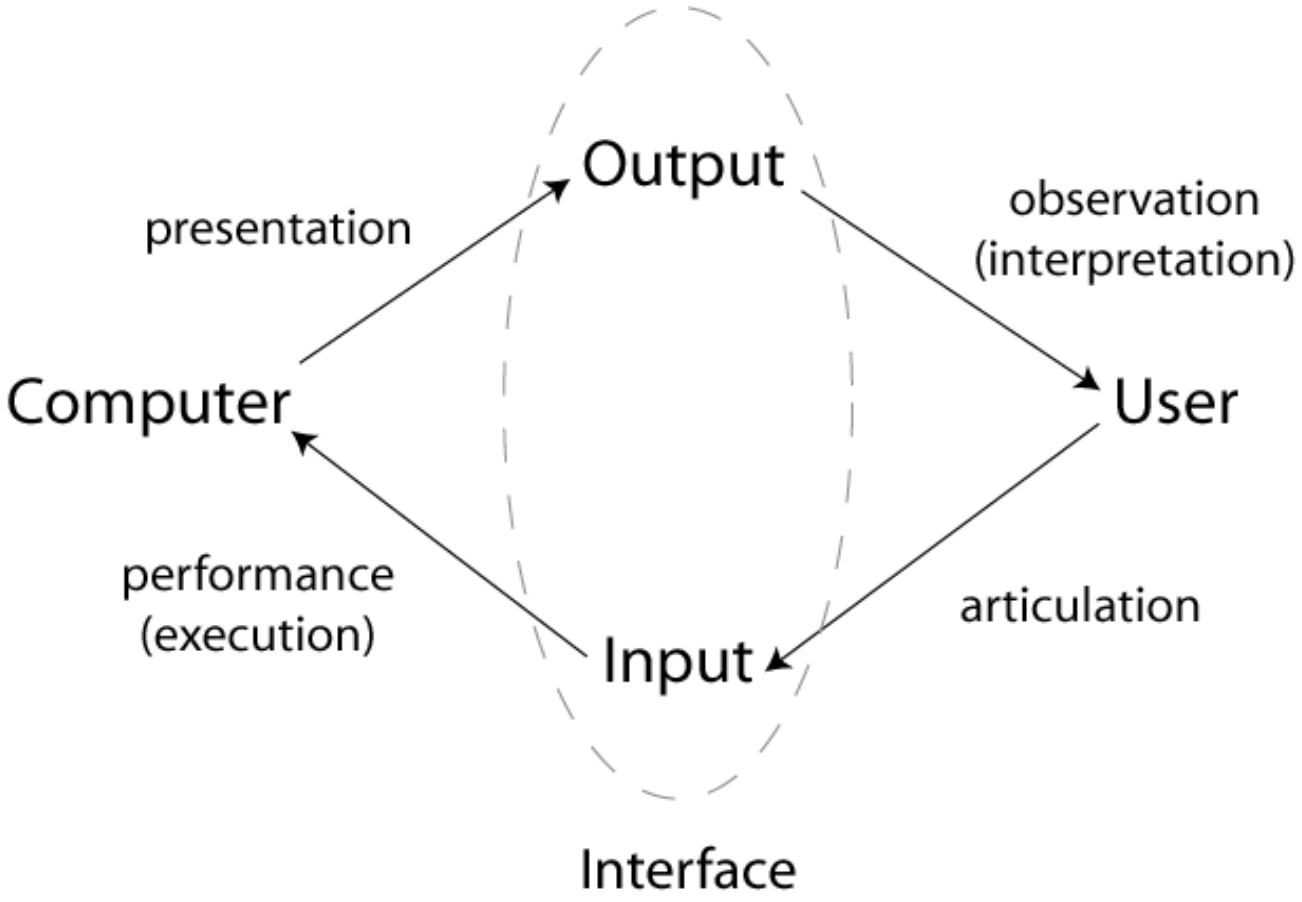
The History of Interaction…

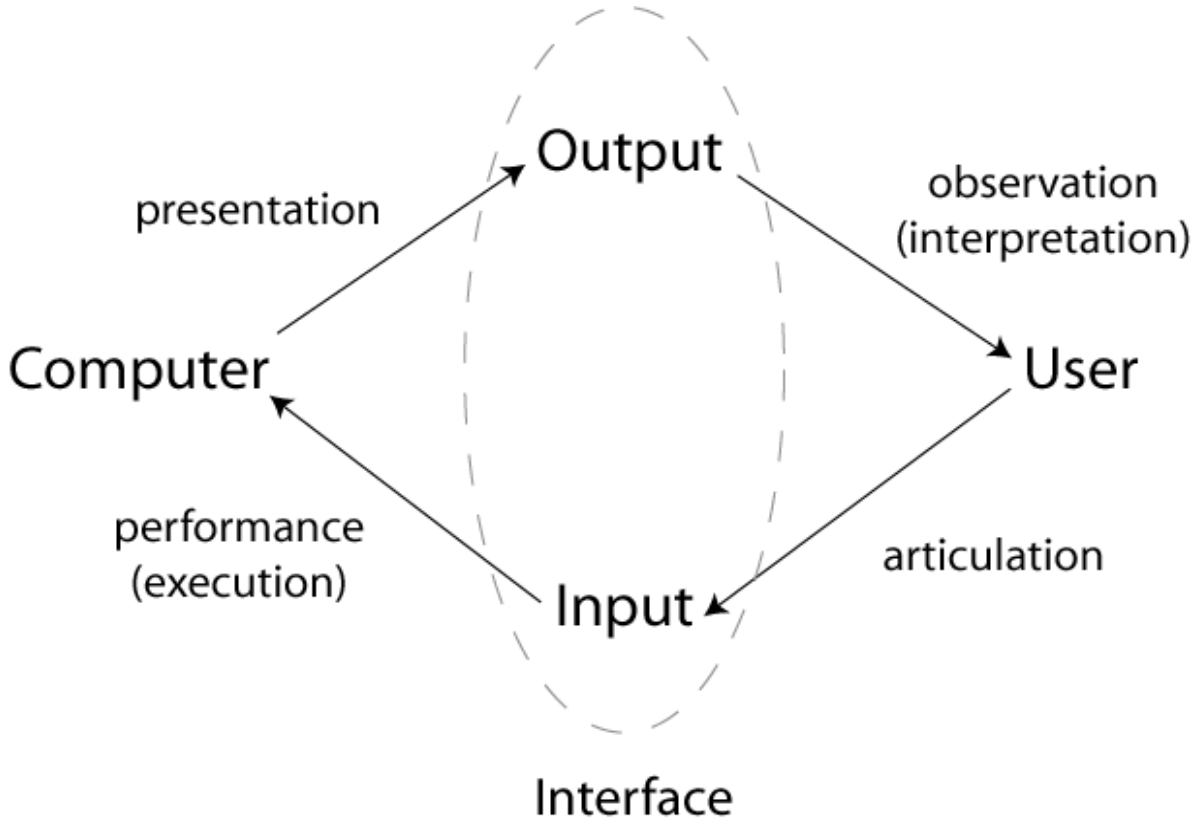
- History of interaction is the history of making the input and output languages of the machine closer to the language of the user and their tasks
- Interaction has evolved from forms that favored the machine (when its time was more valuable) to those that favor the user

Interactive Cycle



From Dix, Finlay, Abowd, & Beale (2004)

Interactive Cycle: Steps



1. User formulates a goal, plans a method to achieve goal
2. User translates task into *system input language*
3. System performs instructions, changes its state

