Creating a Platformer in Game Maker

Foundations of Interactive Game Design
Prof. Jim Whitehead
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Upcoming Events and Assignments

• **Game Concept Document**
  ‣ Extended deadline until Friday
  ‣ May turn in today, if ready
  ‣ SOE Web servers experienced filesystem failure
  ‣ Pages intermittently unavailable over past 24 hours

• **Gamelog**
  ‣ Still due Friday
  ‣ Game of your choice

• **Work Breakdown and Schedule**
  ‣ Due next week, on Wednesday
• **Today:** RPG Maker design session
  ‣ Led by Nate Emond <llama971@gmail.com>
  ‣ 5:30PM, E2 215
  ‣ Note different room for this week

• **Thursday:** Game Maker help/design session
  ‣ Earth & Marine Sciences, room B214
  ‣ 4-5:10PM

• **Game Maker reduced cost license keys**
  ‣ See me after class to pay for keys
  ‣ I will sell all unclaimed keys on Friday
  ‣ Full version of Game Maker on ITS machines as well
Key Mechanics of Platformers

• To create a platform game, need to
  ‣ Handle collision with platforms
  ‣ Handle jumping
  ‣ Scrolling view in large game world
  ‣ Interactions with other enemies and items in gameworld

• Today, will focus on
  ‣ collision detection
  ‣ jumping
  ‣ scrolling view
Collision Detection

- Collision detection is the bane of platform game designers in Game Maker
- Several factors affect collision detection
  - Type of bounding box
    - Automatic, full image, manually defined bounding box (defined in Sprite)
  - Type of collision detection
    - precise, non-precise (defined in Sprite)
  - Whether object is solid
    - Defined in object
  - Actions taken in response to a collision event
    - Defined in object
  - May need to examine multiple dialog boxes to completely understand collision detection behavior
• **Bounding box** is a rectangle (or square) drawn around a sprite image, used for collision detection
  ‣ Typically, is outer boundary of the sprite image
    ❖ Game Maker selects this using the “Automatic” feature under “Bounding Box” in the Sprite dialog
  ‣ Can manually set the size of the bounding box
    ❖ Example: if creating a bullet hell (manic) shmup, may want to make the vulnerable region of the ship smaller than the visible sprite
    ❖ Select “Manual” under “Bounding Box” in Sprite dialog, then fill in dimensions
  ‣ Can also set to the full size of the sprite file
    ❖ If sprite is defined in 48x48 pixel box, “Full image” option would make bounding box the full 48x48 pixels, even if sprite image is smaller
Basic Collision Detection

Non-precise collision detection:
Just overlap of bounding boxes. May mean sprite images do not overlap (player would visually perceive a near miss).

Precise collision detection:
Must have overlap of bounding boxes and sprite images must overlap. Best collision detection, but more computationally expensive. Unless you choose otherwise, this is the collision detection behavior sprites use.

To toggle between these collision detection modes:
Choose “Precise collision checking” in Sprite dialog box.
Step sequence in Game Maker

• Begin step: generate Begin Step event
• Save current position of object
• Compute new position
  ‣ $x = \text{old}_x + \text{hspeed}$
  ‣ $y = \text{old}_y + \text{hspeed}$
  ‣ But, don’t move sprite just yet!
• Determine if there is a collision at the new position
  ‣ If either object in collision is solid: reset position: $x = \text{old}_x$, $y = \text{old}_y$
  ‣ In both cases (solid, not solid), now generate Collision event
• Generate Step event
• Update visual representation of sprite on screen
  ‣ Draw sprite at new location $(x, y)$
• End step: generate End Step event
My sprite is embedded in a wall: why?

Ball and Wall are both not solid

- In tick 2 (both objects not solid)
  - Compute new position: \( y = \text{old}_y + \text{vspeed} \) (\( y = 105 + 10 = 115 \))
  - Actions in collision event just set vspeed to 0
    - Actions do not modify position of the object
  - Visual depiction of objects updated to new position
  - Sprite is now embedded in a wall
My sprite stopped above the wall: why?

• In tick 2 (one or both objects solid)
  ‣ Store old positions old_y = y, old_x = x
  ‣ Compute new position: y = old_y + vspeed (y = 105+10 = 115)
  ‣ Check for collision at new position: **yes**
  ‣ **Revert** to old position (y = y_old = 105)
  ‣ Do actions in collision event
    ✷ Set vspeed to 0
  ‣ Draw sprite: now stopped in mid-air
My sprite fell through a wall: why?

