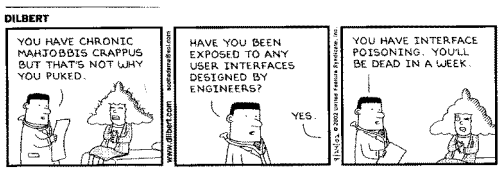
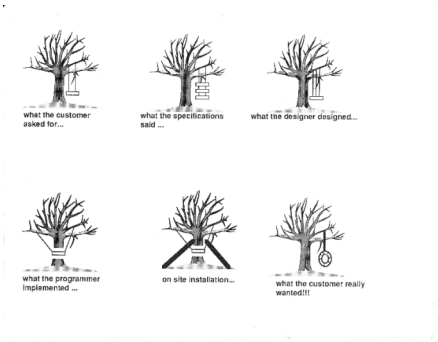
Lecture 4

Human-Centered Development
(chapters 2 & 3)



Three Approaches to UI Design

- Attitude of technology-centered development
  - Progress made by technological advances
  - The more bells & whistles the better
- Attitude of designer-centered development
  - Progress made by considering the intuitions of the designer
  - Imagining what the user will do and feel
- Attitude of human-centered development
  - Progress made by incorporating the users into the design process
  - Empirical studies integrated early into the design



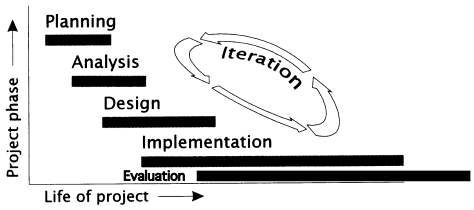
Human-centered software development

(John Gould, IBM 1983)

- Definition
  - Early and Continual Focus on Users
    - Direct contact through interviews, observations, surveys, participative design in order to understand characteristics of users and their jobs
  - Integrated Design
    - All aspects of usability evolve in parallel; All aspects of usability under one focus or person
  - Early and Continual User Testing
    - Throughout development, intended users do real work with simulations and prototypes; their performance and reactions are measured qualitatively and quantitatively
  - Iterative Design
    - The system (functions, user interface, help system, reading material, training approach) is modified based upon results of user testing; testing cycle is repeated

Iterative Model of Development

- Steps in method



Steps in method (note: iterative!)

1. Planning
   - Scope of project, investigate user population (document analysis, interviews, surveys, observation) & related systems
2. Requirements Analysis
   - Task analysis of existing system, problem scenario development
   - Requirements for usefulness (functionality) and usability
3. Design (Presentation & Interaction Design)
   - Specifications (yes!) for human-computer interaction (UI)
4. Implementation (Prototyping)
   - Storyboards, mock-ups, software prototypes
5. Usability Evaluation
   - Evaluation without users: cognitive walkthrough, heuristic evaluation (guidelines), GOMS, Keystroke Level Model (KLM)
   - Evaluation with users (usability testing, interviews, questionnaires)

Step 1: Planning

- Scope of project
  - Time frame
  - Costs and other resources
  - Purpose
  - Context

Step 2: Requirements Analysis

- What is a requirement?
  - What the system will do, not how
  - Captures constraints as well
    - Hardware, software, etc.
  - Types of requirements
    - (User) Functions: what the user can do
    - Usability: combines functions with usability measures
    - Other: hardware, software functions or constraints

Gathering information about needed system

- Prior and related systems
- User studies
  - Who are the users?
  - What should the system do?
  - User needs
  - User constraints

User Studies

How do you get user information?

- Artifact analysis
- Interviews
- Observation
- Participation
- Survey/Questionnaire
- Data Collection from computer transactions

Artifact Analysis

- Collect and examine the documents, objects and other resources that people use in their activities
- Try to understand the content of the information and the role it plays in activities

Interviews

- Advantages
  - Gathers opinion, Creates rapport
- Disadvantages
  - Must be well-planned
  - Bias: Information often filtered
- Types
  - Structured
    - Fixed set of questions with simple answers
  - Unstructured
    - More open questions

Observation

- Advantages
  - Not an opinion, but an objective record
  - Captures detail
- Disadvantages
  - Intrusive, Time consuming
- Types
  - Passive: "Hanging out"
    - Used in very early design when don't have much information about user's activities
  - Active
    - Provide users with problems to solve or tasks

