

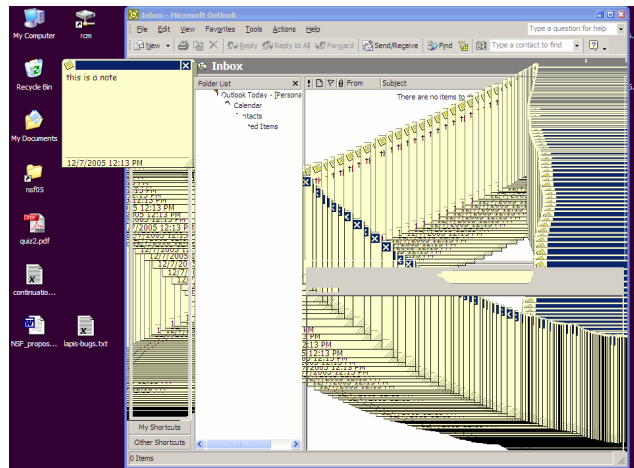
Lecture 20: HCI Research Topics

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UI Hall of Fame or Shame?



Suggested by Chris Child

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Our Hall of Fame/Shame candidate for today is the undo behavior of Outlook's sticky notes.

You can try this yourself in Outlook: create a sticky note (File/New/Note). Type some text into the note, and move the note to a different place on the screen. Then press Ctrl-Z to undo. It undoes not only what you typed, but also the position of the note – and the note animates through all the different positions you moved it to on the screen.

Recall the important dimensions of an undo model:

- what stream of actions is undone? Only the actions that affected this sticky note; other sticky notes, and other Outlook windows, aren't affected.
- how is the stream divided into units? It turns out that the entire stream of actions since the note was created is a single unit – everything gets undone when you press Ctrl-Z once.
- what state is actually restored? everything about the note – its position, its size, even its color.
- how far back can you undo? As far as the creation of the note – unless you switch to another window. Switching away from the note clears the note's undo history, so further undo is impossible.

What else is wrong here? As the screenshot shows, the animation wasn't even done properly – instead of animating using automatic redraw, Outlook paints the moving note directly on the screen, leaving a smear behind it. Notice that the smear is visible in some parts of the Outlook window, but not in others. Why do you think that is?

Today's Topics: HCI Research

- Input modalities
 - Vision, speech, pen, tangible
- Output modalities
 - Large, small, ambient
- Information visualization
- End-user programming
- Ubiquitous computing

This is only a sample. There's a ton of HCI research out there.

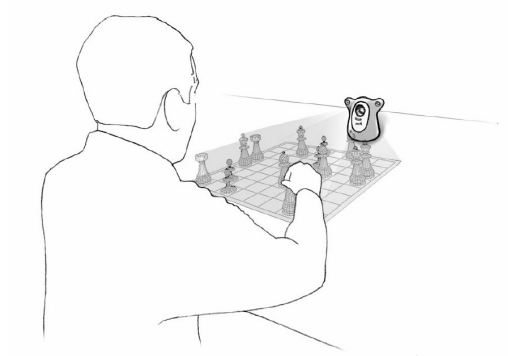
Input Modalities

- Vision
- Speech
- Pen gesture & sketching
- Tilting & bending
- Tangible objects
- Multimodal: several kinds of inputs at once

Input: Vision

- Camera watches the user to detect:
 - Eye gaze
 - Head pose
 - Body gestures
 - User presence
 - Movement of physical objects

PlayAnywhere



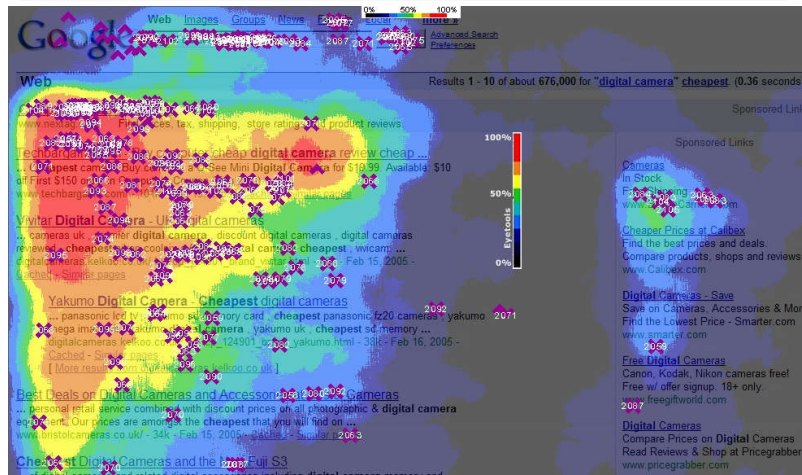
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<http://research.microsoft.com/~awilson/PlayAnywhere%20final%201Mbps.wmv>

