



More Pygame

Writing Games with Pygame, continued

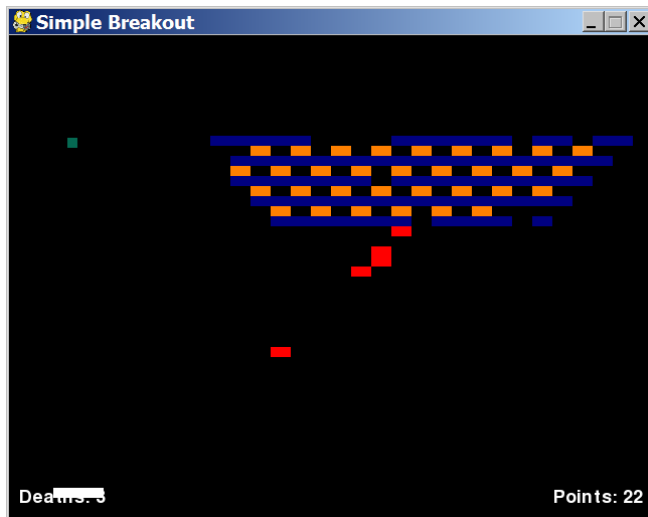
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Animated Action Games

- Consider an action game such as Space Invaders or Mario. How does it differ from our Whack-a-Mole game?
 - What features are present in an action game?
 - What are some major challenges in writing such a game?



Our Task

- Implement Pong!
 - 800x480 screen, 10px white border around all edges
 - 15x15 square ball bounces off of any surface it touches
 - two 20x150 paddles move when holding Up/Down arrows
 - game displays score on top/center of screen in a 72px font



Major Steps

1. Set up the (non-moving) paddle/ball/wall sprites
2. Handle key presses, sprite movement, and animation
3. Handle collisions
4. Scoring



Step 1

Setting Up Sprites

Recall: Sprites

```
class name(Sprite):  
    # constructor  
    def __init__(self):  
        Sprite.__init__(self)  
        self.image = image.load("filename")  
        # or, self.image = Surface((w, h))  
        self.rect = self.image.get_rect()  
        self.rect.center = (x, y)
```

other methods (if any)

- Pre-defined fields in every sprite:

`self.image` - the image or shape to draw for this sprite
– images are `Surface` objects, which includes shapes and images

`self.rect` - position and size of where to draw the image



Recall: Surface

- In Pygame, every 2D object is an object of type `Surface`
 - The screen object returned from `display.set_mode()`, each game character, images, etc.
 - Useful methods in each `Surface` object:

Method Name	Description
<code>Surface((width, height))</code>	constructs new <code>Surface</code> of given size
<code>fill((red, green, blue))</code>	paints surface in given color (<i>rgb 0-255</i>)
<code>get_width()</code> , <code>get_height()</code>	returns the dimensions of the surface
<code>get_rect()</code>	returns a <code>Rect</code> object representing the x/y/w/h bounding this surface
<code>blit(src, dest)</code>	draws this surface onto another surface

RectangularSprite

- Suggested template for simple white rectangular sprites:

```
class RectangularSprite(Sprite):  
    def __init__(self, size, center):  
        Sprite.__init__(self)  
        self.image = Surface(size)  
        self.image.fill((255, 255, 255))  
        self.rect = self.image.get_rect()  
        self.rect.center = center
```

- Now the various sprites in the Pong game can be **RectangularSprites** or **extend RectangularSprite** to add their own behavior

Recall: Sprite Groups

```
name = Group(sprite1, sprite2, ...)
```

– To draw sprites on screen, they must be put into a Group

Example:

```
my_mole = Mole()           # create a Mole object  
other_mole = Mole()  
all_sprites = Group(my_mole, other_mole)
```

Group methods:

- draw(**surface**) - draws all sprites in group onto a surface
- update()
- updates every sprite's appearance

Exercise

- Define the sprites for the PyPong game:
 - four 15px-thick borders around the 800x480 board edges
 - two 20x150 paddles, centered vertically, at L/R edges of board
 - a 15x15 ball, in the center of the board
- Use `RectangularSprite` as the basis for your sprites.
- The sprites don't move yet.



