

#WWDC19

Building AR Experiences with Reality Composer

Michelle C., Designer

Pau Sastre Miguel, Software Engineer

Abhi Ashutosh, Software Engineer

Reality Composer

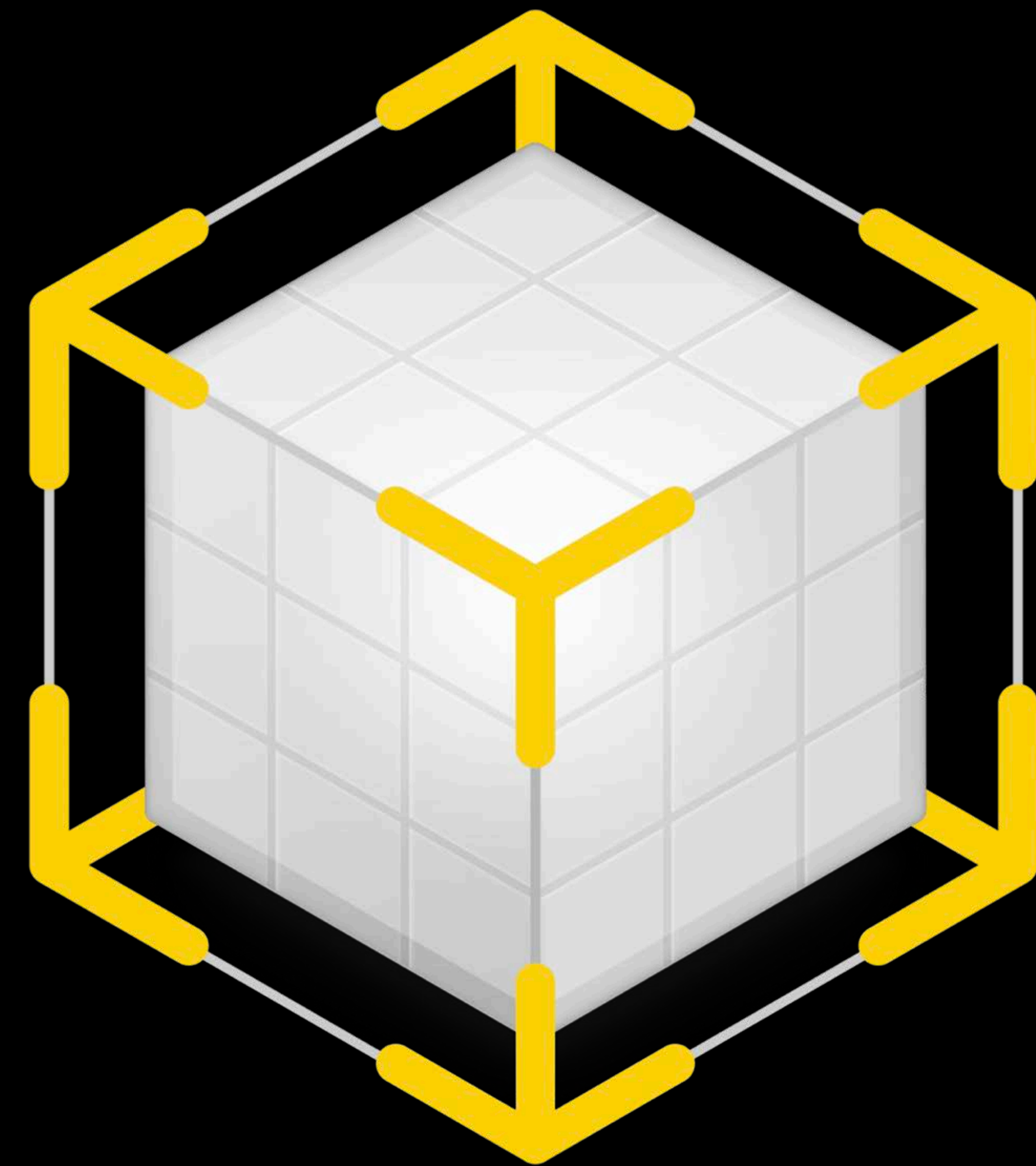
Get started with AR and 3D

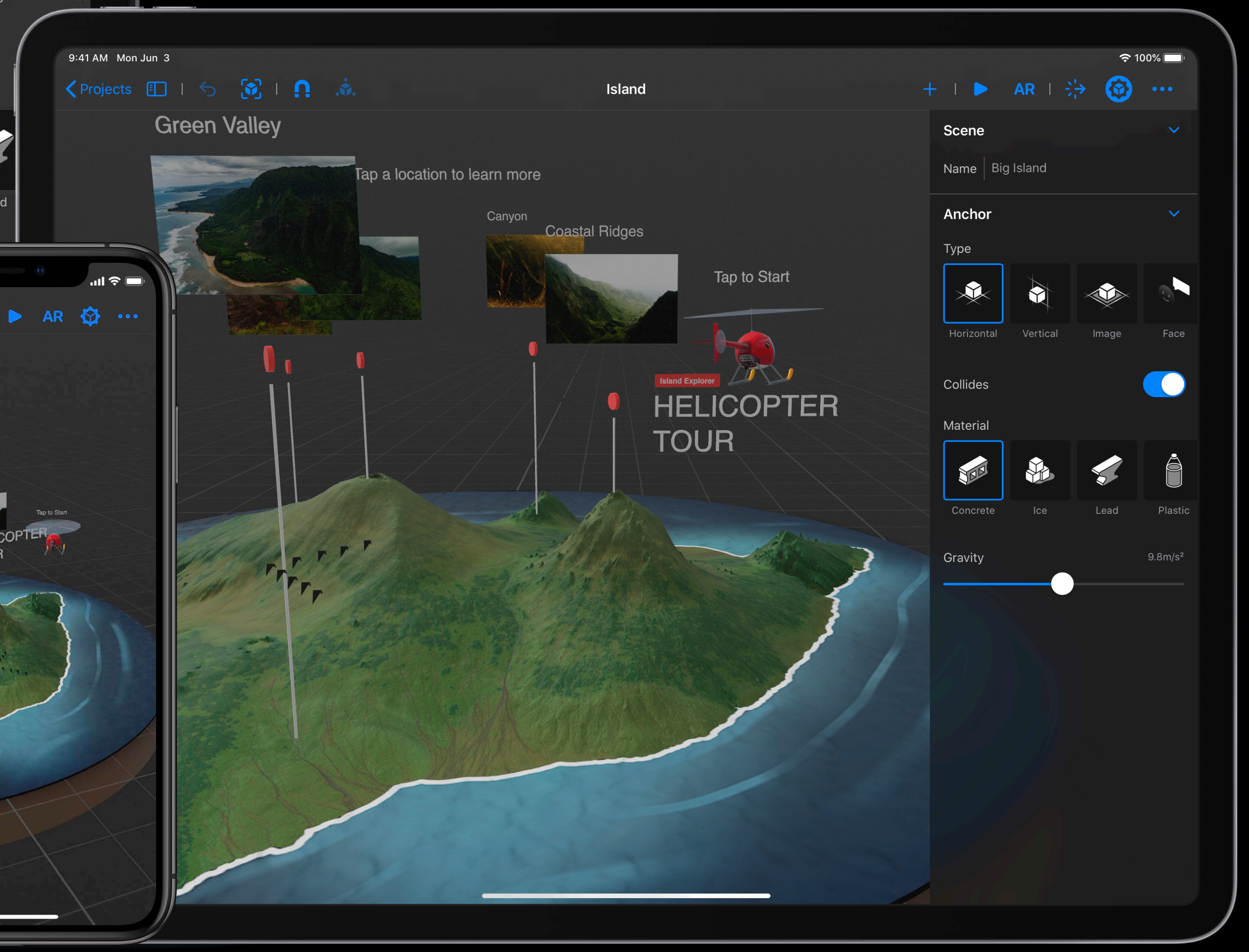
Layout and pre-visualization

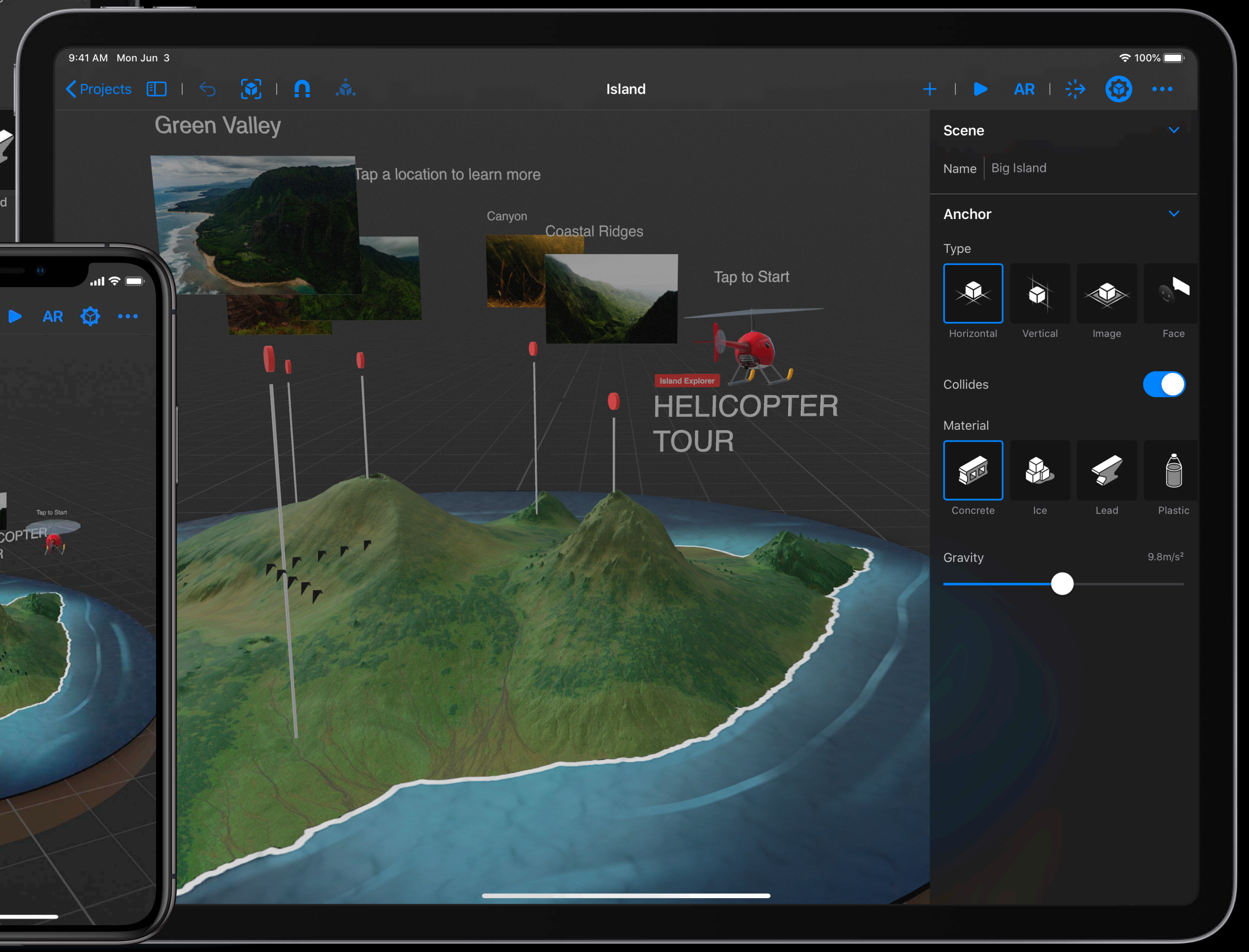
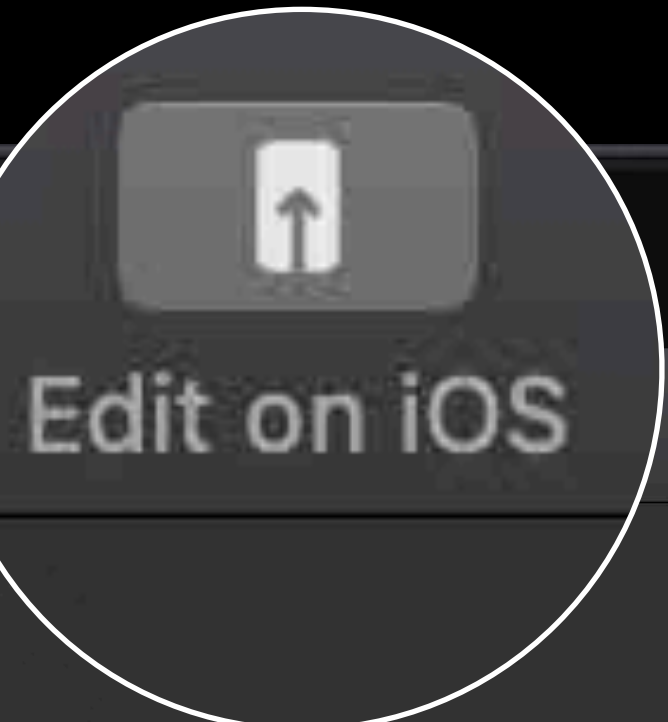
Content library

