cisc3650
human-computer interaction
spring 2012
lecture # IV.1
devices

topics:

- multisensory and multimedia
- organic user interfaces
- CAVE

references:

- Designing Interactions,by Bill Moggridge, *Ch 8, Multisensory and multimedia*
- *Organic User Interfaces: Designing Computers in Any Way, Shape, or Form,* by David Holmand and Roel Vertegaal, Communications of the ACM, volume 51, number 6, June 2008.
- *The Cave: Audio Visual Experience Automatic Virtual Environment,* by Carolina Cruz-Neira, Daniel J. Sandin, Thomas A. DeFanti, Robert V. Kenyon and John C. Hart, Communications of the ACM, volume 35, number 6, June 1992.

multisensory and multimedia

- computer interfaces have not yet taken full advantage of all 5 senses:
  - vision, touch, sound — yes
  - taste, smell — no
- vision
  - Terry Winograd (Stanford): spatial/visual representation should match up with cognitive structure of the user
  - importance of relationship between visual and cognitive
  - *augmented* reality versus *virtual* reality: the latter was more popular initially, and remains popular in the entertainment industry; but the former is now more popular for research
- touch
  - tactile aspects of everyday artifacts support the *affordance* of these objects (i.e., how they are used), e.g., spoon, telephone
- interviews with four multimedia researchers:

  - Hiroshi Ishii
  - Durrell Bishop
  - Joy Mountford
  - Bill Gaver

Hiroshi Ishii

- Ishii's web page: `http://web.media.mit.edu/~ishii/`
- professor and associate director of MIT Media lab
- created "weather forecast" device, that produces sound-based feedback (e.g., music. sound effects) indicating the weather forecast
- explores "seamless interface" between digital and physical worlds
- "Tangible Bits" paradigm: give physical form to digital information

	input	output
physical	mouse	screen
digital	information/computation	

(a) GUI (graphical user interface)

	input	output
physical	box (tangible)	shadow (intangible)
digital	information/computation	

(b) TUI (tangible user interface)

- also talks about the importance of *sound* as a feedback mechanism
- uses the example of an abacus — the clicking of the beads to provide feedback for a range of actions
- other interesting projects include (see web page for details):

  - Ping Pong Plus
  - Music Bottles
- applied projects (wee web page and book chapter for details):
  - urban planning (URP)
  - business supply-chain visual interface

Durrell Bishop

- Bishop's web page: `http://www.luckybite.com/`
- UK designer
- wants physical (electronic) objects to be visually self-evident
- what is the relationship between an object and what it represents?
- money example:
  - money displays its value (i.e., its numeric amount in pounds or dollars), along with size, shape, distance to owner
  - money IS what it represents
- projects explore this relationship with less obvious items, for example (see book chapter for details):
  - frog object interacts with computer to represent a person and contains information about that person
  - LG home entertainment wall

Joy Mountford

- Mountfords's web page: `http://www.idbias.com/`
- was on project team at Apple that invented and developed initial version of QuickTime
- mid-to-late 1980's: general shift in western world from "computers only at work" to computers in the home
- needs of the computing industry changed
- Mountford wanted to something other than "paperwork" with computers—e.g., what would my grandmother want to use a computer for?
- collaborated with Mike Mills (from NYU) to develop "Dicon"—dynamic icon
- Dicon evolved into "Simple Player" which evolved into "QuickTime"
- eventually extended into QuickTime VR
  supporting the idea of "navigable movies"
- after Apple, Mountford went to Interval Research (check out article on company's demise here: `http://www.wired.com/wired/archive/7.12/interval.html`)
- she worked on projects that linked sound and music to computational devices

- example project: BeadBox, which associates sounds (audio effects) with actions (see book chapter for description)

Bill Gaver

- Gaver's web page: `http://www.gold.ac.uk/design/staff/gaver/`
- professor at Goldsmith's College, University of London
- former student of Donald Norman
- interned at Apple
- created "SonicFinder"
  - i.e., Apple's Finder application with sound effects
  - type of sound was determined by the type of action and primary and secondary properties of the object being manipulated
- then went to Xerox PARC
- interesting projects (see book chapter and web page for details):
  - Equator project: integration of physical and digital objects for the home
  - History Tablecloth: has a "memory" of objects placed on it
  - Key Table: has a memory of objects placed on it and attempts to reflect the mood of the person placing the object on it

  - Drift Table: images displayed on table "drift" toward person who places objects on the table

organic user interfaces

- organic design / natural morphology inspire design of digital devices
- properties missing in flat LDC computer screens:
  - ability to take on "organic shape"
  - deformability
- eBook reader is an example of an organic device, or a "blobject"
- tangible, ubiquitous technologies: e.g., Ishii's tangible user interfaces (TUI)
- organic user interfaces (OUI): e.g., Jeff Han's multitouch screen
- three principles for OUI design:
  - *input equals output*—not usually separated in a physical device
  - *function equals form*—implies affordance; form of object determines what we do with it
  - *form follows flow*—implies activity flow, e.g., folding (flip) cell phone, because we have to open it in order to answer it

CAVE

- display device paradigms:
  - CRT (cathode ray tube)
  - HMD (head mounted display)
  - BOOM (binocular omni-oriented monitor)
  - CAVE (audio-visual experience automatic virtual environment)
- example: Omnimax or Imax theatres
- immersion issues:
  - *field of view:* visual angle achieved without viewer turning their head
  - *panorama:* ability of display to surround viewer (turning the head is okay)
  - *viewer-centered perspective:* speed/accuracy of viewer location sensing, i.e., ability of display to respond to viewer's movement
  - *body and physical representations:* to support viewer interacting with the device
  - *intrusion:* restriction of viewer's senses imposed by the device
- visualization issues:

– *visual acuity:* resolution of display and field-of-view; portion of user's view that a pixel takes
– *linearity:* curvature of display; concentrate more pixels in the middle of display to improve perceived image resolution and acuity
– *look around:* viewer's ability to move around a (viewed) object
– *progressive refinement:* ability to dynamically increase resolution when user pauses (stops moving)
– *collaboration:* ability to support communication and interaction between multiple users

videos watched in class

- Jeff Han, multitouch screen: `http://www.ted.com/talks/lang/en/jeff_han_demos_his_breakthrough_touchscreen.html` (2006)
- Anand Agarawala, BumpTop: `http://www.ted.com/talks/lang/en/anand_agarawala_demos_his_bumptop_desktop.html` (2007)
- Pattie Maes and Pranav Mistry, SixthSense: `http://www.ted.com/talks/lang/en/pattie_maes_demos_the_sixth_sense.html` (2009)
- Kate Hartman, Wearable Communication `http://www.ted.com/talks/lang/en/kate_hartman_the_art_of_wearable_communication.html` (2011)
- CAVE: `http://www.evl.uic.edu/files/movies/Showcase_and_CAVE_documentation.mov` (1992)