Introducing Swift Playgrounds

Exploring with Swift on iPad

Session 408

Matt Patenaude Playgrounds Engineer
Maxwell Swadling Playgrounds Engineer
Jonathan Penn Playgrounds Engineer
Izzy Fraimow Playgrounds Engineer

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FaceTime
Calendar
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Camera
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News
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Playgrounds
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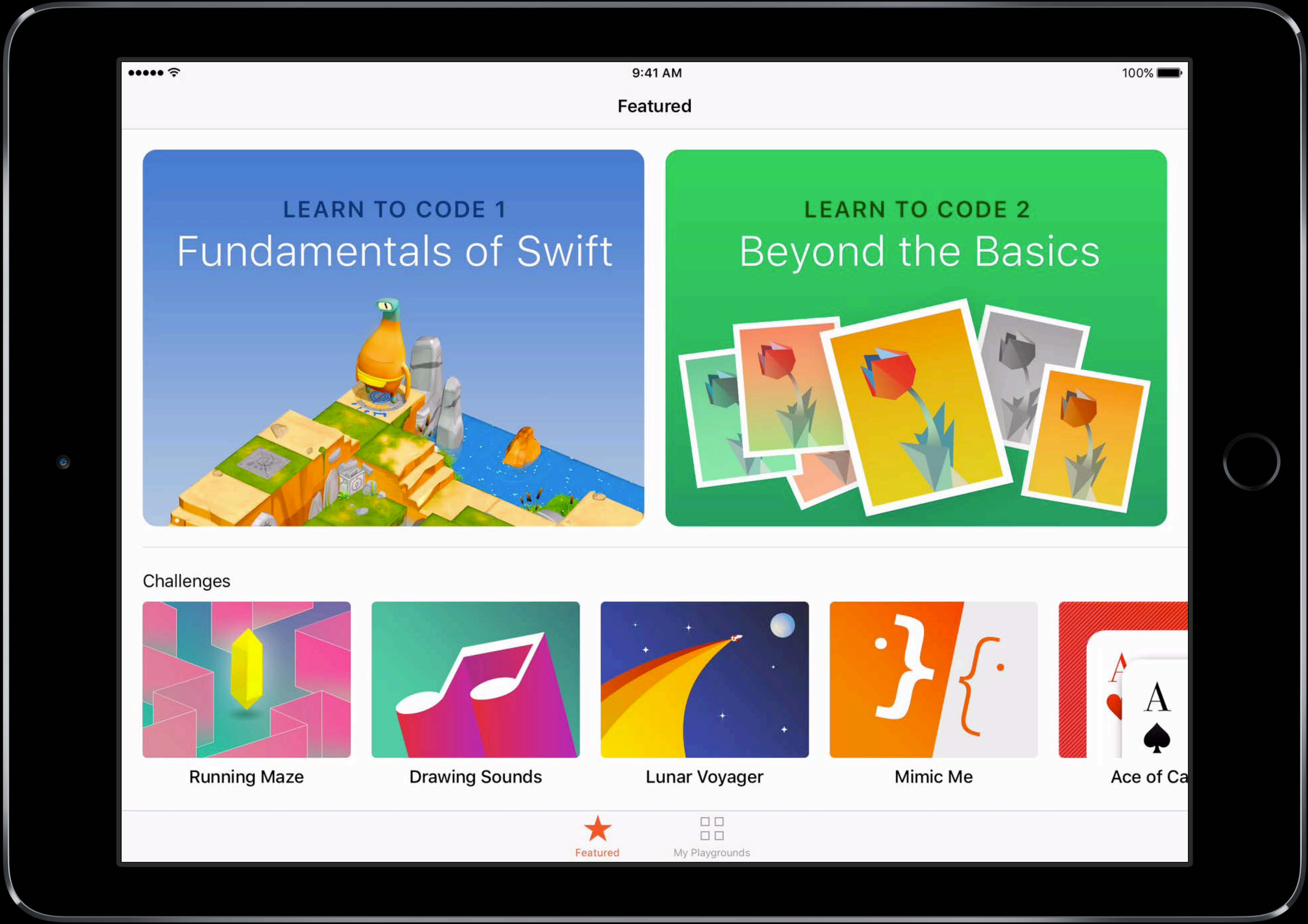

