Multimedia-Programmierung
Übung 5

Ludwig-Maximilians-Universität München

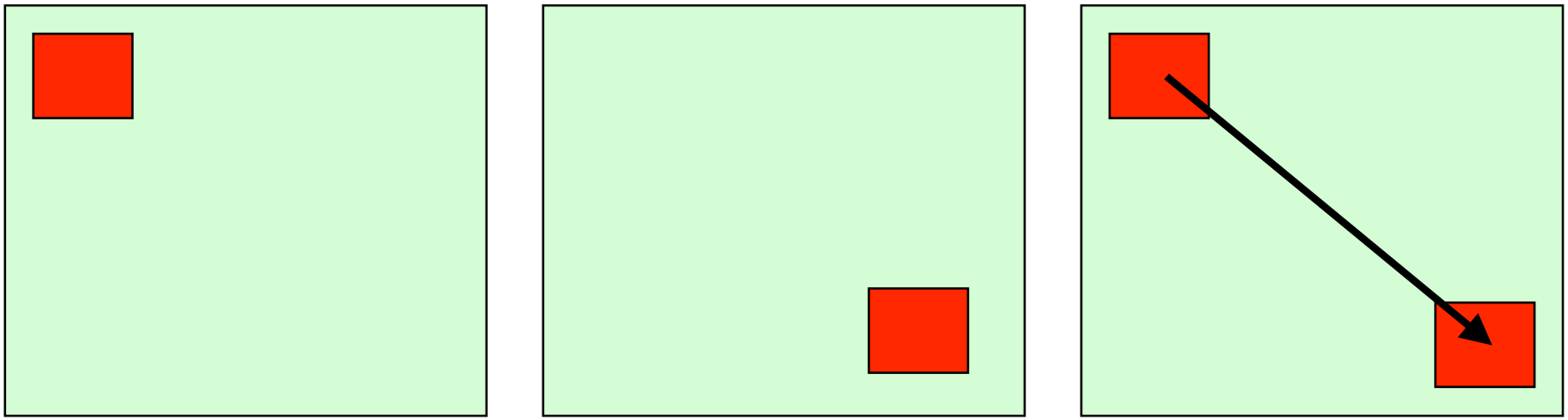
Sommersemester 2009

Today

- Sprite animations in 
- Advanced collision detection

Keyframe Animations

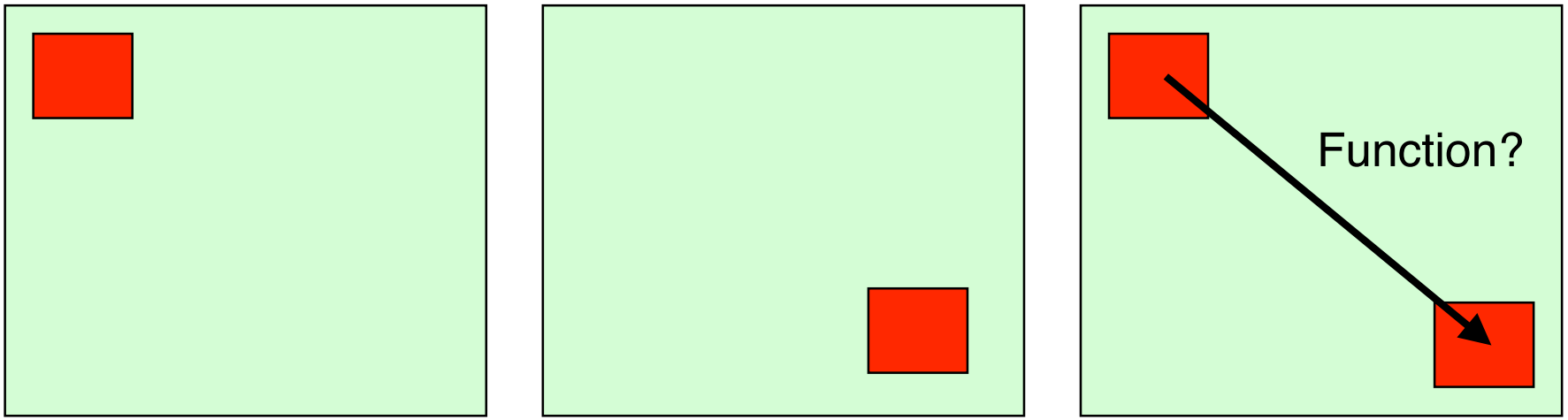
- Keyframes are defined
- Intermediate steps are interpolated
- Basic interpolators/tweens/... built into many programming environments (e.g. Flash, JavaFX)
- Examples: motion, color, shape



Keyframe Animations

Keyframe Animations in Pygame

- Pygame has no built-in interpolators
- Logic has to be added by the programmer
- Question: How can we calculate the intermediate points?