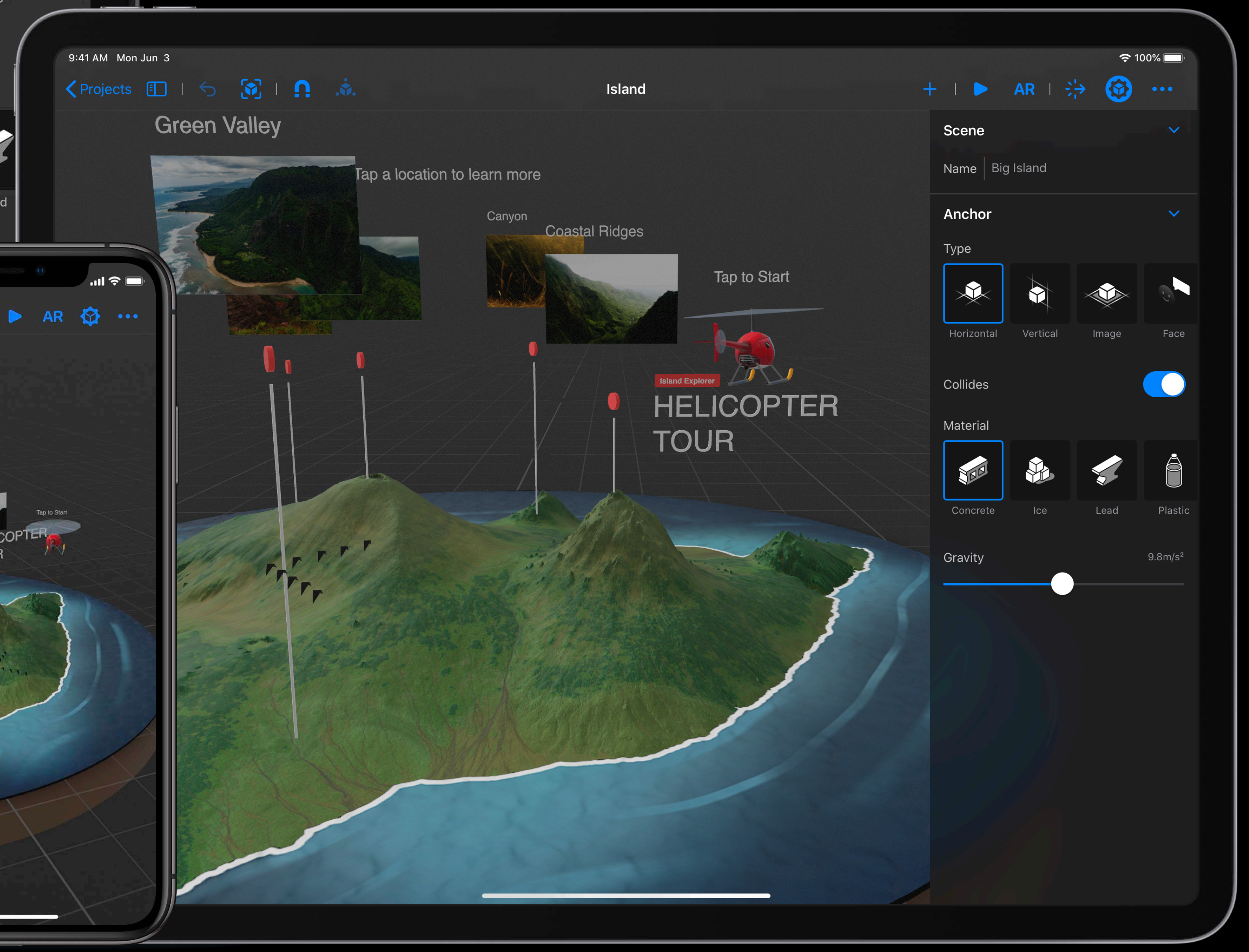
Simple interactions

Xcode integration









Building Scenes

Adding Behaviors

Using Physics

Building Apps

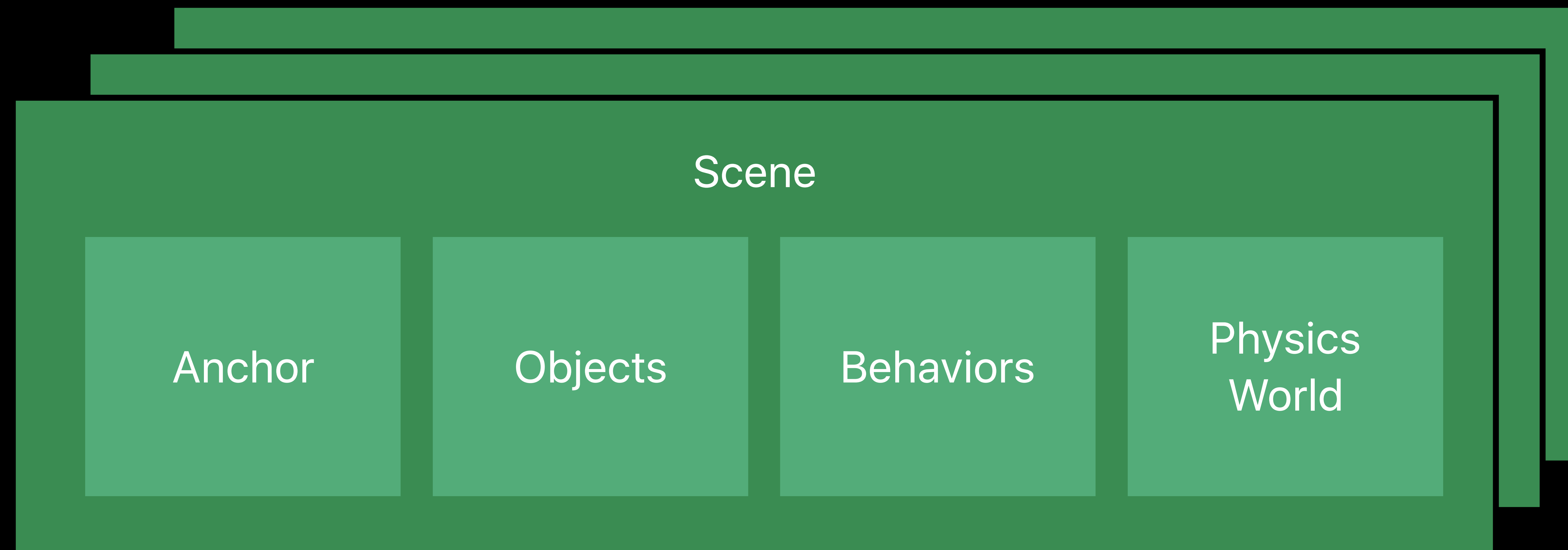
Building Scenes

Adding Behaviors

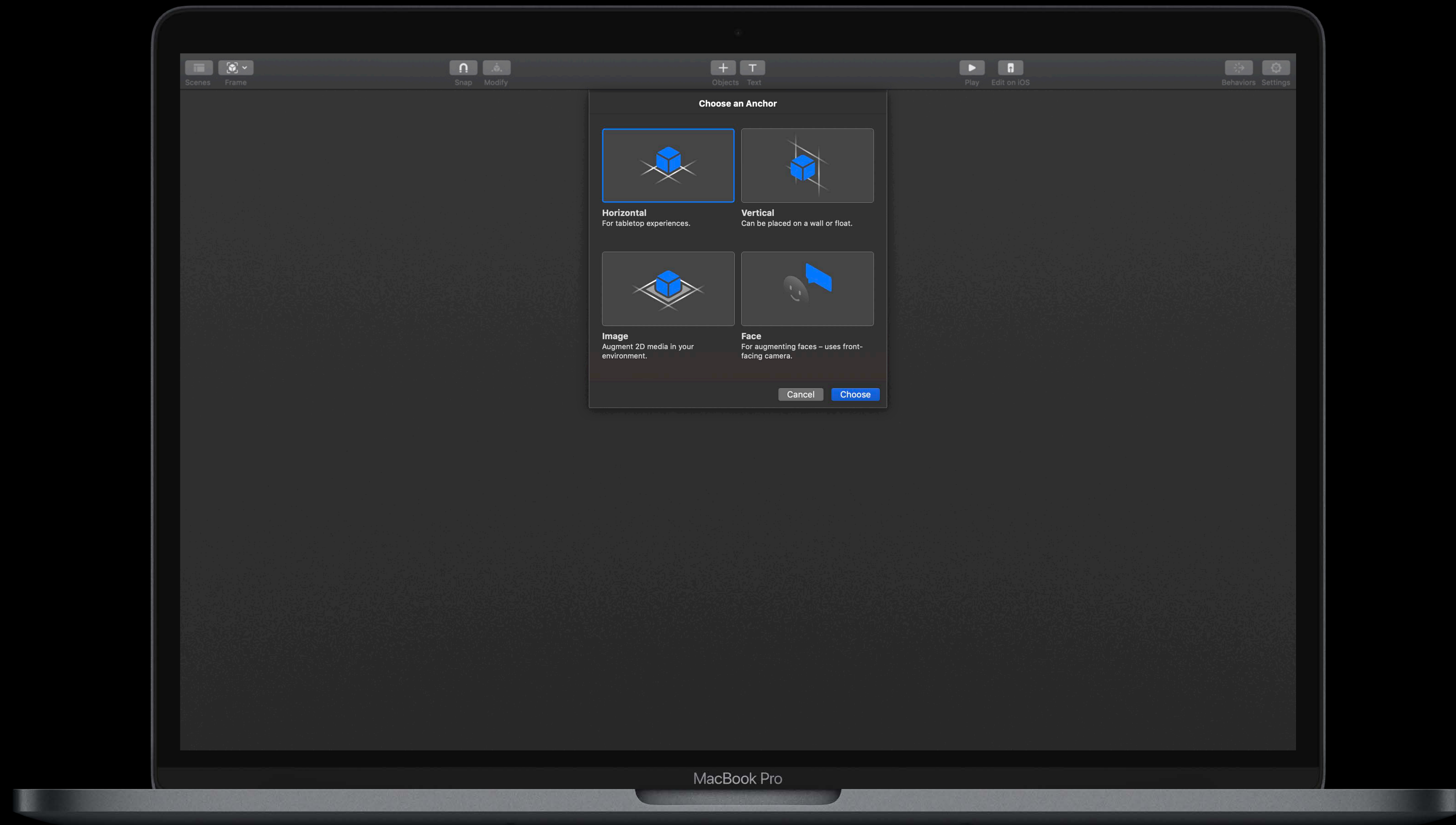
Using Physics

Building Apps

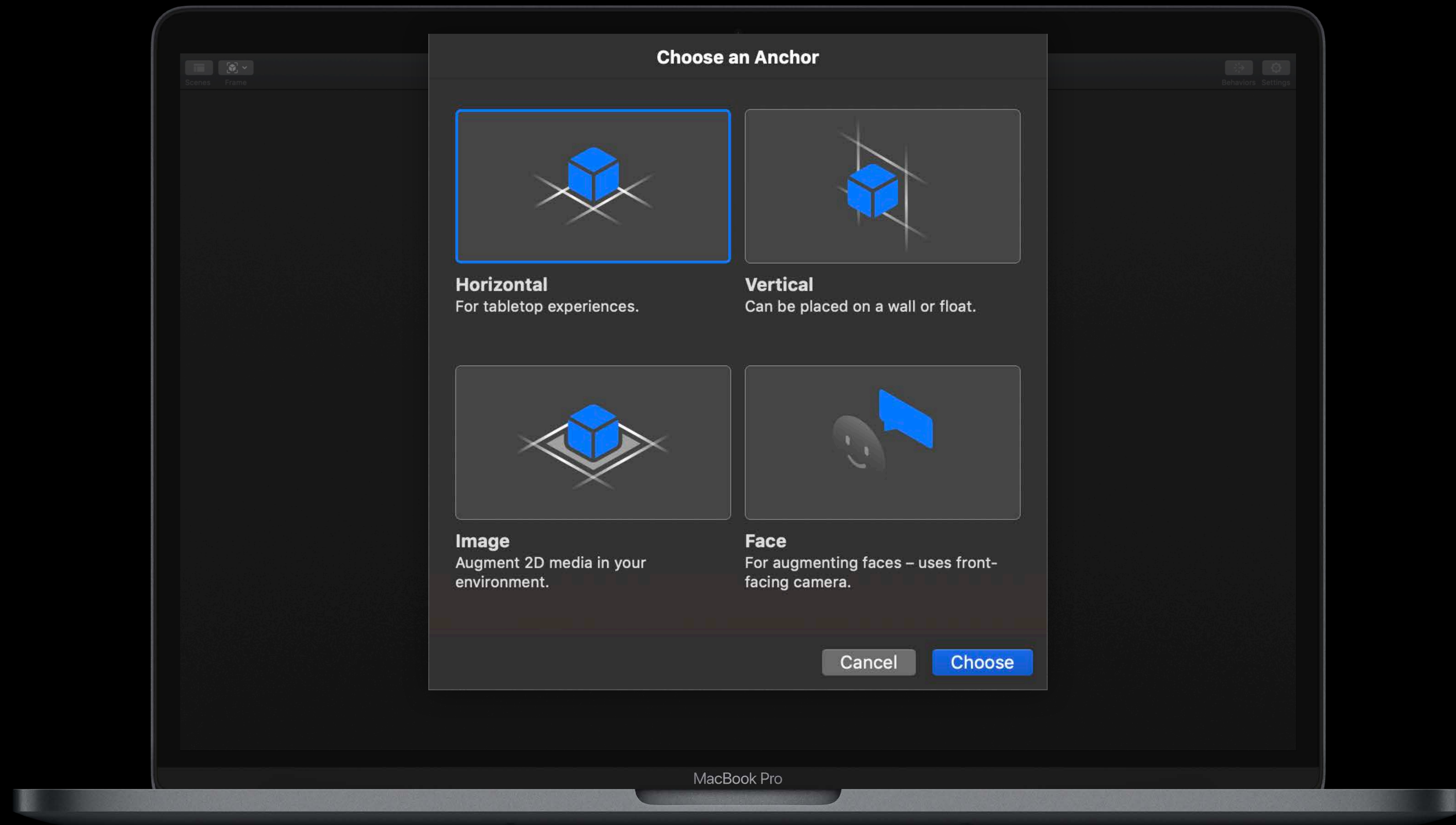
Anatomy of a Scene



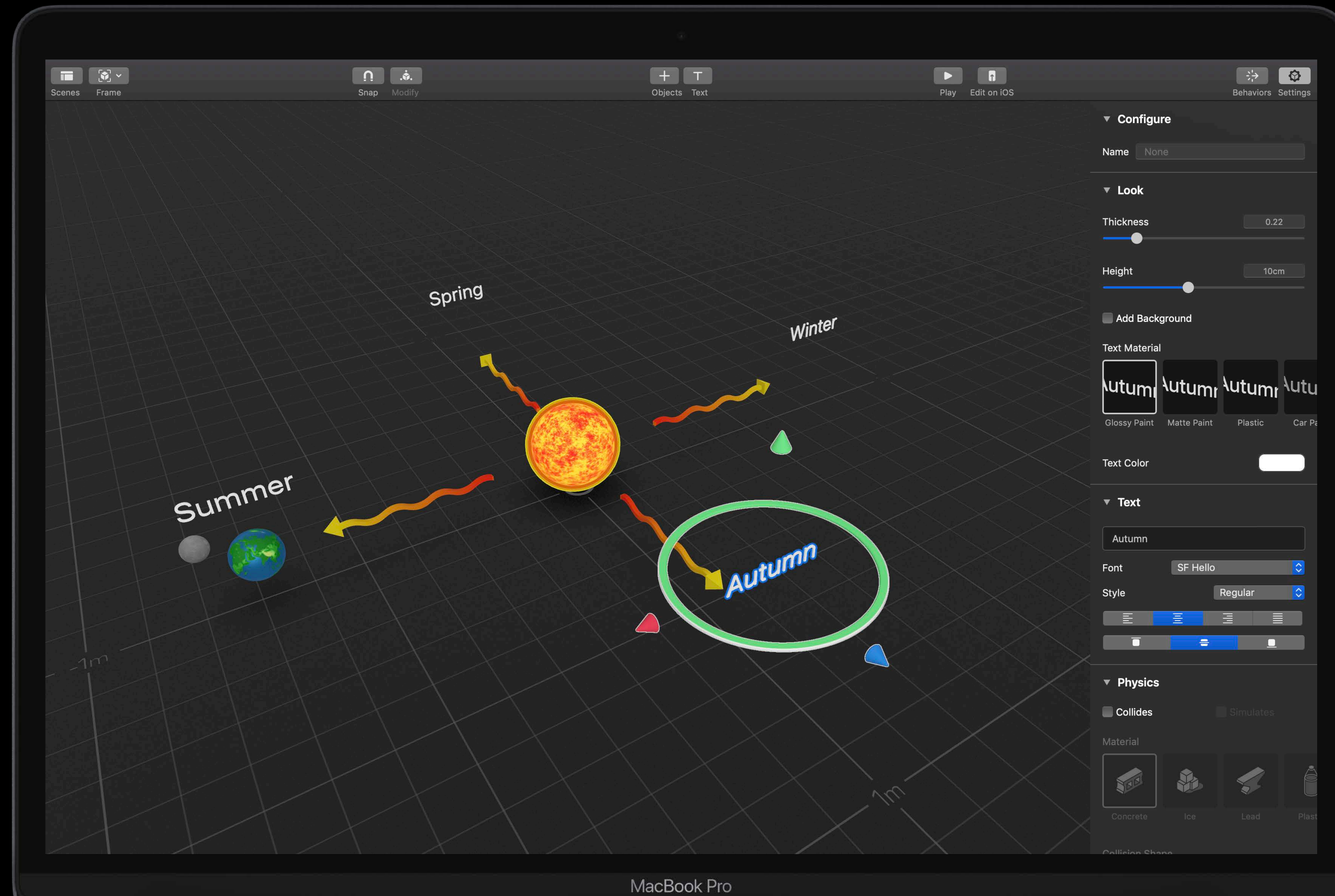
Anchoring the Scene



Anchoring the Scene



Working with Scenes



Demo

Building Scenes

Adding Behaviors

Using Physics

Building Apps

Building Scenes

Adding Behaviors

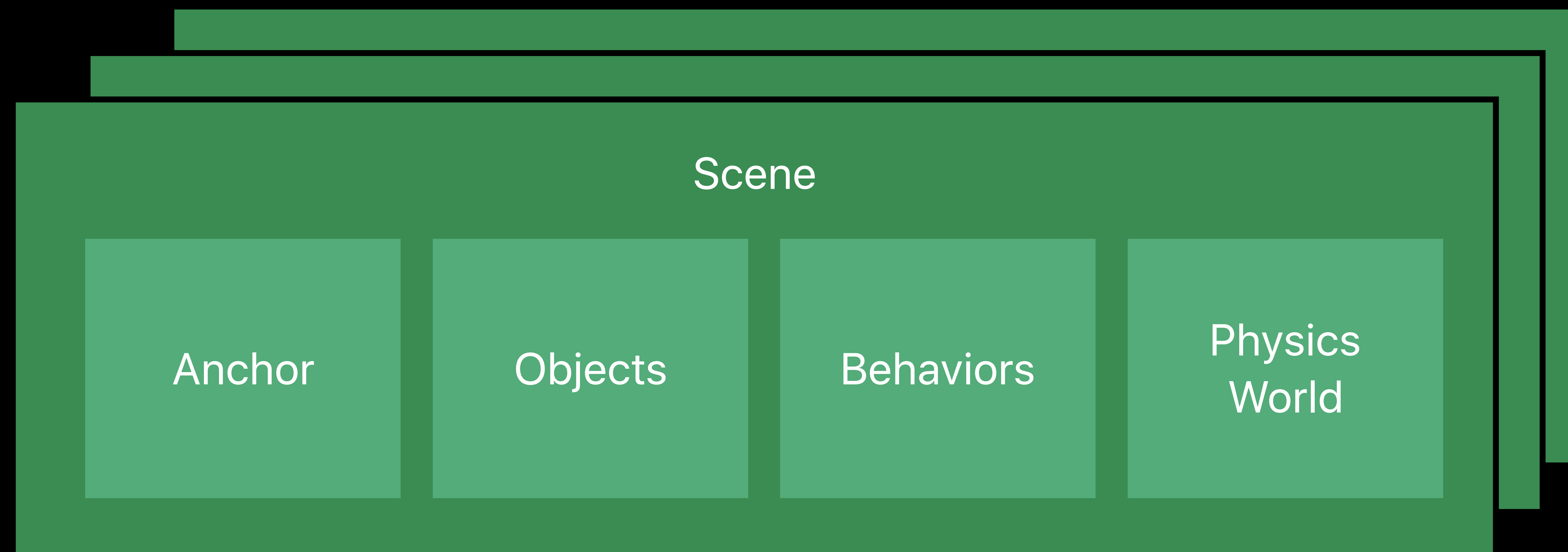
Using Physics

Building Apps

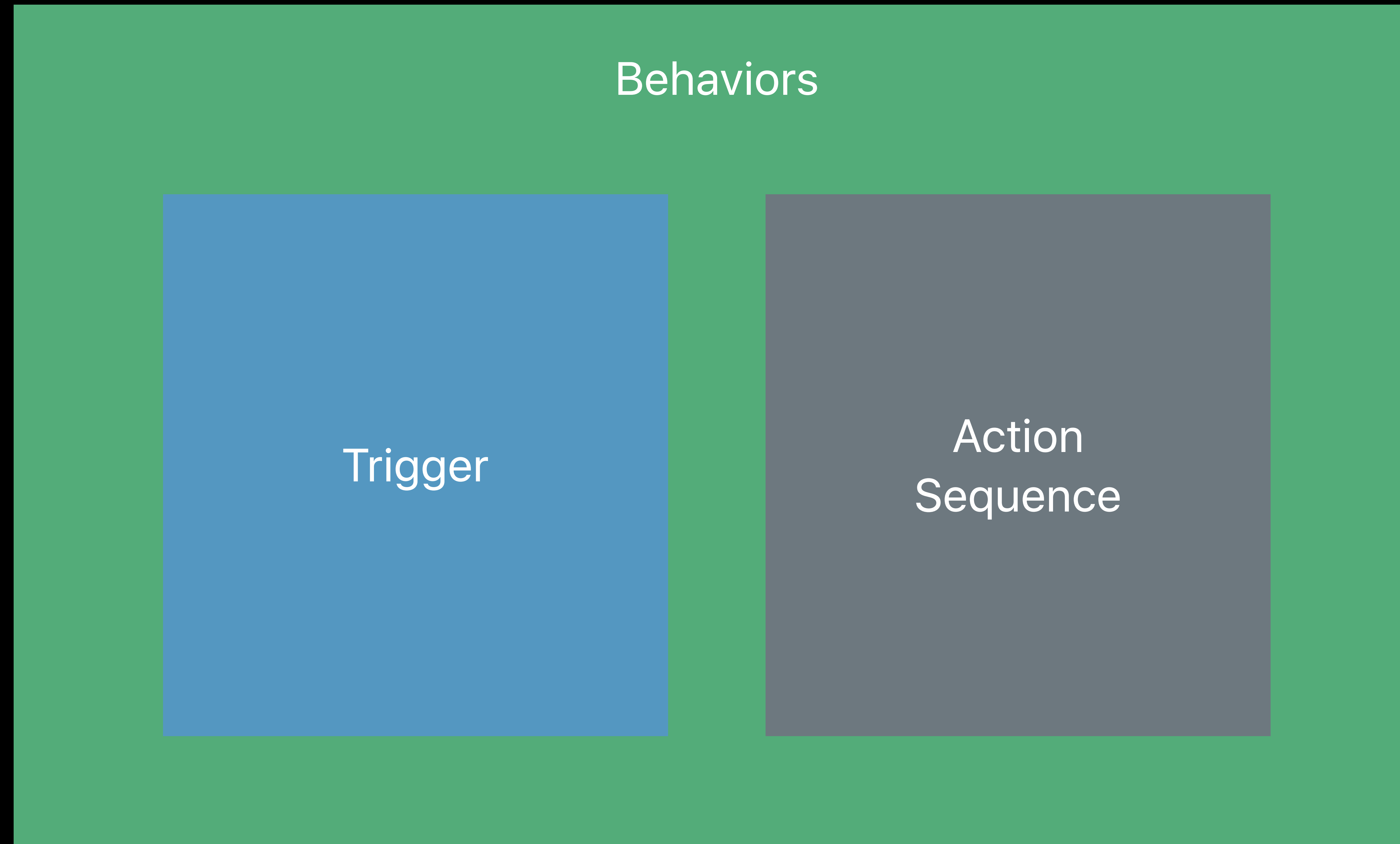
Adding Behaviors

Pau Sastre Miguel, Software Engineer

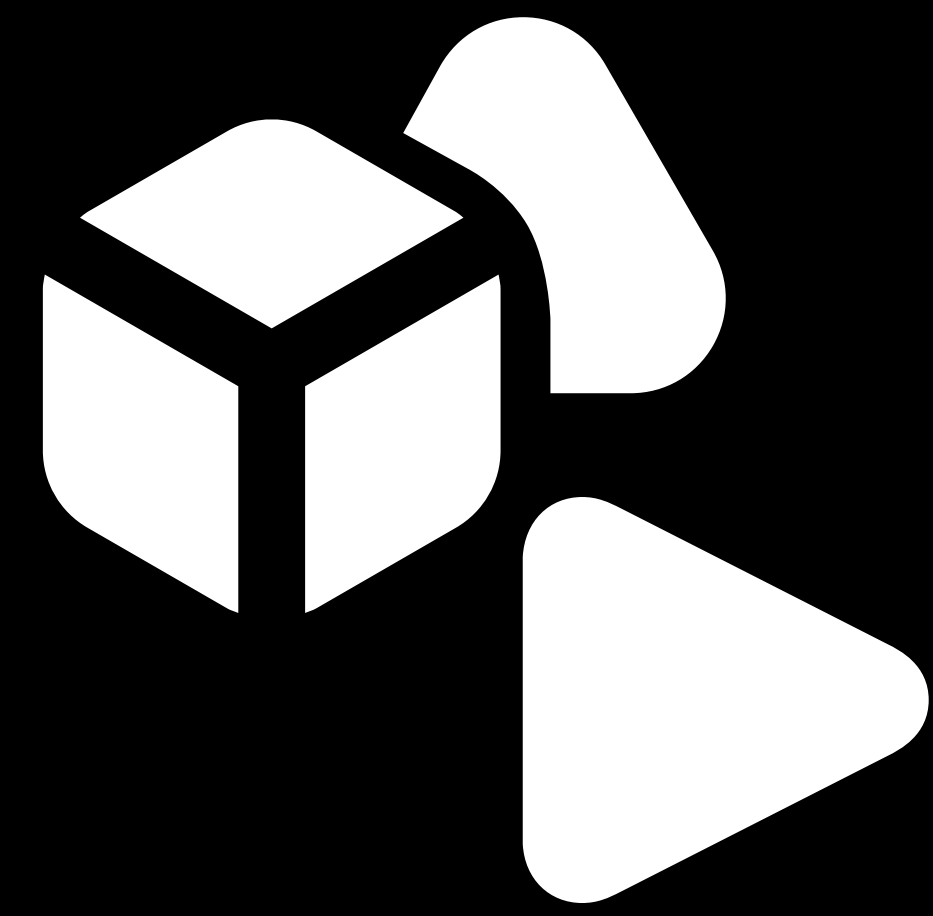
Anatomy of a Scene



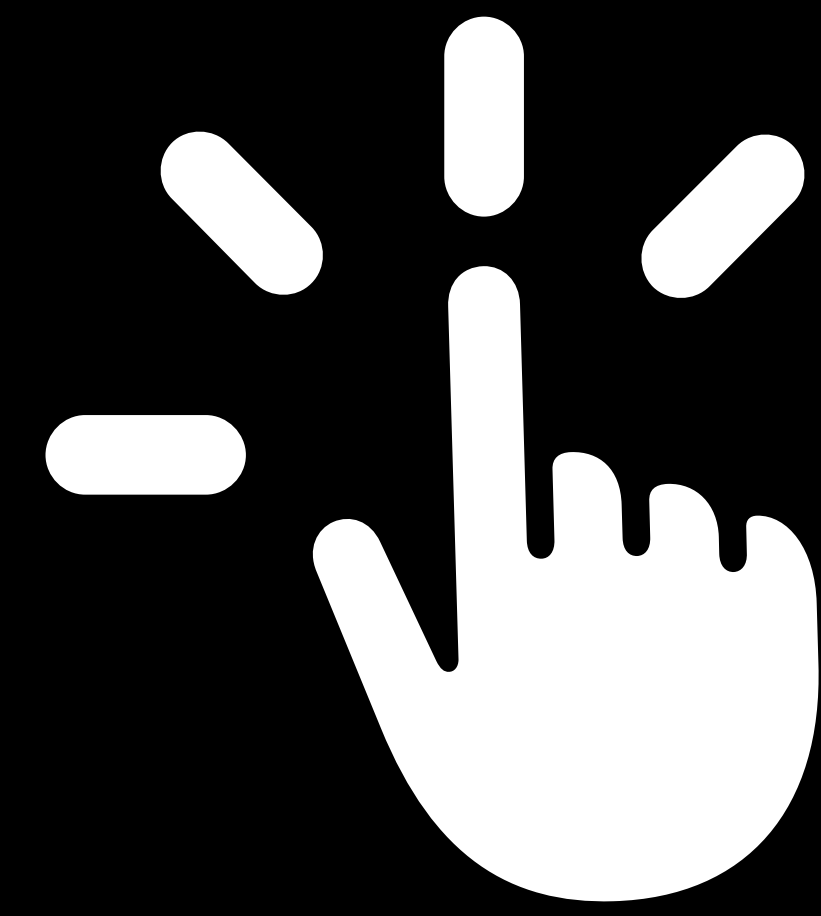
Behaviors



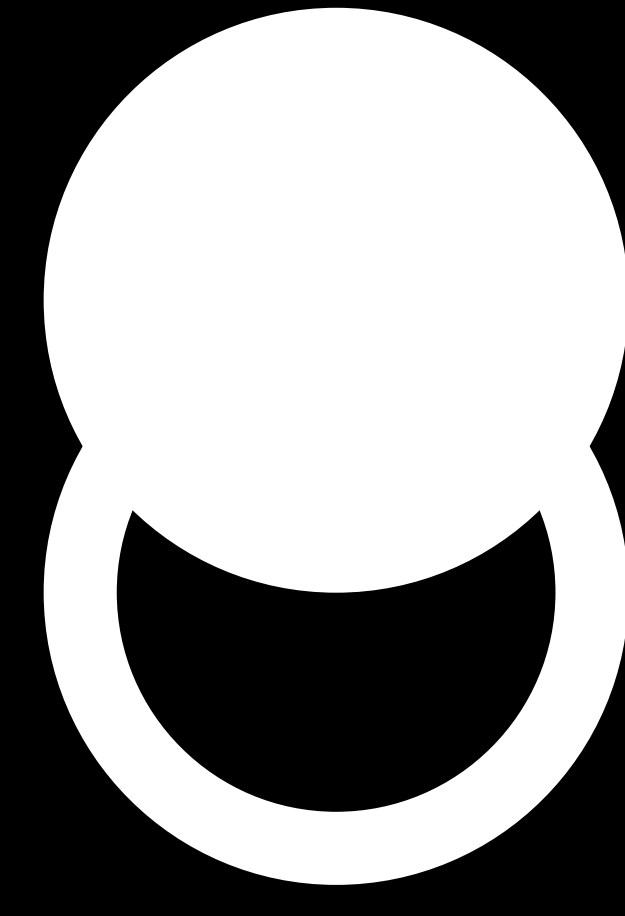