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Featured

LEARN TO CODE 1

Fundamentals of Swift

LEARN TO CODE 2

Beyond the Basics

Challenges

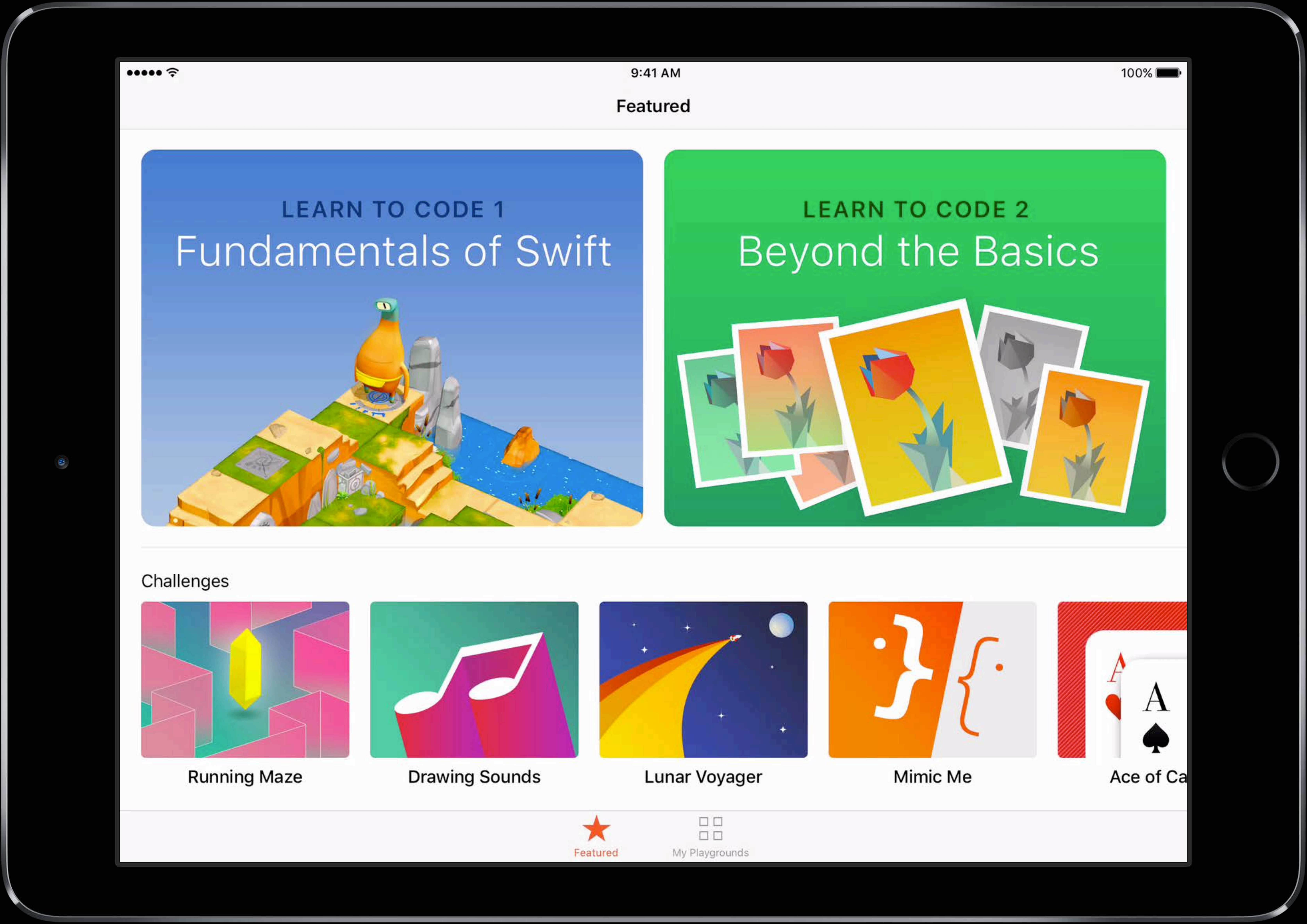
Running Maze

Drawing Sounds

Lunar Voyager

Mimic Me

Ace of Ca



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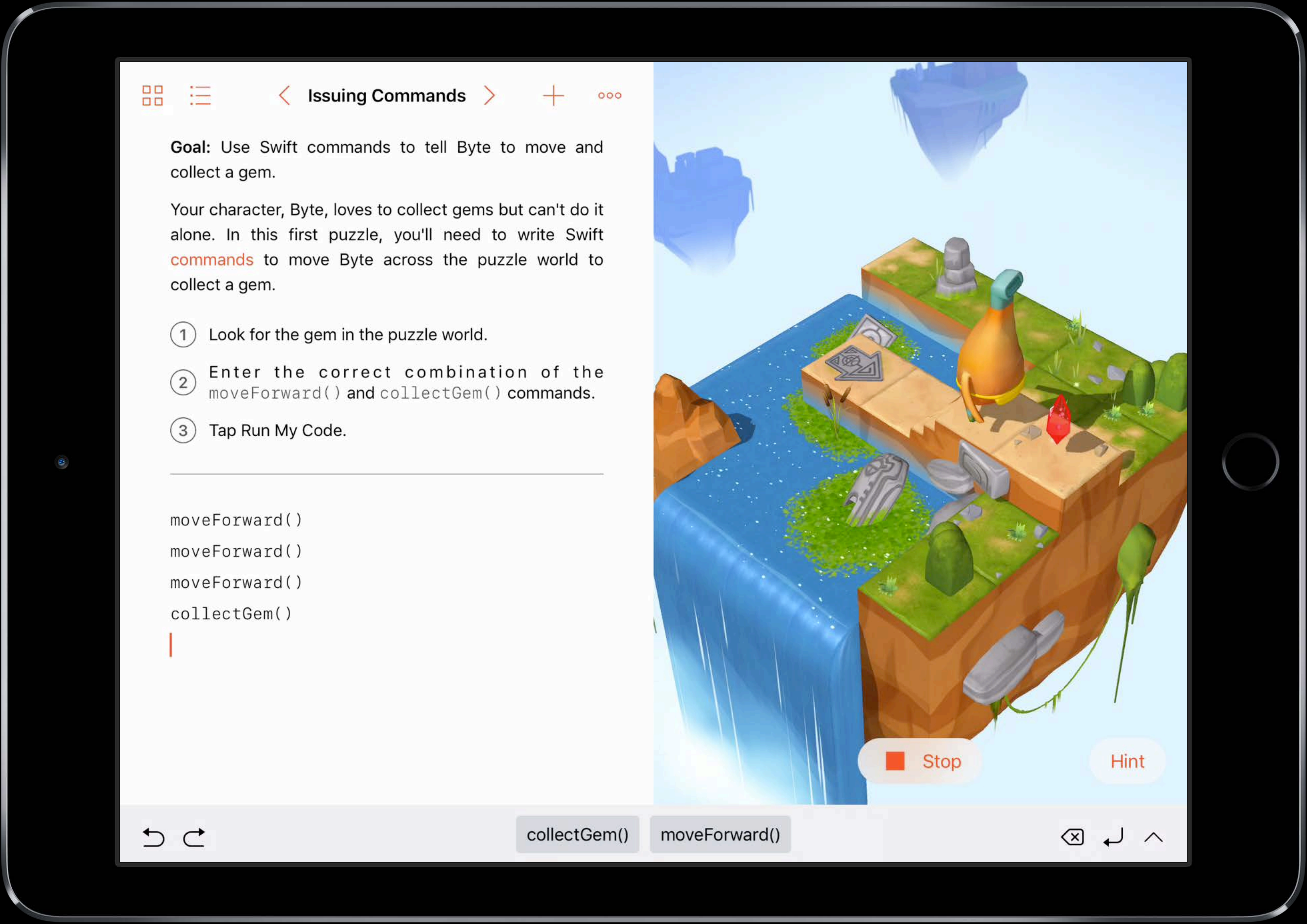

Goal: Use Swift commands to tell Byte to move and collect a gem.

Your character, Byte, loves to collect gems but can't do it alone. In this first puzzle, you'll need to write Swift commands to move Byte across the puzzle world to collect a gem.

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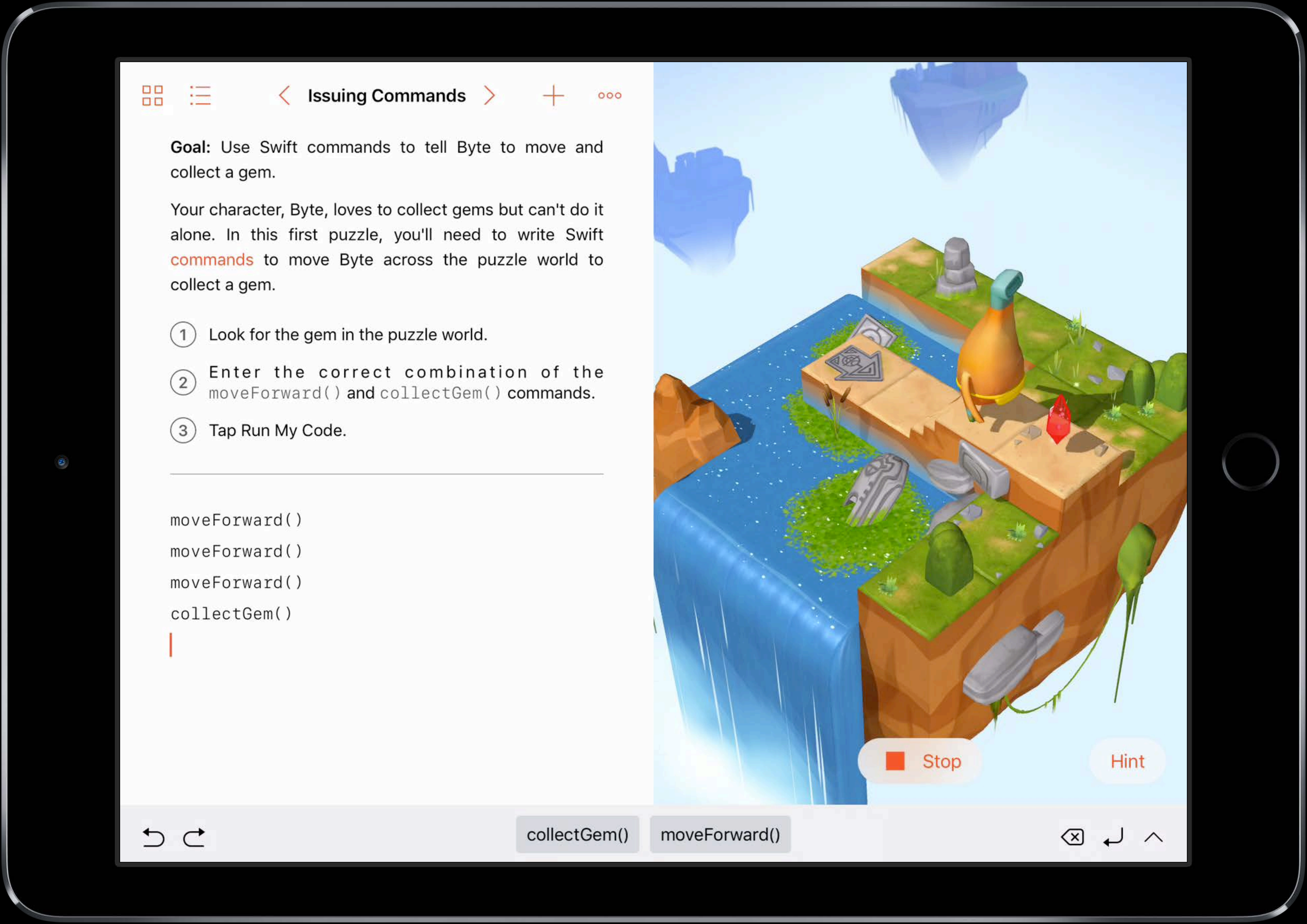

