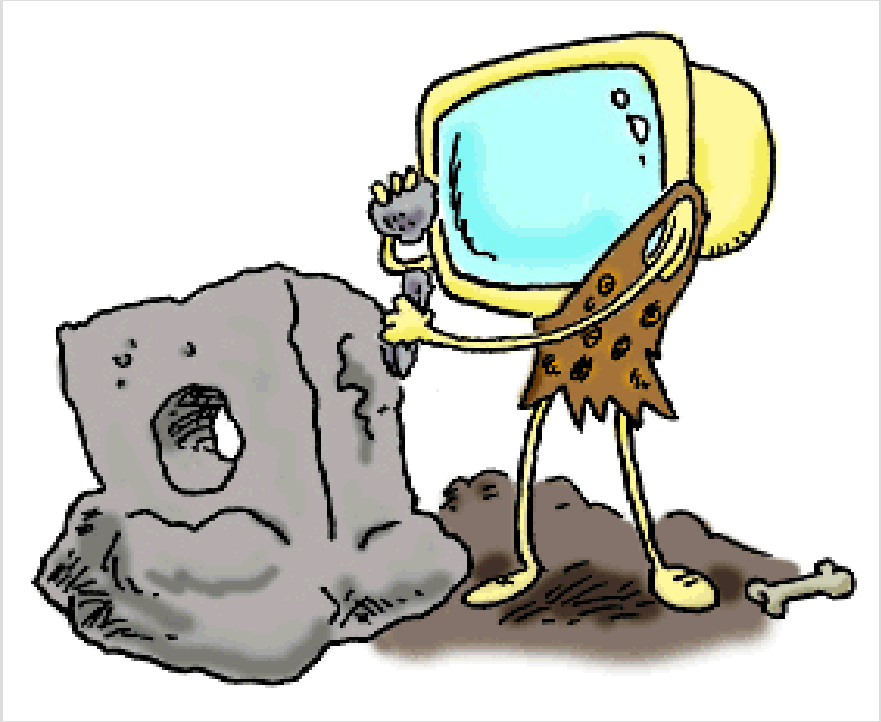
Design, Prototyping & Construction



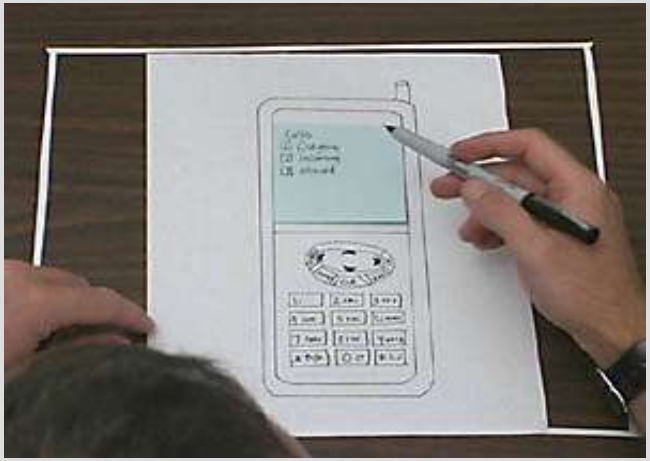
Based on the slides available at www.id-book.com

Overview

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

Prototyping & construction

- What is a prototype ?
- Why prototype ?
- Different kinds of prototyping
  - Low fidelity
  - High fidelity
- Compromises in prototyping
  - Vertical
  - Horizontal
- Construction



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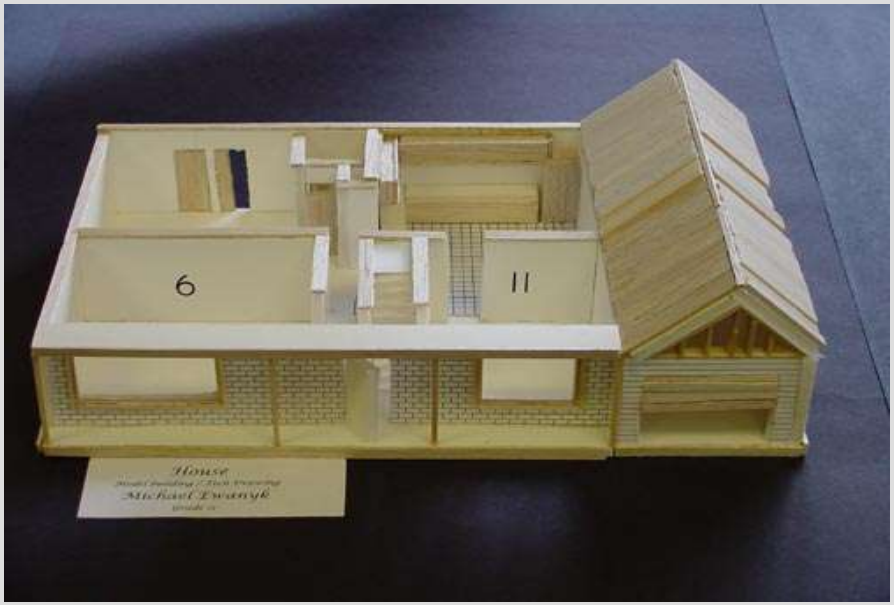
What is a prototype ?

