Creating Immersive Apps with Core Motion

Session 704

John Blackwell, Core Motion Engineer
Ahmad Bleik, Core Motion Engineer

Overview

Authorization

Historical Accelerometer

DeviceMotion

Badger with Attitude

Overview

Authorization

Historical Accelerometer

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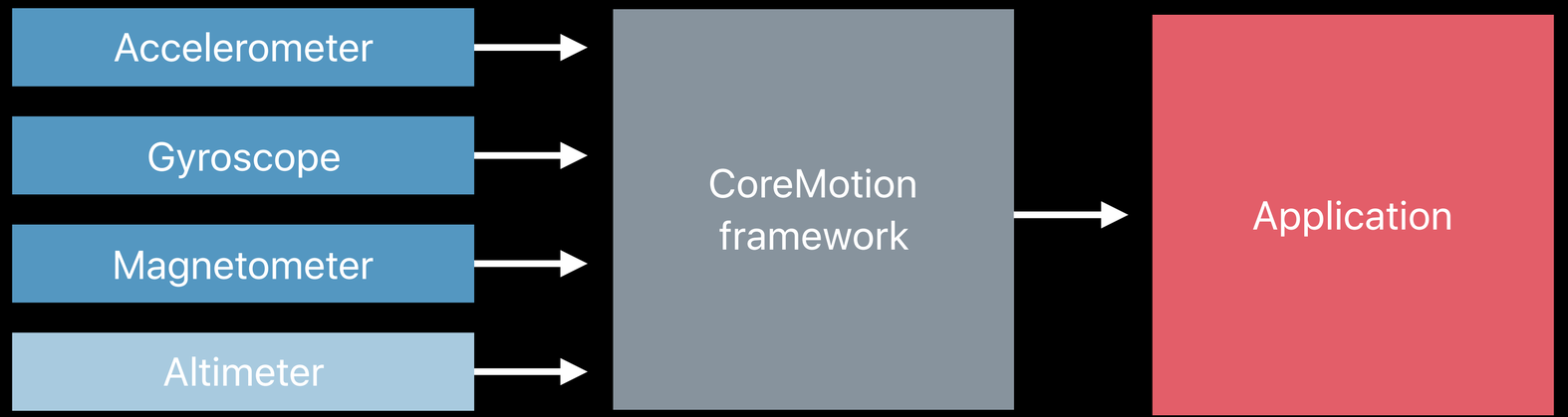
Badger with Attitude

Core Motion

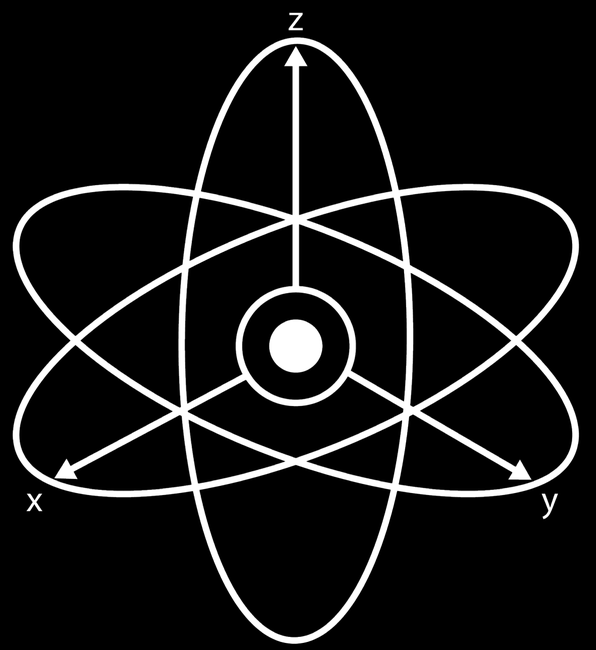
At a glance



Motion Interfaces

Motion Interfaces

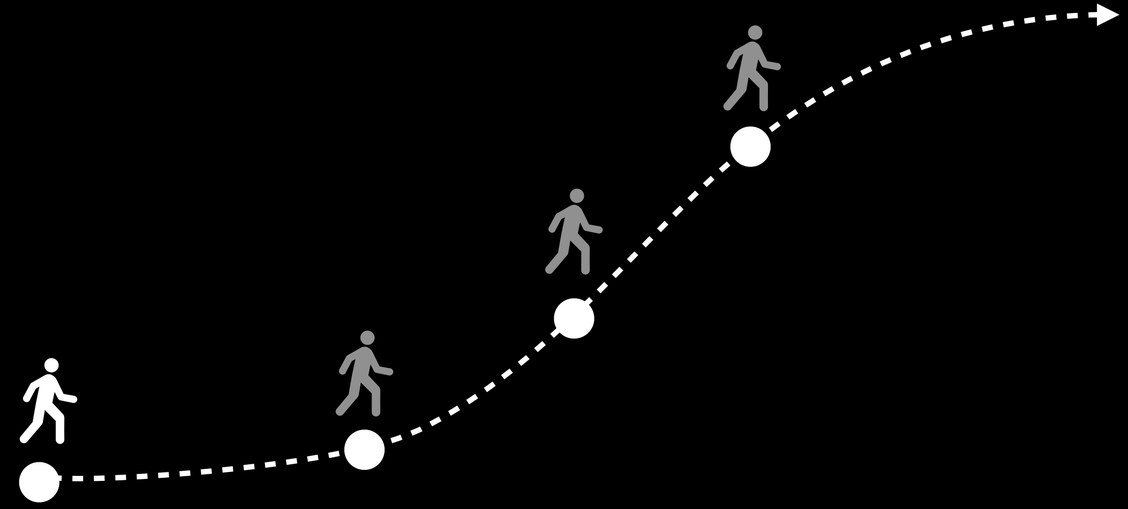
CMMotionManager



Motion Interfaces

CMMotionManager

CMAltimeter

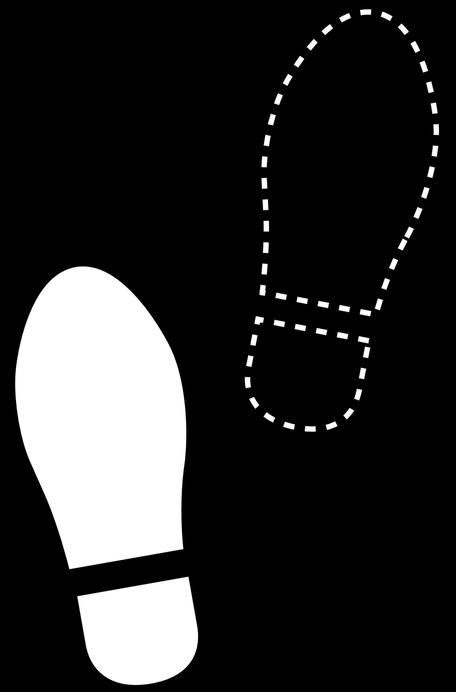


Motion Interfaces

CMMotionManager

CMAltimeter

CMPedometer



Motion Interfaces

CMMotionManager

CMAltimeter

CMPedometer

CMMotionActivityManager

Motion Interfaces

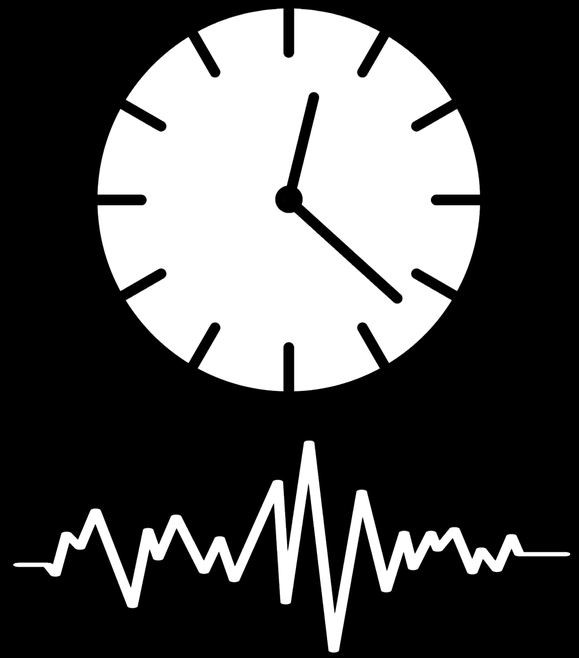
CMMotionManager

CMAltimeter

CMPedometer

CMMotionActivityManager

CMSensorRecorder



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Sensitive Interfaces

CMAltimeter

CMPedometer

CMMotionActivityManager

CMSensorRecorder

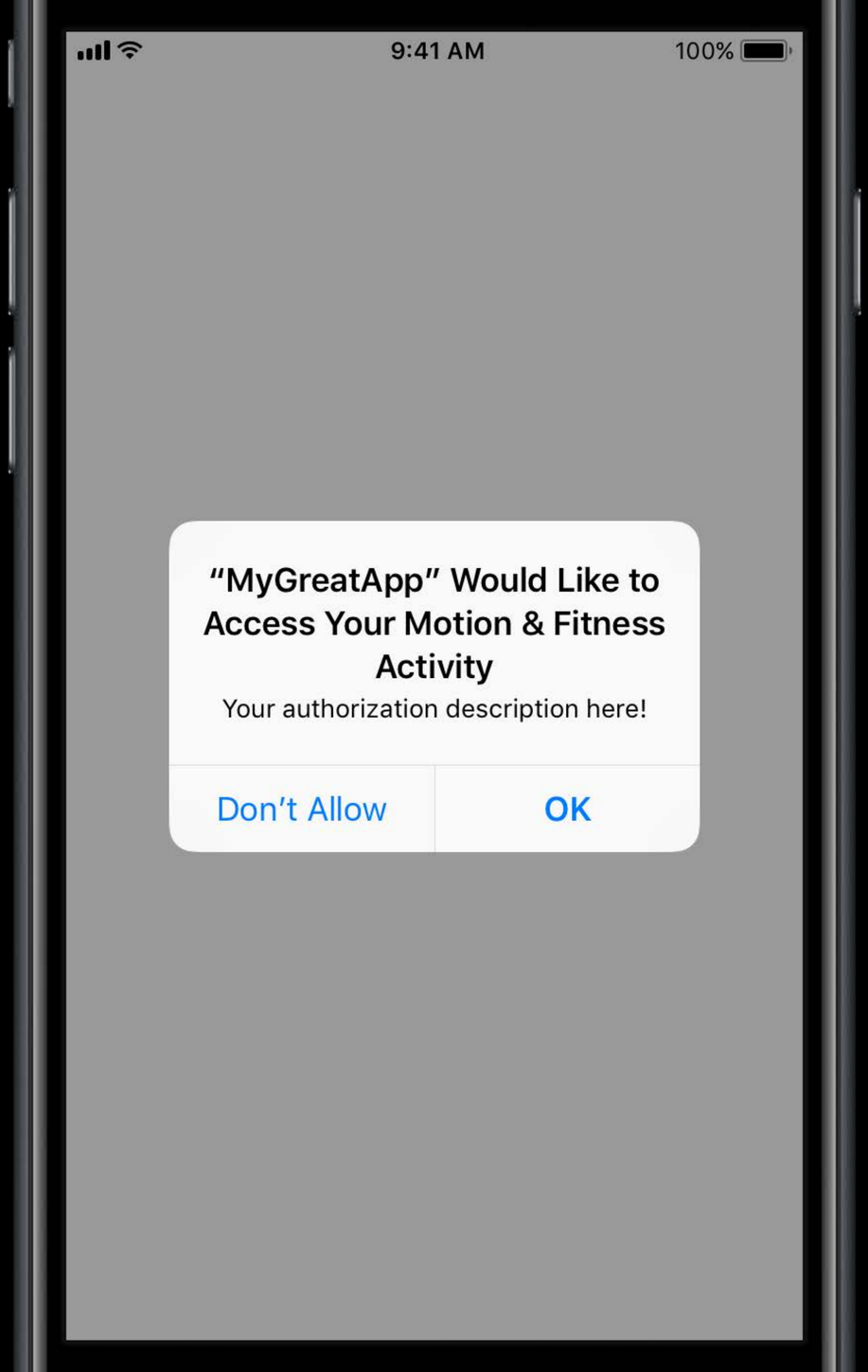
Authorization

Sensitive API causes prompt

Authorization

Sensitive API causes prompt

Appears only once


9:41 AM
100%
“MyGreatApp” Would Like to Access Your Motion & Fitness Activity
Your authorization description here!
Don’t Allow
OK

```
// Authorization Check
let pedometer = CMPedometer()
let now = Date()

pedometer.queryPedometerData(from:now, to:now) { (data, error) in
    if let code = error?._code {
        if code == CMErrorMotionActivityNotAuthorized.rawValue {
            // Ask the user for authorization!
        }
    }
}
```

