

Sphero R2D2

Swift Playground

Command Reference

Roll

```
roll(heading: Int, speed: Int)
```

heading: 0 - 360

speed: 80 - 255

Dependencies:

Requires wait() followed by stopRoll() as subsequent commands

```
wait(for: Double)
```

```
stopRoll() // stops roll action
```

Stance

```
setStance(R2D2Stance. [bipod | tripod | waddle | stop ])
```

Dependencies:

requires wait(for: 3) as next command after R2D2Stance.waddle.

```
wait(for: 3.0)
```

Sound

```
playSound(sound: R2D2Sound. [happy | cautious | excited | hello | joyful  
| sad | scan | scared | talking])
```

Dome

```
setDomePosition(angle: Int)
```

angle: -100 - 100

Dependencies:

requires „wait(for: Int)“ command as next command

```
wait(for: Double)
```

Lights

```
setFrontPSILed(color: FrontPSIColor. [black | blue | red])
```

```
setBackPSILed(color: BackPSIColor. [black | green | yellow])
```

```
setHoloProjectorLed(brightness: Int)
```

```
setLogicDisplayLeds(brightness: Int)
```

brigntness: 0 - 255

Wait

```
wait(for: Int)
```

for: 0 - 255

Preface

Limiting your creativity

Swift Playgrounds sometimes limits you to a subset of the possible solutions to a problem. It can happen that you are able to program syntactically correct answer but R2D2 just shakes it's head and makes a beeping noise. Your solution in a formal way might be correct but the person who programmed the playground limited your freedom for writing the code you want.

For example on Page 3 - Head Swivel this would be formally correct code but it fails as the developer requested you to set the angle to -100 or 100 degrees - and nothing else. Always keep in mind that even if your code is correct it might not be what the playground expects.

```
setDomePosition(angle: -100)
wait(for: 1.0)
setDomePosition(angle: 100)
wait(for: 1.0)
setDomePosition(angle: 0)
play(sound:R2D2Sound.cautious)
```

Paste the same code on a different page and R2D2 will swivel it's dome in any angle you specify.

This is not because of a bad programmer or a bug, but to make you stick to the task and limit distraction.

R2D2 Playground exercises

Page 2: Roll

In this lecture you are tasked with driving R2D2 along a course.

To fulfill this task you'll need the following commands, which are described in detail above in the command reference:

- setStance()
- roll()
- wait
- play()

Here are some examples of how to concour the task. From a basic linear approach to a solution that uses a array of structs that describe the path that R2D2 will drive along.

2.1 Basic version

```
func escape() {
    setStance(R2D2Stance.tripod)
    roll(heading: 0, speed:80)
    wait(for: 1.0)
    stopRoll()
    play(sound: R2D2Sound.happy)
}
```

Explanation

This code snippet lets R2D2 drive for one second on a straight line. At the beginning he sets the stance and polls it in after he arrived. Then he plays a happy sound.

Task

Play along with the values of R2D2Stance, heading, speed, for and R2D2Sound in order to understand the basics of what R2D2 is capable of.

2.2 Using an array for patrolling in a square

```
func escape() {
    let angle = [0, 90, 180, 270]
    setStance(R2D2Stance.tripod )
    for a in angle {
        roll(heading: a, speed:80)
        wait(for: 1)
    }
    stopRoll()
    play(sound: R2D2Sound.happy)
}
```

Explanation

This code snippet lets R2D2 drive along a path that is defined by an array which contains the heading values. In a for loop the value for heading is read from the array.

Task

Play along with the angle array. Find other values for the angle array. Add more values to the array.

2.3 Using arrays for angle and speed

```
func escape() {
    let angle = [0, 90, 180, 270]
    let speed = [80, 100, 120, 140]
```

```

    setStance(R2D2Stance.tripod )
    for i in 0 ... 3 {
        roll(heading: angle[i], speed: speed[i])
        wait(for: 2.0)
    }
    stopRoll()
    play(sound: R2D2Sound.happy)
}

```

Good to know:

Arrays always start at index 0.

Explanation

This code snippet lets R2D2 drive along a path that is defined by an array which contains the heading values. The corresponding speed is defined in a second array named speed. In a for loop the values for heading and speed are read from the arrays.

Task

Play along with the angle and speed arrays. Find other values for the angle and speed array. Add more values to the arrays.

Quiz

- What happens, if you add more values to the angle array but not to the speed array?
- How could you prevent this? *
- Which other value do you have to change if you add more values to the arrays - why?

*compare angle.count to speed.count and loop to the smaller value

2.4 Using a two dimensional array for angle and speed

```

func escape() {
    let angle = 0
    let speed = 1
    var way = [[0,80], [90,100], [180,120], [270,140], [45,255]]
    setStance(R2D2Stance.tripod )
    for waypoint in way {
        roll(heading: waypoint[angle], speed: waypoint[speed])
        wait(for: 2.0)
    }
    stopRoll()
    play(sound: R2D2Sound.happy)
}

```

Explanation

This code snippet lets R2D2 drive along a path that is defined by an 2-dimensional array which contains the heading and speed values. The constants angle and speed are indexes into the array. This gives us better readability of the code. In a for loop the values for heading and speed are read from the array.