Participation

- When the observer learns and participates in the work activities
- Overcomes the Hawthorne effect
  - Bias of being observed
- Obtain otherwise privileged information
- Creates first-hand domain knowledge

Survey/Questionnaire

- Purpose
  - Reaches lots of people
  - Perform statistical analysis on data
  - Avoids bias by anonymity
  - Consistent questions
- Design Issues
  - Must be carefully designed, do pilot
  - Must not be time-consuming & easy to reply
  - Must make sense
  - Must gather precise answers, not vague ones
  - Ask only questions which support the design
  - Sample vs. population

Survey: Good Example

GUEST COMMENTS

Date of Visit: ____ ____ Time:_____

YOUR FEEDBACK

How was your food?
Was your order right?
Were we fast enough?
Were we friendly?
How did we look?
Were we clean?
Will you return?

Thank you for coming to Skippers

What would you like?_____

To enable us to promptly respond to your evaluation, please include your name, address and phone number.

Name_____

Address_____

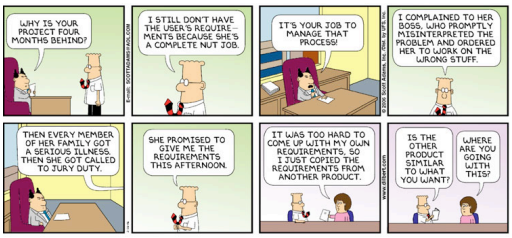
City_____ State____ Zip

Phone (_____)_____

Goals for requirements analysis

- **Ascertain the user's needs**
  - Determine what tasks and subtasks must be carried out
  - Include tasks which are only performed occasionally. Common tasks are easy to identify.
  - Functionality must match need or else users will reject or underutilize the product

Getting User Requirements



Requirements

- Example: Rapid Transit Ticket Dispenser
  - Functional requirement: User must be able to purchase ticket
  - Usability requirement: User must be able to purchase simple ticket in under 2 minutes.
  - Functional requirement: Support for blind users.
  - Usability requirement: Blind user must be able to purchase simple ticket in under 4 minutes.
  - Functional requirement: User instructions should be in English and Spanish.
  - Usability requirement: User must be able to read instructions at 8th grade level.

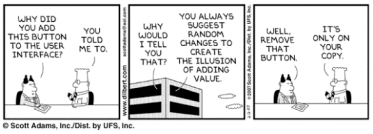
Requirements as Tasks

- Example: Rapid Transit Ticket Dispenser
  - Function: Purchase ticket
    - Subfunction: Determine fare
      - Sub-subfunction: Give the destination
      - Sub-subfunction: Specify journey type, either one-way or round trip
      - Sub-subfunction: Receive quoted fare
    - Subfunction: Obtain ticket
      - Sub-subfunction: Pay the money
      - Sub-subfunction: Receive the ticket and any change due
- NOTE: Hierarchical levels of abstraction
- Task Analysis (suggested Greenberg reading)

Step 3: Design

- Implements requirements (*How* system will work)
- Design process produces design specifications!
  - Formalizes Design, "Blueprints"
    - Specification proposes the exact user interaction and presentation; leaves nothing to ad hoc decisions
  - Guides Implementation
    - Used to define the programming implementation, user studies justify design decisions
      - » Widget types, Graphics and text, Error and help processing
  - Creates Communication
    - Represents the evolving design to the client and all members of the team
  - Evaluates design
    - completeness, correctness, consistency and performance times

Justifying Design Decisions



Design Specification of Functions are Tasks

- Example: Rapid Transit Ticket Dispenser
  - Function: Purchase ticket
    - Subfunction: Determine fare
      - Sub-subfunction: Give the destination
      - Sub-subfunction: Specify journey type, either one-way or round trip
      - Sub-subfunction: Receive quoted fare
    - Subfunction: Obtain ticket
      - Sub-subfunction: Pay the money
      - Sub-subfunction: Receive the ticket and any change due
- Will be implemented as a network of dialog boxes on an ATM type machine (limited buttons, number keypad)

