CS 160: Lecture 2

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History of HCI

Personalities:
* Vannevar Bush - Universal information access
* J.C.R. Licklider - Networking, Agents
* Ivan Sutherland - Sketchpad
* Doug Engelbart - Mouse, GUI, Word proc...
* Ted Nelson - Hypertext
* Alan Kay - OO programming, Laptops
* Don Norman - Cognitive principles
* Jacob Nielsen - Usability
History of HCI

Systems:
* Memex - 1945 (concept)
* Sketchpad - 1963
* NLS (oNLine System) - 1963-68
  + (mouse '64)
* Xerox Alto '72, Star '81
* Grid Compass 1983
* Apple Lisa '83, Mac '84, NeXT '88
* Powerbook 1991
* HTML, HTTP 1994

1968 Dynabook
1983
History of HCI

Politics
* Military Funding
  + NDRC - OSRD - ARPA - DARPA
* Elite universities (MIT, Stanford, CMU, Berkeley)
* NSF 1950 → present
* Xerox PARC - 1970 → present
* Apple - NeXT
* Hypertext 1967...
  + Prototypes: HES 1969, ZOG 1975...
  + Xanadu 1981, not funded 'til 87 (Hypercard 1987)
  + 1989 Xanadu -> Autodesk, WWW proposal
Vannevar Bush (1890-1974)
* Engineer by training (MIT)
* Differential analyzer - 1930
* Led computing research in '30s
* Created military research
  + NDRC '40, OSRD '41-47
* Managed nuclear weapons research throughout the 40’s
* Wrote “science - the endless frontier” 1945
* Military consultant through 50’s
Bush’s “as we may think” 1945
* Proposed the “Memex” a very modern computer
Bush’s Memex

- Individuals store all personal books, records, communications
- Items retrieved rapidly through indexing, keywords, cross references,...
- Can annotate text with margin notes, comments...
- Can construct a trail through the material and save it
- Acts as an external memory
After WWII, Bush continued to push for analogue computers (and against digital). You can’t win ‘em all!
J.C.R. Licklider  
1915-1990

- Ph.D. 1942 Rochester, Psychologist
- Started “Human Engineering group” at MIT’s Lincoln labs in 1951
- Tried to evolve psych. into a department within Electrical Engineering
- With ARPA sponsorship, the first CS programs were created:
  * MIT, CMU, Berkeley, Stanford
At ARPA, Licklider promoted computing research and sponsored:

* Time-sharing
* Networking
* Engelbart’s and Sutherland’s online computing work
J.C.R. Licklider publications

- Man-computer symbiosis - 1960
- Libraries of the future - 1965
- The computer as communication device - 1968
Man-Computer Symbiosis - 1960

Did self-observation of his daily work.
* Observed that much work was mundane and related to accessing and organizing information

Proposed:
* Digital libraries
* Display screens with pen input and character recognition
* Wall displays for collaborative work
* Speech recognition and production for HCI
The Computer as a Communication Device - 1968

- Cooperative work with shared and individual screens
- Pen chat
- Online communities
- Agents - OLIVERs On-Line Vicarious Expediter and Responder
Much of Licklider’s sponsored research was unpopular in the engineering community:

“Time-sharing is a waste of valuable computer time”

“Why are we doing this?”

* BBN engineer about the first computer network
Ivan Sutherland
1938 -

- MIT Ph.D. in 1963
- Ph.D. work was “Sketchpad”
- Pioneered computer graphics and CAD
- Started Evans and Sutherland in 1968
Doug Engelbart
1925 -

- Ph.D. UC Berkeley (EE) in 1955
- Thesis on “plasma digital devices”
  - a way into computing
- Strongly influenced by Bush’s article
- Moved to SRI, started formulating
  human augmentation ideas in 1959
- Funding from ARPA in 1963
- NLS (oNLine System) demo 1968
Engelbart’s innovations