Eye Tracking in User Testing



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Source: eyetools.com

Input: Pen & Touch

- Handwriting
- Sketching
- Touch

The Perils of Handwriting Recognition

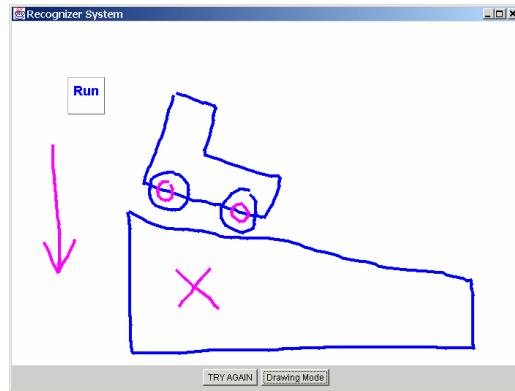


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Pen Sketching



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<http://www.ai.mit.edu/projects/rationale/video/oxygen-sketch%20design.mpg>

Touch & Play



Figure 1. Using TAP, which enables the user to print the desired photo in the camera by touching the printer while holding the digital camera

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1 Mbps human body network

Connecting a source of digital media (camera, DVD player, laptop) to a sink (display, printer, overhead projector)

File or information transfer: file delivery, copy/paste, business card transfer

Input: Speech Dialog Systems

Mercury: Welcome. How may I help you?

USER: I WOULD LIKE TO FLY FROM BOSTON TO LONDON

Mercury: Flights from Boston to London. What date will you be travelling?

USER: NEXT FRIDAY IN THE EVENING

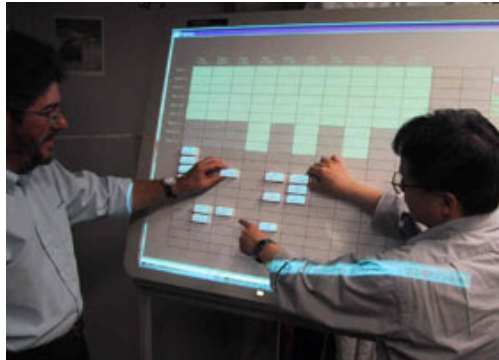
Mercury: Okay. flights from Boston to London departing between 5:00 pm and midnight on June 25. Can you provide a departure or arrival time? The earliest nonstop flight from Boston to London departing between 5:00 pm and midnight on June 25 leaves at 5:30 p.m. and arrives at 4:55 a.m. on British Airways. You arrive one day later.

USER: IS THERE A UNITED FLIGHT

Mercury: Okay. United flights from Boston to London departing between 5:00 pm and mid night on June 25. One moment please... I have a nonstop United flight leaving at 6:40 p.m. and arriving at 6:25 a.m.?

USER: BOOK THAT FLIGHT

Input: Tangible Objects



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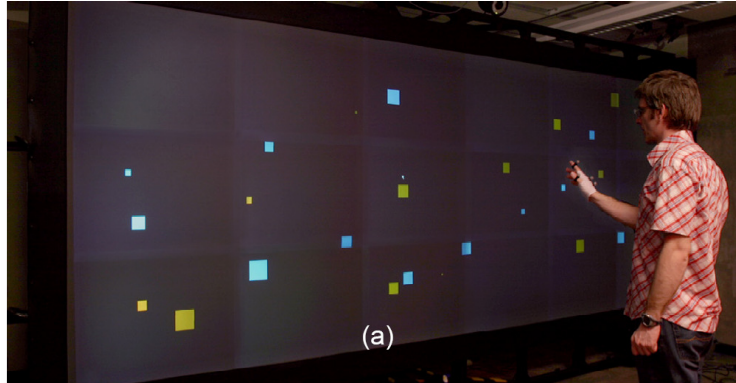
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http://tmg-video.media.mit.edu/senseboard/senseboard_352x240.mpg