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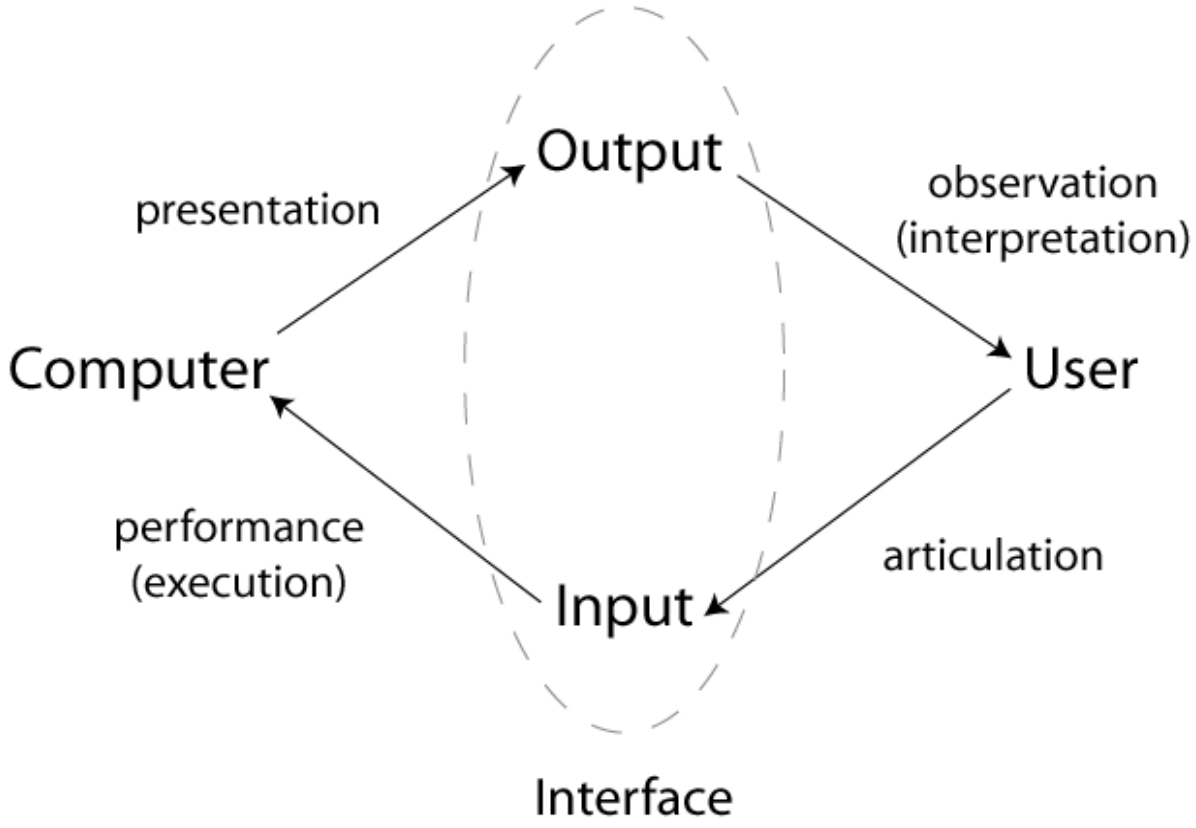
Interactive Cycle: Steps



4. System translates its state into its *output language*
5. User interprets result, repeats the cycle

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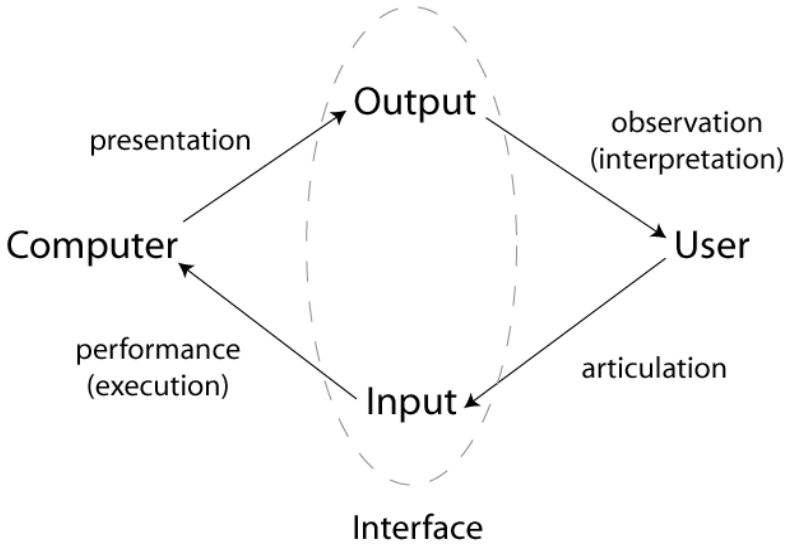
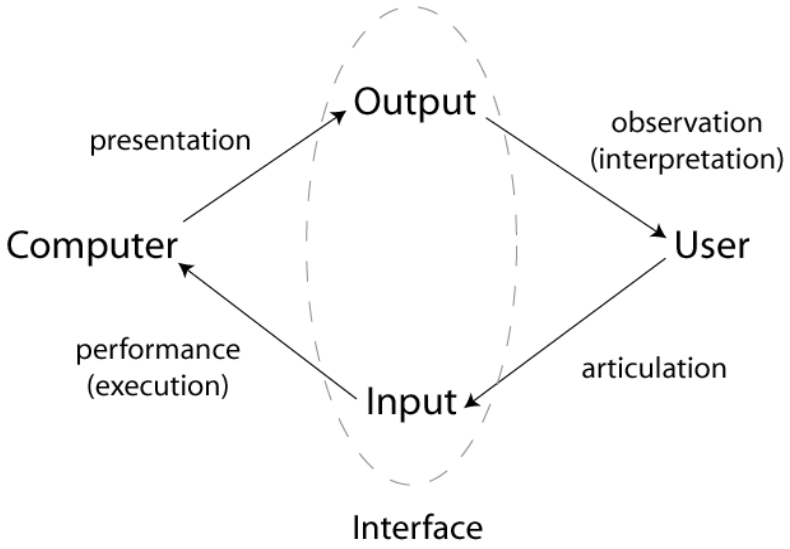
Interaction

