User-Centered Design and Development

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Copyright Notice

- These slides are a revised version of the originals provided with the book “Interaction Design” by Jennifer Preece, Yvonne Rogers, and Helen Sharp, Wiley, 2002.
- I added some material, made some minor modifications, and created a custom show to select a subset.
  - Slides added or modified by me are marked with my initials (FJK), unless I forgot it …

484-W09 Quarter

- The slides I use in class are in the Custom Show "484-W09". It is a subset of the whole collection in this file.
- Week 5 contains slides from Chapters 8 and 9 of the textbook.
- The original slides are a bit of a mess, and I cleaned up various issues
  - outline view didn't show body text
  - quite a bit of "manual" formatting (bulleted/numbered lists)
  - in the end, I modified all of the slides to some degree; only the ones where I made significant changes are initialed

Chapter 8

Designing and Prototyping

Chapter Overview

- Prototyping and Construction
- Conceptual Design
- Physical Design

Motivation

- the design of products usually involves several intermediate stages
- especially for interaction aspects, early feedback is critical
- prototypes are frequently used for validation and the elicitation of feedback
- conceptual design identifies the most important aspects of the product
- physical design considers the tools, methods, and materials used for the final product

Objectives

- be aware of the purpose and value of creating prototypes
- consider the importance of early feedback for interaction design
- identify interaction aspects critical for the physical design of the product
- select the appropriate tools and methods to provide interactivity

Design, prototyping and construction

Overview

- Prototyping and construction
- Conceptual design
- Physical design
- Tool support

Prototyping and construction

- What is a prototype?
- Why prototype?
- Different kinds of prototyping
  - low fidelity
  - high fidelity
- Compromises in prototyping
  - vertical (“deep”)
  - horizontal (“shallow”)
- Construction

What is a prototype?

- In other design fields a prototype is a small-scale model:
  - a miniature car
  - a miniature building or town

What is a prototype?

- In interaction design it can be
  - a series of screen sketches
  - a storyboard
    - cartoon-like series of scenes
  - a PowerPoint slide show
  - a video simulating the use of a system
  - a lump of wood
    - e.g. hand-held computer
  - a cardboard mock-up
  - a piece of software with limited functionality
    - written in the target language or in another language

Why prototype?

- evaluation and feedback
  - central to interaction design
  - Stakeholders can see, hold, interact with a prototype more easily than a document or a drawing
- communication among team members
- validation of design ideas
- encourages reflection
  - very important aspect of design
- choosing between alternatives

What to prototype?

- Technical issues
- Work flow, task design
- Screen layouts and information display
- Difficult, controversial, critical areas

Low-fidelity Prototyping

- simple medium
  - e.g. paper, cardboard
  - often different from the final medium
- flexible
  - changes quick, cheap and easy
- examples
  - sketches of screens, task sequences, etc
  - 'Post-it' notes
  - storyboards
  - 'Wizard-of-Oz'

Storyboards

- often used with scenarios
  - more detail
  - chance to role play
- series of sketches
  - shows how a user might progress through a task using the device
- used early in design
  - cheap and simple
  - validation of design ideas
  - feedback from stakeholders

