Designing Interactive Systems I

History I – From Abacus to Macintosh

Prof. Dr. Jan Borchers
Media Computing Group
RWTH Aachen University

Winter Semester ’22/’23

http://hci.rwth-aachen.de/dis
Review

• What are the four basic principles of Visual Design?

• How to create contrast using color?

• What font types are there?
  • When do you typically use serif types?

• Maximal text line width?
Radically New Interface

- **No Single Hero**: Even interfaces that seem “radically new” were built on lots of previous iterations (mouse, touch screens, ...)

Image: Buxton Collection
research.microsoft.com/en-us/um/people/bibuxton/buxtoncollection/

Released in 1984
“Picasso knew everything about art history, because he had to know the rules before he could break them.”

— Bill Buxton, CHI ’11
Pre-Computing

• Abacus (Babylon, ~ 2000 BC): no UI
  • First known mechanical calculating aid

• Da Vinci’s mechanical calculator (1500s)
  • First design of mechanical calculator

• Pascal’s Arithmetic Machine (1642)
  • First working model, +/-
  • ~ Leibniz, Schickard

• Driving force
  • Early: direct representation of conceptual model
  • Later: increasing level of abstraction
First Computers

- Plugboards (e.g., ENIAC 1946)
  - Just data, no program memory
First Computers

• Von Neumann architecture (1945)

• Key advances:
  • Defined basic components of today's computer
  • Storing instructions in memory

• ~ Zuse Z1–Z4 (1936–50)
Mainframes & Batch Processing

- Prepare data on punch cards—submit—wait for result as printout offline

- Mode of interaction on mainframes of 60’s & 70’s

- Efficient use of machine; no waiting for human input

- “0-D user interface” [Nielsen’93: Usability Engineering]
  - Single point in time for submission of the batch job as a single unit
Transaction Systems

- SABRE system (1960)
- IBM 3270 (1971)
- Key advances: Immediate response for lots of users from distant terminals (for a special-purpose application)
Time Sharing

• Key advances: Provide general purpose interactive response efficiently to many users simultaneously with one computer
  • MIT CTSS/ITS/Unix etc.
  • First teletypes, then glass teletypes
  • Addressable character Terminals
  • Command-line interfaces

• “1-D interfaces” [Nielsen’93: Usability Engineering]
  • Enter and edit one command line, then hit SEND key
Memex: A Vision of Computing

• Vannevar Bush: “As We May Think”, The Atlantic Monthly, July 1945

• The Memex is a device storing all of an individual’s books, records, and communications

• Information may be consulted with exceeding speed and flexibility

• Predicted: Hypertext, PC, internet, WWW, speech recognition, online encyclopaedias
Memex

From Vannevar Bush’s Essay *As We May Think*
The Long Nose

$1B$

Radar

Invention

Refinement & Augmentation

Productization

~ 20 years

Radar Systems

• Example: SAGE Air Defense (MITRE, 1963)

• Key advances:
  • Real-time response for complex (but specific) tasks including graphics
  • First GUI (sort-of)
Sketchpad (Sutherland, 1963)

• First interactive computer graphics program

• Key advances:
  • Techniques for direct manipulation of graphics on a screen, including constraint satisfaction
Part 3: Historical Perspective: "Computer Sketchpad"

* a classic and beautiful system
* first CAD system
* introduced constrained input
* introduced instantiation

(not shown at CHI ‘83)

(Excerpt)
NLS: oN-Line System (Engelbart, 1968)

• Word processing and linking

• Key advances:
  • Mouse, windows, hyperlinking, video conferencing, revision control, word processing, and collaborative real-time editor

• Focused on enhancing expert performance, not on initial ease of use
  • Failed in user tests because of its complexity
  • Perfect for trained users with 4 hands :)

• But: “Mother Of All Demos” :)
Engelbart’s First Mouse (1964)

- Outperformed other devices of that time:
  - Light pen, track ball, foot-pedal, knee-operated devices, head-operated devices
Early Hobbyist PCs & Games

• Atari PONG (Bushnell, 1972)

• MITS Altair (1975)

• Key advances:
  • Machines cheap enough to be used by someone other than government and big business or research labs
Early Personal Computers

• Apple II, 1977
  • Key advances: First general purpose personal computer used widely in business (because of VisiCalc)

• IBM PC, 1981
  • Key advances: Making the PC respectable to business in general by putting the IBM label on it

• Features
  • Character terminal
  • Text UI standards (IBM CUA)
  • Graphics: non-standard
Bitmap Displays and GUls
Xerox Alto (PARC, 1973)

- 2.5MB removable HD (pre-floppy), 128-256K RAM, 600x800, mouse, Ethernet, not commercialized

- Smalltalk platform, Bravo WYSIWYG editor, email

- Key advances:
  - Bitmap Display and GUI
  - Menus, windows, pointing, dragging, etc., as we now know them
Xerox Star (1981)

- Introduced window systems commercially, $17K
- Key advances:
  - Integrated networked document environment, WYSIWYG text editing, icons, property sheets, window management, …
- Built to improve Alto
- Unique design process (8 years of prototyping)
- “2.5-D interfaces” [Nielsen’93]
  - Interacting with 2D display + overlapping windows
Xerox Star keyboard and mouse
Star: Design Lessons

✓ Design first, then code
✓ Objects & Actions
✓ Detail
✓ Graphic designers
✓ DIA cycle
But:

✗ Industry trends
✗ Customer focus
✗ Extensibility
✗Responsiveness
✗ Metaphor limits
✗ Selling radical innovation
Apple Lisa (1983)

• Apple’s first bitmapped-GUI computer

• Inspired by Alto (not Star) — One-button mouse

• Key advances: Fixed menu bar (instead of pop-up menus: Fitts’ Law)

• But: underpowered, bad marketing ($10K)
Lisa User Interface

[Craig, 1993]
No Need To Save: Why History Matters

• Apple, 2011: “New feature: Documents are saved automatically and continuously—only need to save explicitly for checkpoints!”

• Relaunching an application brings back all open documents in their last state

• Guess what? Lisa had these features in 1983!
  • Got lost with Mac due to hardware/software performance limitations at the time

• History tends to repeat itself — although 2011 adds better versioning UI
Apple Macintosh (1984)

- Lisa follow-up

- Key advances:
  - First commercially successful WIMP system, $2500
  - GUI affordable to huge new user community
  - Targeted at hobbyists, not just office use
  - Most consistent commercial WIMP UI
    - Macintosh Human Interface Guidelines
    - Apple Evangelists
  - MacPaint & Quickdraw now open source
    - (http://www.computerhistory.org/highlights/macpaint/)
Macintosh System 1.1

Hello System 1.1

More in DIS2
Microsoft Windows (1985)

- Key advances: Bringing Alto/Star/Mac interaction style to huge populations of DOS and Unix computers
OSF/Motif (1980’s)

- Key advances: OO toolkit architecture (simpler dev.)
Summary

- There are no single heroes in interface design.
- Interfaces have evolved from 0D interfaces to 2.5D interfaces.
- Many “new” interaction principles and technologies were envisioned and/or implemented decades ago.
  - Long Nose of Innovation.