Human-Computer Interaction: An Overview

CS2190
Spring 2010
There must be a problem because...

WE CAN FIX OUR INCOMPREHENSIBLE USER INTERFACE FOR A MILLION DOLLARS.

OR WE CAN CLOSE OUR EYES AND WISH REAL HARD THAT OUR USERS WON'T CARE.

HE'S SAVING A MILLION DOLLARS. WHAT DID YOU DO TODAY?
What is HCI?

- **Human-Computer interface**
  - Where people “meet” or come together with machines or computer-based systems
  - Physical interface (e.g. buttons, screens, menus, etc.)
  - Logical interface
    - The model a system presents a user
    - Set of tasks available and how they’re organized
From the SIGCHI Website

• HCI is...
  – An inter-disciplinary discipline (engineering, CS, psychology, graphic design, ergonomics, etc.)
  – Concerned with design, evaluation, and implementation
  – Addresses people’s needs, capabilities, limitations
HCI: Wide Range of Concerns

• Make an interactive system be useful for a task, and support that task effectively
  – Easy to use, easy to learn, avoid errors
  – Must understand users, understand users’ tasks

• Create a usable logical interface
  – A user’s conceptual model of the system
  – Overall design of how we interact

• Physical and low-level design
  – Physical interface: buttons, keys, screens
  – SW interface: menus, screens, colors

• Evaluating usability
  – During development, after completion
Usability

• A definition from ISO standard 9241
  – The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

• Effectiveness:
  – accuracy and completeness in achieving goals

• Efficiency:
  – resources expended…

• Satisfaction:
  – comfort, acceptability (happiness, pleasure)
Discussion

• Effectiveness, efficiency and satisfaction:
  – Are all of these equally important?
  – All the time?
What is User-Centered Design?

• An approach to UI development and system development.
• Focuses on understanding:
  – Users, and
  – Their goals and tasks, and
  – The environment (physical, organizational, social)
• Pay attention to these throughout development
ISO on User-centered Design

• ISO 13407 describes human-centered design processes for interactive systems

• Principles of human-centered design:
  – Active involvement of users
  – Appropriate allocation of function between user and system
  – Iteration of design solutions
  – Multidisciplinary design teams
ISO on User-centered Design (2)

- Essential activities in human-centered design:
  - Understand and specify the context of use
  - Specify the user and organizational requirements
  - Produce design solutions (prototypes)
  - Evaluate designs with users against requirements
Are You Experienced? (in UC Design, I mean)

• Think about a significantly complex software project you’ve been involved in
  – Work, research, CS2110, etc.

• Did it seem like an example of user-centered design?
  – How did it, or how did it not?
What do professionals do in the HCI or ID business?

- **interaction designers** - people involved in the design of all the interactive aspects of a product

- **usability engineers** - people who focus on evaluating products, using usability methods and principles

- **web designers** - people who develop and create the visual design of websites, such as layouts

- **information architects** - people who come up with ideas of how to plan and structure interactive products

- **user experience designers** - people who do all the above but who may also carry out field studies to inform the design of products
Reminder: What is involved in the process of UC design

- Identify needs and establish requirements
- Develop alternative designs
- Build interactive prototypes that can be communicated and assessed
- Evaluate what is being built throughout the process

(This is what you’ll do in CS3205!)
Class Activity

• Think-Pair-Share:
  – Pairs write down differences
  – Pairs merge results
  – Instructor calls on pairs to share answers

• Question:
  – Think about a hard-to-use software product (or computer-based system).
  – In what way does it have poor usability?
    • General problems
    • Specific examples
Goals and Design Principles

• Some well-known usability goals
  – Effective to use (an overall measure, perhaps)
  – Efficient to use
  – Safe to use (prevent errors, recover from errors)
  – Have good utility (help users accomplish tasks)
  – Easy to learn
  – Easy to remember how to use

• Example of bad systems failing in these terms?
User experience goals

- Satisfying - rewarding
- Fun - support creativity
- Enjoyable - emotionally fulfilling
- Entertaining …and more
- Helpful
- Motivating
- Aesthetically pleasing
Design principles

• Generalizable abstractions for thinking about different aspects of design
• The do’s and don’ts of interaction design
  – But at a high level. (Not detailed guidelines.)
• What to provide and what not to provide at the interface
• Derived from a mix of theory-based knowledge, experience and common-sense
Higher-level Principles

• A possible list:
  – Visibility
  – Feedback
  – Constraints
  – Mapping
  – Consistency
  – Affordances

• Ideas well-known (e.g. from Norman’s *Design of Everyday Things*)
Affordances: to give a clue

• Refers to an attribute of an object that allows people to know how to use it
  – E.g. a mouse button invites pushing, a door handle affords pulling

• Norman (1988) used the term to discuss the design of everyday objects

• Since then has been popularized in interaction design to discuss how to design interface objects
  – E.g. scrollbars to afford moving up and down, icons to afford clicking on
A Good Example

- Kodak DC-290 digital camera
Adjusting Tabs in MS Word

• What’s the idea here? Problems?
• What principle(s)?
  – Affordance
  – Metaphor (more on this later)
Affordance Examples

• Tabs – like file folders (metaphor)
• Icons – e.g. floppy, learned metaphor since we no longer use floppies
• Image apps – pens, highlighters, spray can
• iPod touch – variable scroll rate, momentum
• Skype – reproduces a phone dial (also can type in)
Design an Interface for Users

• What’s in the user’s head, and how can you use it?