Task

Play along with the angle array. Find other values for the angle array. Add more values to the array.

Quiz

- What is the advantage of the 2-dimensional array?*

*Heading and speed are defined in pairs as required.

2.5 Using a function to initialize the two dimensional array

```
func makeWay(numberOfWayPoints: Int) -> [[Int]] {
    let angle = 0
    let speed = 1
    var way = Array(repeating: Array(repeating: 0, count: 2), count:
numberOfWayPoints)
    var angleValue = 0
    var speedValue = 80
    for i in 0 ... numberOfWayPoints-1 {
        way[i][angle] = angleValue
        way[i][speed] = speedValue
        angleValue += Int(360/numberOfWayPoints)
        speedValue += Int(175/numberOfWayPoints)
    }
    return way
}

func escape() {
    let angle = 0
    let speed = 1
    var way = makeWay(numberOfWayPoints: 6)

    setStance(R2D2Stance.tripod )
    for waypoint in way {
        roll(heading: waypoint[angle], speed: waypoint[speed])
        wait(for: 1.0)
    }
    stopRoll()
    play(sound: R2D2Sound.happy)
}
```

Explanation

Here we use a function to create and initialize the 2-dimensional array. When the array way is created, it is initialized with zeros.

The variable angleValue is calculated as a fraction of a full circle (360°). The variable speedValue is calculated as a fraction of (maximum speed - minimum speed) with an offset of minimum speed.

With this we always do a full circle in our movement and we give R2D2 linear acceleration.

This time we loop over the array using an index variable i.

Task

Find other ways to fill the array distributing angle and acceleration differently.

Rewrite the code in a way it doesn't need i as an index variable.

Quiz

- Do you have to initialize the array immediately when the var is defined? *
- Why is using an index variable like i error prone?**

*???

** An Arrays index always starts at 0. Thus i will be out of bounds if you forget to subtract 1 from the number of elements in the array calculating the upper bound.

2.6 Using an array of struct

```

struct leg {
    var angle: Int
    var speed: Int
    var wait: Double
}

func makeWay(numberOfWayPoints: Int) -> [leg] {
    var way = [leg]()
    var angleValue = 0
    var speedValue = 80
    var waitValue = 1.0
    var thisLeg = leg(angle: 0, speed: 0, wait: 0.0)

    for i in 0 ... numberOfWayPoints-1 {
        thisLeg.angle = angleValue
        thisLeg.speed = speedValue
        thisLeg.wait = round((waitValue + (Double(i)/
            Double(numberOfWayPoints)) * 10) / 10)
        angleValue += Int(360/numberOfWayPoints)
        speedValue += Int(175/numberOfWayPoints)
        way.append(thisLeg)
    }
    return way
}

func escape() {
    var way = makeWay(numberOfWayPoints: 6)

    setStance(R2D2Stance.tripod )
    for waypoint in way {
        roll(heading: waypoint.angle, speed: waypoint.speed)
        wait(for: waypoint.wait)
    }
    stopRoll()
    play(sound: R2D2Sound.happy)
}

```

Explanation

Now we use an array of struct to describe R2D2s way. Doing so we could predefine a quite complex way R2D2 can go to get to the escape pod. Each part of the way is named a leg, like in a relay. For each leg we can now predefine not only angle and speed but also the distance to travel (which is defined by the wait time).

Task

Preinitialize the array way with zero values for numberOfWayPoints at declaration.

Quiz

Describe how thisLeg.wait is calculated. What could be the idea behind this?

Wouldn't it be more memory efficient to declare leg.wait as Float instead of Double - discuss this.

Page 3 - HeadSwivel

Actually there is not much to do in this lesson. It teaches you to set the dome position and that you have to wait for some amount of time before you can turn the dome to the opposite direction.

To fulfill this task you'll need the following commands, which are described in detail above in the command reference:

- `setDomePosition()`
- `wait`
- `play()`

3.1 Basic Version

```
setDomePosition(angle: -100)
wait(for: 1.0)
setDomePosition(angle: 100)
wait(for: 1.0)
play(sound:R2D2Sound.cautious)
```

3.2 Swivel Dome with increasing angle

As written in the preface this code can't be executed on page 3, as this playground page limits you to the angles of -100 or 100 respectively. But you can run this code by copying it to let's say page 4.

```
var angle = 10
while (angle <= 100) {
    setDomePosition(angle: -angle)
    wait(for: 1.0)
    setDomePosition(angle: angle)
    wait(for: 1.0)
    angle += 10
}
```

Explanation

Here we use a while loop to iterate through values from 10 to 100 for the angle.

Task

- Make R2D2 swivel the dome for different angles on either side e.g 100°, 90°, 80°, ... on the right and 10°, 20°, 30°, ... on the left.
- Make R2D2 swivel the dome first on the right side in steps of 10° and repeat that on the left side.

Quiz

How far can R2D2 turn it's dome - try it out?

What happens if you commit the `wait()` command?