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



What is a prototype in HCI ?

- It can be (among other things):
  - A series of screen sketches
  - A storyboard i.e a cartoon like sequence of scenes
  - Slideshow
  - Video simulating the use of the system
  - A lump of wood (Palm Pilot)
  - A cardboard mock-up
  - A piece of software with limited functionality written in the target language or another language

Why prototype ?

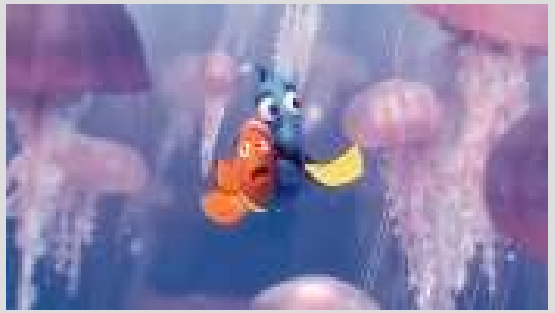
- Evaluation and feedback are central to ID
- Stakeholders can see, hold, interact with a prototype more easily than a document or a drawing
- Team members can communicate effectively
- You can test out ideas for yourself
- It encourages reflection – very important
- Prototypes answer questions and support designer in choosing between alternatives

What to prototype ?

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

Low Fidelity Prototyping

- Uses a medium that 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
  - Story boards
  - Wizard of Oz



