

# CS 315 – Intro to Human Computer Interaction (HCI)

A decorative graphic consisting of a solid blue horizontal bar that spans the width of the slide. Below this bar, on the right side, there are several horizontal lines of varying lengths and colors (light blue and white) that create a stepped, layered effect.

# 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

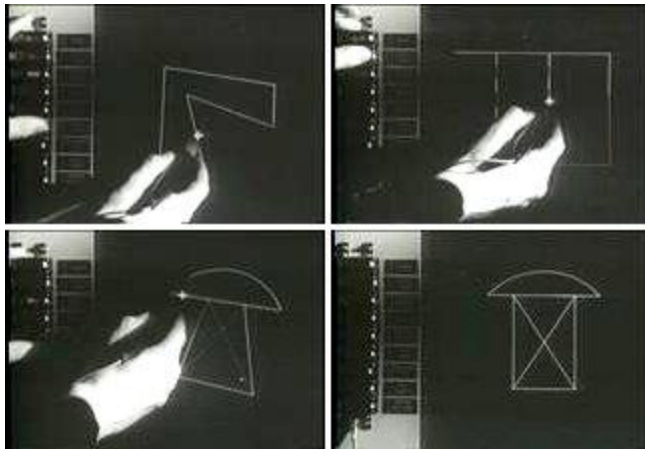
- Positive feelings associated with good user interfaces:
  - Mastery of the interface
  - Competence in performing tasks
  - Ease in learning the system originally and in assimilating advanced features
  - Confidence in the capacity to retain mastery over time
  - Enjoyment in using the system
  - Eagerness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

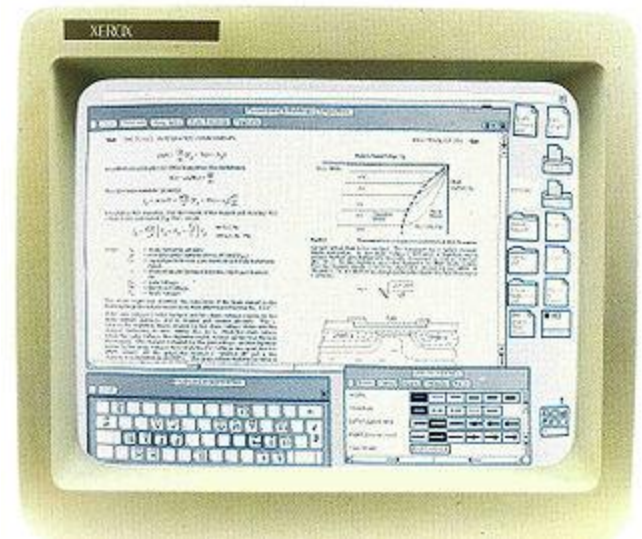
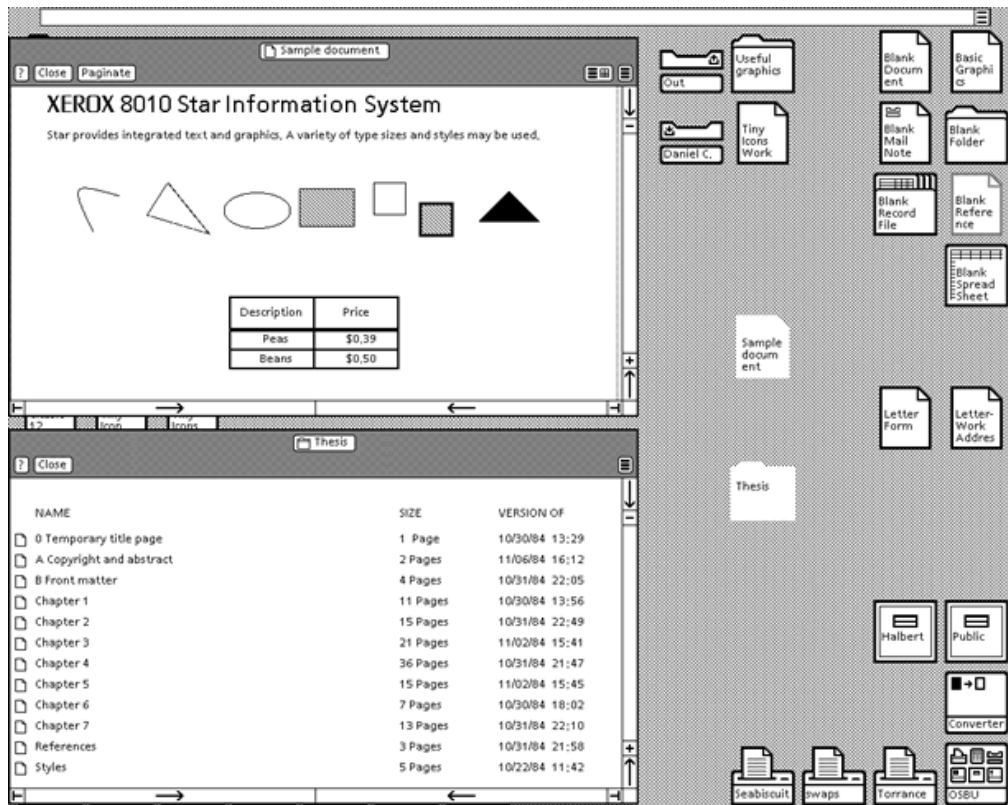
- Desktop Metaphor
- Mouse-driven GUI
- Not a commercial product



