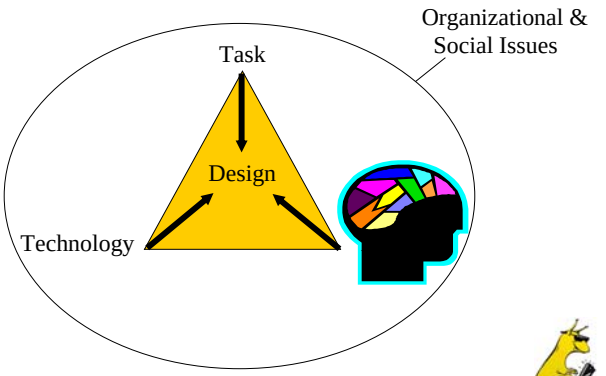
HCI Application: The Future of HCI



Jobs, internship, etc

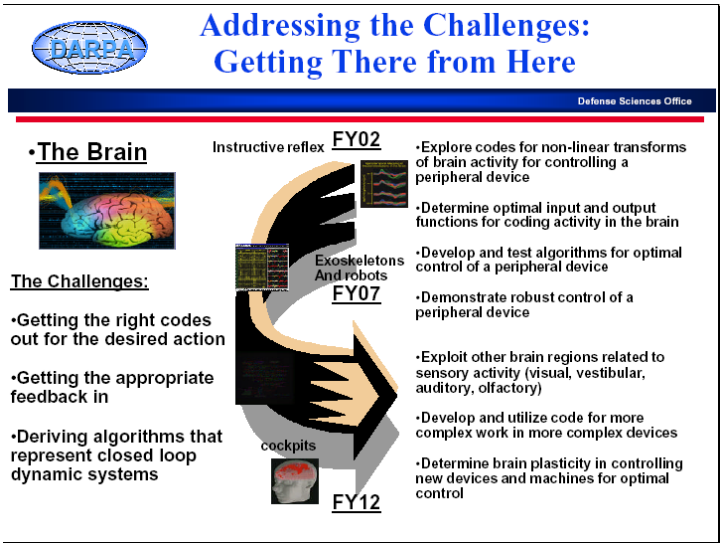
- Jobs:
  - http://listserv.acm.org/scripts/wa.exe?A0=CHI-JOBS
  - http://www.usabilitynews.com/default.asp?c=2
  - http://www.hcirn.com/jobs/index.php
- Internship:
  - http://www.job-search-engine.com/keyword/hci-internship
  - http://www.job-search-engine.com/keyword/usability-internship
  - http://triux.org/2008/02/25/blue-cross-blue-shield-of-nc-usability-summer-intern-durham/

Graduate advisor?

- Top 10 Most Frequently Cited CHI Authors
  - Stu Card (484 citations)
  - Bill Buxton (351)
  - Thomas Moran (344)
  - Ben Shneiderman (322)
  - Hiroshi Ishii (298)
  - Brad Myers (287)
  - Jakob Nielsen (286)
  - Allen Newell (222)
  - Jock Mackinlay (217)
  - George Robertson (215)
- SIGCHI Award Recipients: (http://www.sigchi.org/documents/awards/)
- Authors in multiple significant HCI journals: http://eprints.rclis.org/archive/00012942/01/Meho-Rogers.pdf
- Authors in Handbooks of HCI: http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=11330
- Check HCI programs: http://www.hcibib.org/education/

Psych contribution: Theory-driven Design

- Why theory, especially now?
  - Advances to GUI desktops arguably stalled
  - Lots of evolution on designs but less new theories
  - Many new tools used both singly and by multiple people
  - A way to guarantee progress
  - Invite new disciplines to work in HCI
  - Cognitive neuroscientists, biologists, ethicists?
- The importance/role of theory
  - Descriptive: clarify terms, key concepts
  - Explanatory: reveal relationships and processes
  - Predictive: about performance and situations
  - Prescriptive: convey guidance for decision making in design by recording best practice
  - Generative: enable practitioners to create, invent or discover something new



Cocktail Party Phenomenon

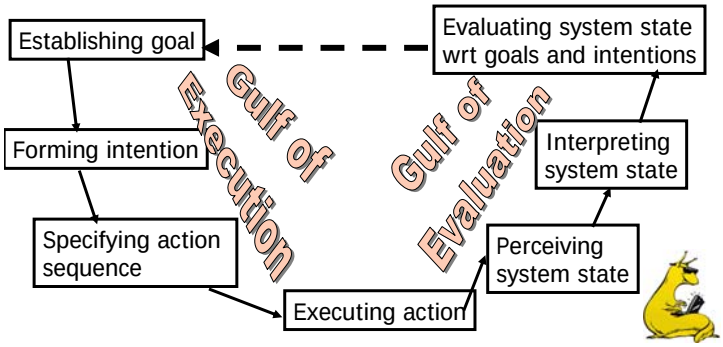
- Cocktail party *problem*
  - How is it that out of a sea of voices we can focus on a single conversation?
- Cocktail party *effect* (Moray, 1959)
  - While you are usually unaware of identity of words in a non-attended conversation…
  - A notable exception is your *name*
- Attenuation Theory of Attention (Treisman, 1960)
  - Blocking out the irrelevant content easy until….
  - It's semantically meaningful or important to you
- Guidelines for speech communication applications, cockpits, etc.
  - Provide a mechanism to "pull" one voice into focus
  - Do not present too much information simultaneously
  - Provide enough time for the user to fully fuse streams if necessary

VeriChip

- FDA approved implantable chips
- RFID tags → transmit data via radio (already in your passports)
- Rooted in the skin for accessing medical records
- Privacy issues are becoming pervasive in our research
- What are other issues?
- What theories can inform design of such system (both at hardware and software levels)?

