

CPE/CSC 484: User-Centered Design and Development

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Logistics

- ❖ **Senate appearance by the instructor**
 - ❖ during the first half of the lab period
- ❖ **Assignments**
 - ❖ A3 - Storyboards deadline Thu, May 3
- ❖ **Term Project**
 - ❖ mid-quarter project displays Thu, May 3
 - ❖ allocation of display stations
 - ❖ external visitors anticipated
 - ❖ don't reveal confidential information
 - ❖ e.g. names of collaboration partners

Chapter 11

Design, prototyping and construction



Overview

- Prototyping and construction
- Conceptual design
- Physical design
- Generating prototypes
- Support for 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

Prototyping and construction

- What is a prototype?
- Why prototype?
- Different kinds of prototyping
 - low fidelity
 - high fidelity
- Compromises in prototyping
 - vertical
 - horizontal
- Construction

What is a prototype?

In other design fields a prototype is a small-scale model:

- a miniature car
- a miniature building or town
- the example here comes from a 3D printer



What is a prototype?

In interaction design it can be (among other things):

- a series of screen sketches
- a storyboard, i.e. a cartoon-like series of scenes
- a Powerpoint slide show
- a video simulating the use of a system
- a lump of wood (e.g. PalmPilot)
- 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 are central to interaction design
- Stakeholders can see, hold, interact with a prototype more easily than a document or a drawing
- Team members can communicate effectively
- You can test out ideas for yourself
- It encourages reflection: very important aspect of design
- Prototypes answer questions, and support designers in choosing between alternatives

Filtering dimensions of prototyping

Filtering dimension	Example variables
Appearance	size; color; shape; margin; form; weight; texture; proportion; hardness; transparency; gradation; haptic; sound
Data	data size; data type (e.g., number; string; media); data use; privacy type; hierarchy; organization
Functionality	system function; users' functionality need
Interactivity	input behavior; output behavior; feedback behavior; information behavior
Spatial structure	arrangement of interface or information elements; relationship among interface or information elements – which can be either two-or three-dimensional, intangible or tangible, or mixed

Manifestation dimensions of prototyping

Manifestation dimension	Definition	Example variables
Material	Medium (either visible or invisible) used to form a prototype	Physical media, e.g., paper, wood, and plastic; tools for manipulating physical matters, e.g., knife, scissors, pen, and sandpaper; computational prototyping tools, e.g., Macromedia Flash and Visual Basic; physical computing tools, e.g., Phidgets and Basic Stamps; available existing artifacts, e.g., a beeper to simulate a heart attack
Resolution	Level of detail or sophistication of what is manifested (corresponding to fidelity)	Accuracy of performance, e.g., feedback time responding to an input by a user (giving user feedback in a paper prototype is slower than in a computer-based one); appearance details; interactivity details; realistic versus faked data
Scope	Range of what is covered to be manifested	Level of contextualization, e.g., website color scheme testing with only color scheme charts or color schemes placed in a website layout structure; book search navigation usability testing with only the book search related interface or the whole navigation interface

What to prototype?

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

Low-fidelity Prototyping

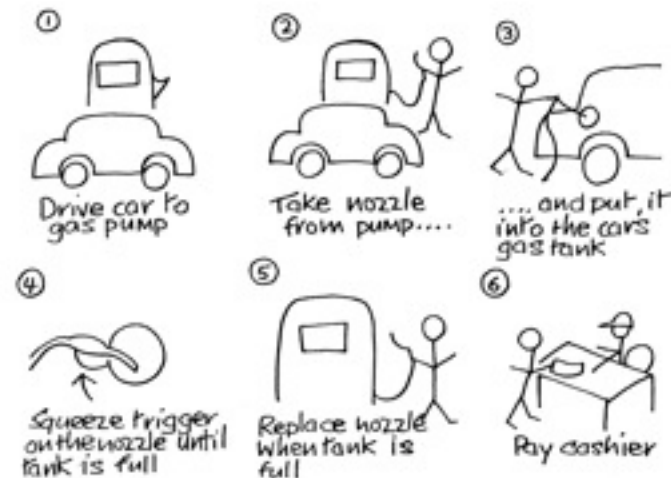
- Uses a medium which is unlike the final medium, e.g. paper, cardboard
- Is quick, cheap and easily changed
- Examples:
 - sketches of screens, task sequences, etc
 - 'Post-it' notes
 - storyboards
 - 'Wizard-of-Oz'

Storyboards

- Often used with scenarios, bringing more detail, and a chance to role play
- It is a series of sketches showing how a user might progress through a task using the device
- Used early in design

Sketching

- Sketching is important to low-fidelity prototyping
- Don't be inhibited about drawing ability. Practice simple symbols



Card-based prototypes

- Index cards (3 X 5 inches)
- Each card represents one screen or part of screen
- Often used in website development

A hand-drawn card-based prototype for a 'Travel Organizer' application. The card is titled 'Travel Organizer' with a small globe icon and the date '23 August'. The main text reads 'WELCOME HELEN'. Below this are four questions with corresponding input fields: 'Where do you want to go?' with a text box containing 'YORK'; 'What date do you want to travel?' with a text box containing '16 Sept'; 'Which form of transport do you want?' with a dropdown menu showing 'TRAIN'; and 'Do you need accommodation?' with a dropdown menu showing 'YES'.