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        }
    }
}
```

Authorization Status

NEW

```
// CMAltimeter, CMPedometer, CMMotionActivityManager, CMSensorRecorder

@available(iOS 11.0, *)
@available(watchOS 4.0, *)
open class func authorizationStatus() -> CMAuthorizationStatus
```

Authorization Status

NEW

```
@available(iOS 11.0, *)
@available(watchOS 4.0, *)
public enum CMAuthorizationStatus : Int {
    case notDetermined
    case restricted
    case denied
    case authorized
}
```

```
// Authorization Check


// Best Practice: Check availability first!
if CMPedometer.isStepCountingAvailable() {

    switch CMPedometer.authorizationStatus() {
        case .notDetermined: // Handle state before user prompt
            break
        case .restricted: // Handle system-wide restriction
            break
        case .denied: // Handle user denied state
            break
        case .authorized: // Ready to go!
            break
    }
}
```

// Authorization Check

```
// Best Practice: Check availability first!
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}
```

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Authorization

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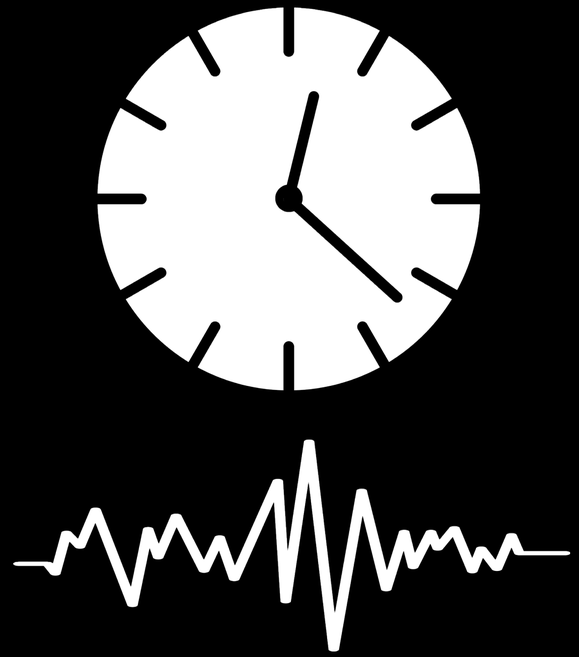
Historical Accelerometer

CMSensorRecorder

Records 50Hz accelerometer in the background

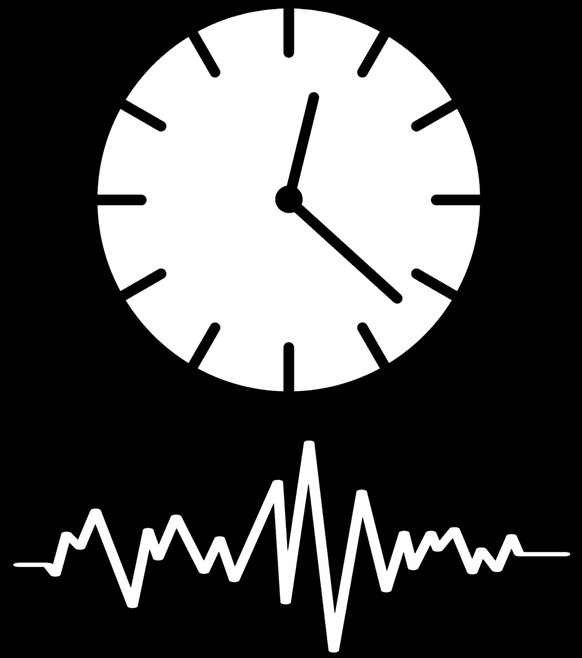


Historical Accelerometer

CMSensorRecorder

Records 50Hz accelerometer in the background

Request up to 36 hours



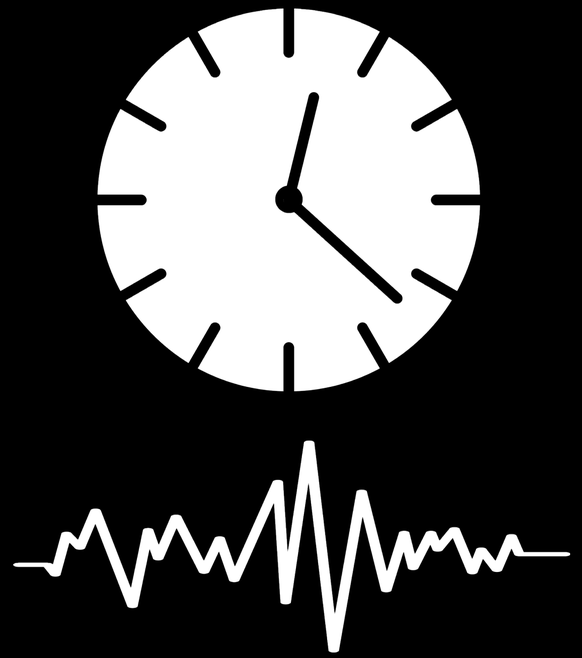
Historical Accelerometer

CMSensorRecorder

Records 50Hz accelerometer in the background

Request up to 36 hours

Stored for up to three days



Historical Accelerometer

Availability

	Available
Apple Watch	
Apple Watch Series 1	
Apple Watch Series 2	

Historical Accelerometer

Availability

	Available
Apple Watch	
Apple Watch Series 1	
Apple Watch Series 2	
iPhone 7 and 7 Plus (on iOS 11)	

App Inspiration

Automotive Performance Tracker

App Inspiration

Automotive Performance Tracker

Use Motion Activity for automotive periods

App Inspiration

Automotive Performance Tracker

Use Motion Activity for automotive periods

Automotive detection improved in iOS 11

App Inspiration

Automotive Performance Tracker

Use Motion Activity for automotive periods