- Where do translations occur in this process?



Interaction

- Translations occur:
  - From intention to system input language
  - From input language to core system language
  - From core system language to output channel
  - From output channel to user's interpretation of output



Interaction

- Input/output channels affect what can, cannot be expressed
  - Can result in an interactive language far removed from task domain
  - User may need to expend effort translating between task domain's language and that of the system
  - Examples?
- Example: Doctor remotely examining a patient
  - May wish to physically examine patient, but cannot actually touch, feel patient

A (Brief) History of Interaction

- History of interactive interfaces is history of moving system's interactive language closer to user's language, needs, expectations, and the task domain
- Major paradigms of interaction
  - Batch interfaces
  - Conversational interfaces
  - Graphical interfaces
  - "Ubicomp"
- Visionaries who inspired advances
  - Vannevar Bush, Douglas Engelbart, Alan Kay, Mark Weiser

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Batch Interfaces

- Time period: ca. 1945-1965
- Interaction style
  - Set of instructions prepared *a priori*, fed to computer via punch cards, paper tape, magnetic tape
  - Response 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
- System time costs more than human time
  - $100's/hr vs. $10-30/hr

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Conversational Interfaces

- Time period: ca. 1965 – 1985+
- Command line interface
  - First commonly used interactive style
- Interaction style
  - User types command, waits for response
  - Programs usually run to completion
  - Feedback can be given during execution
  - User can be prompted for information during execution
- User is guided through heavily scripted / structured interaction

Conversational Interface

- First commonly used interactive style
- Advantages
  - Highly flexible: Can combine commands to create sophisticated sets of operations
- Disadvantages
  - Requires recall rather than recognition
    - What does this mean and what are consequences?
  - System in control during execution: User cannot refine execution / make modifications during program execution

Recognizing User Needs

- Batch and Conversational interfaces offer interaction language closer to system language than task language
  - Onus on *user* to conform to system
- These interfaces were common at a time when computer's time was more expensive than a person's time
- Several visionaries imagined a different form of human-computer interaction

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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* inspires computer scientists to present day (http://www.theatlantic.com/doc/194507/bush)
- Goal was to augment human intellect

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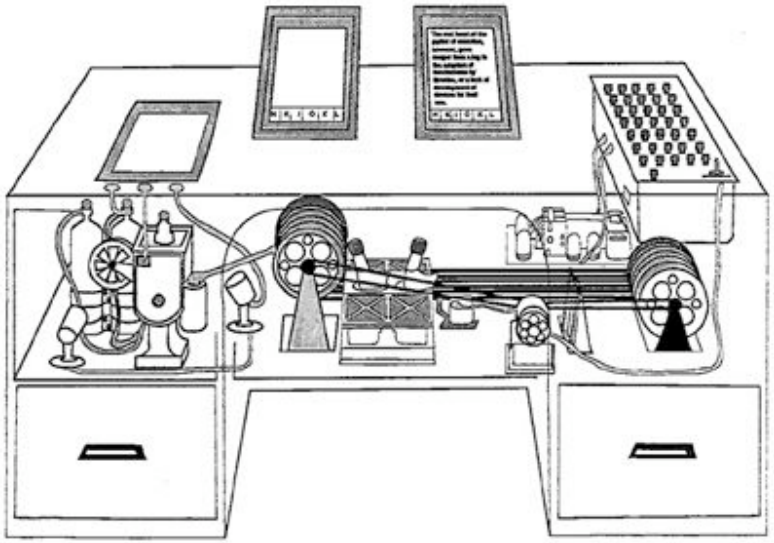
Vannevar Bush

