

# Multimedia-Programmierung

## Übung 3

Ludwig-Maximilians-Universität München  
Sommersemester 2009

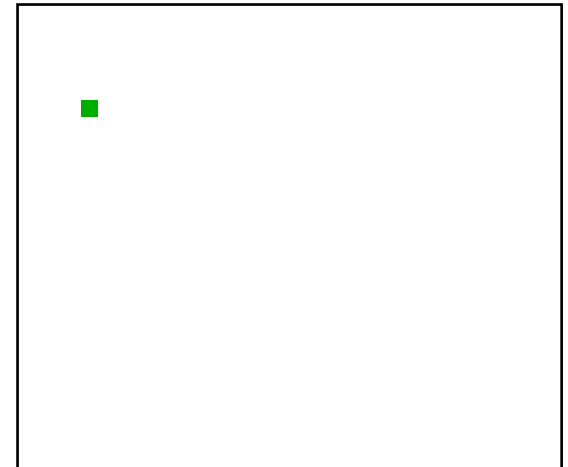
# Today

- Animations with  Pygame

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

# Objects on the Screen don't actually move

- Basically, only the colours of pixels are changed
- Everytime something changes, the whole screen is repainted
- Framerate defines the appearance of the animation (the higher, the better)
- Possible framerate depends on the hardware (e.g. hertz of the monitor)



# Moving an object in a straight line



```
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: ← event loop
```

```
    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()
```

← if the object left the screen, reset x

← animated in steps of 10 pixels

# Timing and Framerate

- Problem: The previous example creates an animation that runs in different speed depending on the power of the cpu
- Solution: [time-based animations](#)
- [pygame.time.Clock\(\)](#) provides an appropriate tool for time-based animations
- [Clock.tick\(\)](#) returns the time that passed since its last call

```
clock = pygame.time.Clock()  
clock.tick()
```

# Moving an object time-based



...

```
clock = pygame.time.Clock()
```

```
speed = 300.0
```

← speed in pixels per second

```
x = 0 - mouse_cursor.get_width()
```

```
y = 10
```

```
while True:
```

```
    time_passed = clock.tick() / 1000.0
```

← time passed since last tick() in seconds

```
    moved_distance = time_passed * speed
```

← distance moved since last call

```
    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+=moved_distance
```

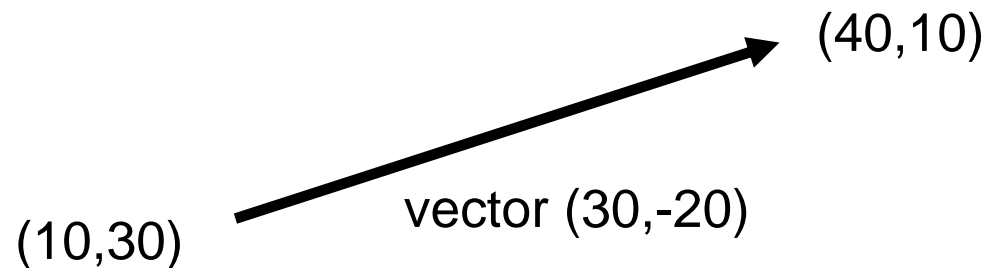
← move the sprite the calculated distance

```
    pygame.display.update()
```

# Diagonal Movement

or: Vectors, yeah!

- Moving a sprite to a specific coordinate requires movement on the x- and y-axis
- Best achieved using **vectors**
- E.g. a vector of (10,30) means move 10 pixels on the x- and 30 on the y-axis
- Store vectors as tuples, lists or create a class



# Vectors I

- Example class

```
class Vector(object):
    def __init__(self, x, y):
        self.x = x
        self.y = y

    def __str__(self):
        return "vector (%s,%s)"%(self.x, self.y)

    @classmethod
    def vector_from_points(cls,from_p,to_p):
        return cls(to_p[0]-from_p[0],to_p[1]-
from_p[1])
```

Use:

```
vector1 = Vector(10.0,20.0)
print vector1

print
Vector.vector_from_points((10,10),
(30,10))
```

Output:

```
vector (10.0,20.0)
vector (20,0)
```



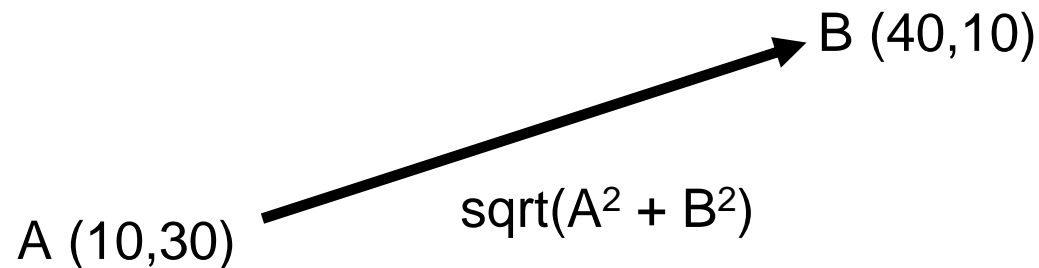
# Vectors II

- Vector magnitude

```

import math
class Vector(object):
    ...

    def get_magnitude(self):
        return math.sqrt(self.x**2 + self.y**2)
    
```

