CS 315 – Intro to Human Computer Interaction (HCI)

Direct Manipulation

Direct Manipulation Examples

- Drive a car
- If you want to turn left, what do you do?
- What type of feedback do you get?
- How does this help?
- Think about turning left using a menu/text interfaces



Goals for our Interfaces

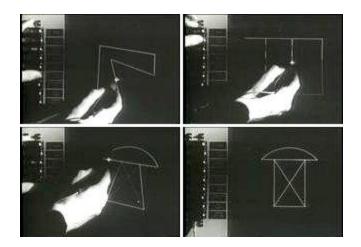
- Positive feelings associated with good user interfaces:
 - Mastery of the interface
 - Competence in performing tasks
 - Ease in learning the system originally and in assimilating advanced features
 - Confidence in the capacity to retain mastery over time
 - Enjoyment in using the system
 - Eagerness to show the system off to novices
 - Desire to explore more powerful aspects of the system

Principles of Direct Manipulation

- Continuous representation of the objects of interest
- Physical actions instead of complex syntax
- Rapid incremental reversible operations whose impact on the object of interest is immediately visible

Sketchpad 1963

Ivan Sutherland's PhD thesis at MIT





WIMP

- Window
- Icon
- Menu
- Pointing Device

Mouse

- When was the mouse invented?
- 1963 by Douglas Engelbart
- SRI International



Xerox Alto - 1973

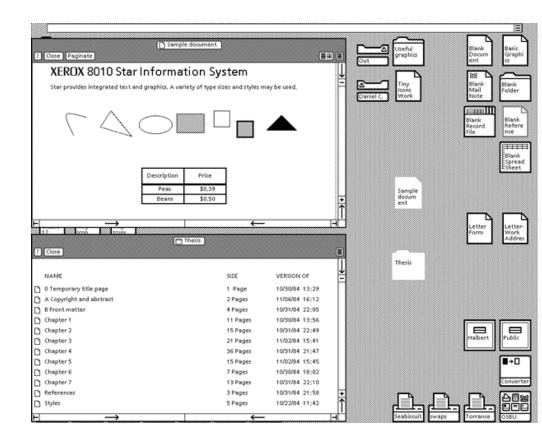
- Desktop Metaphor
- Mouse-driven GUI
- Not a commercial product



Xerox Alto Commercial

<u>http://www.youtube.com/watch?feature=player_em</u>
 <u>bedded&v=M0zgj2p7Ww4</u>

Xerox Star - 1981





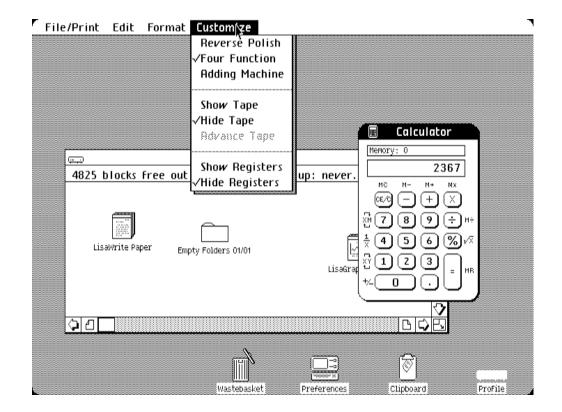
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Apple

