

CS 161 Workshop – Oct 18-20

Animation

Animation is the illusion of motion created by a rapid series of still images. In this workshop we will explore algorithms for simple motion, and how motion can be used to express the intentions and emotional state of animated characters.

Part 1: Creating the Illusion of Motion

For the following exercise, consider a graphical display that is 600 units wide and 400 units tall. The coordinate (0,0) is the lower left hand corner (as in ordinary geometry). Such a display can be created by the following Python commands:

```
from graphics import *
w = GraphWin('animation', 601, 401)
w.setCoords(0.0,0.0,600.0,400.0)
```

The setCoords method changes the (0,0) position to the lower left corner, and makes (600,400) the upper right corner. (We will learn more about setCoords in class on Monday 10/19.)

We can create a blue circle in the center of the window using the commands:

```
c = Circle(Point(300,200), 20)
c.setFill('blue')
c.draw(w)
```

We can animate the circle moving right by repeatedly moving it a one unit to the right:

```
for x in range(100):
    c.move(1,0)
```

Each time the move method is called, the circle is erased and then redrawn at a different position. The speed of the animation can be controlled by introducing a variable “speed”, the number of units to move for each cycle of the loop. For example, this will make the circle move twice as fast:

```
speed = 2.0
for x in range(100):
    c.move(speed,0)
```

It also works to make speed less than 1 in order to move slowly – the graphics library handles fractional coordinates properly. So this makes the circle move half as fast:

```
speed = 0.5
for x in range(100):
    c.move(speed, 0)
```

Problem 1: Write a program that makes the circle move in a square pattern – right, up, left, down – where each side of the square is 50 units.

In the workshop last week, we determined that an object could be moved at an angle A (where angles are measured counter-clockwise, with 0 pointing horizontally to the right) by K units by using the method

```
move(k*cosine(A), k*sine(A))
```

The math library functions cosine and sine take angles measured in radians as input. The library function radians(D) converts D degrees to radians. Once we have imported the math library with the command

```
from math import *
```

we can animate the circle moving at a given speed for 100 units at an angle of D degrees using the code:

```
for x in range(100):
    c.move(speed*cosine(radians(D)), speed*sine(radians(D)))
```

Suppose the animated circle “hits” a vertical wall. We would like it to appear to bounce off, changing its direction in a realistic manner. In a bounce (where gravity is ignored), the angle of incident equals the angle of reflection.

Problem 2: Suppose you are animating a ball moving at an angle of D degrees. How can you detect whether the ball is hitting a wall represented by a vertical line, whose upper point is $P1$ and whose lower point is $P2$? If the ball does hit the wall, how should its angle of motion D be changed?

Problem 3: Describe in English the basic algorithm for animating a ball bouncing around inside a box. Have you played or seen a video game that includes such an animation?

Part II: The Affect of Animation

Consider the following qualities that might be used to describe a motion:

speed: fast / moderate / slow

direction: up / down / horizontal / diagonal

path: straight / curved / angular

repetition: one time / several times / many repetitions

motion relative to another object: towards / away / parallel / unrelated

position relation to another object: above / below / besides

Animated motion can be used to express emotion and relationships. In a group discussion, fill out the following table with the motion qualities that you feel best correspond with the specific emotion or relationship. Any workshop members who have trained as dancers should be encouraged to describe what they have been taught about expression and motion. Feel free to add additional motion qualities to the list above.

Joy

Sadness

Curiosity

Boredom

Anger

Fear

Love

Cooperation

Conflict