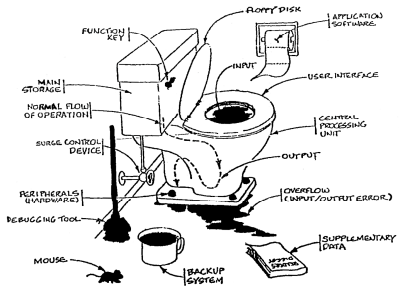
Design Specification Types

- Presentation specification
- Interaction specification

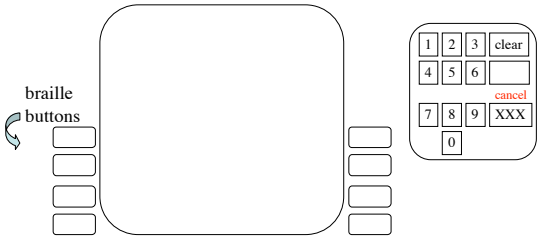
Presentation Specification

- Start with low fidelity sketches then progress to screen shots
- Next 4 slides show different presentation (picture) representations for designs

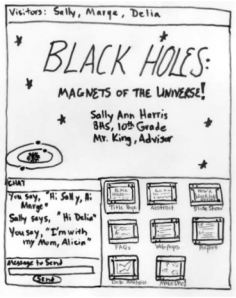
A Picture Is Worth 1000 Words!



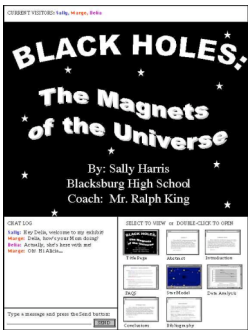
ATM User Interface Layout



Sketch: Virtual Science Fair Exhibit Window



Screen shot: Virtual Science Fair Exhibit Window



Interaction Specification

- Describes the Tasks beginning with the core
- Types
  - Narrative
    - Scenario
  - Storyboard
  - Network

Interaction as Narrative

- Definition
  - Sentences describing the tasks: how the user accomplishes each functional requirement
- Reference within the text to a view of the presentation (screen)
- Can also represent tasks and actions as indented text
- Can include the context for the task and fictional users: scenario (Example in Greenberg reading)
- Can be used in user documentation for completed system

Interaction as Narrative

- Example: Graphics editor
  - To draw a Bezier curve, the user selects "Bezier" from the Draw menu (see Figure 1), and then chooses either "Point-to-point" or "Curve fit". In point-to-point mode the user then clicks on positions in the drawing window. The system draws a Bezier curve fit to each point. (See Figure 2 for an example.) . . .

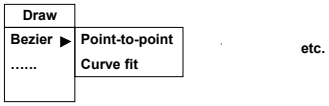


Figure 1

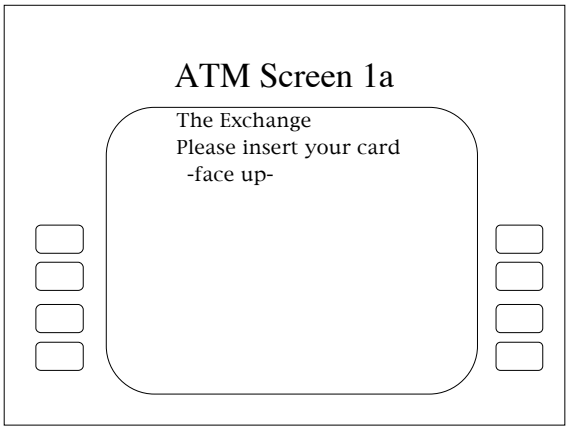
Interaction as Storyboard

- Definition
  - a method developed by animators many years ago to design cartoons
- Storyboard shows the major "moments" in an animation as a sequence of pictures
- Storyboard can be used to show user interaction as a sequence of pictures of the screen
- May be annotated with comments