# Xerox Alto Commercial

- [http://www.youtube.com/watch?feature=player\\_embedded&v=M0zgj2p7Ww4](http://www.youtube.com/watch?feature=player_embedded&v=M0zgj2p7Ww4)

# Xerox Star - 1981

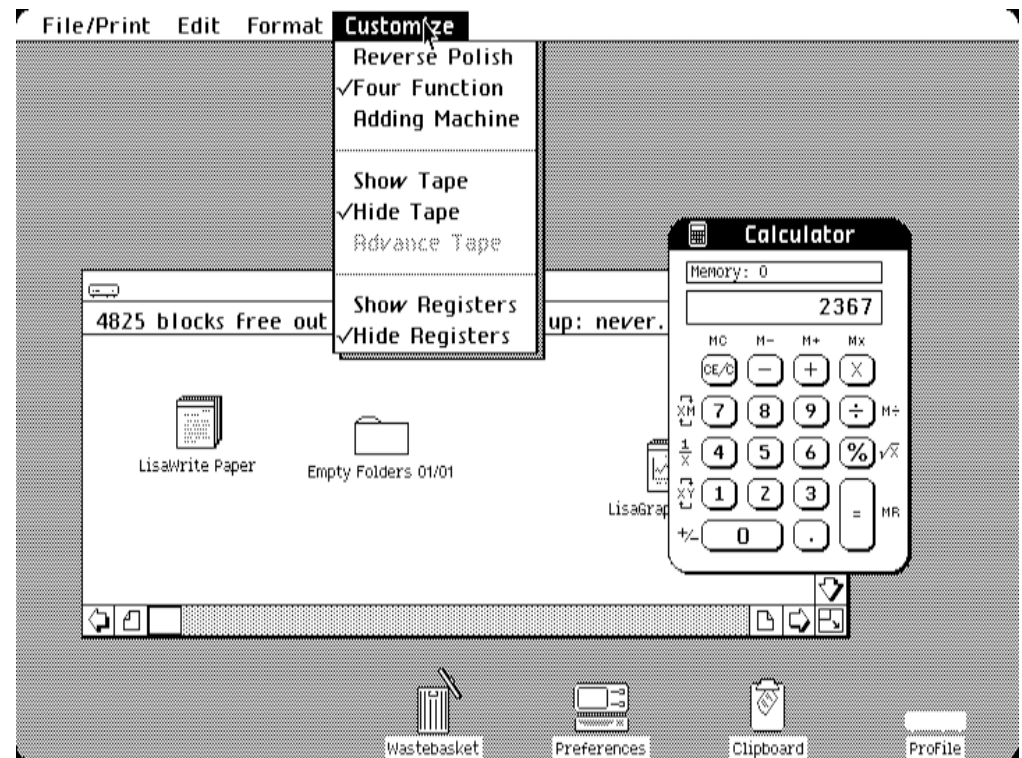