• <u>http://www.youtube.com/watch?v=NxEmJu8OSug</u>

Apple Lisa - 1982

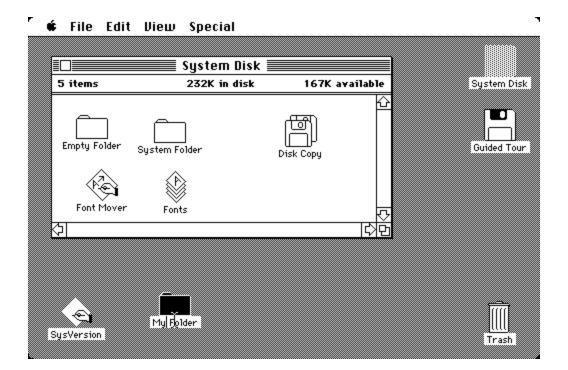




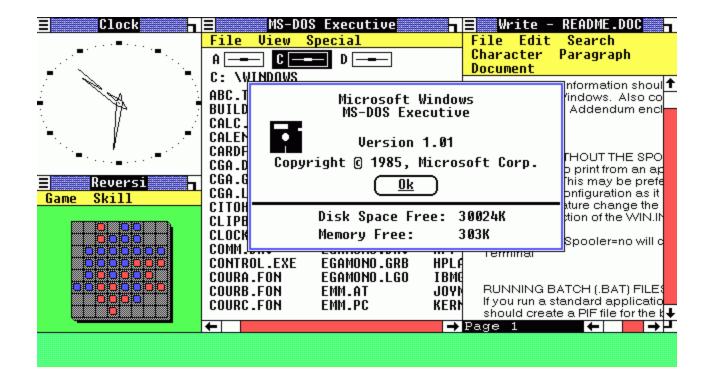
Apple Lisa

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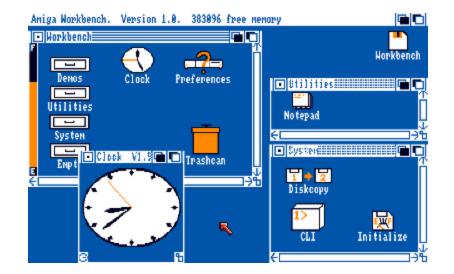
Apple Macintosh - 1984



Microsoft Windows 1.0 - 1985



Amiga Workbench - 1985



- Multi-touch wall 2008
 - <u>http://www.youtube.com/watch?v=mtLX52z4kPU&feature</u> <u>=related</u>
- Restaurant 2008
 - <u>http://www.youtube.com/watch?v=OmD0Dd02dFl</u>
- School 2010
 - <u>http://www.youtube.com/watch?v=gikZUDuy4OA</u>
- Hybrid Solutions 2009
 - <u>http://www.youtube.com/watch?v=qIASBXG3-Sk&feature=player_embedded</u>
- Multi-top Gestures Acquired by Google!
 - <u>http://www.youtube.com/watch?v=6jhoWsHwU7w</u>

Word Processors

Command line vs. display editors and word processors

Wordstar



Word Processors

WordPerfect 5.1 - 1989

File Edit Search Layout Mark Tools Font Graphics Help

(Press F3 for Help)

IN CONGRESS, JULY 4, 1776

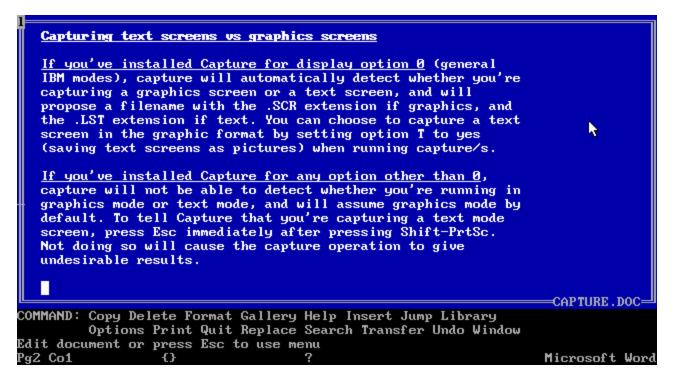
The unanimous Declaration of the thirteen united States of America

When in the Course of human events it becomes necessary for one people to dissolve the political bands which have connected them with another and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. - That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed, - That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect A:NDEC-IND.TXT Doc 1 Pg 1 Ln 1" Pos 1"

Word Processors

Microsoft Word 5.0 - 1989



Word Processors Today

- WYSIWYG
- Full page of text
- Document seen as it will be printed
- Cursor action is visible
- Labeled icons make frequent actions rapid
- Immediate display of results of an action
- Rapid response and display
- Easily reversible actions