Triggers



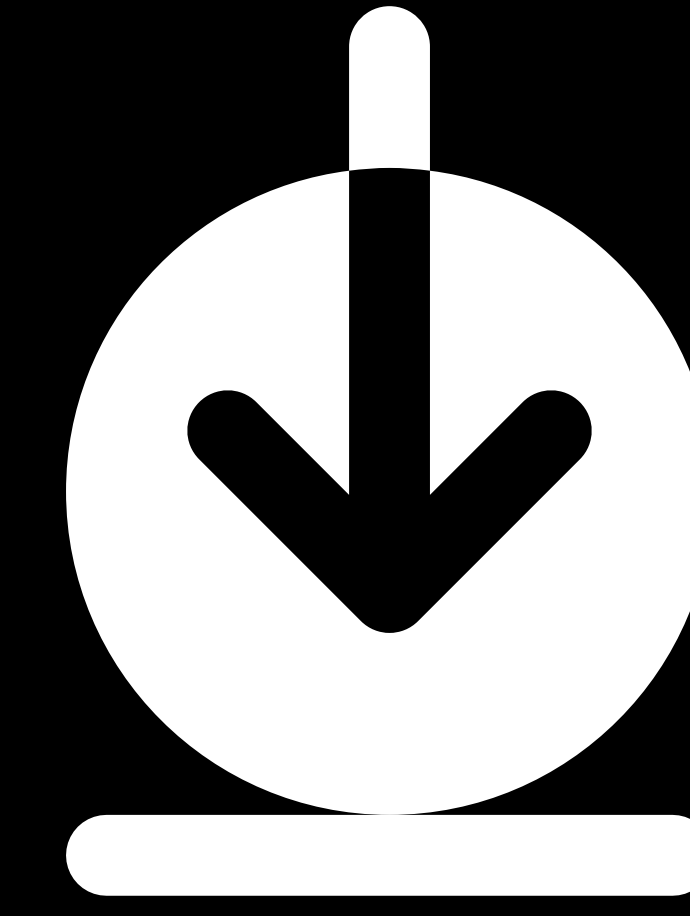
Start



Tap



Proximity

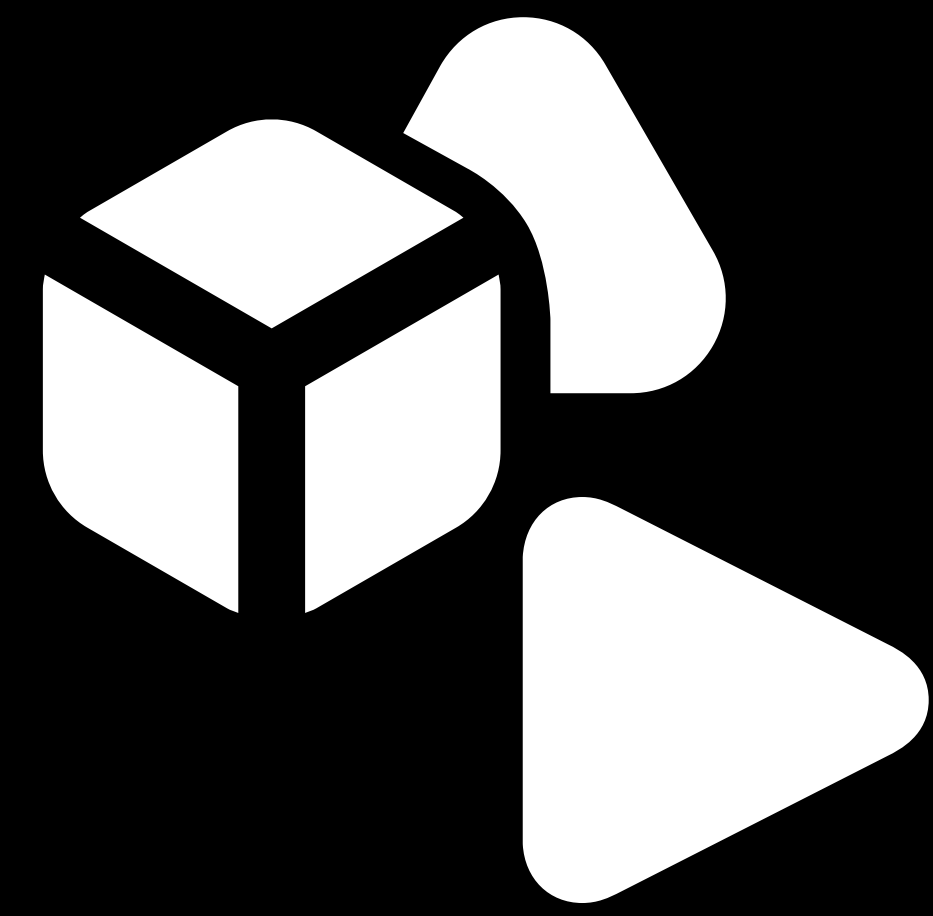


Collision

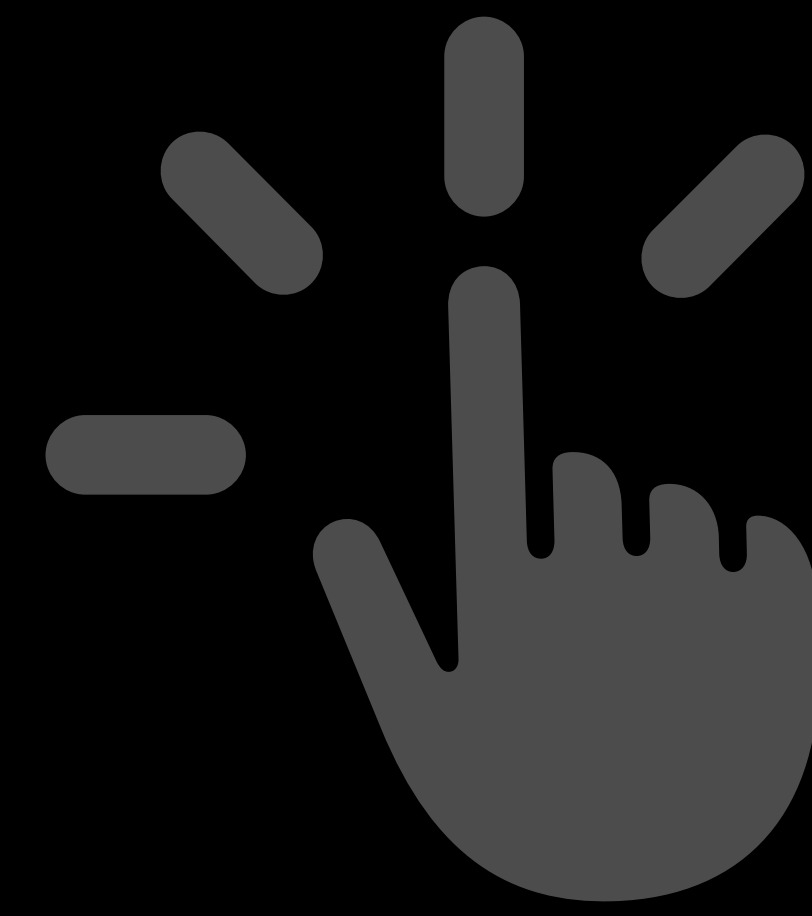


Notification

Triggers



Start



Tap



Proximity

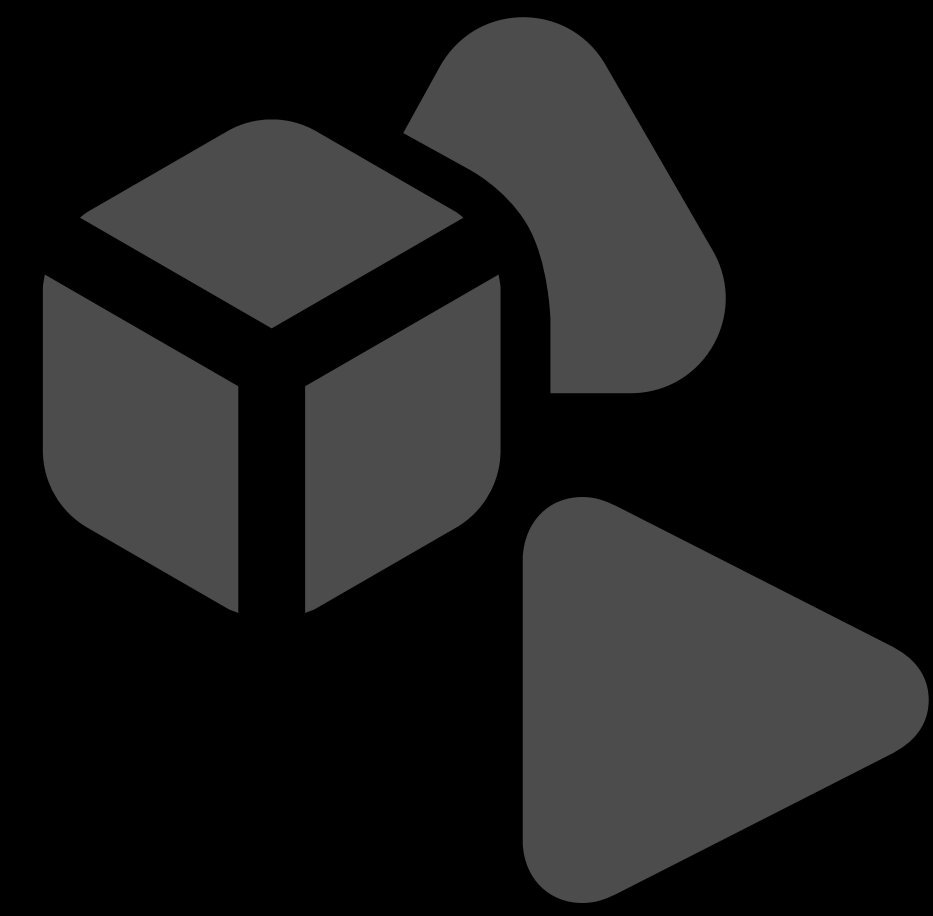


Collision

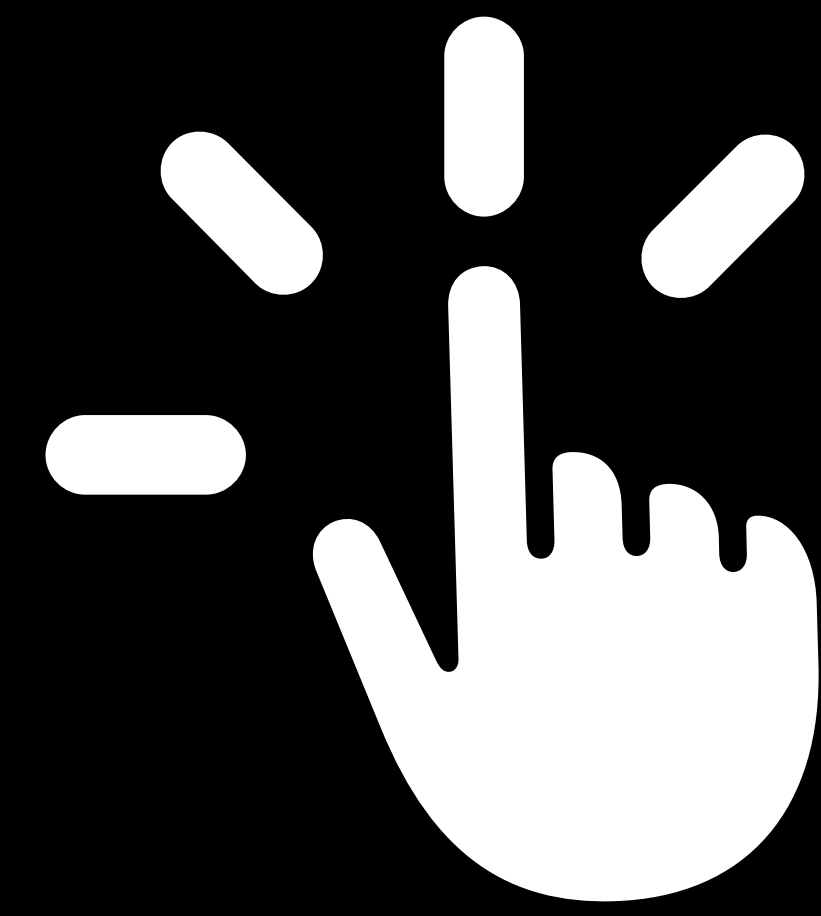


Notification

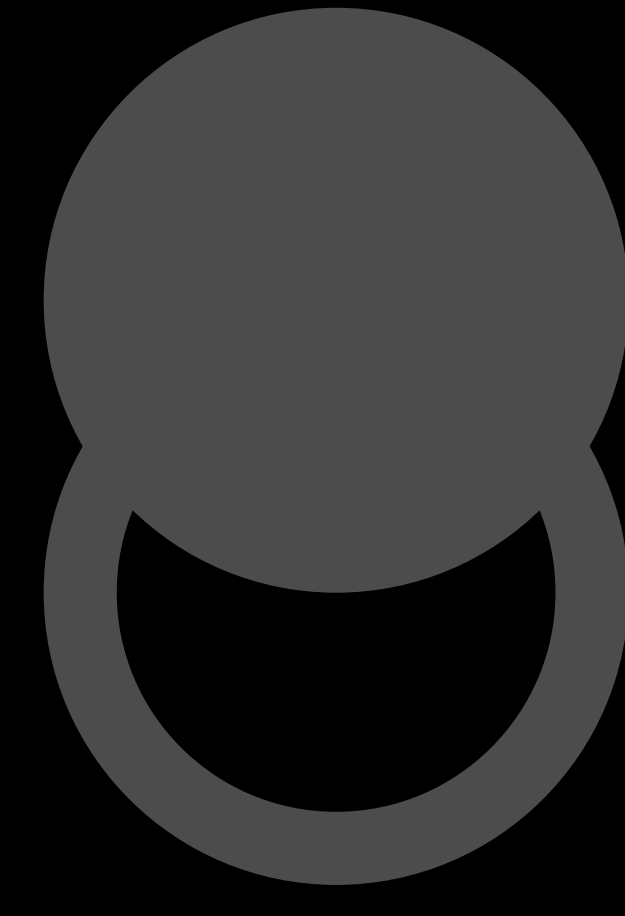
Triggers



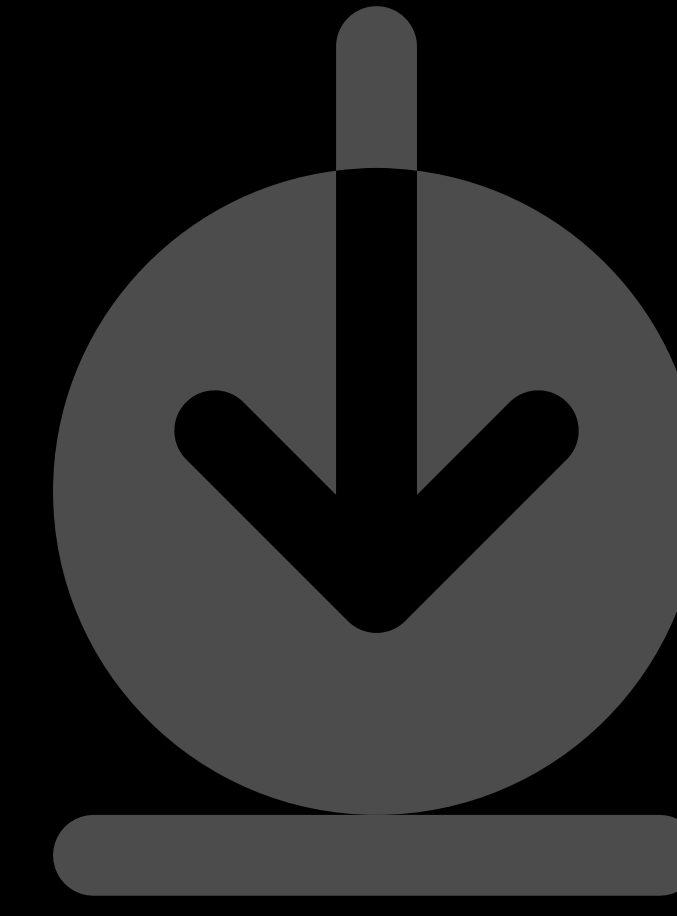
Start



Tap



Proximity

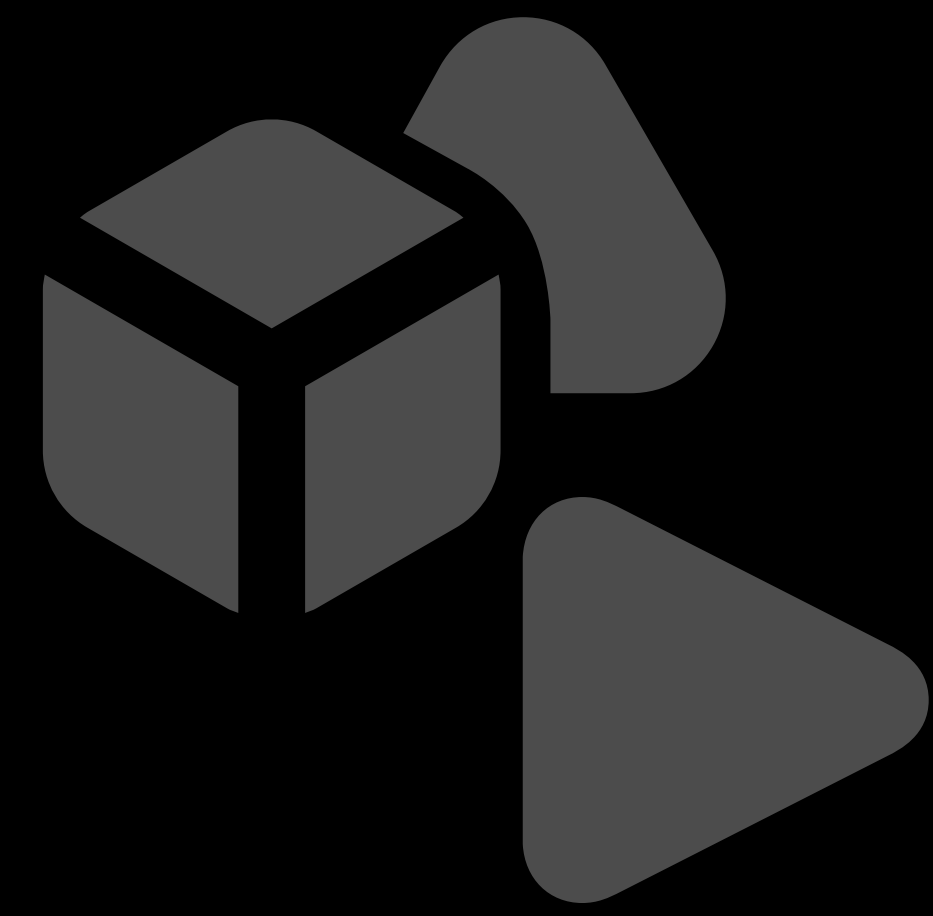


Collision

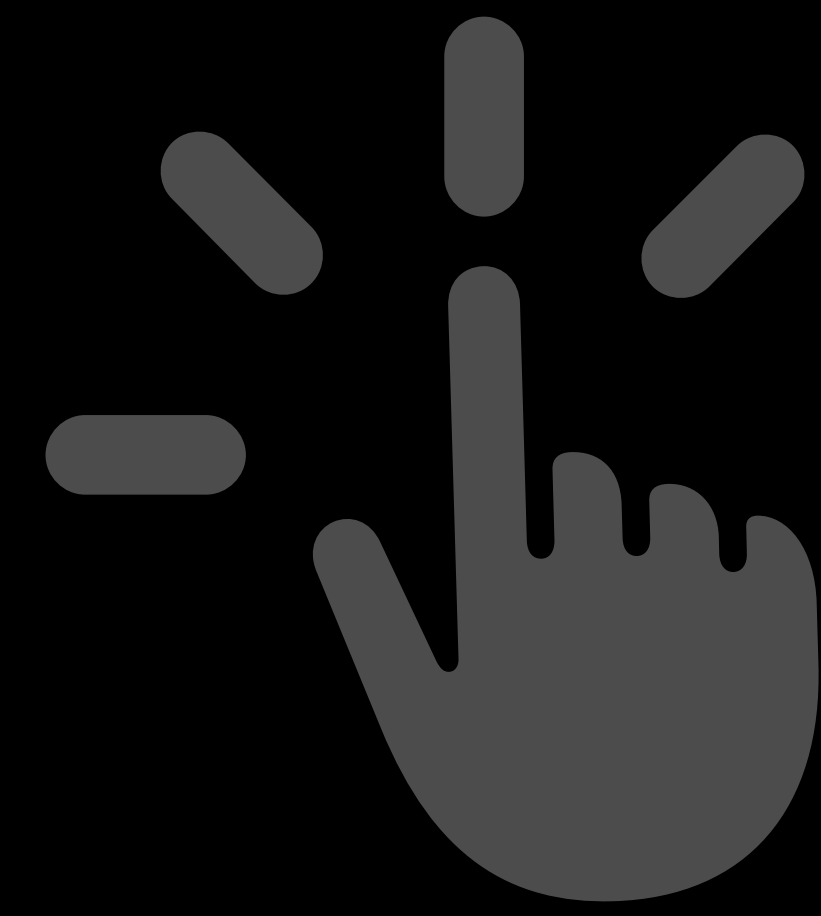


Notification

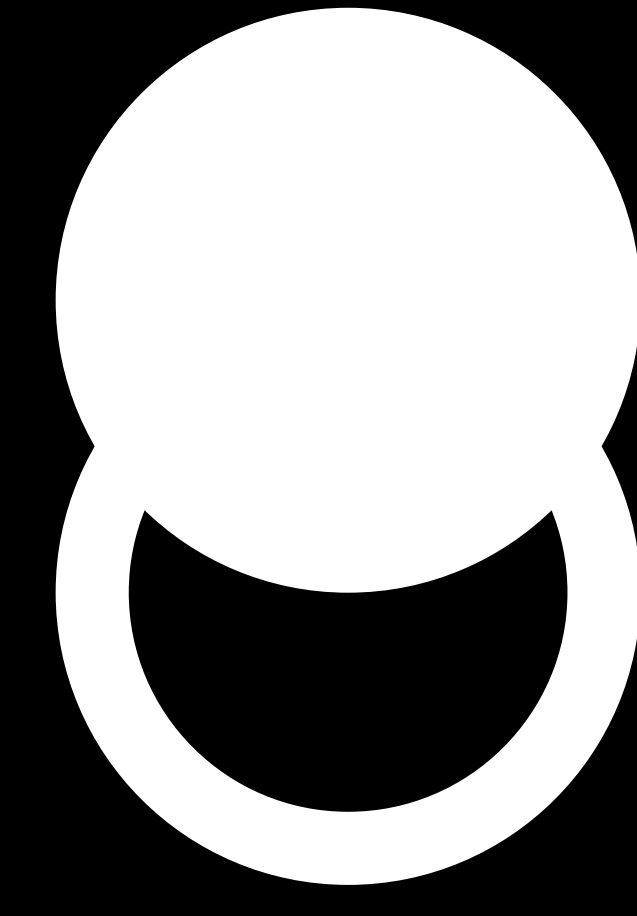
Triggers



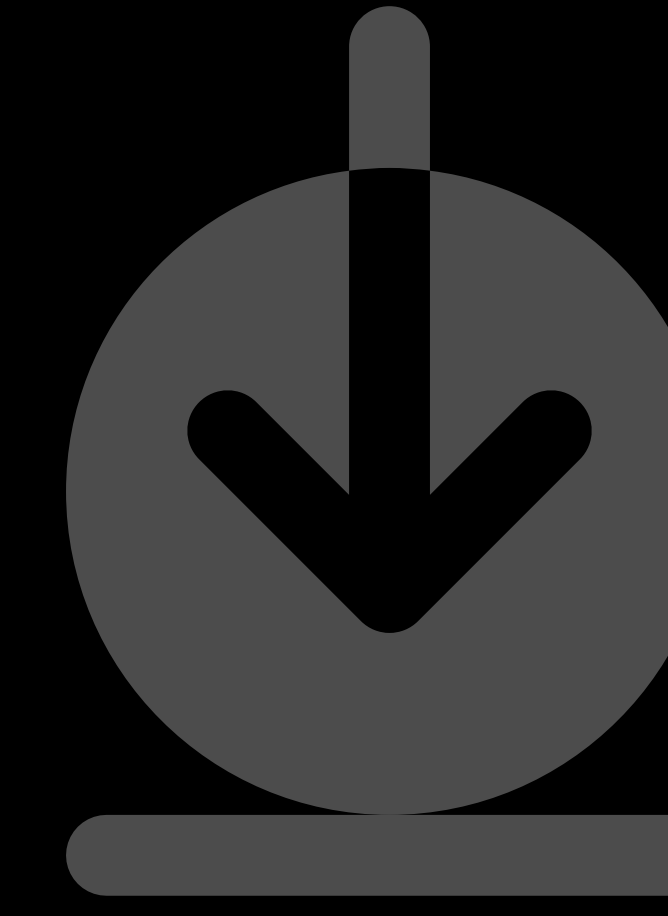
Start



Tap



Proximity

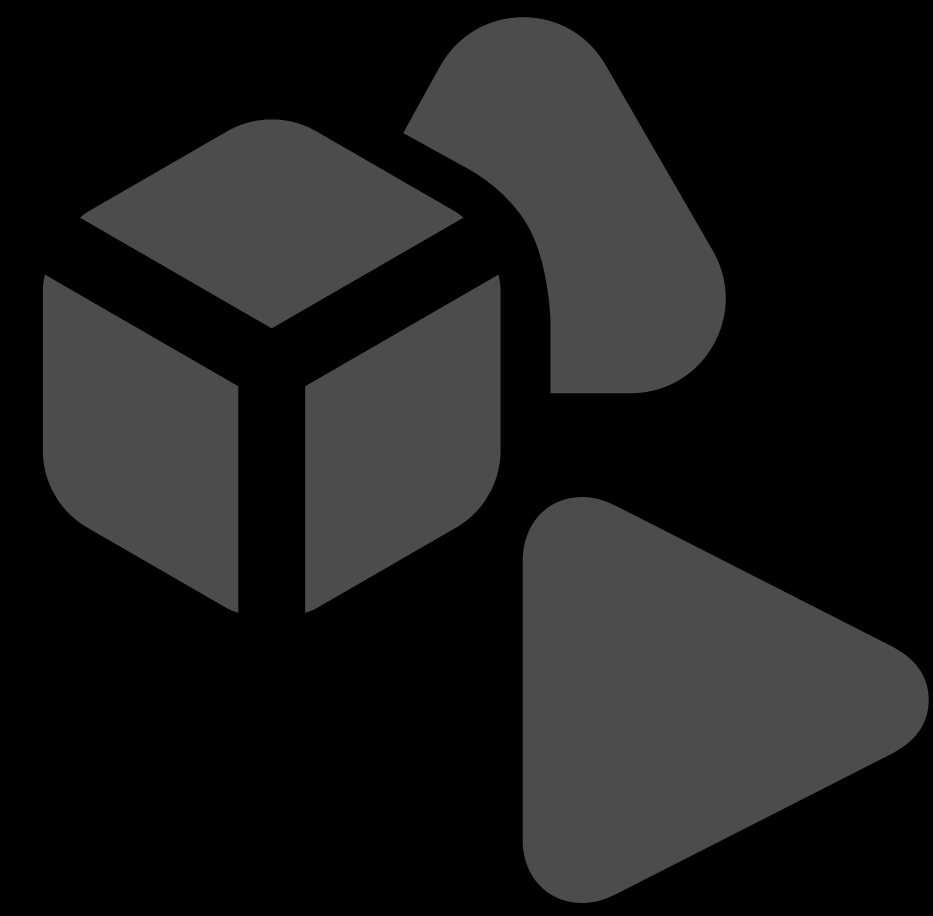


Collision

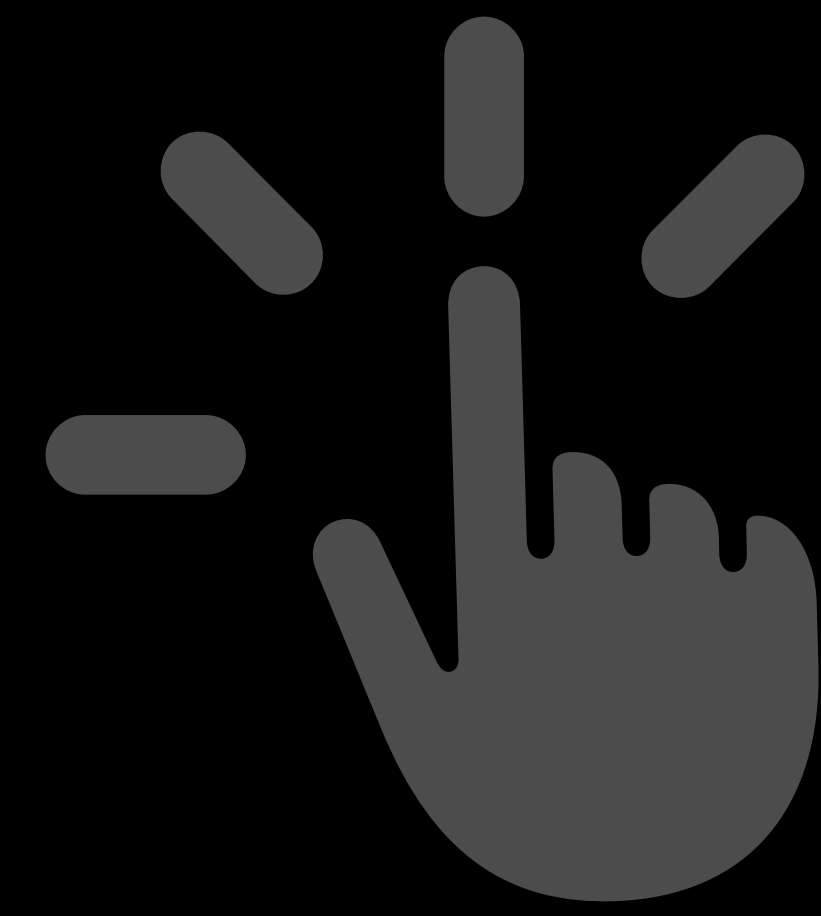


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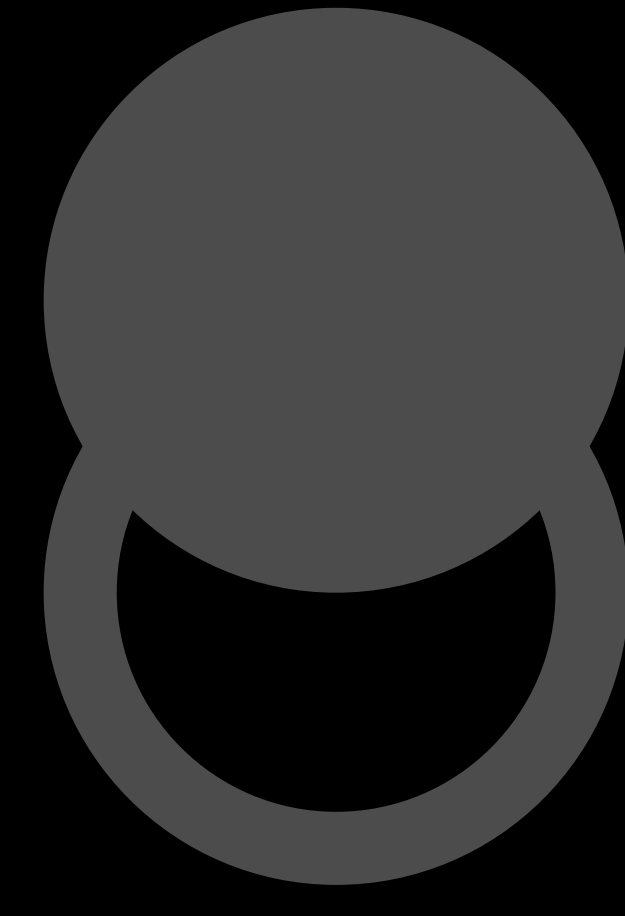
Triggers