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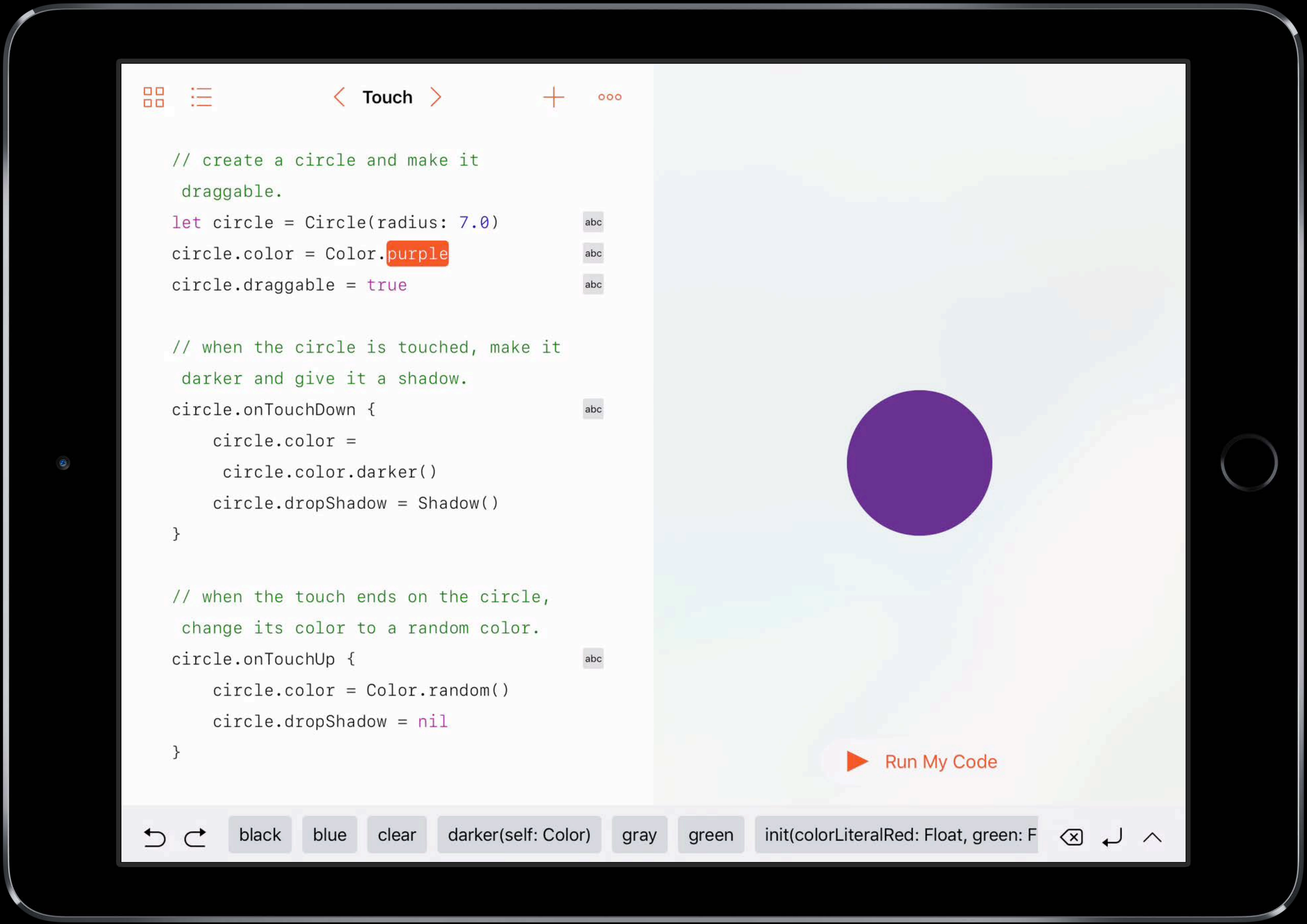
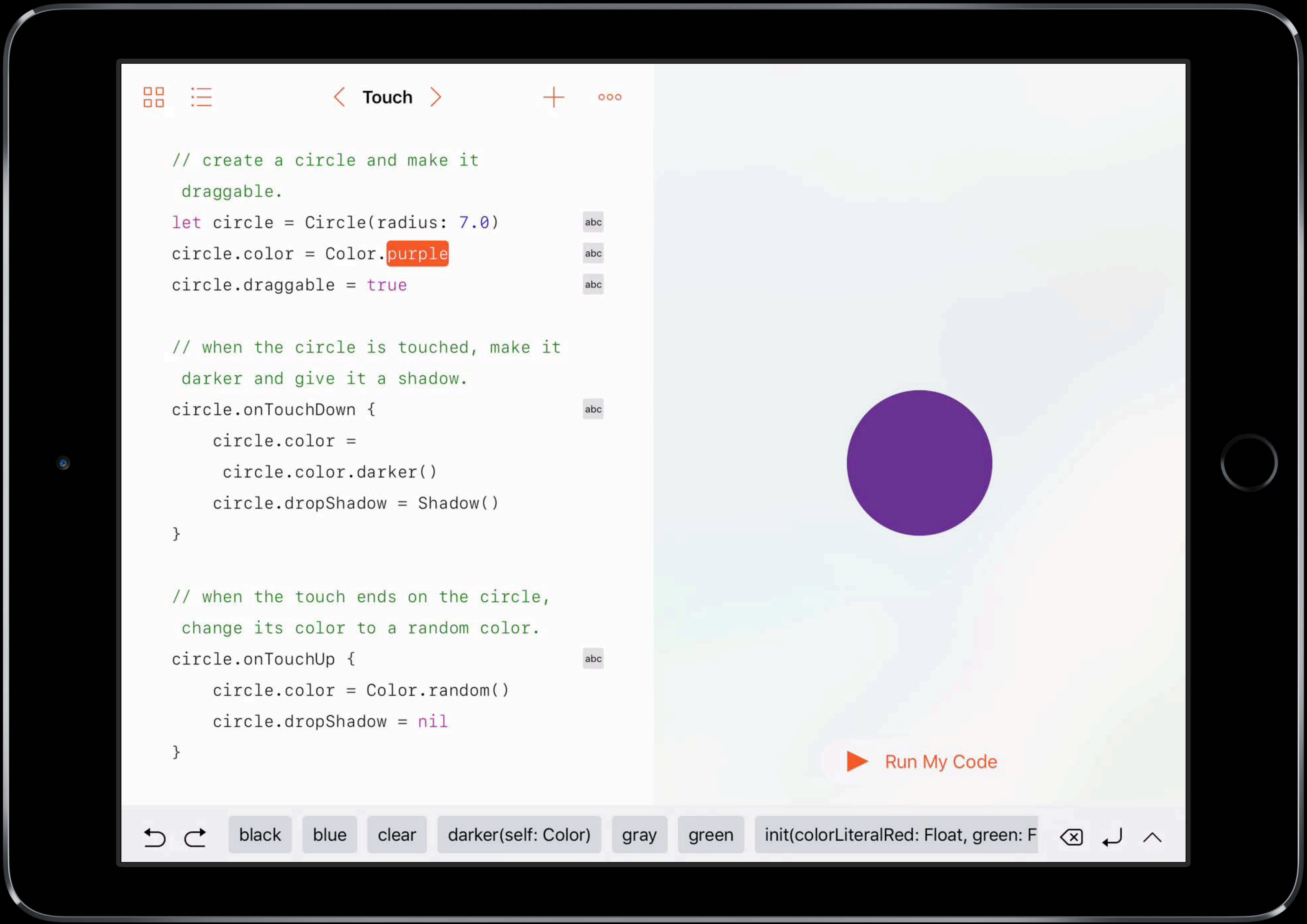


```
// create a circle and make it
 draggable.
let circle = Circle(radius: 7.0)
circle.color = Color.purple
circle.draggable = true

// when the circle is touched, make it
 darker and give it a shadow.
circle.onTouchDown {
    circle.color =
     circle.color.darker()
    circle.dropShadow = Shadow()
}

// when the touch ends on the circle,
 change its color to a random color.
circle.onTouchUp {
    circle.color = Color.random()
    circle.dropShadow = nil
}
```