Sketching

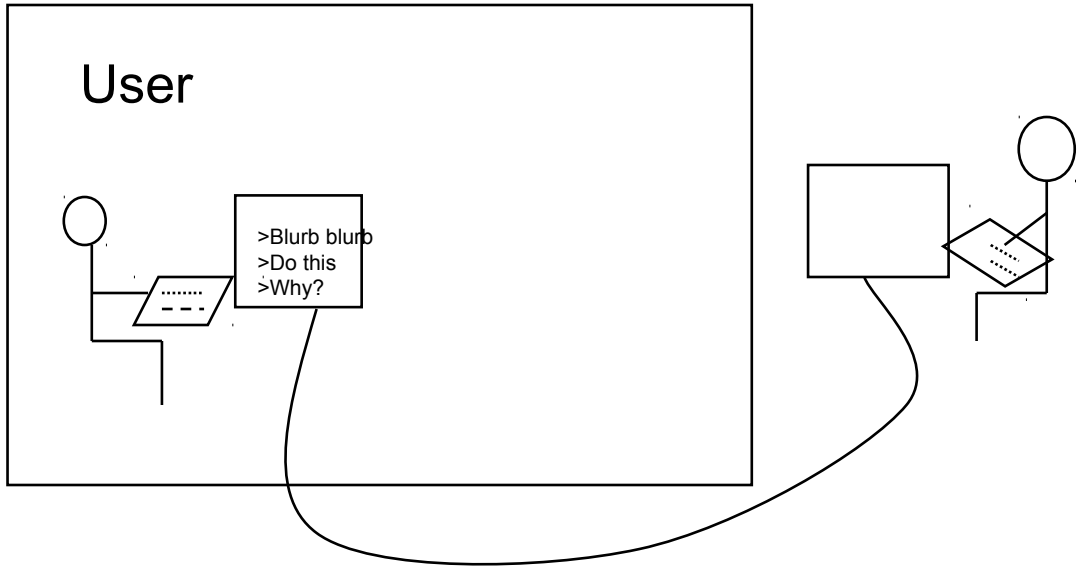
- important to low-fidelity prototyping
- drawing skills are not critical
  - symbols to indicate tasks, activities, objects
  - flowcharts for time-related issues
  - block diagrams for functional components
- computer support
  - some drawing and brainstorming programs have functions that help with sketching
  - may make things more complicated than necessary

Index Cards

- small cards (3 X 5 inches)
  - usually lined
- each card represents one screen
  - multiple screens can be shown easily on a table or the wall
- thread or lines can indicate relationships between screens
  - sequence
  - hyperlinks
- often used in website development

‘Wizard-of-Oz’ prototyping

- simulated interaction
  - the user thinks they are interacting with a computer, but a developer is providing output rather than the system
- user expectations
  - usually done early in design



http://musicman.net/oz.html

Activity: 'Wizard of Oz' Problems

- identify some problematic aspects with this approach
  - for novice users of the system
  - for experienced users of the system
  - for the developer providing the system's responses

High-fidelity prototyping

- choice of materials and methods
  - similar or identical to the ones in the final product
- looks more like the final system
  - appearance, not functionality
- common development environments
  - Macromedia Director, Visual Basic, Smalltalk,
  - Web development tools
- misled user expectations
  - users may think they have a full system

Compromises in prototyping

- all prototypes involve compromises
- software-based prototyping
  - slow response
  - sketchy icons
  - limited functionality
- two common types of compromise
  - 'horizontal': provide a wide range of functions, but with little detail
  - 'vertical': provide a lot of detail for only a few functions
- compromises should not be ignored
  - indicates the need for engineering

Construction

- creation, manufacturing of the final system
  - based on experiences and feedback gathered from the prototypes
- engineering
  - evolutionary, 'throw-away' prototyping
  - feasibility, materials, processes, economic and other considerations
- quality
  - usability, reliability, robustness, maintainability, integrity, portability, efficiency, etc

Conceptual Design

- transformation of user requirements/needs into a conceptual model
- stepwise refinement
  - iterate, iterate, iterate
- consideration of alternatives
  - prototyping helps

Definition 'Conceptual Design'

"a description of the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by the users in the manner intended"

Three perspectives for a conceptual model

- interaction mode
- interaction paradigm
- metaphor

Interaction Mode

- how the user invokes actions
  - activities by the user and the system's responses
- activity-based
  - instructing, conversing, manipulating and navigating, exploring and browsing.
- object-based
  - structured around real-world objects

Interaction Paradigm

- coherent collection of interaction methods
- desktop paradigm,
  - WIMP interface (windows, icons, menus and pointers),
- ubiquitous computing
- pervasive computing
- wearable computing
- mobile devices
- . . .

Metaphors

- interface metaphors
  - combine familiar knowledge with new knowledge
  - help the user understand the product
- three steps towards a metaphor
  - understand functionality,
  - identify potential problem areas,
  - generate metaphors

Evaluation of a metaphor

- How much structure does it provide?
- How relevant is it to the problem?
- Is it easy to represent?
- Will the audience understand it?
- How extensible is it?

