Announcements

• Read Chapter 6 Tips and Techniques for next class
• Reading quiz due next time
• New groups today
• Assignment 5 out
  – Part 1 due Feb 26 and Part 2 due Mar 3
• Today
  – Interactive programming, event handlers
  – Create billboards
Control of Flow

- Control of flow – how the sequence of actions in a program is controlled
  - What action happens first, second, third, ….
- In movie-style programs (Chaps 1-4) the sequence of actions is determined by the programmer
  - Creating a storyboard design
  - Writing program methods to carry out the designed sequence
Interactive Animations

• In interactive programs, the sequence of actions is determined at runtime, when the user provides **input**
  – Clicks the mouse
  – Presses a key on the keyboard
• Other sources of input are possible
Interactive Games

• In a video game where the user is guiding a spaceship, the sequence of actions …
  – Depends on what direction the user guides the ship
  – How fast the user presses the controls
• Each time the program runs, user input may cause a different sequence of actions
• Control of flow is “in the hands of the user”
Event Handlers

• An event may
  – Trigger a response, or
  – Move objects into positions that create some condition (e.g. a collision) that triggers a response

• An event handler is a *method* that is called to carry out the response.

• When an event is linked to an event handler, a *behavior* is created.
How does this effect your program?

- Our goal is to write interactive programs.
- The approach is the same as before, but the difference is now must be concerned with behaviors.
  - input from the user (events)
  - How objects respond to an event (event handler methods)
Example 1

- Build an air show flight simulator. The pilot (user) uses the biplane controls to perform acrobatic stunts.

- Problem: How do we write program code to provide a guidance system that allows the user to be the pilot?
Solution

• Use keyboard input
  – “F” key to move the biplane forward
  – Spacebar to make the biplane do a barrel roll
  – Note: other keys could be chosen

• Write event handler methods that respond to each key press

• Storyboards (next slide) and DEMO building world
Event Storyboards

• Since two keys are used, two events are possible – so two storyboard scenes

Event: Spacebar press
Response: Do together
      roll biplane a full revolution
      play biplane engine sound

Event: F-key press
Response: Do together
      move biplane forward
      play biplane engine sound

• Each storyboard outlines an event handler
  – Responds to a particular event
biplane.flyForward

- Do not modify the length of the sound
  - use “as is”
- Coordinate duration of move and play sound
  - Match duration of move to duration of sound
Events Editor - Linking

- Each event handler method must be linked to an event

1) Select “create new event”
   Then choose the type of event

2) A template linking is created
Events Editor – Linking (cont)

3) Select type of key for event  

4) Select event handler method

Final result:
More Functionality

- When 'F' is typed, do `biplane.flyForward`
- When 'Space' is typed, do `biplane.barrel`
- When '^' is typed, do `biplane.flyDirection direction = up`
- When '↓' is typed, do `biplane.flyDirection direction = down`
- When '<' is typed, do `biplane.flyDirection direction = left`
- When '->' is typed, do `biplane.flyDirection direction = right`
Add a Billboard with Instructions

- Add an event “I” to make the instructions hide or show
Mouse Clicks

• Interactive programs – allow user to mouse click an object
  – Buttons in an interface
  – Targets in a game
  – Checklist of items on a form

• Will see how to pass information about a mouse clicked object to an event handler
Example 2

• Burning Building
• People are trapped in a burning building
• Select which person will be rescued
• See firetruck.savePerson
Storyboard

- Three people are to be rescued
- Could write 3 different methods

**Event:** click on guy1
**Responding Method:**
Save guy on first floor

**Event:** click on girl2
**Responding Method:**
Save girl on second floor

**Event:** click on girl3
**Responding Method:**
Save girl on third floor
A Better Solution

• Write one event handler
• Send in information needed for action

firetruck.savePerson:

parameters: whichFloor, whichPerson, howFar
Do in order
  point ladder at whichFloor
  extend ladder howFar meters
  whichPerson slides down ladder to fire truck
  pull ladder back howFar meters

What type are the parameters?
Three Events

- The argument sent to parameters depends on which person is mouse clicked.

- Note - we positioned fire truck so distance from floor X is X meters (to floor 3 is 3 meters)
Example 3 – put events in

- Zeus was a powerful god in Greek mythology. When Zeus was angry, he would shoot a thunderbolt out of the heavens to strike anyone who got in the way.

- The user will choose the philosopher who will be the next target of Zeus’ anger.
Storyboard

- Possible design – method with Object parameter named *who*, for object clicked

  **Event**: an object is mouse-clicked

  **Event handler**: *shootBolt*

  **Parameter**: *who* – object clicked

  Do in order

  - prepare to strike object that was clicked
  - thunder plays and lightning strikes object clicked
  - lightning is repositioned for next strike

- The actions in storyboard are complex
- Break actions into simpler steps using stepwise refinement
A Driver

- **shootBolt method** - top level of our design
- It calls other methods and controls the overall action of the program – we call this a **driver**
One Link

- In the fire rescue example, we used three links – one for each person in the burning building. In this example, we use only one link by selecting “object under mouse cursor” as the argument.
Demo

- Test run of Zeus world – (this version doesn’t have the if statements from Chap 6 added in)
- When parameters are used in interactive programming – especially important to test that all possible parameter values work as expected
  - What happens if you click on each philosopher, one at a time?
- Also try things that shouldn’t work
  - What happens if you click on a column?
  - What happens if you click on a philosopher twice?
  - What happens if you click on Zeus?
Classwork today

• Create 2 worlds (or can combine them)
  – Problem 14, page 163
  – Problem 15, page 164 (can use any person)
  – Include instructions in both…(see handout)