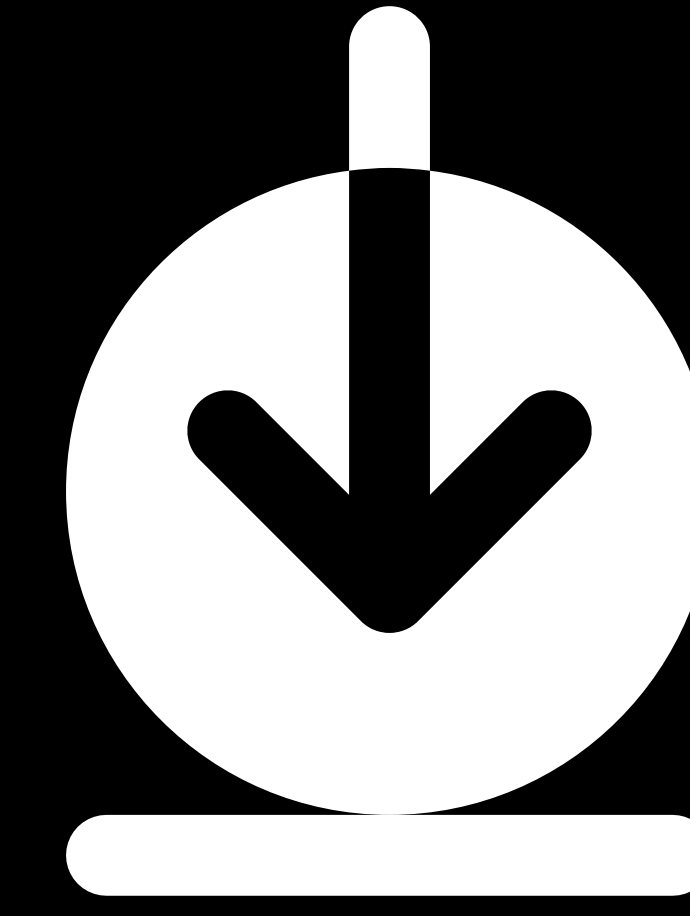
Start



Tap



Proximity

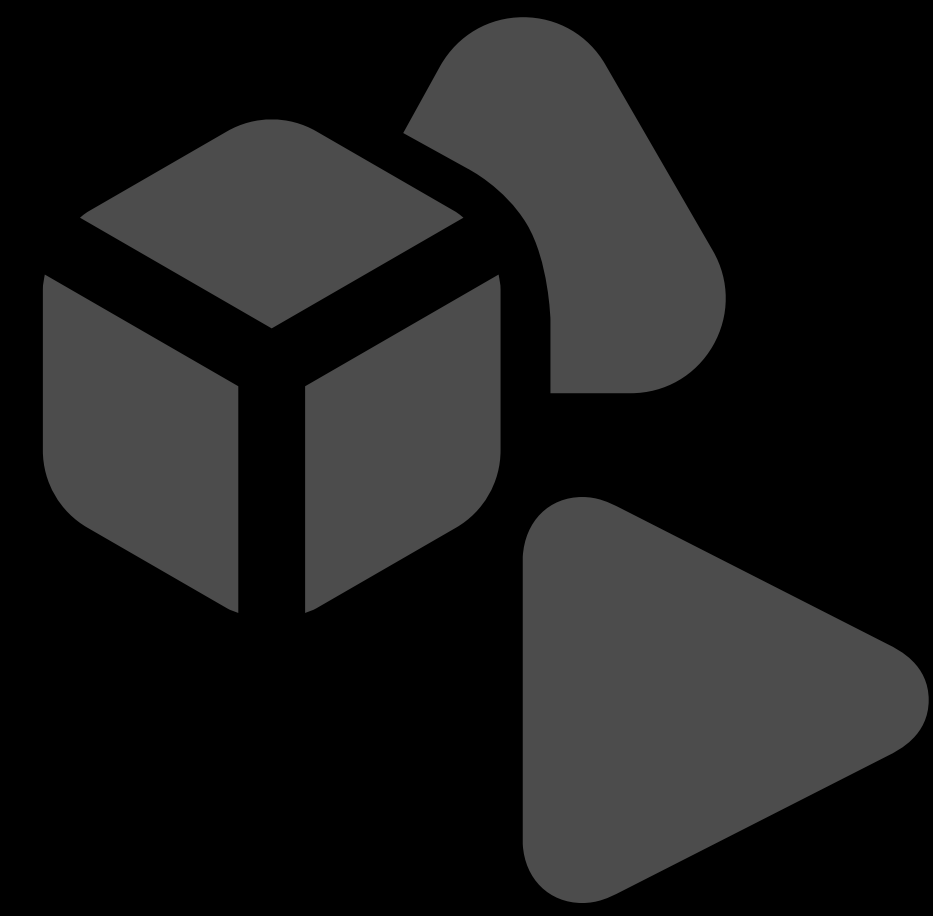


Collision

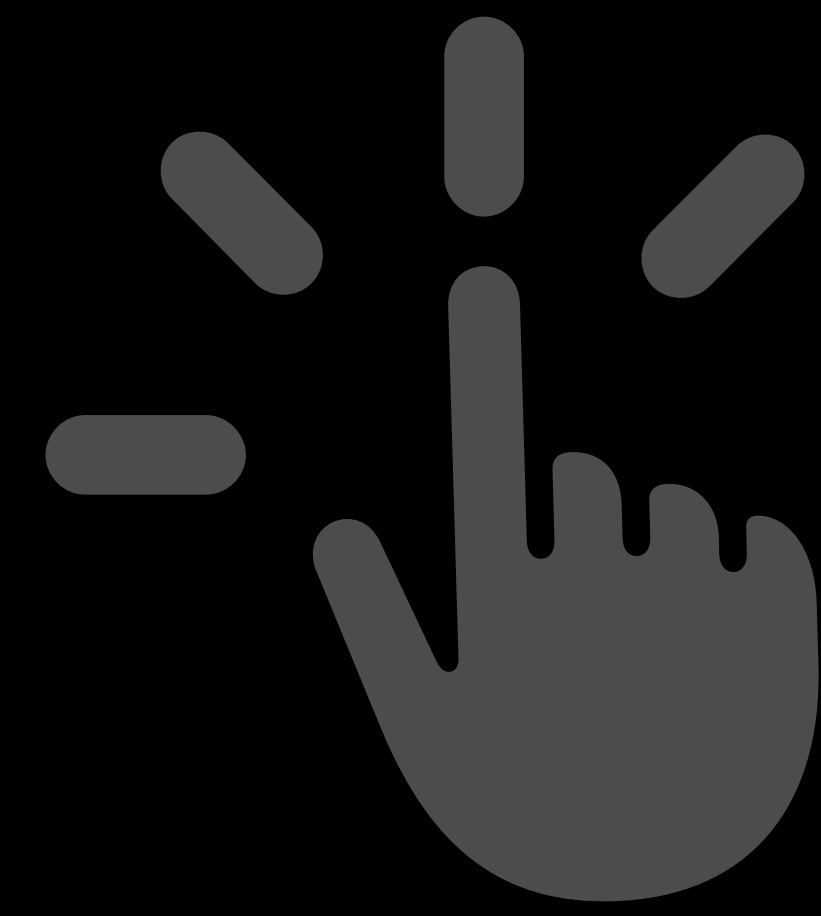


Notification

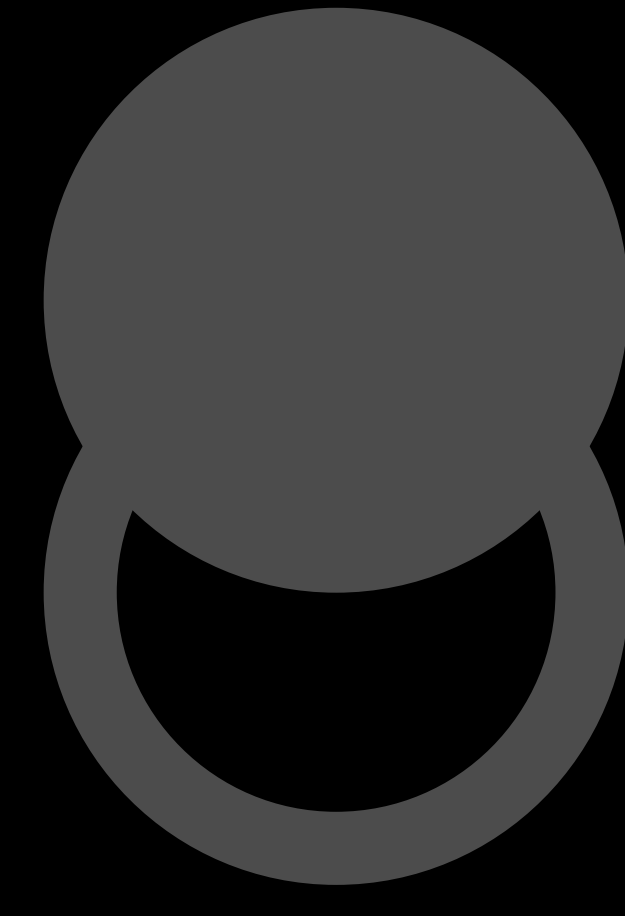
Triggers



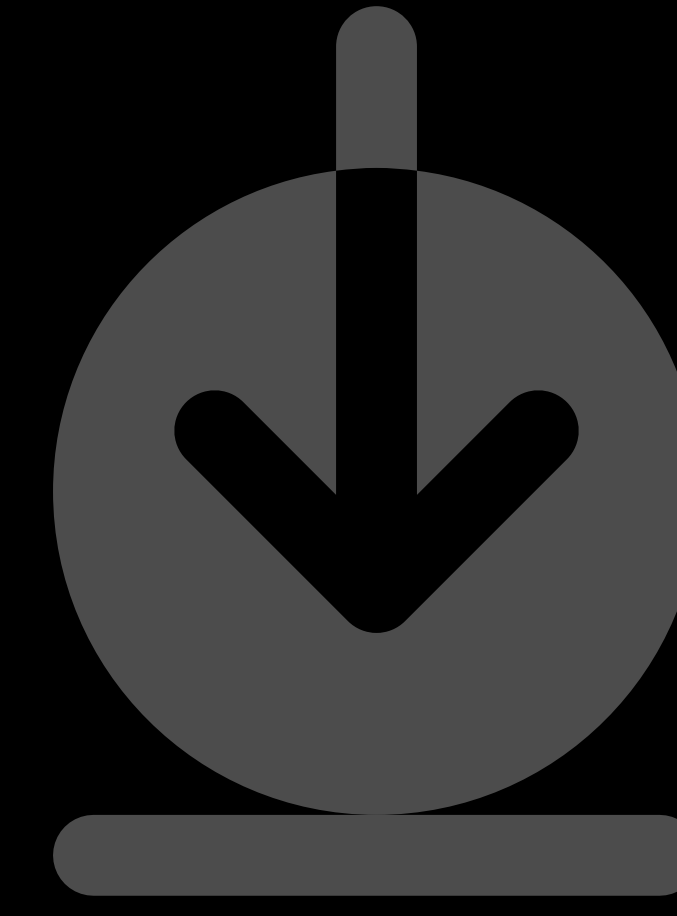
Start



Tap



Proximity



Collision



Notification

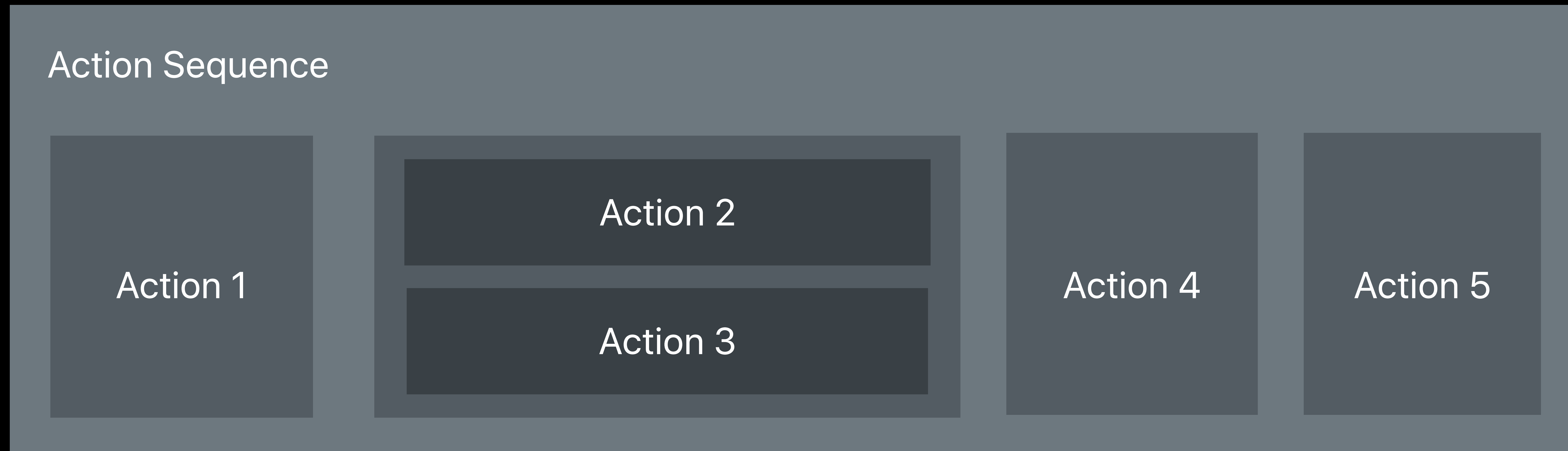
Action Sequence

Groups

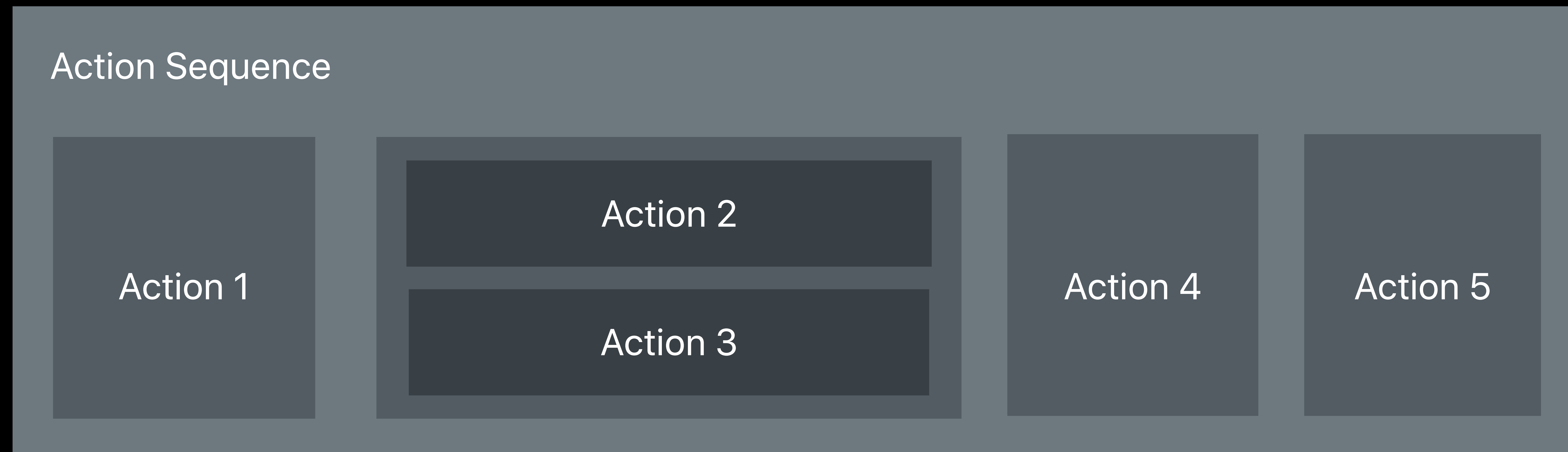
Looping

Exclusive action sequences

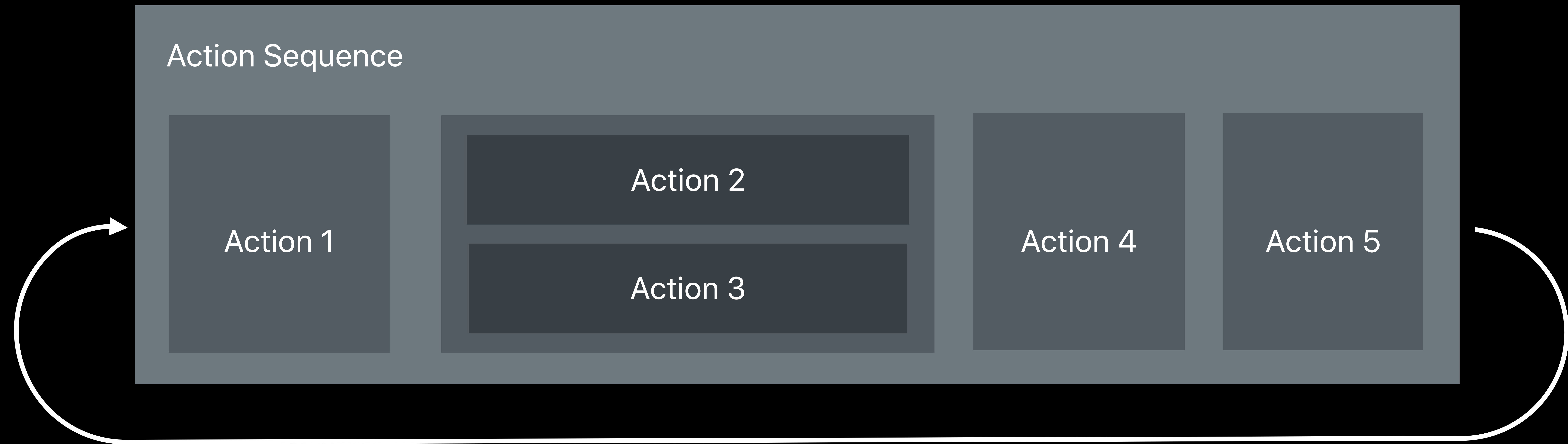
Groups



Looping

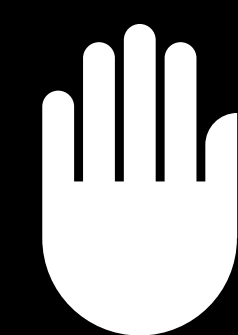


Looping



Exclusive Action Sequences

Exclusive
Action Sequence 1



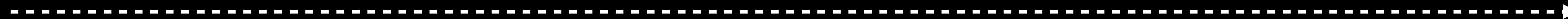
Exclusive
Action Sequence 2



Action Sequence 3



Time



Visibility Actions



Show



Hide



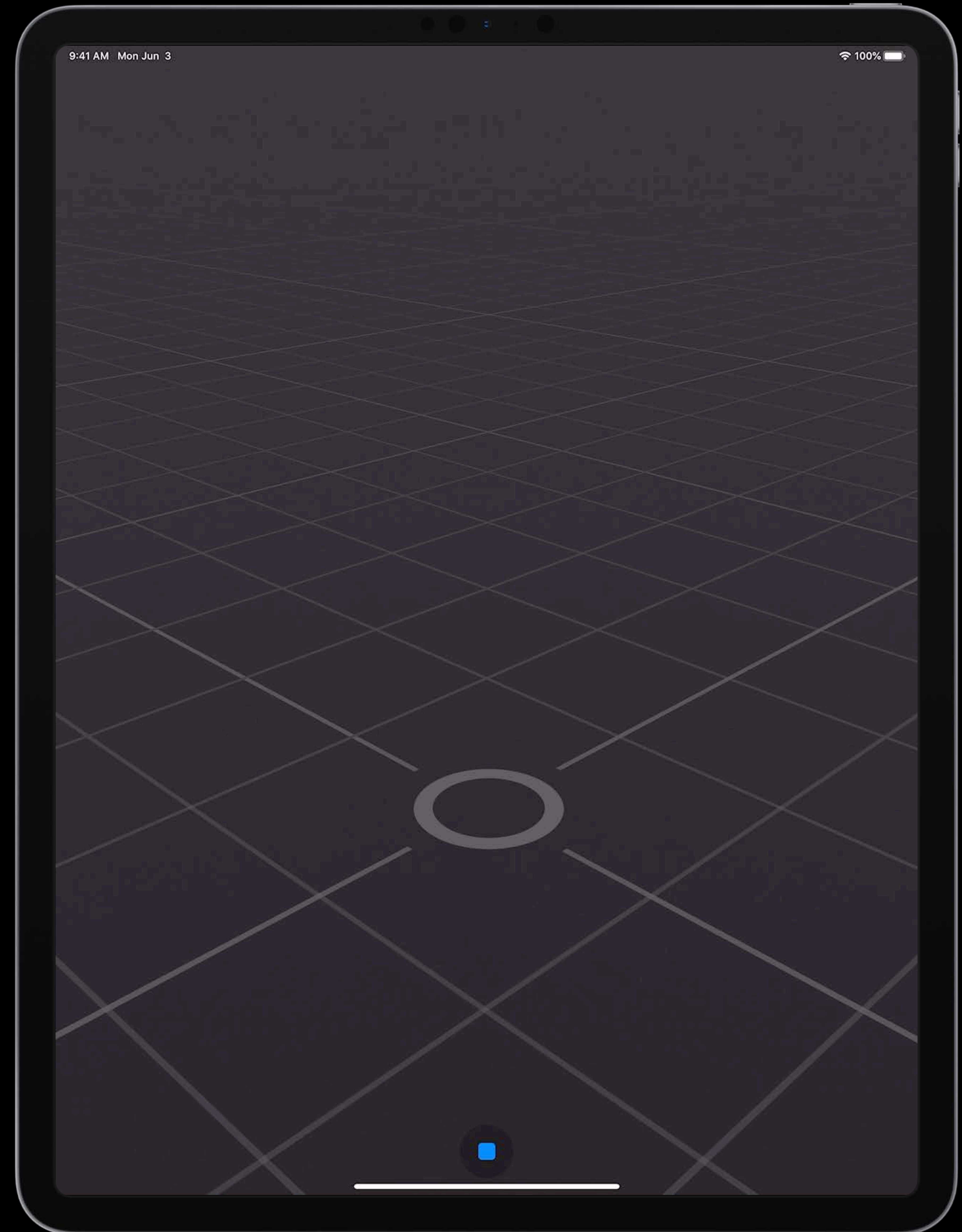
Visibility Actions



Show



Hide



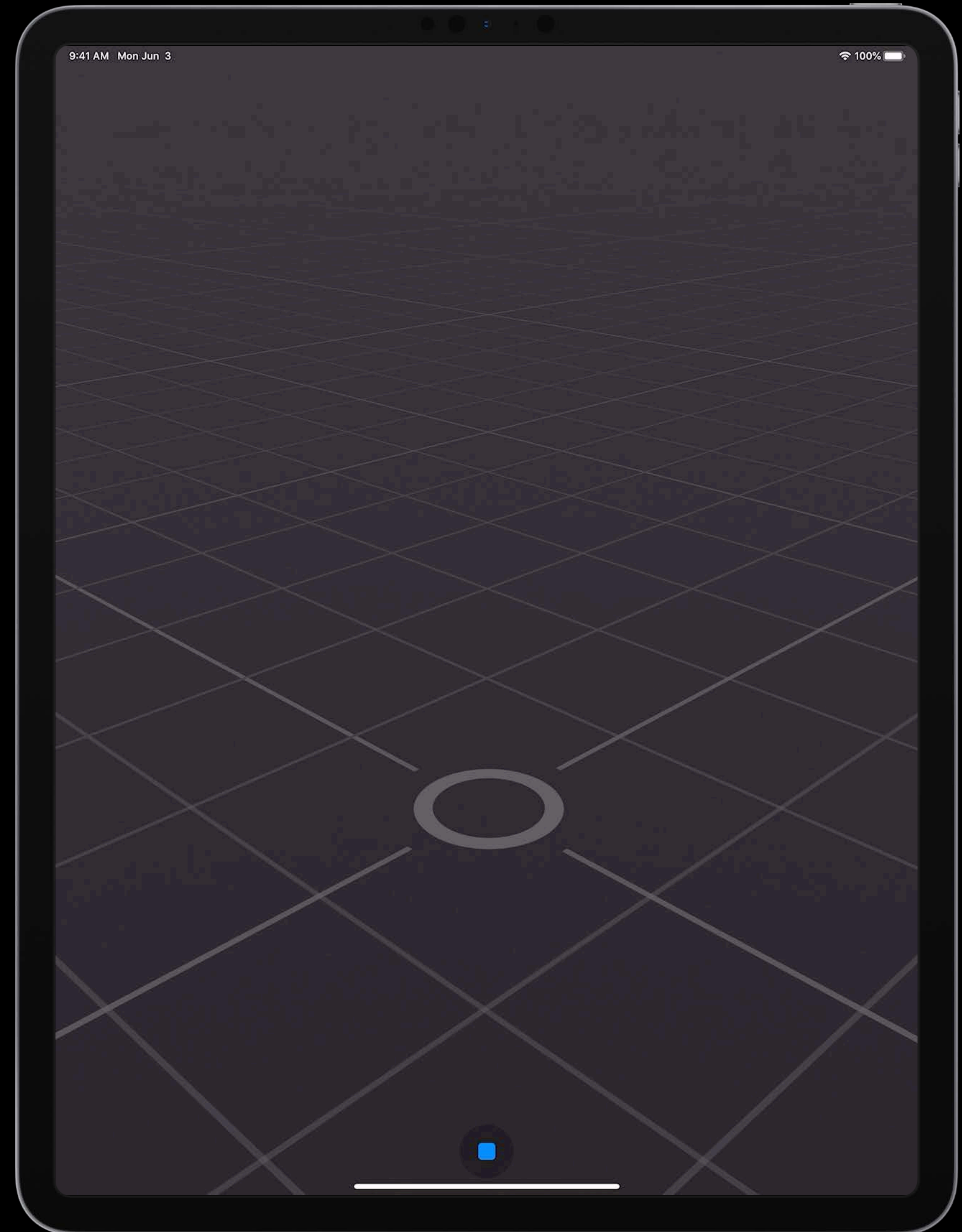
Visibility Actions



Show



Hide



Visibility Actions



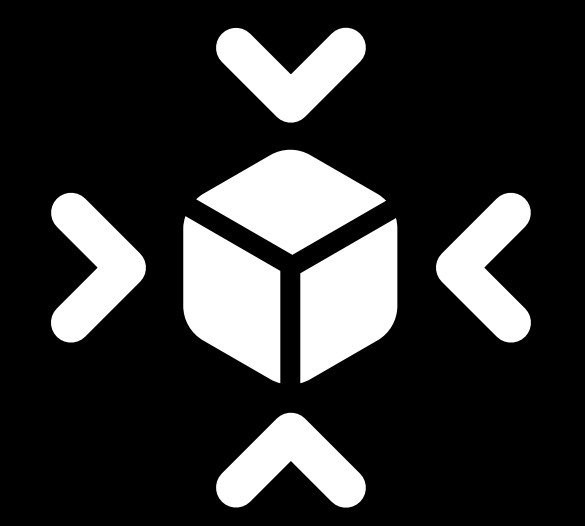
Show



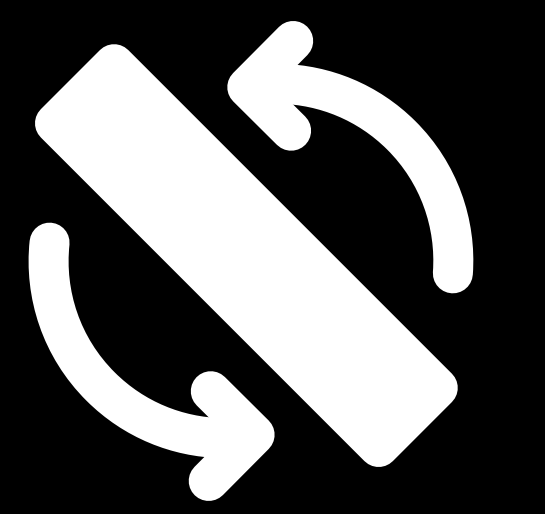
Hide



Animate Actions



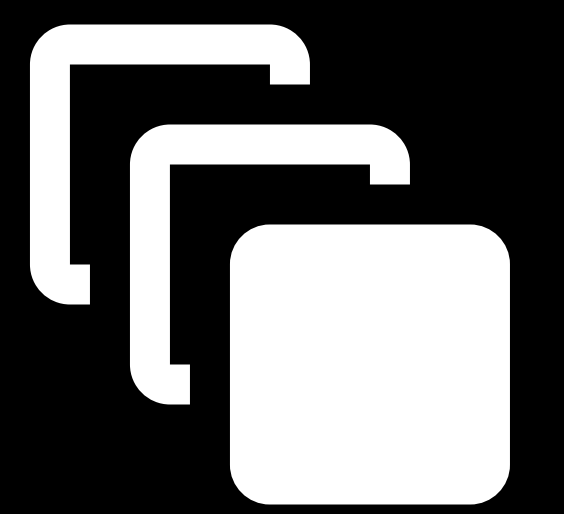
Emphasis



Spin



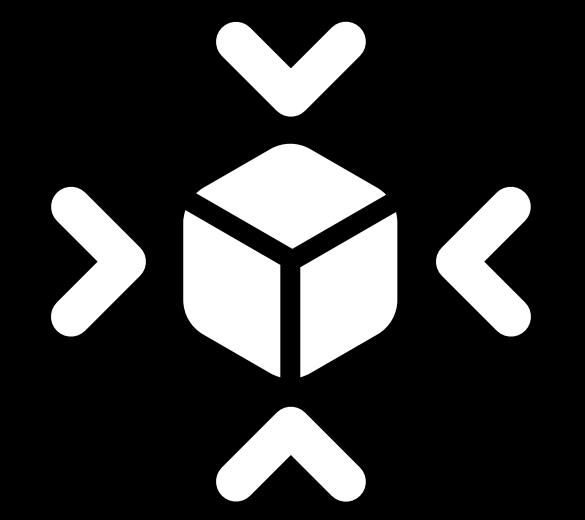
Orbit



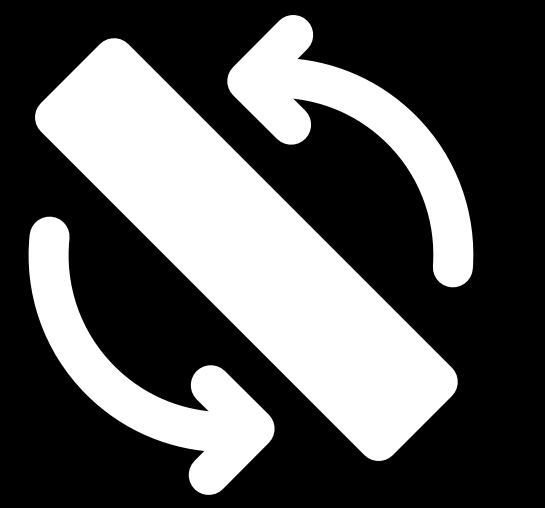
Usdz Animation



Animate Actions



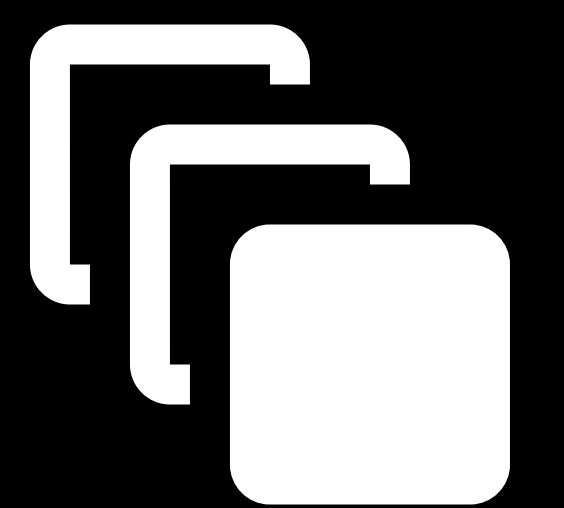
Emphasis



Spin



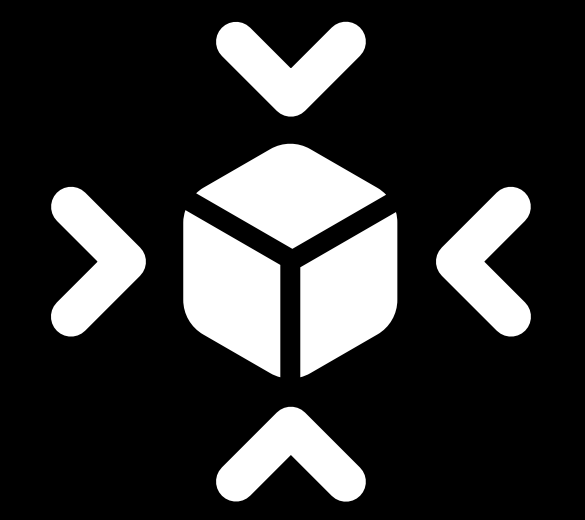
Orbit



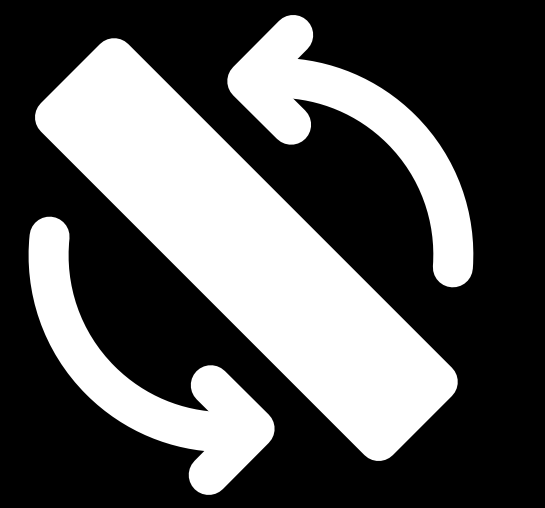
Usdz Animation



Animate Actions



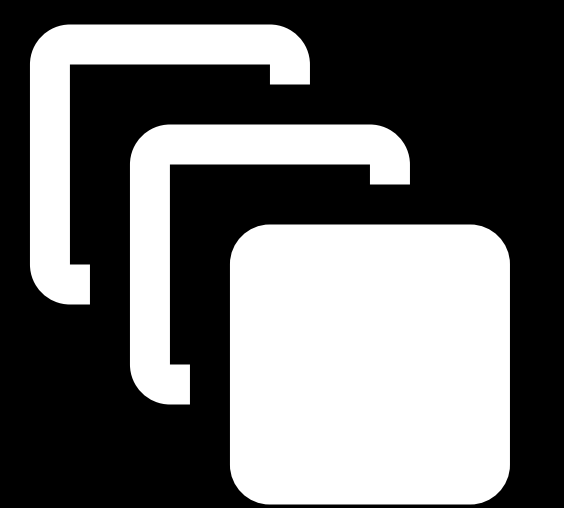
Emphasis



Spin



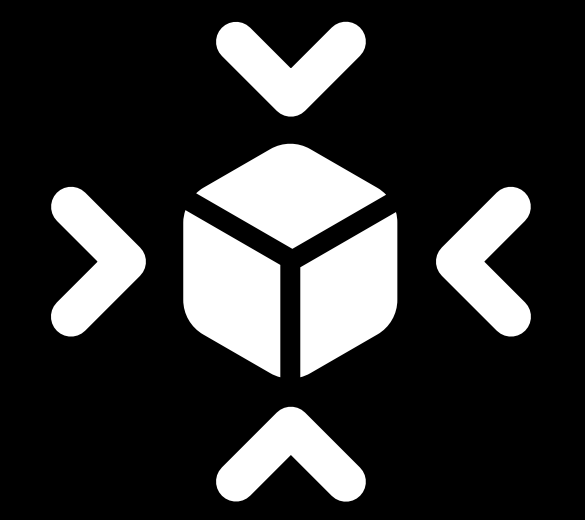
Orbit



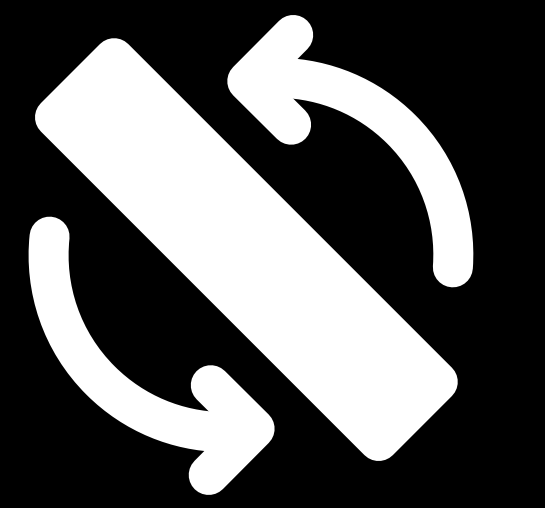
Usdz Animation



Animate Actions



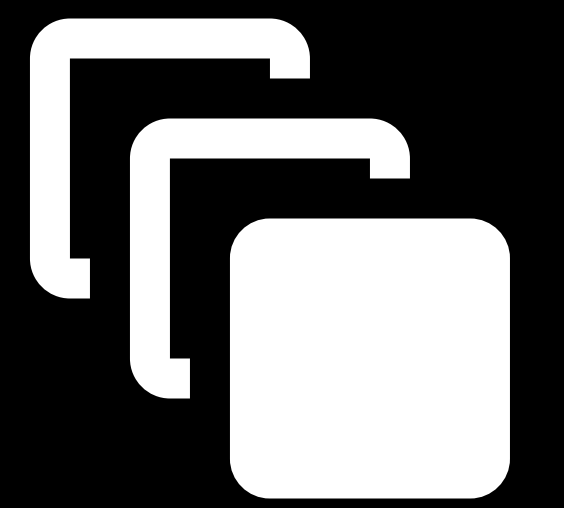
Emphasis



Spin



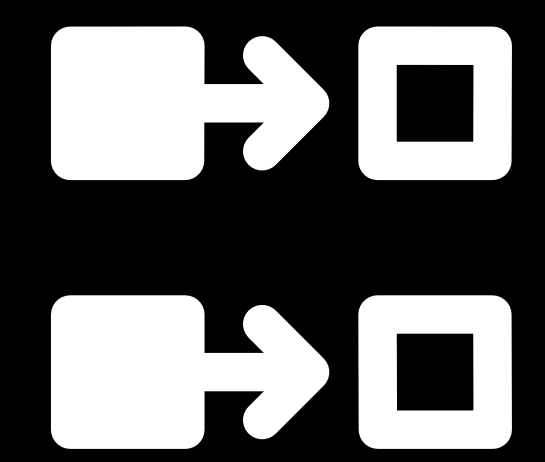
Orbit



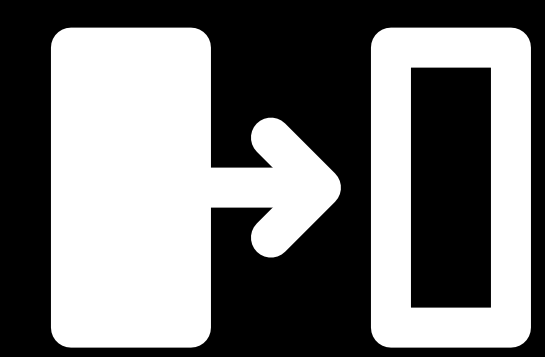
Usdz Animation



Move Actions



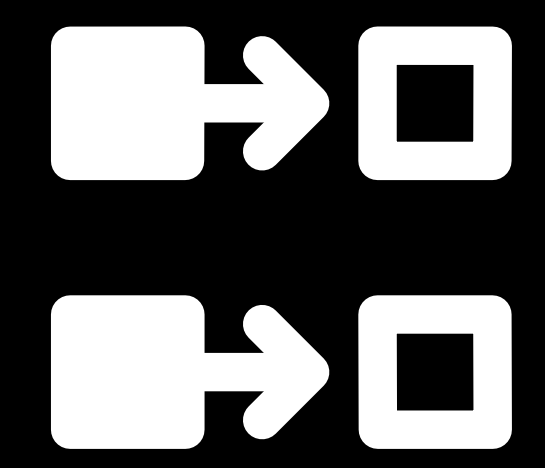
Move By



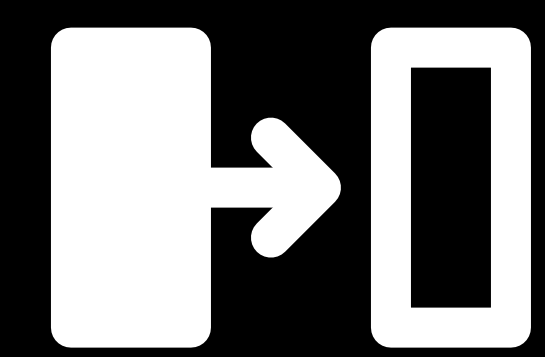
Move To



Move Actions



Move By



Move To



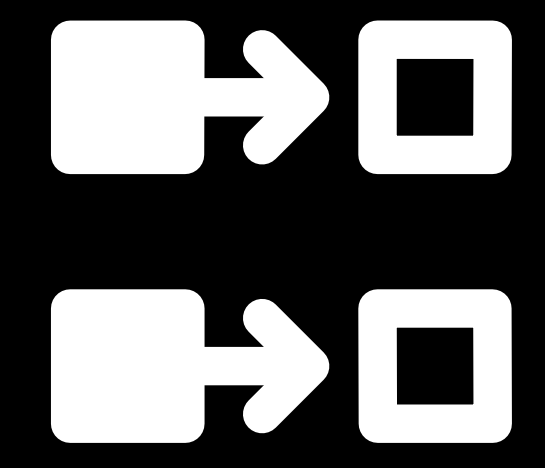
Move Actions

  Move By

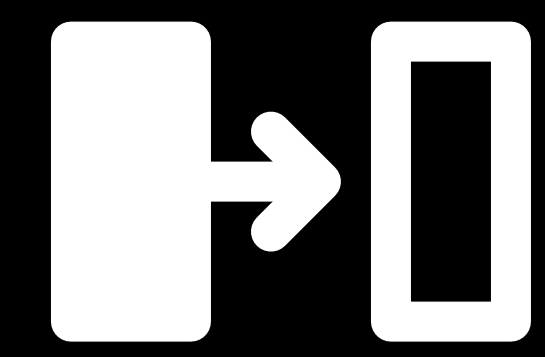
 Move To



Move Actions



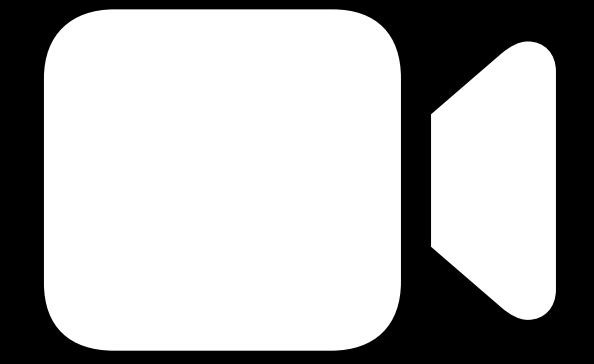
Move By



Move To



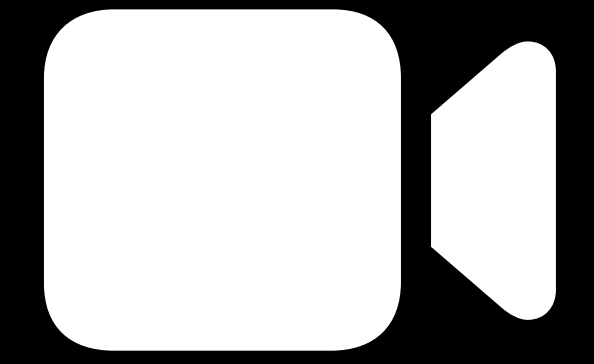
Look At Action



Look At



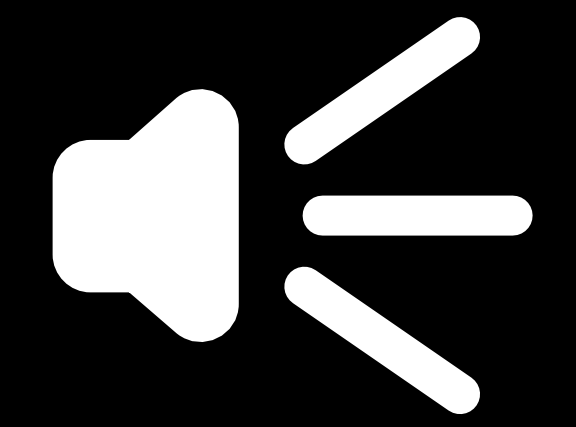
Look At Action



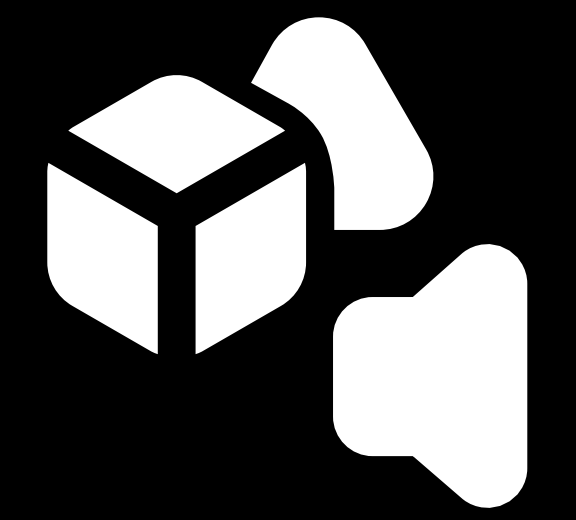