- "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
- Dual display setup!
- Direct annotation of stored content
- Proposes direct connection to nervous system
- But hardware a long way off



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Douglas Engelbart

"By 'augmenting human intellect' we mean increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems…

[We seek] more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble…"

Augmenting Human Intellect, 1962 SRI Report

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Douglas Engelbart

- Known for…
- Creating the mouse, chording keyboard
- Demonstrates concepts such as copy/paste, computer-supported collaborative work in a 1968 live demo

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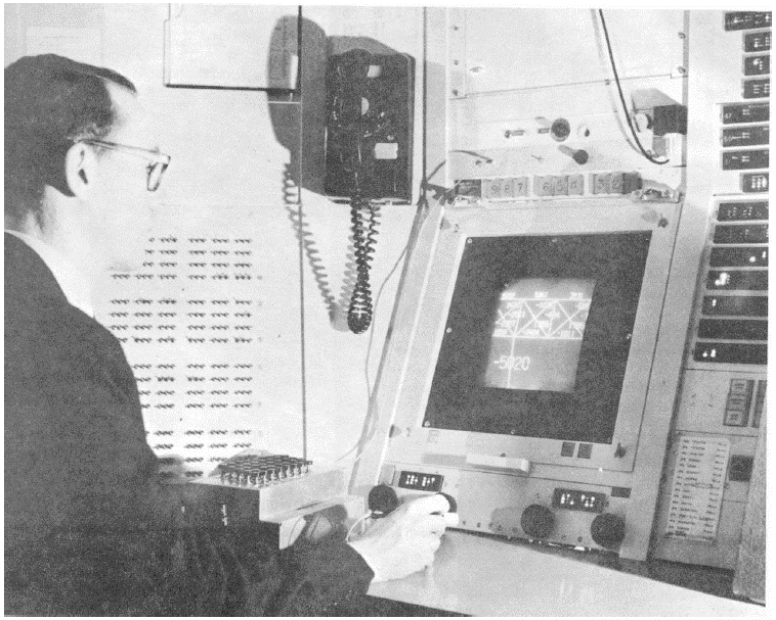
Beyond the Knowledge Worker

- Ivan Sutherland's Sketchpad (1963)
  - Light pen
  - Direct manipulation
  - Early "WYSIWYG"
- Expands computer domain to include artists, draftsmen, and more
- Language of interface moves substantially closer to task domains



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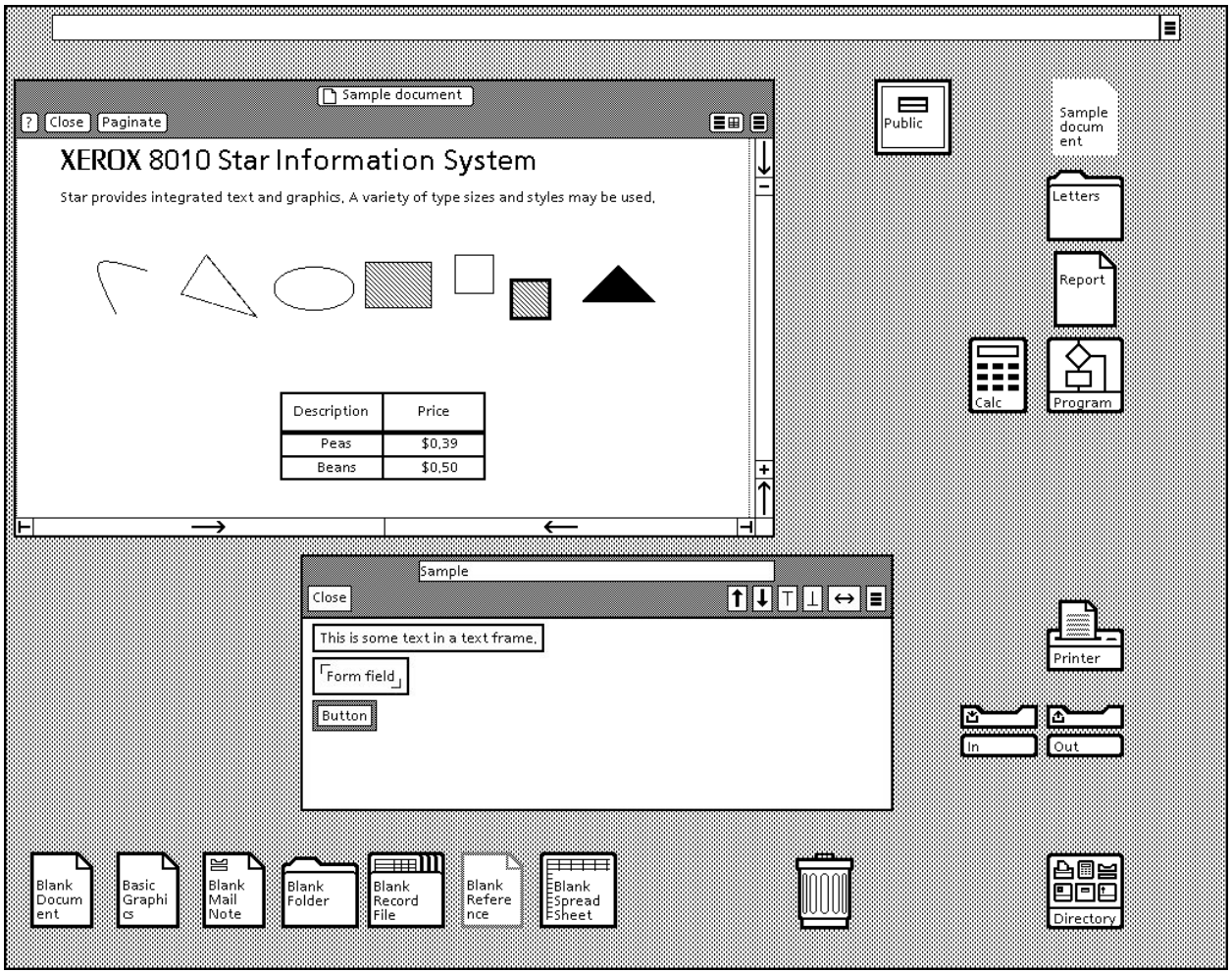
Graphical User Interface