Horizontal Animation (old slides)


```
import pygame
from pygame.locals import *
from sys import exit

player_image = 'head.jpg'
pygame.init()

screen = pygame.display.set_mode((640, 280), 0, 32)
pygame.display.set_caption("Animate X!")
mouse_cursor = pygame.image.load(player_image).convert_alpha()

x = 0 - mouse_cursor.get_width()
y = 10

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((255,255,255))
    if x > screen.get_width():
            x = 0 - mouse_cursor.get_width()
    screen.blit(mouse_cursor, (x, y))
    x+=10
    pygame.display.update()
```

Result:

Sprite Animations

- Animations consist of frames that are displayed one after another

Frame 1

Frame 2

First Sprite Animation 1

```
import pygame
from pygame.locals import *

class Box(pygame.sprite.Sprite):
    def __init__(self, color, initial_position, fps):
        pygame.sprite.Sprite.__init__(self)
        self.act_frame = 0
        # create the images for the animation
        self.create_images(color)
        self.rect = self.image.get_rect()
        self.rect.topleft = initial_position
        self.fps = fps
        self.change_time = 1.0/self.fps
        self.time = 0
...
```

remember the current frame

create the frames (defined later)

Based on the frames per second (fps) calculate the time needed for animation changes

First Sprite Animation 2

```
...
  def create_images(self,color):
      self.frames = []
      image = pygame.Surface((20,20),pygame.SRCALPHA,32)
      pygame.draw.rect(image,color,(0,0,10,10))
      self.frames.append(image)
      image = pygame.Surface((20,20),pygame.SRCALPHA,32)
      pygame.draw.rect(image,color,(10,0,10,10))
      self.frames.append(image)
      image = pygame.Surface((20,20),pygame.SRCALPHA,32)
      pygame.draw.rect(image,color,(0,10,10,10))
      self.frames.append(image)
      image = pygame.Surface((20,20),pygame.SRCALPHA,32)
      pygame.draw.rect(image,color,(10,10,10,10))
      self.frames.append(image)
      self.image = self.frames[self.act_frame]

   def update(self, time_passed):
      self.time += time_passed
      if self.time >= self.change_time:
         self.act_frame = (self.act_frame + 1) % len(self.frames)
         self.image = self.frames[self.act_frame]
         self.time = 0
```

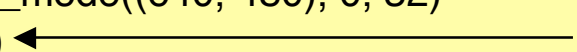
draw 4 frames

Frame changed?

change frame

First Sprite Animation 3

```
...
pygame.init()

screen = pygame.display.set_mode((640, 480), 0, 32)
box1 = Box((255,0,0),(0,0),4)
clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((100, 200, 0))
    time_passed = clock.tick() / 1000.0
    box1.update(time_passed)
    screen.blit(box1.image,box1.rect)
    pygame.display.update()
```



animated box in red

Multiple Parallel Animations

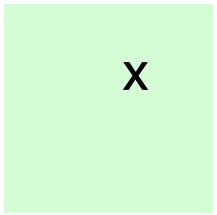
```
...
pygame.init()

screen = pygame.display.set_mode((640, 480), 0, 32)
box1 = Box((255,0,0),(0,0),4)
box2 = Box((0,100,255),(40,40),2)
clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((100, 200, 0))
    time_passed = clock.tick() / 1000.0
    box1.update(time_passed)
    screen.blit(box1.image,box1.rect)
    box2.update(time_passed)
    screen.blit(box2.image,box2.rect)
    pygame.display.update()
```

two boxes in two different framerates

Collision Detection

Rect

- Rect provides several method to test collisions
  http://www.pygame.org/docs/ref/rect.html
- Rect.collidepoint(point) tests whether a point is within the Rect's area