Expanding the conceptual model

- functionality
  - task allocation
    - What will the product do and what will the human do?
- relationship of functions
  - sequential or parallel
  - categorizations
    - all actions related to one particular aspect
- information
  - data required to perform the task
  - transformation of data by the system

Scenarios in Conceptual Design

- express proposed or imagined situations
- used throughout the design process in various ways
  - scripts for user evaluation of prototypes
  - concrete examples of tasks
  - as a means of co-operation across professional boundaries
- 'plus' and 'minus' scenarios
  - exploration of extreme cases

Prototypes in Conceptual Design

- evaluation of emerging ideas
  - user feedback, feasibility
  - choice of methods and materials
- iterative prototyping
  - low-fidelity prototypes early on
  - high-fidelity prototypes later
- evolutionary prototyping
  - early prototypes are gradually enhanced and augmented
    - appearance
    - functionality

Physical Design

- more concrete, detailed issues of designing the interface
  - although inaccurate, the term is also used for software-based systems
- iteration physical /conceptual design
- guidelines for physical design
  - Nielsen's heuristics
  - Shneiderman's eight golden rules
  - Styles guides: commercial, corporate
    - decide 'look and feel' for you
    - widgets prescribed, e.g. icons, toolbar

Physical design for Computer Interaction

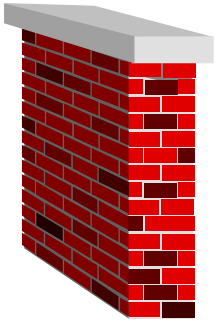
- different kinds of ‘widgets’
  - dialog boxes, toolbars, icons, menus, etc
- emphasis
  - menu design
  - icon design
  - screen design
  - information display

Menu Design

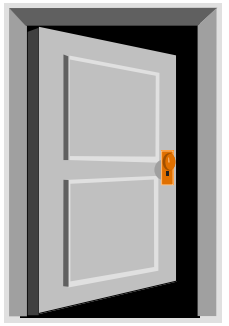
- arrangement
  - number of menus
  - length
  - order of items
- grouping of items
  - categorization
  - visual division (colors, dividing lines)
- structure
  - sub-menus, dialog boxes
- terminology
- constraints
  - screen size, input method
- context
  - applicability of entries

Activity Menu Design

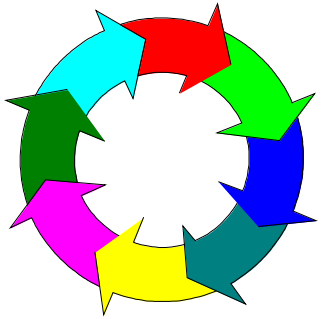
- compare the menu systems used on
  - a digital camera
  - a cell phone
  - a digital music player (e.g. iPod)
- some criteria
  - functionality
    - number of functions, categories
  - usability
    - frequency of use, importance, consequences
  - context
  - constraints
    - space, input methods



Icon design



- good icon design is difficult
- meaning of icons
  - cultural and context sensitive
- practical tips
  - always draw on existing traditions or standards
  - concrete objects or things are easier to represent than actions



Activity Icon Design

- identify two sets of icons
  - e.g. traffic signs, sports disciplines
- compare the two sets
  - purpose
  - context
  - constraints

Screen design

- splitting functions across screens
  - moving around within and between screens
  - how much interaction per screen
  - serial or workbench style
- individual screen design
  - white space
    - balance between information/interaction and clarity
  - grouping of items
    - separation with boxes, lines, colors

Splitting Functions across Screens

- task analysis as a starting point
  - each screen should contain a single simple step
  - user frustration
    - too many simple screens
- context
  - important information should be available
  - multiple screens open at once

Individual Screen Design

- user attention
  - directed to salient point
  - e.g. via color, motion, boxing
  - animation is very powerful but can be distracting
- organization
  - grouping
    - physical proximity, color, shape,
  - structure
    - connections between related items
- trade-off
  - sparse population vs. overcrowding

Information display

- context
  - relevant information available at all times
- types of information
  - imply different kinds of display
  - alpha-numerical, chart, graph, …
- consistency
  - paper display and screen data entry
  - different screens with similar information
  - information content vs. presentation

Summary

- Different kinds of prototyping are used for different purposes and at different stages
- Prototypes answer questions
- Construction: the final product must be engineered appropriately
- Conceptual design (the first step of design)
- Physical design: e.g. menus, icons, screen design, information display
- Prototypes and scenarios are used throughout design