Multimedia-Programmierung
Übung 6

Ludwig-Maximilians-Universität München

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Today

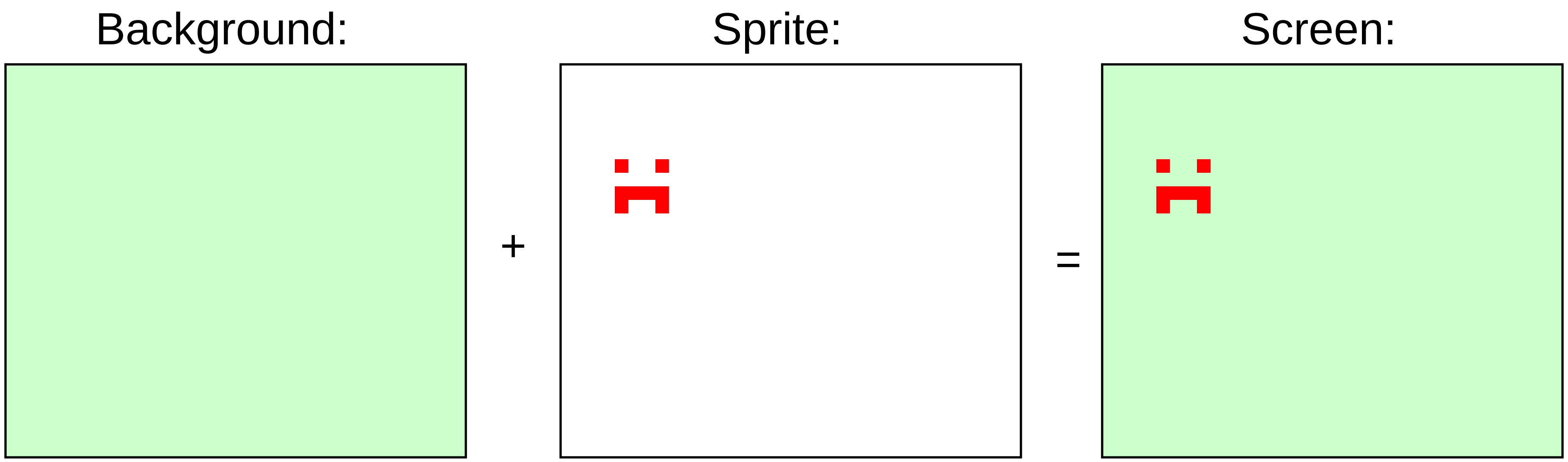
- Sprites and pygame

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

Sprites

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

- Historically:
  - something that is laid over the background
  - realized by special hardware
- Today:
  - anything that moves over the screen
  - hardware fast enough -> sprites 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()
```

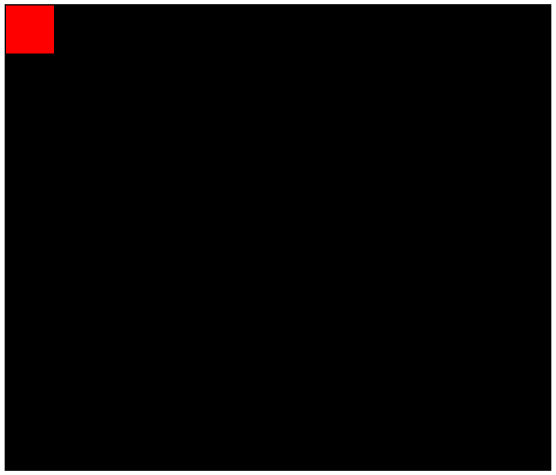
call the superclass constructor

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

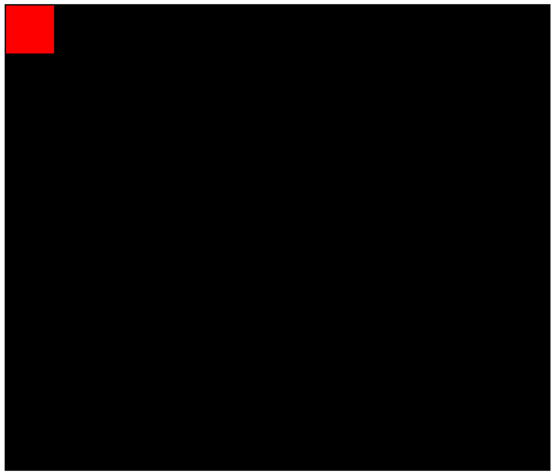
```
class Box(pygame.sprite.Sprite):
    def __init__(self, color, initial_position):
        pygame.sprite.Sprite.__init__(self)
        self.image = pygame.Surface((20,20))
        self.image.fill(color)
        self.rect = self.image.get_rect()
        self.rect.topleft = initial_position
       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

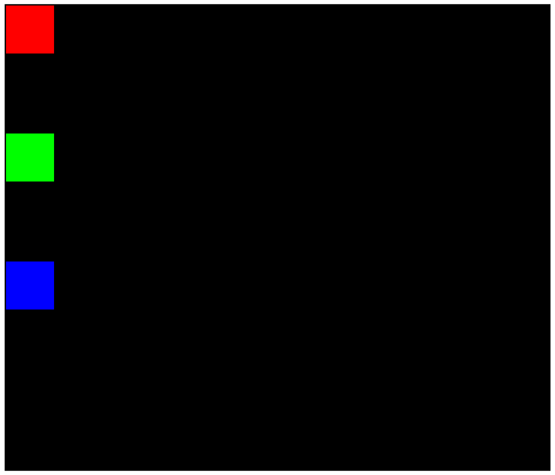


Using the update Method - Several Objects

```
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

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()
```

RenderUpdates group

call draw and store the changed areas

clear the changes done

Useful Links

- Pygame Sprite Tutorial
  http://kai.vm.bytemark.co.uk/~piman/writing/sprite-tutorial.shtml
- Pygame API !!!!
  http://www.pygame.org/ctypes/pygame-api/