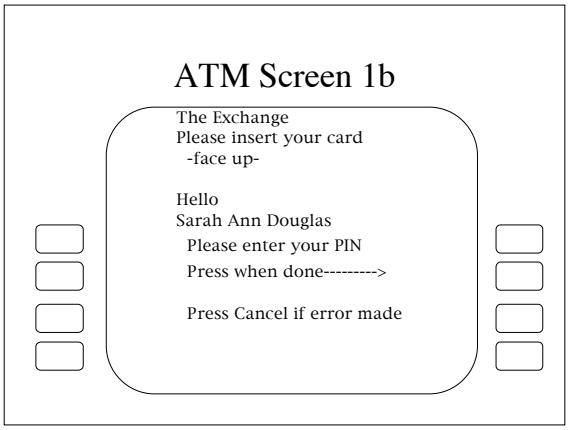
Storyboard Example: ATM Machine

- Type: Sequence of Screens
- Task: Fast Cash Money Withdrawal

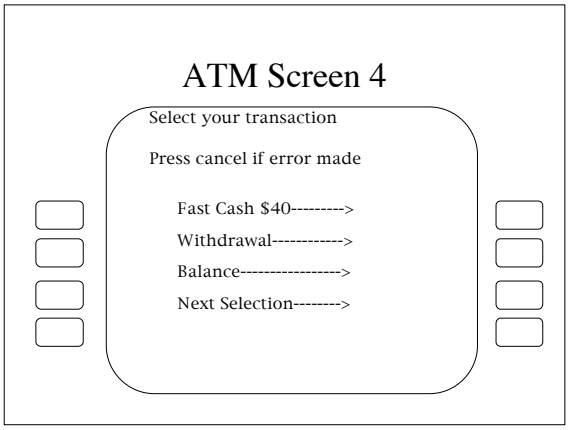
ATM Screen 1a

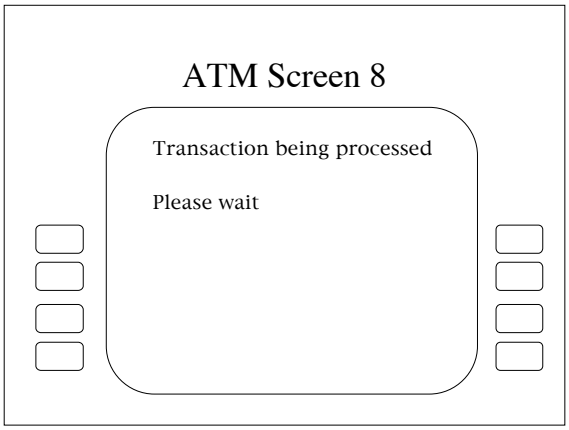


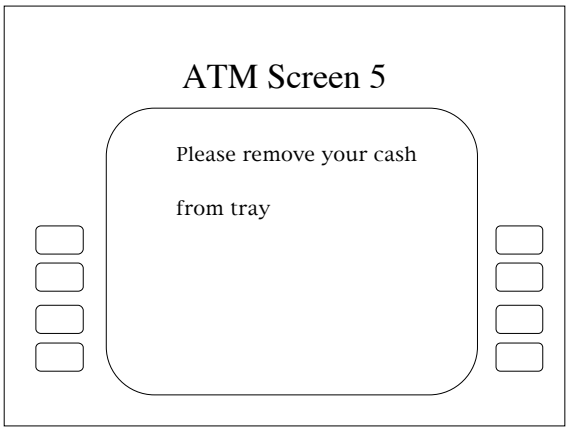
ATM Screen 1b

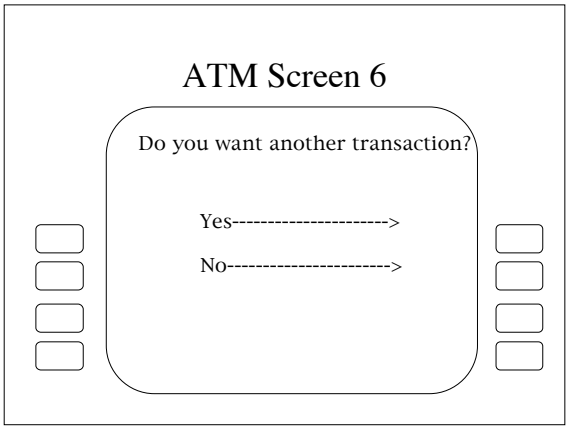


ATM Screen 4

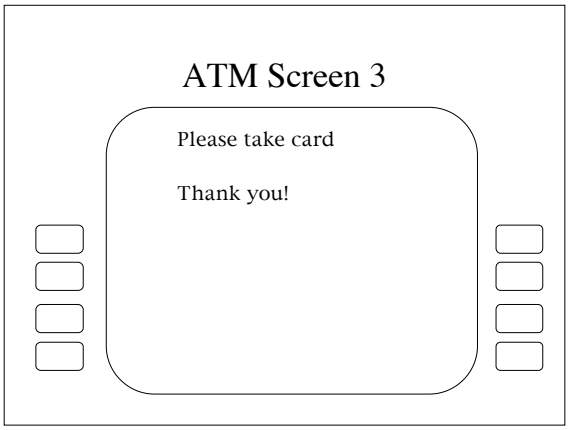



ATM Screen 8
Transaction being processed
Please wait

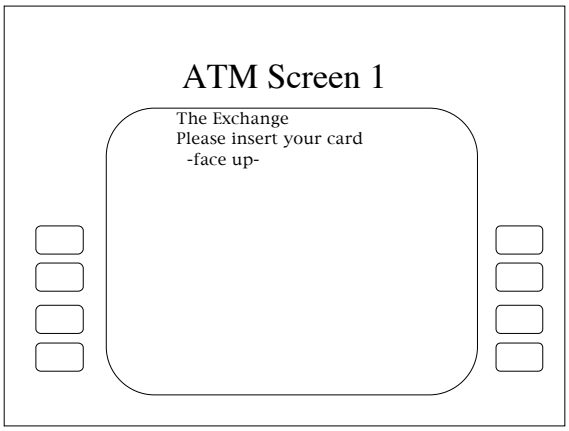

ATM Screen 5
Please remove your cash
from tray


ATM Screen 6
Do you want another transaction?
Yes---------->
No---------->>

ATM Screen 3



ATM Screen 1



Skype Storyboard

Example Storyboard: Skype

Downloading Skype

You need a Mac computer with Mac OS X, version 10.3.9 or later.

1 **Close Skype for Mac, if you have an earlier version running**

2 **Download the latest version of Skype for Mac**

Download

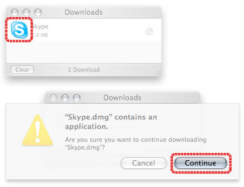
