Usability & Human Factors

Approaches to Design

Lecture a

This material (Comp15_Unit8a) was developed by Columbia University, funded by the Department of Health and Human Services, Office of the National Coordinator for Health Information Technology under Award Number 1U24OC000003.
Approaches to Design
Learning Objectives

• Explain a user-centered design approach (Lecture a)
• Define conceptual models (Lecture a)
  – Explain the iterative design process
  – Describe how requirements analysis influences design
Design

• A plan or scheme conceived in mind and intended for subsequent execution
• Tradeoffs balancing conflicting requirements
• Generating alternatives
• Use representations
  – Diagrams, prototypes
Interaction Design

• Focus on Users
• Specific Targets
  – Usability
  – Experience
• Iteration
• Key Question: How to optimize the users’ interactions with a system so they support and extend users’ activities in effective, useful and usable ways
Why All the Fuss About Design?

• Documented usability problems in healthcare and their consequences
• Clinical information systems present problems in implementation & beyond
• Many systems do not adequately address customer specifications
• Fixing a problem in development phase costs 10 times more than in design phase
Usability Engineering

Requirements Analysis

Conceptual Mockup

Screen Design Standards
  • Prototype

Detailed UI Design

Install

Feedback

Enhancement
A User-Centered Approach

Early focus on users and task

- Cognitive, behavioral & attitudinal characteristics
- Nature of tasks performed

Empirical measurement

- Study of users

Iterative Design

- Design and development are responsive to user problems
- Cyclical process
Focus on Users and Tasks

- Users’ tasks and goals drive development
- Focus on user behavior and context of use
  - System designed to support them
- Capture characteristics of users (capabilities & constraints)
- Users are involved from the inception through cycles of iterative development
- All design decisions taken within context of users, their work and environment
Design Process

Needs Analysis
Develop Alternatives
Prototype
Implement
Evaluate
Design Thought Exercise

- Imagine you organize your books, CDs and DVDs into a system/database that provides easy access to all information that you need.
- Imagine doing it for a friend or your father who is just learning to use a computer.

Think About the Space Problem

What are we trying to accomplish?

Organizing content

Supporting tasks
  - Ease of access, support queries

Users with different skill levels

Support different displays
  - (desktop, laptop, iPhone)

Define conceptual model
Conceptual Model

Abstraction outlines what people can do with a product and concepts needed to understand how to interact with it

- Structure outlining the concepts and relations that form the product—not the user interface

Metaphors used to convey a product

Concepts including the task domain objects, their attributes and operations that can be performed

Mappings between concepts and user experience
Visicalc

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SUBTOTAL   13155.50
9.75% TAX   1282.66

TOTAL      14438.16

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Visicalc Conceptual Model

First spreadsheet—a robust conceptual model (CM) that endures

Key goals of CM:

- Create a piece of software analogous to a ledger sheet—already familiar to users
- Make it interactive allowing user to input and change data in any of the cells
- Perform a range of calculations in response to user input
- Target a range of users
# Lifecycle Models

Represents activities involved in the design process

<table>
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<tr>
<th>Prototypical Models</th>
<th>Waterfall</th>
<th>Spiral</th>
<th>RAD</th>
<th>Star</th>
<th>Usability Engineering</th>
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Health IT Workforce Curriculum
Version 3.0/Spring 2012

Usability & Human Factors
Approaches to Design
Lecture a
Waterfall Lifecycle Model

- Requirements Analysis
- Design
- Code
- Test
- Maintain
Waterfall Model

• The original model for software engineering
• Linear model with clearly delineated tasks
• Problems
• No central role for users/no iteration and limited feedback
• Too rigid—not responsive to requirement changes
• Inconsistent with designers inherently nonlinear work practices
Star Lifecycle Model

- Implement
- Evaluate
- Concept
- Requirements
- Prototype
- Task Analysis

Star Lifecycle Model (cont.)

• Inherently nonlinear—does not specify ordering of activities
• Accentuates bottom-up, free thinking and creative practices of designer
• Evaluation is viewed as integral to all stages and continuous
• Problem: Too much flexibility, lack of systematic coordination and process is underspecified
The Usability Engineering Life Cycle

Requirements Analysis

- User Profile
- Task Analysis
- Platform Capabilities/Constraints
- General Design Principles

Usability Goals

Style Guide

Design/Testing/Development

Level 1
- Work Re-engineering
- Conceptual Model (CM) Design
- CM Mockups
- Iterative CM Evaluation

Eliminated Major Flaws?

Start Application Architecture

Level 2
- Screen Design Standards (SDS)
- SDS Prototyping
- Iterative SDS Evaluation
- Iterative CM Evaluation

Met Usability Goals?

Start Application Design/Development Model/Implementation Model

Level 3
- Detailed User Interface Design (DUID)
- Iterative DUID Evaluation

Met Usability Goals?

Yes

Style Guide

Functionality Addressed?

Yes

Start Application Architecture

No

Level 1

Start Application Design/Development Model/Implementation Model

No

Level 2

No

Level 3
Usability Engineering Lifecycle (UEL)

- Developed by Mayhew (1999) with the goal of thoroughly integrating usability considerations into all phases of design
- Core aspects/superordinate phases:
  - Requirements analysis
  - Design/testing/development
  - Decomposed into levels & detailed subprocesses
UEL Requirements Analysis

User(s) Profile
• Specific user/population characteristics related to interface design

Contextual task analysis
• Users’ current tasks, workflows and conceptual frameworks

Usability goal setting
• Qualitative and quantitative goals reflecting minimal acceptable performance

Platform capabilities and constraints

General design guidelines
UEL Design Phase: Level 1 Design

- **Work Re-engineering**: Based on requirements analysis
- **Conceptual Model (CM) Design/Mockups**: Abstract organization and workflow
- **Navigational pathways and major displays are identified**
- **Expressed as paper and pencil or prototype**
- **Iterative CM Evaluation**: Mockup is evaluated as if it were a real interface
UEL Design Phase: Levels 2 and 3

Screen Design Standards/Prototyping & Evaluation
- Standards, conventions and themes applied to all screens
- Formal usability testing evaluation
- Standardized and validated as a style guide

Detailed User Interface Design
- Based on refined conceptual model and screen design standards

Iterative Detailed User Interface Design Evaluation
- Expanded usability evaluation to unassessed subsets of functionality and categories of users
Approaches to Design
Summary – Lecture a

• Focus on design as a plan or scheme conceived in mind and intended for subsequent execution
  – Tradeoffs
• Conceptual model outlines what people can do with a product and ways to understand how to interact with it
• Design Lifecycles
• Up next: focus on requirements, prototypes and participatory design
Approaches to Design References – Lecture a

References


Images

Slide 13: Retrieved August 20th, 2010 from Wikimedia Commons GNU General Public License http://upload.wikimedia.org/wikipedia/commons/7/7a/Visicalc.png.