# Apple

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

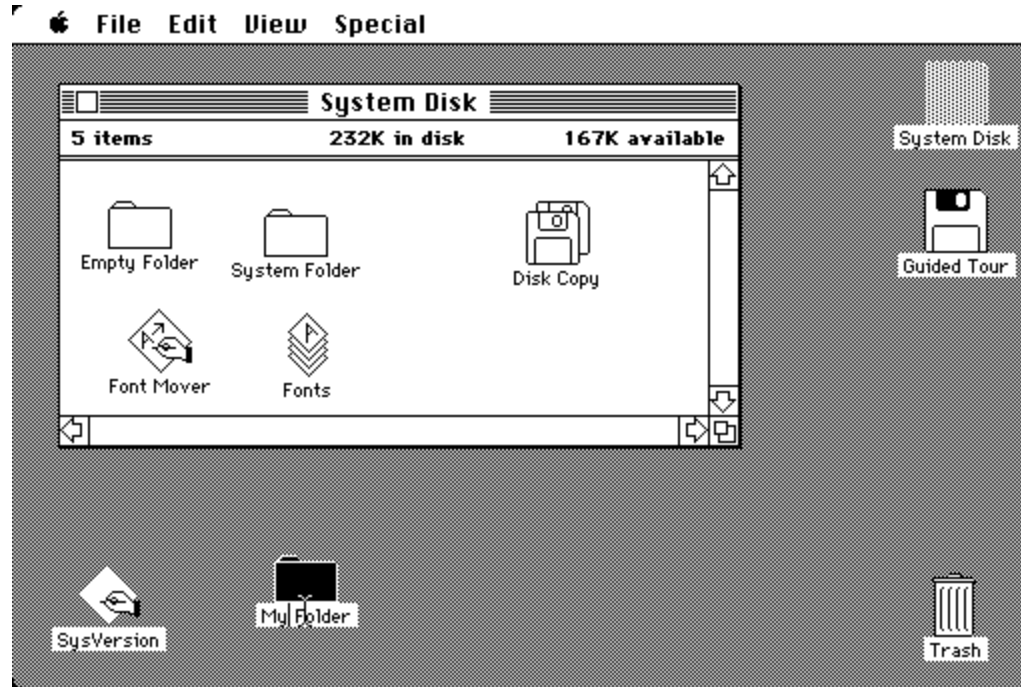
# Apple Lisa - 1982



# Apple Lisa

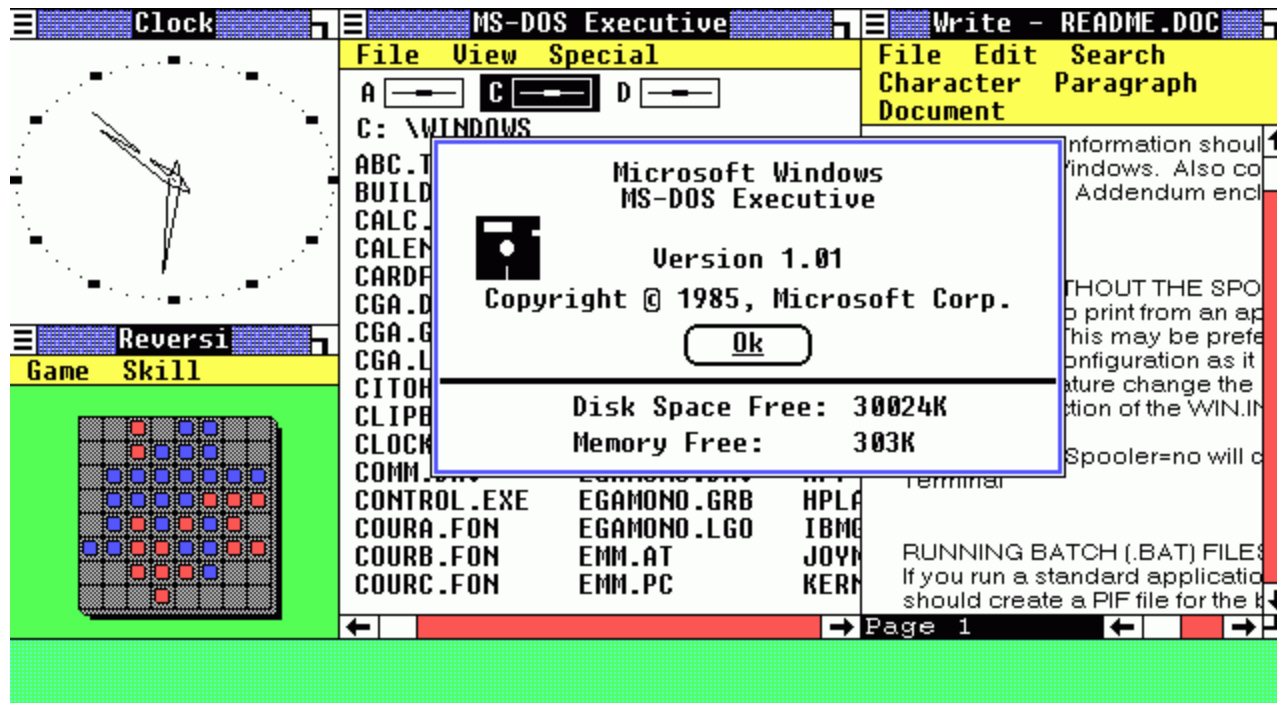
- <http://www.youtube.com/watch?v=a4BlmsN4q2I&feature=related>