Automotive detection improved in iOS 11

Use Sensor Recorder for performance data

App Inspiration

Automotive Performance Tracker

Use Motion Activity for automotive periods

Automotive detection improved in iOS 11

Use Sensor Recorder for performance data

Low-power, all-day experience

Historical Accelerometer

Best practices

Choose the minimum duration

Historical Accelerometer

Best practices

Choose the minimum duration

Decimate if possible

Overview

Authorization

Historical Accelerometer

DeviceMotion

Badger with Attitude

Sensors

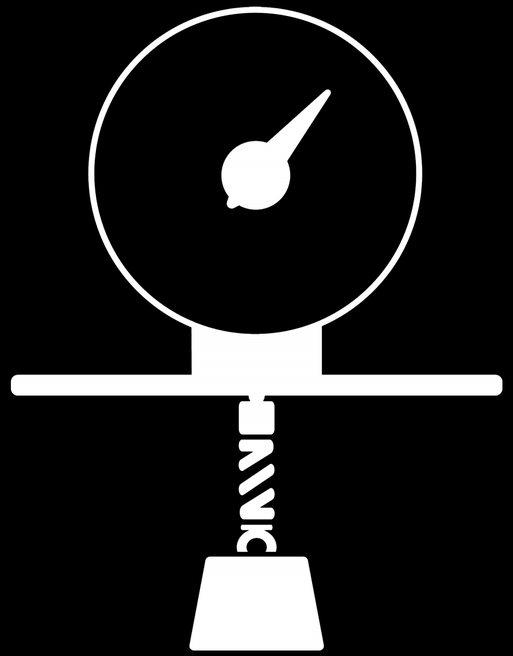
What goes into DeviceMotion?

Sensors

What goes into DeviceMotion?

Accelerometer

- Acceleration from user and gravity



Sensors

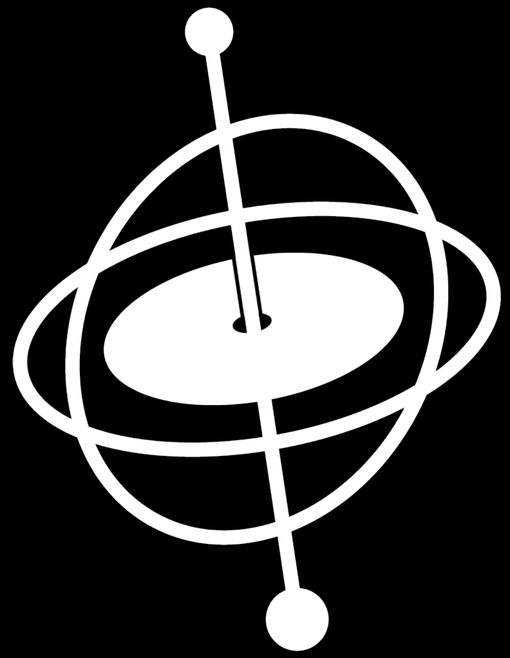
What goes into DeviceMotion?

Accelerometer

- Acceleration from user and gravity

Gyroscope

- Rotation rate



Sensors

What goes into DeviceMotion?

Accelerometer

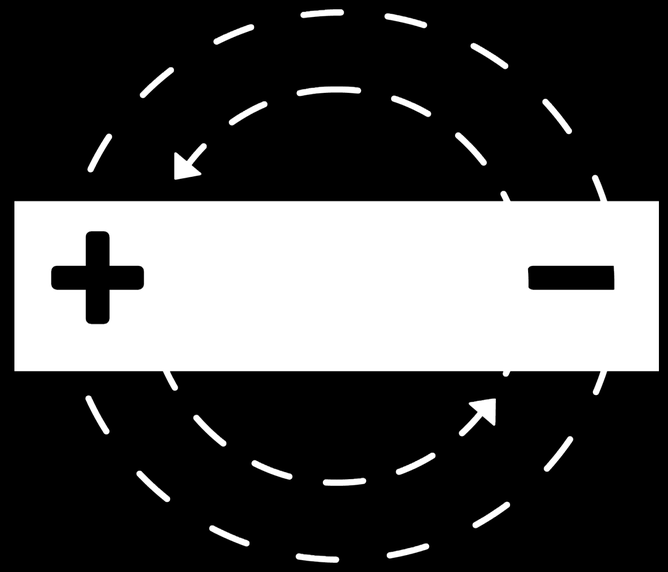
- Acceleration from user and gravity

Gyroscope

- Rotation rate

Magnetometer

- Local fields and Earth’s field



Sensors

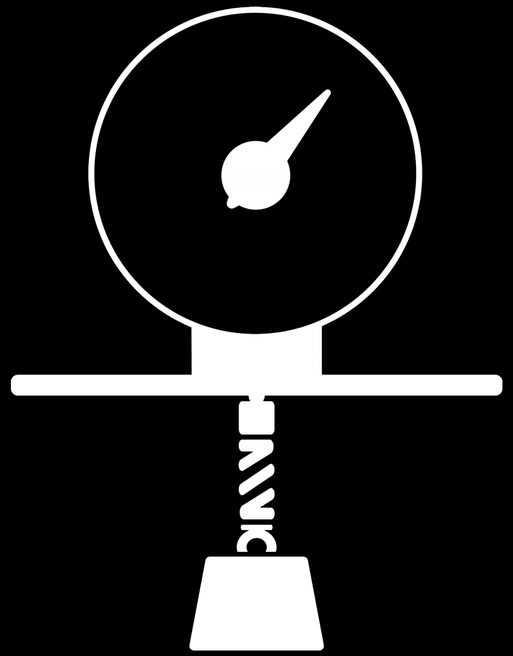
Challenges

Sensors

Challenges

Accelerometer

- Distinguishing user vs. gravity



Sensors

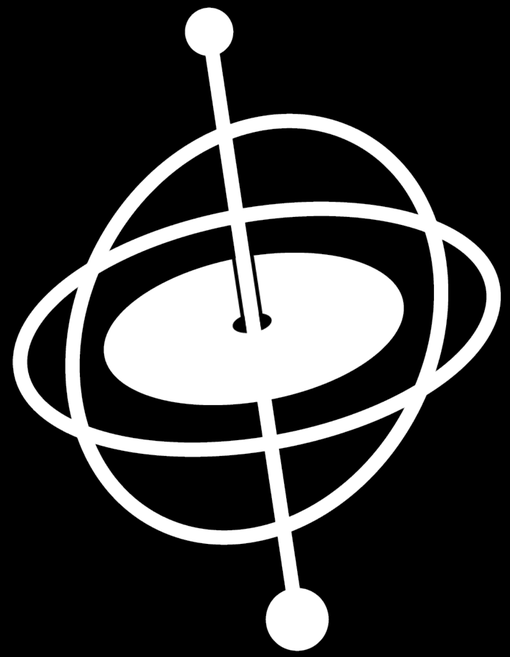
Challenges

Accelerometer

- Distinguishing user vs. gravity

Gyroscope

- Bias over time



Sensors

Challenges

Accelerometer

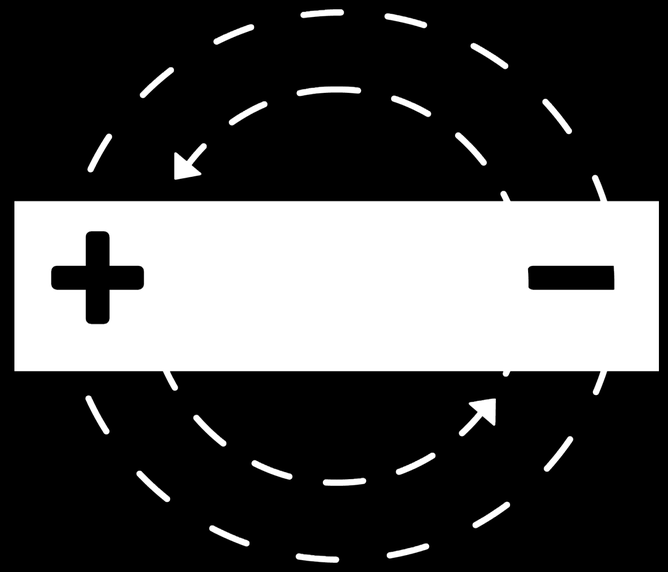
- Distinguishing user vs. gravity

Gyroscope

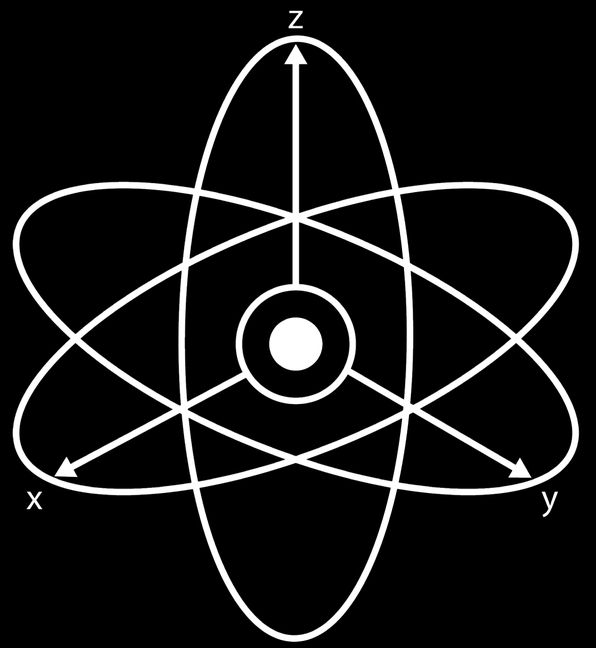
- Bias over time

Magnetometer

- Distinguishing local vs. Earth

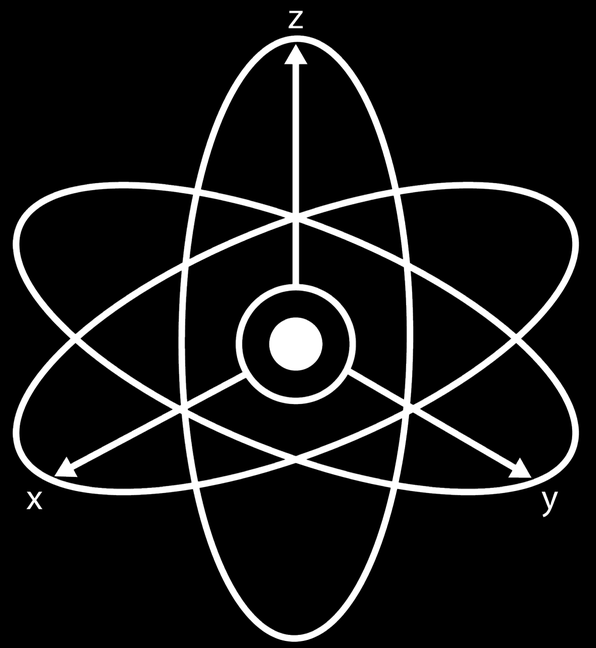


DeviceMotion



DeviceMotion

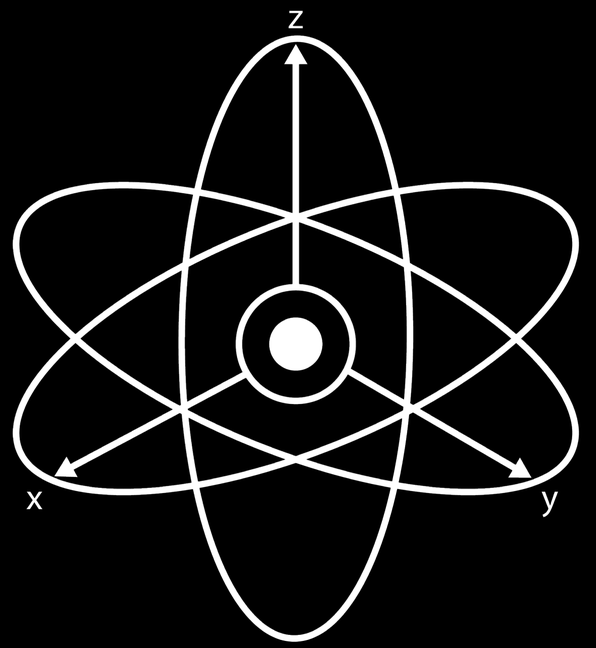
3D attitude during motion



DeviceMotion

3D attitude during motion

Fuses accelerometer, gyroscope, and magnetometer

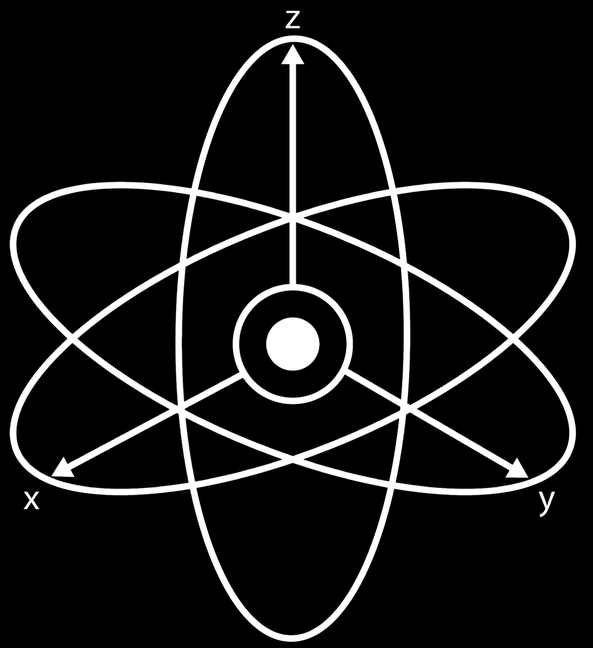


DeviceMotion

3D attitude during motion

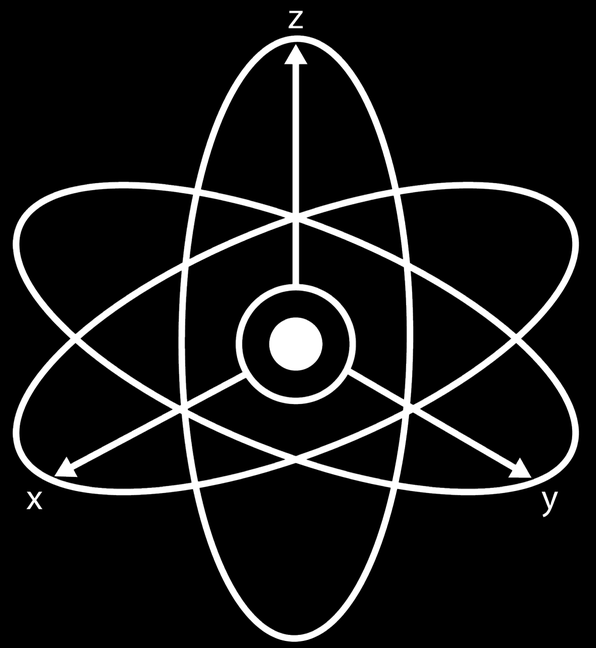
Fuses accelerometer, gyroscope, and magnetometer

Allows you to focus on the app



DeviceMotion

More references



What’s New in Core Motion	WWDC 2011
Understanding Core Motion	WWDC 2012
Health And Fitness With Core Motion	WWDC 2016

Reference Frames

	Accelerometer and Gyroscope	Magnetometer
xArbitraryZVertical		
xArbitraryCorrectedZVertical		
xMagneticNorthZVertical		