- Time period: ca. 1984 – present
- Hardware interface
  - High resolution, high refresh graphics display
  - Keyboard
  - Pointing device (e.g., mouse)
- Typical instantiation: WIMP interface
  - Windows, Icons, Menus, and Pointer
- First instantiation of WIMP interface?



Source: http://www.guidebookgallery.org/site/about

Graphical User Interfaces

- Xerox's 8010 Star Information System (1981) first commercial WIMP offering
  - Xerox's Alto the experimental precursor
  - Many ideas from Engelbart's earlier work
- Apple's Macintosh follows years later, brings the GUI to the masses

(See http://www.digibarn.com/stories/finalstardemo for videos of these early systems)

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Graphical User Interfaces

- Interaction style
  - User in control: System waits for input, responds
  - *Recognition over recall* enables discovery of options, experimentation
  - Simulated world metaphor employed
    - What does this mean and what are its consequences for interaction?

Graphical User Interfaces

- Interaction style continued…
  - Simulated world metaphor uses real-world metaphors to represent data, enable interaction
  - *Interaction language closer to users' own language, closer to task domain*
  - Examples:
    - Files, folders, trashcan
    - How to "refile" a file?
- Users
  - Language of interaction opens interface up to broader audience

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Direct Manipulation

- Defining characteristic of many GUI's is *direct manipulation*
- Direct manipulation (Shneiderman, 1982)
  - Sense of directly manipulating objects of interest

Direct Manipulation

- Objects of interest visible
- Incremental action with rapid feedback
- Reversibility of all actions
  - Users can explore without severe consequences
- Syntactic correctness of all actions
  - Every user action is a legal operation
- Complex command languages replaced by directly manipulating visible objects

- *What is, is not, direct manipulation in modern UI's?*

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Interaction: Now What?