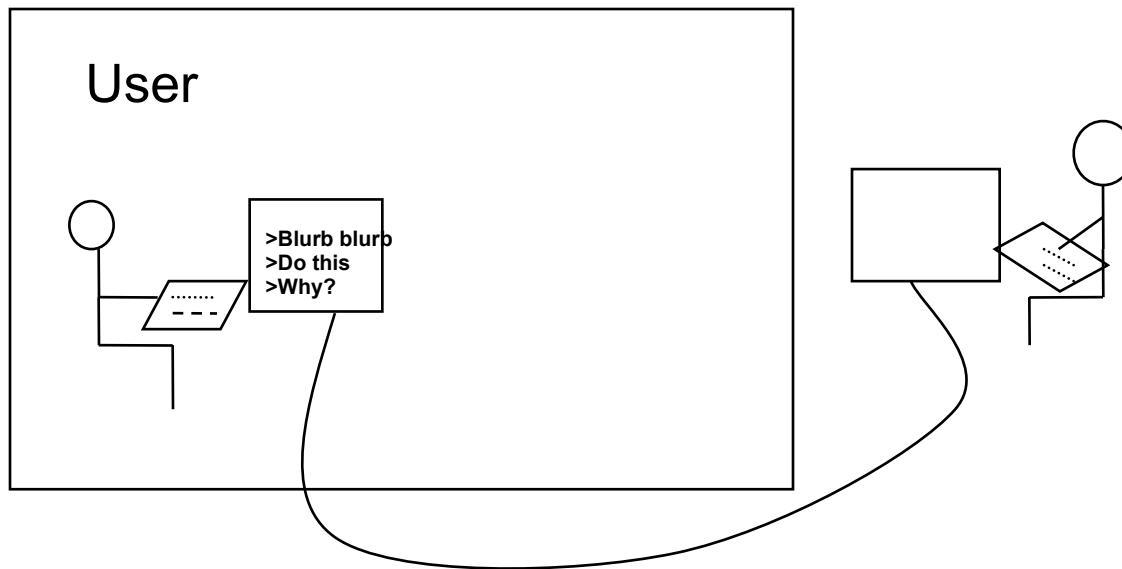
A hand-drawn card-based prototype for a 'Train timetable' application. The card is titled 'Travel Organizer' with a small globe icon and the date '23 August'. The main text reads 'Train timetable from Milton Keynes Central to York on 16 Sept'. Below this is a table with two rows: 'Depart' and 'Arrive'. The 'Depart' row shows times 09:09, 10:09, 11:09, and 12:09. The 'Arrive' row shows times 12:30, 13:30, 14:30, and 15:30. Below the table is a section for 'Accommodation' with a table showing 'Hotel' and 'B&B' options, with prices ranging from £40 to £60.

	09:09	10:09	11:09	12:09
Depart	09:09	10:09	11:09	12:09
Arrive	12:30	13:30	14:30	15:30

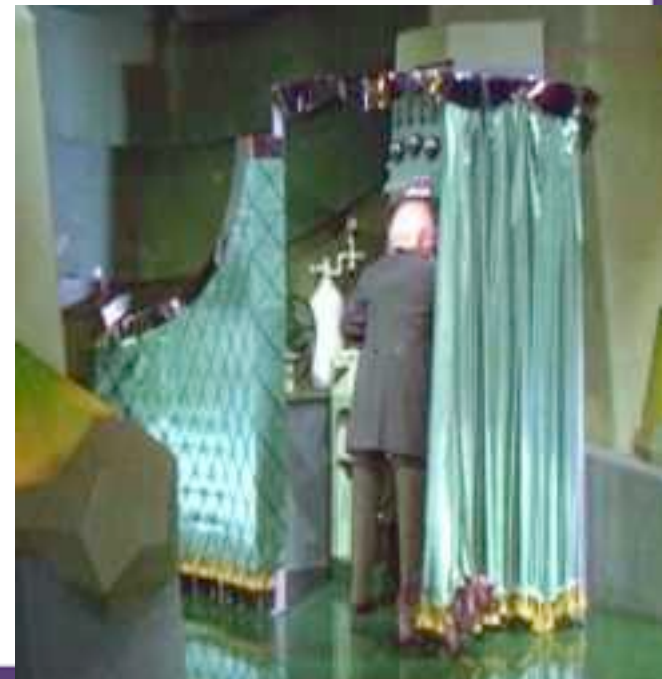
Accommodation	Hotel	B&B
	£40 to £150	£20 to £60

'Wizard-of-Oz' prototyping

- The user thinks they are interacting with a computer, but a developer is responding to output rather than the system.
- Usually done early in design to understand users' expectations
- What is 'wrong' with this approach?