xTrueNorthZVertical		

Reference Frames

	Accelerometer and Gyroscope	Magnetometer
xArbitraryZVertical		
xArbitraryCorrectedZVertical		
xMagneticNorthZVertical		
xTrueNorthZVertical		

Reference Frames

	Accelerometer and Gyroscope	Magnetometer
xArbitraryZVertical		
xArbitraryCorrectedZVertical		
xMagneticNorthZVertical		
xTrueNorthZVertical		


2nd
120 mph

Game Control

Accelerometer

Tilt left and right to steer

Game Control

Accelerometer

Tilt left and right to steer

Game Control

Accelerometer

Tilt left and right to steer

Estimate gravity from accelerometer

Game Control

Accelerometer

Tilt left and right to steer

Estimate gravity from accelerometer

Determine tilt from gravity

Acceleration Ambiguity

Gestures can be ambiguous

Acceleration Ambiguity

Gestures can be ambiguous

Acceleration Ambiguity

Gestures can be ambiguous

Acceleration Ambiguity

Gestures can be ambiguous

Could isolate gravity by averaging

Acceleration Ambiguity

Gestures can be ambiguous

Could isolate gravity by averaging

Filtering affects responsiveness

Acceleration Ambiguity

Gestures can be ambiguous

Could isolate gravity by averaging

Filtering affects responsiveness

DeviceMotion means less filtering

xArbitraryZVertical

Default reference frame

xArbitraryZVertical

Default reference frame

Great for tip and tilt

xArbitraryZVertical

Default reference frame

Great for tip and tilt

Accelerometer and gyroscope fused

xArbitraryZVertical

Default reference frame

Great for tip and tilt

Accelerometer and gyroscope fused

Gravity for tilt

xArbitraryZVertical

Default reference frame

Great for tip and tilt

Accelerometer and gyroscope fused

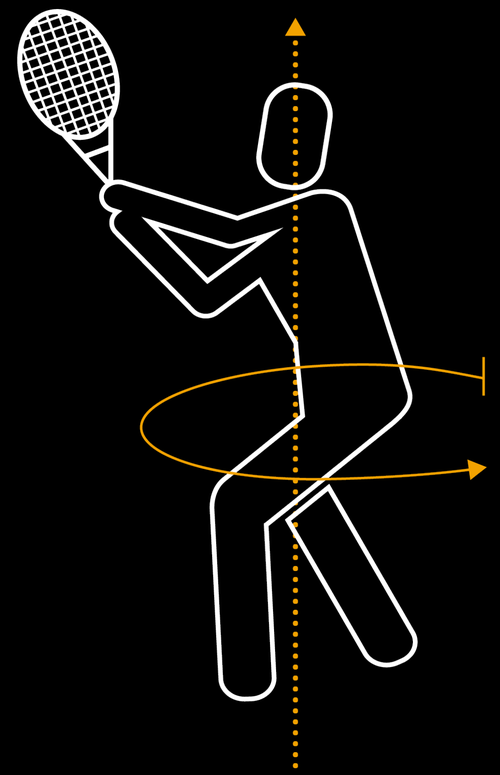
Gravity for tilt

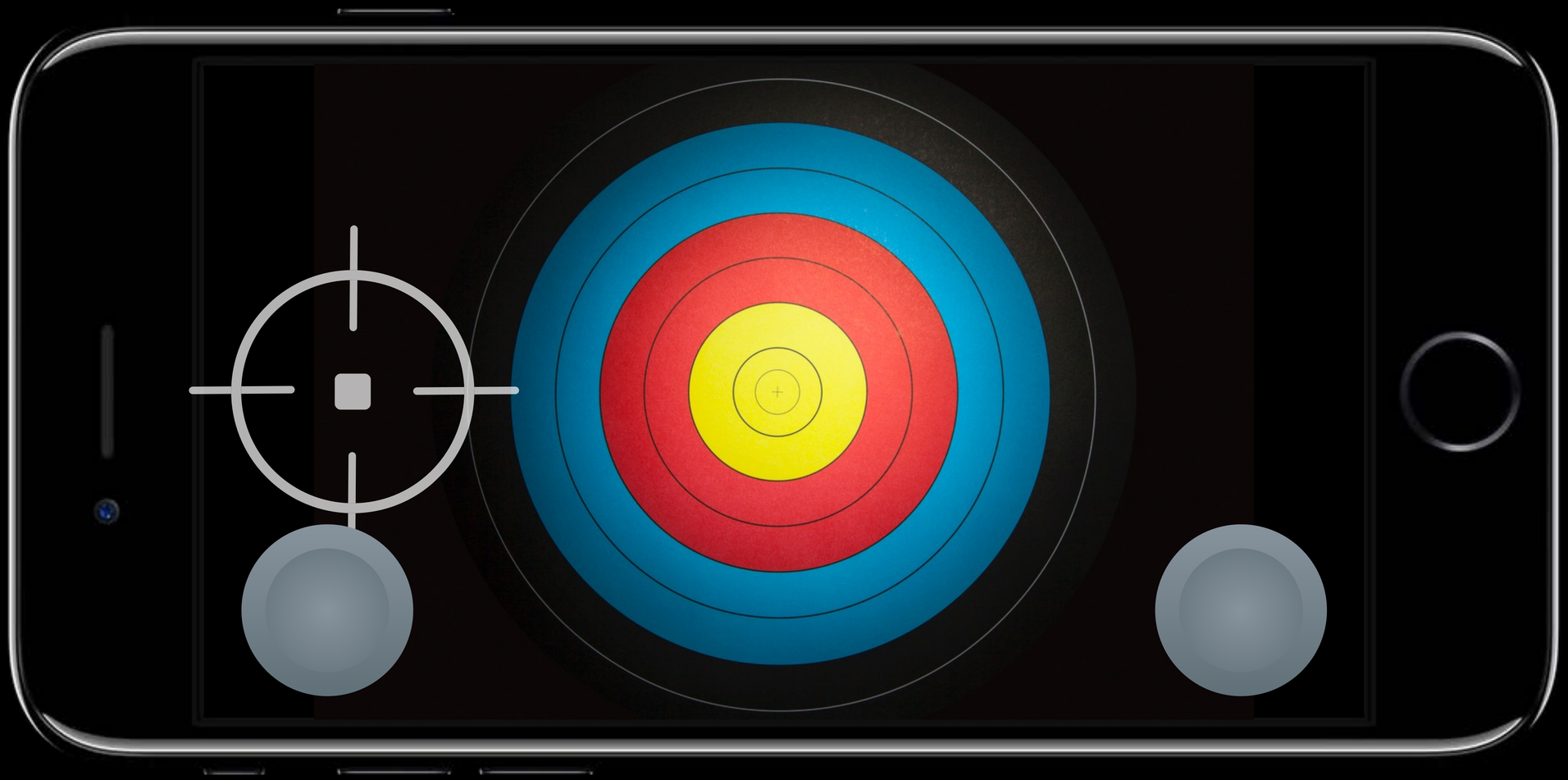
Demo a bit later!

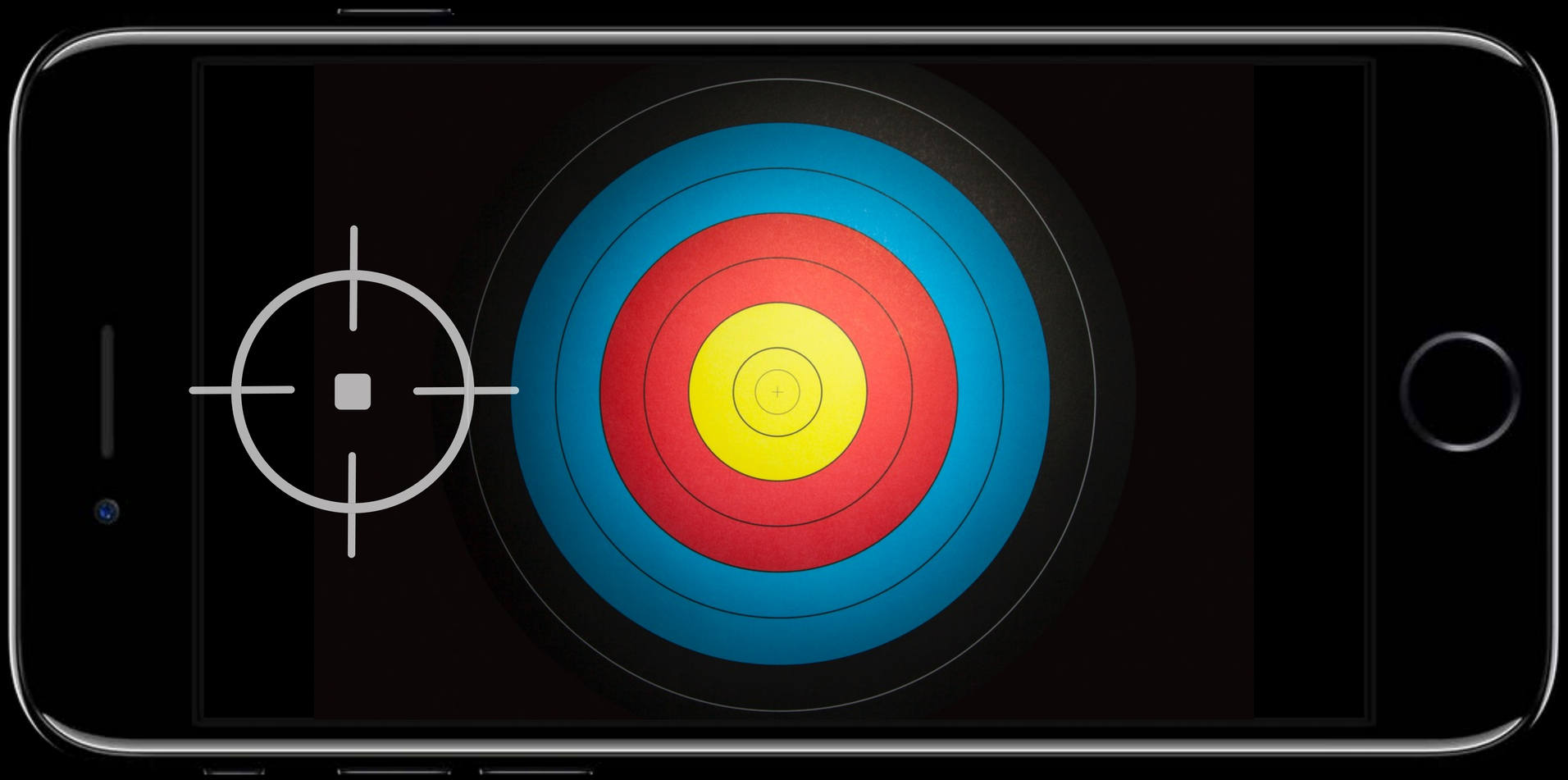
xArbitraryZVertical

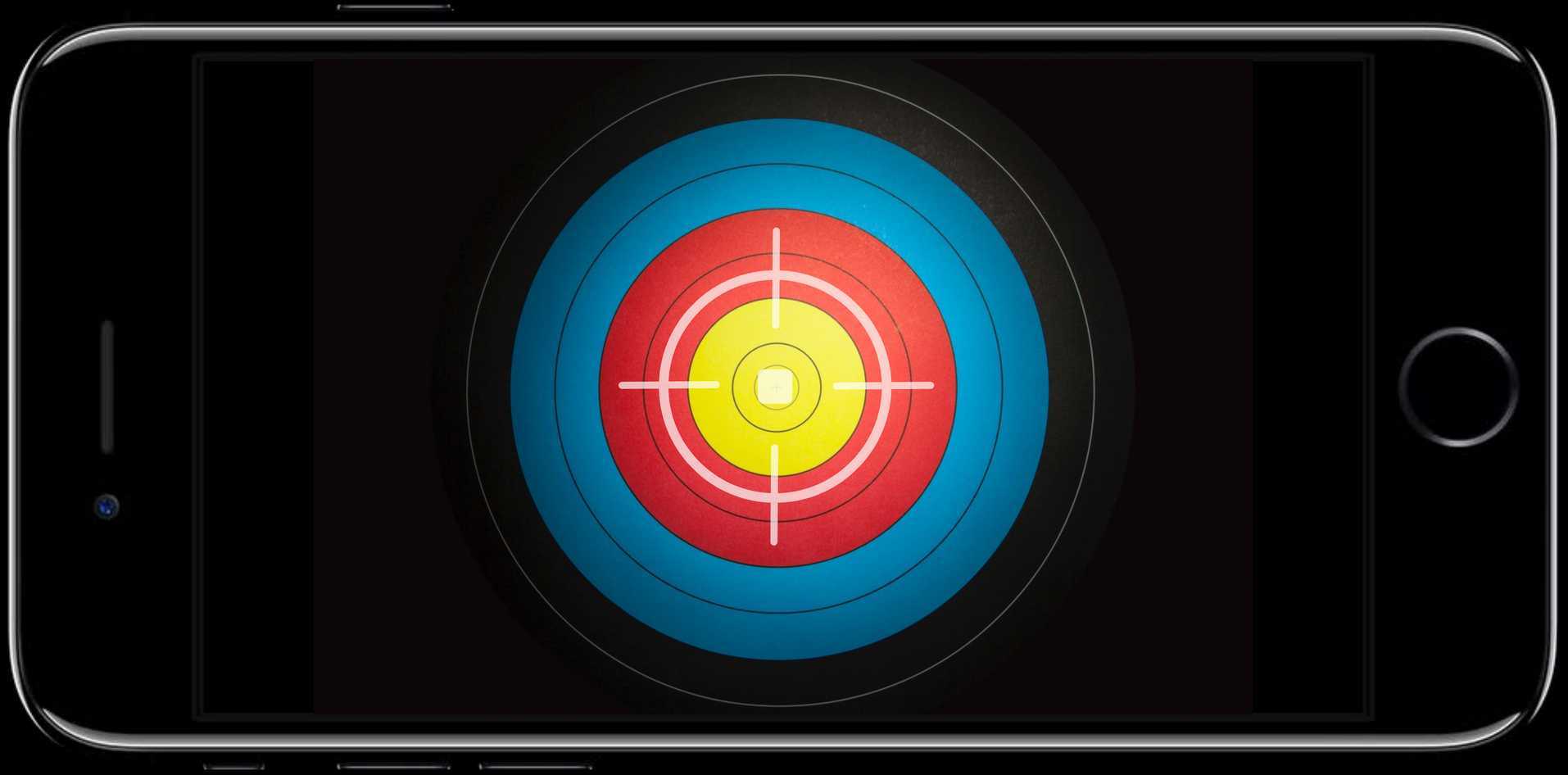
Great for gestures

Check out SwingWatch









Game Control

Attitude for aiming

Game Control

Attitude for aiming

Attitude provides rotation from reference frame

Game Control

Attitude for aiming

Attitude provides rotation from reference frame

Avoid taking integral of raw gyroscope

xArbitraryCorrectedZVertical

Uses magnetometer to improve horizontal attitude

xArbitraryCorrectedZVertical

Uses magnetometer to improve horizontal attitude