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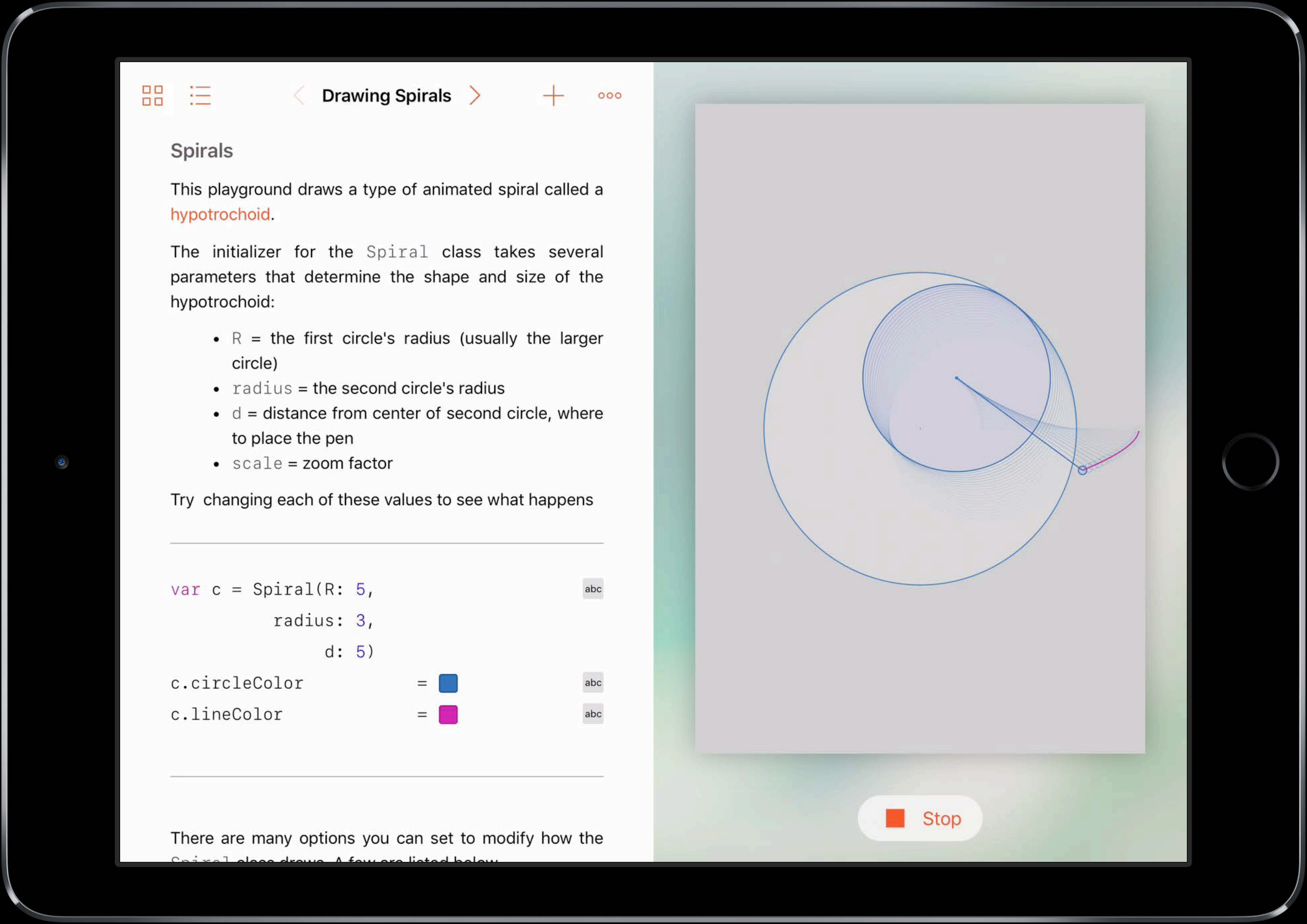


Spirals

This playground draws a type of animated spiral called a hypotrochoid.

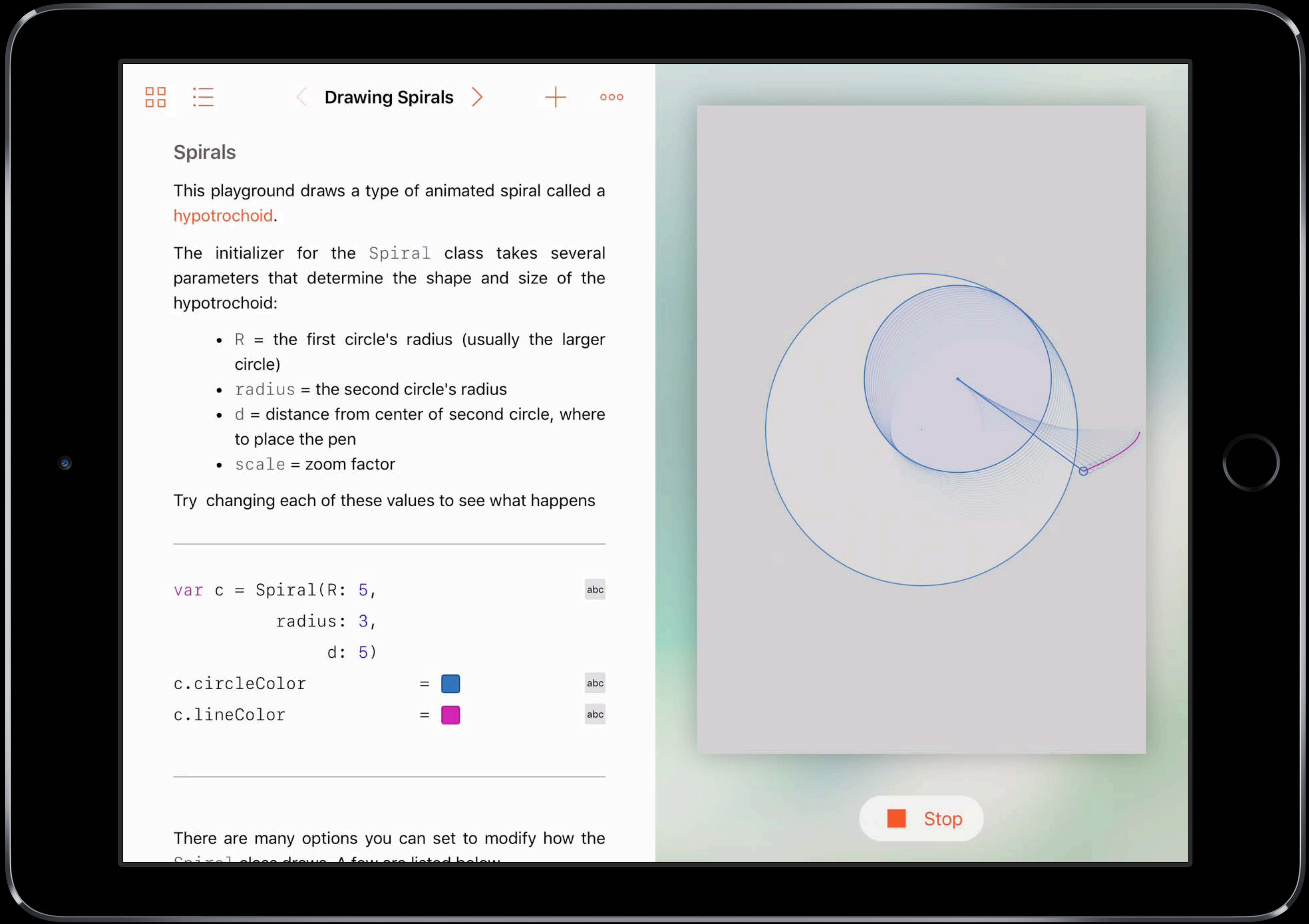
The initializer for the `Spiral` class takes several parameters that determine the shape and size of the hypotrochoid:

- `R` = the first circle's radius (usually the larger circle)
- `radius` = the second circle's radius
- `d` = distance from center of second circle, where to place the pen
- `scale` = zoom factor

Try changing each of these values to see what happens

```
var c = Spiral(R: 5,
          radius: 3,
               d: 5)
c.circleColor          = 🟦
c.lineColor            = 🟪
```

There are many options you can set to modify how the



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There are many options you can set to modify how the `Spiral` class draws. A few are listed below.