End of Tick 1

- y: 100
- y: 105
- vspeed: 20

End of Tick 2

- y: 110
- y: 115

Will occur for solid and non-solid objects

- y: 110
- y: 115

- y: 120
- y: 125
- vspeed: 20

• Velocity of ball is so great that in one tick its position is incremented such that it never intersects the wall.
• Direction angles in Game Maker are different from normal.
Gravity

• Can set “gravity” in Game Maker
• Very simple
  ‣ Define a speed and a direction
  ‣ Every step, the speed is added to the player’s current speed
  ‣ This is a dv/dt (change in velocity per change in time), hence is acceleration
  ‣ Normal gravity is an acceleration downwards of 9.8 m/s²
• To create sensation of downward gravity in Game Maker
  ❖ Use “Set the gravity” action
  ❖ Have direction be 270
  ❖ Set speed to 2
    • Arbitrary value
    • This speed may vary with your gameworld, tune until it feels right
Jumping

- **Jumping behavior**
  - Press a key, and player jumps up
  - Pressing key while in the air should not result in more jumping
    - Unless you intentionally want a “double-jump”, in which case you only want to allow two, and only two jumps.
  - Jumping should not affect side-to-side movement
  - Need to decide if player can change side-to-side direction in mid-air
  - Need to handle collisions correctly
    - Not going into the side of platforms
    - Correctly landing on the top of platforms
    - Correctly handling jumps up into platforms
Handling Jump Keypress

- Need a simple **state machine**
- Create a variable called “jumping” on player
  - Set to 0 initially
  - Can only jump when it is 0
  - Set to 1 when jumping
Details of Creating State Machine

• Initialize variable jumping
  ‣ Add “Set variable to a value” action to Create event for player
  ‣ “Var” square on Control tab in Object window
    ❖ Variable: jumping
    ❖ Value: 0
    ❖ Relative: must be unchecked

• Add jumping logic
  ‣ Add keyboard event
  ‣ Add variable conditional
    ❖ Octagon with “Var” on Control tab of Object window
    ❖ Applies to “self”
    ❖ Variable: jumping
    ❖ Value: 0
    ❖ Operation: equal to
    ❖ Creates conditional: if jumping = 0 then ... {then behavior on next slide}
Details of Creating State Machine (2)

• Then behavior if jumping = 0 in keypress event
  ‣ Add a “Start of a block” (grey up triangle on Control tab)
    ❖ Equivalent to curly braces found in many languages
    ❖ Means: “group the following actions together until the end of block”
  ‣ Set vertical speed to a negative number
    ❖ Downward red arrow on Move tab of Object window
    ❖ Yes, click the down arrow to make your player go up
    ❖ Tunable value, try vert. speed of -25 to -30 for starters
  ‣ Set variable jumping to 1
    ❖ That is, we have shifted to the “jumping” state in our simple state machine
    ❖ “Var” square on Control tab of Object
      • Applies to “self”
      • Variable: jumping
      • Value: 1
      • Relative: unchecked
  ‣ Add an “End of a block” (grey down tirangle on Control tab)
Details of Creating a State Machine (3)

- OK, have initialization and state transition to jumping state
- Now need transition back to non-jumping state
- When a collision is detected, need to set jumping to 0
  - In collision event with Wall
    - Set vertical speed to 0
      - Down red arrow on Move tab of Object
      - Set vert. speed to 0
    - Set variable jumping to 0
      - Var square on Control tab of Object
      - Applies to “self”
      - variable: jumping
      - value: 0
Drawbacks of the State Machine

• Collision events between player and wall do not distinguish the three cases
  ‣ Ball landing on top of wall
  ‣ Ball hitting side of platform
  ‣ Ball hitting underside of platform

• Currently, state machine leads to following behavior
  ‣ Sticking to side of a platform (ball or wall is solid)
    ❖ Player receives collision event, and sets vspeed to 0
    ❖ Gravity should cause player to fall, but gravity never has chance to affect position
    ❖ Solid object behavior means collision event occurs before ball actually moved
    ❖ Horizontal movement means ball keeps going towards platform
    ❖ Results in a collision every step!
Drawbacks of the State Machine

- Hitting the underside of the platform also has problems
  ‣ Ball strikes underside of platform
  ‣ Causes collision event
    ❖ Sets vspeed to 0
    ❖ Also sets jumping to 0
      • Can’t distinguish between landing on platform, and jumping up into underside of platform
  ‣ Result: undesired perpetual double-jump ability

- How do I fix all of this?
  ‣ Complicated: details in class on Friday...