Reliable attitude

xArbitraryCorrectedZVertical

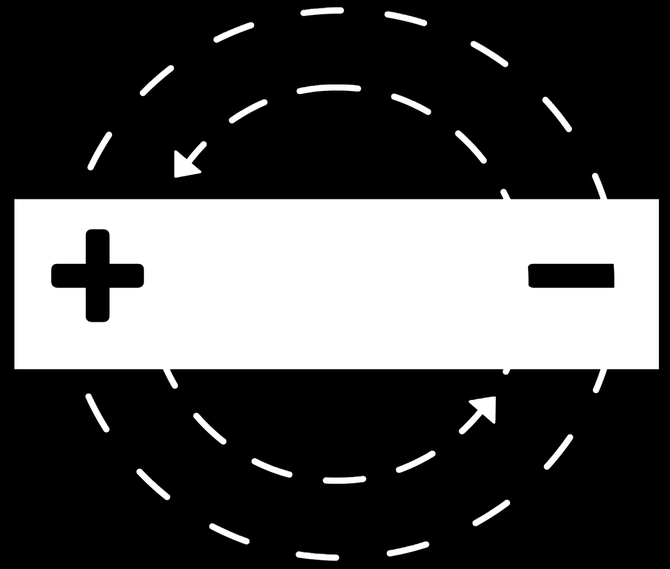
Uses magnetometer to improve horizontal attitude

Reliable attitude

Provides fixed center reference

Magnetometer

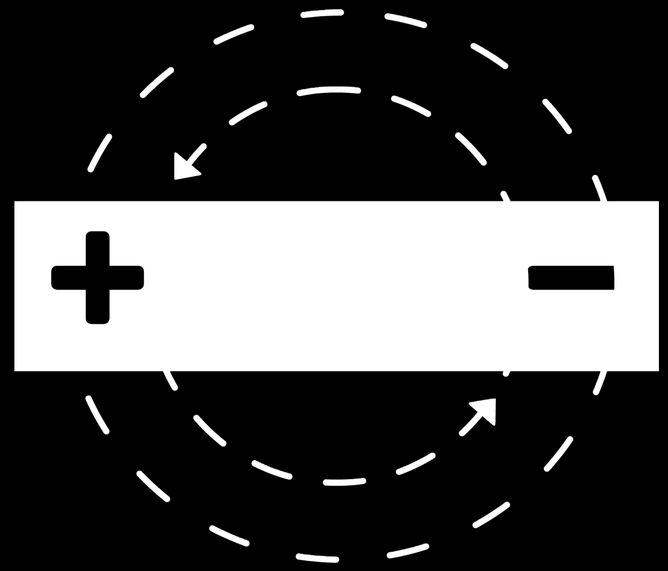
Provides world reference



Magnetometer

Provides world reference

Raw magnetometer susceptible to disturbances

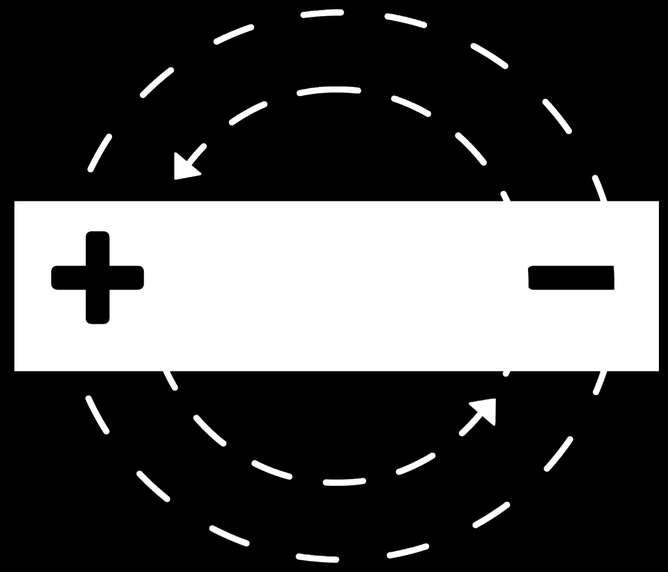


Magnetometer

Provides world reference

Raw magnetometer susceptible to disturbances

- Within the device

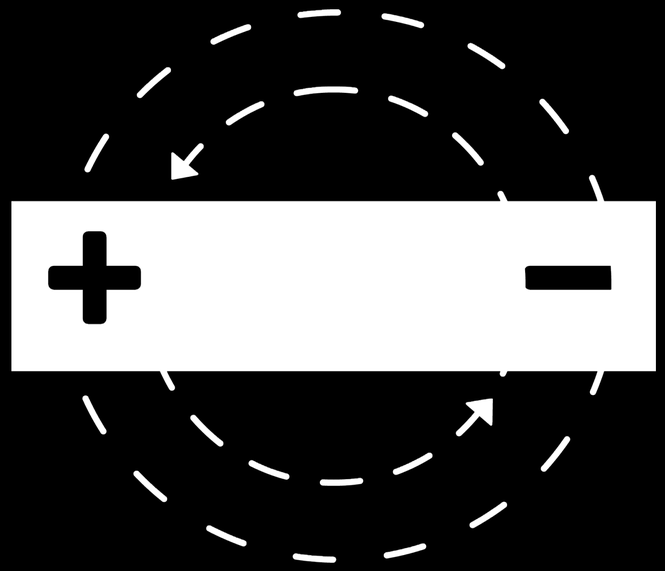


Magnetometer

Provides world reference

Raw magnetometer susceptible to disturbances

- Within the device
- Outside the device



xMagneticNorthZVertical and xTrueNorthZVertical

Orients device to the world

xMagneticNorthZVertical and xTrueNorthZVertical

Orients device to the world

Handles:

- Device level effects

xMagneticNorthZVertical and xTrueNorthZVertical

Orients device to the world

Handles:

- Device level effects
- Challenging magnetometer situations

xMagneticNorthZVertical and xTrueNorthZVertical

Orients device to the world

Handles:

- Device level effects
- Challenging magnetometer situations

Pick frame based on your app needs

App Inspiration

xMagneticNorth and xTrueNorth

App Inspiration

xMagneticNorth and xTrueNorth

Star gazing apps

App Inspiration

xMagneticNorth and xTrueNorth

Star gazing apps

Augmented Reality apps

App Inspiration

xMagneticNorth and xTrueNorth

Star gazing apps

Augmented Reality apps

Check out ARKit

Heading

Direction with respect to north

Heading

Direction with respect to north

Heading

Direction with respect to north

Heading

Direction with respect to north

Could use CoreLocation

Heading

Direction with respect to north

Could use CoreLocation

CoreLocation’s heading can fuse course

Heading

Direction with respect to north

Could use CoreLocation

CoreLocation’s heading can fuse course

Could calculate from attitude

Heading

Direction with respect to north

Could use CoreLocation

CoreLocation’s heading can fuse course

Could calculate from attitude

DeviceMotion now provides heading

Heading

NEW

Fuses accelerometer, gyroscope, and magnetometer

Heading

NEW

Fuses accelerometer, gyroscope, and magnetometer

iOS only

Heading

NEW

Valid for XMagneticNorth, XTrueNorth

