Review

- UI for programming before Von Neumann/Zuse architecture?
- Important eras: 0-D/I-D user interfaces?
- HCI innovations in
- Memex
- Sketchpad?
- NLS?
- What made the Apple II a success?



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Engelbart's First Mouse (1964)

- Two wheels, wire is on the back, one button
- Won the test when comparing with other pointing devices at the time:
- Light pen, tracking balls, foot-pedal, knee-operated devices, head-operated devices



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Interaction Design History of the Mouse

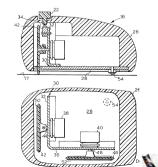


NLS Mouse (1968)

- Two wheels, three button
- Click
- Command accept
- Command delete (undo)
- E.g., Delete
- Chord: d (3rd key)
- Mouse: point at the beginning + click
- Mouse: point at the end + click
- Mouse: command accept

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www.dougengelbart.org

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Scientific Foundations of the Mouse (1974)



- Stuart Card aimed to create scientific process that guides the design rather than only evaluation
- Use the theory to quickly indicate that a circuit for mouse movement during Xerox Star development was too slow
- Found that Fitts's law curve of mouse have slope about 10 bits/sec
- Close to the hand movement ⇒ mouse theoretically almost optimal
- "The science doesn't design the mouse, but provided constraints to do it"



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Apple's Lisa & Macintosh (1983-4)

- Apple + David Kelly Design
- Single button decision
- User study showed that it reduces selection error in text editing
- More reliable tracking mechanism
- Two wheels that were read by LED + phototransistors
- Tested with turntable: "Mouse miles"
- Less than 10% cost of Xerox Star mouse



David Kelly Larry Tesler



Photo: Buxton Collection



Xerox Alto (1973) and Star (1981)

- Alto
 - Three buttons (descendant of NLS)
- Steel ball
- Star
 - Two buttons Reduce confusion over button function
 - Optical tracking





Images: www.oldmouse.com

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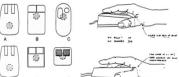


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Microsoft Mouse (1987)

- Interdisciplinary collaboration \Rightarrow leads to IDEO
- Interaction design: ID TWO
- Industrial design:Matrix Product Design
- · Mechanical engineering: David Kelly Design
- Findings informed design
- Move the ball forward for higher precision
- Larger left button: people usually left click more
- Enable holding by only fingers
- Buttons extend to cover the entire front



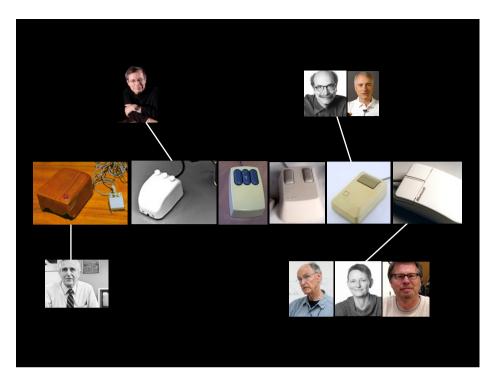


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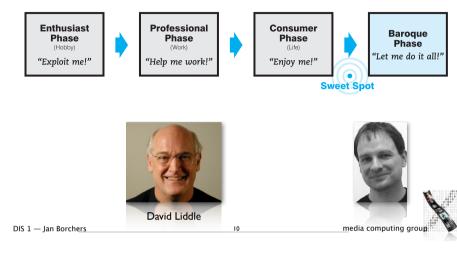
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Force Shifts During Phases of the Technology Lifecycle















Sweet Spot

- Simplifies your life
- Rule-changing new functionality

Baroque Phase

- Complicates your life
- Feature creep

Visions of HCI

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Next Step...