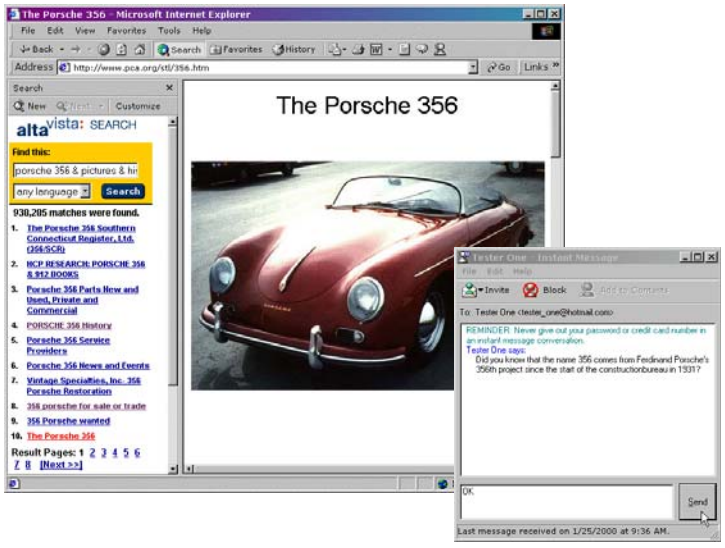
Explanatory Theory Example

- Norman's seven stage model of interaction from POET (Psychology of Everyday Thing, 1988)
- An approximate model with a continuous feedback loop



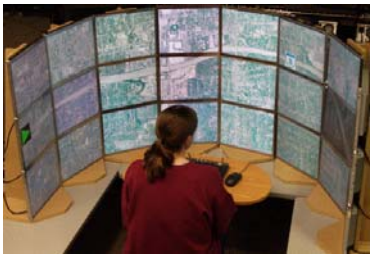
Using Norman's model predictively...

- Miyata & Norman (1986)
  - Predicted interruptions between task execution and evaluation as less harmful when multitasking
- Attention-based principles of notification, Czerwinski et al, Microsoft, 2000, tested this model using IM and multiple tasks
  - Examined planning, execution and evaluation phases of tasks
  - Early in a task was the worst time to interrupt if you want user to remember
  - Make notifications situation-aware
  - Look for cognitive breakpoints in users' interactions.
  - When possible, use smart monitoring
  - Monitor the user (what stage in task?)
  - Content of interruption—similar is better



Predictive Theory Examples

- Large display research (Tan, Czerwinski & Robertson, 2001-2003)
  - Most early research carried out around cockpit design
  - New hardware often necessitates the need for new software/interaction
  - Serendipitous gender and spatial cognition findings based on theories of perception and cognition



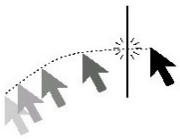
Prescriptive Theory Examples

- Gestalt Theory of Perception
- Feature Integration Theory (Treisman et al., 80s) → feature search (performed fast and pre-attentively for targets defined by primitive features) & conjunction search (serial search for targets defined by a conjunction of primitive features);
- Utilized well in design guidelines today for guided visual search and pop out effects

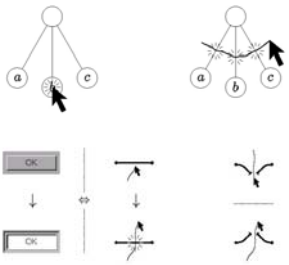
Generative Theory Examples

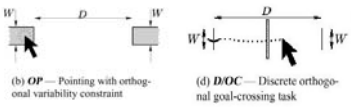
- Buxton's 3-State Model of Graphical Input (1990)
- Pointing devices follow an STD of 3 states: out-of-range, tracking and dragging
- Model inspired Mackinlay, Card & Robertson (1991) to write "A Semantic Analysis of the Design Space of Input Devices"
- Hinckley et al. (1998) extended the ideas to add notation for continuous properties during state transitions of devices

Crossing – more than dotting the i's



- Why crossing?
  - increasing interaction vocabulary
  - Pen based computing
- How does crossing compare with pointing?
  - What is the theoretical foundation of crossing?