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

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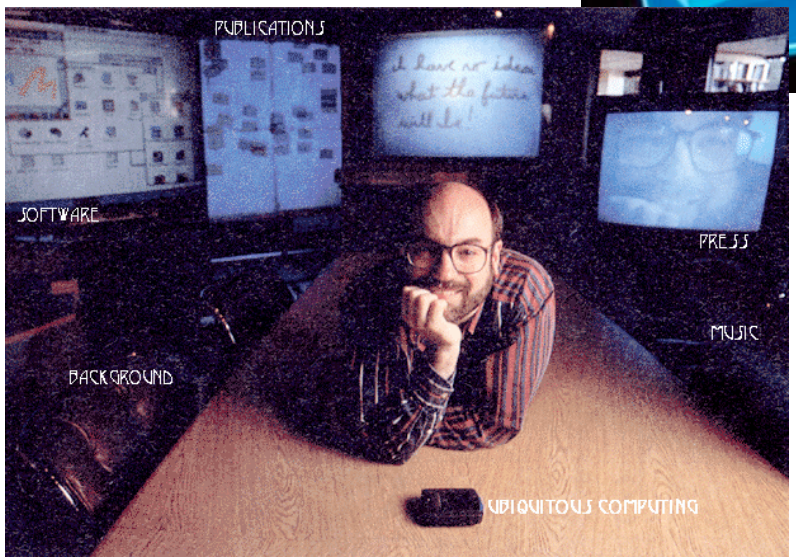
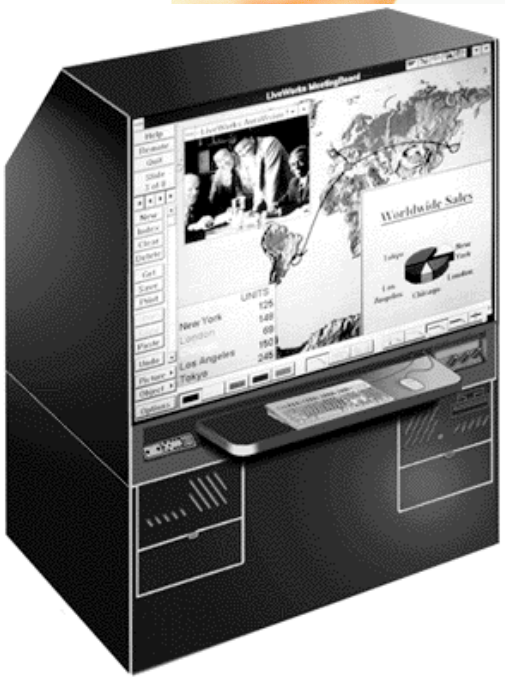
1990's: Get off the Desktop

- Two visions of the future digital age
  - Virtual reality
  - Ubiquitous computing



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)
- Envisions computing on three scales: inches, feet, yards
- Computing as "natural" as writing, fading into the environment



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Ubicomp

- Ubiquitous computing (ubicomp) highly active research area now
- Goal is to create language of interaction so close to task domain that the computer and its interface essentially become invisible
  - Not conscious of the fact that we are interacting with a computer
- How can this be achieved?

Some Ubicomp Approaches

- Make use of greater context in interaction
  - What is context?
- Context is the current physical, social, and psychological situation
  - Emotional, psychological state of user
  - Nature of task, where user is within a larger task
  - Who is present, what they are doing
  - Other examples?

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Ubicomp and Context

- How can context change nature of interaction?
- System can potentially do more for you, act more "intelligently" if it knows more about your goals

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Some Ubicomp Approaches

- Increase range of input, output devices
  - Sensors (heat, light, sound, etc.) throughout the environment
  - Artifacts at appropriate scales, in appropriate form factors (handheld devices, wall-sized devices…)
  - Computation embedded in situationally appropriate places
- Fold in machine learning to aid in interpreting new inputs
  - Not necessarily interfaces that work for you
  - Rather, system may offer assistance by being able to interpret, manage your data at a higher semantic level
  - Example: Determine whether you are interruptable, help you find interesting features of a large data set

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Pushing the Boundaries of Interaction

- Interfaces should rise to meet us and our task domain
  - We shouldn't need to expend effort translating our intentions, actions into a language far removed from task for the convenience of the system
- Throughout term, you should be thinking how interfaces you construct are rising to meet needs of users
  - Focus on creating interaction language close to the way users conceive of the task
- Some inspirations…

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Pushing the Interface

- EyeDraw (Hornof *et al*, 2003)
  - http://www.cs.uoregon.edu/research/cm-hci/EyeDraw/
- MIT's Counter-Intelligence (Bonanni *et al*, 2005)
  - http://web.media.mit.edu/~jackylee/kitchen.htm
  - http://web.media.mit.edu/~jackylee/projects/ckitchen/augkitchen_s.avi
- I/O Brush (Ryokai *et al*, 2004)
  - http://web.media.mit.edu/~kimiko/iobrush/
- Kick-Ass Kung Fu (Hämäläinen *et al*, 2005)
  - http://www.kickasskungfu.net/en/