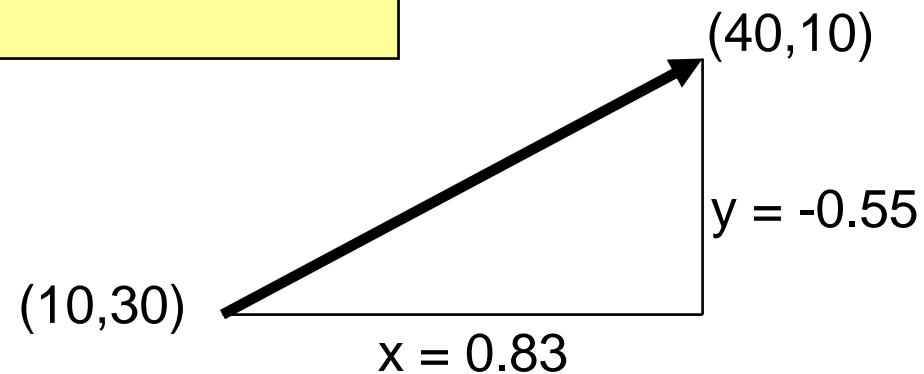


# Vectors 3

- Normalizing a vector

```
class Vector(object):
...

def normalize(self):
    magnitude = self.get_magnitude()
    self.x /= magnitude
    self.y /= magnitude
```



# Diagonal movement using vectors 1



```
import pygame
from pygame.locals import *
from sys import exit
import math ← needed for magnitude calculation
```

```
class Vector(object):
    def __init__(self, x=0.0, y=0.0):
        self.x = x
        self.y = y

    def __str__(self):
        return "(%s, %s)"%(self.x, self.y)

    def get_magnitude(self):
        return math.sqrt(self.x**2 + self.y**2)

    def normalize(self):
        magnitude = self.get_magnitude()
        self.x /= magnitude
        self.y /= magnitude

    @classmethod
    def vector_from_points(cls, from_p, to_p):
        return cls(to_p[0]-from_p[0], to_p[1]-from_p[1])
```

# Diagonal movement using vectors 2



```
...
mpos = (0.0,0.0) ← start and end positions
destination = (500,430)
player_image = 'head.jpg'
pygame.init()

screen = pygame.display.set_mode((640, 640), 0, 32)
pygame.display.set_caption("Animate X!")

mouse_cursor = pygame.image.load(player_image).convert_alpha()
clock = pygame.time.Clock()

speed = 300.0 # pixels per second
heading = Vector.vector_from_points(mpos, destination)
heading.normalize() ← calculate the vector and normalize it

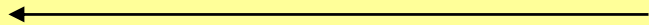
...
```

# Diagonal movement using vectors 3



...

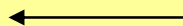
`while True:`



within the event loop ...

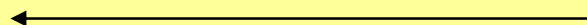
```
for event in pygame.event.get():
    if event.type == QUIT:
        exit()
screen.fill((255,255,255))
```

```
time_passed = clock.tick() / 1000.0
moved_distance = time_passed * speed
```



... the distance is calculated as usual

```
screen.blit(mouse_cursor,mpos)
mpos= (mpos[0]+heading.x * moved_distance,mpos[1] + heading.y *
moved_distance)
pygame.display.update()
```

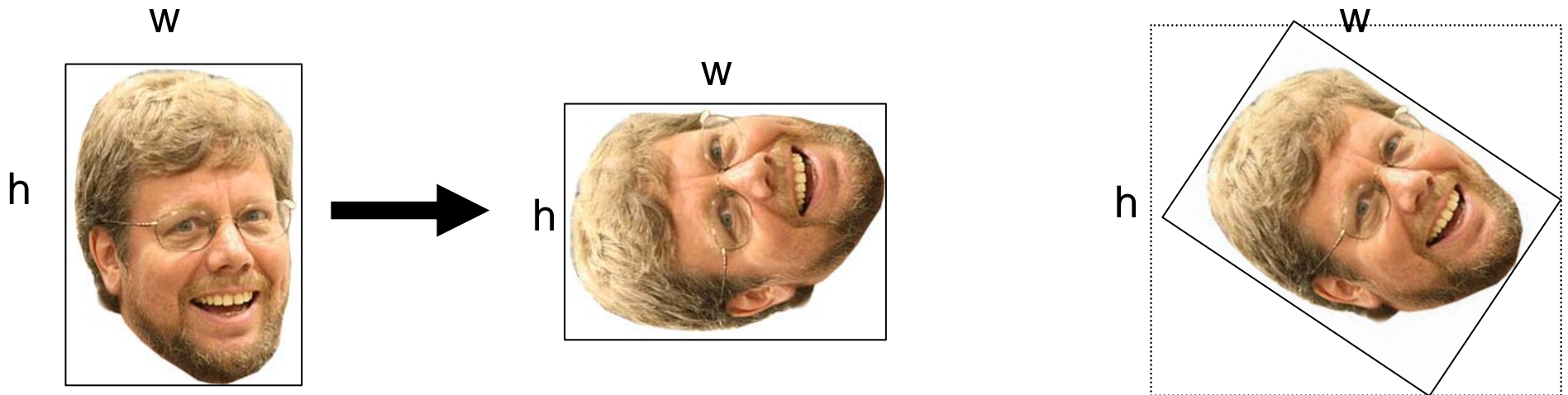


new position is based on the normalized vector

# Rotating Surfaces

- Use `pygame.transform.rotate(surface,angle)` to rotate a surface (counterclockwise)
- Returns a new Surface Object
- **Attention:** the new Surface can have different width and height than the original

```
rotated_surface = pygame.transform.rotate(old_surface,90)
```



# Useful Links

- Pygame API !!!!

<http://www.pygame.org/ctypes/pygame-api/>