# Apple Macintosh - 1984

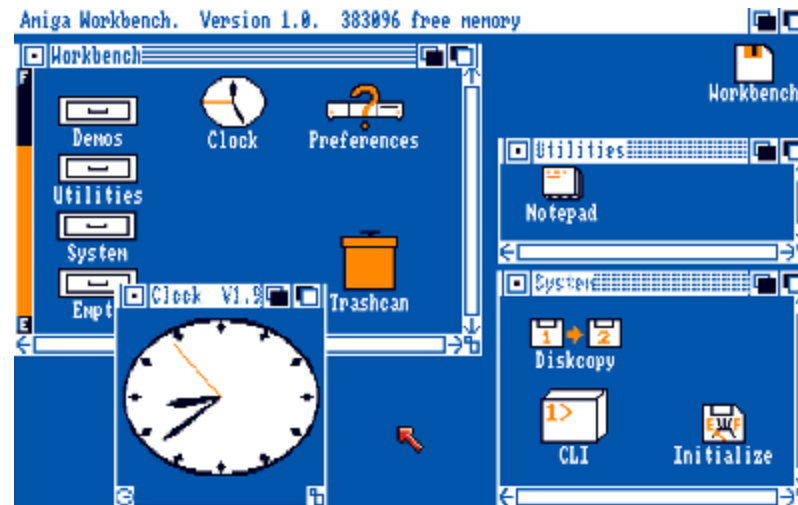




# Microsoft Windows 1.0 - 1985



# Amiga Workbench - 1985



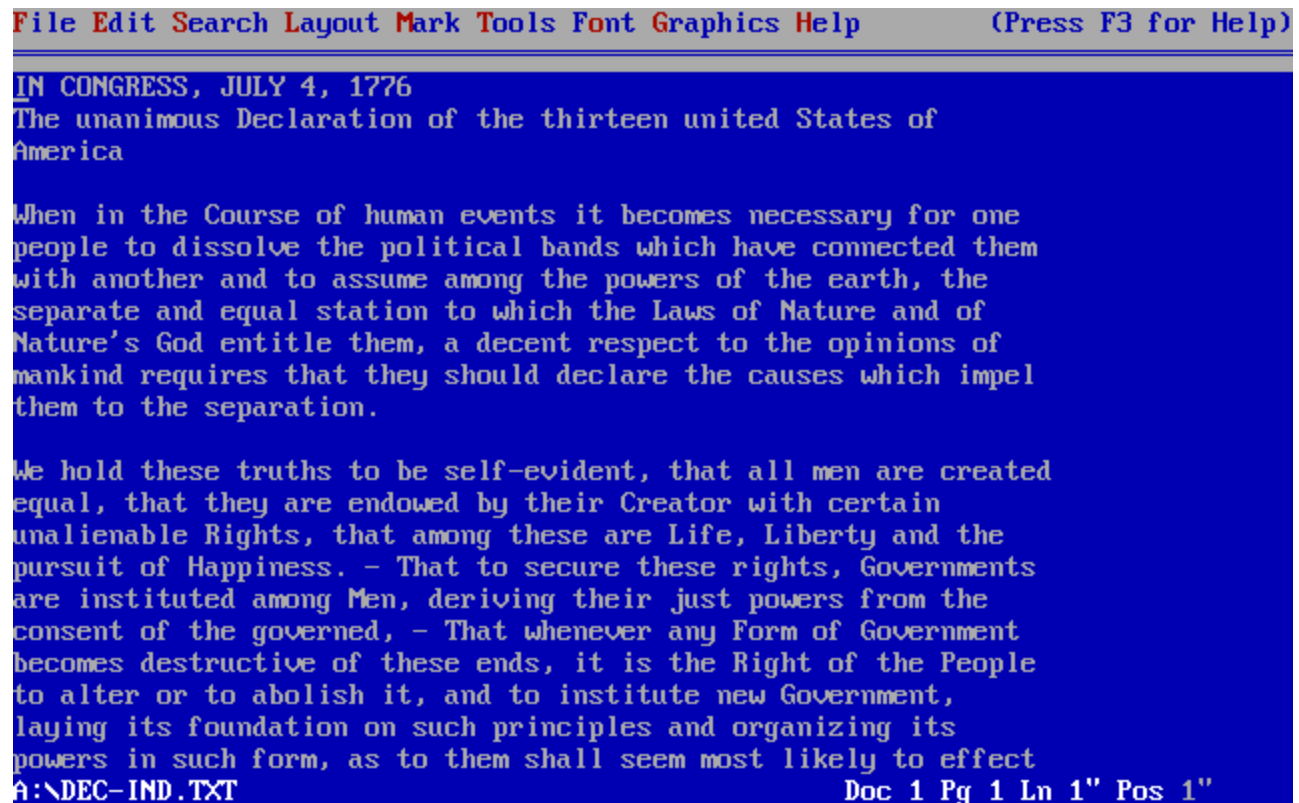
- Multi-touch wall - 2008
  - <http://www.youtube.com/watch?v=mtLX52z4kPU&feature=related>
- Restaurant – 2008
  - <http://www.youtube.com/watch?v=OmD0Dd02dFI>
- School – 2010
  - <http://www.youtube.com/watch?v=gikZUDuy40A>
- Hybrid Solutions – 2009
  - [http://www.youtube.com/watch?v=qIASBXG3-Sk&feature=player\\_embedded](http://www.youtube.com/watch?v=qIASBXG3-Sk&feature=player_embedded)
- Multi-top Gestures – Acquired by Google!
  - <http://www.youtube.com/watch?v=6jhoWsHwU7w>