- NLS (1968) featured:
  - Video screen and keyboard
  - Mouse and chordal keyboard
  - Videoconferencing
  - Hypertext linking
  - Word processing
  - E-mail
  - A window system
  - User testing!
Engelbart’s work

- Continued at SRI, worked on network extensions
- Funding dwindles through the 70’s..., AI ↑ HCI ↓
- NLS project sold in 1977 to Tymshare
  * Half of the (~40) NLS engineers moved to Xerox PARC, others to Tymshare
  * Engelbart fired from SRI in ’77, moves to Tymshare
- Migrated to McDonnell-Douglas in 1984, until 1989 pushed for open hypertext systems
- Started Bootstrap institute in 1989
Engelbart’s work

- 80s and 90s: Personal computing and the web happen
- Engelbart Receives the ACM Turing award in 1997

“For an inspiring vision of the future of interactive computing and the invention of key technologies to help realize this vision”
Ted Nelson
1937 -

- M.A. Sociology, Harvard ’63
- Coined “hypertext” in 1960
- Worked with Van Dam at Brown on HES - 1967
- Designed Xanadu in 1981
  * Global hypertext
  * Pay-per-view
  * Not funded until 1987
- Hypertext as a more natural medium than linear text for creative writing
- “I build paradigms. I work on complex ideas and make up words for them. It is the only way.”
Alan Kay
1940 -

- Ph.D. 1969 (Utah) Computer Graphics
- In 1968, met Seymour Papert (LOGO) in the MIT AI Lab.
  - kids can program!
- Moved to Xerox PARC in 1972
- Started developing “Smalltalk”, in the Learning Research Group
- First general OO programming language
- Influenced by Simula
  * Engineers can program!
Dynabook (laptop computer) conceived in 1968, well ahead of its time.

As interim steps, Kay develops the Xerox Alto (1972) and Star, the first real personal computers.
The Star (1981 and begun in 1975) in particular was a very advanced machine. It had most of the "WIMP" elements we know today.

The Star was the result of extensive user testing, and its design has stood the test of time (Liddle article).

Many design features were better than its successors (e.g. object-oriented editing features).
The Star design team developed a new methodology for system design:

- Task analysis
- Wide range of users
- Usage scenarios
- Decomposition of design:
  - display and control interface
  - User's conceptual model
- Many prototyping cycles
- Desktop metaphor, direct manipulation, WYSIWYG
But the Star was expensive and slow ($25k).
Steve Jobs and Apple engineers visited PARC in 1979, and that set the path for Apple
15 PARC engineers migrated to Apple
Apple Lisa ships in 1983 at $10,000, and fails in the marketplace

The Apple Macintosh ships in 1984 at $2500, and the personal computing market changes for good
Alan Kay after PARC

- Kay worked briefly at Atari, then became an Apple fellow in 1984. Often visited the MIT Media Lab in the 80’s and 90’s.
- In 1996 he left for Disney to become a Disney fellow.
- Left Disney because of cutbacks, joined HP labs in 2002.
"Don't worry about what anybody else is going to do... The best way to predict the future is to invent it. Really smart people with reasonable funding can do just about anything that doesn't violate too many of Newton's Laws!"
Small Devices

- The Apple Newton was the first “PDA” (1993) but didn’t succeed commercially.
- Still popular, though out of production.
- Has achieved a kind of cult status.
Jeff Hawkins was an EE with an interest in cognitive science and the brain.

Worked at GRiD.

Wrote Ph.D. proposal at Berkeley in Biophysics in 1987 - rejected.

Back to GRiDPad - first pen computer?

Developed a handwriting recognizer based on his interests in the Brain.
Next try “Zoomer” 1993 - a failure commercially
Intensive studies of Zoomer users began in 1994.
Decided the PDA should be a paper replacement, not a PC replacement.
Switched to graffiti.
Shrank to pocket size.
Unveiled the Palm Pilot in 1994.
Excellent writing surface, pen, digital ink.

Compromise on:
* Keyboard
* Weight
* Battery life

Still trying to be a PC.