Using Swift Playgrounds

Using Swift Playgrounds

Authoring for Swift Playgrounds

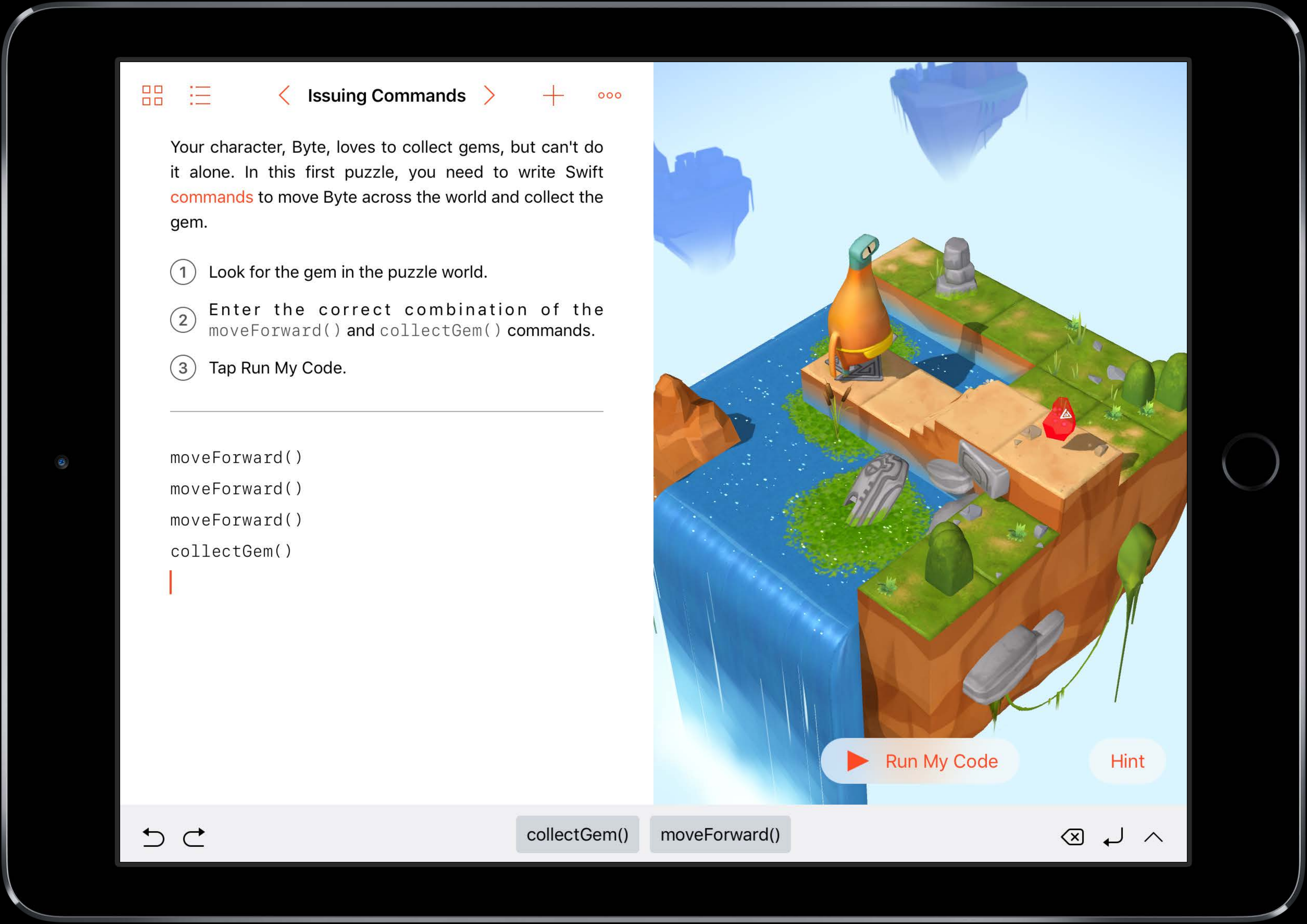
Using Swift Playgrounds

Authoring for Swift Playgrounds

Growing and Exploring

Using Swift Playgrounds

Maxwell Swadling
Playgrounds Engineer



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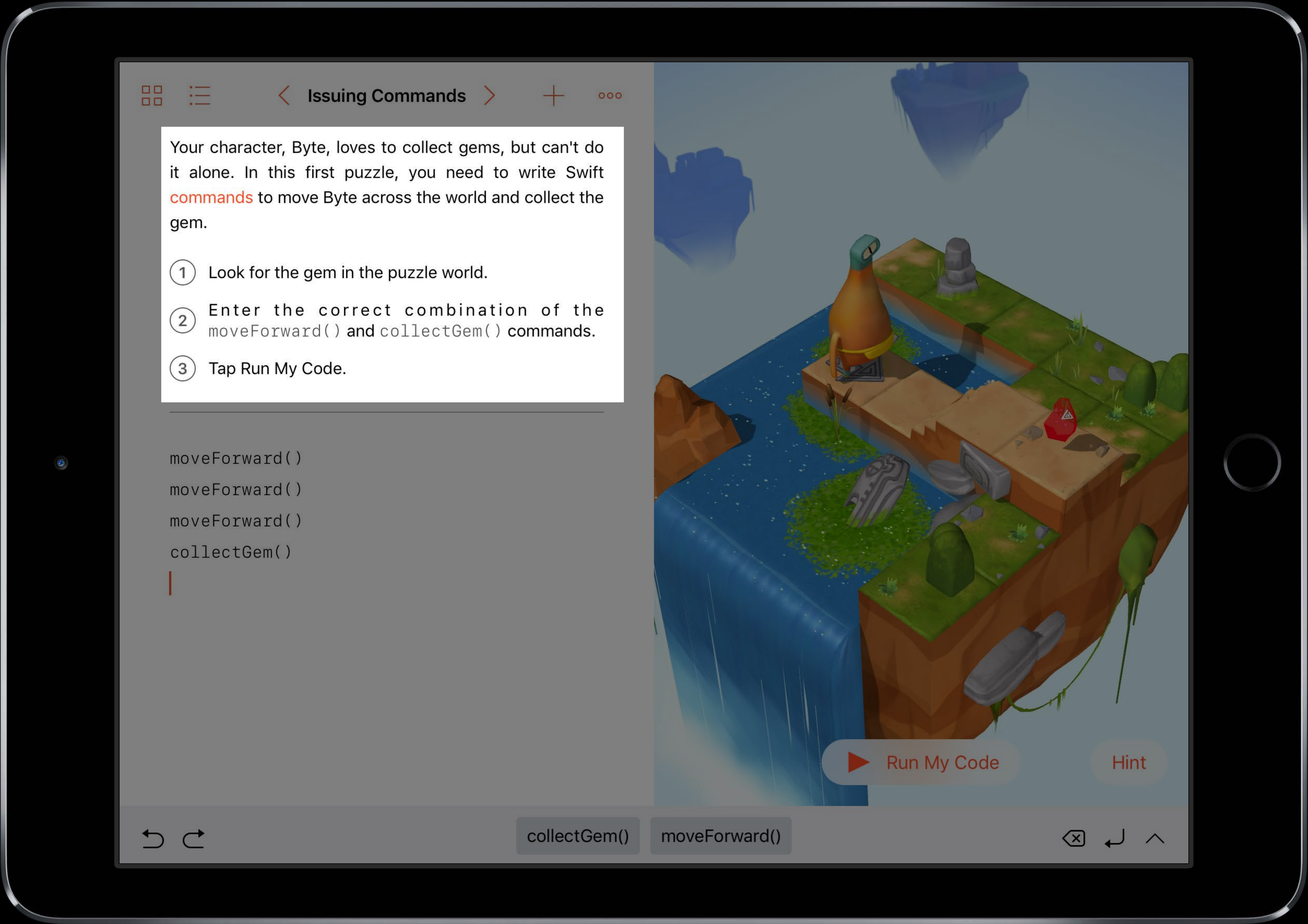
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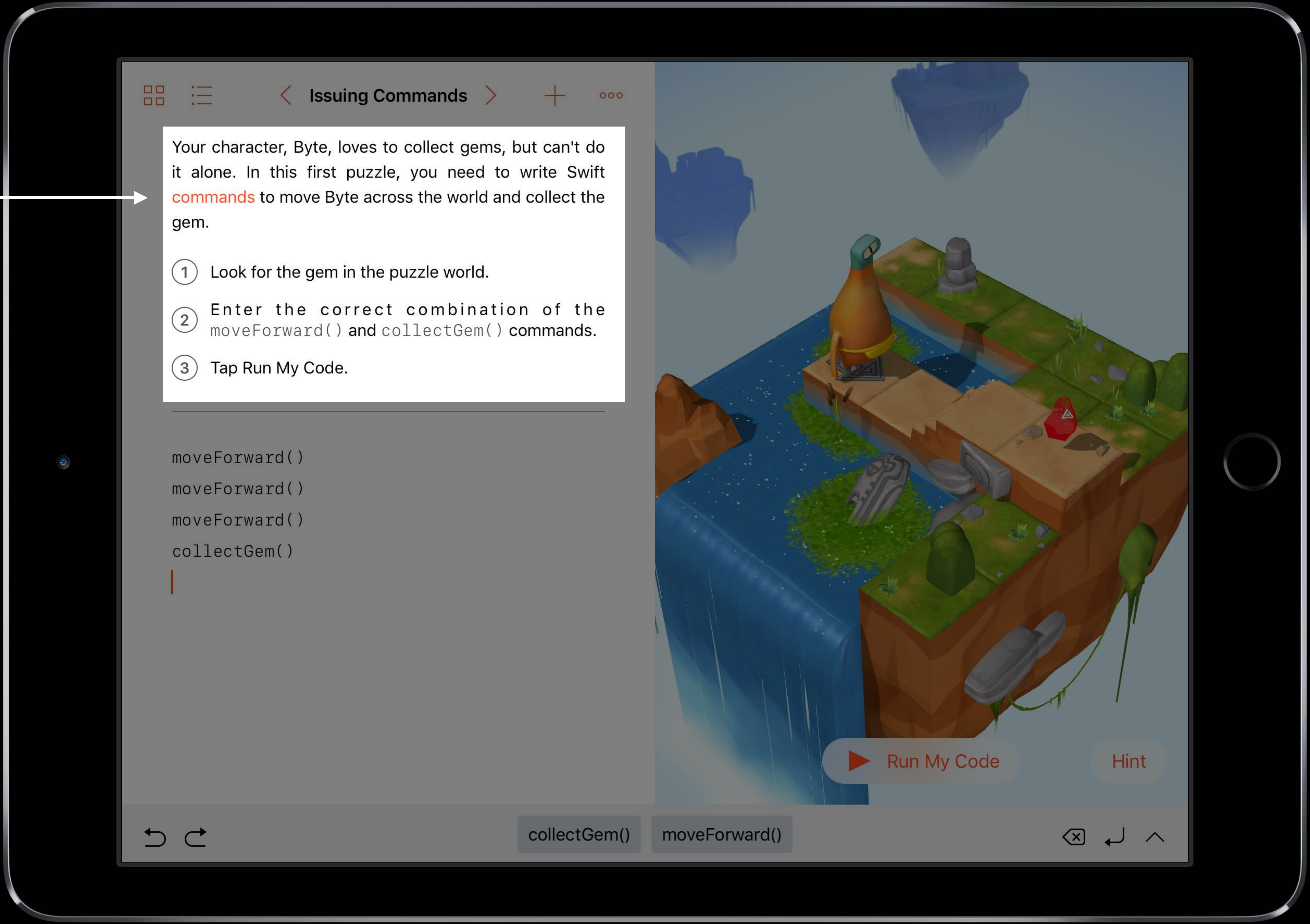
Playground Markup