Look At



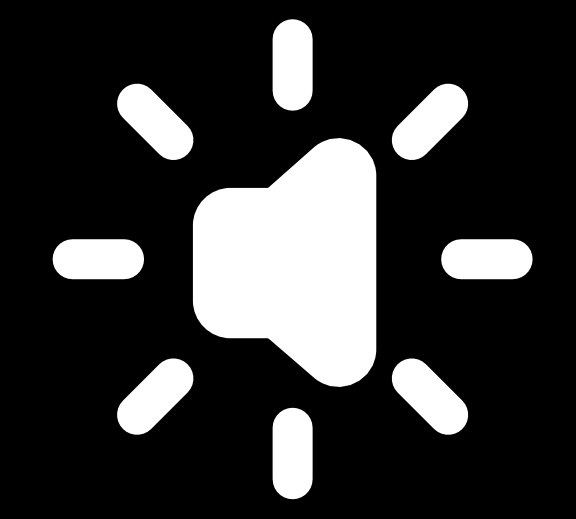
Audio Actions



Play Sound



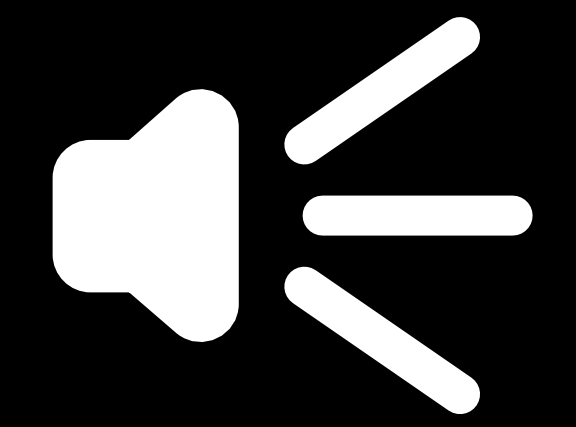
Play Ambient



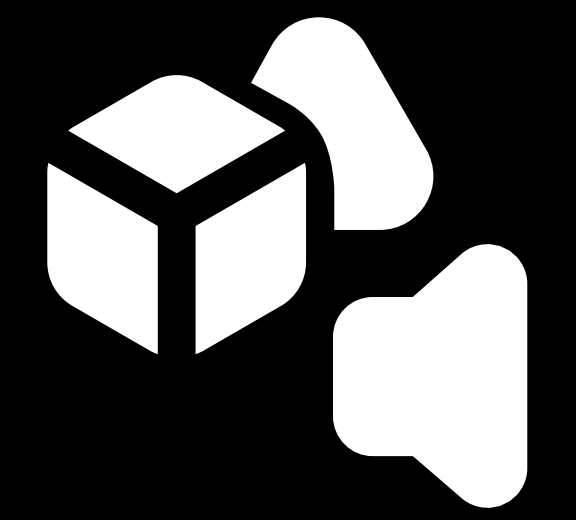
Play Music



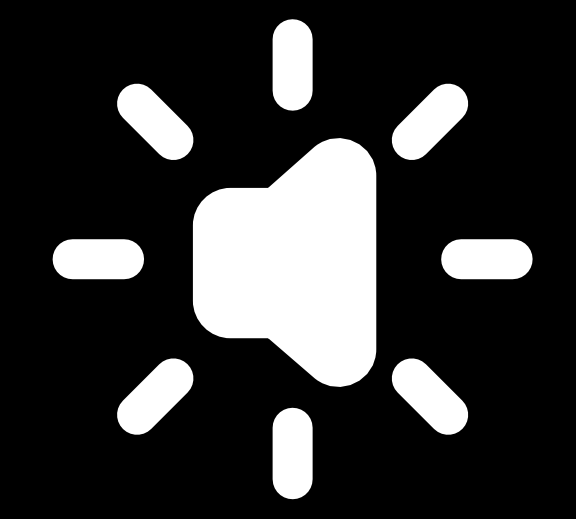
Audio Actions



Play Sound



Play Ambient



Play Music



Demo

Building Scenes

Adding Behaviors

Using Physics

Building Apps

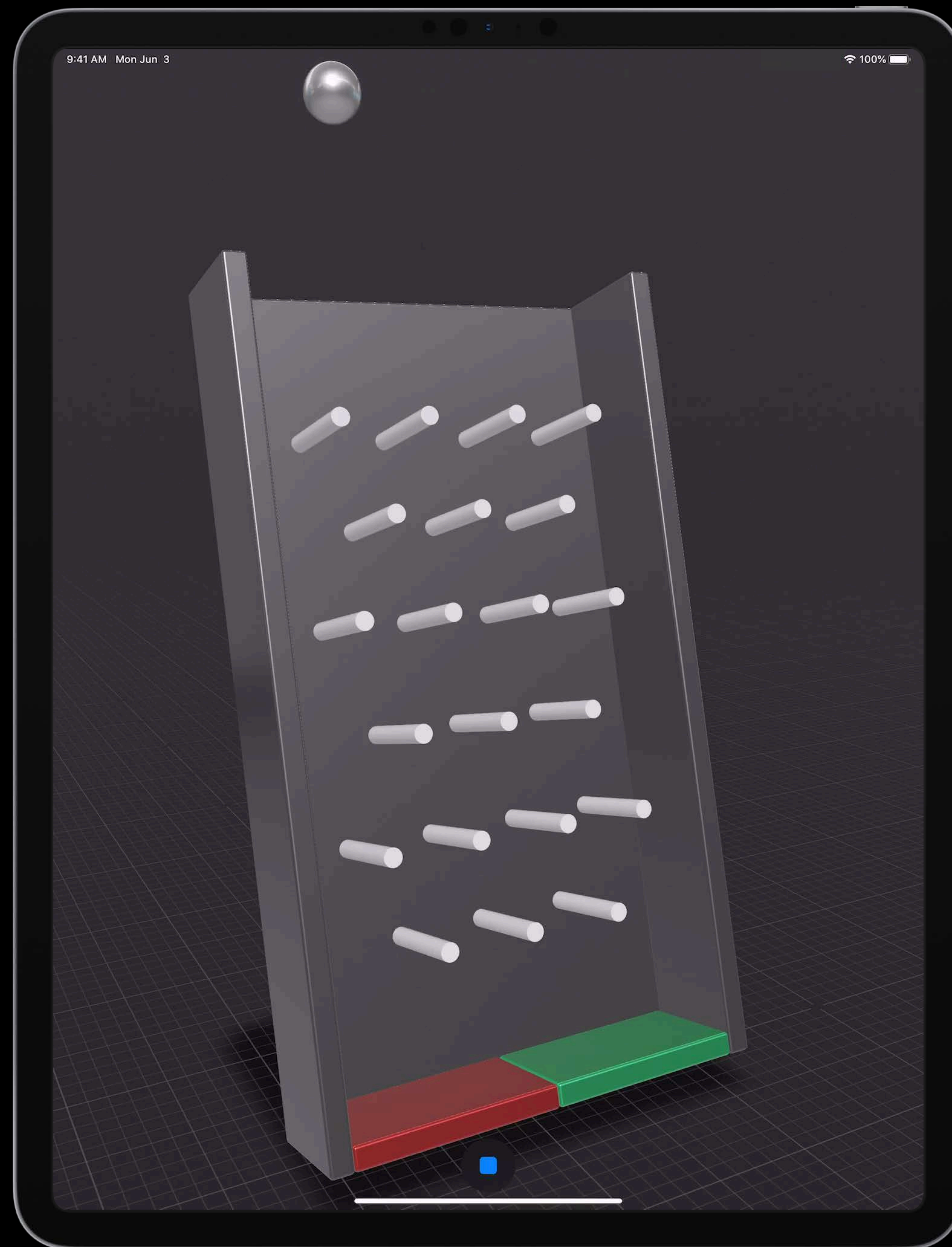
Building Scenes

Adding Behaviors

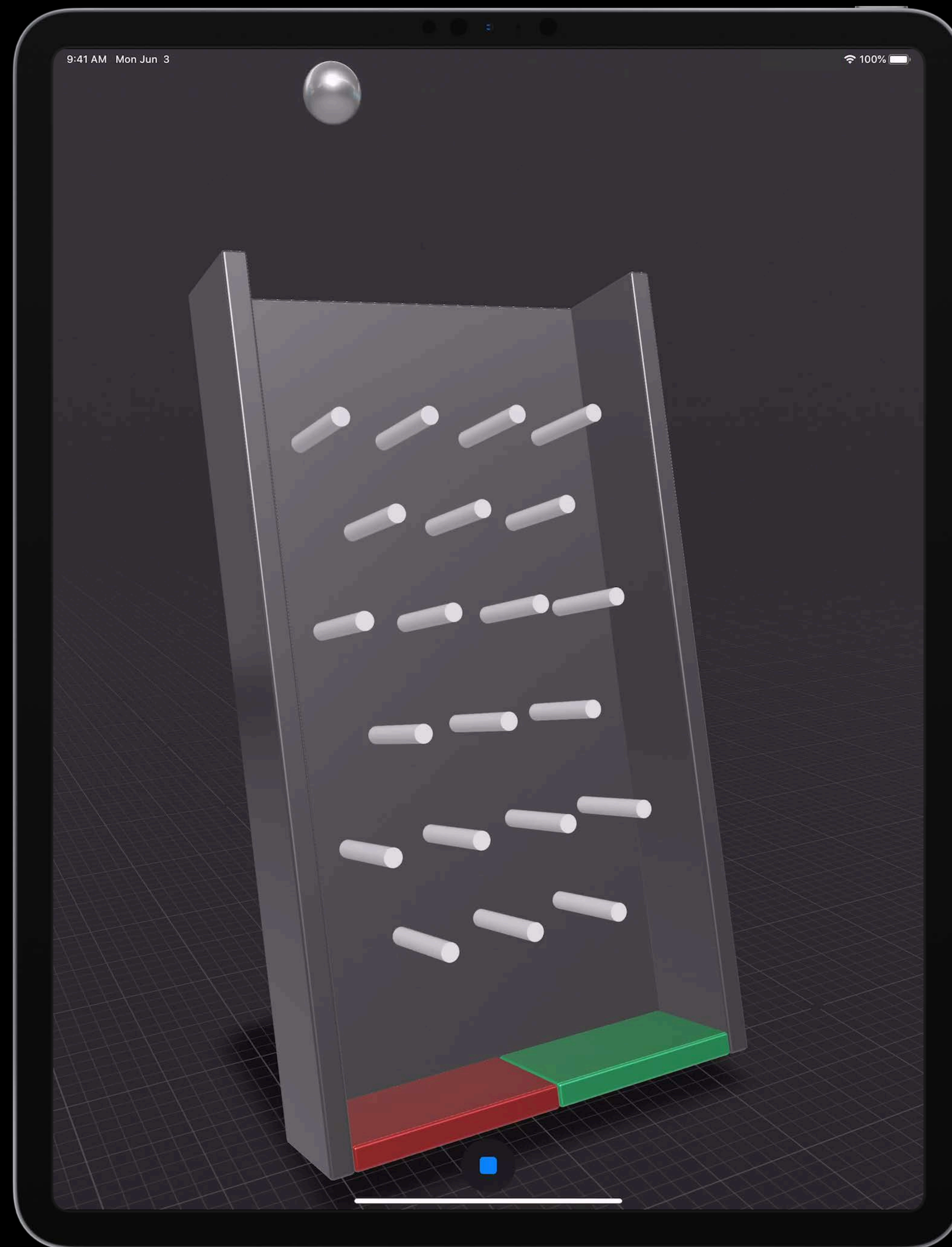
Using Physics

Building Apps

Physics



Physics



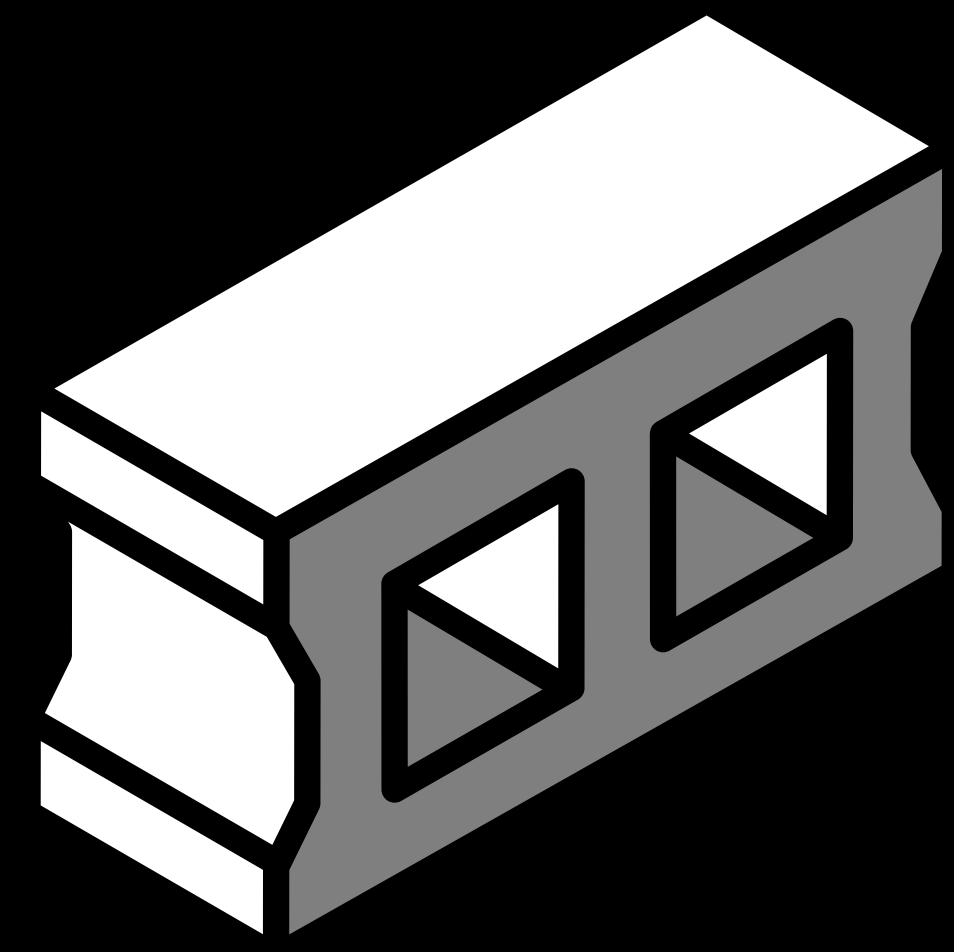
Physics

Physical materials

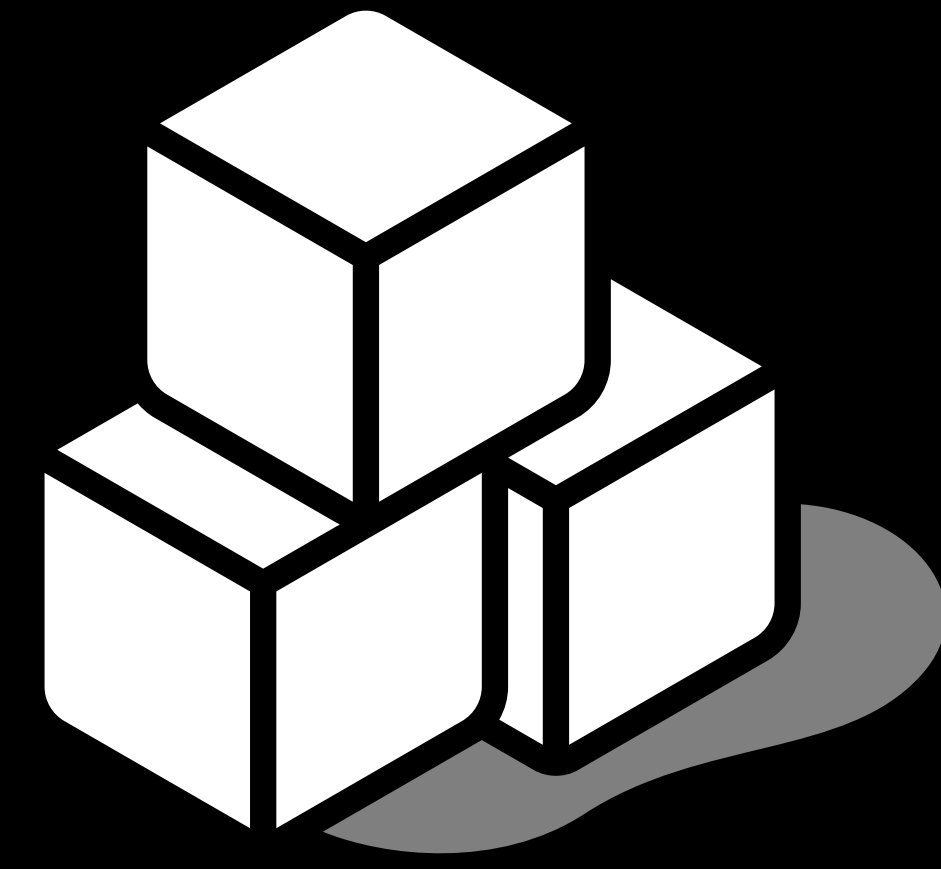
Forces

Collisions

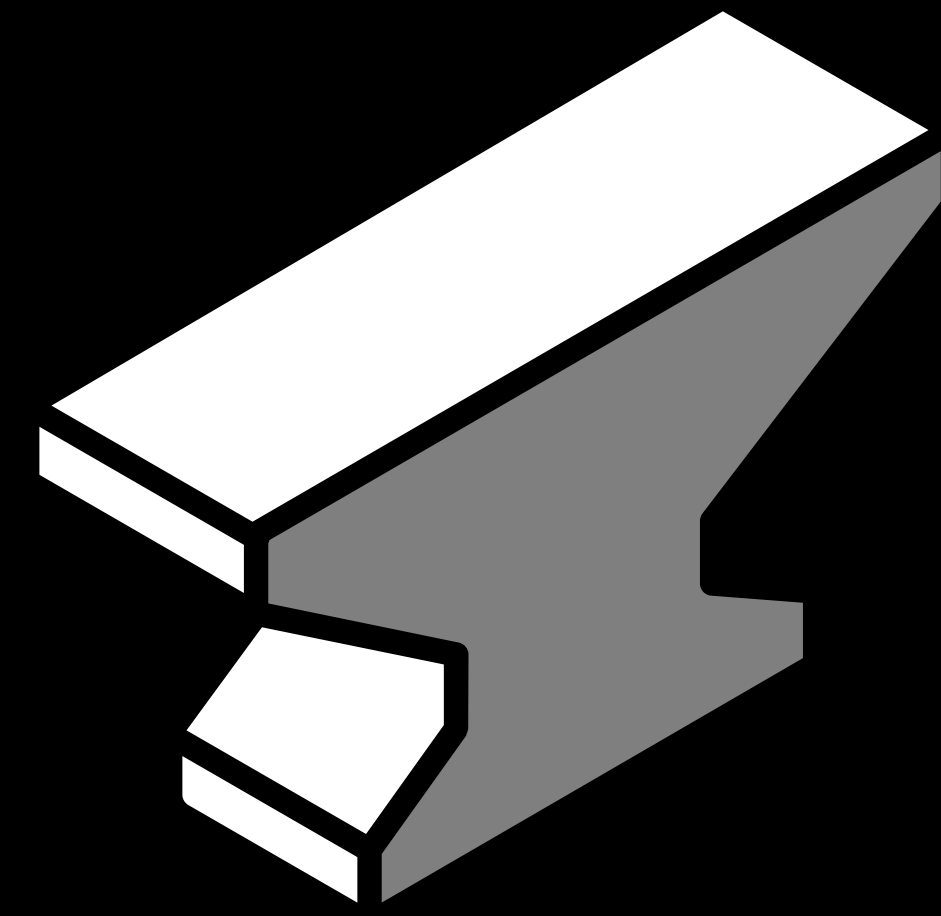
Materials



Concrete



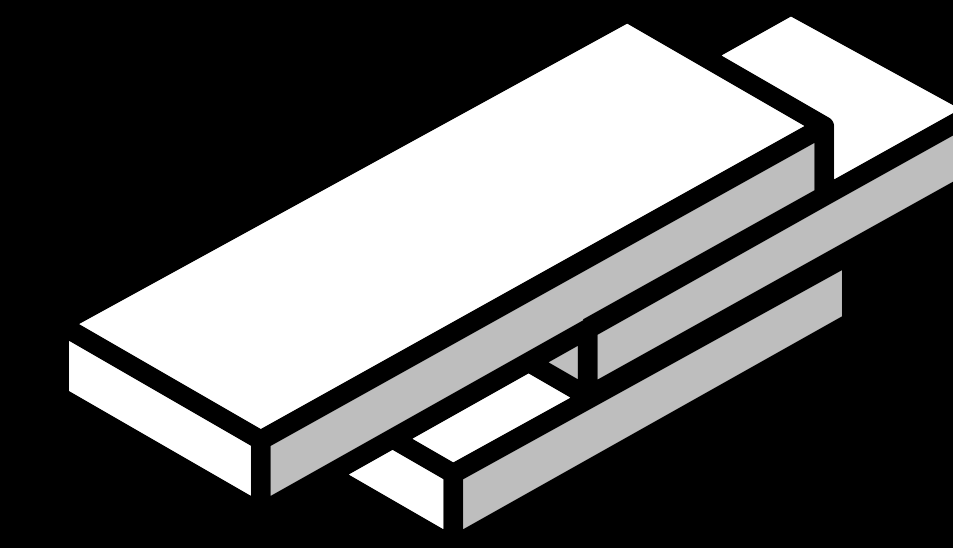
Ice



Lead



Plastic



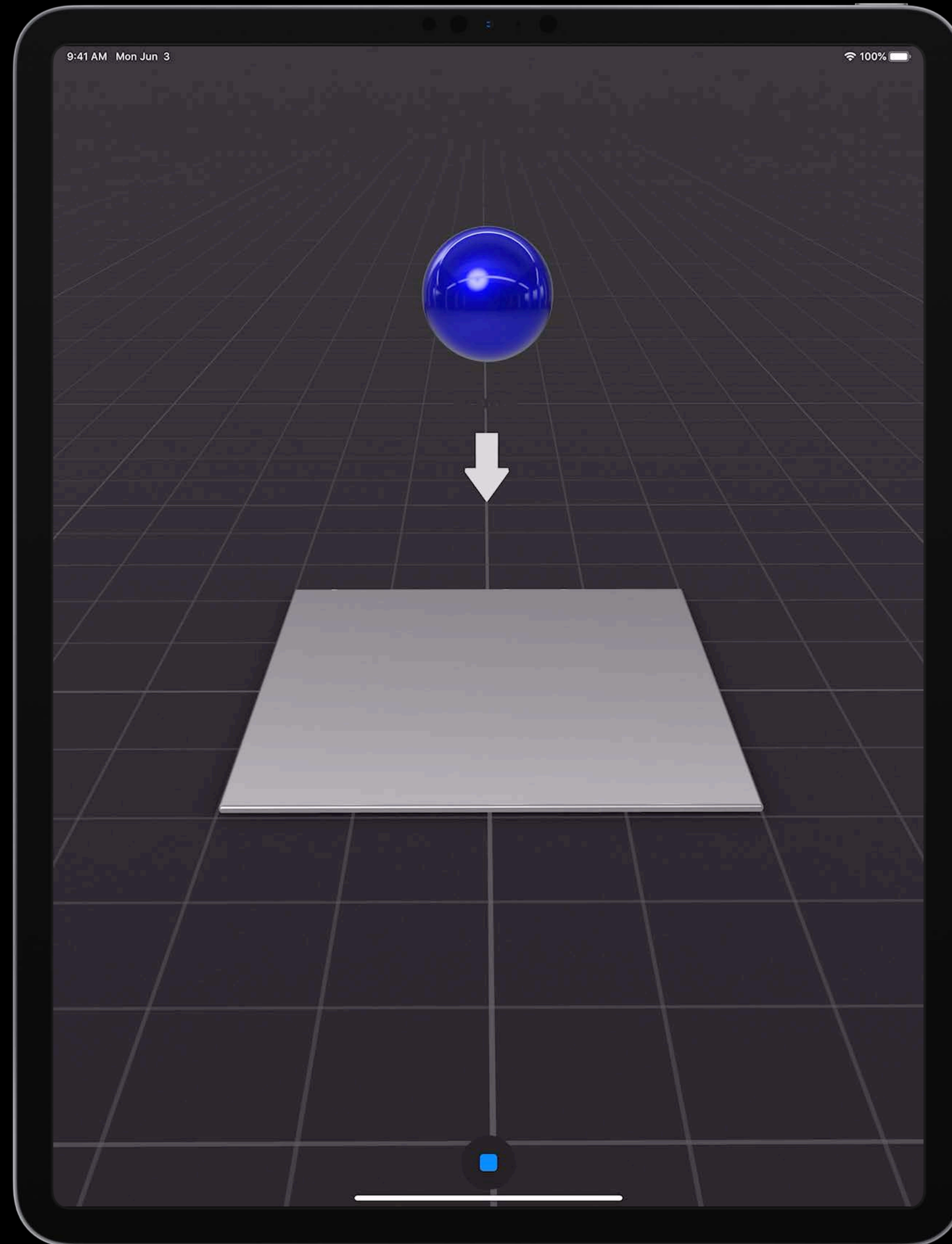
Wood



Rubber

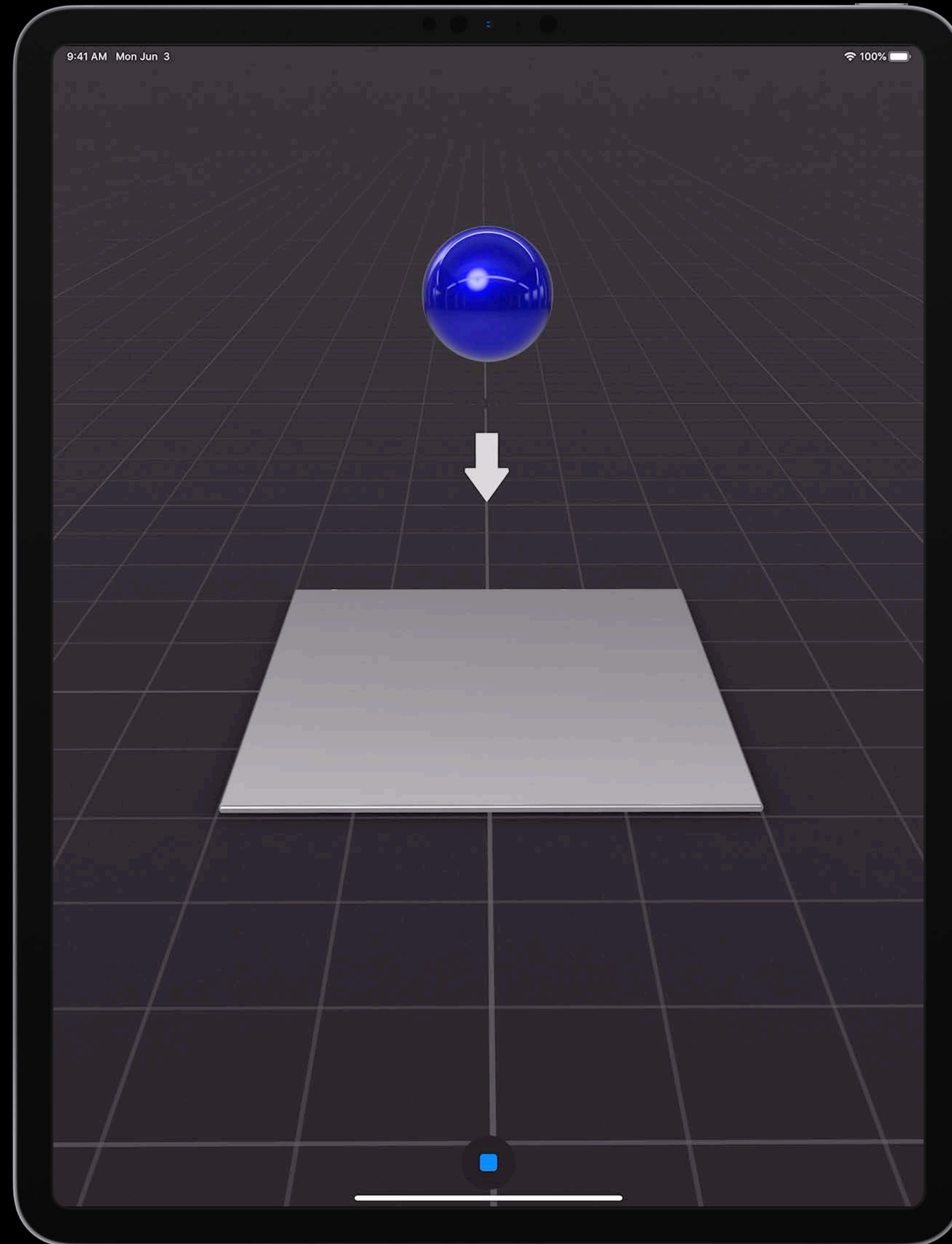
Forces

Gravity



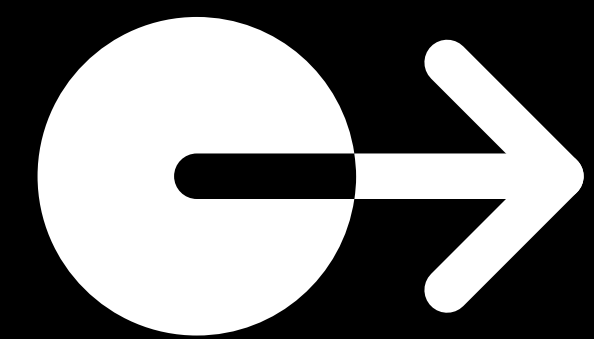
Forces

Gravity

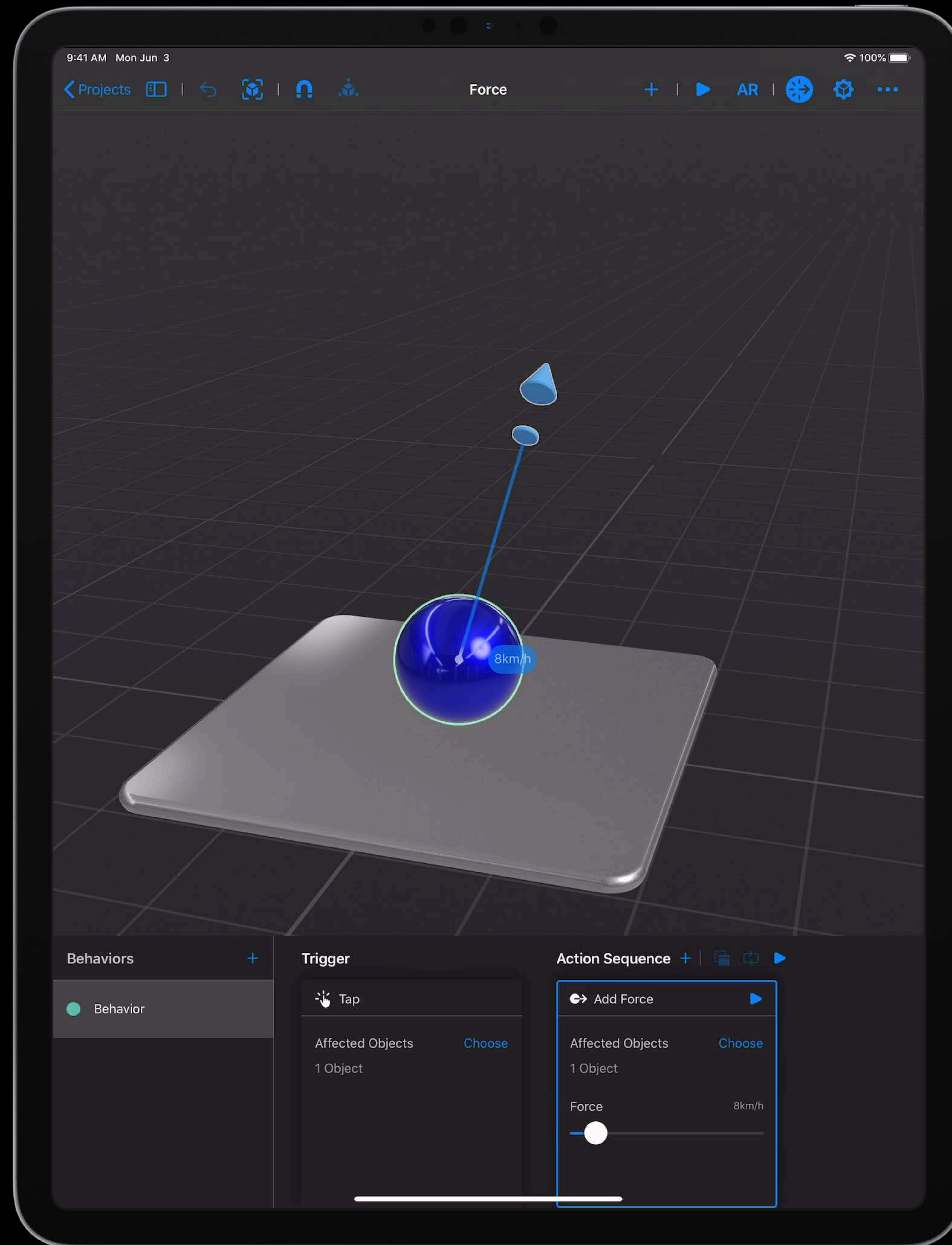


Forces

Force action

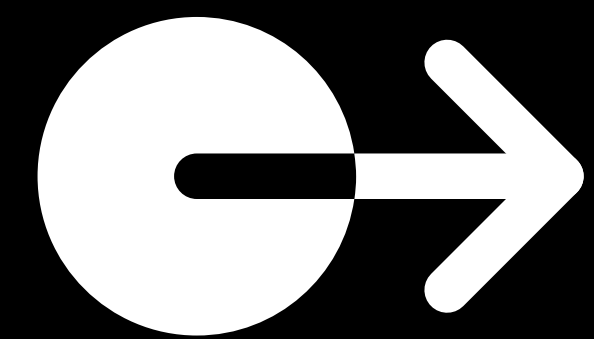


Add Force

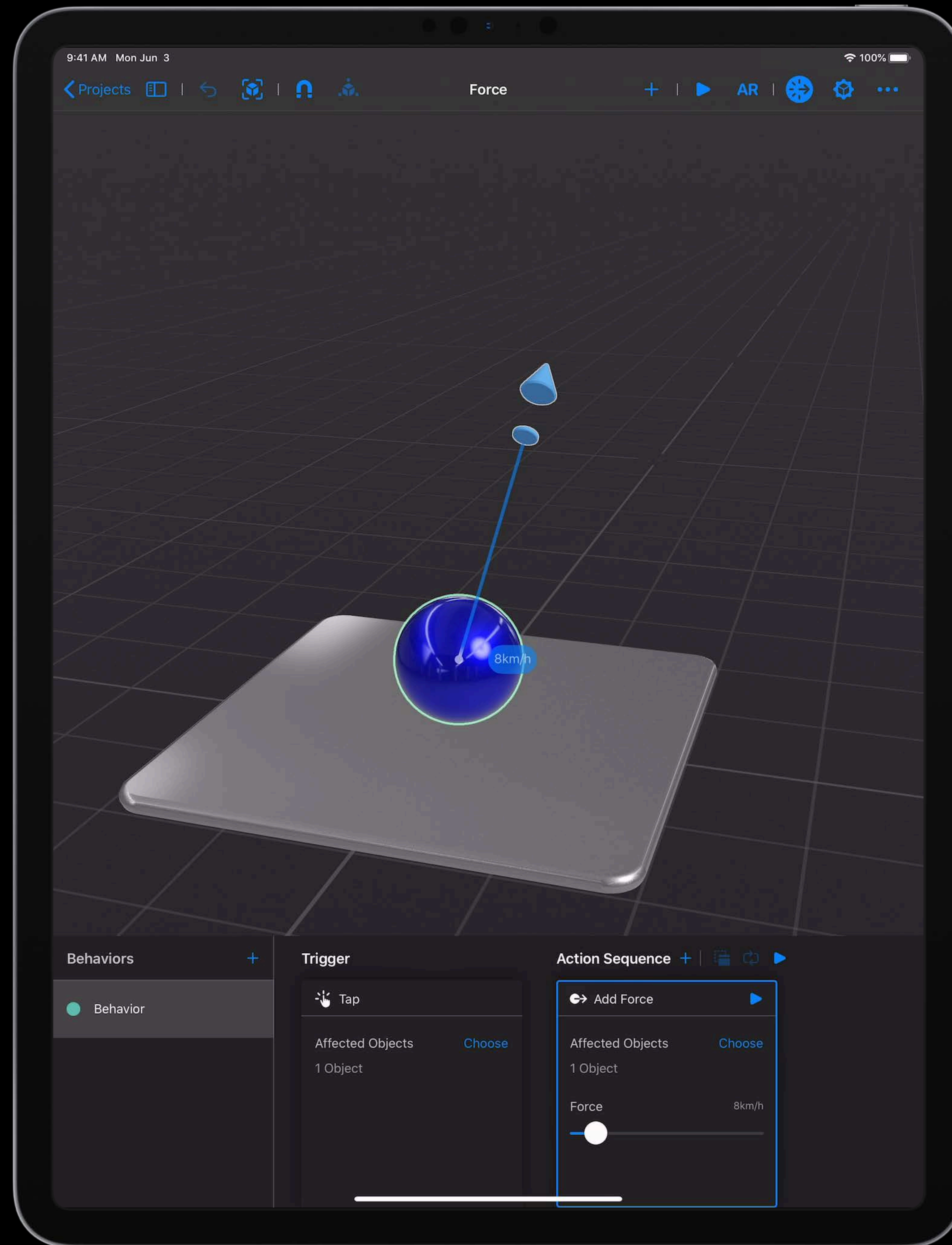


Forces

Force action

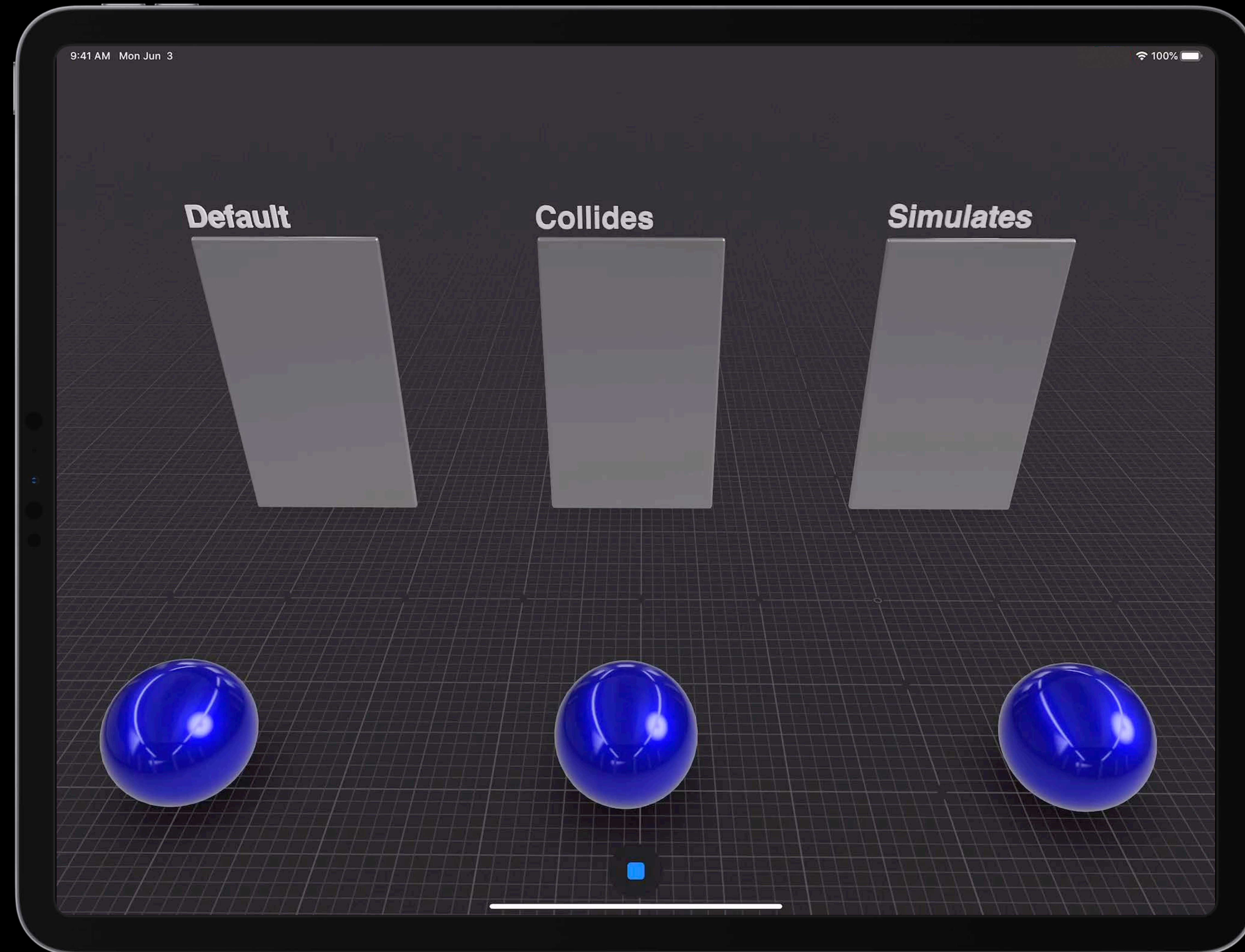


Add Force



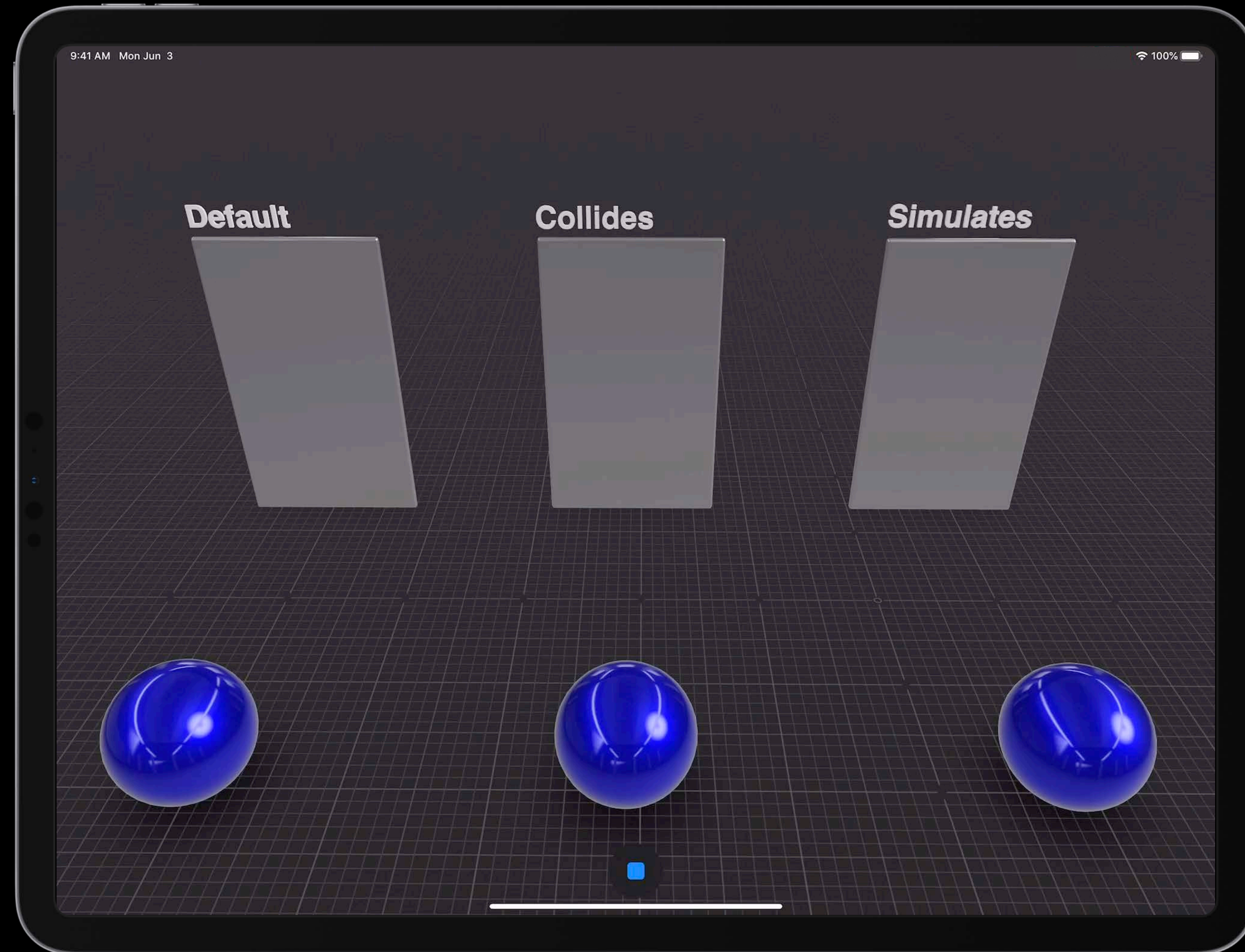
Collisions

Collides vs. simulates



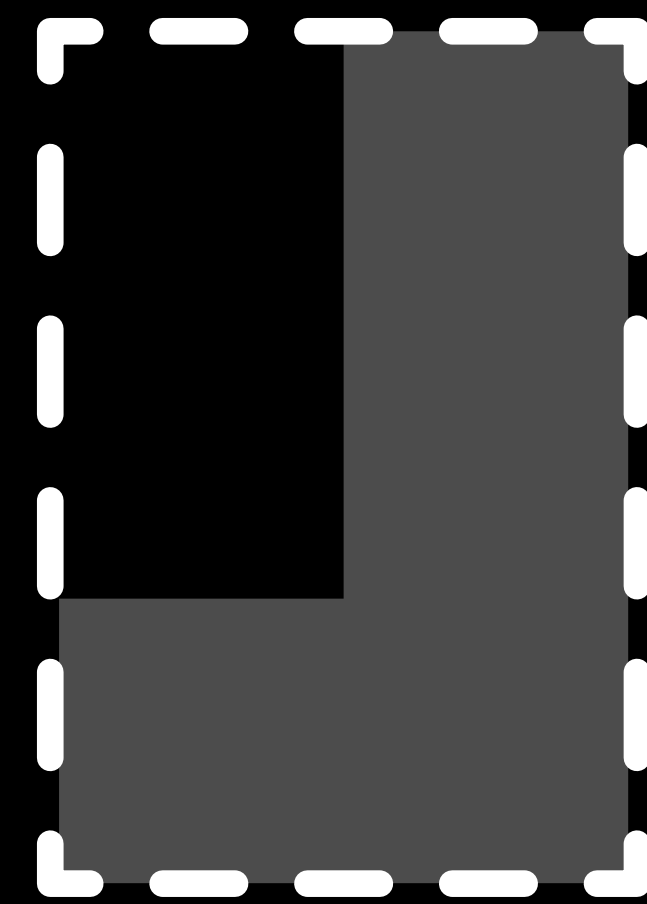
Collisions

Collides vs. simulates

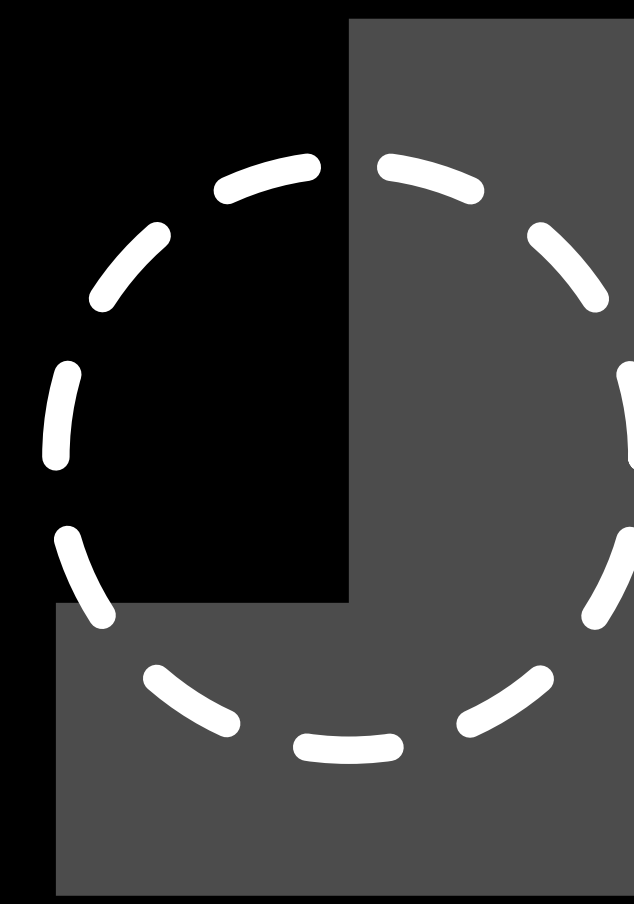


Collisions

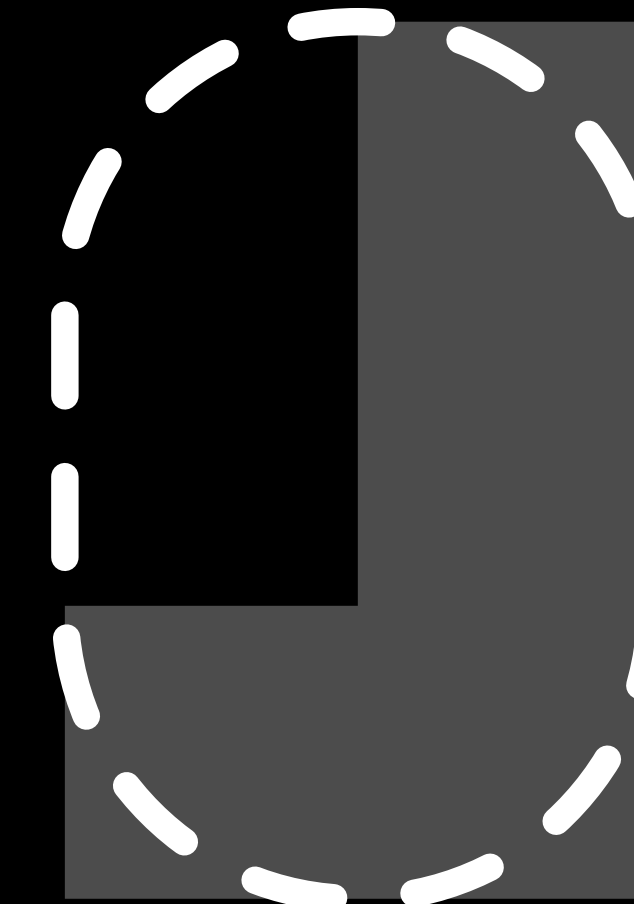
Shapes



Box



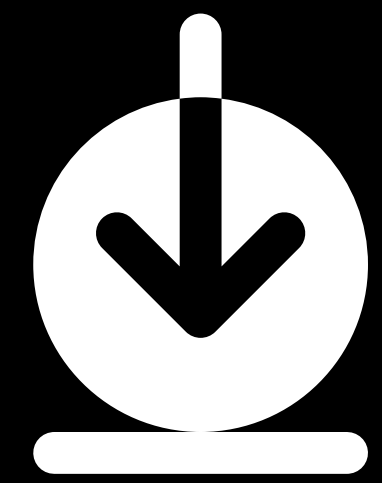
Sphere



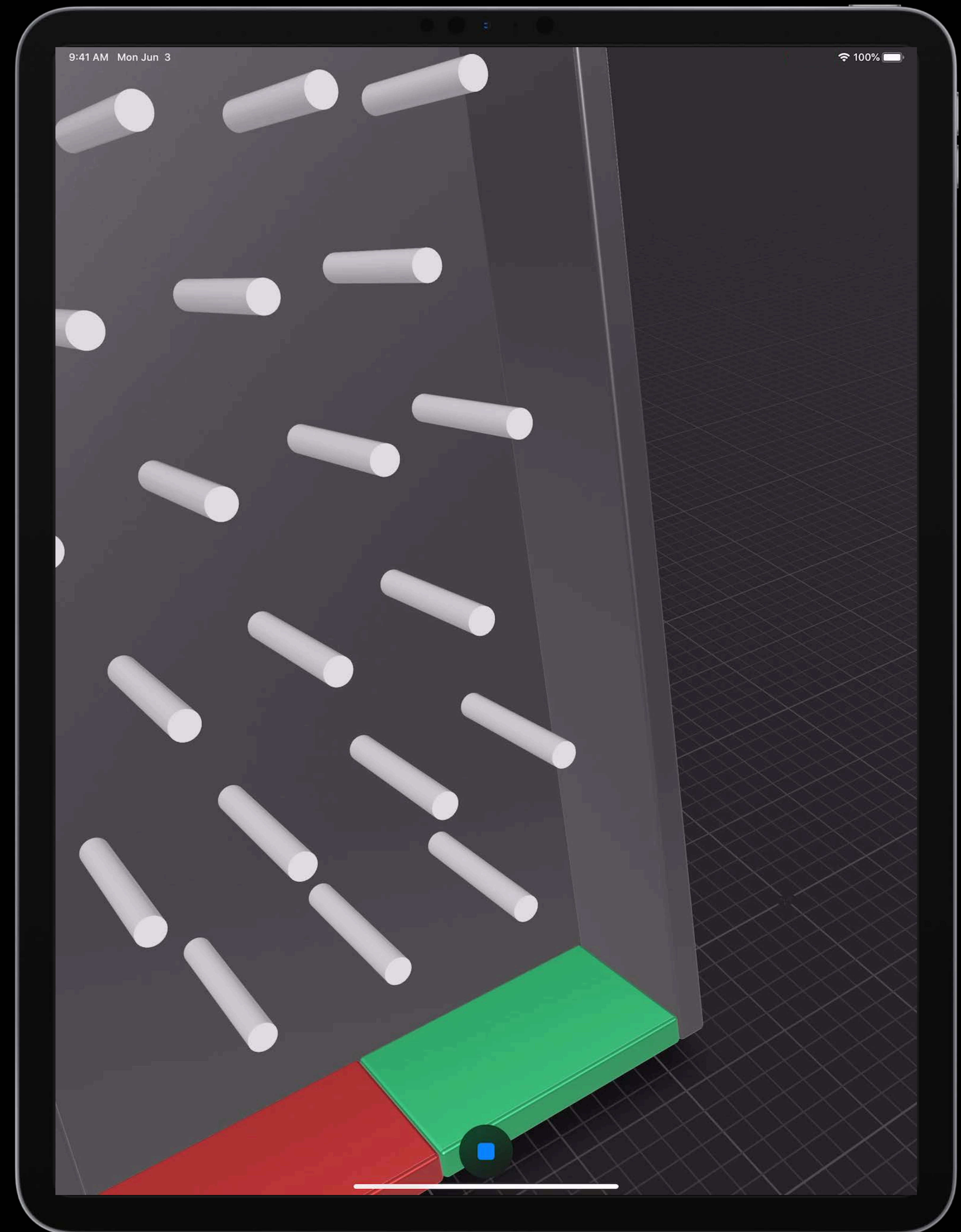
Capsule

Collisions

Trigger

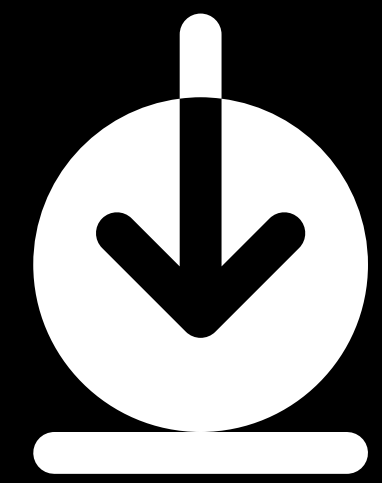


Collide

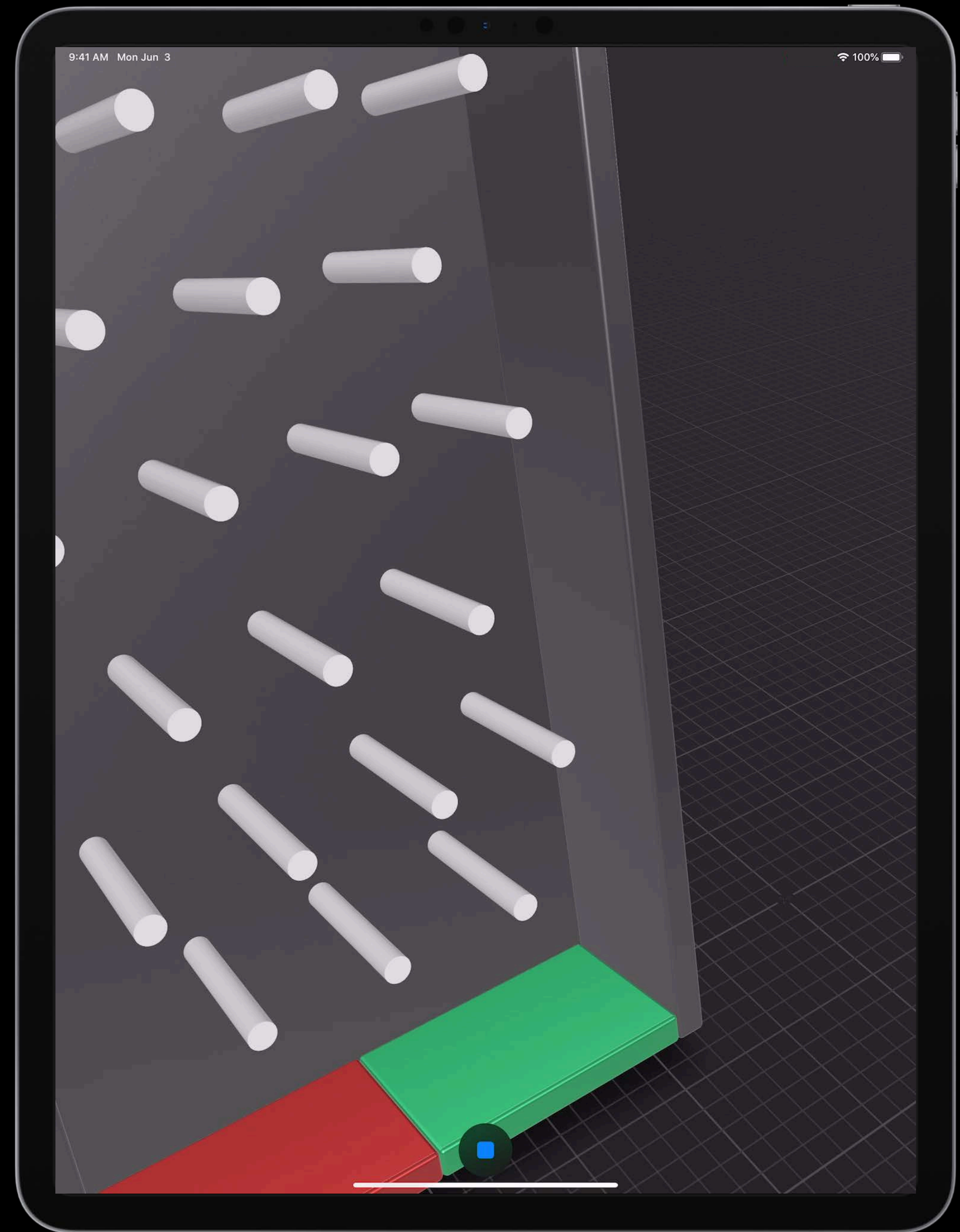


Collisions

Trigger



Collide



Building Scenes

Adding Behaviors

Using Physics

Building Apps

Building Scenes

Adding Behaviors

Using Physics

Building Apps

Building Apps

Abhi Ashutosh, Software Engineer

Getting Started

RealityKit AR or Game template in Xcode

New project from Reality Composer

Reality File exported from Reality Composer



Getting Started



Reality Composer Project



Reality File

Reality Composer Project

Project file for Reality Composer

Included in RealityKit AR and Game templates

Preview available in Xcode

Xcode automatically exports as a Reality File



SolarSystemLesson | Build SolarSystemLesson: **Succeeded**