Many formats, will natural selection choose a winner? - or is it headed the way of the Newton?
Smart phones

- Qualcomm’s PDQ 1999 (Jacobs) - phone with a complete Palm Pilot inside. Other models followed.
- Latest generation of phones support “applets”.
- Motorola J2ME phones.
- Qualcomm’s BREW (binary) environment.
- GPS will enable location-based services.
Break
Admin issues

- First assignment is due Monday at 529 Soda (in mailbox or slide under door).
- If you’re ready you can hand it in at end of class.
Wilfred Hansen (1971) introduced principles for UI design:

- "Know the user"
- "Minimize Memorization"
- "Optimize Operations"
- "Engineer for Errors"
“The Psychology of Human-Computer Interaction” by Card, Moran and Newell, 1983

Included mechanistic models of human behavior, the MHP or “Model Human Processor”.

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Don Norman introduced many principles from cognitive science: (1980s - 90s)
- Mental representation.
- Gibson's affordances.
- Direct Manipulation (WYSIWYG).
- Human-centered design.
John Gould (1988) in “How to Design Usable Systems” outlined many modern principles of UI design:

- Early, continuous, focus on users
- Early and continuous user testing
- Iterative Design
- Integrated Design

- Suggested observation of users in their workplace, “thinking aloud”, videotaping, task analysis, discovery of work context,...
Jacob Nielsen fostered a science of “Usability” in the 1990s.

Structured processes for evaluation and development of UIs and web sites.

Pioneered “heuristic evaluation” and other low-cost usability methods.

Emphasized the economic benefit of usability improvement to companies.
Contextual Inquiry

- Main advocates: Hugh Beyer and Karen Holtzblatt
- Structured interview process and thinking aloud.
- Almost universal now in user interface design.
Virtual Reality: create a world in the computer that’s like the “real world”: Microsoft “BOB”.
What hasn’t happened (yet)

- VR still has potential, but it must be applied carefully. Keep in mind that:
  - People adapt their real-world skills quite well to non-physical environments: navigation on the web.
  - Much of the detail in the physical world is irrelevant to the task.
  - In the real world, we rely a great deal on text and documents.
What hasn’t happened (yet)

- Speech interfaces haven’t “taken over” UI design.
- There are growing applications of speech interfaces (especially telephone systems).
- But speech is only part of natural human-human interaction.
- Speech requires shared understanding and “everyday” knowledge that is hard for computers.
- In real life, we still rely on text and graphics to communicate complex ideas.
- Visual representations of information have many advantages: scanning, recognizing, summarizing
Today, most HCI researchers believe speech will be used in combination with other I/O modes whenever possible.

This is the area of “Multimodal” UIs.
What hasn’t happened (yet)

- Intelligent “agents” that you interact with like a person.
- There are some examples and this is still a research area, but it has been found that:
  - Some benefits of agent interaction apply in much simpler cases: people are “influenced by” and make human-like attributions to text interfaces.
  - Successful agents are complex and expensive to build - realism takes work that doesn’t translate into profit for a company.
What hasn’t happened (yet)

- On the other hand, agents have great potential for entertainment.
- Many successful games use agents, e.g. The Sims
- Toys are appearing with agent-like behavior (Sony’s Aibo).
- This creates powerful infrastructure for agent design, which may yield results for HCI.
The future?

- Smart rooms, cars & homes
- Wearable computers
- Multimodal and tangible UIs
- Context-aware and “anywhere” interfaces
Summary

- Many seminal ideas came from the very early years of computing.
- Considering the user (even if it’s yourself) leads to new ideas.
- Innovation happened in bursts, depending on funding and the right environment.
- A modern design process led to a very modern design (the Xerox Star).
Summary

1. The theoretical influences in HCI have not been obvious (a little cognitive science and AI, quite a lot of anthropology and social psychology).
2. User-centered design and iteration evolved by trial-and-error.
3. Some appealing kinds of interaction haven’t taken over (VR, speech, agents) - beware naïve models of human behavior.