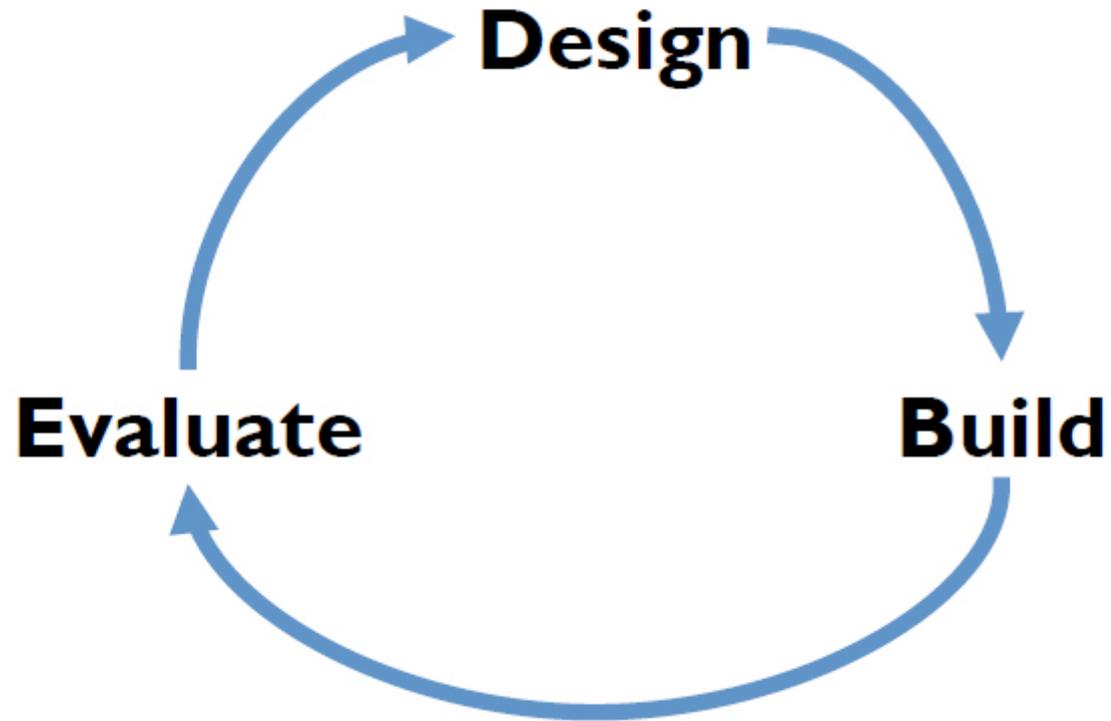# 6.811 / PPAT:
Principles and Practice of Assistive Technology
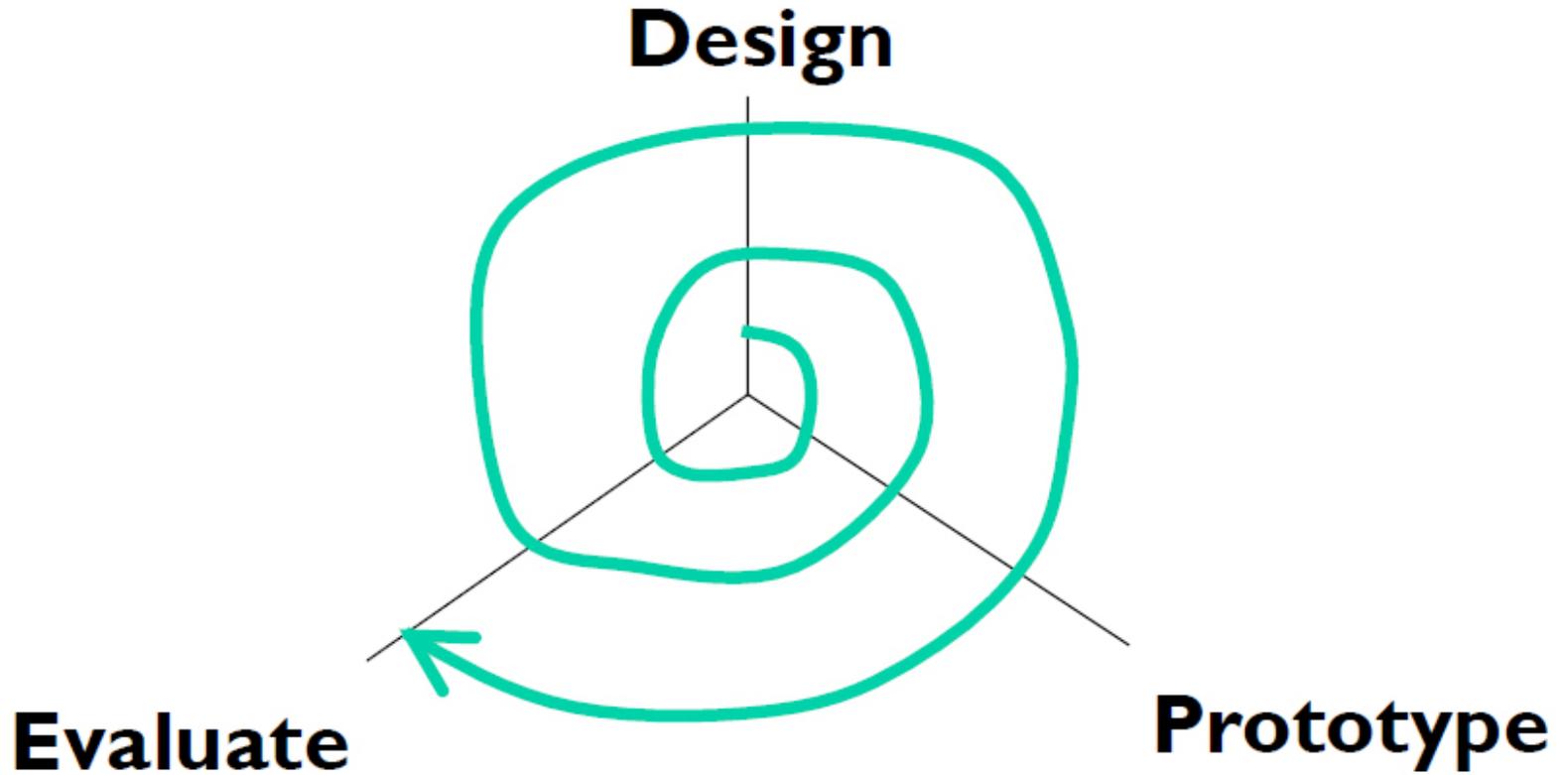
Today: User-Centered Design