SolarSystemLesson > SolarSystemLesson > SolarSystemLesson.rcproject

Scenes

- Seasons Chapter
- Size Chapter**

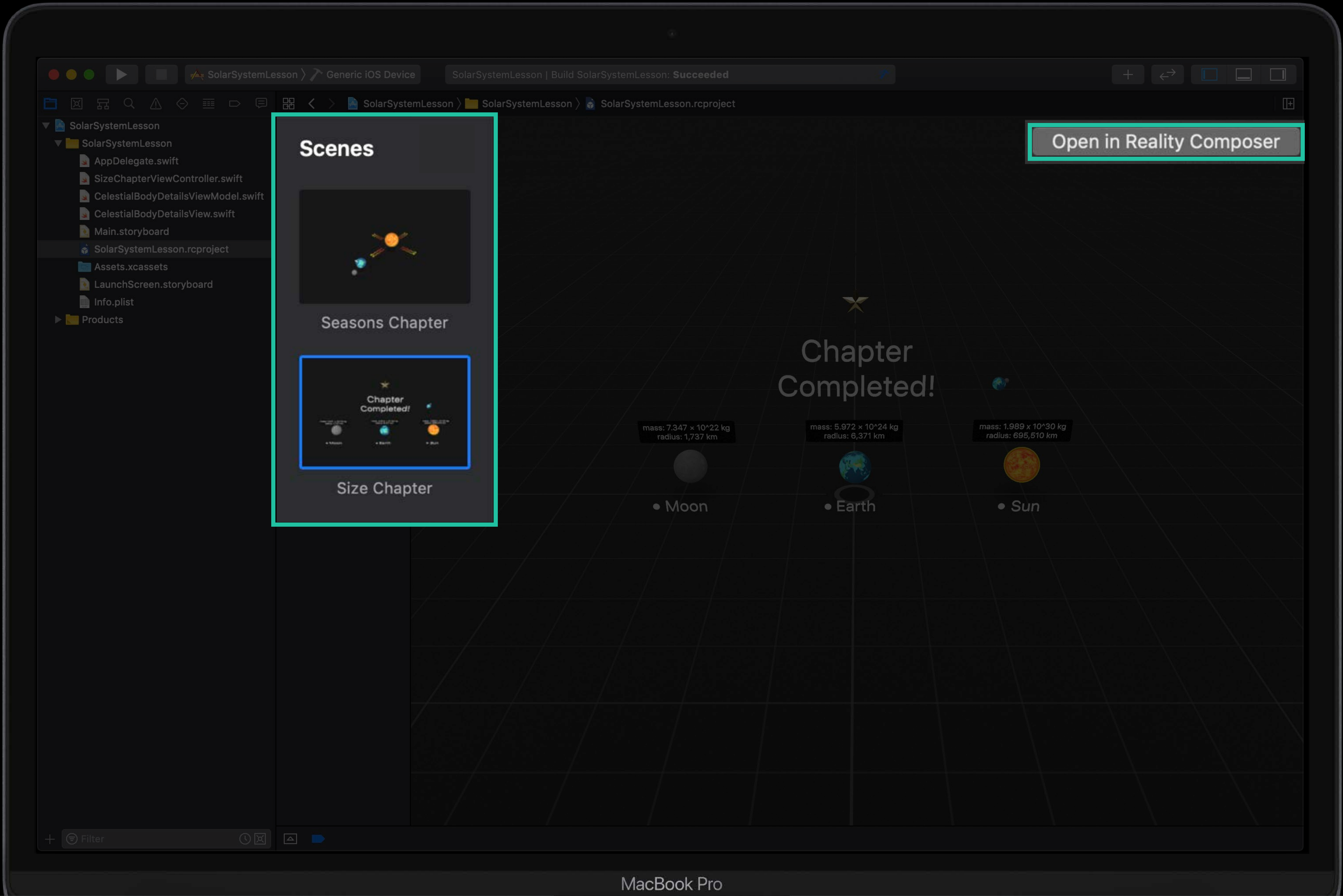
Open in Reality Composer

Chapter Completed!

Body	mass	radius
Moon	7.347×10^{22} kg	1,737 km
Earth	5.972×10^{24} kg	6,371 km
Sun	1.989×10^{30} kg	695,510 km

Filter

MacBook Pro



Open in Reality Composer

Scenes



Seasons Chapter



Size Chapter

Chapter Completed!

mass: 7.347×10^{22} kg
radius: 1,737 km

• Moon

mass: 5.972×10^{24} kg
radius: 6,371 km

• Earth

mass: 1.989×10^{30} kg
radius: 695,510 km

• Sun

MacBook Pro

Reality Composer Project

Automatic export in Xcode



SolarSystem.rcproject



Build in Xcode



SolarSystem.reality

Reality Composer Project

Automatic export in Xcode



SolarSystem.rcproject



Build in Xcode



MyExperience.app

Reality File

Contains all data required for rendering and simulation, optimized for RealityKit

Exported from Reality Composer

Automatically exported by Xcode

Reference directly in an application

Preview in AR Quick Look



Reality File

Contains all data required for rendering and simulation, optimized for RealityKit

Exported from Reality Composer

Automatically exported by Xcode

Reference directly in an application

Preview in AR Quick Look



Reality File

Structure



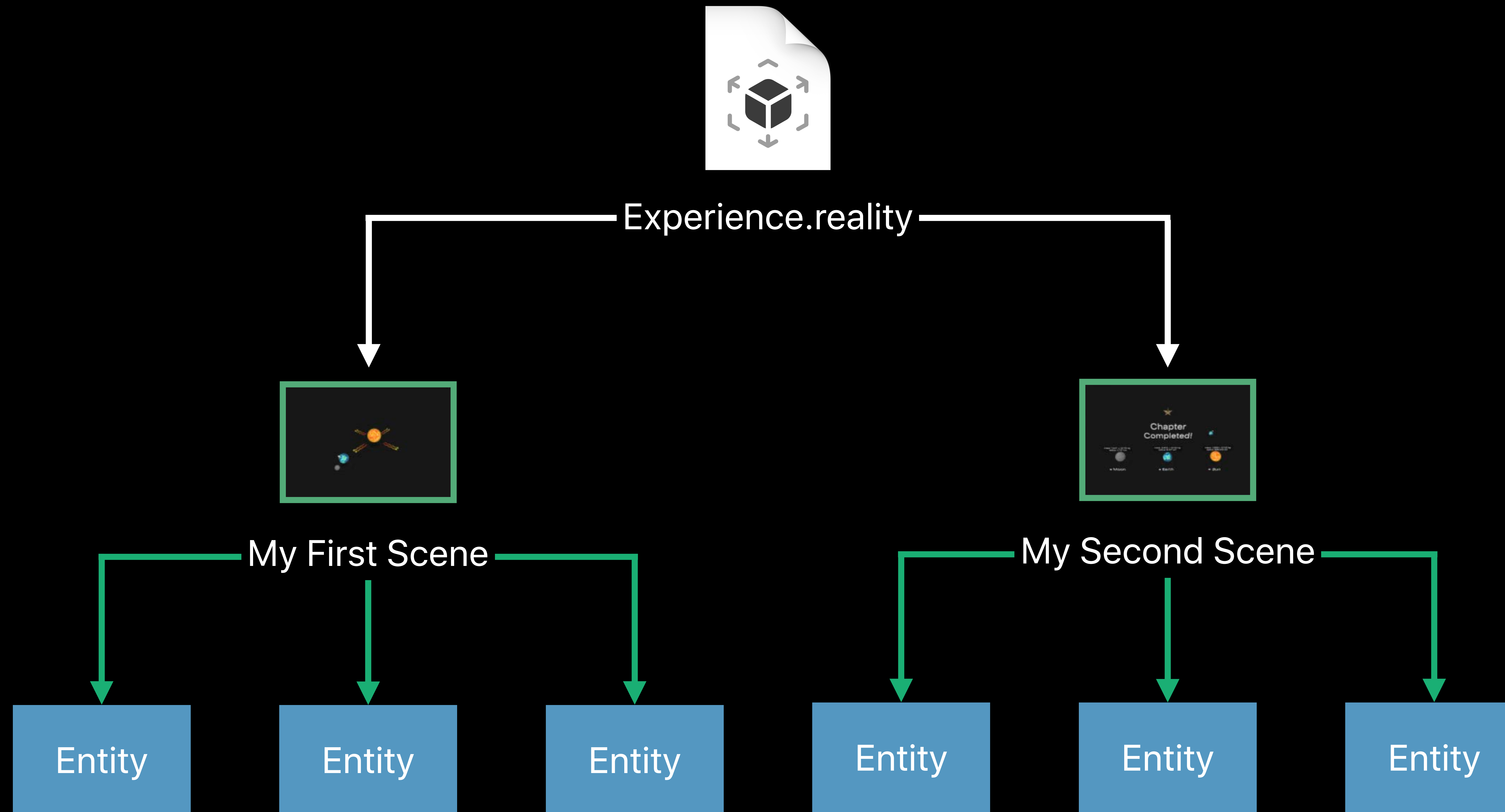
Experience.reality

Reality File Structure



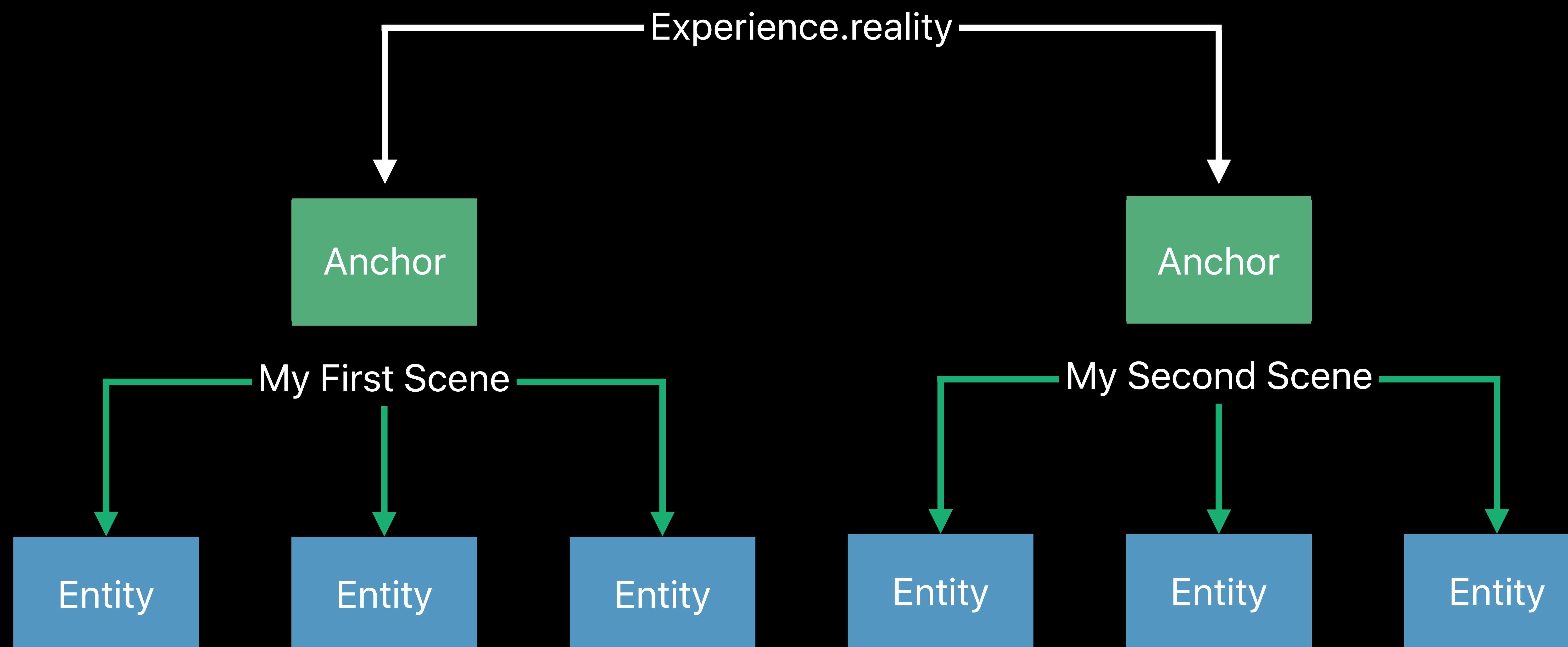
Reality File

Structure



Reality File

Structure



Reality Composer Project in Xcode



SolarSystem.rcproject



Build in Xcode



SolarSystem.reality

Code Generation in Xcode



SolarSystem.rcproject

→
Build in Xcode



SolarSystem.reality



SolarSystem.swift

Code Generation in Xcode

Automatically generated by Xcode

Application-specific, generated API for

- Scenes
- Named entities
- Notify Actions
- Notification Triggers



SolarSystemLesson

Scenes Frame Snap Modify Objects Text Play Edit on iOS Behaviors Settings

Chapter Completed!

mass: 5.972×10^{24} kg
radius: 6,371 km

• Earth

mass: 1.989×10^{30} kg
radius: 695,510 km

• Sun

▼ Configure

Name Sun

▼ Physics

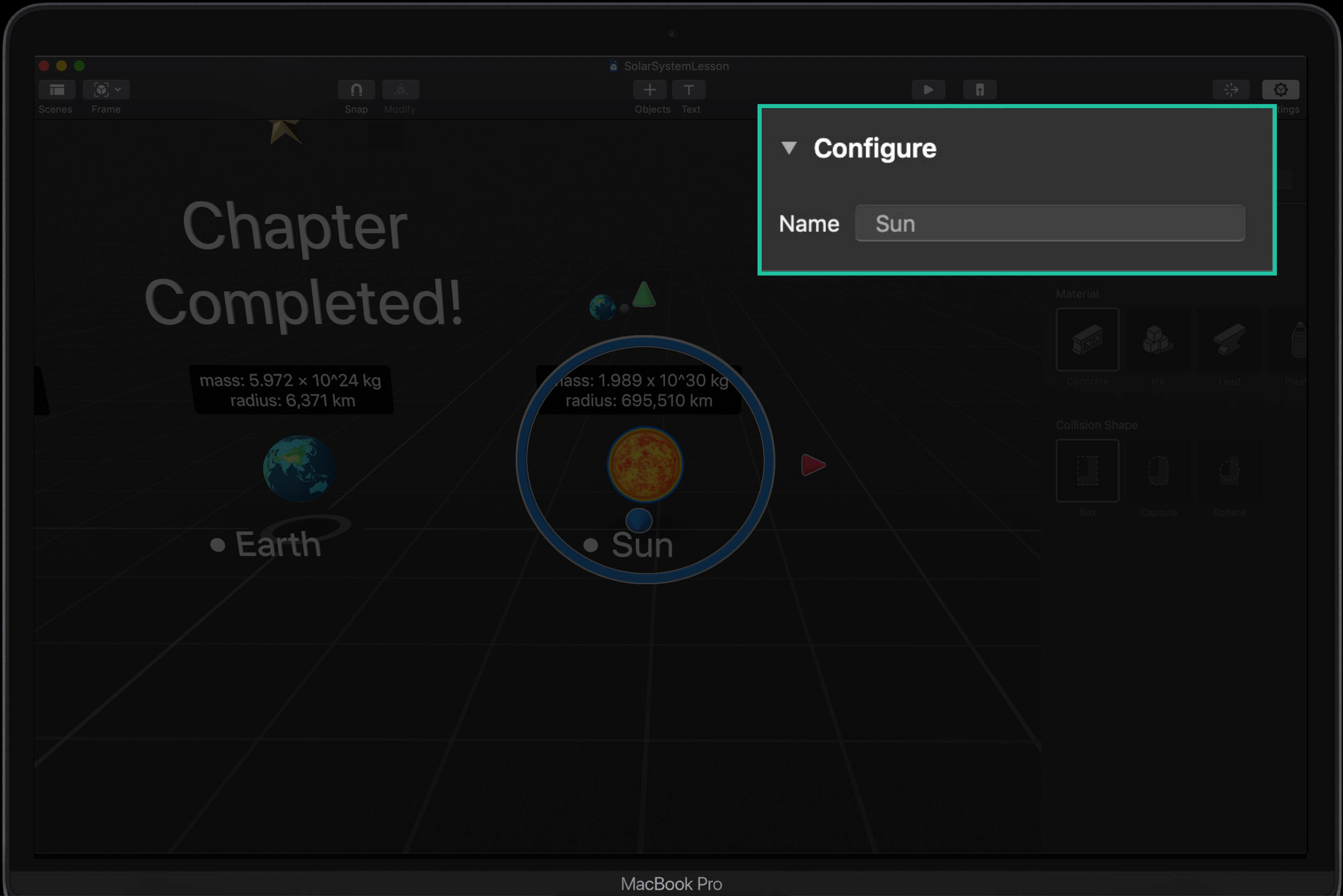
Collides Simulates

Material

Concrete Ice Lead Plastic

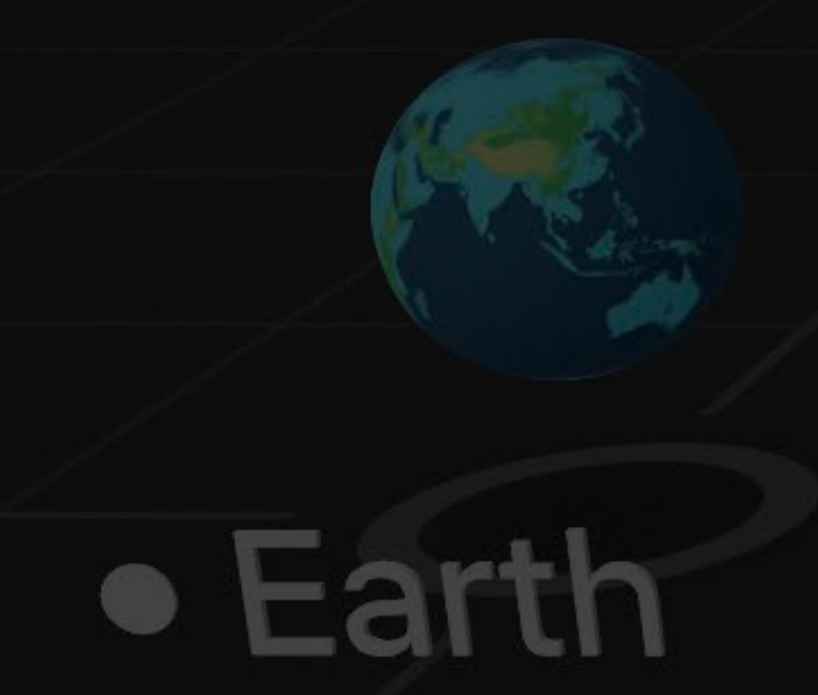
Collision Shape

Box Capsule Sphere



Chapter Completed!