```
// CMDeviceMotion

@available(iOS 11.0, *)
open var heading: Double { get }
```

Heading

NEW

Valid for XMagneticNorth, XTrueNorth

0-359 degrees from X axis (North)

```
// CMDeviceMotion

@available(iOS 11.0, *)
open var heading: Double { get }
```

DeviceMotion

Best practices

Check for availability

DeviceMotion

Best practices

Check for availability

```
@available(iOS 5.0, *)
open class func availableAttitudeReferenceFrames() -> CMAttitudeReferenceFrame
```

DeviceMotion

Best practices

Check for availability

Reference frame choice is key

DeviceMotion

Best practices

Check for availability

Reference frame choice is key

- Attitude definition

DeviceMotion

Best practices

Check for availability

Reference frame choice is key

- Attitude definition
- Sensors used

Overview

Authorization

Historical Accelerometer

DeviceMotion

Badger with Attitude

Badger with Attitude

Ahmad Bleik, Core Motion Engineer

Badger

Badger

Badger with Attitude

Badger controls

Getting started with DeviceMotion

Gesture detection

Badger Controls

Swipe gestures

Badger Controls

Swipe gestures

Badger Controls

Swipe gestures

Badger Controls

Swipe gestures

Badger Controls

Motion gestures

Badger Controls

Motion gestures

Badger Controls

Motion gestures

Badger Controls

Motion gestures

Badger Controls

Motion gestures

Badger with Attitude

Badger with Attitude

DeviceMotion

Badger with Attitude

DeviceMotion

- Sensor fusion

Badger with Attitude

DeviceMotion

- Sensor fusion

Query mechanisms

Badger with Attitude

DeviceMotion

- Sensor fusion

Query mechanisms

- Push

Badger with Attitude

DeviceMotion

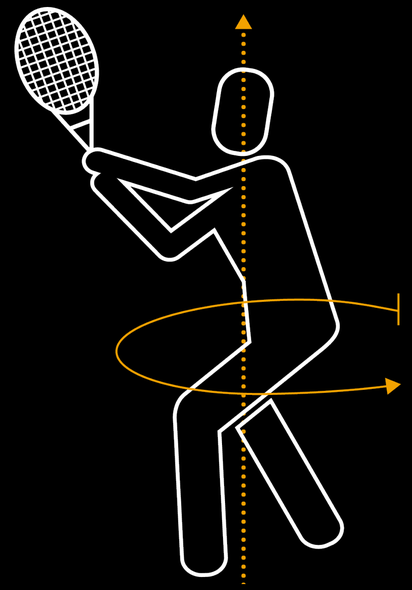
- Sensor fusion

Query mechanisms

- Push
- Pull

DeviceMotion

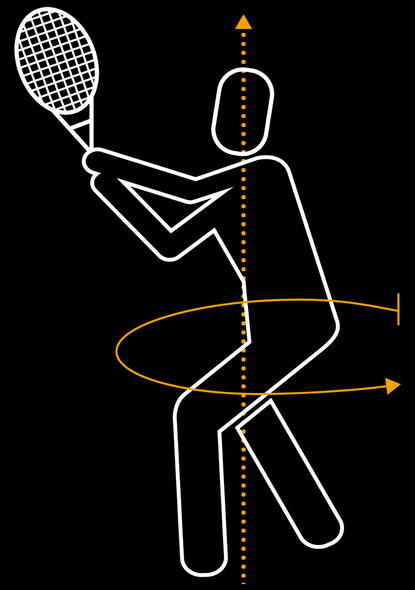
Push



DeviceMotion

Push

Detecting discrete gestures over time

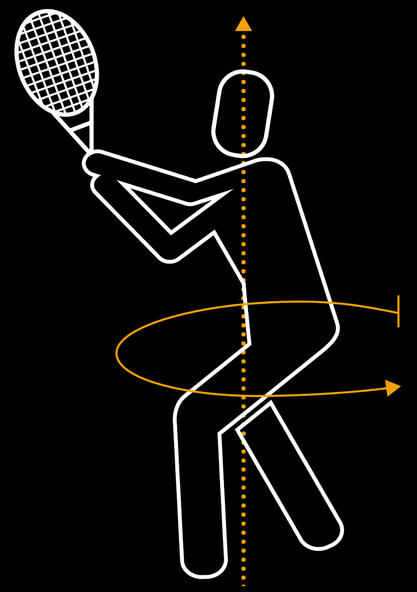


DeviceMotion

Push

Detecting discrete gestures over time

Get data at a fixed interval

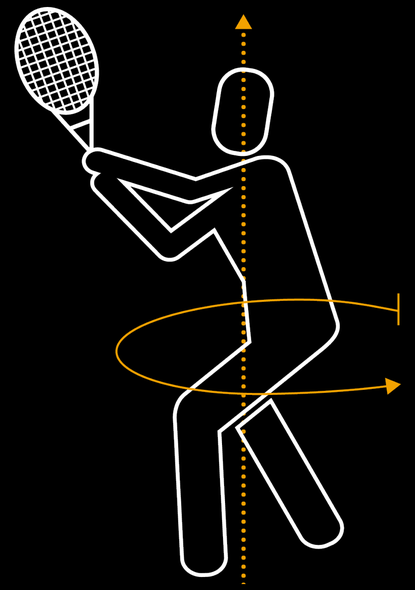


DeviceMotion

Push

Detecting discrete gestures over time

Get data at a fixed interval



```
// Push
func startDeviceMotionUpdates(using referenceFrame: CMAttitudeReferenceFrame,
                                          to queue: OperationQueue,
                                withHandler handler: CoreMotion.CMDeviceMotionHandler)
```

DeviceMotion

Pull

DeviceMotion

Pull

Current device state

DeviceMotion

Pull

Current device state

Responsive

DeviceMotion

Pull

Current device state

Responsive


```
// Pull
func startDeviceMotionUpdates(using referenceFrame: CMAttitudeReferenceFrame)
```

```
// Using DeviceMotion

import CoreMotion
let motionManager = CMMotionManager()

// Before starting game logic
guard motionManager.isDeviceMotionAvailable else {
    print("Device Motion is not available.")
    return
}

let myFrame = CMAttitudeReferenceFrame.xArbitraryZVertical
guard CMMotionManager.availableAttitudeReferenceFrames().contains(myFrame) else {
    print("The reference frame XArbitraryZVertical is not available.")
    return
}
```

```
// Using DeviceMotion

import CoreMotion
let motionManager = CMMotionManager()

// Before starting game logic
guard motionManager.isDeviceMotionAvailable else {
    print("Device Motion is not available.")
    return
}

let myFrame = CMAttitudeReferenceFrame.xArbitraryZVertical
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    print("The reference frame XArbitraryZVertical is not available.")
    return
}
```

```swift
// Using DeviceMotion

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let motionManager = CMMotionManager()

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    print("The reference frame XArbitraryZVertical is not available.")
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```
// Using DeviceMotion

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let motionManager = CMMotionManager()

// Before starting game logic
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    print("The reference frame XArbitraryZVertical is not available.")
    return
}
```

Gesture Detection

Jump

Gesture Detection

Jump

Gesture Detection

Jump

Rotate Up

+y

+x

Gesture Detection

Jump

Gesture Detection

Jump

Rotating rate property

Gesture Detection

Jump

Rotating rate property

Detect a pulse

Gesture Detection

Jump

Rotating rate property

Detect a pulse

Use the push mechanism

```
// Starting DeviceMotion updates using push

motionManager.deviceMotionUpdateInterval = 1 / 50

motionManager.startDeviceMotionUpdates(using: CMAttitudeReferenceFrame.xArbitraryZVertical,
                                       to: queue,
                                       withHandler: motionHandler)
```

```
// Starting DeviceMotion updates using push

motionManager.deviceMotionUpdateInterval = 1 / 50

motionManager.startDeviceMotionUpdates(using: CMAttitudeReferenceFrame.xArbitraryZVertical,
                                       to: queue,
                                       withHandler: motionHandler)
```

```
// Starting DeviceMotion updates using push

motionManager.deviceMotionUpdateInterval = 1 / 50

motionManager.startDeviceMotionUpdates(using: CMAttitudeReferenceFrame.xArbitraryZVertical,
                                       to: queue,
                                       withHandler: motionHandler)
```

```
// Rotation rate

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in
    if let error = error {
        print("Encountered error: \(error!)”)
        return
    }

    let rotationRate = deviceMotion.rotationRate
    var rateAlongHorizontal = rotationRate.y
    // ...
    rateAlongHorizontalBuffer.addSample(rateAlongHorizontal)
}
```

```
// Rotation rate

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in
    if let error = error {
        print("Encountered error: \(error!)”)
        return
    }

    let rotationRate = deviceMotion.rotationRate
    var rateAlongHorizontal = rotationRate.y
    // ...
    rateAlongHorizontalBuffer.addSample(rateAlongHorizontal)
}
```

```
// Rotation rate

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{ (deviceMotion: CMDeviceMotion?, error: Error?) in
    if let error = error {
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        return
    }

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    var rateAlongHorizontal = rotationRate.y
    // ...
    rateAlongHorizontalBuffer.addSample(rateAlongHorizontal)
}
```

```
// Rotation rate

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    if let error = error {
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    var rateAlongHorizontal = rotationRate.y
    // ...
    rateAlongHorizontalBuffer.addSample(rateAlongHorizontal)
}
```

```
// Rotation rate

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in
    if let error = error {
        print("Encountered error: \(error!)”)
        return
    }

    let rotationRate = deviceMotion.rotationRate
    var rateAlongHorizontal = rotationRate.y
    // ...
    rateAlongHorizontalBuffer.addSample(rateAlongHorizontal)
}
```

```
// Rotation rate

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in
    if let error = error {
        print("Encountered error: \(error!)”)
        return
    }

    let rotationRate = deviceMotion.rotationRate
    var rateAlongHorizontal = rotationRate.y
    // ...
    rateAlongHorizontalBuffer.addSample(rateAlongHorizontal)
}
```

```
// Check the buffer

func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let didJump = rateAlongHorizontalBuffer.mean() > jumpThreshold
    // ...
}
```

```
// Check the buffer

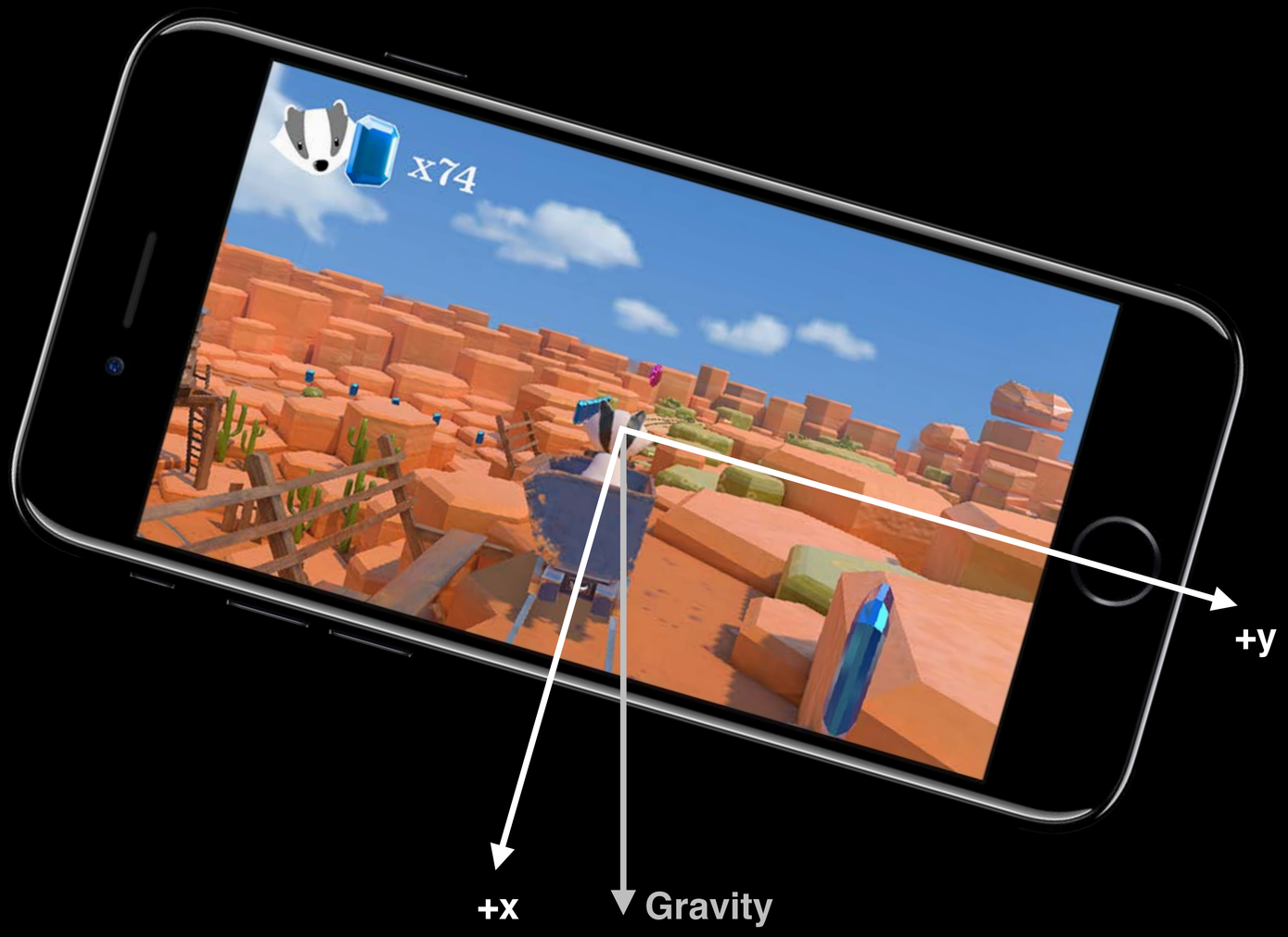
func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let didJump = rateAlongHorizontalBuffer.mean() > jumpThreshold
    // ...
}
```

