Programming: Model-View-Controller

Reading #5: "Chapter 5.1-5.8 Basic Interaction" by Dan Olsen, *Developing User Interfaces*, 1998, pp. 129-166.

Model-View-Controller

- A programming style for O-O programming
  - – Developed in Smalltalk (circa 1980)
- Model
  - – information state of the application
- View (Output)
  - – visual display of model
- Controller (Input)
  - – receives input events from user
- Event Propagation
  - – Controller to Model, Model to View, Controller to View

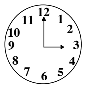
Model-View-Controller

Clock Example

MODEL

Time
- Hrs {1-12}
- Mins {0-59}
- Secs {0-59}
- AM {true, false}
- Zone {PST, PDT}

VIEWS



3:00:00 PM

CONTROLLER

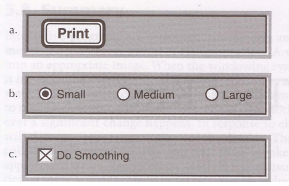
TIME menu
Set Time
Change Clock
analog
digital

- **Event Propagation**
  - **–Controller to Model, Model to View, Controller to View**

Model-View-Controller Advantages

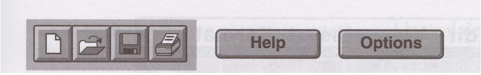
- Separation of Model from I/O allows scale up
  - May change View or Controller without changing Model
  - May have multiple models
  - May have multiple views
  - May have multiple controllers

Buttons



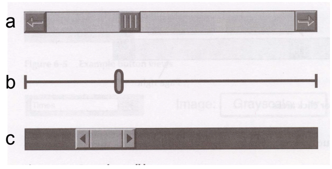
- Model
  - All buttons have a single model value that can be set to one or more discrete values
    - On/off (a)
    - Radio Buttons (b)
    - Checkbox (c)

Buttons cont.



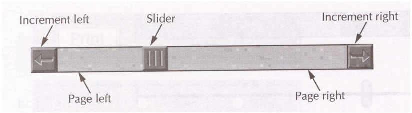
- View
  - Maps mouse locations for controller
- Controller
  - Responds to single mouse click

Scroll bars



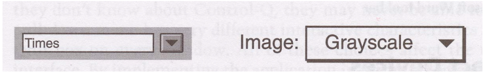
- Model
  - Manipulate continuous bounded range of values
  - Two limits and a current value between the limits
  - May include window width and page size
    - See *a*: left arrow moves one page left & page size may vary

Scroll bars cont.



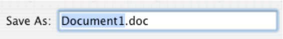
- View
  - Maps mouse locations for controller
- Controller
  - Respond to single mouse clicks in left and right edges
  - Respond to mouse dragging of slider

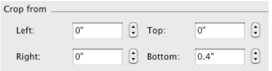
Menus



- Model
  - Select from a potentially large number of possibilities, similar to button
  - Menu selection
    - Sets model variables to particular values
    - Issues one of model's commands
- View
  - Maps mouse locations for controller
- Controller
  - Responds to single mouse click, drag and release

Text Entry Boxes


Save As: Document1.doc


Crop from

Left: 0" Top: 0"

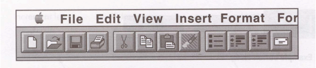
Right: 0" Bottom: 0.4"

- Model
  - String of characters that can be typed from scratch or edited
  - Integers only, dollars, dates?
  - Error processing

MVC and Widgets

- Widgets combine View and Controller in one object
  - For most widget sets, for a given controller, there is only one view
  - Single view per controller leads to merging of view and controller
  - Exception: Product differentiation

Exception: Microsoft Toolbar



- Microsoft added this to the Mac menu bar to differentiate the Office products
- Within the toolbar, all buttons look and behave alike
- Simpler for Microsoft to implement its own button widgets rather than modify Mac code

MVC

- Object-oriented approach
  - Exploits use of abstract classes & message/method-binding mechanisms to do all event dispatching and change notification
  - Makes it easy to handle variety of messages and notifications that must pass between the objects that make up the interactive architecture

MVC

- OO Drawbacks
  - Every model must have its own abstract view class
  - Every view must inherit both the method interface necessary to receive input from the windowing systems and the method interface neede to receive change notification
  - More complicated whtn views contatin other views and must communicate with them

MVC

- Alternative implementation to OO
  - Views have only one Event method that handles all input events, system notification events, model change notification, etc.
  - When object receives an event, its Event method looks at the type of event to sort out what should be done
  - Eliminates need for abstract view class because any can receive the Event message
  - Much more flexible than OO but programmer must do type checking and event management rather than compiler