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- Bill Moggridge: Designing Interactions
 - Enjoyable coffee table book
- Buxton Collection
- Input devices
- http://research.microsoft.com/enus/um/people/bibuxton/ buxtoncollection/



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 $\stackrel{\frown}{\longrightarrow}$

Multimodal interfaces

- Put That There (MIT, 1980)
- Key advances:
- Recognizing human gestures
- Combining voice with other input modes





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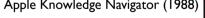
Multimodal interfaces

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- Apple Knowledge Navigator (1988)
- Vision video mockup (not implemented)
- Key advances: Got people enticed with ideas of user agents and multimedia







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Virtual Reality



• Key advances: Producing the illusion of being in a 3-dimensional world of computer-generated objects

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• Head-Mounted Display, Ivan Sutherland, University of Utah, 1967



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World-Wide Web

- Tim Berners-Lee, 1989, CERN
- Key advances: Provided quick easy ways to view both text and graphics files from remote networked sites

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• Now getting closer to desktop-like fluid interactivity with AJAX, Web 2.0, etc.

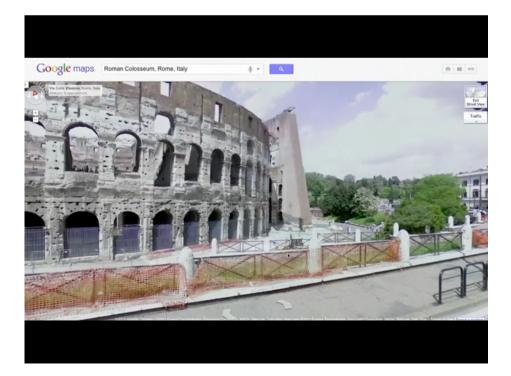
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• Example: Google Maps





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Ubiquitous Computing

- Mark Weiser, Xerox PARC †
- 1991: The Computer For The 21st Century
- · Most profound technologies disappear in fabric of everyday life
- Example: writing
 - Early scribes had to know how to make ink, bake clay,...
 - Today, writing is on candy wrappers
- A modern world without writing?
- In comparison, information technology is still at the "scribe" stage
- Example: motors

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- 1900: I engine per factory
- Now 22 motors in your car, hard and unnecessary to notice

Reading assignment nedia computing grou



Ubicomp vs. PC, VR

- Ubicomp = disappearing computer = augmented reality = calm computing
- Goal is to activate the world, putting computers into everything
- "PC" is just a transition towards real potential of computing, which will focus on human environment
 - Carrying a super-laptop is like owning just one very important book. Even customizing or having millions of it doesn't unleash literacy.
 - Multimedia as used today makes machines even more attention-grabbing, not disappearing
 - Psychological reasons for disappearing technology: Heidegger's hammer, compiling
- \neq VR:VR lets you explore unreachable worlds but tries to simulate infinite variety of reality instead of augmenting it.

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Ubicomp: PARC Devices

- Must know where they are (crucial to human perception)
- Knowing room it's in can make computer adapt significantly, without any AI
- Tabs/Pads/Boards: inch/foot/yard scale, 100s/dozens/1 or 2 per room
- A tab for each book spine



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The PARC Tab



- 1993, ca. 50 deployed in PARC/EuroPARC
- Activated post-it note, can animate objects (find mislaid book,...), voting/consensus tool in meetings
- Use as active badge, identify wearer/object
- Use to shrink windows onto tab to carry with you
- Research product: assumed constant connectivity
- What is today's Tab? What's still missing?



The PARC Pad



- Paper crossover with laptop
- Scrap computer (not personal to carry around with you)
- Antidote to windows: who wants 9x11" desk?
- Compare to modern Pads like the iPad: what's still missing?



The PARC Board

- Used as video screen
- Bulletin board (attuning to reader!)
- Whiteboard
- Flip chart
- Need different UI:
- Keyboard awkward
- Menubar hard to reach
- Shared across Atlantic





Ubicomp Predictions

- Small displays, faster CPUs: correct
- Battery prediction too optimistic (days of use at 1000x800)
- Memory underestimated
- High-resolution walls (80+dpi, 10s of Mpix) not there yet
- OSs today assume fixed hardware configuration, but in Ubicomp, devices come and go
- Window systems assume fixed base computer
- Ubicomp diversity of input devices not being dealt with well

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• Network: Bluetooth, problem of multiple connections



Ubicomp Scenarios

- Neighborhood tracks (privacy vs. "coziness")
- Paper(!) newspaper, but with electronic pen.
- Finding lost garage door opener manual
- Foreview car mirror for traffic jams and parking spots and shops
- Fresh coffee indicator.
- Collaboration via replicated/miniaturized tabs/pads, awareness, move content to board for active collaboration
- Switch effortlessly between machines, displays, and devices. Meeting review example.