# Word Processors



# Word Processors

- WordPerfect 5.1 - 1989



# Word Processors

- Microsoft Word 5.0 - 1989

```
1
Capturing text screens vs graphics screens

If you've installed Capture for display option 0 (general
IBM modes), capture will automatically detect whether you're
capturing a graphics screen or a text screen, and will
propose a filename with the .SCR extension if graphics, and
the .LST extension if text. You can choose to capture a text
screen in the graphic format by setting option T to yes
(saving text screens as pictures) when running capture/s.

If you've installed Capture for any option other than 0,
capture will not be able to detect whether you're running in
graphics mode or text mode, and will assume graphics mode by
default. To tell Capture that you're capturing a text mode
screen, press Esc immediately after pressing Shift-PrtSc.
Not doing so will cause the capture operation to give
undesirable results.

█

CAPTURE.DOC

COMMAND: Copy Delete Format Gallery Help Insert Jump Library
          Options Print Quit Replace Search Transfer Undo Window
Edit document or press Esc to use menu
Pg2 Co1      {}      ?      Microsoft Word
```

# 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

The screenshot shows a VisiCalc spreadsheet window titled "C11 (L) TOTAL" with a cursor at cell C125. The spreadsheet contains a table with columns labeled A, B, C, and D. The data is as follows:

	A	B	C	D
1	ITEM	NO.	UNIT	COST
2	BUCK RAKE	43	12.95	556.05
3	TONER	150	6.75	1012.50
4	TONER	250	49.95	12487.50
5	SNUFF	2	4.95	9.90
			SUBTOTAL	13155.50
			9.75% TAX	1282.66
			TOTAL	14438.16