Output Modalities

- Large screens
 - Multiple monitors, desk surfaces, walls
- Small screens
 - Handhelds, cellphones, watches
- Ambient displays
- Other senses
 - Audio: speech, “earcons”
 - Touch: haptic feedback
 - Olfactory

Output: Large Screens



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http://www.dgp.utoronto.ca/~ravin/videos/uist2005_distantpointing.avi

Output: Small Screens



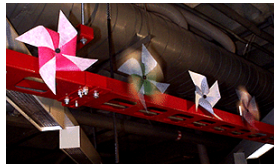
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<http://www.patrickbaudisch.com/publications/2005-Baudisch-CHI05-SummaryThumbnails.wmv>

Output: Ambient Displays



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Dangling string (Weiser & Brown, 1995)

- 8 foot plastic string hanging from ceiling

- Mounted to motor

- Motor is connected to Ethernet

- Motor turns slightly with every Ethernet packet

- Bursty traffic causes string to jiggle

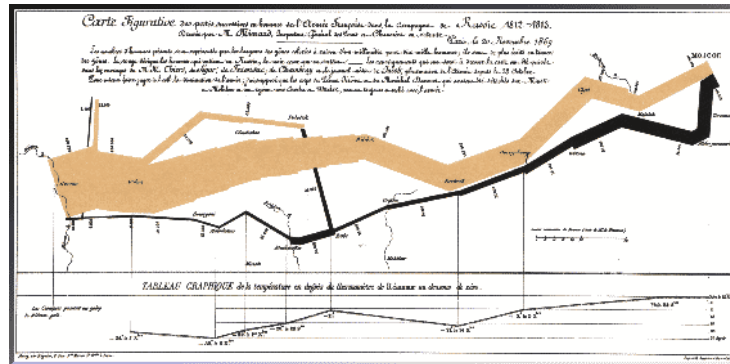
- Constant heavy traffic causes string to whirl: not just visual information, but also auditory (the frequency of the hum)

Information Percolator, also called BubbleVis: 32 tubes filled with water, with aquarium air pumps at the bottom of each tube, each separately controlled. Turning on the pump produces a pixel of bubbles that rises up the tube. Can be used as a textual display (marquee-style). Also hooked up to a camera to display awareness of someone moving down the corridor. Both visual and auditory, since each pump makes a little noise.

Pinwheels: each pinwheel has a motor. Visual and tactile (feeling breeze generated by the pinwheel).

Digital family portrait: provides awareness of a loved one's life, even at a distance. Kinds of information displayed: health (sleeping well? Eating? Feeling good?), activity, social interaction, quality of environment (cold? Snowy?) Picture doesn't change, but frame displays icons (updated daily). Tested in Wizard of Oz study.

Information Visualization



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Goal of info viz: shift load from cognitive system to perceptual system, representing data in such a way that relationships become evident to visual perception

From Tufte's Visual Display of Quantitative Information

A famous example of an excellent static information visualizations

6 variables:

- direction of travel
- size of army
- x and y position of army
- temperature during return
- dates during return

Simple use of color for a nominal attribute

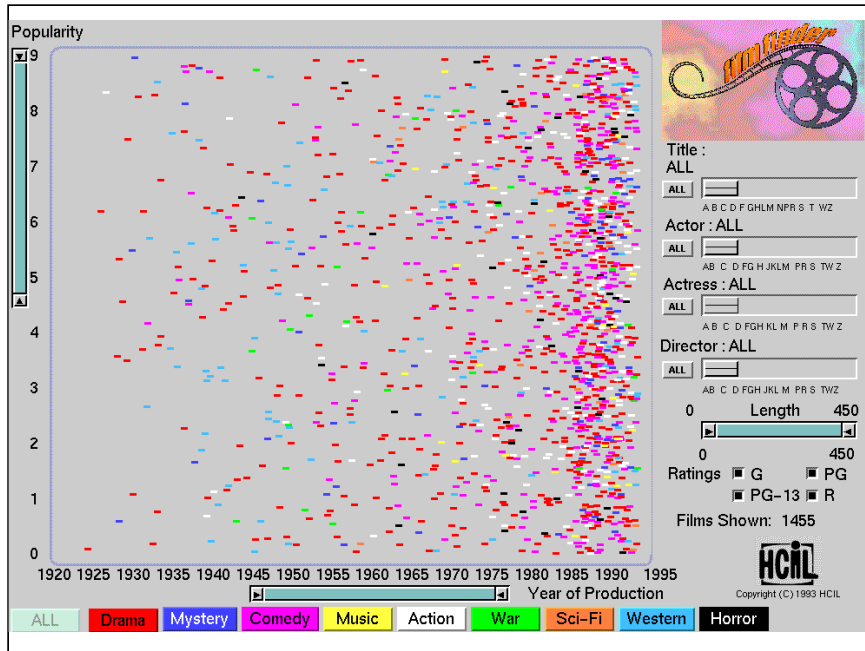
Appropriate use of size as scalar attribute

