6.811 / PPAT: Principles and Practice of Assistive Technology

Today: User-Centered Design
Today’s Topics

• Design process
  – Iterative design
  – User-centered design

• Information gathering
  – User analysis
  – Task analysis
  – Contextual inquiry
  – Defining success end-to-end
Iterative Design

Design → Build → Evaluate → Design
Spiral Model

Design

Evaluate

Prototype
Iterative Design of User Interfaces

- Early iterations use cheap prototypes
  - Parallel design is feasible: build & test multiple prototypes to explore design alternatives
- Later iterations use richer implementations, after UI risk has been mitigated
- More iterations generally means better UI
- Only mature iterations are seen by the world
Early & Late Prototypes
User-Centered Design

• Spiral design
  – repeated iterations of cheap prototypes

• Early focus on users and tasks
  – user analysis: who the users are
  – task analysis: what they need to do
  – involving users as evaluators, consultants, and sometimes designers

• Constant evaluation
  – users are involved in every iteration
  – every prototype is evaluated somehow
User Analysis: Know Your Client

• Identify characteristics of target user
  – Age, gender, culture, language
  – Education (literacy? numeracy?)
  – Functional limitations
  – Technology experience (computers? typing?)
  – Motivation, attitude
  – Relevant environment and other social context
  – Relevant relationships and communication patterns
Skills Evaluation: Sensory

- Visual function
  - acuity, field, tracking, scanning
- Visual perception
  - depth, spatial relationships
- Tactile function
- Auditory function
Skills Evaluation: Motor

- Range of motion
- Muscle strength
- Muscle tone
- Balance
- Tremor/involuntary movement
- Functional grasp patterns
Skills Evaluation: Cognitive

- Memory
- Problem-solving
- Sequencing
- Language
Task Analysis

• Identify the individual tasks the assistive technology might address
• Each task is a goal (*what*)
• Start with a high-level activity
• Then decompose it hierarchically into subtasks (*how*)
Essential Parts of Task Analysis

• What needs to be done?
  – Goal

• What must be done first to make it possible?
  – Preconditions
    • Tasks on which this task depends
    • Information that must be known to the user

• What steps are involved in doing the task?
  – Subtasks
    • may be further decomposed, recursively
Other Questions to Ask About a Task

• Where is the task performed?
• What is the environment like?
  – noisy, dirty, dangerous, crowded
• How often is the task performed?
• What are its time or resource constraints?
• What can go wrong?
  – exceptions, errors, emergencies
• Who else is involved in the task?
• What assistive technology (if any) is the client currently using for the task?
Hints for Better Task Analysis

• Questions to ask
  – Why do you do this? (goal)
  – How do you do it? (subtasks)

• Look for weaknesses in current situation
  – Goal failures
  – Wasted time
  – User irritation or fatigue
Contextual Inquiry

• Observe client doing the tasks in their real environment
  – Be concrete

• Establish a master-apprentice relationship
  – Client shows how and talks about it
  – You watch and ask questions

• Challenge your own assumptions
  – Share your assumptions openly with client
  – Probe surprises
Needfinding Exercise

- Improve the experience of shopping at IKEA
Exercise 1: Collect Observations

• Since we can’t go there ourselves right now, we’ll collect information through a proxy: social media

• Go to http://www.yelp.com/biz/ikea-stoughton-stoughton
  – Find interesting comments pertaining to user experience
  – Jump around so that we cover the space of ~300 reviews
  – Capture snippets of comments & notes in a text editor
  – Organize the comments according to recurring good and bad themes

• Work in a small group, then we’ll discuss results as a class
Exercise 2: Analyze User Classes

• Based on your observations, perform a user analysis on IKEA shoppers
  – What user classes do you find?
  – What characteristics do these classes have?
  – What are their roles and motivations?

• Work in a small group, then we’ll discuss results as a class
Exercise 3: Identify User Needs/Goals

• Identify high-level goals in the process of IKEA shopping
  – Do NOT yet identify solutions
  – What about the environment could make these tasks difficult to complete?

• Work in your group, then we’ll discuss as a class
Exercise 4: Needfinding

• What problems in the IKEA user experience might we target?
  – Do NOT yet identify solutions

• Let’s discuss this as a class
Participatory Design

• Include client directly in the design team
Success Metrics

• Choose evaluation metric(s) with client
  – efficiency: time on task
  – success rate
  – errors: frequency or severity
  – fatigue: how many times task can be done

• Set quantitative and qualitative targets
  – “get dressed in 2 minutes”
  – “make coffee without assistance”
  – “control my bed while hand is holding something else”

• Use the metrics and targets in subsequent process
  – evaluate on system models
  – predict outcome
  – measure on prototypes
Challenges for UCD for Assistive Technology

• Cognitive impairments
  – May need to include others in information-gathering

• Hidden impairments
  – May be hard to find people
Summary

• User-centered design manages project risk and stays focused on user needs
• User analysis assesses the client
• Task analysis discovers their tasks
• Success metric keeps you on track