mass: 5.972×10^{24} kg
radius: 6,371 km



mass: 1.989×10^{30} kg
radius: 695,510 km



▼ **Configure**

Name

Material

Concrete Ice Lead Plastic

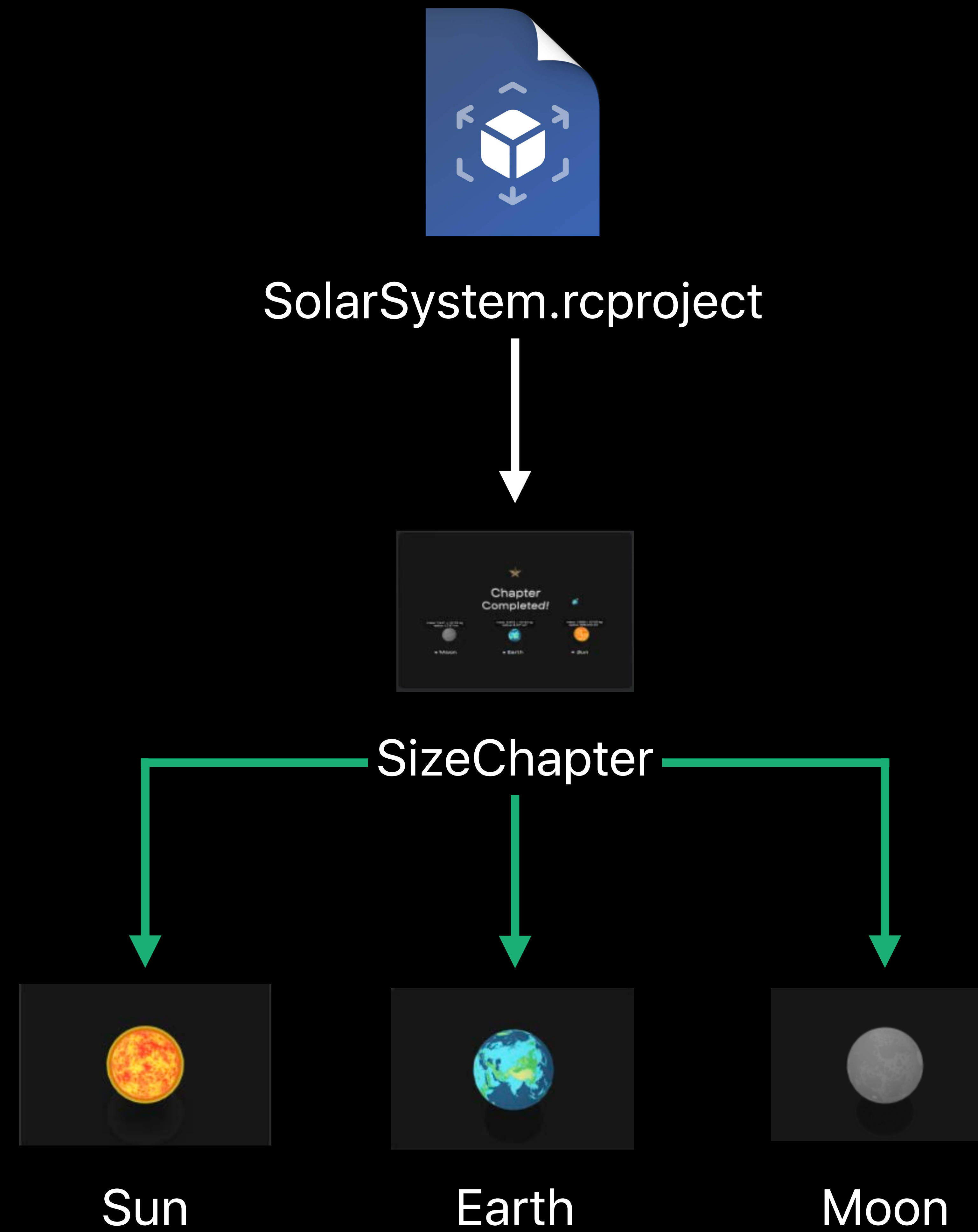
Collision Shape

Box Capsule Sphere

MacBook Pro

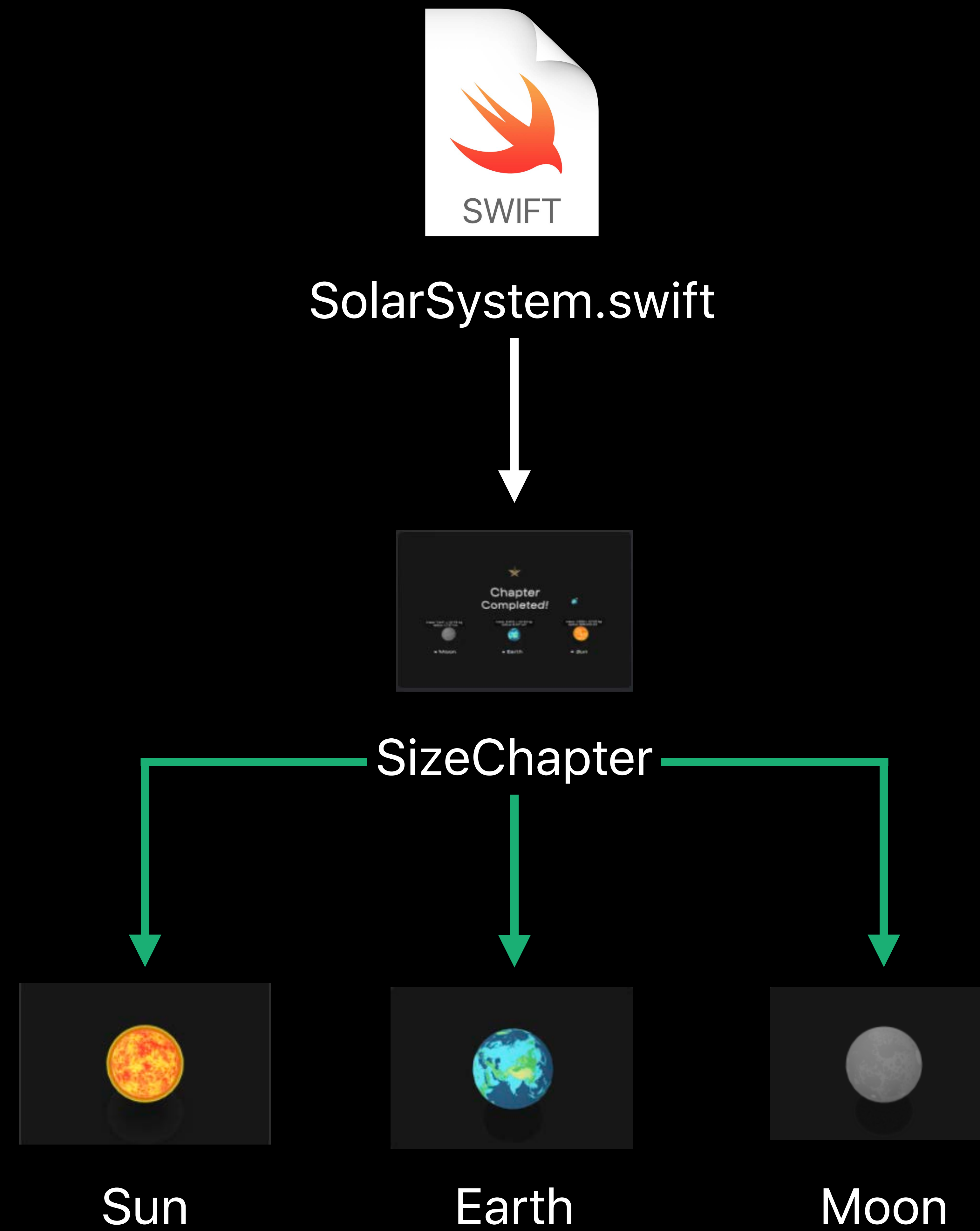
Code Generation in Xcode

Generated code structure



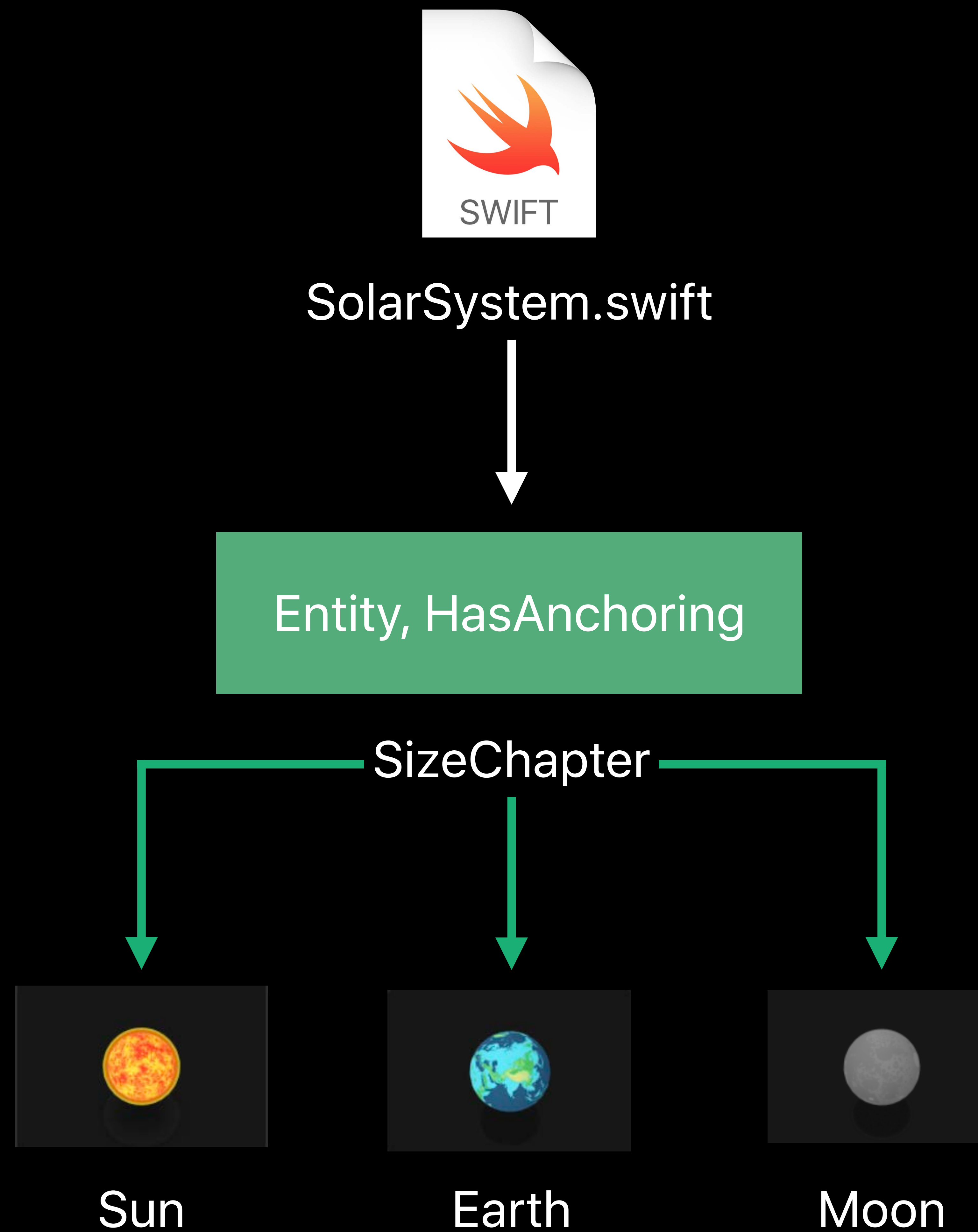
Code Generation in Xcode

Generated code structure



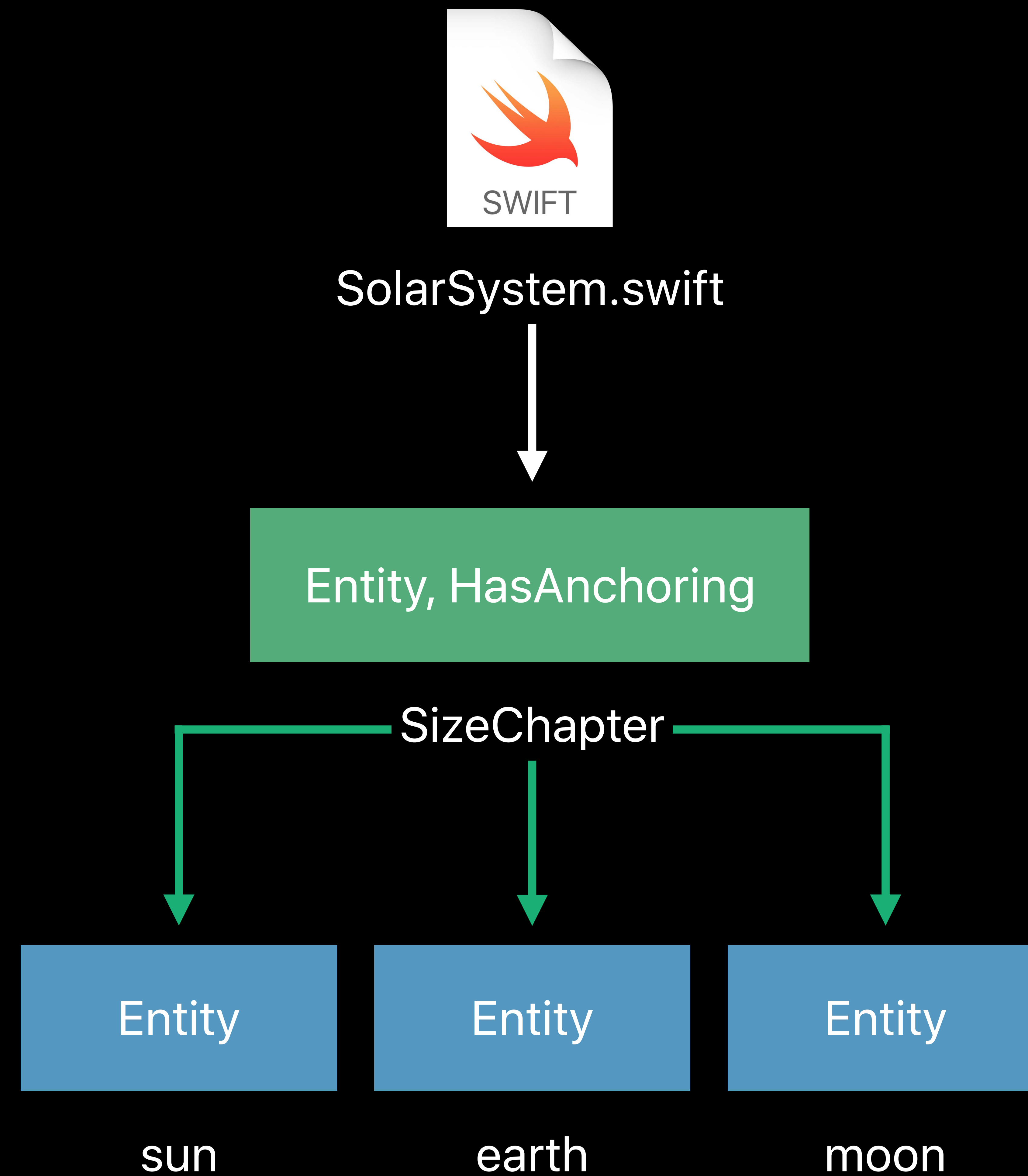
Code Generation in Xcode

Generated code structure



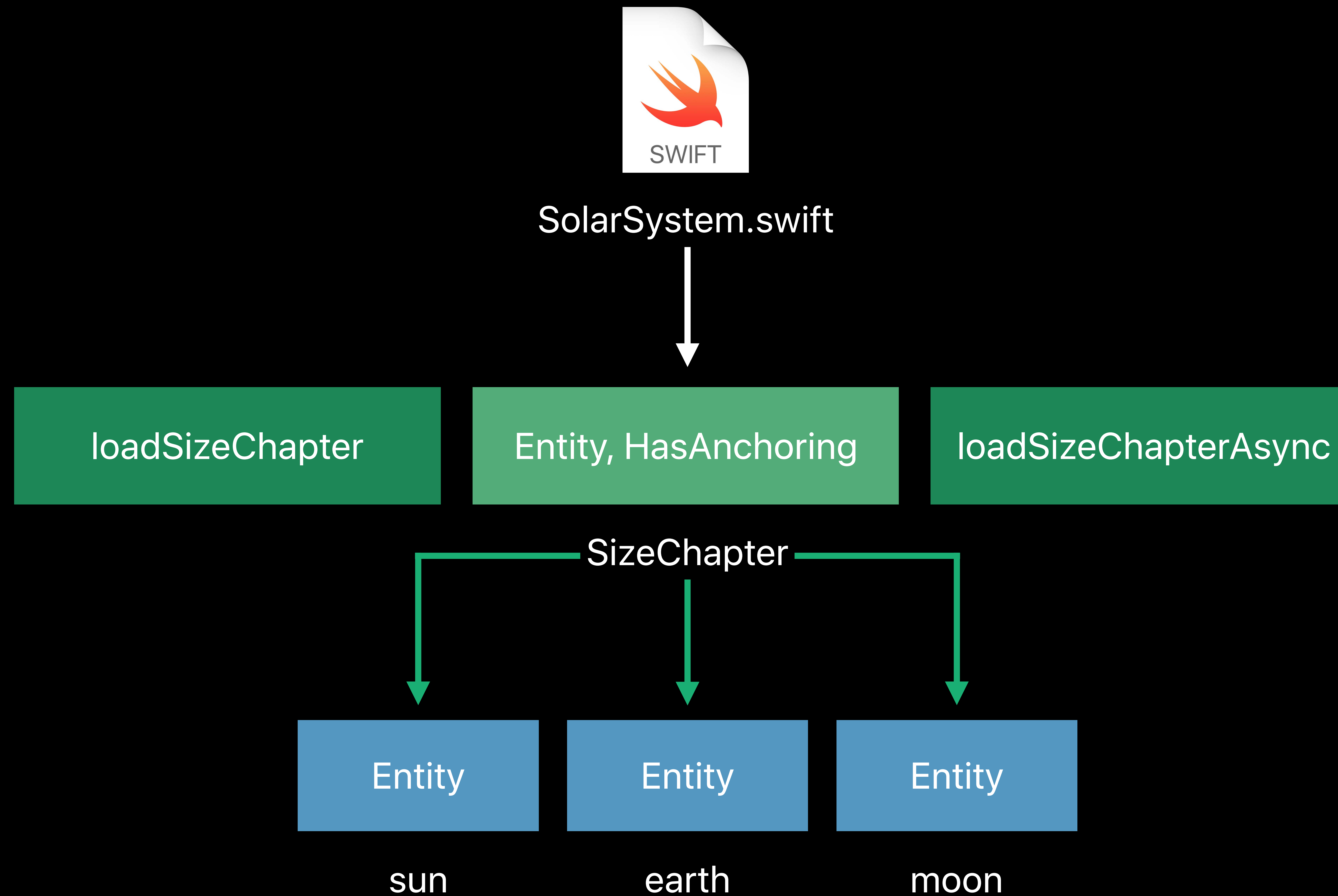
Code Generation in Xcode

Generated code structure



Code Generation in Xcode

Generated code structure



Code Generation in Xcode

Loading a Reality File synchronously

```
let seasonsChapter = try? SolarSystem.loadSeasonsChapter()
```

```
// Use the loaded anchor here
```

Code Generation in Xcode

Loading a Reality File synchronously

```
let seasonsChapter = try? SolarSystem.loadSeasonsChapter()
```

```
// Use the loaded anchor here
```


Code Generation in Xcode

Loading a Reality File asynchronously

```
SolarSystem.loadSeasonsChapterAsync { result in
    switch result {
    case .success(let anchor):
        // Use loaded anchor here
    case .failure(let error):
        // Handle failure
    }
}
```

Code Generation in Xcode

Loading a Reality File asynchronously

```
SolarSystem.loadSeasonsChapterAsync { result in
    switch result {
    case .success(let anchor):
        // Use loaded anchor here
    case .failure(let error):
        // Handle failure
    }
}
```

Code Generation in Xcode

Loading a Reality File asynchronously

```
SolarSystem.loadSeasonsChapterAsync { result in
    switch result {
    case .success(let anchor):
        // Use loaded anchor here
    case .failure(let error):
        // Handle failure
    }
}
```

Code Generation in Xcode

Loading a Reality File asynchronously

```
SolarSystem.loadSeasonsChapterAsync { result in
    switch result {
    case .success(let anchor):
        // Use loaded anchor here
    case .failure(let error):
        // Handle failure
    }
}
```

Code Generation in Xcode

Accessing entities

```
// Load Reality File anchor, `seasonsChapter`, above...
```

```
let sun = seasonsChapter.sun
```

```
let earth = seasonsChapter.earth
```

```
let moon = seasonsChapter.moon
```

Code Generation in Xcode

Accessing entities

```
// Load Reality File anchor, `seasonsChapter`, above...
```

```
let sun = seasonsChapter.sun
```

```
let earth = seasonsChapter.earth
```

```
let moon = seasonsChapter.moon
```

Code Generation in Xcode

Getting started

```
// Load the "Seasons Chapter" scene from the "SolarSystem" Reality File
let seasonsChapter = try! SolarSystem.loadSeasonsChapter()

// Add the seasons chapter anchor into the scene
arView.scene.anchors.append(seasonsChapter)
```

Code Generation in Xcode

Getting started

```
// Load the "Seasons Chapter" scene from the "SolarSystem" Reality File
let seasonsChapter = try! SolarSystem.loadSeasonsChapter()

// Add the seasons chapter anchor into the scene
arView.scene.anchors.append(seasonsChapter)
```


Code Generation in Xcode

Getting started

```
// Load the "Seasons Chapter" scene from the "SolarSystem" Reality File  
let seasonsChapter = try! SolarSystem.loadSeasonsChapter()
```

```
// Add the seasons chapter anchor into the scene  
arView.scene.anchors.append(seasonsChapter)
```

Code Generation in Xcode



SolarSystem.rcproject



Build in Xcode



MyExperience.app

Reality File

Loading synchronously

```
guard let url = Bundle.main.url(forResource: "SolarSystem", withExtension: "reality") else {  
    return  
}  
  
let anchor = try? Entity.loadAnchor(contentsOf: url, withName: "SeasonsChapter")  
  
// Use the loaded anchor here...
```

Reality File

Loading synchronously

```
guard let url = Bundle.main.url(forResource: "SolarSystem", withExtension: "reality") else {  
    return  
}
```

```
let anchor = try? Entity.loadAnchor(contentsOf: url, withName: "SeasonsChapter")
```

```
// Use the loaded anchor here...
```

Reality File

Loading synchronously

```
guard let url = Bundle.main.url(forResource: "SolarSystem", withExtension: "reality") else {  
    return  
}
```

```
let anchor = try? Entity.loadAnchor(contentsOf: url, withName: "SeasonsChapter")
```

```
// Use the loaded anchor here...
```

Reality File

Loading asynchronously

```
guard let url = Bundle.main.url(forResource: "SolarSystem", withExtension: "reality") else {
    return
}

let loadRequest = Entity.loadAnchorAsync(contentsOf: url, withName: "SeasonsChapter")
_ = loadRequest.sink(receiveCompletion: { completion in
    // Handle completion state
}, receiveValue: { anchor in
    // Use loaded anchor here
})
```

Reality File

Loading asynchronously

```
guard let url = Bundle.main.url(forResource: "SolarSystem", withExtension: "reality") else {  
    return  
}
```

```
let loadRequest = Entity.loadAnchorAsync(contentsOf: url, withName: "SeasonsChapter")  
_ = loadRequest.sink(receiveCompletion: { completion in  
    // Handle completion state  
}, receiveValue: { anchor in  
    // Use loaded anchor here  
})
```

Reality File

Loading asynchronously

```
guard let url = Bundle.main.url(forResource: "SolarSystem", withExtension: "reality") else {  
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}
```

```
let loadRequest = Entity.loadAnchorAsync(contentsOf: url, withName: "SeasonsChapter")  
_ = loadRequest.sink(receiveCompletion: { completion in  
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})
```


Reality File

Loading asynchronously

```
guard let url = Bundle.main.url(forResource: "SolarSystem", withExtension: "reality") else {
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}

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_ = loadRequest.sink(receiveCompletion: { completion in
    // Handle completion state
}, receiveValue: { anchor in
    // Use loaded anchor here
})
```

Reality File

Loading asynchronously

```
guard let url = Bundle.main.url(forResource: "SolarSystem", withExtension: "reality") else {
    return
}

let loadRequest = Entity.loadAnchorAsync(contentsOf: url, withName: "SeasonsChapter")
_ = loadRequest.sink(receiveCompletion: { completion in
    // Handle completion state
}, receiveValue: { anchor in
    // Use loaded anchor here
})
```

Reality File

Accessing entities

```
// Load Reality File anchor above...  
  
let sun = anchor.findEntity(named: "Sun")  
let earth = anchor.findEntity(named: "Earth")  
let moon = anchor.findEntity(named: "Moon")  
  
// Use fetched entities below...
```

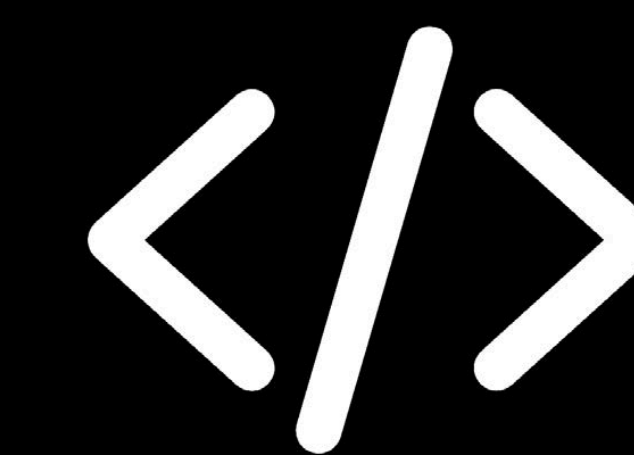
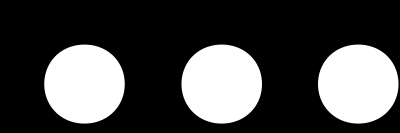
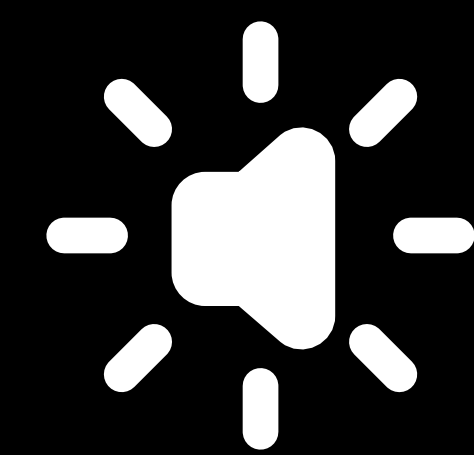
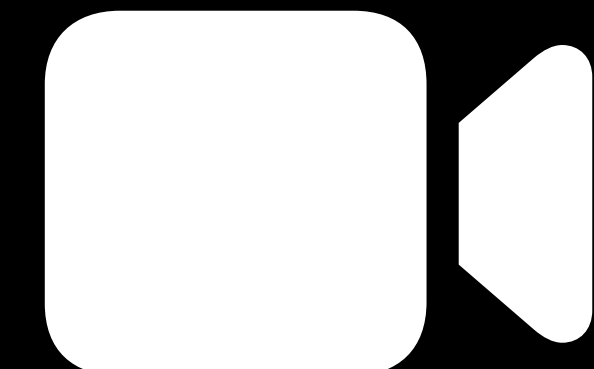
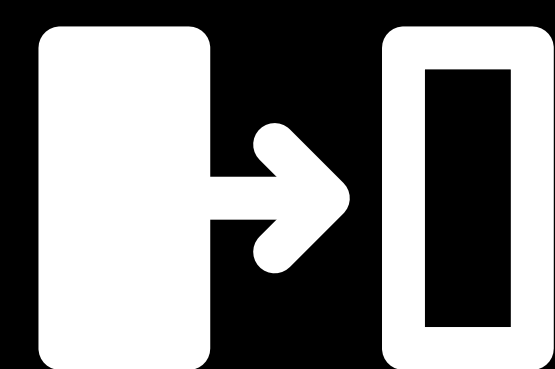
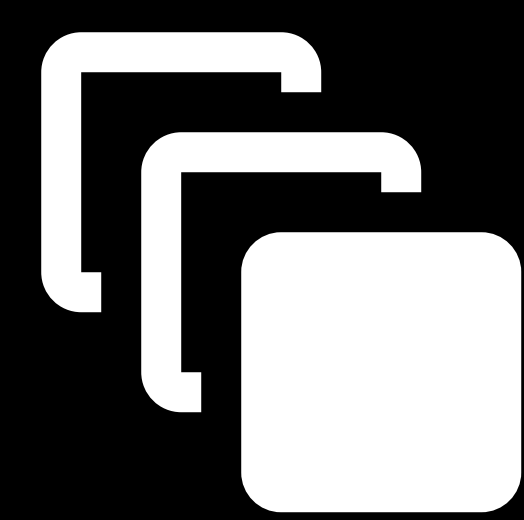
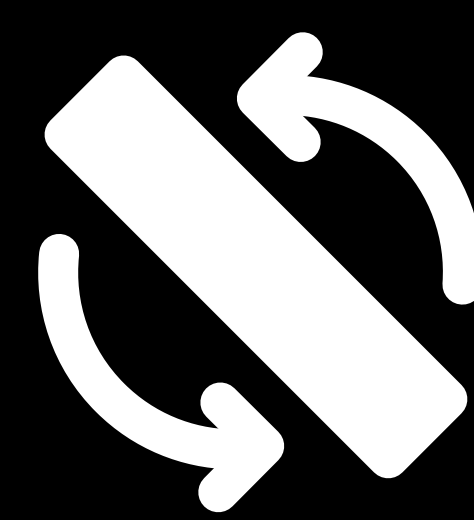
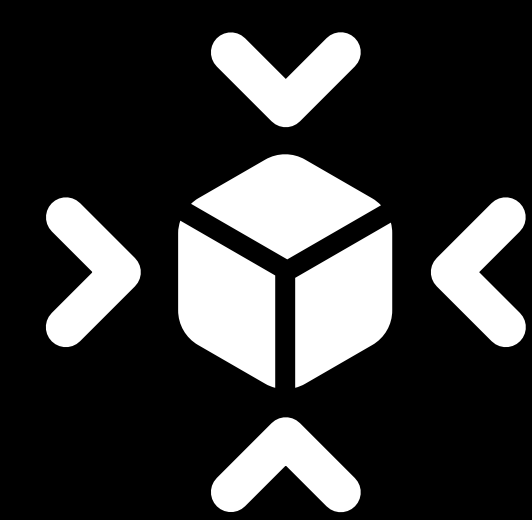
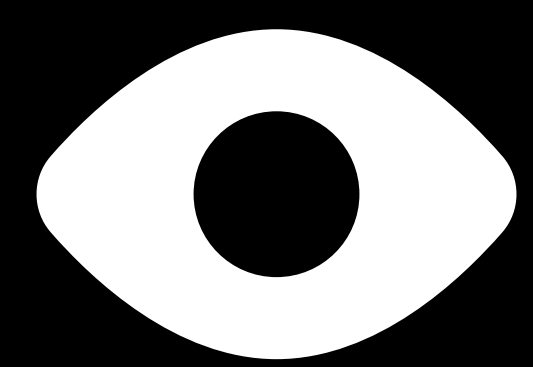
Reality File

Accessing entities

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// Load Reality File anchor above...  
  
let sun = anchor.findEntity(named: "Sun")  
let earth = anchor.findEntity(named: "Earth")  
let moon = anchor.findEntity(named: "Moon")  
  
// Use fetched entities below...
```

UI Applications and AR Content

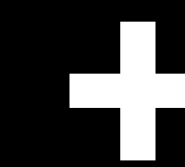
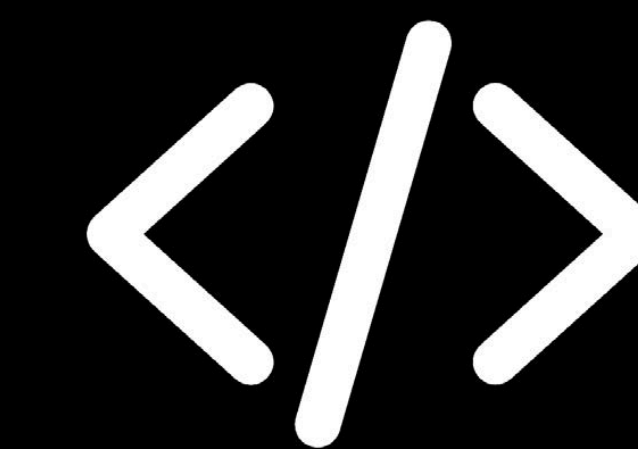
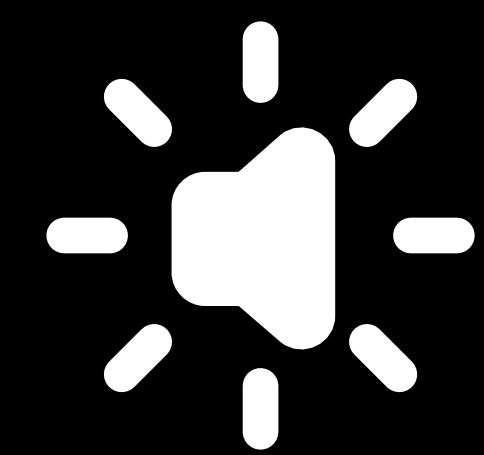
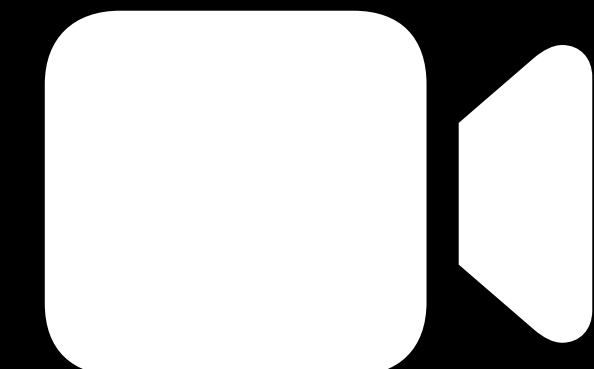
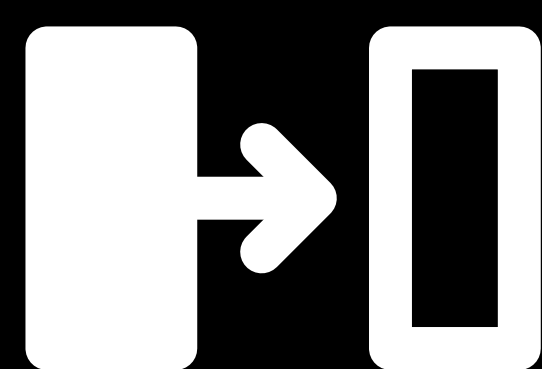
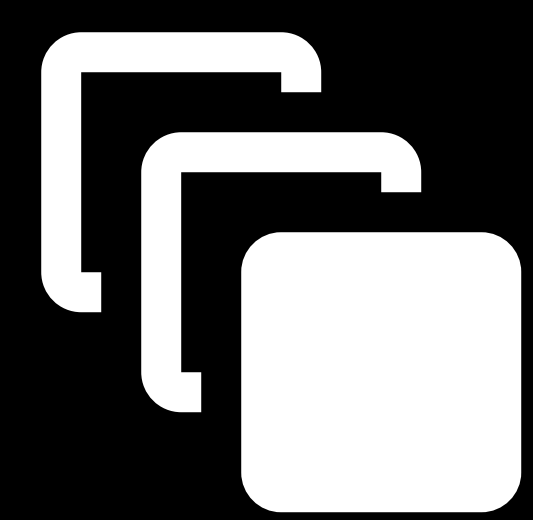
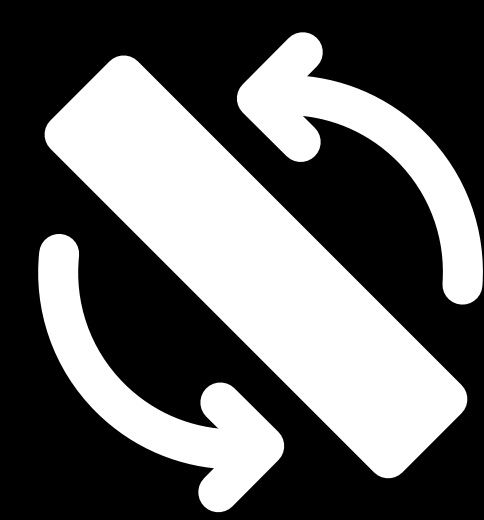
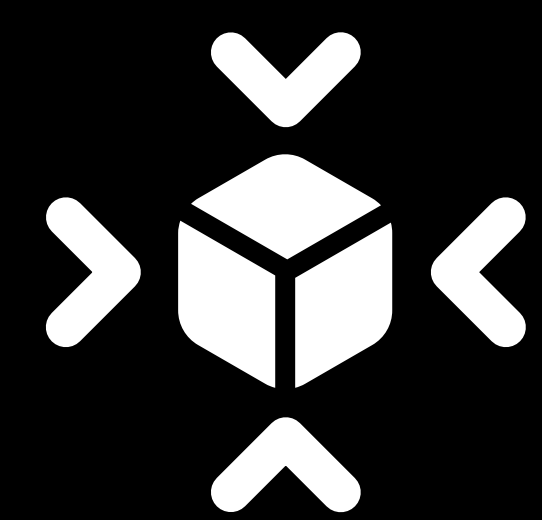
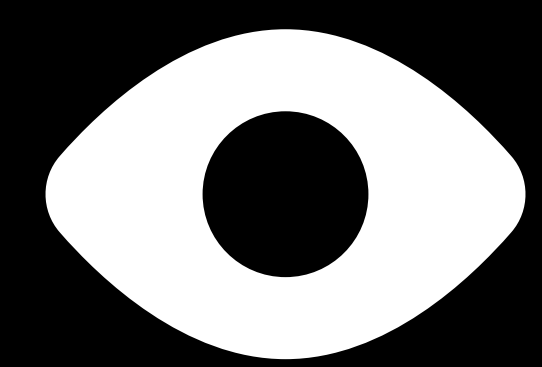
Actions



Application Logic

UI Applications and AR Content

Actions



Application Logic

Notify Action

Notify Action

Set up in Reality Composer

Invoked in action sequences

Settable closure in application code

Accessible by name in code





Behaviors +

- Moon
- Earth
- Sun
- Look At Camera
- Hide on Start
- Scale to Relative Sizes

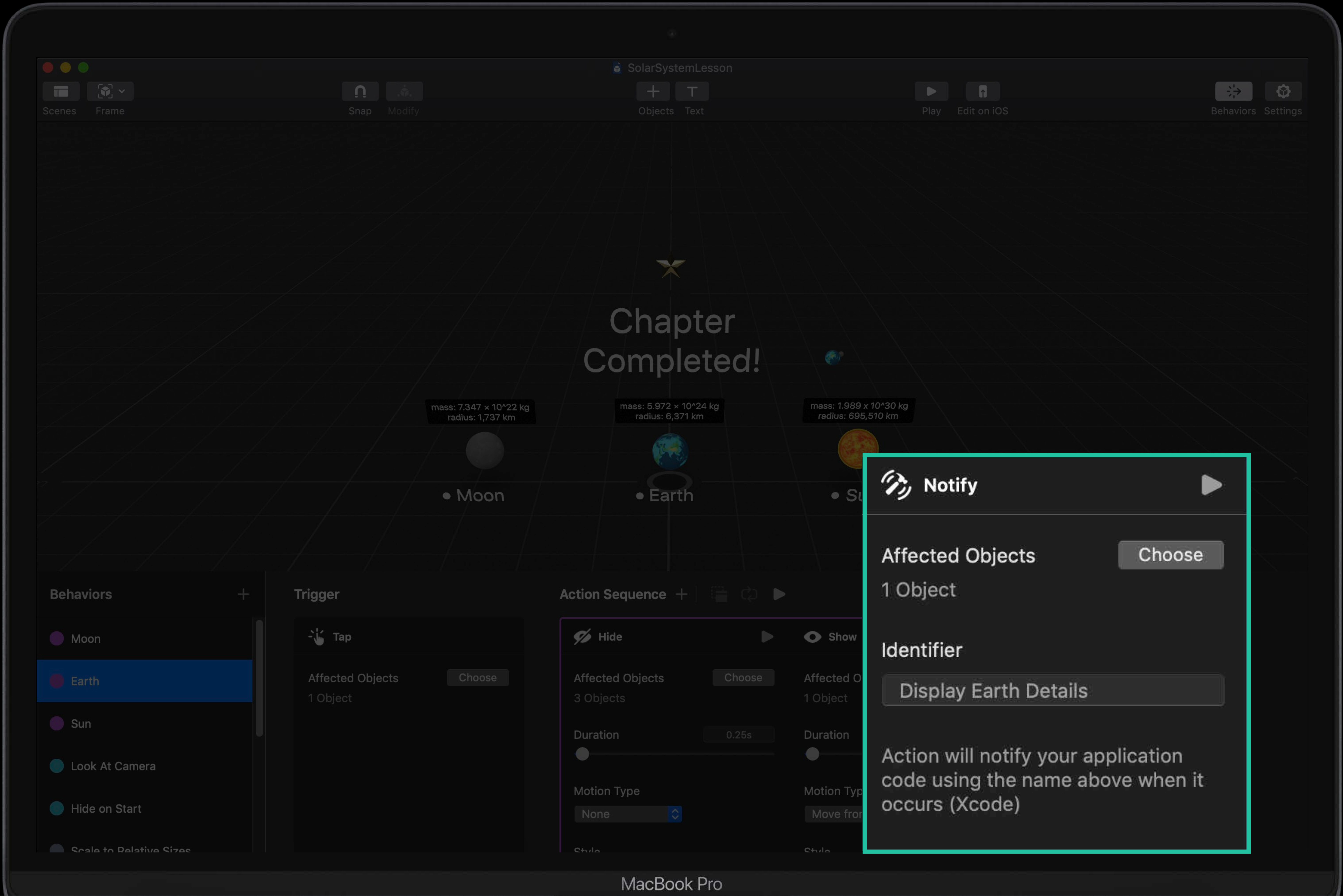
Trigger

Tap

Affected Objects Choose
1 Object

Action Sequence +

Hide	Show	Notify
Affected Objects Choose 3 Objects	Affected Objects Choose 1 Object	Affected Objects Choose 1 Object
Duration 0.25s	Duration 0.25s	Identifier Display Earth Details
Motion Type None	Motion Type Move from Above	Action will notify your application code using the name above when it occurs (Xcode)



Chapter Completed!

mass: 7.347×10^{22} kg
radius: 1,737 km
• Moon

mass: 5.972×10^{24} kg
radius: 6,371 km
• Earth

mass: 1.989×10^{30} kg
radius: 695,510 km
• Sun

- Behaviors +
- Moon
 - Earth
 - Sun
 - Look At Camera
 - Hide on Start
 - Scale to Relative Sizes

Trigger

Tap

Affected Objects Choose

1 Object

Action Sequence +

Hide Show

Affected Objects Choose Affected O

3 Objects 1 Object

Duration 0.25s Duration

Motion Type None Move from

Style

Notify

Affected Objects Choose

1 Object

Identifier

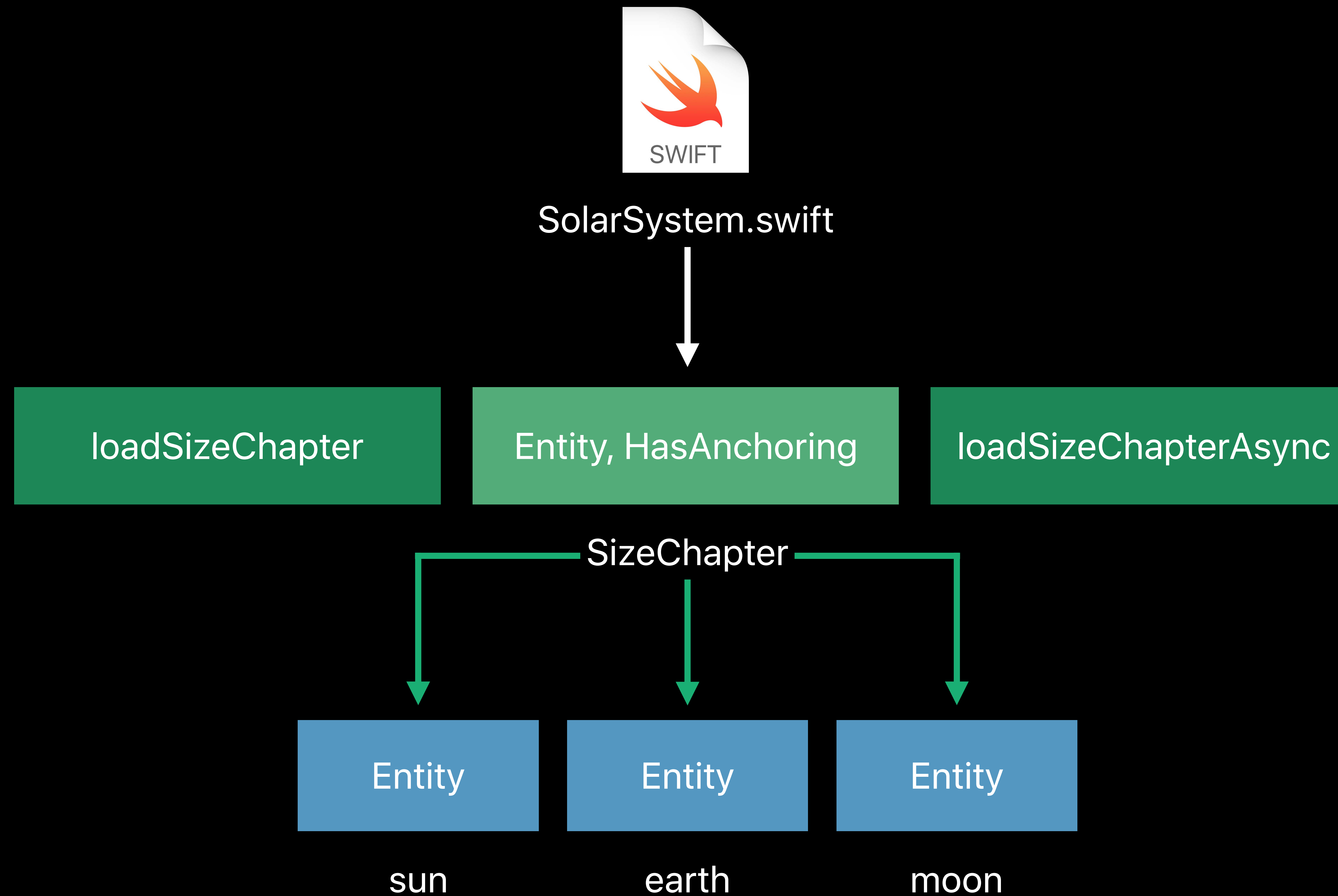
Display Earth Details

Action will notify your application code using the name above when it occurs (Xcode)

MacBook Pro

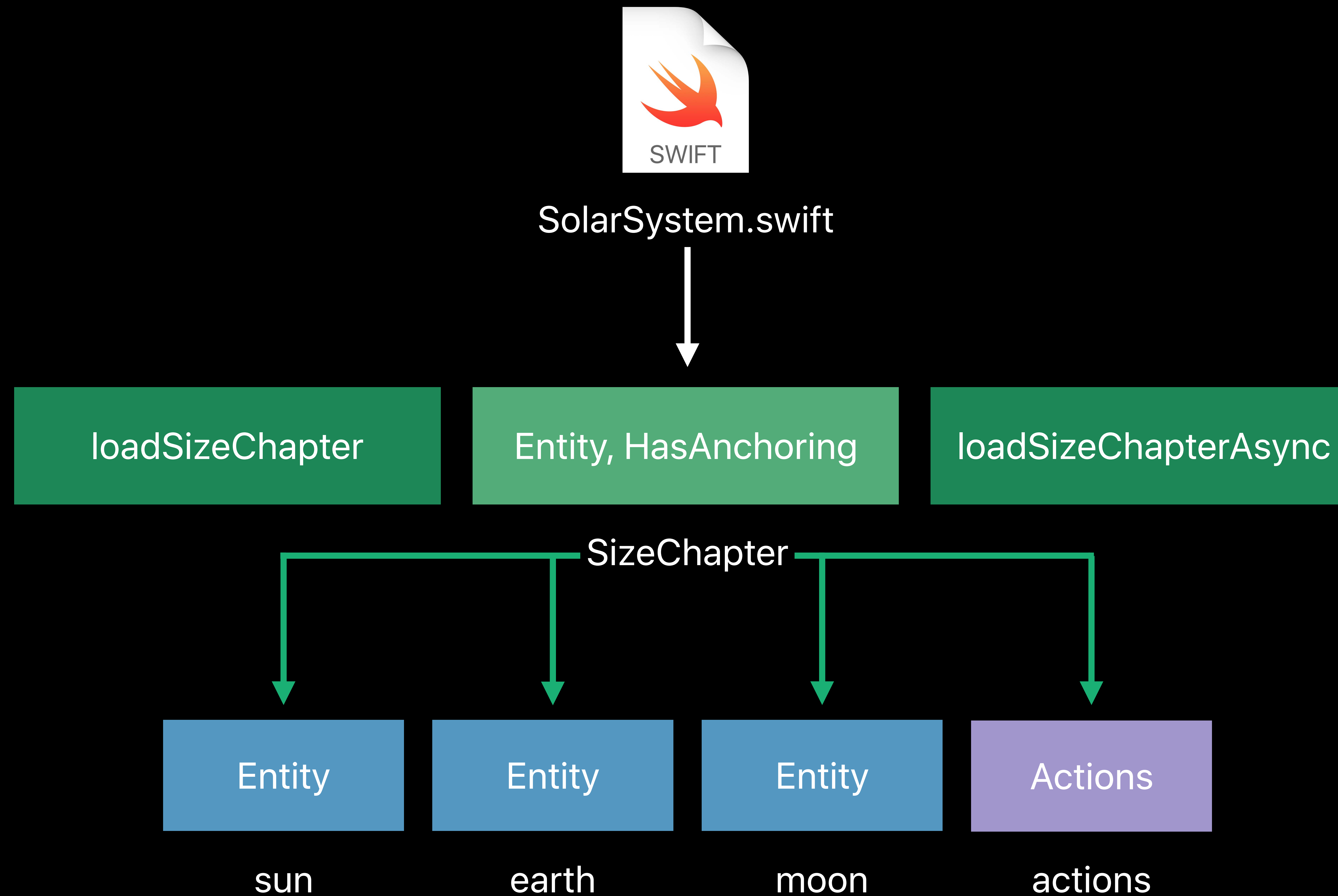
Notify Action

Generated code structure



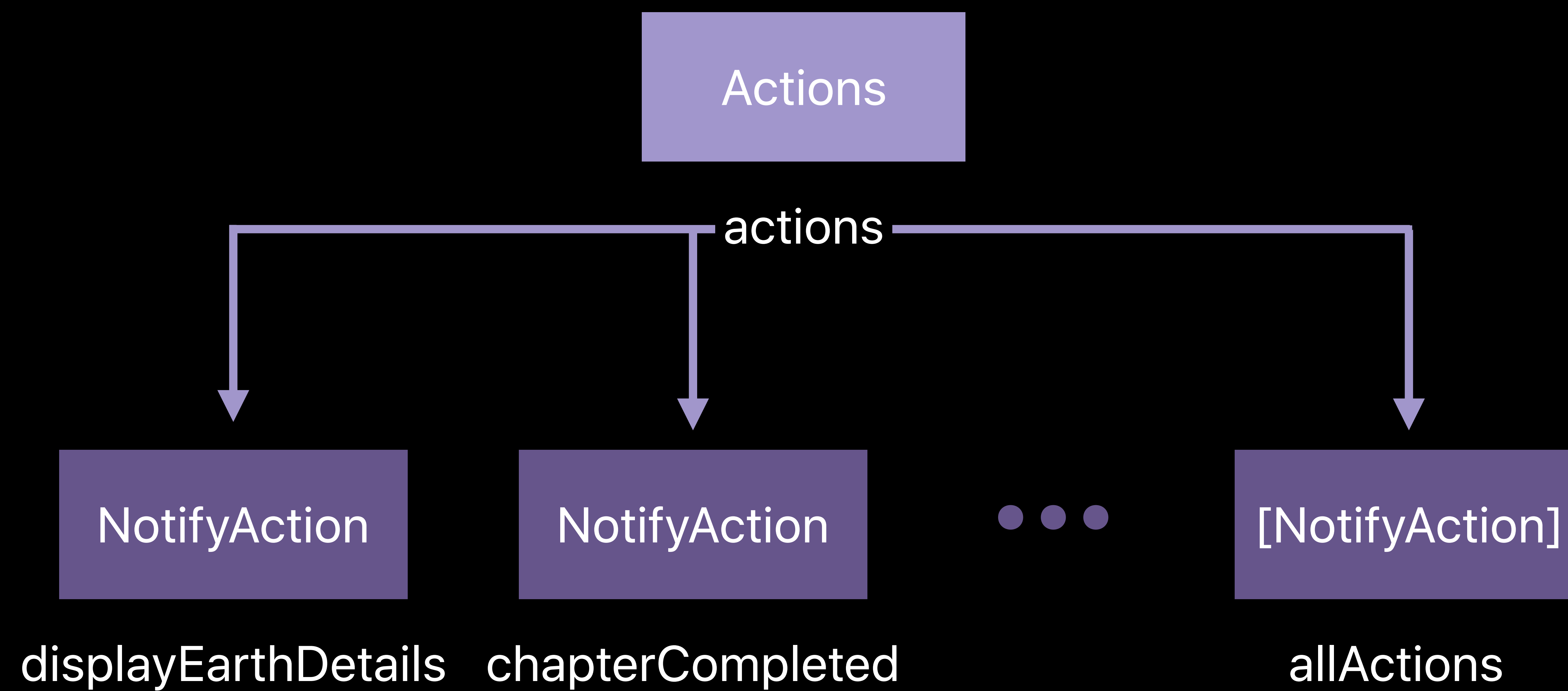
Notify Action

Generated code structure



Notify Action

Generated code structure



Notify Action

Defining closure