Accot & Zhai 2002

Computing off the desktop

- Desktop computing "workstation" interface foundation
  - Large and personal display
  - Input device (mouse)
  - Typewriter keyboard
- HCI Frontier – beyond the desktop
  - Interfaces without display-mouse-keyboard tripod
  - Numerous difficult challenges

Zhai, Sue, Accot 2002

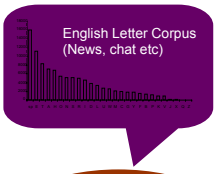
Alphabetically Tuned and Optimized Mobile Interface Keyboard (ATOMIK)

Human Movement Study: Fitts' law

$MT = a + b\,Log_2(D_{si}/W_i + 1)$

Word connectivity

$CI = \sum_{i=1}^{N} f(i)c(i)$



"Fitts-digraph energy"

$\bar{t} = \sum_{i=1}^{27}\sum_{j=1}^{27} \frac{P_{ij}}{IP}\left[Log_2\left(\frac{D_{ij}}{W_i}+1\right)\right]$

$W(A \to B) = e^{-\Delta E/kT}$ if $\Delta E > 0$; $= 1$ if $\Delta E \le 0$

Metropolis "random walk" optimization

$e = t + \lambda \sum_{i=a}^{z} \eta(i)(y_i - x_i)$

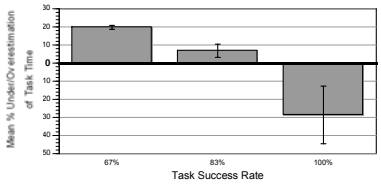
Alphabetical tuning

Metrics Development—"Subjective Duration Assessment"

- HCI and iterative usability metrics
  - Performance (task times, success rates)
  - Preference (user satisfaction questionnaires)
- Usually correlated, but not always
- Users notoriously "positive" w/ratings
- Neilsen & Levy (1994): need an average of 5 on a 7 point scale

Zeigarnik Effect (1927)

MSN Study



- People remember uncompleted/interrupted tasks better than completed ones
- Weybrew (1984) used time estimation
  - People overestimate time on unfinished tasks
  - People underestimate time on completed tasks
- Jared Spool (2001)
  - Found a strong correlation between perceived download time and whether users successfully completed their tasks on a site
  - When people accomplish task on a site, they perceive that site to be fast, and vv

The Marriage of HCI and Games

- There are many things HCI community can learn from the games community
  - Effortless community: forming groups and participating
  - Learning by watching: Learn from more experienced users
  - Deep customizability: customizing for each individual users
  - Fluid Human-Computer Interaction: transparent interaction with minimal disruption to the main activity

Effortless Community

- Motivation
  - Communities serve as valuable resources
  - Comment on content
  - Resolve problems
  - Provide collaboration
- Challenges for general HCI applications
  - Participation occurs outside of the application
  - Interaction is often asynchronous (i.e. newsgroup)
  - Ability to find or form the right subgroups is limited as users are often disconnected and unaware of others
- Why are games successful in community building?
  - Nature of games (multi-player, guilds, friends)
  - Host servers enable gamers to host communities on their own game servers
  - Others?

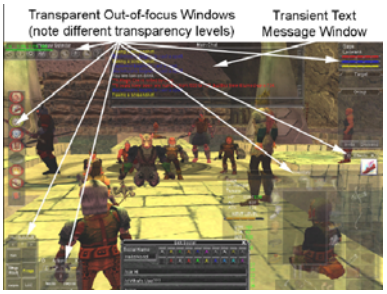
Learning by watching

- Motivation
  - Proven benefits of observational learning (remember developmental psychology?)
- Challenges for general HCI applications
  - Users are distributed, not face-to-face
  - Requires embodiment and workspace awareness
  - Requires understanding of detailed actions
- Why are games successful in learning by watching?
  - Clearly conveys embodiment, real-time awareness, and task based info
  - Allows easy interpretation of fine-grained actions, e.g. 3D Avatar in GhostRecon - crouch, crawl, jump, run, open doors, and pick up items
  - Others?

Deep customizability

- Motivation
  - "There is no single configuration best for all tasks."
  - Increase efficiency & usability
- Challenges
  - Usually takes effort to customize
- Why are games successful?
  - Anything-goes UI malleability (UI element locations, new command container, remap controls)
  - Natural extensibility – Macros: Everquest: 2 mouse clicks vs. MS Word: 7 actions before starting, 5 more to place onto a toolbar to use
  - Portable customizations - "Mod kits" for simplifying creation, editing, and installation of extensions, layouts, and skins – even novice users can use
  - Others?

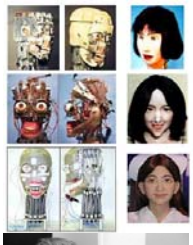
Fluid HCI



- Motivation
  - Minimize disruptions to work flow
  - Less user attention
  - Less user effort
- Why are games successful?
  - Calm messaging – spatialized environmental sound, gradually fading text, scrolling message area
  - Attention-aware interface elements: transparency levels reflect user attention
  - Context-aware view behaviors: Neverwinter Nights: 3 camera behaviors; easy to toggle using key shortcuts

The Marriage of HCI and Robotics

- In the past: animated but sessile





In the present: social mobile robot

- Invasive: shared physical space
  - extended interaction context: the human social-physical frame
  - social communication as a co-habitant
  - incidental & opportunistic interaction

- Asynchronous; episodic
  - demands intentional transparency
  - active communication acts (social competency, expressiveness, perceptual action)