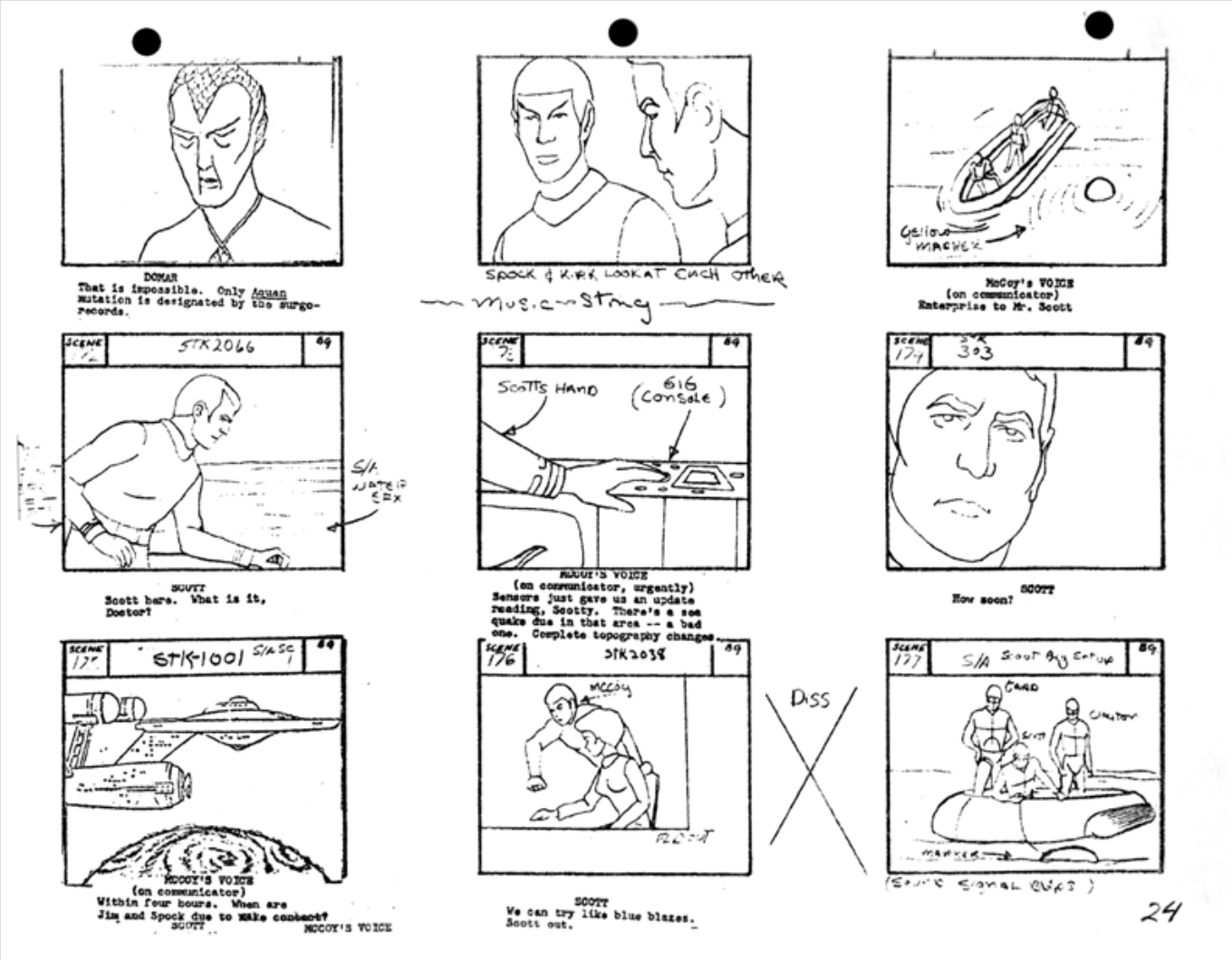
The Palm Pilot story

- "Less is more"
- 1996: 0.5 million units in the first 7 months
- Apple Newton
  - Elegant, powerful
  - Failure
- Jeff Hawkins (founder)
  - Walked around with a block of wood in his pocket
- Concentrate on usability & essential functionality – every pixel counts
- No save button – 1 application at a time

Storyboards & sketching

- 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 the design
- Sketching
  - Important to low fidelity prototyping
  - Don't be inhibited about drawing ability. Practice simple symbols

Storyboard



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Participatory case study

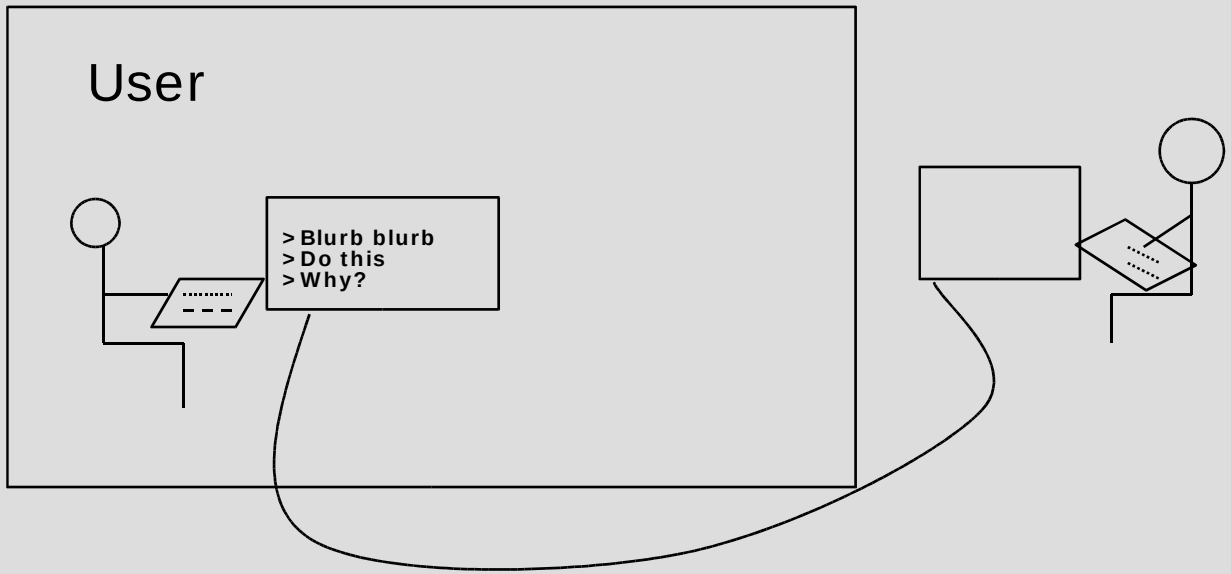
- Automatic library checkout system
  - Lookup book on computer
  - Note down the locator
  - Scan barcode of book
  - Green light indicates book has been scanned

Using index cards

- Index cards (3x5 inches)
- Each card represents one screen
- Often used in website development

“Wizard of Oz” prototyping

- The user thinks they are interacting with a computer, but a developer is responding to output rather than the the system
- Usually done early in design to understand users expectations
- Applications ?
- Cons ?