Step 2

Animation and Key Presses

Recall: Event Loop

```
# after Pygame's screen has been created
while True:
    name = event.wait()           # wait for an event
    if name.type == QUIT:
        pygame.quit()           # exit the game
        break
    elif name.type == type:
        code to handle another type of events
    ...

code to update/redraw the game between events
```

Timer Events

```
time.set_timer(USEREVENT, delayMS)
```

- Animation is done using **timers**
 - Events that automatically occur every *delayMS* milliseconds
 - Your event loop can check for these events. Each one is a "frame" of animation

```
while True:  
    ev = event.wait()  
    if ev.type == USEREVENT:  
        # the timer has ticked; move sprites,  
        # redraw the screen, etc.
```

Key Presses

<http://www.pygame.org/docs/ref/key.html>

- `key.get_pressed()` returns an array of keys held down
 - indexes are constants like `K_UP` or `K_F1`
 - values are booleans (`True` means pressed)
 - Constants for keys: `K_LEFT`, `K_RIGHT`, `K_UP`, `K_DOWN`, `K_a` - `K_z`, `K_0` - `K_9`, `K_F1` - `K_F12`, `K_SPACE`, `K_ESCAPE`, `K_LSHIFT`, `K_RSHIFT`, `K_LALT`, `K_RALT`, `K_LCTRL`, `K_RCTRL`, ...

```
keys = key.get_pressed()
if keys[K_LEFT]:
    # left arrow is being held down...
```

Updating Sprites

```
class Jet(Sprite):  
    def __init__(self):  
        # ...  
  
    def update(self):    # move right 3px / tick  
        self.rect = self.rect.move(3, 0)
```

- Each sprite can have an `update` method that describes how to move that sprite on each timer tick.
 - Move a rectangle by calling its `move(dx, dy)` method.
 - Calling `update` on a `Group` updates all its sprites.

Exercise

- Implement animation and key response in PyPong:
 - Make a timer that ticks every 50 ms.
 - When the timer ticks:
 - Give the ball a dx/dy of 5px and move the ball by that amount. (The ball will fly off the screen after a moment.)
 - If the up arrow is held down, move the paddles up by 5px.
 - If the down arrow is held down, move the paddles down by 5px.



Step 3

Collisions Between Sprites

Collisions Btwn. Rectangles

- Recall: Each `Sprite` contains a `Rect` collision rectangle
- `Rect` objects have useful methods for detecting collisions between the rectangle and another sprite:

Method Name	Description
<code>collidepoint(p)</code>	returns <code>True</code> if this <code>Rect</code> contains the point
<code>colliderect(rect)</code>	returns <code>True</code> if this <code>Rect</code> contains the rect

- However, `Sprite` and `Group` objects have more useful methods to detect collisions...

Collisions Between Groups

```
spritecollideany(sprite, group)
```

– Returns `True` if `sprite` has collided with any sprite in the group

- Useful for finding collisions in a sprite's `update` method:

```
class name(Sprite):  
    def update(self):  
        if spritecollideany(self, group):  
            # I collided with a sprite in group
```

Exercise

- Implement collision response in PyPong:
 - Constrain the paddles; if a paddle collides with one of the top/ bottom borders, stop its movement.
 - Make the ball bounce off of the other sprites on the board:
 - If it hits the top or bottom walls, it should invert its y direction.
 - If it hits a paddle, it should invert its x direction.



Step 4

Scoring, Polish, etc.

Font

- Text is drawn using a `Font` object:
`name = Font(filename, size)`
 - Pass `None` for the file name to use a default font.
- A `Font` draws text as a `Surface` with its `render` method:
`name.render("text", True, (red, green, blue))`

Example:

```
my_font = Font(None, 16)
text = my_font.render("Hello", True, (0, 0, 0))
```

Displaying Text

- A `Sprite` can be text by setting that text's `Surface` to be its `.image` property.

Example:

```
class Banner(Sprite):
    def __init__(self):
        my_font = Font(None, 24)
        self.image = my_font.render("Hello", \
                                   True, (0, 0, 0))
        self.rect = self.image.get_rect()
        self.rect.center = (250, 170)
```

Exercise

- Implement scoring of points in PyPong.
 - Make a sprite to represent the current scoreboard.
 - Draw the score in 72px font, in the top/middle of the board.
 - Draw it in a format such as "0:0".
 - Expand the collision detection for the ball:
 - If it hits the right wall, it should score a point for Player 1.
 - If it hits the left wall, it should score a point for Player 2.

Sounds

- Loading and playing a sound file:

```
from pygame.mixer import *  
mixer.init()           # initialize sound system  
mixer.stop()          # silence all sounds  
  
Sound("filename").play() # play a sound
```

- Loading and playing a music file:

```
music.load("filename") # load bg music file  
music.play(loops=0)    # play/loop music  
                        # (-1 loops == infinite)
```

others: stop, pause, unpause, rewind, fadeout, queue

Further Exploration

- Physics: Sprites that accelerate; gravity; etc.
- AI: Computer opponents that play "intelligently"
- Supporting other input devices
 - See documentation for Pygame's `Joystick` module
- Multi-player (local or network)