Today's Topics

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

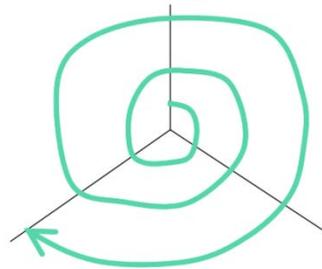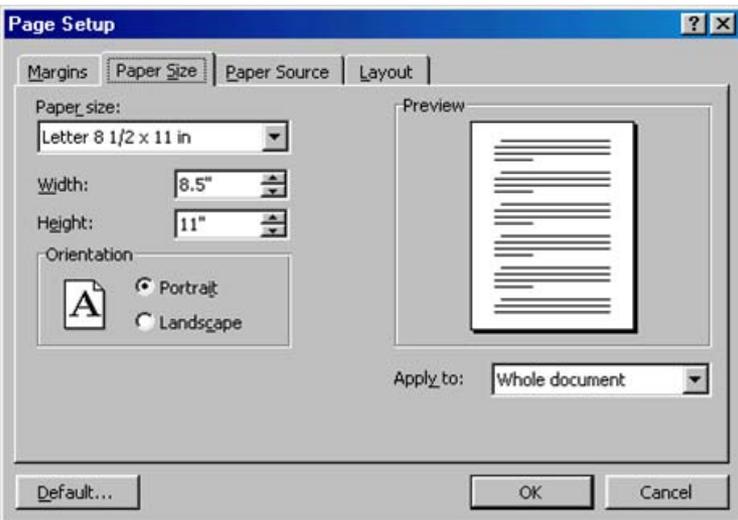# Iterative Design

Design

Evaluate

Build
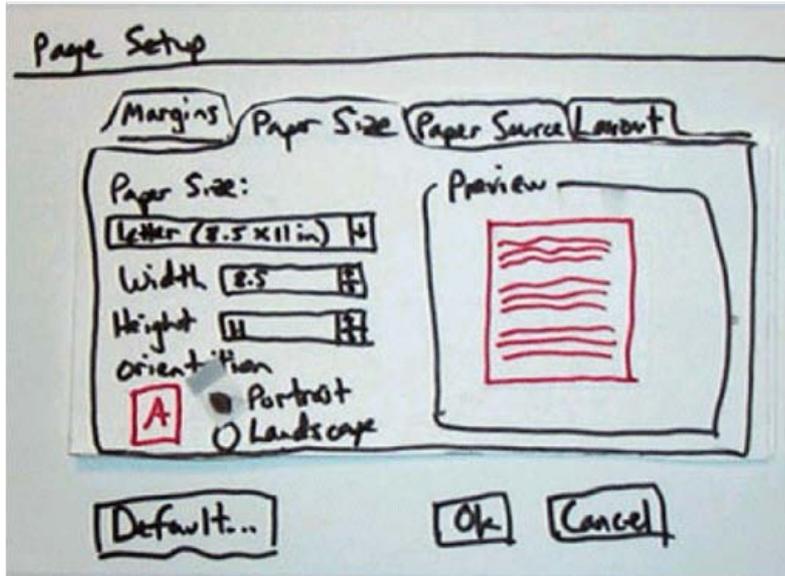
Spiral Model

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

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

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