Introducing Human-Computer Interaction Design

- **What is worth getting across in an hour?**
  - Interaction vs. interface – designing the experience
  - Design in a space of complex tradeoffs
  - Feel for the kind of thinking that goes into assessing designs from interaction point of view
  - Some new modes of interaction
Dimensions of Human-Computer Interaction

Human characteristics
Perception / Cognition / Control

Devices
Presentation / Sensing / Integration

Activities
Settings / Tools / Tasks
Dimensions of Human-Computer Interaction

- Experiment (Psychology / Physiology)
- Human characteristics: Perception / Cognition / Control
- Interaction
- Devices: Presentation / Sensing / Integration
- Activities: Settings / Tools / Tasks
- Invention
- Design
The Interaction Loop

Understanding
Intention
Planning

Response

Gulf of
Evaluation

Human

Machine

Presentation

Computation

Action

Motion

Interpretation

Perception

Gulf of
Execution

Human
Designing Fluent Interaction

- **Fluent** (from Webster’s)
  - capable of moving with ease and grace; effortlessly smooth and rapid
Disfluencies (Breakdowns)

- **Failure**
  - System malfunction
  - Error [unintended effects]

- **Distraction**
  - Interruption
  - Waiting
  - Switch of attention

- **Search**
  - Visibility
  - Clutter

- **Thinking**
  - Action articulation
  - Response to breakdowns

- **Tool acquisition and operation**

- ...
Levels of Interaction Design

- Conceptual model
- Presentation
- Control
  - Devices
  - Affordances

If the conceptual model doesn’t work, no amount of design at the other levels can fix it.
Example: Desktop vs. Mural
PostBrainstorm Design Goals

- Large screen
- Pen only
- No modes
- Fluid action
- No decorations for actions
- Emphasize sketching
Why HCI Design is hard

Interaction directly involves people (unlike traditional engines)
People encounter your design in a context you don't control
(and may not be familiar with)
People interpret everything as communicating, whether you intend it to or not.
People are not all alike
People always interpret and anticipate in their own context
People have limited memory
People have limited attention
People develop habits
• Interaction directly involves people (unlike much of traditional engineering)
• People are not all alike
• People encounter your design in a context you don't control (and may not be familiar with)
• People always interpret and anticipate in their own context
• People interpret everything as communicating, whether you intend it to or not.
• People have limited memory
• People have limited attention
• People are creatures of habit
• …
Design of the Conceptual Model

• Ontology Design
  – Objects
  – Properties
  – Operations

• Interaction Modes and Affordances
  – The space of actions and consequences
    • What can I do?
    • How do I do it?
    • What just happened?

• Contextual Integration
Contextual Issues

- User experience / Transfer
- Task demands and frequencies
- Learning
  - Chunking
  - Memorization
  - Dexterity
  - Habituation
- Coping - Network of equipment
- Culture, Affect, Aesthetics
Evaluation Methods

- **Self Report**
  - Think-aloud Protocols
  - Incident Diaries
  - Questionnaires, Interviews, Focus Groups, etc.

- **Observation / Co-discovery**

- **Heuristic Evaluation**
  - Usability Guidelines
  - Cognitive Walkthroughs

- **Systematic Testing**
  - System testing
  - Generalized human studies
Human studies

- **Perception**
  - e.g., Spatialization, Perceptual grouping,

- **Cognition**
  - e.g., Info exploration, Expression recognition

- **Affect**
  - e.g., Social responses, Emotional state
Design Example: Virtual Auditorium

• User Studies
  – Responsiveness
  – Eye gaze
  – Speech synchronization
  – …
Technological Possibilities
Ubiquitous Computing

Marc Weiser
Xerox
Palo Alto Research Center
The Mobile Convergence
Computing by the Inch, the Foot, and the Yard
Interactive Workspaces
Active Tables
Augmented Reality
The Office of the Future
ambient information

MIT Media Lab

www.ambientdevices.com
Tangible and Haptic Interaction
Multimodal Interaction
Wearable Computers

Thad Starner
Contextual Computing Group
Georgia Tech
Sensor networks - Intel Motes
Sensor networks – Smart Dust
Sensing Affect

Blood Volume Pressure (BVP) earring

Galvanic Skin Response (GSR) rings and bracelet

Rosalind Picard, Affective Computing Group
Mit Media Lab
Cyborgs - The Body Electric

STELARC
– Designers
– Users
– Clients
• Design by doing
  – Clarify goals and requirements
  – “Reflective conversation with the materials”

• Give users the experience of use
  – Look and feel

• Test specific aspects
  – Compare alternatives
  – Make changes

• Show feasibility for buy-in
  – Proof of concept
  – Manage expectations
What to Prototype?

“…Prototypes provide the means for examining design problems and evaluating solutions. Selecting the focus of a prototype is the art of identifying the most important open design questions.”

Houde and Hill – What do Prototypes Prototype?
Design Process

UNDERSTAND → OBSERVE → IMPLEMENT

VISUALIZE → EVALUATE → PROTOTYPE

CS447/ME325 - Terry Winograd – 1/11/04
Iterative Prototyping

- Quality is a function of the number of iterations and refinements a design undergoes before it hits the street.
- To get a good idea, get lots of ideas.
- Enlightened trial and error is better than the planning of a flawless intellect.
FAIL EARLY

(Cost of failure vs. project time curve)

From Hans Haenlein, IDEO
FAIL OFTEN

(Risk vs. iteration curve)

From Hans Haenlein, IDEO
3 stages of prototyping

From Hans Haenlein, IDEO

<table>
<thead>
<tr>
<th>Project Time</th>
<th># of Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSPIRE</td>
<td></td>
</tr>
<tr>
<td>EVOLVE</td>
<td></td>
</tr>
<tr>
<td>VALIDATE</td>
<td></td>
</tr>
</tbody>
</table>

prototype driven specs ≈ spec driven prototypes
What can be a Prototype?

- Sketches
- Diagrams & Frameworks
- Hand Made Constructions
- Machined Constructions
- Virtual Models
- Graphics
- Packaging
- Spaces
- Role Play, Experiences
- Video
- …
Prototypes

• Look like…

• Work like…

• Experience like ….
- Work with artifacts

- Understand roles and context
  Focus on concepts, not detail
  Low investment in status quo
  Openness to change
Paper Prototype

http://www.mindspring.com/~bryce_g/projects/lo_fi.html
Wireframes
Low-Fidelity Prototype
Goober's Marathon

HELP
QUIT

EAT!

UNDO

ENERGY LEVEL
Flipbook

Flipbook

PLAYS

LETS PERFORM...

- GUTS & DOLLS
- MACBETH
- SOUTH PACIFIC
- A LONG DAY'S JOURNEY INTO NIGHT

0 0 0 0 0

0 

0 0 0 0 0
Flipbook

Characters

- Macbeth
- Lady Macbeth
- Macduff
- Witches
Flow Diagrams

From a previous cs147 project…
- HTML, XML, CSS…
- Javascript, Web 2.0, AJAX…
- Dreamweaver, FrontPage, …
- Flash, …
- Ruby on Rails,…
Components of Usability

- Guessability
- Learnability
- Retention
- Error protection
- Experienced User Performance
- Supportability
- Transfer
- Delight
- Simple and natural dialogue
- Speak the users’ language
- Minimize the users’ memory load
- Consistency
- Feedback
- Clearly marked exits
- Shortcuts
- Good error messages
- Prevent errors
- Help and documentation
References

- Terry Winograd (ed.), *Bringing Design to Software*, Addison Wesley, 1996