

Lecture 6: Models & Metaphors

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Today's Topics

- Conceptual models
- Interaction styles
- Direct manipulation
- Errors
- Metaphors

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Models

- **Model** of a system = how it works
 - its constituent parts and how they work together to do what the system does
- Implementation models
 - Pixel editing vs. structured graphics
 - Text file as single string vs. list of lines
- Interface models
 - RealCD's online help as liner notes

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Models in UI Design

- Three models are relevant to UI design:



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Interface Model Hides System Model

- Interface model should be:
 - Simple
 - Appropriate: reflect user's model of the task (learned from task analysis)
 - Well-communicated

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User Model May Be Wrong

- Sometimes harmless
 - Electricity as water
- Sometimes misleading
 - Thermostat as a valve

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Interaction Styles

- Command language
- Menus & forms
- Direct manipulation

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Command Language

- User types in commands in an artificial language
- Examples
 - Unix shell ("ls -l *.java")
 - Search engine query language ("AND, OR, site:www.mit.edu")
 - URLs ("http://www.mit.edu/admissions/")
- Command syntax is important

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Menus and Forms

- User is prompted to choose from menus and fill in forms
- Examples
 - virtually all web sites
 - dialog boxes
- Navigation structure is important
 - Menu trees (Yahoo!)
 - Wizard: linear sequence of forms

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Direct Manipulation

- User interacts with visual representation of data objects
 - Continuous visual representation
 - Physical actions or labeled button presses
 - Rapid, incremental, reversible, immediately visible effects
- Examples
 - Files and folders on a desktop
 - Scrollbar
 - Dragging to resize a rectangle
 - Selecting text
- Visual representation and physical interaction are important

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Comparison of Interaction Styles

- Knowledge in the head vs. world
- Error messages
- Efficiency
- User experience
- Synchrony
- Programming difficulty
- Accessibility

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Direct Manipulation Cues

- Affordances
- Constraints
- Natural mapping
- Visibility
- Feedback

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Affordances

- Perceived and actual properties of a thing that determine how the thing could be used
 - Chair is for sitting
 - Knob is for turning
 - Button is for pushing
 - Listbox is for selection
 - Scrollbar is for continuous scrolling or panning
- Perceived vs. actual

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Natural Mapping

- Physical arrangement of controls should match arrangement of function
- Best mapping is direct, but natural mappings don't have to be direct
 - Light switches
 - Stove burners
 - Turn signals
 - Audio mixer

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Visibility

- Relevant parts of system should be visible
 - Not usually a problem in the real world
 - But takes extra effort in computer interfaces

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Feedback

- Actions should have immediate, visible effects
 - Push buttons
 - Scrollbars
 - Drag & drop
- Kinds of feedback
 - Visual
 - Audio
 - Haptic

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Modeling Human Error

- Description error
- Capture error
- Mode error

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Description Error

- Intended action is replaced by another action with many features in common
 - Pouring orange juice into your cereal
 - Putting the wrong lid on a bowl
 - Throwing shirt into toilet instead of hamper
 - Going to Kendall Square instead of Kenmore Square
- Avoid actions with very similar descriptions
 - Long rows of identical switches
 - Adjacent menu items that look similar

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Capture Error

- A sequence of actions is replaced by another sequence that starts the same way
 - Leave your house and find yourself walking to school instead of where you meant to go
 - Vi :wq command
- Avoid habitual action sequences with common prefixes

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Mode Error

- Modes: states in which actions have different meanings
 - Vi's insert mode vs. command mode
 - Caps Lock
 - Drawing palette
- Avoiding mode errors
 - Eliminate modes
 - Visibility of mode
 - Spring-loaded or temporary modes
 - Disjoint action sets in different modes

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Metaphors

- Another way to address the model problem
- Examples
 - Desktop
 - Trashcan

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Dangers of Metaphors

- Hard to find
- Deceptive
- Constraining
- Breaking the metaphor

- Use of a metaphor doesn't excuse bad communication of the model:
 - RealCD's bad affordances, visibility

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