```
seasonsChapter.actions.displayEarthDetails.onAction = { entity in  
    // Display details about Fall  
}
```

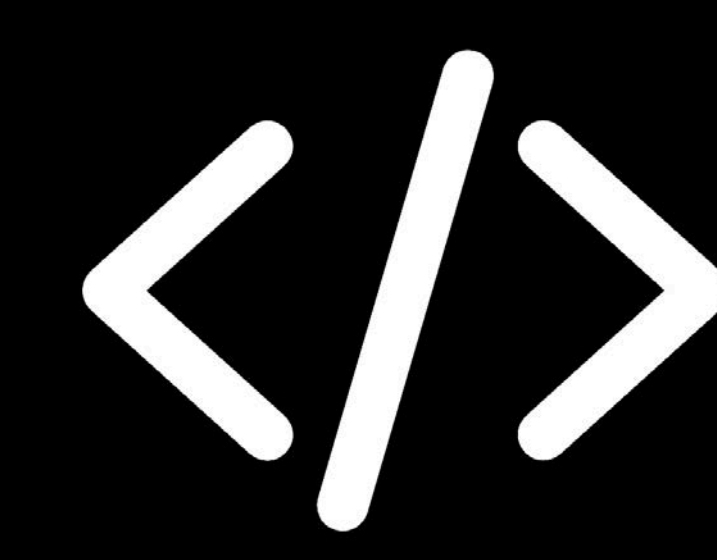
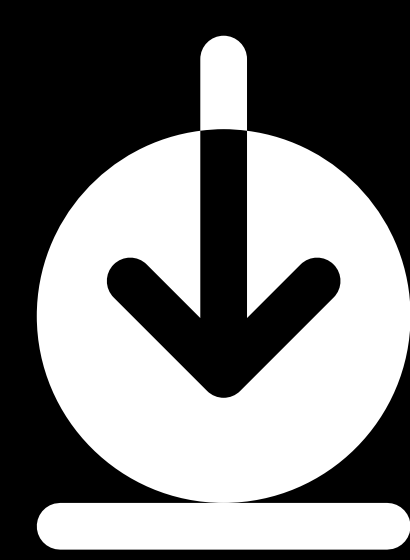
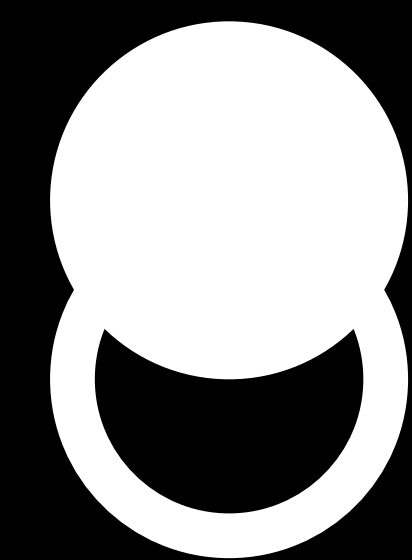
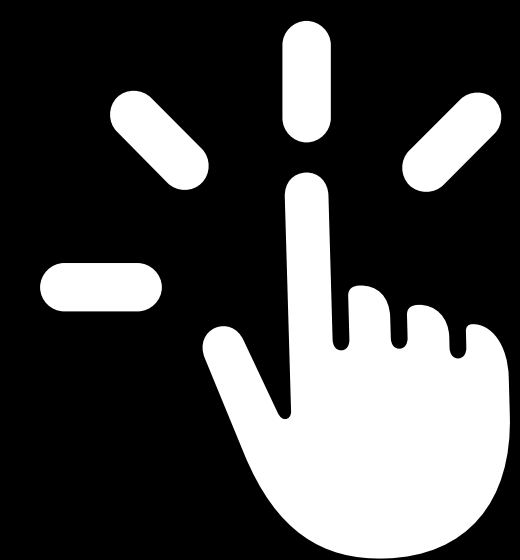
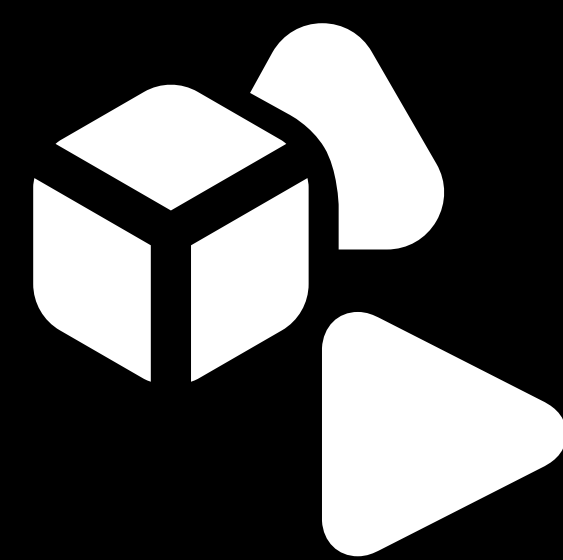
Notify Action

Defining closure

```
seasonsChapter.actions.displayEarthDetails.onAction = { entity in  
    // Display details about Fall  
}
```

UI Applications and AR Content

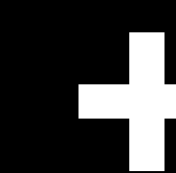
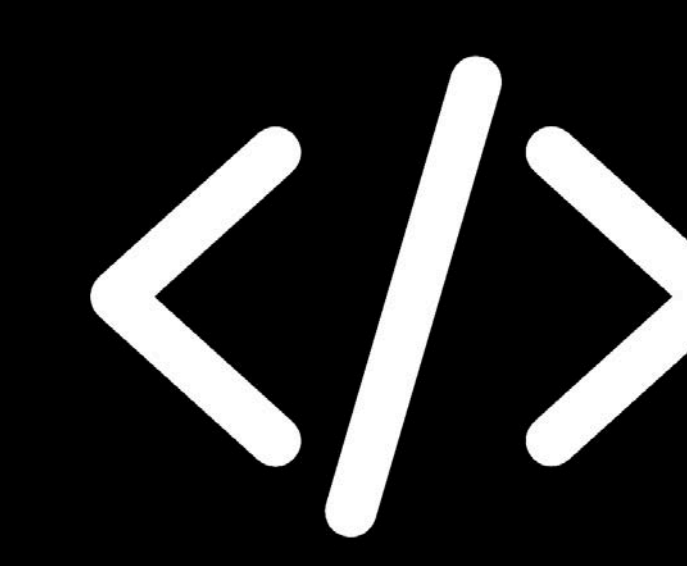
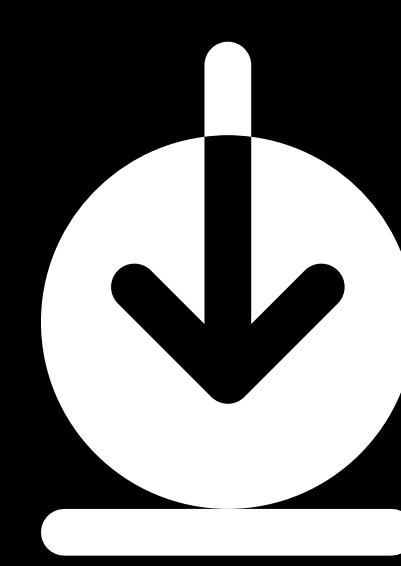
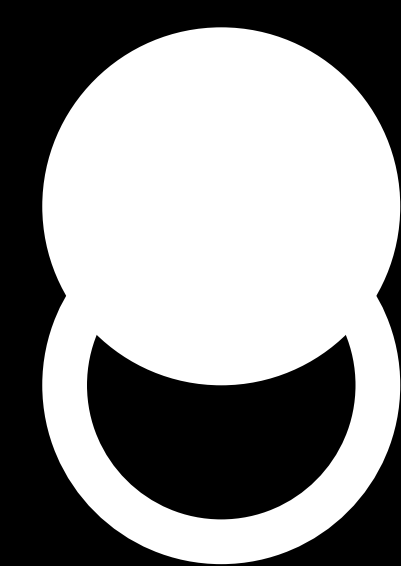
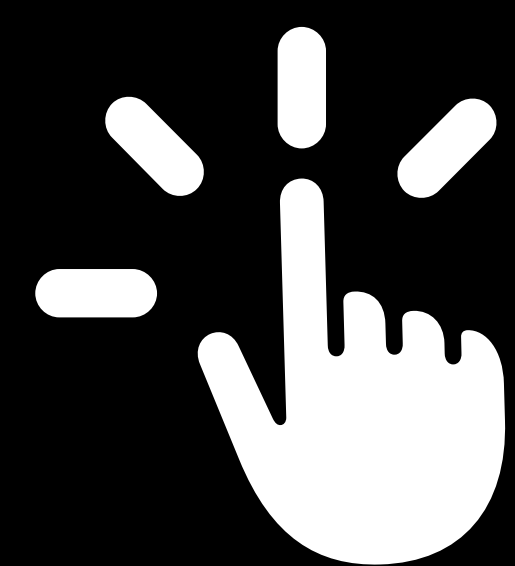
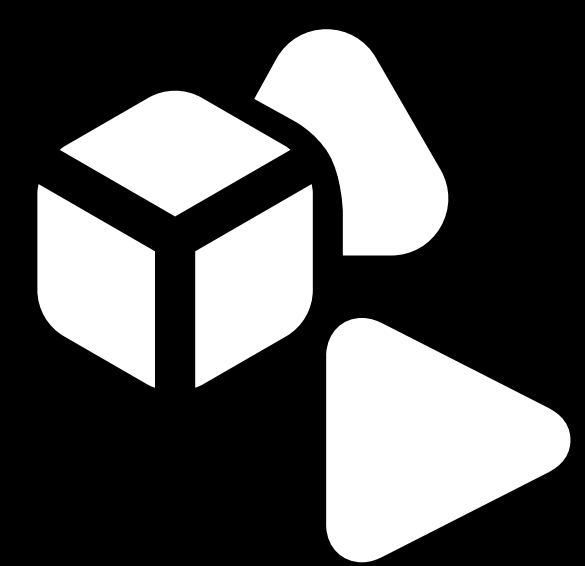
Triggers



Application Logic

UI Applications and AR Content

Triggers



Application Logic

Notification Trigger

Notification Trigger

Set up in Reality Composer

Starts action sequences

Posted from the application

Accessible by name in code



Chapter Completed!

mass: 7.347×10^{22} kg
radius: 1,737 km

• Moon

mass: 5.972×10^{24} kg
radius: 6,371 km

• Earth

mass: 1.989×10^{30} kg
radius: 695,510 km

• Sun

- ### Behaviors
- Scale to Relative Sizes
 - Scale to Same Size
 - Chapter Completed - Fade
 - Chapter Completed - Orbit
 - Chapter Completed - Show
 - Show Gold Star**

Trigger

Notification

Identifier: Show Gold Star

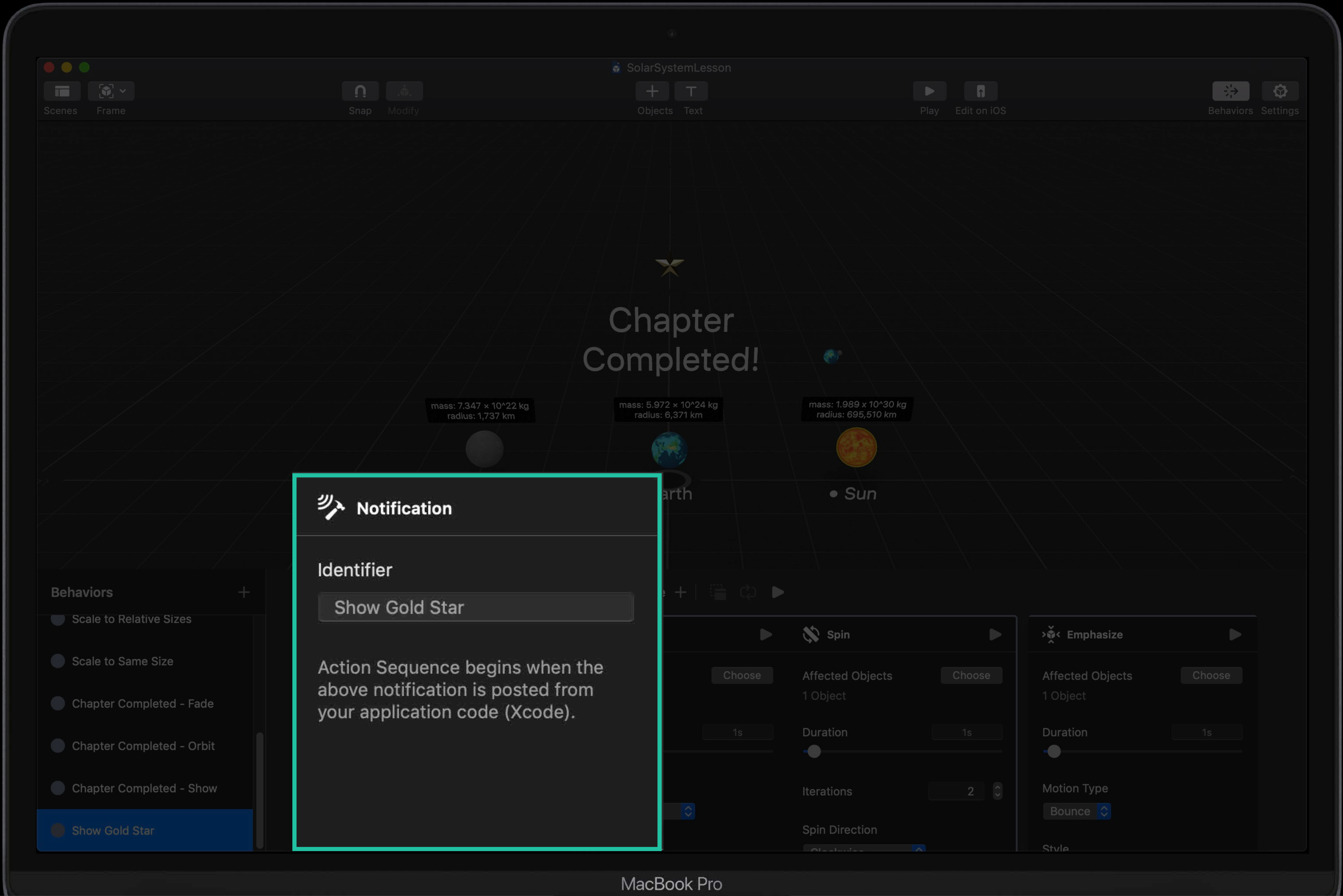
Action Sequence begins when the above notification is posted from your application code (Xcode).

Action Sequence

Show	Spin
Affected Objects: Choose (1 Object)	Affected Objects: Choose (1 Object)
Duration: 1s	Duration: 1s
Motion Type: Scale	Iterations: 2
Style: [dropdown]	Spin Direction: [dropdown]

Action Sequence

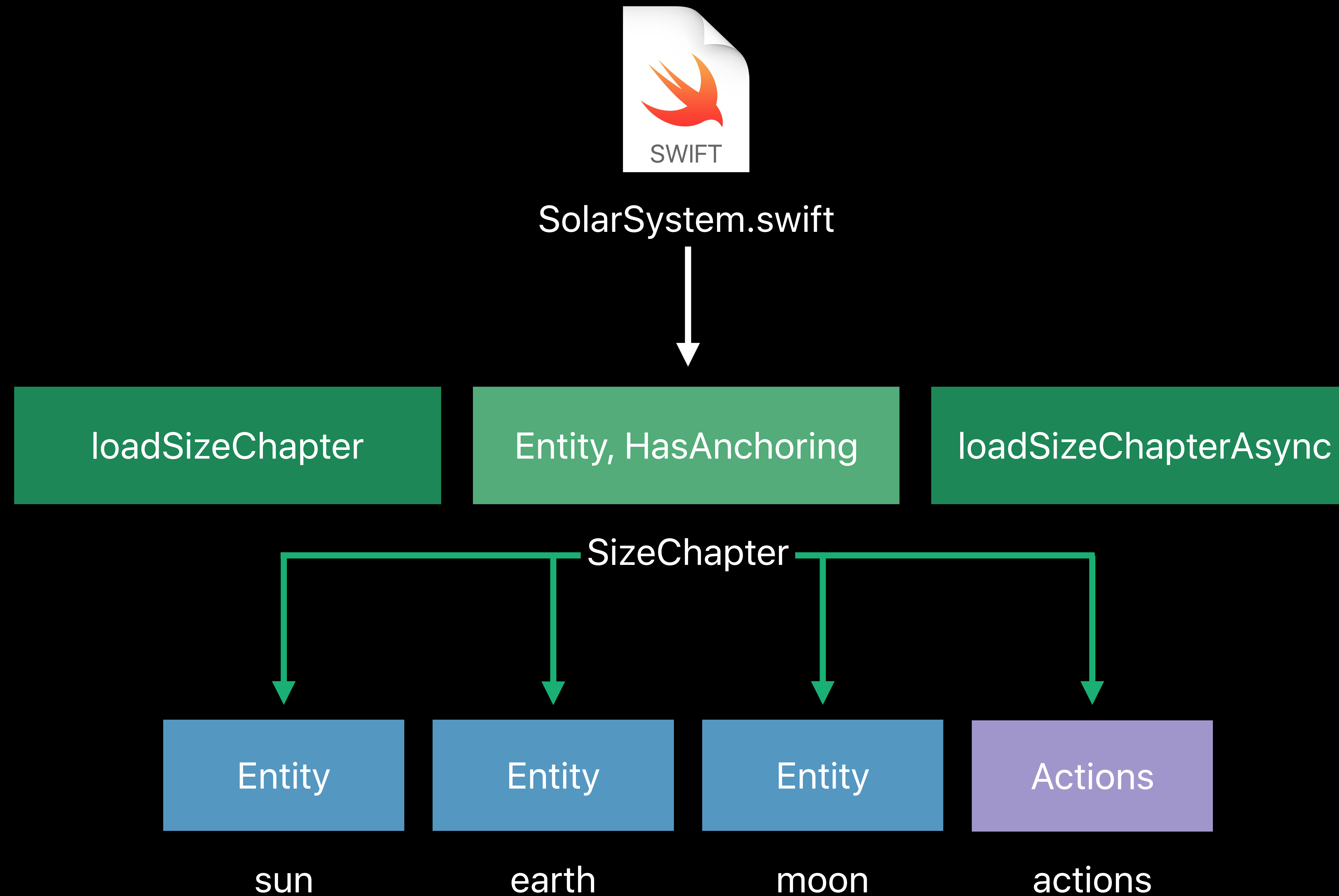
Emphasize
Affected Objects: Choose (1 Object)
Duration: 1s
Motion Type: Bounce
Style: [dropdown]



MacBook Pro

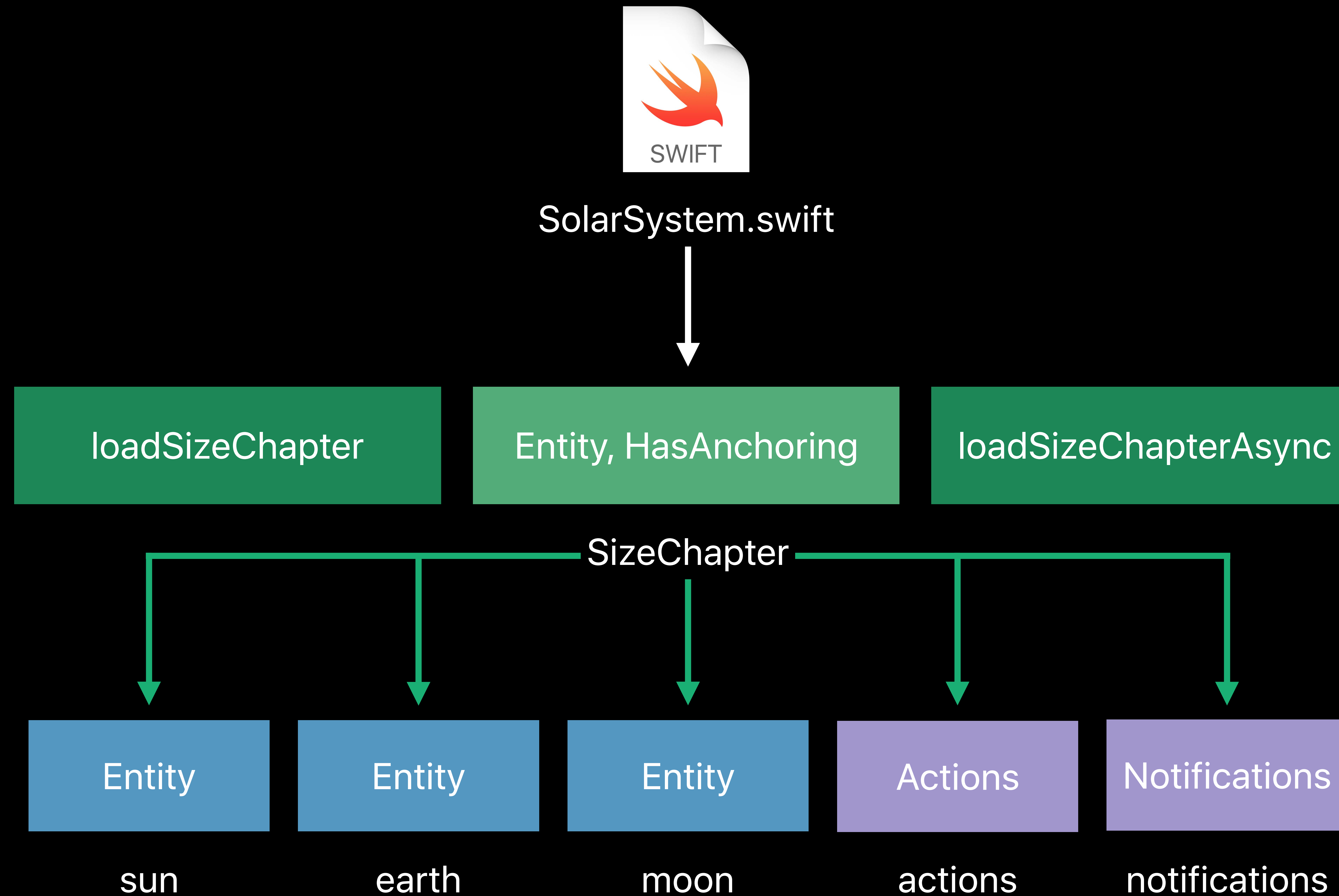
Notification Trigger

Generated code structure



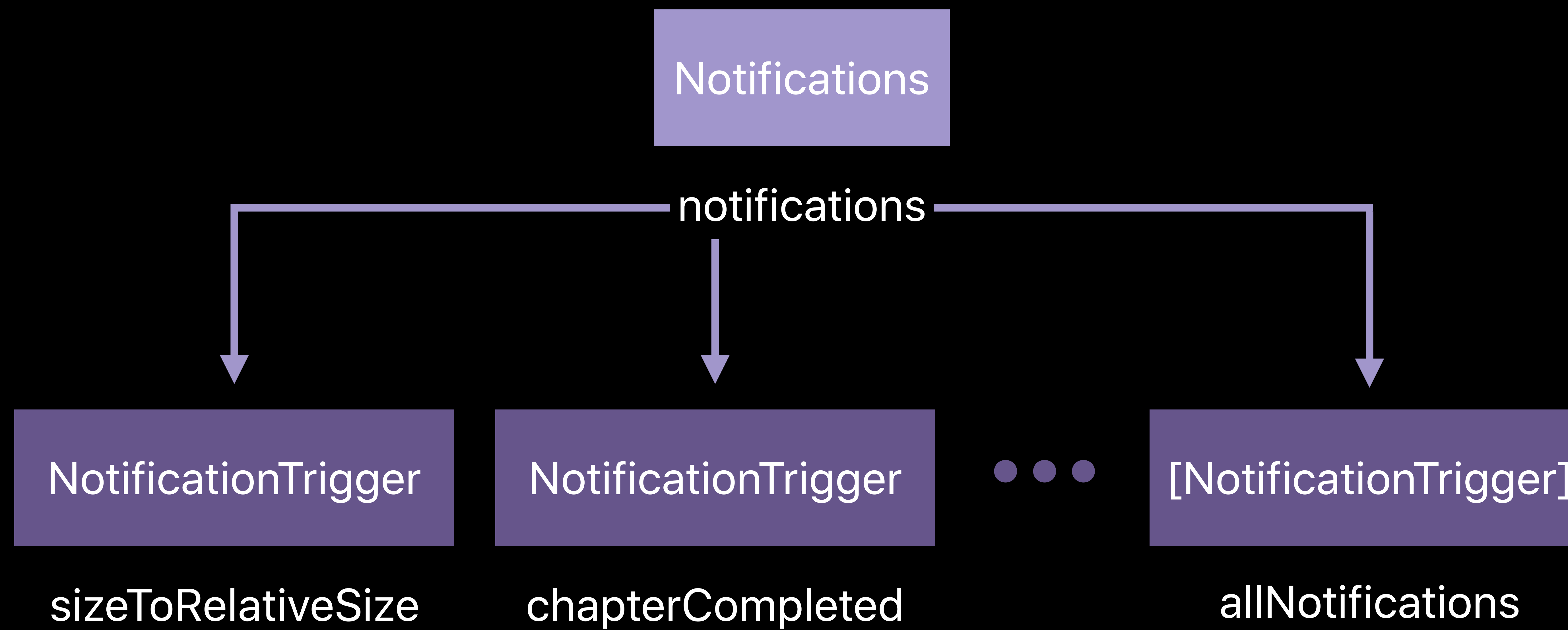
Notification Trigger

Generated code structure



Notification Trigger

Generated code structure



Notification Trigger

Starting an action sequence

```
seasonsChapter.notifications.showGoldStar.post()
```

```
// Replaces targets in the action sequence named `originalTarget.name` with `newTarget`  
seasonsChapter.notifications.showGoldStar.post(overrides: [originalTarget.name: newTarget])
```

Notification Trigger

Starting an action sequence

```
seasonsChapter.notifications.showGoldStar.post()
```

```
// Replaces targets in the action sequence named `originalTarget.name` with `newTarget`  
seasonsChapter.notifications.showGoldStar.post(overrides: [originalTarget.name: newTarget])
```


Notification Trigger

Starting an action sequence

```
seasonsChapter.notifications.showGoldStar.post()
```

```
// Replaces targets in the action sequence named `originalTarget.name` with `newTarget`
```

```
seasonsChapter.notifications.showGoldStar.post(overrides: [originalTarget.name: newTarget])
```

Demo

Reality Composer

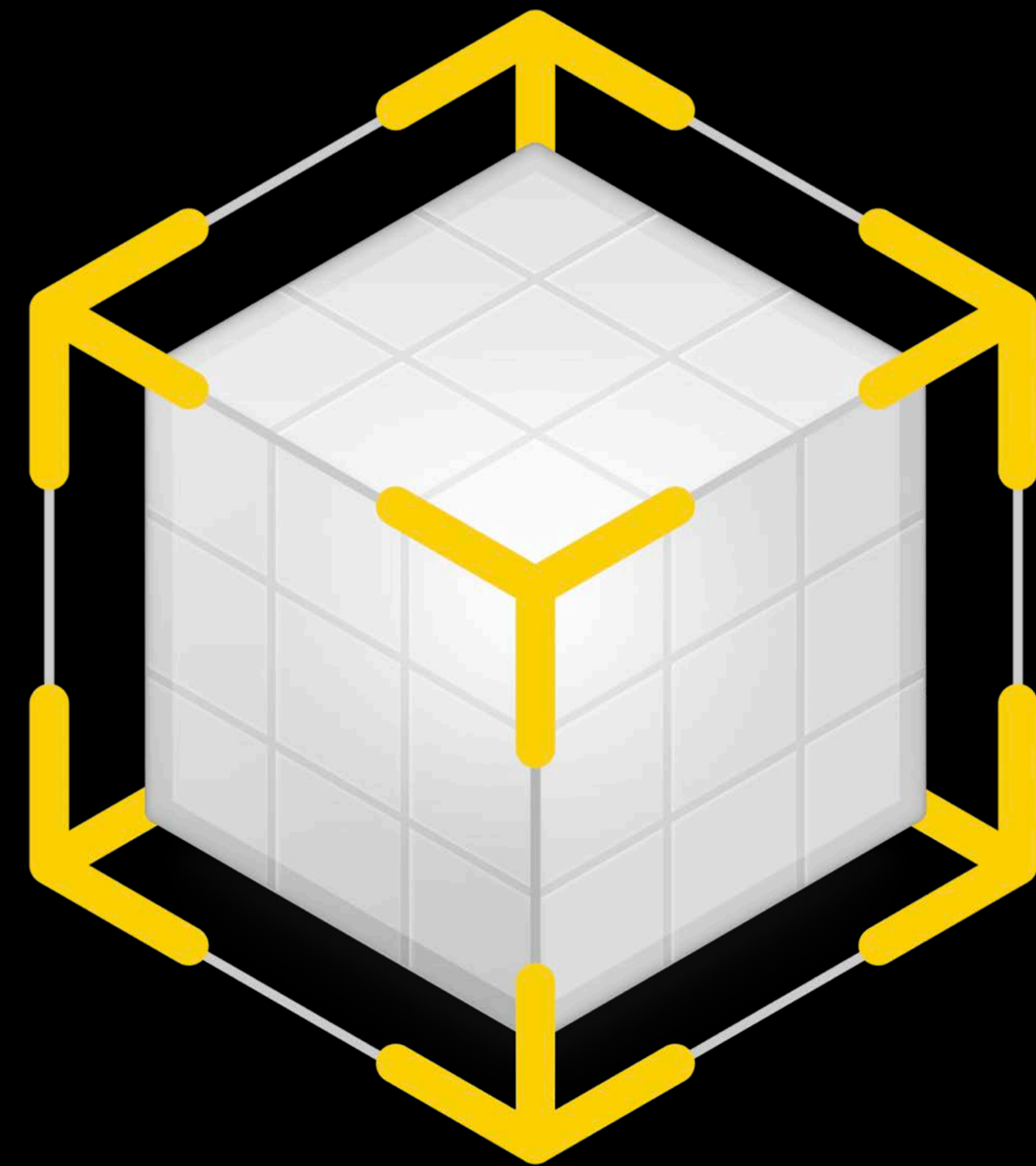
Get started with AR and 3D

Layout and pre-visualization

Content library

Simple interactions

Xcode integration



More Information

developer.apple.com/wwdc19/609

RealityKit and Reality Composer Lab

Thursday, 3:00

Advances in AR Quick Look

Friday, 9:00

AR Quick Look and Reality Composer Lab

Friday, 11:00