# 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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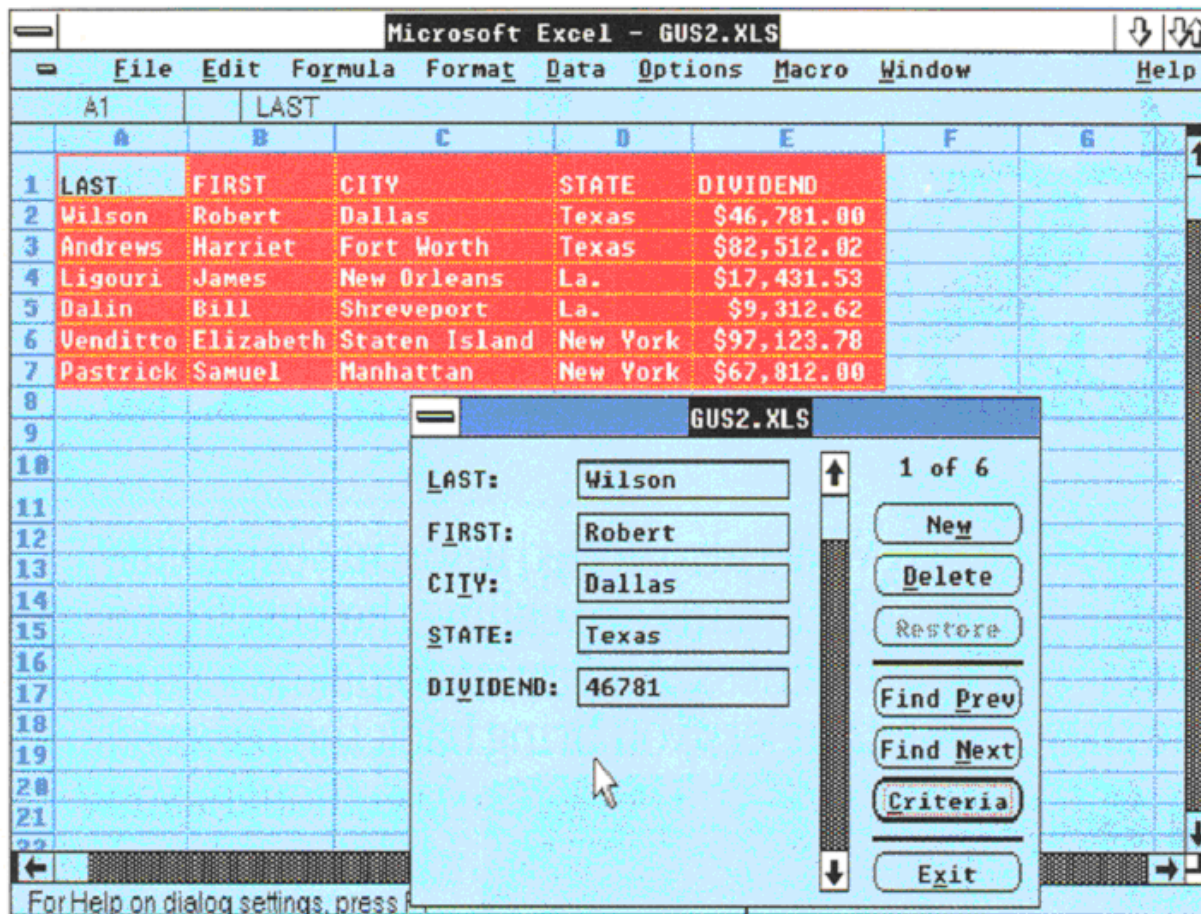
# Lotus 1-2-3 - 1983

B1: "Principal" MENU

Worksheet Range Copy Move File Print Graph Data Quit  
Global, Insert, Delete, Column-Width, Erase, Titles, Window, Status

	A	B	C	D	E
1		Principal	\$50,000		
2		Rate	13.0%		
3		Years	5		
4		Payment	1,137.65		
5					
6	Year	Begin Bal.	End Bal.	Total Paid	Interest
7	1	50,000.00	42,406.26	13,651.84	6,058.10
8	2	42,406.26	33,764.33	13,651.84	5,009.92
9	3	33,764.33	23,929.53	13,651.84	3,817.05
10	4	23,929.53	12,737.22	13,651.84	2,459.53
11	5	12,737.22	0.00	13,651.84	914.63
12					
13					
14					
15					
16					
17					
18					
19					
20					

# Microsoft Excel - 1985



# Microsoft Excel

Microsoft Excel [Compatibility Mode] - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Team

Clipboard Font Alignment Number Styles Cells Editing

Calibri 11

General

Conditional Formatting Format as Table Cell Styles Insert Delete Format Sort & Find & Filter Select