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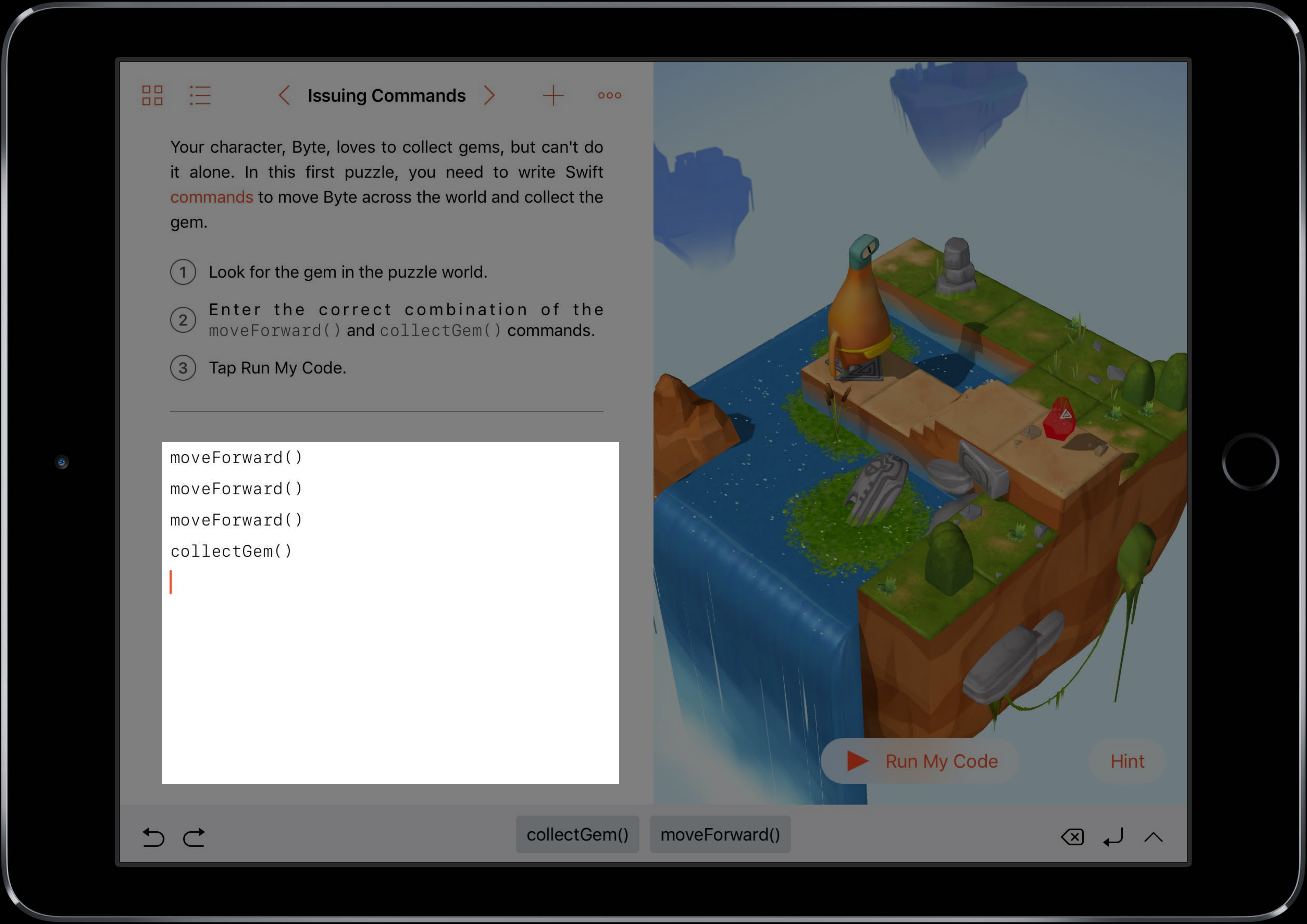

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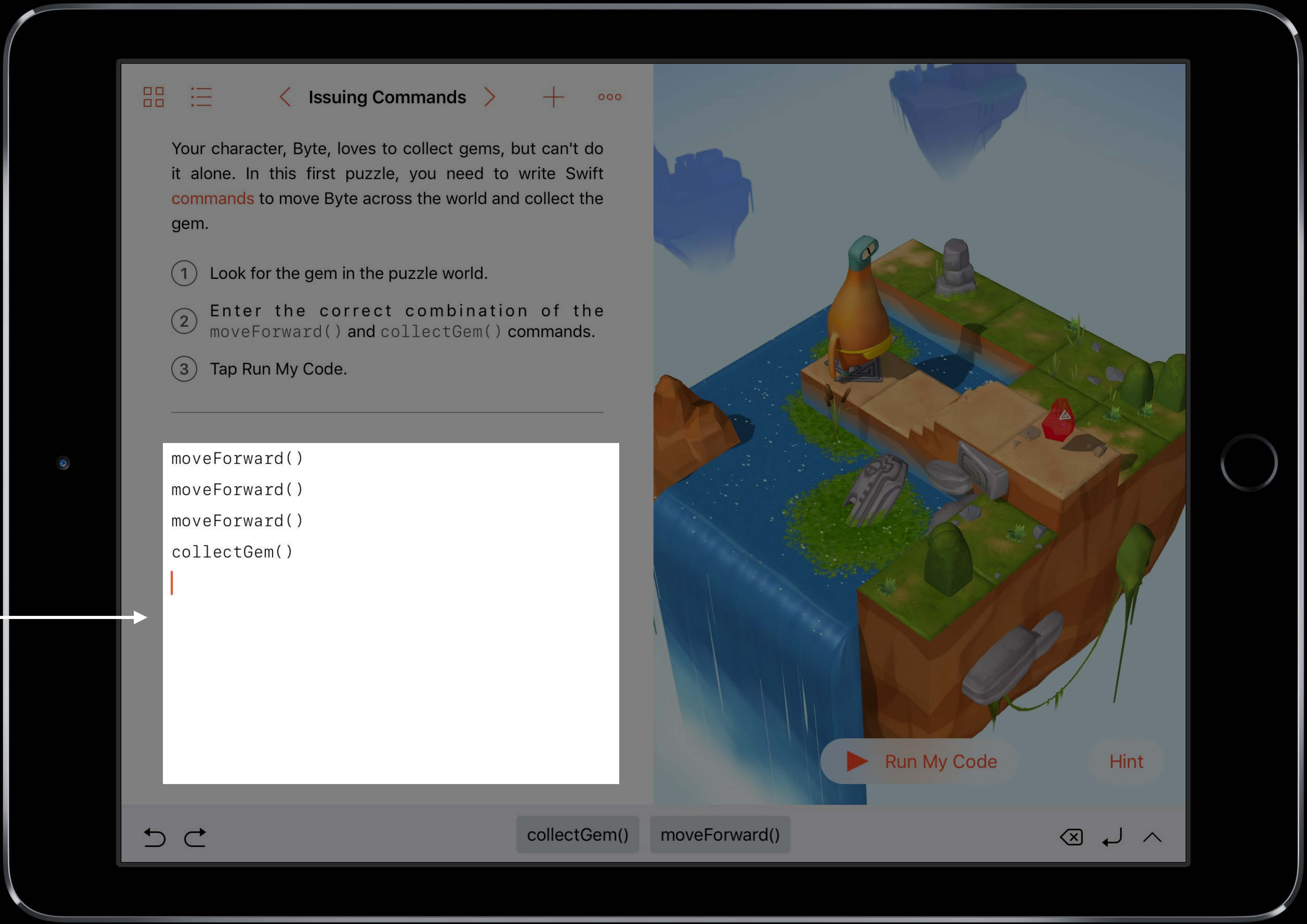