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, Smalltalk
- Danger that users think they have a full system … compromises

Vertical vs Horizontal Prototyping

- Where the compromises are made ?
- For software-based prototyping maybe there is a slow response ? sketchy icons ? limited functionality ?
- Horizontal
  - Wide range of function but with little detail
- Vertical
  - A lot of detail for only a few functions
- Compromises can't be ignored – importance of engineering

Construction

- Taking the prototypes (or learning from them) and creating a whole
- From design to implementation
  - Evolutionary prototyping
  - Throwaway prototyping
- Quality must be attended to: usability, reliability, robustness, maintenability, integrity portability, efficiency
- “Software is the only engineering field that throws together prototypes and then attempts to sell them as delivered goods” Constantine & Lockwood 1999

Conceptual Design: from requirements to design

- Transform user needs/requirements 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

Three perspectives for a conceptual model

- Which interaction mode ?
- How the user invokes actions
  - Activity-based: instructing, conversing, manipulating and navigating, exploring and browsing
  - Object-based: structured around real world objects

Three perspectives for a conceptual model

- Which interaction paradigm ?
  - Desktop paradigm with WIMP interface (windows, icons, menus, pointer)
  - Ubiquitous computing
  - Pervasive computing
  - Wearable computing
  - Mobile devices
  - ....

Three perspectives for a conceptual model

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

Expanding the conceptual model

- What functions will the product perform ?
- What will the product do and what will the human ? (task allocation)
- How are functions related to each other
  - Sequential or parallel ?
  - Categorizations, e.g all functions related to editing
- What information needs to be available ?
  - What data is required to perform the task ?
  - How is this data transformed/represented 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
  - Everything great
  - Everything goes wrong

Using prototypes in conceptual design

- Allow evaluation of emerging ideas
- Low fidelity prototypes used early on, high fidelity prototypes used later

Physical Design

- Considers more concrete, detailed issues of designing the interface
- Iteration between conceptual and physical design
- Guidelines for physical design
  - Nielsen's heuristics
  - Shneiderman's eight golden rules
  - Style Guides: commercial, corporate
    - Decide “look & feel” for you
    - Widgets prescribed e.g icons, toolbar

Physical Design

- Different kinds of widgets (dialog boxes, toolbars, icons, menus etc)
  - Menu design
  - Icon design
  - Screen display
  - Information display

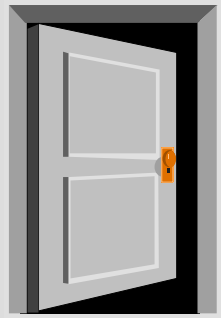
Menu Design

- How long is the menu to be ?
- In what order will the items appear ?
- How is the menu to be structured, e.g when to use sub-menus, dialog boxes ?
- What categories will be used to group menu items ?

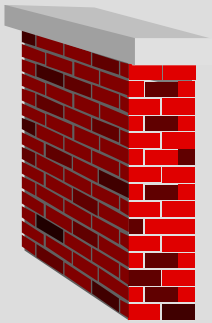
Menu Design

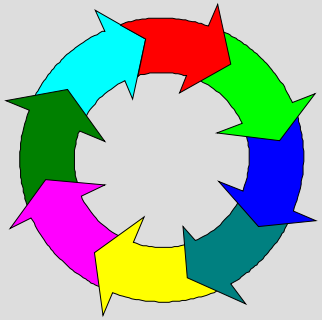
- How will division into groups be denoted, e.g different colors, dividing lines ?
- How many menus will there be ?
- What terminology to use ? (results of the requirements activity will indicate this)
- How will any physical constraints be accomodated e.g mobile phone ?

Icon design



- Good icon design is difficult
- Meaning of icons is cultural and context sensitive
- Some tips:
  - Always draw on existing traditions or standards
  - Concrete objects or things are easier to represent than actions
  - From clip art, what do these mean to you ?