• Conceptual models
  – Mental models
  – Metaphors
  – Interaction styles
    • Command line
    • Menu selection
    • Form-fill
    • Direct manipulation
Evaluating Interaction Styles: E.g. Direct Manipulation

• Adv./Pros:
  – Great where program objects have a natural viz.
  – Easy to learn/remember
    • May follow a metaphor
    • Small memory load: Commands/objects/possibilities are visible
  – Good feedback
  – Safety: recover, prevent

• Disadv./Cons
  – Lots of resources, screen space
  – Maybe bad for repetition, experts (see Menu)
  – Breaks down (eventually)
    • Can be mixed with others
Understanding a conceptual model

• How will the user think about the system?
  – Based on data, functions, a metaphor?

• Are there existing systems, concepts that will influence how the user will think about the system?

• What kind of interface metaphor, if any, will be appropriate?

• What kinds of interaction modes and styles to use?

• Breakdowns?
  – ISIS example and back-button
Question?

• What’s a “portal”?  
  – What’s that mean to you?
• Example of a high-level conceptual model?
• Other ideas:  
  – Sound recording and manipulation  
  – Drawing Tool
Applying this for New System

• After you know about…
  – Learning about users and tasks
  – Conceptual models, mental models, metaphors, interaction styles/modes
  – Lo-fidelity prototyping

• You can use this to:
  – Design physical models of the interface

• Next we want to get more detailed…
  – Plan, prototype and evaluate more of the high-level features of a new system
  – Closer to finished product
Overall UI Flow

• Major UI elements are probably windows or screens (on handhelds)
  – What are they? How are they organized?
  – Do they “match” users’ mental models of how they want to achieve tasks?

– Compare to SW architecture design
  • Major components and their roles
  • How they’re related
  • Save detailed design (inside modules) for later
Book: *Patterns for Effective Interface Design*

- Interesting recent book!
  - Publisher’s site: [http://www.oreilly.com/catalog/designinterfaces/index.html](http://www.oreilly.com/catalog/designinterfaces/index.html)
  - Author’s page: [http://designinginterfaces.com/](http://designinginterfaces.com/)
- Samples!

- Book’s goal: document a collection of interface patterns
  - from large-scale idioms to small-scale controls
Sample Chapter Titles

• Information Architecture and Application Structure
• Navigation, Signposts and Wayfinding
• Layout of Page Elements
• Actions and Commands
• Showing Complex Data
• etc.
From In-class Exercise, Windows
From In-class Exercise, Mac OS
Principles of Good Layout

1. Create natural groupings
2. Separate currently active components
3. Emphasize important components
4. Use “white space” effectively (or: separate components when appropriate)
5. Make controls visible
6. Balance aesthetics and usability
Comments on Layout Principles

• Create natural groupings
  – Both commands/controls and information displayed
  – Is there a natural structure?
  – Use color, fonts, separators etc.

• Separate Currently Active Components
  – Help user focus on what they’re doing now.
  – Can pick back up if interrupted
  – Make things prominent by color, placement,…
Comments on Layout Principles

- Emphasize important components
  - Use color, type, animations, etc.
  - Be selective

- Use “white space” effectively (or: separate components when appropriate)
  - White-space in GUIs, physical space on physical devices
  - Alternative to lines, colors
  - Supports grouping for perception
  - In physical devices, supports physical usability
Comments on Layout Principles

• Make controls visible
  – Support recognition over recall
  – Control must be obvious, but also the controls function
  – Consider conventions, consistency, …

• Balance aesthetics and usability
  – Some say: “Looking pretty is half the battle”
  – How important? What trade-offs?
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Gestalt Principles

• Gestalt psychologists: layout principles
• Proximity
  – Users will associate things that are close together
• Similarity
  – If two things have same shape, size, color, orientation, then users will associate them
• Continuity
  – We want to see things aligned into continuous lines and curves
• Closure
  – We want to see simple closed forms (blocks, lines) rather than random, distinct items
• Symmetry
  – We see regions bounded by symmetrical borders as a coherent thing
HCI and Evaluation

Iterative design & evaluation is a continuous process that examines:

• Early ideas for conceptual model
• Early prototypes of the new system
• Later, more complete prototypes
• Existing systems

Designers need to check that they understand users’ requirements.

– Evaluation may teach you about your users as well as about your current design
Techniques for Evaluation

• User observation:
  – Observe a participant interacting with system etc.

• Inspection (heuristic inspection), Walkthrough
  – Various techniques
  – No participants usually involved

• Questionnaires, Surveys

• Observation of real users in their real world
  – For understanding users, needs, and requirements