

PyGame Sprites

- an excellent tutorial exists for PyGame sprites [here](http://kai.vm.bytemark.co.uk/~piman/writing/sprite-tutorial.shtml) (`http://kai.vm.bytemark.co.uk/~piman/writing/sprite-tutorial.shtml`).
- these notes are derived from this tutorial and the examples extended
 - initially without object orientation and later to include orientation with the previous lecture on PyGame and the bouncing ball example

PyGame Sprites

- sprites are quite complicated
 - in my experience this is due to their close association with object orientation
 - you can use sprites without OO
 - for a small number of sprites this is easy enough and the code is smaller than its OO counterpart (and much simpler)
 - for any reasonable number of sprites ≥ 3 then should use OO as the reduction in code probably offsets the OO complication

When to use Sprites in PyGame

- when you have:
 - many instances of an object on the screen at a time
 - some objects that you need to track closely (e.g. collision detection)
 - Sprites have a `self.rect` attribute, which can be passed to the function `colliderect`
 - objects that need to *update themselves* rather than waiting for events to happen passively
 - a Sprite's `update()` method, with a time argument, makes it easy to deal with a dynamic environment

When to use Sprites in PyGame

- if you absolutely, positively need speed, and know exactly what you're doing
 - sprites and sprite groups are fast, but if you're careful, you can be faster
- do consider this until you have profiled your existing code
 - and have removed the more obvious time sinks

When not to use Sprites

- when your:
 - objects don't share much (if any) code
 - and if you rarely have more than one copy of each instantiated at a time
 - loop is event-based, and things never move *by themselves*
- simple user interfaces are often easier to do with surfaces than with sprites

Creating a simple sprite

- ```
#!/usr/bin/python

import pygame
from pygame.locals import KEYDOWN

width = 320
height = 240
size = [width, height]
pygame.init()
screen = pygame.display.set_mode(size)
background = pygame.Surface(screen.get_size())

b = pygame.sprite.Sprite() # create sprite
b.image = pygame.image.load("ball.png").convert() # load
b.rect = b.image.get_rect() # use image extent values
b.rect.topleft = [0, 0] # put the ball in the top left co
screen.blit(b.image, b.rect)

pygame.display.update()
while pygame.event.poll().type != KEYDOWN:
 pygame.time.delay(100)
```

## Sprite in PyGame

- is an object that contains both:
  - an image (a Surface)
  - and a location at which to draw that image (a Rect)
- term *sprite* is actually a holdover from older display systems that did such manipulations directly in hardware
  - Commodore 64, Commodore Amiga used this technique in early 1980s to early 1990s
  - other manufactures did exactly the same, Atari etc

## Sprite in PyGame

- Sprites work well in object-oriented languages like Python
  - you have a standard sprite interface `pygame.sprite.Sprite`, and extend those classes as specific sprites
- see the `BallSprite` class in the example later on

## Sprite in PyGame

- Sprites have two important instance variables
  - `self.image` and `self.rect`
  - `self.image` is a `Surface`, which is the current image that will be displayed. `self.rect` is the location at which this image will be displayed when the sprite is drawn to the screen
- Sprites also have one important instance method, `self.update`.

## Creating a simple sprite using an extra Class

```
#!/usr/bin/python

import pygame
from pygame.locals import KEYDOWN

class BallSprite(pygame.sprite.Sprite):
 image = None

 def __init__(self, location):
 pygame.sprite.Sprite.__init__(self)

 if BallSprite.image is None:
 # This is the first time this class has been
 # instantiated. So, load the image for this and
 # all subsequent instances.
 BallSprite.image = pygame.image.load("ball.png")
 self.image = BallSprite.image

 # Make our top-left corner the passed-in location
 self.rect = self.image.get_rect()
 self.rect.topleft = location
```

## Creating a simple sprite using an extra Class

```
pygame.init()
screen = pygame.display.set_mode([320, 320])
b = BallSprite([0, 0]) # put the ball in the top left corner
screen.blit(b.image, b.rect)
pygame.display.update()
while pygame.event.poll().type != KEYDOWN:
 pygame.time.delay(10)
```

## Bouncing ball using sprites and no user defined classes

```
#!/usr/bin/python

import pygame
from pygame.locals import KEYDOWN

width = 320
height = 240
size = [width, height]
ydir = 1
xdir = 1
xpos = 0
ypos = 0
pygame.init()
screen = pygame.display.set_mode(size)
background = pygame.Surface(screen.get_size())

b = pygame.sprite.Sprite() # create sprite
b.image = pygame.image.load("ball.png").convert() # load
b.rect = b.image.get_rect() # use image extent values
b.rect.topleft = [xpos, ypos] # put the ball in the top left
screen.blit(b.image, b.rect)
slow = 0
```

## Bouncing ball using sprites and no user defined classes

```
def gravity(y):
 global height
 return 0
 return (((height+height/20) * 3) / y)

pygame.display.update()
while pygame.event.poll().type != KEYDOWN:
 pygame.time.delay(gravity(ypos))
 # If we're at the top or bottom of the screen,
 # switch directions.

 if b.rect.bottom>=height:
 ydir = -1
 elif ypos == 0:
 ydir = 1
 if xpos == 0:
 xdir = 1
 elif b.rect.right>=width:
 xdir = -1
```

## Bouncing ball using sprites and no user defined classes

```
if slow:
 screen.fill([0, 0, 0]) # blank the screen
else:
 rectlist = [screen.blit(background, b.rect)]

Move our position up or down by one pixel
xpos += xdir
ypos += ydir
b.rect.topleft = [xpos, ypos]

if slow:
 screen.blit(b.image, b.rect)
 pygame.display.update()
else:
 rectlist += [screen.blit(b.image, b.rect)]
 pygame.display.update(rectlist)
```

## Bouncing ball using sprites and no user defined classes

```
#!/usr/bin/python

import pygame
from pygame.locals import KEYDOWN

class BallSprite(pygame.sprite.Sprite):
 image = None

 def __init__(self, initial_position):
 pygame.sprite.Sprite.__init__(self)
 if BallSprite.image is None:
 BallSprite.image = pygame.image.load("ball.png")
 self.image = BallSprite.image

 self.rect = self.image.get_rect()
 self.rect.topleft = initial_position
 self.going_down = True # Start going downwards
 self.next_update_time = 0 # update() hasn't been
```

## Bouncing ball using sprites and no user defined classes

```
def update(self, current_time, bottom):
 # Update every 10 milliseconds = 1/100th of a second
 if self.next_update_time < current_time:

 # If we're at the top or bottom of the screen
 if self.rect.bottom == bottom - 1: self.going_down = False
 elif self.rect.top == 0: self.going_down = True

 # Move our position up or down by one pixel
 if self.going_down: self.rect.top += 1
 else: self.rect.top -= 1

 self.next_update_time = current_time + 10
```

## Bouncing ball using sprites and no user defined classes

```
pygame.init()
boxes = []
for location in [[0, 0],
 [60, 60],
 [120, 120]]:
 boxes.append(BallSprite(location))

screen = pygame.display.set_mode([150, 150])
while pygame.event.poll().type != KEYDOWN:
 screen.fill([0, 0, 0]) # blank the screen.

 time = pygame.time.get_ticks()
 for b in boxes:
 b.update(time, 150)
 screen.blit(b.image, b.rect)
 pygame.display.update()
```

- it is worth noting that the OO solution uses processor resources efficiently

## Bouncing ball using sprites and no user defined classes

## Tutorial

- modify the last example so that the balls also move on the x axis as well
- now add the gravity effect