Interactive Techniques

Ben Fry’s Zipdecode

http://acg.media.mit.edu/people/fry/zipdecode/
Topics

Responding to Input
- Polling vs. interrupts
- Event queues

Building UI idioms
- Picking
- Clicking
- Dragging

Game interaction idioms
- Game input loop
- 3rd-person character control

Polling and Interrupts

Polling - Periodically read the state of the device
- Mouse sends messages
  - 100 times per second
  - State of the buttons
  - Relative motion of the mouse (Δx, Δy)
- Joystick/Gamepad interface
  - glutJoyStick(int buttonmask, int x, int y, int z)
  - STJoystick supports multiple joysticks, axes, balls, hats, and buttons

Interrupts - Send changes when they occur
- Keyboard sends “make” and “break” messages
Event Queue

Operating system responds to interrupt
Creates event record and places in a queue
  ■ Time-stamp
  ■ Queues are first-in first-out (FIFO)
  ■ May store state of other devices at time of event
    e.g. polled devices like the mouse

Callback manager
  ■ Event priority
    ■ Reorder events based on priority
      e.g. keyboard has priority over PostRedisplay
  ■ Event coalescing
    ■ Combine mouse motions so current position is returned

Demo of input.py

Building UI Idioms
Picking

Three issues
- How to find objects under the cursor
- How to assign priority to these objects
- How to handle hierarchy

Hit testing / picking
- Bounding rectangle
- Hit method for objects
- Pick support during rendering (OpenGL)
- Object tags

Flash Button Tracking

Tracking: Convert in/out state to enter/leave events
Flash MenuButton Tracking

Tracking: Convert in/out state to enter/leave events

Up
- Idle
  - Over
    - onRollOver
  - onRollOut
  - onRelease
  - onPress

Down
- Down
  - Down
  - onDragOver
  - onDragOut

Sketchpad Video
Game Interaction Idioms

Picking in 3D

“Portal” by Valve
The Simulation Loop

forever:
  readInputDevices()
  updateAI()
  processMovement()
  handleCollisions()
  draw()

Position Control

Direct:
  - obj.pos = device.value

1\textsuperscript{st}, 2\textsuperscript{nd} derivatives
  - “Asteroids”
Smooth Character Control

"Super Mario 64" by Nintendo

Input Filtering

Character rotation over time.

Character speed based on controller input.

"Classic Super Mario 64 Third-Person Control and Animation"
Steve Rabin in Game Programming Gems 2
Animation Graphs

Cross Pollination

Domains
- Desktop, laptop
- Game consoles, DVRs
- Phones, cameras, etc.

Media
- Animation
- Sound
- Touch (Haptics)
Things to Remember

Flow from input to events to method invocation
- Inputs cause interrupts which generate events
- Events are routed to objects
- Pointer events require “hit testing”

Interaction “building blocks” for GUIs, games
- State-machines
- Filtering/smoothing
- Clicking, dragging
- Character movement