Official release. Version: 2.0.0.6. Release date: October 23, 2006
File name: Skype_2.0.0.6.dmg

Example Storyboard: Skype

3 **Open the Skype download**

Open your web browser's Downloads window and double-click on the blue Skype icon.

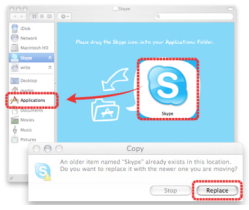
If a warning dialog opens, simply click Continue.



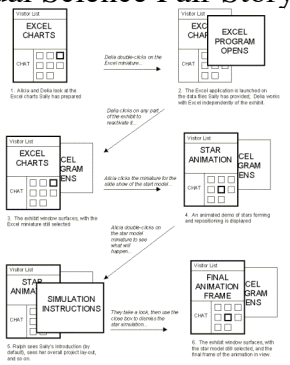
Example Storyboard: Skype

4 **Drag the Skype icon to your Applications folder**

If you have an older version of Skype installed, you'll be asked whether you'd like to replace it with the new one. Click Replace.



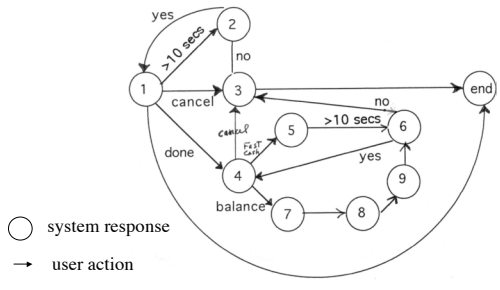
Virtual Science Fair Storyboard



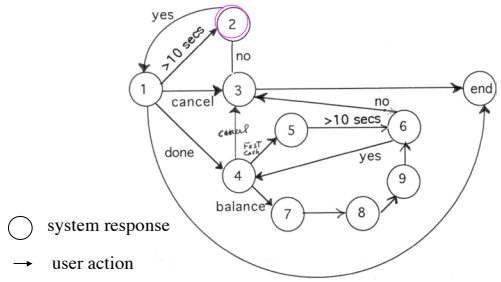
Beyond Storyboards to Interaction Networks

- Definition: Interaction network
  - Abstract representation of the interaction between the user input and the display
  - Augmented Transition Network (ATN)
    - Nodes
      - System response
    - Arcs
      - User action
  - Finite State machine