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Ubicomp Scenarios

- Privacy: "minority report" ads jumping at passer-by. One approach: model physical world (hard but not impossible to break in, but leaves traces).
- Human-Centered: making people more aware of other people at end of computer links. Reverse bad effect of today's email-based workplace (isolation). Enables nothing fundamentally new but takes away mental strain, making things (such as locating information) much easier (like desktop publishing did) which makes an enormous difference.
- Decline of the computer addict?
- Overcome information overload

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- HUC'99 workshop
 → Ubicomp Conference
- Commercial Tabs, Pads and Boards
- Hardware, but often still clinging to the desktop metaphor, and not "plentiful"

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- One of the most intriguing current visions for the future of HCI and CS
- "As calm as a walk in the woods"



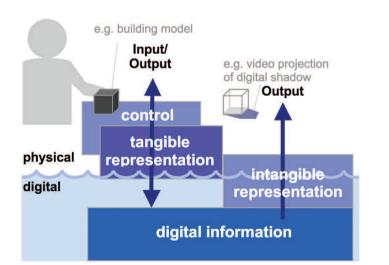




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Pick-and-drop (Rekimoto, 1997)

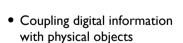


Papier Craft (Liao et al., 2005)

	Operation	Command on Page 1	Command on Page 2
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 Ink gestures to execute commands 	Excerption with cmd name	Topore 3 Consistence of the traditional excitation in the part is solution in the traditional excitation in the part is solutied to the solver, and the stoles infer the part is solvered as the solver, and the solution in the part is solver which togets a solution.	F gparte
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Tangible User Interface





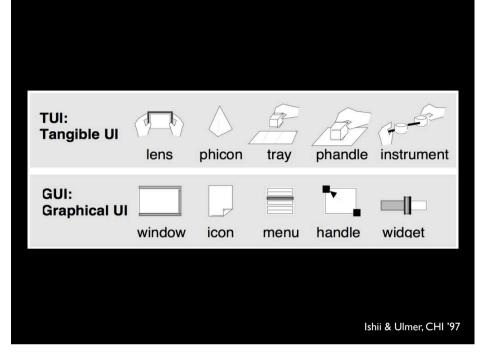
- Give immediate haptic feedback
- Complement with intangible output

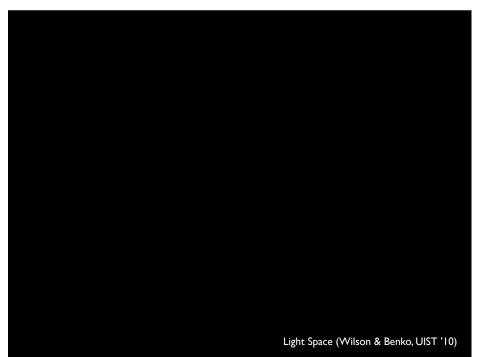


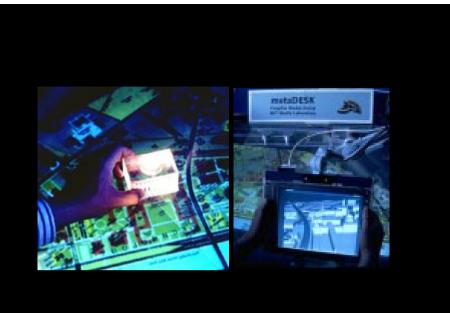
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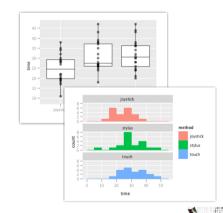
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Phicon and activeLENS Ishii & Ulmer, CHI '97

Next Lecture: Statistics

• Bring your laptop and install programs for hands-on session

- Install R and Deducer
- More details on L²P



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