Technologies that derive from the word processor

- Integration
- Desktop publication software
- Slide-presentation software
- Hypermedia environments
- Improved macro facilities
- Spell checker and thesaurus
- Grammar checkers

VisiCalc - 1979

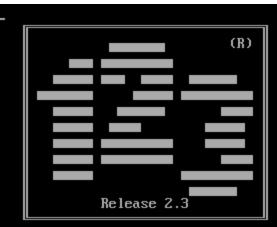
Originally released for Apple II



VisiCalc

- VisiCalc users delighted in watching the program propagate changes across the screen
- In some cases, spatial representations provide a better model of reality
- Successful spatial data-management systems depend on choosing appropriate:
 - Icons
 - Graphical representations
 - Natural and comprehensible data layouts

Lotus 1-2-3



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Lotus 1-2-3 - 1983

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Microsoft Excel - 1985

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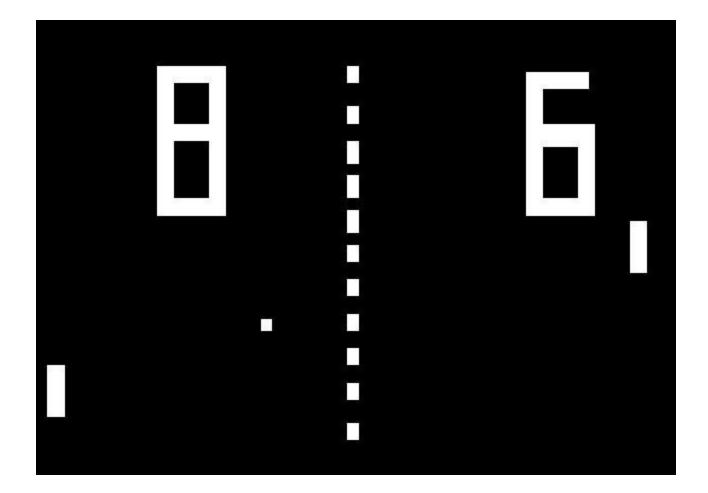
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12	TEACHER RECOMMENTATION/STUDENT ESSAY									
13	Rate: 1 Weak, 3 Neutral, 5 Strong									
14	 suggested level of initiative and strong work ethic. 	5	5	5	5	5	5	5	3	
15	2. suggested level of creativity.	5	3	5	4	3	5	3	3	
16	suggested ability to collaborate with others.	3	3	3	1	3	5	5	3	
17	4. evidence of leadership ability is	3	3	3	3	3	5	3	3	
18	OTHER CRITERIA									
19	5 Opportunities for science/math/ cs experiences	5	1	4	1	1	3	1	5	
20	Rate: 5 for no experience - 1 for much experience									
21	Adds diversity to the participant group. (ethnicity) Applicant#		8	43	47	1	15	41	44	1
22	Rate: 5 if A, C, or D; 4 if E, G or H; 3 if B, F, or I		3	3	3	3	3	3	3	
23	Shows interest in Computer Science, Technology, or Engineering	5	5	5	5	5	2	5	4	
24	Rate: 5 for much interest - 1 if not interest	4	-		-	-				
25 26	8. Shows interest in the issue of women in STEM Rate: 5 show much interest - 1 shows no interest	4	3	3	1	5	3	1	1	
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	TOTAL PTS									
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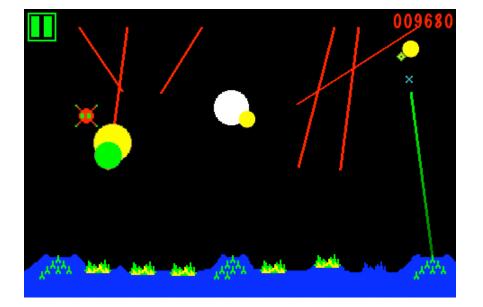
Examples of Direct-Manipulation Systems

- Computer-aided design
 - Computer-aided design (CAD) use direct manipulation
 - Manipulate the object of interest
 - Generate alternatives easily
 - Explain the impact
 - Problem solving by analogy to the real-world

Video games













Discussion of Direct Manipulation

Problems with direct manipulation

- Spatial or visual representations can be too spread out
- High-level flowcharts and database-schema can become confusing
- Users must learn the graphical representations
- The visual representation may be misleading
- Typing commands with the keyboard may be faster

Question

• An airline company is designing a new on-line reservation system. They want to add some direct-manipulation features. For example, they would like customers to click a map to specify the departure cities and the destinations, and to click on the calendar to indicate their schedules. List benefits and problems of the new idea compared with their old system, which required the customer to do the job by typing text.