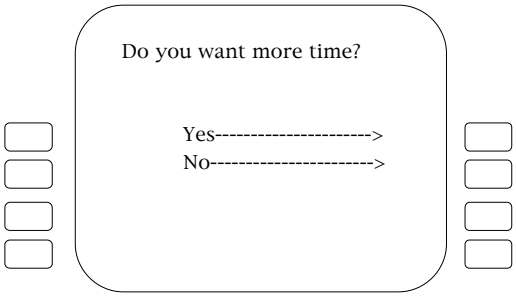
ATM Example



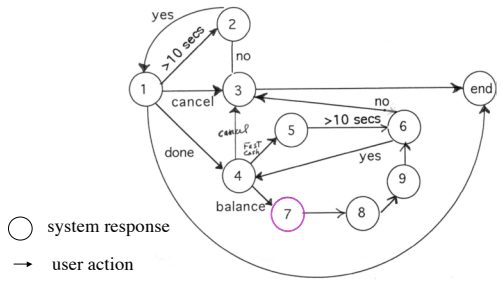
ATM Example



ATM Screen 2



ATM Example



ATM Screen 7

Select Account for Balance inquiry

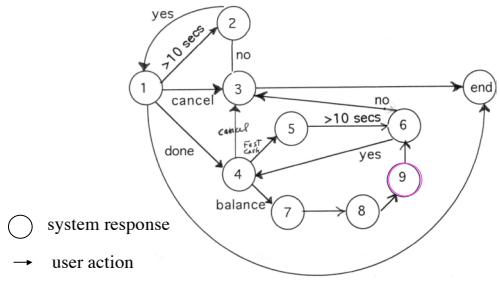
Press cancel if error made

Checking---------->

Savings---------->

Credit Card---------->

ATM Example



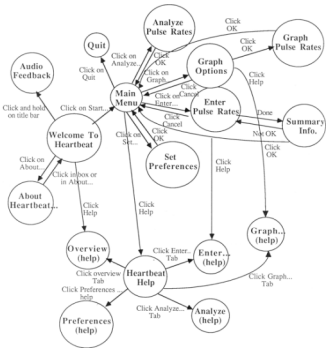
ATM Screen 9

Total

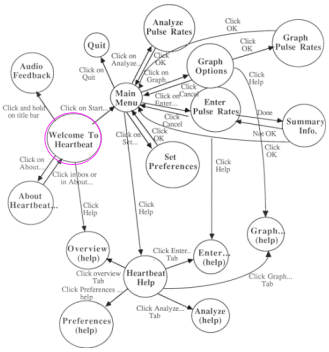
Available
$172.48

Press this key to continue------>

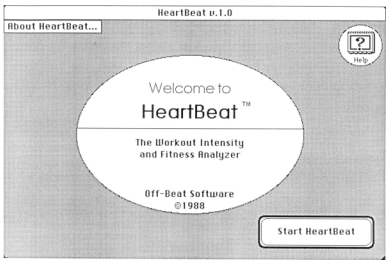
Example: Heartbeat



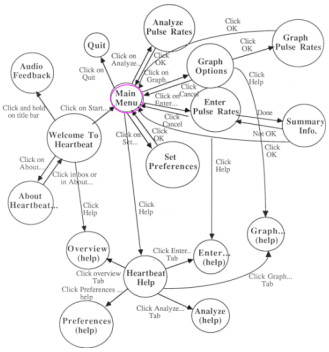
Example: Heartbeat



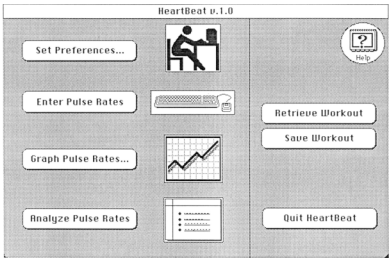
Heartbeat Welcome Screen



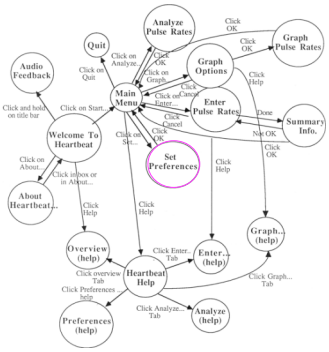
Example: Heartbeat



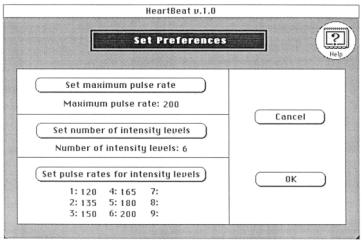
Heartbeat Main Menu



Example: Heartbeat



Heartbeat Set Preferences



Step 4: Implementation (Prototyping)

- Physical Storyboards
- Mock-ups
- Software prototypes

Step 5: Usability Evaluation

- Another whole lecture!