

# Multimedia-Programmierung

## Übung 2

Ludwig-Maximilians-Universität München  
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# Today



... oldie but goldie



- Sam Lantinga, 1998: Simple DirectMedia Layer (SDL) framework, to simplify porting games among platforms
  - Common and simple way to create displays and process input abstracting from platform particularities
  - Originally written in C
- Pygame is a language binding for SDL to the Python language

Download: <http://pygame.org/docs/ref/index.html>

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



# Pygame Modules

**pygame.cdrom** Accesses and controls CD drives

**pygame.cursors** Loads cursor images

**pygame.display** Accesses the display

**pygame.draw** Draws shapes, lines, and points

**pygame.event** Manages external events

**pygame.font** Uses system fonts

**pygame.image** Loads and saves an image

**pygame.joystick** Uses joysticks and similar devices

**pygame.key** Reads key presses from the keyboard

**pygame.mixer** Loads and plays sounds

**pygame.mouse** Manages the mouse

**pygame.movie** Plays movie files

**pygame.music** Works with music and streaming audio

**pygame.overlay** Accesses advanced video overlays

**pygame** Contains high-level Pygame functions

**pygame.rect** Manages rectangular areas

**pygame.sndarray** Manipulates sound data

**pygame.sprite** Manages moving images

**pygame.surface** Manages images and the screen

**pygame.surfarray** Manipulates image pixel data

**pygame.time** Manages timing and frame rate

**pygame.transform** Resizes and moves images



# Pygame Modules

Testing if Modules are available on a Platform

Test:

```
if pygame.font is None:  
    print "no font module"
```

Some modules might not be available on a platform depending on the hardware settings. In this case Pygame sets them to **None**.



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

player_image = 'cursor.gif'

pygame.init()
screen = pygame.display.set_mode((640, 480), 0, 32)
pygame.display.set_caption("Hello, Pygame!")

mouse_cursor = pygame.image.load(player_image).convert_alpha()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
    screen.fill((255,255,255))
    x, y = pygame.mouse.get_pos()
    x-= mouse_cursor.get_width() / 2
    y-= mouse_cursor.get_height() / 2
    screen.blit(mouse_cursor, (x, y))
    pygame.display.update()
```

← import locals, mainly constants (e.g. QUIT)

← initializes ALL python modules (loads drivers etc.)

← initialize a display (Surface object)

← only necessary if alpha channel exists

← used to update the display

# Events

- Module `pygame.event`
- Generated all the time by different entities
- Stored in an event queue
- `pygame.event.wait()` waits until the list is not empty
- `pygame.event.get()` returns a list of the last events
- `pygame.event.poll()` returns the next event of the queue
- The type of the event is specified by `event.type`

Print all events in the list:

```
for event in pygame.event.get():  
    print event.type
```

# Events

## Parameters

- Events can have parameters
- Examples:
  - QUIT: no parameters
  - MOUSEBUTTONDOWN: pos, button
  - VIDEORESIZE: size, w, h
  - Etc.

Left click with the mouse:

```
if event.type == MOUSEBUTTONDOWN:  
    if event.button == 1:  
        print event
```

Output:

```
<Event(5-MouseButtonDown {'button': 1, 'pos': (231, 207)})>
```



# Events

## Mouse Events

- MOUSEMOTION: pos, rel, buttons
  - Example print event:

```
<Event(4-MouseMotion {'buttons': (1, 0, 0), 'pos': (660, 313), 'rel': (-4, -4)})>
```

- MOUSEBUTTONDOWN: pos, button
- MOUSEBUTTONUP: pos, button
- Example: check whether the left mouse button is pushed during mouse movement

```
if event.type == MOUSEMOTION:  
    if event.buttons[0] == 1:  
        pass # or do something
```

# Events

## Keyboard Events

- KEYDOWN: unicode, key, mod
- KEYUP: key, mod
  - `key` is the number of the key that has been pressed
  - `mod` represents combination keys like alt, ctrl and shift
  - `unicode` is the unicode value of the pressed key
- Example: check whether the left key has been pressed

```
if event.type == KEYDOWN:  
    if event.key == K_LEFT:  
        pass # or do something
```

# Events

## (un)blocking events

- `pygame.event.set_blocked(events)` blocks events from the event queue
- `pygame.event.set_allowed(events)` unblocks the events
- Example: block all keyboard events