AE1	A	B	C	D	E	F	G	H	I	
1	<b>2013 G<sup>2</sup>cs Camper Applications Evaluator Review Sheets</b>									
2										
3										
4	Application Number	1	2	3	4	5	6	7	8	
7	Student_Grade	7	7	7	7	7	7	7	7	
8	GPA		4	4	3.4	3.7	3.67	4	4	3
11										
12	<b>TEACHER RECOMMENDATION/STUDENT ESSAY</b>									
13	Rate: 1 Weak, 3 Neutral, 5 Strong									
14	1. 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	3. 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	<b>OTHER CRITERIA</b>									
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	6. Adds diversity to the participant group. (ethnicity) Applicant#	27	8	43	47	1	15	41	44	
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	3	
23	7. 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									
25	8. Shows interest in the issue of women in STEM	4	3	3	1	5	3	1	1	
26	Rate: 5 show much interest - 1 shows no interest									
27	9. Repeat Applicant 3 Bonus Pts									
28	<b>TOTAL PTS</b>	33	26	31	23	28	31	26	25	
29	<b>REVIEWER'S RECOMMENDATION Y=Yes M=Maybe N=No</b>	Yes	Y	Y	Y	M	M	No	Yes	
30	Home school: Christian	MO	Art school	Online scho	(1) teacher	nurse	Asian	Forest Grow	St.	
31					dinged on teamwork	Taken tons of	Saturday academy class	(2) te	done pr	
32	<b>RACE/ETHNICITY INDICATIONS</b>									
33	<b>A: American Indian or Alaskan Native</b>									
34	<b>B: Asian</b>									
35	<b>C: Black or African American, Non-Hispanic</b>									

Ready Applicant Eval School Distribution

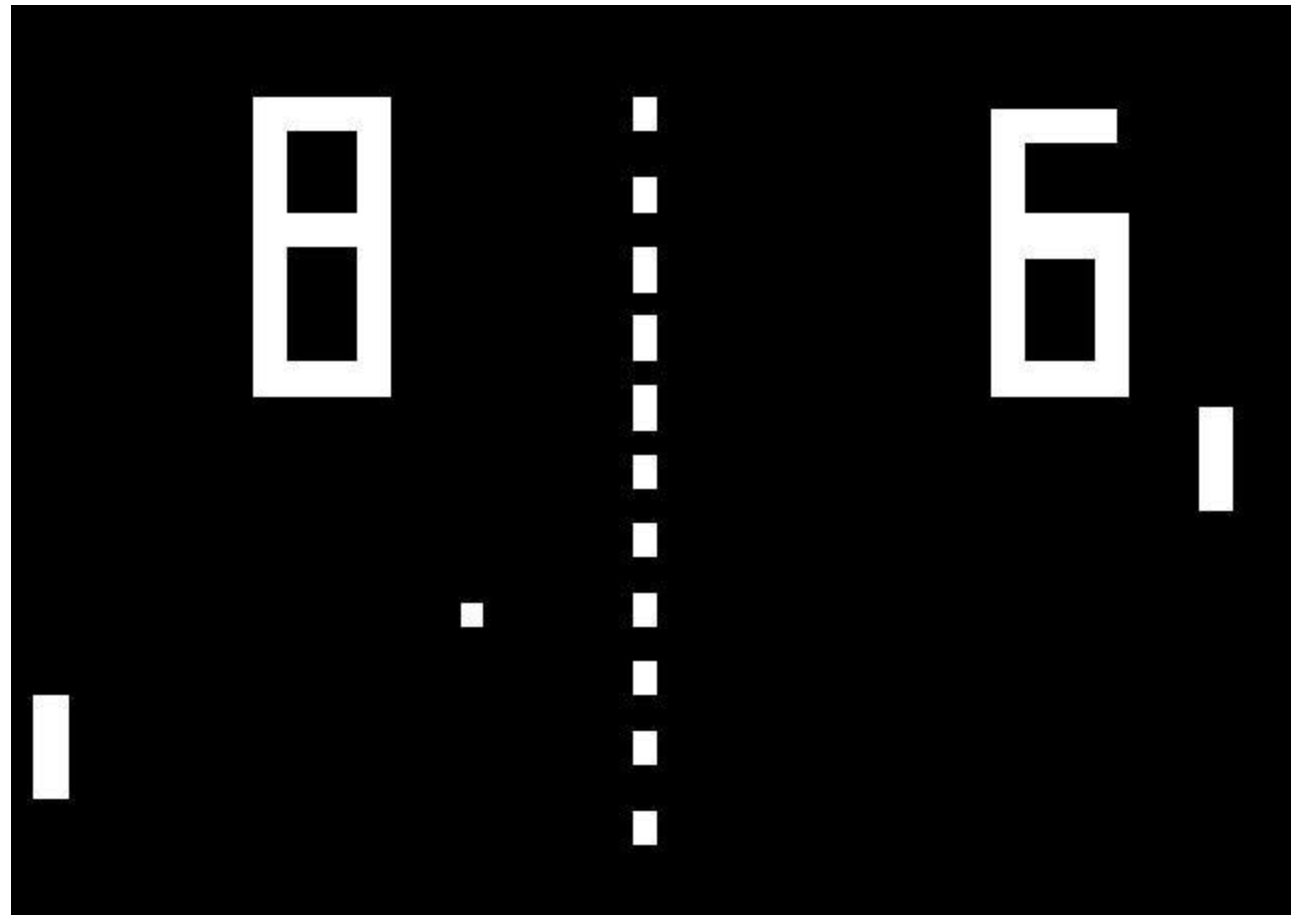
Average: 11.07692308 Count: 15 Sum: 144 100%