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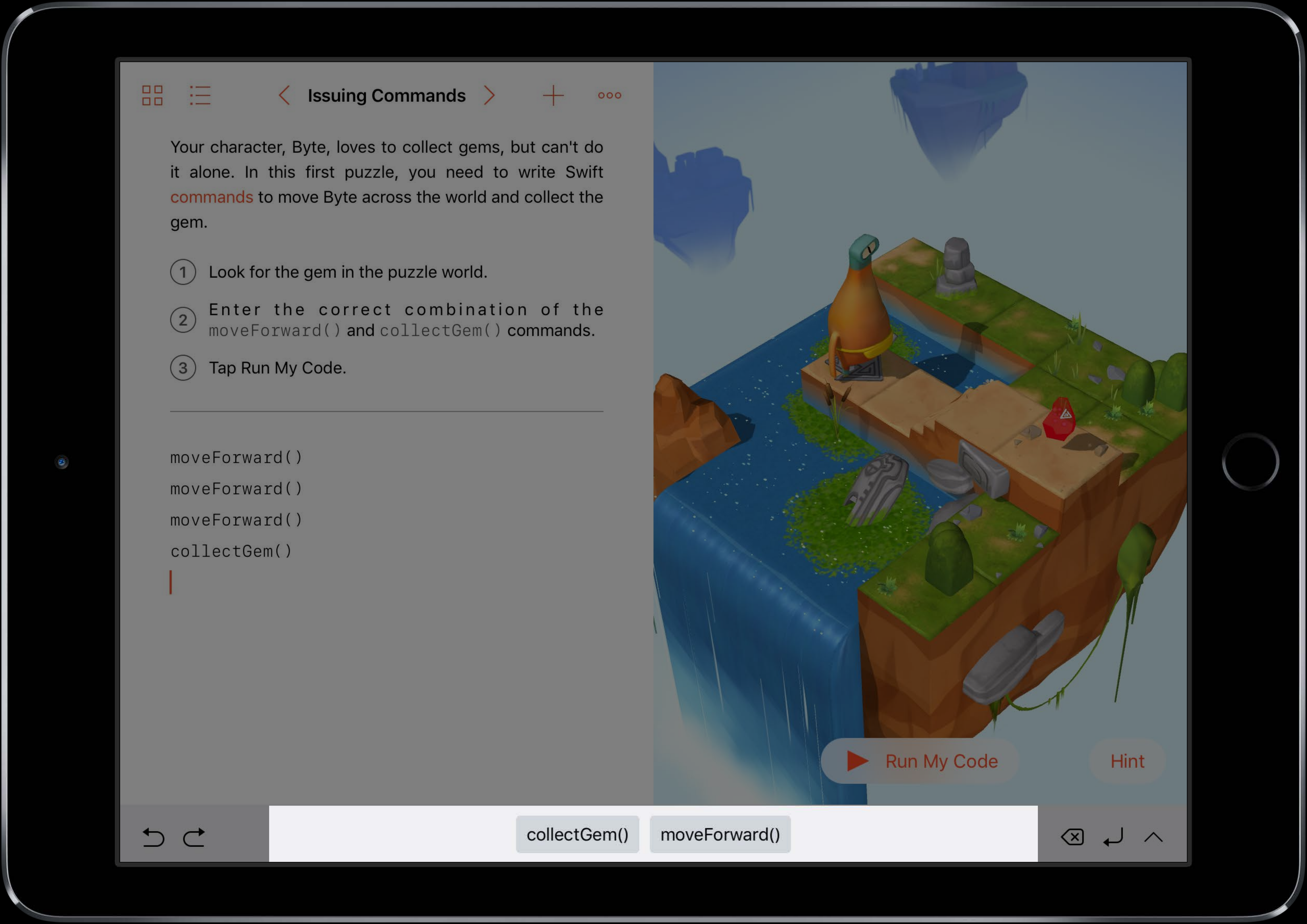
Source Code



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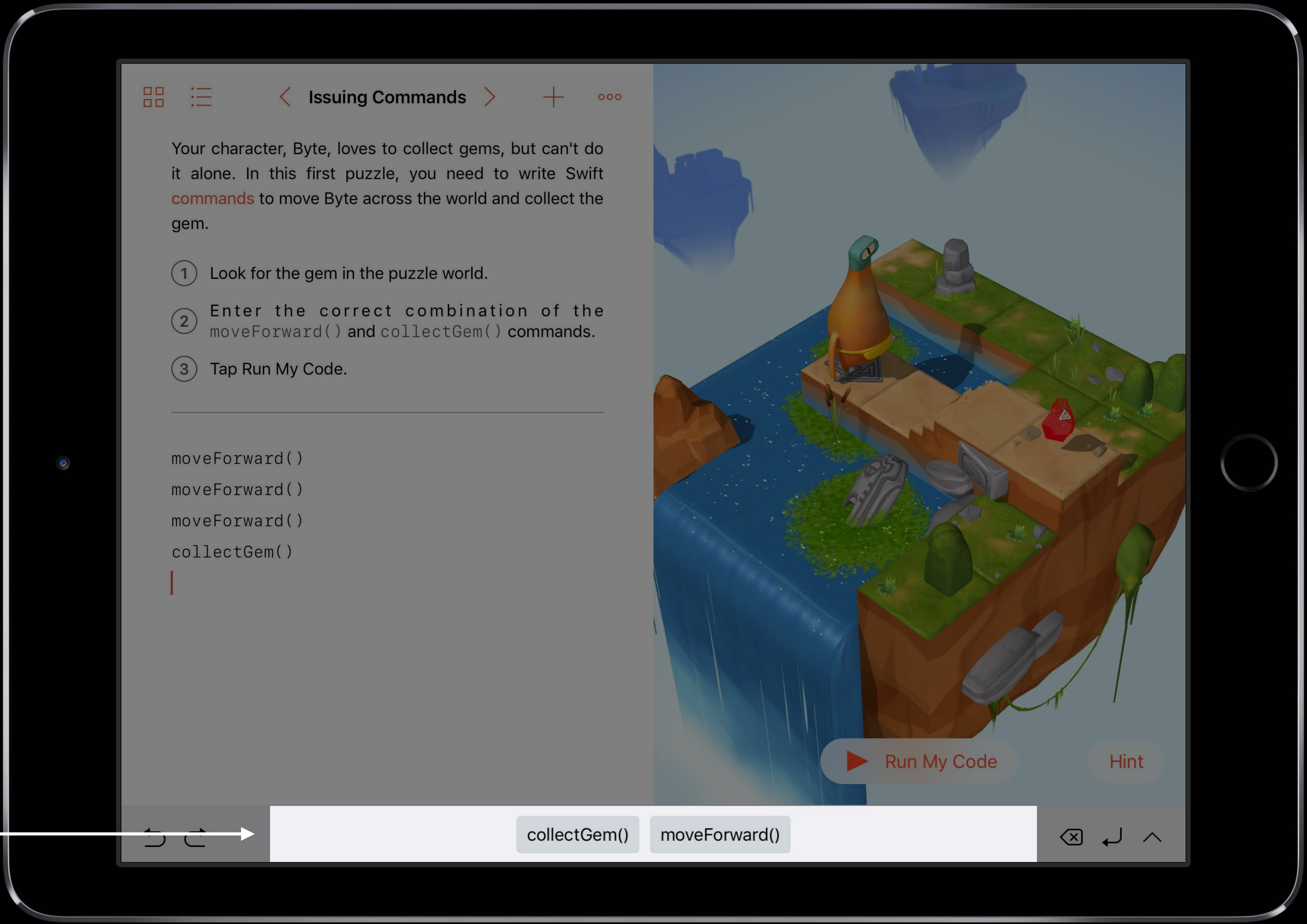