```
// Check the buffer

func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let didJump = rateAlongHorizontalBuffer.mean() > jumpThreshold
    // ...
}
```

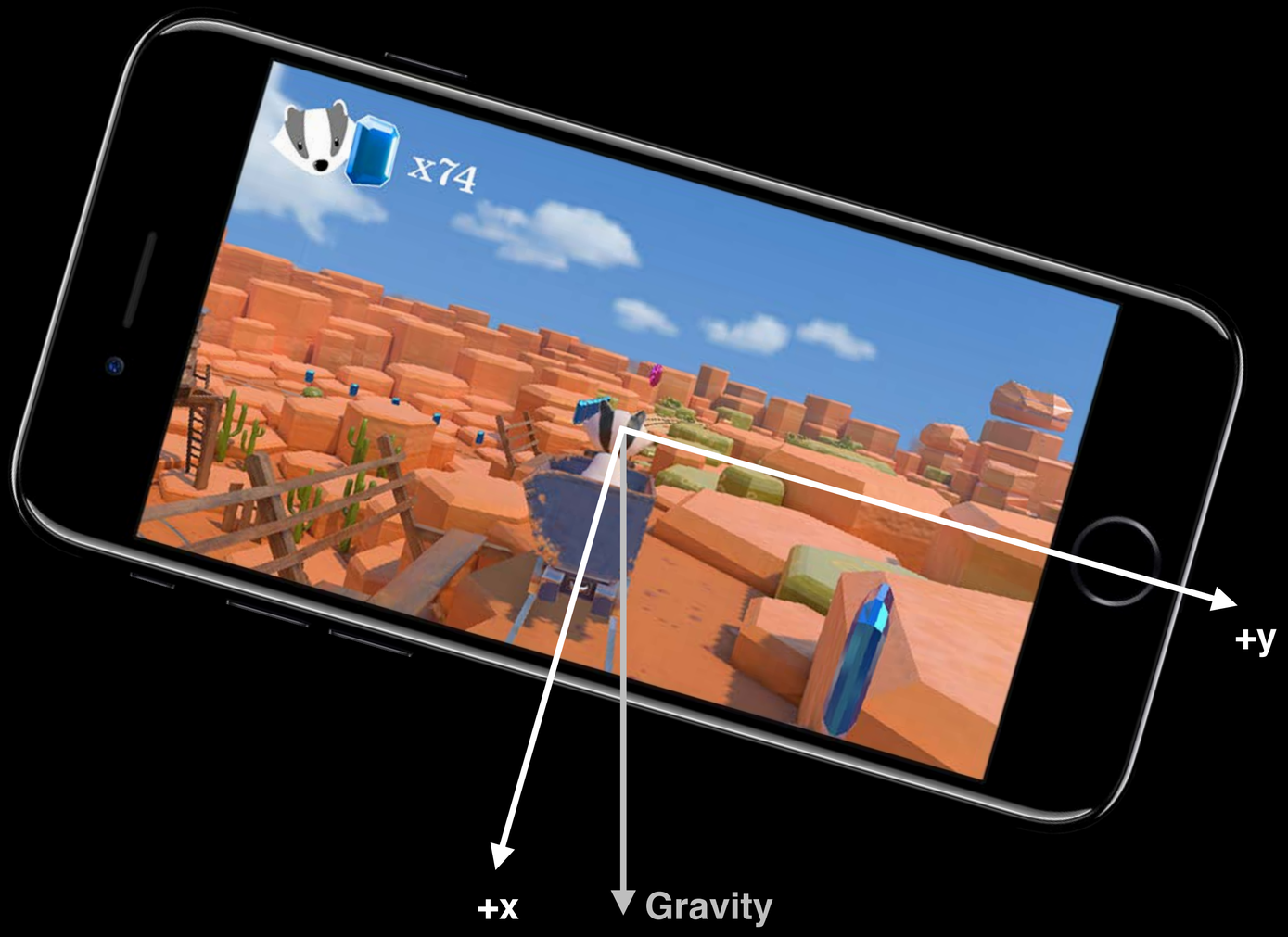
Gesture Detection

Squat



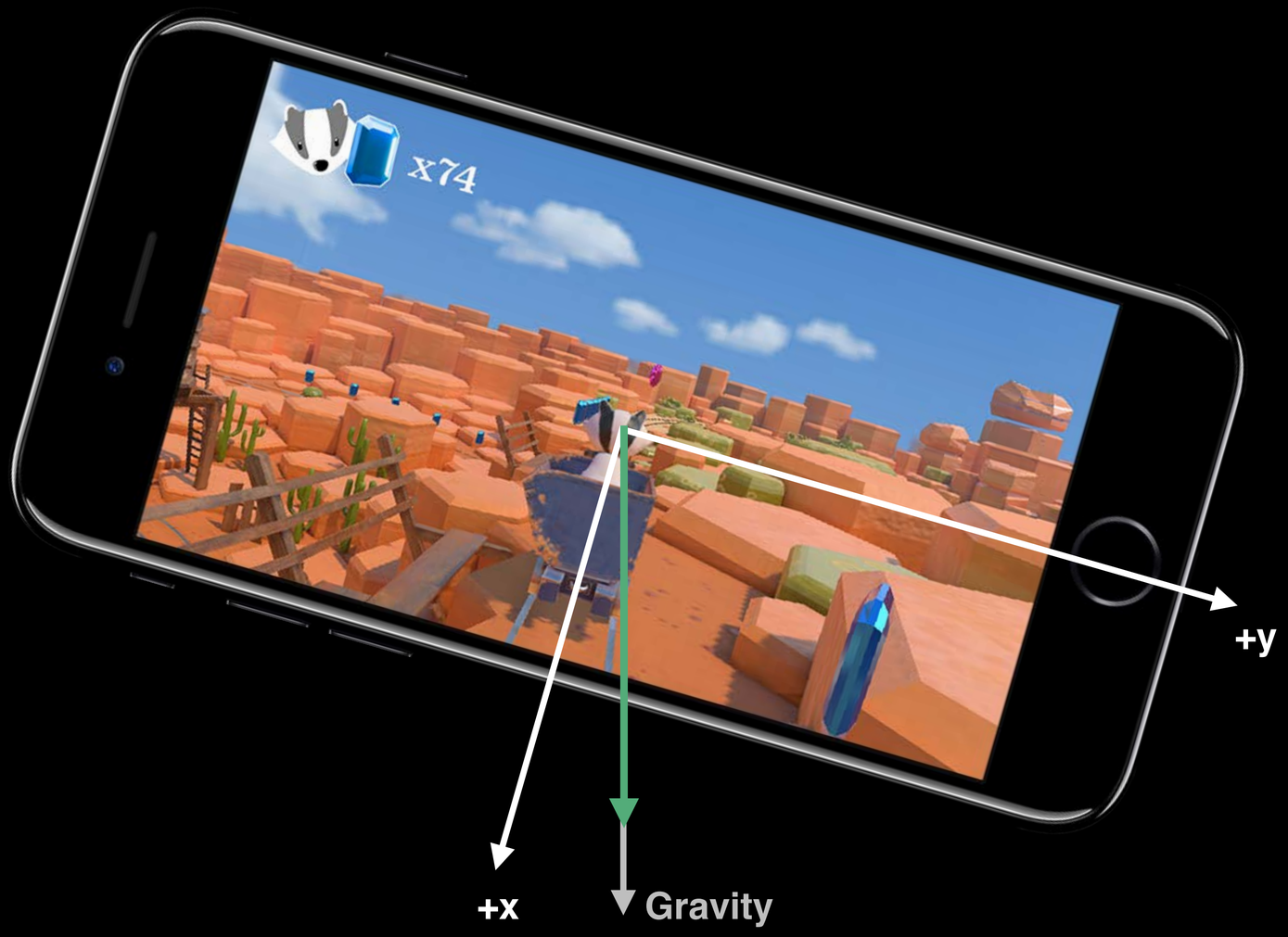
Gesture Detection

Squat



Gesture Detection

Squat



Gesture Detection

Squat

Gesture Detection

Squat

User acceleration property

Gesture Detection

Squat

User acceleration property

Regardless of attitude

Gesture Detection

Squat

User acceleration property

Regardless of attitude

Use the push mechanism

```
// User acceleration

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in

    // Rotation rate
    // ...

    let gravity = deviceMotion.gravity
    let userAcceleration = deviceMotion.userAcceleration

    let userAccelerationAlongGravity = userAcceleration.x * gravity.x +
                                       userAcceleration.y * gravity.y +
                                       userAcceleration.z * gravity.z
    // ...
    accelerationAlongGravityBuffer.addSample(userAccelerationAlongGravity)
}
```

```
// User acceleration

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in

    // Rotation rate
    // ...

    let gravity = deviceMotion.gravity
    let userAcceleration = deviceMotion.userAcceleration

    let userAccelerationAlongGravity = userAcceleration.x * gravity.x +
                                       userAcceleration.y * gravity.y +
                                       userAcceleration.z * gravity.z
    // ...
    accelerationAlongGravityBuffer.addSample(userAccelerationAlongGravity)
}
```

```
// User acceleration

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in

    // Rotation rate
    // ...

    let gravity = deviceMotion.gravity
    let userAcceleration = deviceMotion.userAcceleration

    let userAccelerationAlongGravity = userAcceleration.x * gravity.x +
                                       userAcceleration.y * gravity.y +
                                       userAcceleration.z * gravity.z
    // ...
    accelerationAlongGravityBuffer.addSample(userAccelerationAlongGravity)
}
```

```
// User acceleration

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in

    // Rotation rate
    // ...

    let gravity = deviceMotion.gravity
    let userAcceleration = deviceMotion.userAcceleration

    let userAccelerationAlongGravity = userAcceleration.x * gravity.x +
                                       userAcceleration.y * gravity.y +
                                       userAcceleration.z * gravity.z
    // ...
    accelerationAlongGravityBuffer.addSample(userAccelerationAlongGravity)
}
```

```
// User acceleration

// motionHandler
{ (deviceMotion: CMDeviceMotion?, error: Error?) in

    // Rotation rate
    // ...

    let gravity = deviceMotion.gravity
    let userAcceleration = deviceMotion.userAcceleration

    let userAccelerationAlongGravity = userAcceleration.x * gravity.x +
                                       userAcceleration.y * gravity.y +
                                       userAcceleration.z * gravity.z
    // ...
    accelerationAlongGravityBuffer.addSample(userAccelerationAlongGravity)
}
```