Benefits

Problems

Interface-Building Tools

Visual Thinking and Icons

- The visual nature of computers can challenge the first generation of hackers
- An icon is an image, picture, or symbol representing a concept
- Icon-specific guidelines
 - Represent the object or action in a familiar manner
 - Limit the number of different icons
 - Make icons stand out from the background
 - Consider three-dimensional icons
 - Ensure a selected icon is visible from unselected icons
 - Design the movement animation
 - Add detailed information
 - Explore combinations of icons to create new objects or actions

3D Interfaces

- We live in a 3D world
- Natural interfaces are better
- Therefore 3D interfaces will be the ultimate
- What's wrong with the above?
 - Natural interfaces aren't always better!
 - Making the interface simple (thus unnatural) often aids performance
 - Constrains movement
 - Limiting possible actions
 - Depends on application and goal of the user interface
 - Surgery simulation
 - Military simulation (general vs. soldier training)
 - Architecture, education, product design
 - Video games





3D Interfaces

- What we really want are enhanced interfaces
- Give us powers we don't normally have
 - Flying, x-ray vision, teleportation, undo, etc.
- Be careful we don't become overzealous
 - Air traffic control 3D display
 - Library interfaces using a books on shelves (what is it good for? What is it poor for?)
- Hurts performance
 - Study results: 3D Bar charts don't help
- So what is helped by 3D?



- Social interfaces + 3D can be very powerful
 - MMORPG (EverQuest)
 - ActiveWorlds
 - The Sims Online

• Experiences

- Art gallery
- 3D Desktops
- 3D Web browsing. Sure you can arrange 16 web pages spatially, but why?
- Compromises to provide 3D interfaces might be undermine usability
 - Think RTS games
- Discussion: Is the interface holding back 3D?

Good 3D



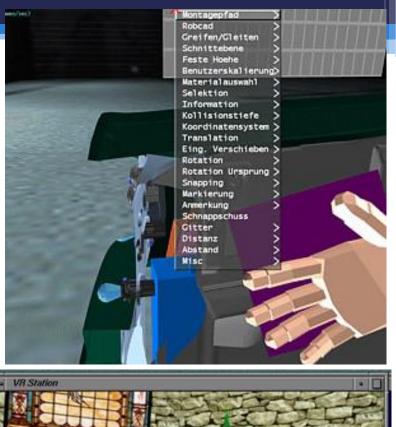


3D Desktop



3D Interfaces

- Use occlusion, shadows, perspective carefully
 - Improves use of spatial memory (Ark '98)
 - Distracting and confusing
- Minimize navigation steps
- Keep text readable (good contrast, 30 degree tilt max)
- Simple user movement (why lock to a floor?) Descent vs Quake
- Prevent Errors (put in guides to help)
- Simplify object movement (connecting two parts, for example, can be abstracted... most of the time)
- Organize groups of items into alignments that facilitate visual search and recall (allow user choice)





3D Interface Development

- 3D can help by:
 - Provide overviews to see big picture
 - Rapid teleportation (context shifts)
 - Zooming (aid disabled)
 - Multiple coordinated views (3dsmax)
 - 3D icons can represent abstract or recognizable concepts

Activity

- Find a UI to accomplish a 3D task.
- Describe the system and explain DM is applied.
 - Include a list of objects you can interact with
 - How it provides a global perspective
 - Feedback mechanism
 - Interaction mechanism (what does the user do to interact)
 - How well it does/does not accomplish task