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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

- Uses materials that you would expect to be in the final product.
- Prototype looks more like the final system than a low-fidelity version.
- For a high-fidelity software prototype common environments include Macromedia Director, Visual Basic, and Smalltalk.
- Danger that users think they have a full system.....see compromises

Compromises in prototyping

- All prototypes involve compromises
- For software-based prototyping maybe there is a 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 in prototypes mustn't be ignored. Product needs engineering

Construction

- Taking the prototypes (or learning from them) and creating a whole
- Quality must be attended to: usability (of course), reliability, robustness, maintainability, integrity, portability, efficiency, etc
- Product must be engineered

Evolutionary prototyping

‘Throw-away’ prototyping

Conceptual design: from requirements to design

- Transform user requirements/needs into a conceptual model
- “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”
- Don’t move to a solution too quickly. Iterate, iterate, iterate
- Consider alternatives: prototyping helps

Is there a suitable metaphor?

- Interface metaphors combine familiar knowledge with new knowledge in a way that will help the user understand the product.
- Three steps: understand functionality, identify potential problem areas, generate metaphors
- Evaluate metaphors:
 - How much structure does it provide?
 - How much is relevant to the problem?
 - Is it easy to represent?
 - Will the audience understand it?
 - How extensible is it?

Considering interaction types

- Which interaction type?
How the user invokes actions
Instructing, conversing, manipulating or exploring
- Do different interface types provide insight?
WIMP, shareable, augmented reality, etc

Expanding the conceptual model

- What functions will the product perform?
What will the product do and what will the human do (task allocation)?
- How are the functions related to each other?
Sequential or parallel?
Categorisations, e.g. all actions related to telephone memory storage
- What information needs to be available?
What data is required to perform the task?
How is this data to be transformed by the system?

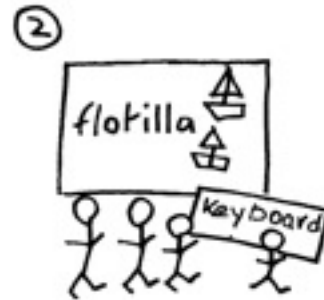
Using scenarios in conceptual design

- Express proposed or imagined situations
- Used throughout design 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 to explore extreme cases

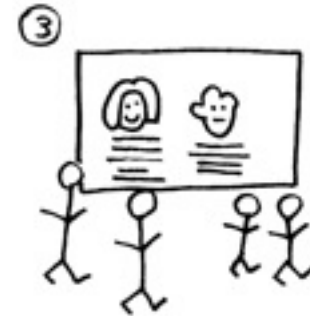
Generate storyboard from scenario



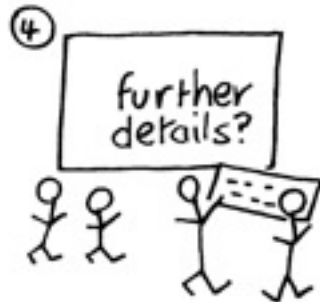
Thomson family
gather around



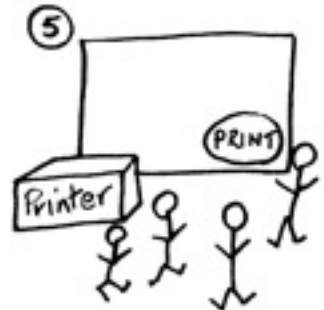
System suggests
flotilla



System shows
descriptions



System asks
for details



Summary printed

Generate card-based prototype from use case

TRAVEL INFORMATION
Visa requirements
Vaccination Recommendations
What to pack before you go

VISA REQUIREMENTS
Destination Country <input type="text"/>
Traveller's Nationality <input type="text"/>
Find Requirements

VISA REQUIREMENTS FOR (COUNTRY)
Print

Support for design

- Patterns for interaction design
 - individual patterns
 - pattern languages
 - pattern libraries
- Open source systems and components



- Tools and environments



Summary

- Different kinds of prototyping are used for different purposes and at different stages
- Prototypes answer questions, so prototype appropriately
- Construction: the final product must be engineered appropriately
- Conceptual design (the first step of design)
- Consider interaction types and interface types to prompt creativity
- Storyboards can be generated from scenarios
- Card-based prototypes can be generated from use cases