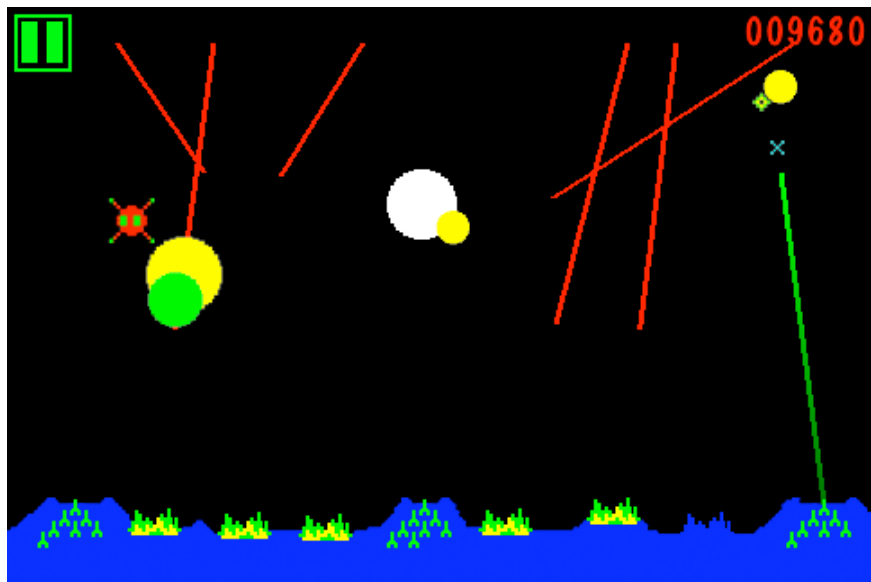
# Examples of Direct-Manipulation Systems

- 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?



# Good 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?

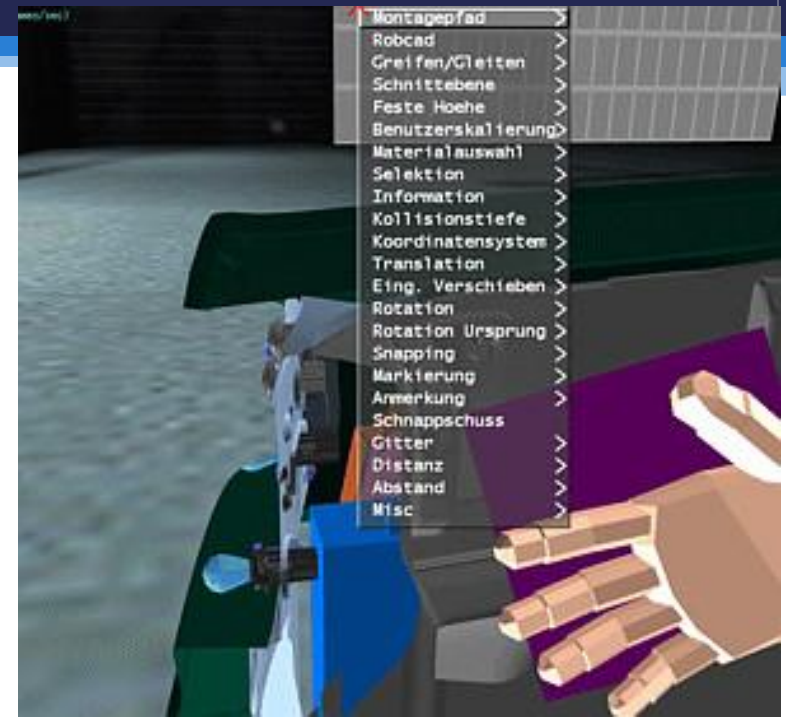


# 3D Desktop



# 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