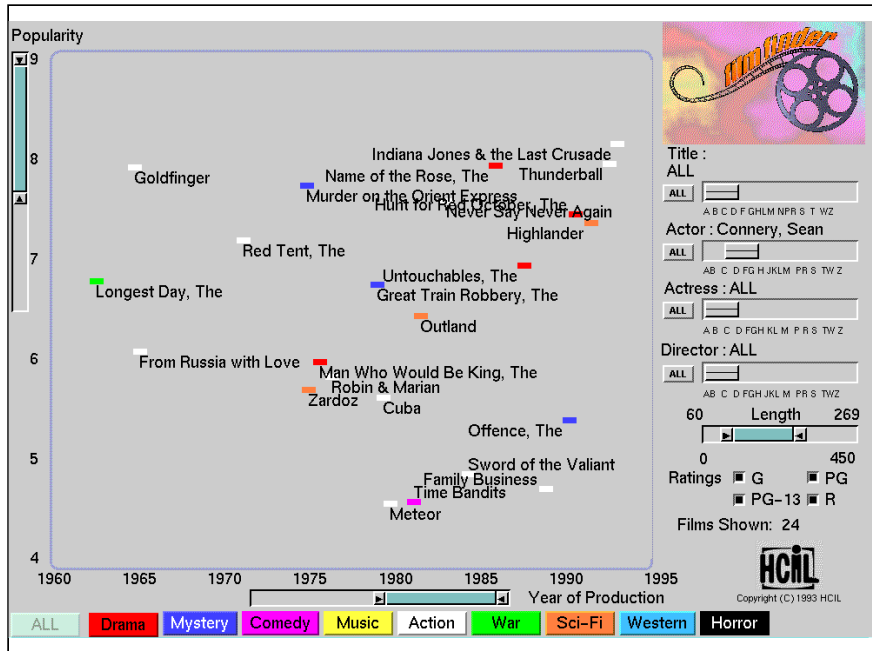
Lines linking two different displays that use position in two different ways (map location vs. date & temp)

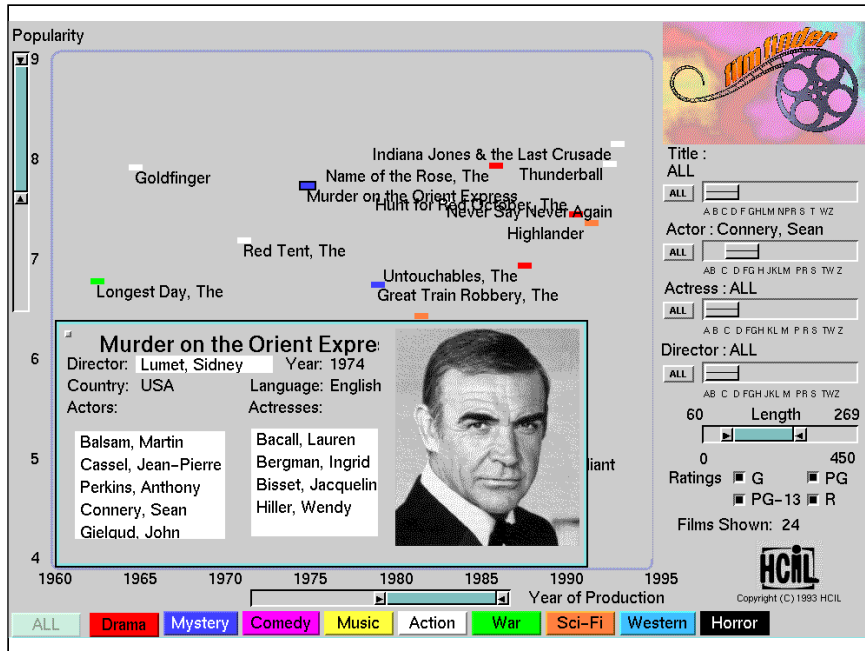
Note detachments that later rejoined the army