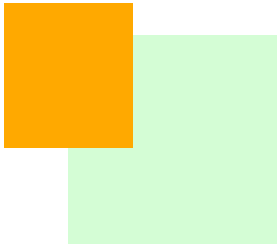


True

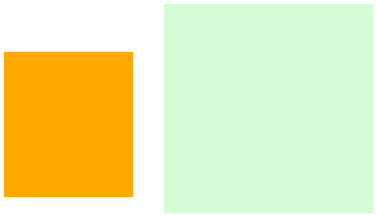
False

x

- Rect.colliderect(rect) tests whether two Rects intersect



True



False

Collision Detection

Rect II

- Rect.collidelist(list) tests whether the Rect collides with **at least one** Rect in the given list
- Rect.collidelistall(list) tests whether the Rect collides with **all** Rects in the list
- Rect.collidedict(dict) tests whether the Rect collides with **at least one** Rect in the given dictionary
- Rect.collidedictall(dict) tests whether the Rect collides with **all** Rects in the dictionary

Collision Detection

Sprites

- The module sprite provides several method to test collision http://www.pygame.org/docs/ref/sprite.html
- sprite.spritecollide(...) returns a list of sprites within a group that intersect with a given sprite
- sprite.collide_rect(a,b) checks whether two sprites intersect (must have rects)
- sprite.collide_circle(a,b) checks whether the radius of two sprites intersect. Radius attribute should be defined in the sprite.

False

True

Collision Detection

Sprites 2

- sprite.groupcollide(a,b) returns a list of sprites of two groups that intersect
- sprite.collide_mask(a,b) checks whether two Sprite collide on a bitmap level (non-transparent pixels overlap)

```
if pygame.sprite.collide_mask(head1,head2):
        print "collide"
```

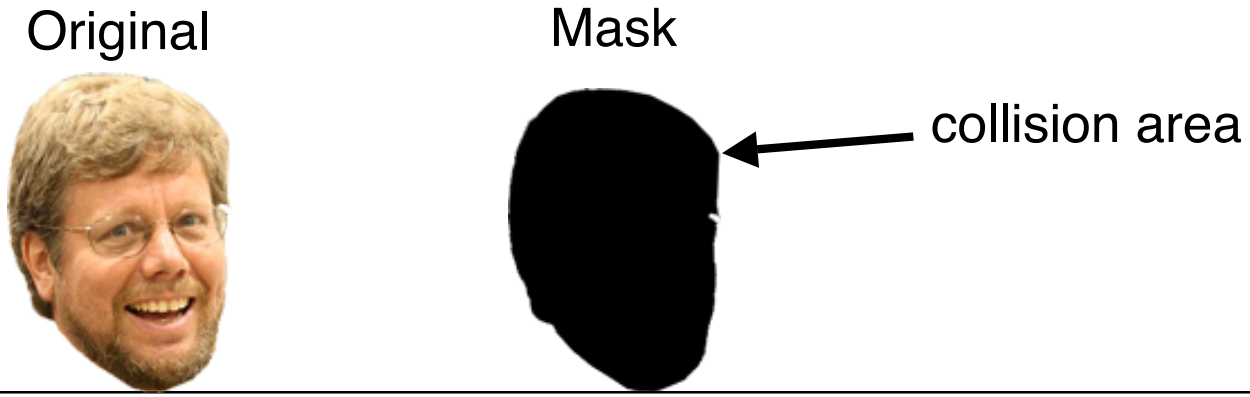
False

True

Collision Detection

Masks

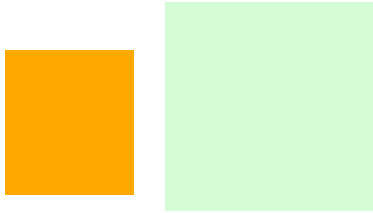
- Masks are 1bit per pixel representations of areas that can collide
- Module mask contains functions and classes to create and use masks
  http://www.pygame.org/docs/ref/mask.html
- mask.from_surface(surface,threshold=127) creates a mask of a surface. Threshold defines the alpha value that counts as collideable
- Class Mask contains methods to work with classes



Collision Detection

Conclusion

- Pygame offers various ways to check for collisions
- **Choose your collision detection algorithm wisely depending on the task**
- Pixel based collision detection is precise but slow
- Rect or radius based collision detection is fast but imprecise



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/