Screen Design

- Two aspects:
  - How to split across screens
    - Moving around within and between screens
    - How much interaction per screen ?
    - Serial or workbench style ?
  - Individual screen design
    - White space: balance enough information/interaction and clarity
    - Grouping items together: separation with boxes ? Lines ? Colors ?

Screen Design: Splitting functions across screens

- Task analysis as starting point
- Each screen contains a single, simple step ?
- Frustration if too many simple screens
- Keep information available: multiple screen open at once

Screen Design: Individual Screen Design

- Draw user attention to salient point, e.g. color, motion, boxing
- Animation is very powerful but can be distracting
- Good organization helps: grouping, physical proximity
- Tradeoff between sparse population and over-crowding

Information Display

- Relevant information available at all times
- Different types of information imply different types of display
- Consistency between paper display and screen data entry (calendar, watch examples)

Tool Support

Myers, 1995

- Help design interface given specification
- Help implement interface given specification
- Create easy to use interfaces
- Allow designer to rapidly investiagate different designs
- Allow non-programmers to design and implement user interfaces
- Automatically evaluate the interface and propose improvements
- Allow the end user to customize the interface
- Provide portability
- Be easy to use

Successes of UI tools

Myers, 2000

- Window managers and toolkits
- Event languages
- Interface builders (Visual Basic)
- Component systems (Direct X, JavaBeans
- Scripting languages (Python, Perl)
- Hypertext and markup languages XML
- Object-oriented programming

Failures of UI tools

Myers, 2000

- User interface management tools:
  - Abstract away from manipulation of interface elements
- Formal language based tools
  - State-transition diagrams, context-free grammars
  - Better for dialog-based systems not direct manipulation
- Constraints
  - Too difficult to set-up, maintain
- Model-based and automatic techniques
  - Generate interface – only work in specific domains

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)
- Physical design (e.g. Menus, icons, screen design, information display)
- Prototypes and scenarios are used throughoutdesign

The design challenge

- Much good design evolves
- Craftspeople – folk objects
  - Hand tools
  - Musical Instruments
  - Chairs
  - Any other examples ?
- Hill climbing – evolution
- Natural design doesn't work always
  - Why ?

Forces that work against evolutionary design

- Time
- Complexity
- Forces of competitive market
- Lack of feedback mechanisms
- Pressure to be different
- Curse of individuality
  - Folk tales vs best sellers
- Telephone
  - Handset, microphone, crank
  - Robust, well-designed buttons
  - Bell labs vs free market

Typewriter

- “Qwerty”, Charles Sholes 1870
- Early layouts – alphabetical ordering
  - Circular, piano-bar
- Solve mechanical problem – too fast typing resulted into jamming
- 1877 – blind typing
- Good enough inertia
- Dvorak – founders of industrial engineering
  - Much better 10% faster typing
- Court stenographers – chord keyboards
  - Syllables instead of letters

Why designers go astray ?

- Putting aesthetics first
- Seattle – employees designed
  - 7% improvement in rated job performance
  - But no award
- Los Angeles – just the architects
  - Lot's of awards – nobody liked it
- Example of good design
  - Exploratorium in San Francisco

Designers are not typical users

- Designers often think they are typical users
  - They are not
- Designers are expert in using device they are designing
- Users are expert in doing task they are trying to perform with device
- Engineers, managers
  - Argue forever never ask the actual users
- Innocence lost is not easily regained

Designer's clients are not users

- Purchasing departments
- Managers
- Landlords
- Factors
  - PRICE, size, appearance, almost never usability
- Designers must fight to get access to the actual users
- Design process is captive of corporate bureucracy
- Gulf of evaluation

The complexity of the design process

- “Design is the succesive application of constraints until only a unique product is left”
- Check Norman for faucet example
- Variety of possible solutions is enormous
- Incredible amount of details

Designing for special people

- There is no average person
- US 250 million – 5% is 12.5 million
- Physical anthropometry
- Adjustments
- Left-hand vs right-hand
- Design for flexibility

Selective attention – focus

- Toaster – knife example
- Fleeing a fire push door instead of pulling
- Helmets strapped on their bike, not their head
- Forcing functions
  - Turn car lights of when key is removed
  - No access to bread until toaster is turned off

Two deadly temptations

- Creeping featurism
  - Adding more features than necessary
  - Everything: constraints, affordances, mappings disappear in order to make room for more features
  - Avoidance – restraint
  - Modularization
- Worshipping of false images
  - Appearance of technical sophistication
  - The “nerd” factor
- Instead explorable systems