Note disastrous crossing of the Berezina river

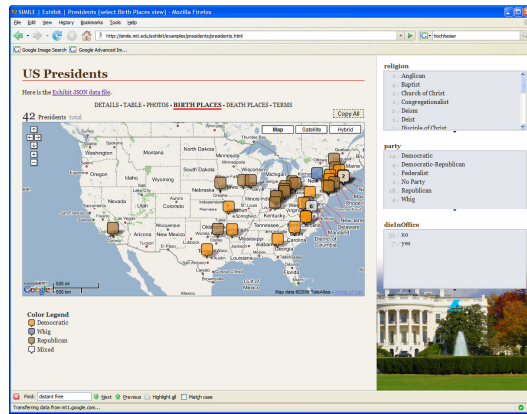
Note abstraction: no heavy grid, only important landmarks (rivers and cities) identified







Exhibit



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<http://simile.mit.edu/exhibit/examples/presidents/presidents.html>

End-user Programming

- Why do users need to program?
 - User analysis can target:
 - Whole population: general-purpose applications like MS Excel
 - Specific user class: bookkeeping for beekeepers
 - One user: a particular beekeeper's bookkeeping practices
 - The tighter the user analysis, the more functional and usable the application
 - But the less revenue will pay for its development
 - Can a single user ask for more features, more iterations?
- Common kinds of EUP
 - Customization (e.g. toolbars)
 - Automation of repetitive tasks (e.g. macros)
 - Application development (e.g. spreadsheets)

Programming by Example (PBE)

- User **demonstrates** how on concrete examples, using familiar UI operations
- System **records** user's demonstration as a program
- Also called programming by demonstration (PBD)

Ubiquitous Computing

- Computing infrastructure constantly surrounding us
 - Small, portable, wearable devices
 - Large and ambient displays
 - Sensors throughout the world for vision & speech
 - Location sensing & context awareness
- Also called pervasive computing

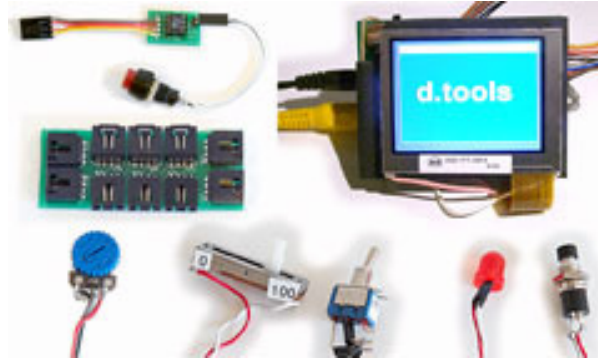
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Computing technology will submerge in the environment around us, becoming invisible, just making everything work better

Prototyping for Ubiquitous Computing



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<http://hci.stanford.edu/dtools/dtools-apr06.mov>

What To Do Next

- Courses in spring 2007
 - 6.883 Pervasive, Human-centric Computing (Rudolph)
 - 6.870 Multimodal/Intelligent Interfaces (Darrell/Davis)
 - MAS.630 Affective Computing (Picard)
 - MAS.632 Speech Interfaces & Mobile Devices (Schmandt)
 - MAS.672 New Paradigms for HCI (Maes)
- Research at MIT
 - CSAIL
 - Vision (Darrell)
 - Pen (Davis)
 - 3D (Durand, Popovic)
 - Speech (Glass, Seneff, Zue)
 - End-user programming & usable security (Miller)
 - Ubiquitous (Rudolph)
 - Media Lab
 - Tangible (Ishii)
 - Agents, end-user programming (Lieberman)
 - Ambient & ubiquitous (Maes)
 - Wearable (Pentland)
 - Emotion (Picard)
 - Speech and audio (Schmandt)
 - Context aware (Selker)