Multimedia-Programmierung
Übung 7

Ludwig-Maximilians-Universität München

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Today

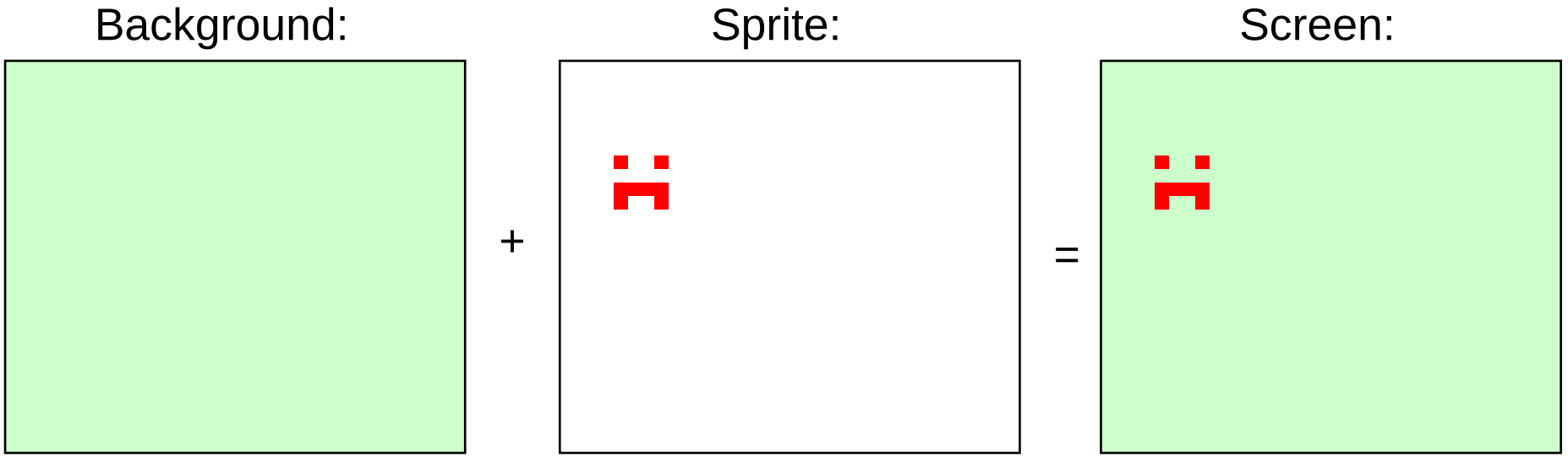
- Sprites and 

Literature: W. McGugan, Beginning Game Development with Python and Pygame, Apress 2007

Sprites

a.k.a. Spooky things that move but are not really there

- Historically:
  - something that is laid over the background
  - implemented in hardware
- Today:
  - anything that moves over the screen
  - hardware fast enough -> sprites are now software-generated



Sprites in Pygame

- Module pygame.sprite provides basic classes and methods to handle sprites
- Class pygame.sprite.Sprite used as base class for game objects
- Group Objects are provided as containers/lists for sprites
- Collision detection included
- http://www.pygame.org/docs/ref/sprite.html

The Sprite Class

- Sprite objects **must** contain an image and a location
- self.image is a Surface that contains the image information
- self.rect is a Rect object that determines the location of the sprite
- A subclass of Sprite should also overwrite the update() method
- Contains derived methods that handle the object in groups:
  - kill() removes the sprite from all groups
  - remove(*groups) removes the sprite from a list of groups
  - add(*groups) adds the sprite to groups
  - groups() returns a list of groups the sprite belongs to
  - alive() tests whether the sprite belongs to any groups

Our First Sprite

```
import pygame
from pygame.locals import *

class Box(pygame.sprite.Sprite):
    def __init__(self, color, initial_position):
        pygame.sprite.Sprite.__init__(self)
        self.image = pygame.Surface((20,20))
        self.image.fill(color)
        self.rect = self.image.get_rect()
        self.rect.topleft = initial_position

    def update(self):
        pass

pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)
box = Box((255,0,0),(0,0))
while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((0, 0, 0))
    screen.blit(box.image,box.rect)
    pygame.display.update()
```

call the superclass constructor

define the image Surface

define the rect

blit the sprite

Result:

Using the update Method

- Update can hold any number of arguments
- For efficient use of groups, sprites that do the same should have the same arguments

```
class Box(pygame.sprite.Sprite):
    def __init__(self, color, initial_position):
        pygame.sprite.Sprite.__init__(self)
        self.image = pygame.Surface((20,20))
        self.image.fill(color)
        self.rect = self.image.get_rect()
        self.rect.topleft = initial_position
        self.speed = 300

    def update(self, time_passed):
        moved_distance = time_passed * self.speed
        self.rect.left += moved_distance
```

Using the update Method II

```
import pygame
from pygame.locals import *
... # Box Class here

pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)

box = Box((255,0,0),(0,0))
clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((0, 0, 0))
    time_passed = clock.tick() / 1000.0
    box.update(time_passed)
    screen.blit(box.image,box.rect)
    pygame.display.update()
```

update the sprite

Result:

Using the update Method - Several Objects

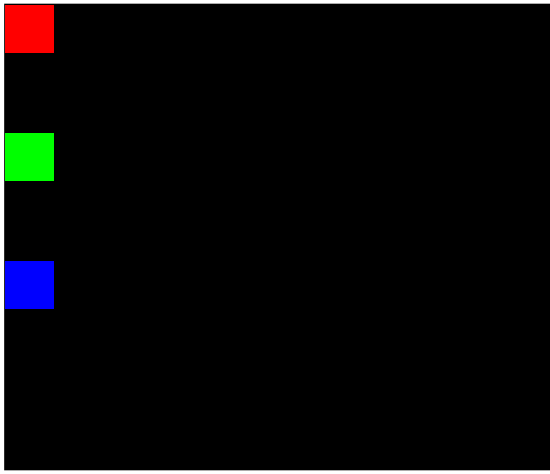
```
import pygame
from pygame.locals import *
... # Box Class here
pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)

box = Box((255,0,0),(0,0))
box2 = Box((0,255,0),(0,60))
box3 = Box((0,0,255),(0,120))
clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((0, 0, 0))
    time_passed = clock.tick() / 1000.0
    box.update(time_passed)
    box2.update(time_passed)
    box3.update(time_passed)
    screen.blit(box.image,box.rect)
    screen.blit(box2.image,box2.rect)
    screen.blit(box3.image,box3.rect)
    pygame.display.update()
```

too cumbersome

Result:



Sprite Groups

- Sprite groups (e.g. pygame.sprite.Group) are basically lists for sprites
- Handle the cumbersome details for the programmer:
  - sprites() returns a list of the sprites in that group
  - copy() returns a copy of the group
  - add(*sprites) adds a sprite to the list
  - remove(*sprites) removes the specified sprites from the list
  - has(*sprites) determines whether all sprites are in this group
  - update(*args) calls the update method of all sprites in this group (requires that they use the same arguments)
  - draw(surface) draws all the sprites in this group to the specified surface (uses Sprite.image and Sprite.rect)
  - clear(surface,background) erases the last drawn sprites from the list
  - empty() removes all sprites from the list

In-class exercise

Use Groups to simplify the example!

Handling Complexity using Groups

```
import pygame
from pygame.locals import *
... # Box Class here
pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)

boxes = ([(255,0,0),(0,0)],[(0,255,0),(0,60)],[(0,0,255),(0,120)])
sprites = pygame.sprite.Group()
for box in boxes:
    sprites.add(Box(box[0],box[1]))

clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((0, 0, 0))
    time_passed = clock.tick() / 1000.0
    sprites.update(time_passed)

    sprites.draw(screen)
    pygame.display.update()
```

create a group

call update on the group

draw all sprites in the group onto the screen surface

Advanced Groups (RenderUpdates)

- Drawing the whole screen every time a sprite moves is inefficient
- RenderUpdates helps to avoid this
- Special draw() method:
  - draw(*sprites) returns a list of Rect objects that define the areas that have been changed
  - Efficient for non-animated backgrounds

Using RenderUpdates

```
import pygame
from pygame.locals import *
... # Box Class here
pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)

boxes = ([(255,0,0),(0,0)],[(0,255,0),(0,60)],[(0,0,255),(0,120)])
sprites = pygame.sprite.RenderUpdates()
for box in boxes:
    sprites.add(Box(box[0],box[1]))
clock = pygame.time.Clock()

background = pygame.surface.Surface((640,480))
background.fill((0,0,0))
screen.blit(background,(0,0))

while True:
    ... QUIT procedure here
    time_passed = clock.tick() / 1000.0
    sprites.update(time_passed)
    rects = sprites.draw(screen)
    pygame.display.update(rects)
    sprites.clear(screen,background)
```

RenderUpdates group

call draw and store the changed areas

clear the changes done

Advanced Groups (OrderedUpdates)

- Remembers the order in which sprites are added
- Order is used for drawing the sprites to the screen
- Helps painting objects in the correct order
- Slower to add and remove sprites than other groups

Iterating Sprite Groups

```
sprites = pygame.sprite.Group()
...
for sprite in sprites:
print sprite
```

Collision Detection

- Rect.collidepoint(point) can be used to see whether a coordinate is within the area of a Rect object
- pygame.sprite has advanced methods to check for collisions
  - E.g. pygame.sprite.collide_rect(a,b) checks whether two sprites intersect

A simple collision detection

```
import pygame
from pygame.locals import *

...

pygame.init()

screen = pygame.display.set_mode((640, 480), 0, 32)
box = Box((255,0,0),(0,0))

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
        if event.type == MOUSEBUTTONDOWN:
                if box.rect.collidepoint(event.pos):
                                print "in"
                else:
                                print "out"
    box.update()
    screen.blit(box.image,box.rect)
    pygame.display.update()
```

In-class exercise

- Erstellen Sie eine 600x500 Pixel große Spielfläche.

- Spielfigur: Am unteren Rand des Spielfeldes befindet sich die Spielfigur. Drückt der Spieler die Steuerungstaste „rechts“, bewegt sich die Figur mir konstanter Geschwindigkeit (ohne Reibungsverlust) nach rechts, solange die Taste gedrückt bleibt. Drückt der Spieler die Steuerungstaste „links“ bewegt sie sich nach links. Die Spielfigur darf dabei das Spielfeld nicht verlassen. D.h. sie stoppt, wenn sie an eine Ecke stößt.

In-class exercise

- Gegner: Am Anfang befinden sich 5 Kreise (oder andere Objekte) am oberen Spielfeldrand. Diese bewegen sich nach rechts. Sobald ein Kreis den rechten Spielfeldrand berührt bewegt er sich um seine Höhe plus x nach unten (wählen Sie hierbei einen sinnvollen Wert) und bewegt sich anschließen nach links. Berührt der Kreis nun den linken Spielfeldrand findet die gleiche Bewegung statt nur eben in die andere Richtung. Das Ganze passiert solange, bis die Kreise das Spielfeld unten verlassen haben. D.h. die Kreise bewegen sich im Zickzack nach unten.

Useful Links

- Pygame Documentation !!!!
  http://www.pygame.org/docs