```
// Check the buffer

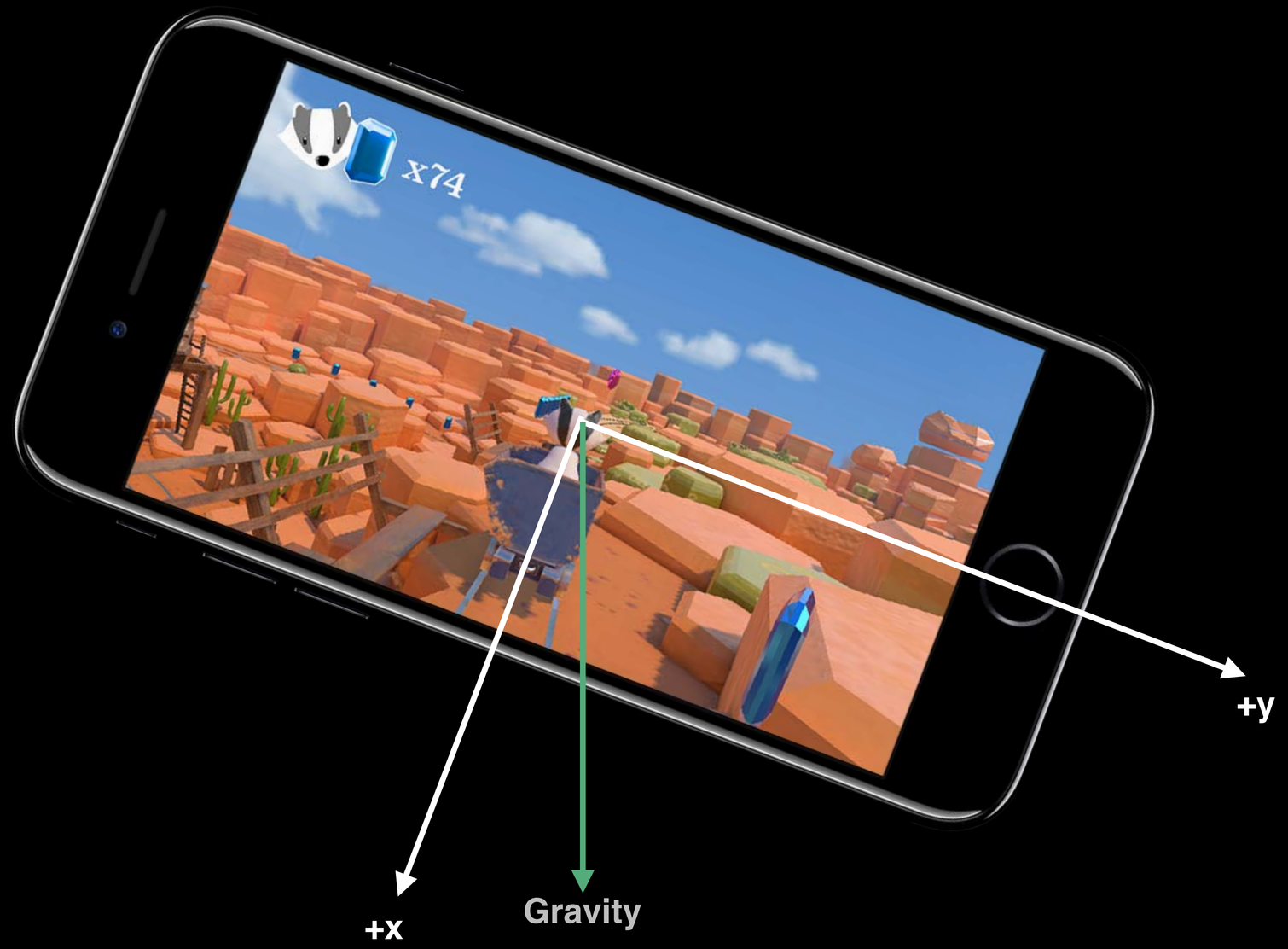
func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let didSquat = accelerationAlongGravityBuffer.mean() > squatThreshold
    // ...
}
```

```
// Check the buffer

func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let didSquat = accelerationAlongGravityBuffer.mean() > squatThreshold
    // ...
}
```

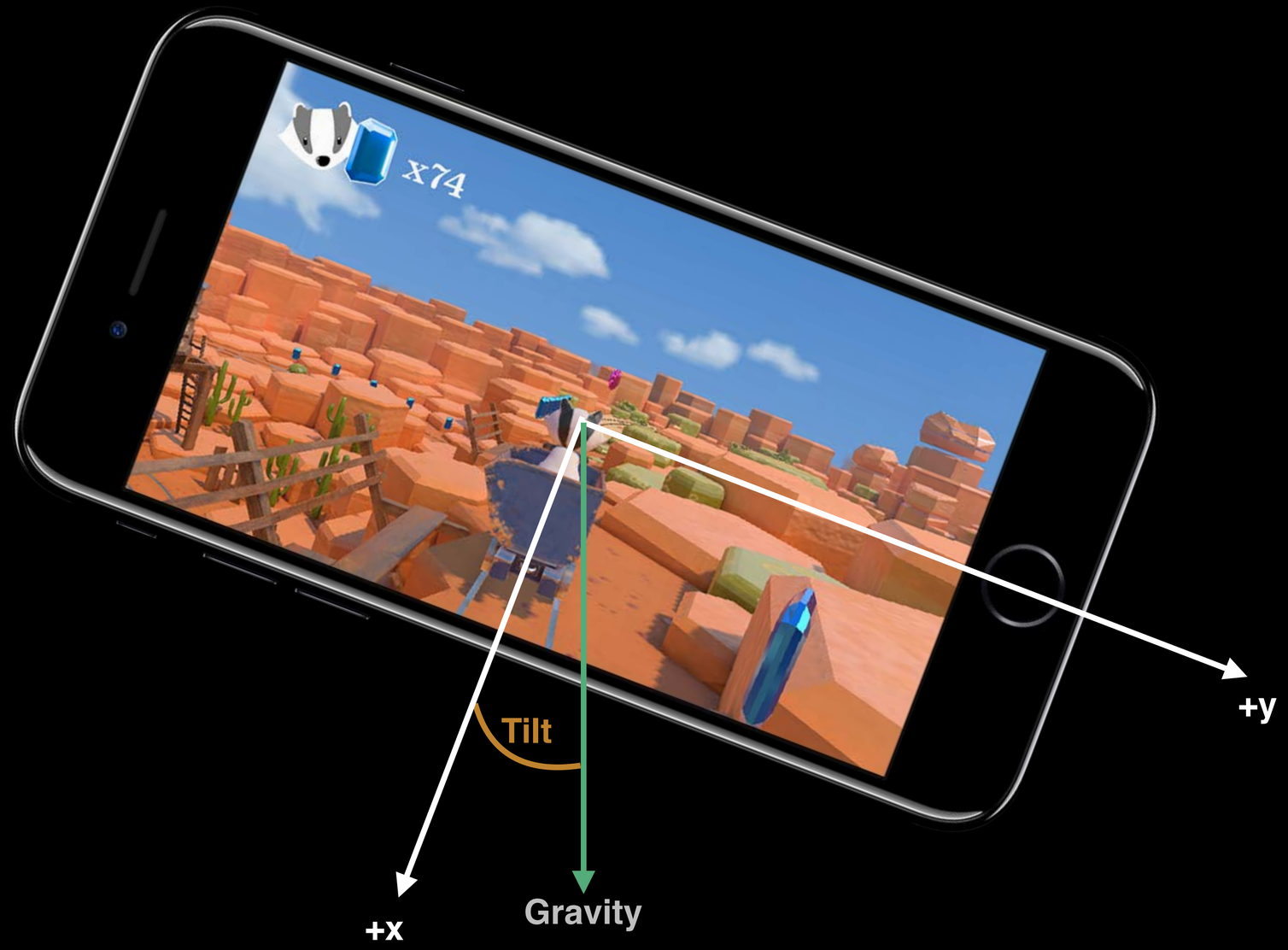
Gesture Detection

Tilt



Gesture Detection

Tilt



Gesture Detection

Tilt

Gesture Detection

Tilt

Current state of the device

Gesture Detection

Tilt

Current state of the device

Responsive

Gesture Detection

Tilt

Current state of the device

Responsive

Use the pull mechanism

```
// Pull DeviceMotion samples

func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let deviceMotion = motionManager.deviceMotion
    let gravity = deviceMotion.gravity

    // Component of gravity in the x-z body frame
    let xzComponent = sqrt(pow(gravity.x, 2) + pow(gravity.z, 2))

    let tilt = atan2(gravity.y, xzComponent)
}
```

```swift
// Pull DeviceMotion samples

func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let deviceMotion = motionManager.deviceMotion
    let gravity = deviceMotion.gravity

    // Component of gravity in the x-z body frame
    let xzComponent = sqrt(pow(gravity.x, 2) + pow(gravity.z, 2))

    let tilt = atan2(gravity.y, xzComponent)
}
```

```swift
// Pull DeviceMotion samples

func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let deviceMotion = motionManager.deviceMotion
    let gravity = deviceMotion.gravity

    // Component of gravity in the x-z body frame
    let xzComponent = sqrt(pow(gravity.x, 2) + pow(gravity.z, 2))

    let tilt = atan2(gravity.y, xzComponent)
}
```

```swift
// Pull DeviceMotion samples

func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let deviceMotion = motionManager.deviceMotion
    let gravity = deviceMotion.gravity

    // Component of gravity in the x-z body frame
    let xzComponent = sqrt(pow(gravity.x, 2) + pow(gravity.z, 2))

    let tilt = atan2(gravity.y, xzComponent)
}
```

```swift
// Pull DeviceMotion samples

func renderer(_ renderer: SCNSceneRenderer, updateAtTime time: TimeInterval) {
    // ...
    let deviceMotion = motionManager.deviceMotion
    let gravity = deviceMotion.gravity

    // Component of gravity in the x-z body frame
    let xzComponent = sqrt(pow(gravity.x, 2) + pow(gravity.z, 2))

    let tilt = atan2(gravity.y, xzComponent)
}
```

```
// Stop Device Motion updates

if motionManager.isDeviceMotionActive {
    motionManager.stopDeviceMotionUpdates()
}
```


x392


x392

Summary

Summary

Authorization

Summary

Authorization

DeviceMotion

Summary

Authorization

DeviceMotion

- Sensor fusion

Summary

Authorization

DeviceMotion

- Sensor fusion
- Smooth and consistent experience

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Authorization

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- Sensor fusion
- Smooth and consistent experience
- Performance enhancements

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- Sensor fusion
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Query mechanism

Summary

Authorization

DeviceMotion

- Sensor fusion
- Smooth and consistent experience
- Performance enhancements

Query mechanism

- Push: Gesture over time

Summary

Authorization

DeviceMotion

- Sensor fusion
- Smooth and consistent experience
- Performance enhancements

Query mechanism

- Push: Gesture over time
- Pull: Responsive

Related Sessions

Introducing ARKit: Augmented Reality for iOS	Hall 3	Tue 5:10PM-6:10PM
What's New in Location Technologies	Grand Ballroom B	Thu 3:10PM-3:50PM

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Advances in SceneKit Rendering	WWDC 2016

Labs

Core Motion Lab	Technology Lab D	Thu 4:10PM-6:00PM
Location and Mapping Technologies Lab	Technology Lab B	Wed 11:00AM-1:00PM
Location and Mapping Technologies Lab	Technology Lab K	Fri 10:00AM-12:00PM
ARKit Lab	Technology Lab A	Wed 1:00PM-3:00PM
ARKit Lab	Technology Lab A	Thu 12:00PM-2:00PM

More Information

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