6.S196 / PPAT: Principles and Practice of Assistive Technology

Today: User-Centered Design
[C&H Ch. 4]

Wed, 19 Sept. 2012
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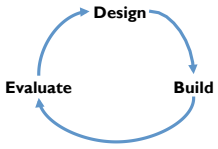
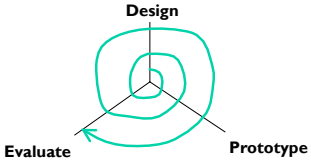
Today's Topics

- Design process
  - Iterative design
  - User-centered design
- Information gathering
  - User analysis
  - Task analysis
  - Contextual inquiry
  - Defining success end-to-end

Iterative Design



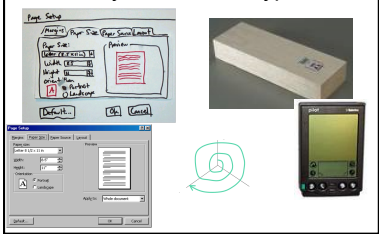
Spiral Model



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

Skills Assessment

- Bring a questionnaire
  - Sample assessment forms in C&H Ch. 4, pp. 128-142
- Don't have to ask every question
  - Focus on assessments likely to be relevant to target user and target activity
    - Which sensory evaluations are relevant to a blind client?
      - vision? audio? tactile?

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?

Common Errors in Task Analysis

- Thinking from the system's point of view, rather than the user's
  - "Notify user about appointment"
  - vs. "Get a reminder about appointment"
- Fixating too early on a UI design vision
  - "A bell will ring to remind the user about an appointment..."
- Bogging down in *what* the client does now (**concrete** tasks), rather than *why* they do it (**essential** tasks)
  - "Save file to disk"
  - vs. "Make sure my work is kept"
- Duplicating a flawed existing method in your design
- Failing to capture good aspects of existing method

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

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