```
pygame.event.set_blocked([KEYDOWN,KEYUP])
```

# Events

## custom events

- `pygame.event.post(event)` posts a user event
- The value for events created by the user must have the value of `USEREVENT` or higher
- Example:

```
MMPROCKS = USEREVENT+1
new_event = pygame.event.Event(MMPROCKS, message="MMP Rocks")
pygame.event.post(new_event)
```

# Fonts

- `pygame.font.SysFont(font,size)` loads a system font
- `pygame.font.Font(font,size)` loads a font from a file
- `Font.render(text,aliasing,color,bg_color)` creates a surface of a text
- Example:

```
test_font = pygame.font.SysFont("arial", 16)
test_surface = test_font.render("test",True,(0,0,0))
screen.blit(test_surface,(0,0))
```

# Images

- Pygame can load different image types:
- JPG
- PNG
- GIF (non animated)
- BMP
- PCX
- TGA (uncompressed)
- TIF
- LBM (and PBM)
- PBM (and PGM, PPM)
- XPM
  
- Images are loaded by `pygame.image.load(image)` (returns a `Surface` object)

# Images

- Saving is limited to:
  - BMP
  - JPEG
  - PNG
  - TGA
- Images are saved by `pygame.image.save(surface, file)`

# Surfaces

## Creating a Surface

- Surface objects are containers for images
- Used as canvases
- Even the Pygame screen is represented as a Surface
  
- Several functions return a Surface object (e.g. `pygame.image.load(image)`)
- Blank surfaces can be created by calling the constructor `pygame.Surface((100,100))`



# Surface 2 Image

- Any surface can directly be stored as an image
- `pygame.image.save(surface, name)`

Example:

```
pygame.image.save(screen, "name.png")
```



“coooooool”

# Surfaces

## Converts

- Converts are used to convert surfaces to an efficient format
- Use `convert()` or `convert_alpha()` if the image contains transparency

Example:

```
mouse_cursor = pygame.image.load(player_image).convert_alpha()
```

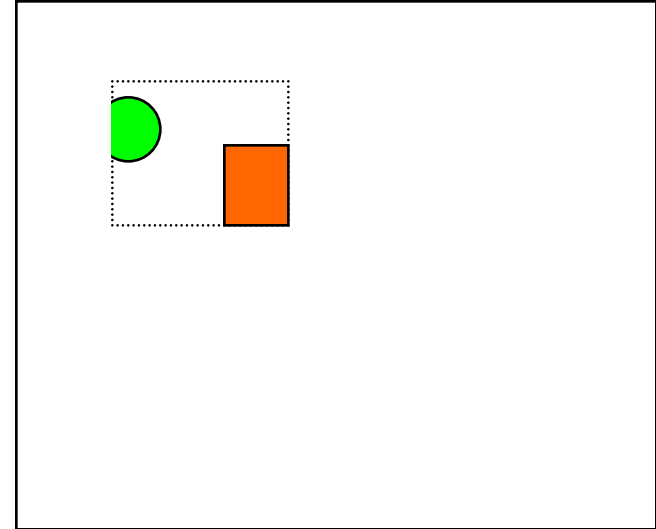
# Surfaces

## Clipping

- If clipping is set, only pixels in that area will be displayed
- `set_clip(Rect)`
- `set_clip()` resets the clipping area

Example:

```
screen.set_clip(100,100,200,200)
```



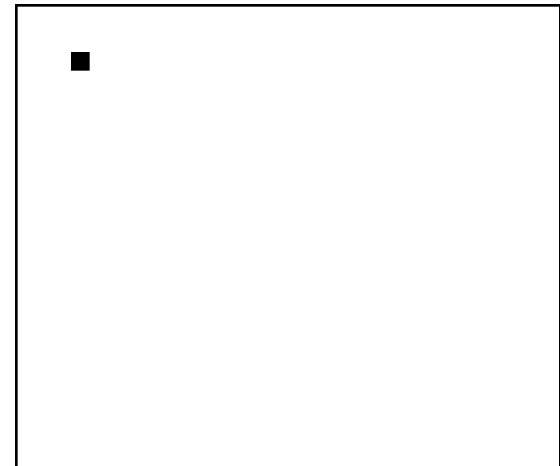
# Surfaces

## Filling and Setting and Getting Pixels

- `fill(color)` fills the surface with the defined color
- `set_at(pos,color)` can be used to manipulate single pixels
- `get_at(pos)` returns the pixel color of a surface

Set pixel 10,10 to black:

```
screen.set_at((10,10),(0,0,0))
```



# Surfaces

## Blitting

- `blit(source, pos, sourceroct=None)` copies pixel data from one surface to another

Copy test\_surface to 0,0:

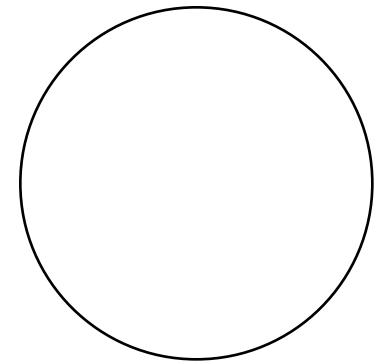
```
mouse_cursor = pygame.image.load("cursor.gif").convert_alpha()  
screen.blit(mouse_cursor, (0, 0))
```

# Drawing

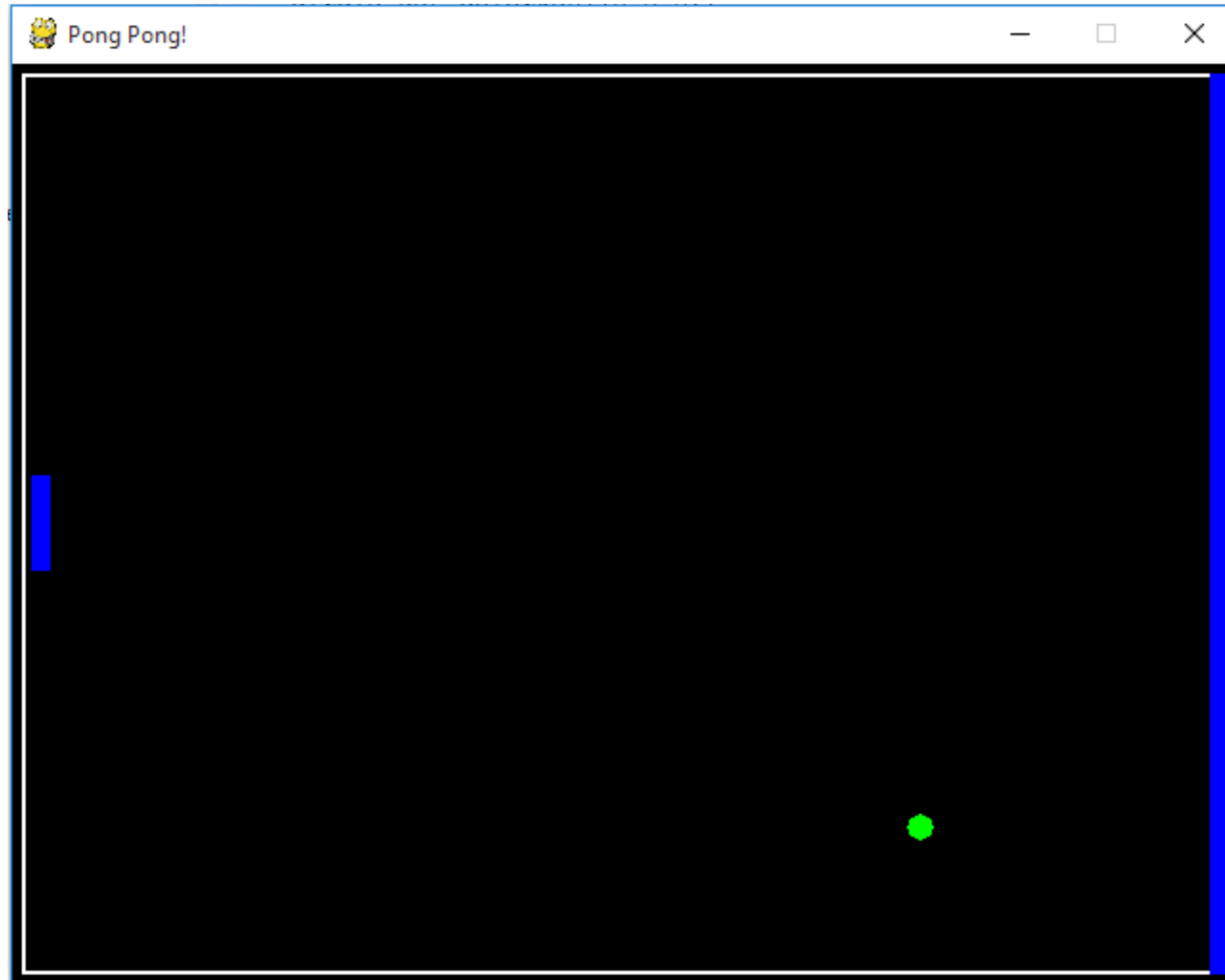
- `pygame.draw.rect(surface,color,rect,width=0)` draws a rectangle to a surface
- `pygame.draw.polygon(surface,color,pointlist,width=0)` draws a polygon to a surface
- `pygame.draw.circle(surface,color,pos,radius,width=0)` draws a circle to a surface
- `pygame.draw.arc`, `pygame.draw.ellipse`, `pygame.draw.line` etc.

Draw an empty circle:

```
pygame.draw.circle(screen,(0,0,0),(100,100),100,1)
```



# Super Quick Wallpong Game



# Super Quick n Dirty Wallpong Game (1)

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

pygame.init()
screen=pygame.display.set_mode((640,480),0,32)
pygame.display.set_caption("Pong Pong!")

#Creating 2 bars, a ball and background.
back = pygame.Surface((640,480))
background = back.convert()
background.fill((0,0,0))
bar = pygame.Surface((10,50))
bar1 = bar.convert()
bar1.fill((0,0,255))
wall = pygame.Surface((11,471))
wall = wall.convert()
wall.fill((0,0,255))
circ_sur = pygame.Surface((15,15))
circ = pygame.draw.circle(circ_sur,(0,255,0),(7,7),7)
circle = circ_sur.convert()
circle.set_colorkey((0,0,0))

# some dimnsions and start positions
bar1_x, bar1_y = 10., 215.
```

Init Pygame  
Create Window

Build the Game  
World



# Super Quick n Dirty Wallpong Game (2)

Game Loop

Make it Move!

```

circle_x, circle_y = 307.5, 232.5
bar1_move = 0.
speed_x, speed_y, speed_circ = 250., 250., 250.
clock = pygame.time.Clock()

while True:
    for event in pygame.event.get():
        if event.type == QUIT:
            exit()
        if event.type == KEYDOWN:
            if event.key == K_UP:
                bar1_move = -ai_speed
            elif event.key == K_DOWN:
                bar1_move = ai_speed
        elif event.type == KEYUP:
            if event.key == K_UP:
                bar1_move = 0.
            elif event.key == K_DOWN:
                bar1_move = 0.

    screen.blit(background,(0,0))
    frame = pygame.draw.rect(screen,(255,255,255),Rect((5,5),(630,470)),2)
    screen.blit(bar1,(bar1_x,bar1_y))
    screen.blit(wall,(625,5))
    screen.blit(circle,(circle_x,circle_y))
    bar1_y += bar1_move
    ....

    bar1_y = 420
    
```

# Super Quick n Dirty Wallpong Game (3)

Simple Physics!

```
# movement of ball
time_passed = clock.tick(30)
time_sec = time_passed / 1000.0
circle_x += speed_x * time_sec
circle_y += speed_y * time_sec
ai_speed = speed_circ * time_sec

#since we don't know anything about collision, ball hitting bars goes like this.
if circle_x <= bar1_x + 10.:
    if circle_y >= bar1_y - 7.5 and circle_y <= bar1_y + 42.5:
        circle_x = 20.
        speed_x = -speed_x
if circle_x < 5.:
    circle_x, circle_y = 320., 232.5
    speed_x = -speed_x
    bar1_y = 215.
elif circle_x > 608.:
    speed_x = -speed_x
    circle_x = 608.
if circle_y <= 10.:
    speed_y = -speed_y
    circle_y = 10.
elif circle_y >= 457.5:
    speed_y = -speed_y
    circle_y = 457.5

pygame.display.update()
```



**Do it yourself!**

**<http://inventwithpython.com/blog/2010/09/01/the-top-10-pygame-tutorials/>**

# Useful Links

- Pygame API !!!!

<http://pygame.org/docs/>

<http://pygame.org/docs/ref/index.html>