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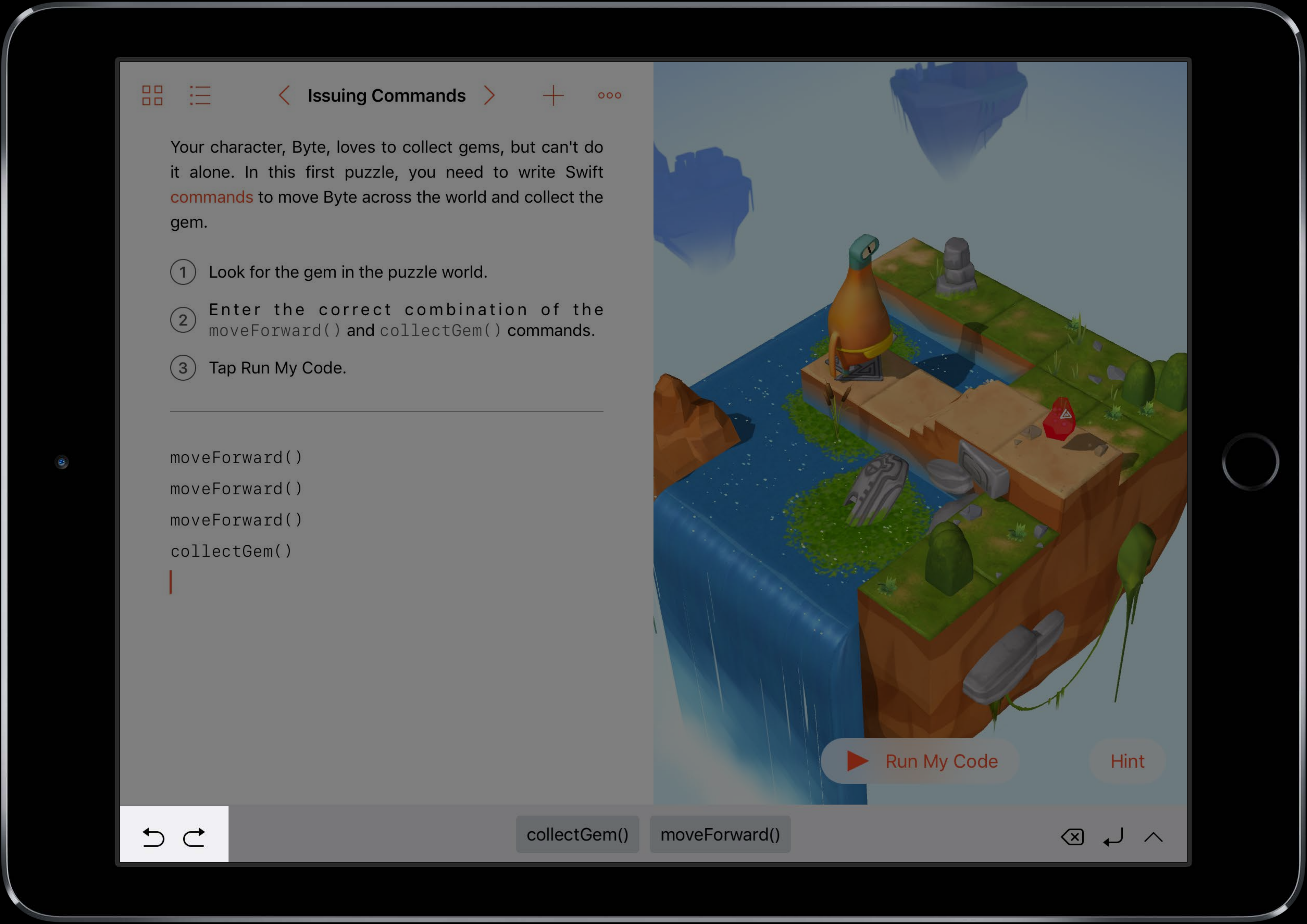
Code Completion



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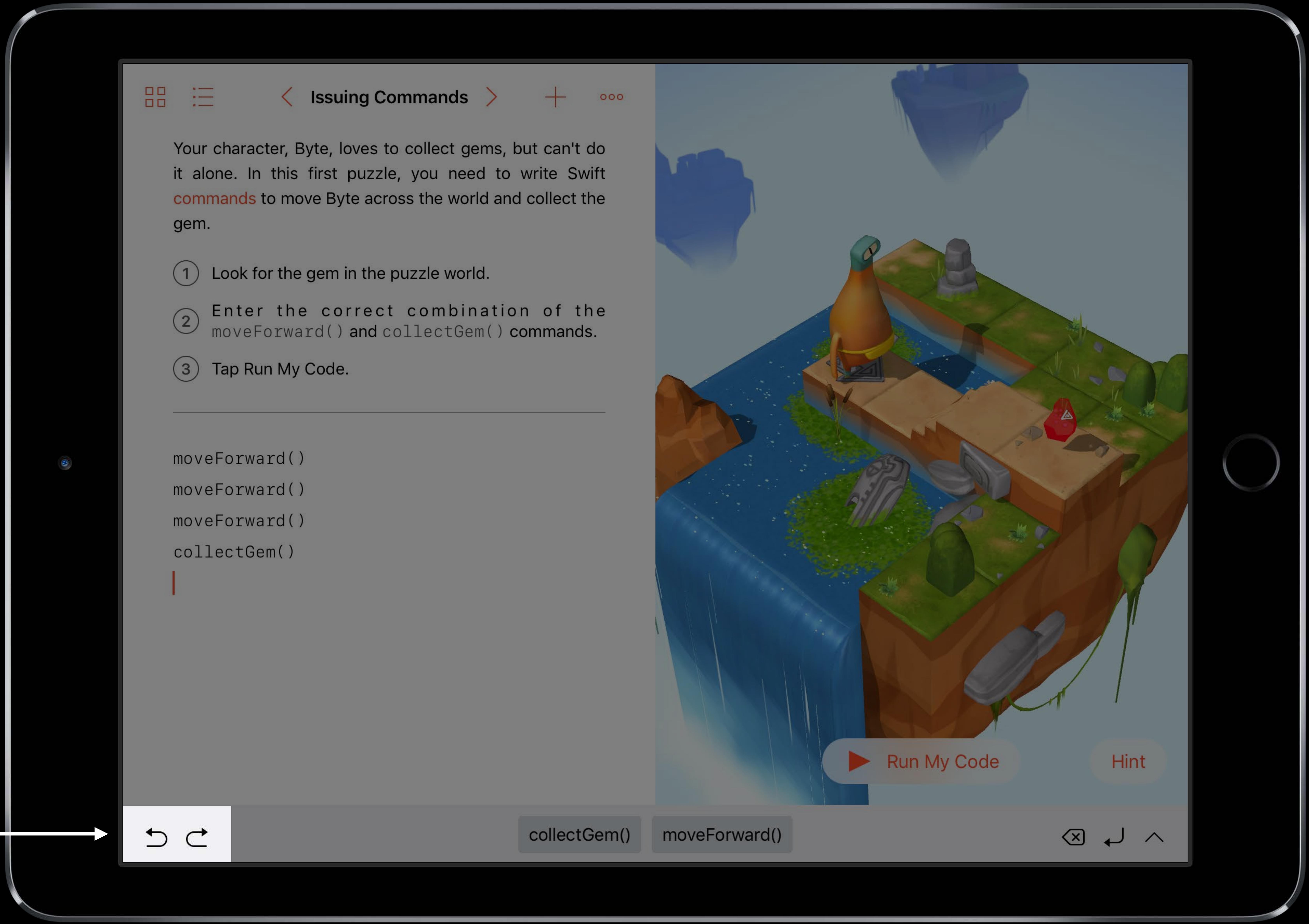

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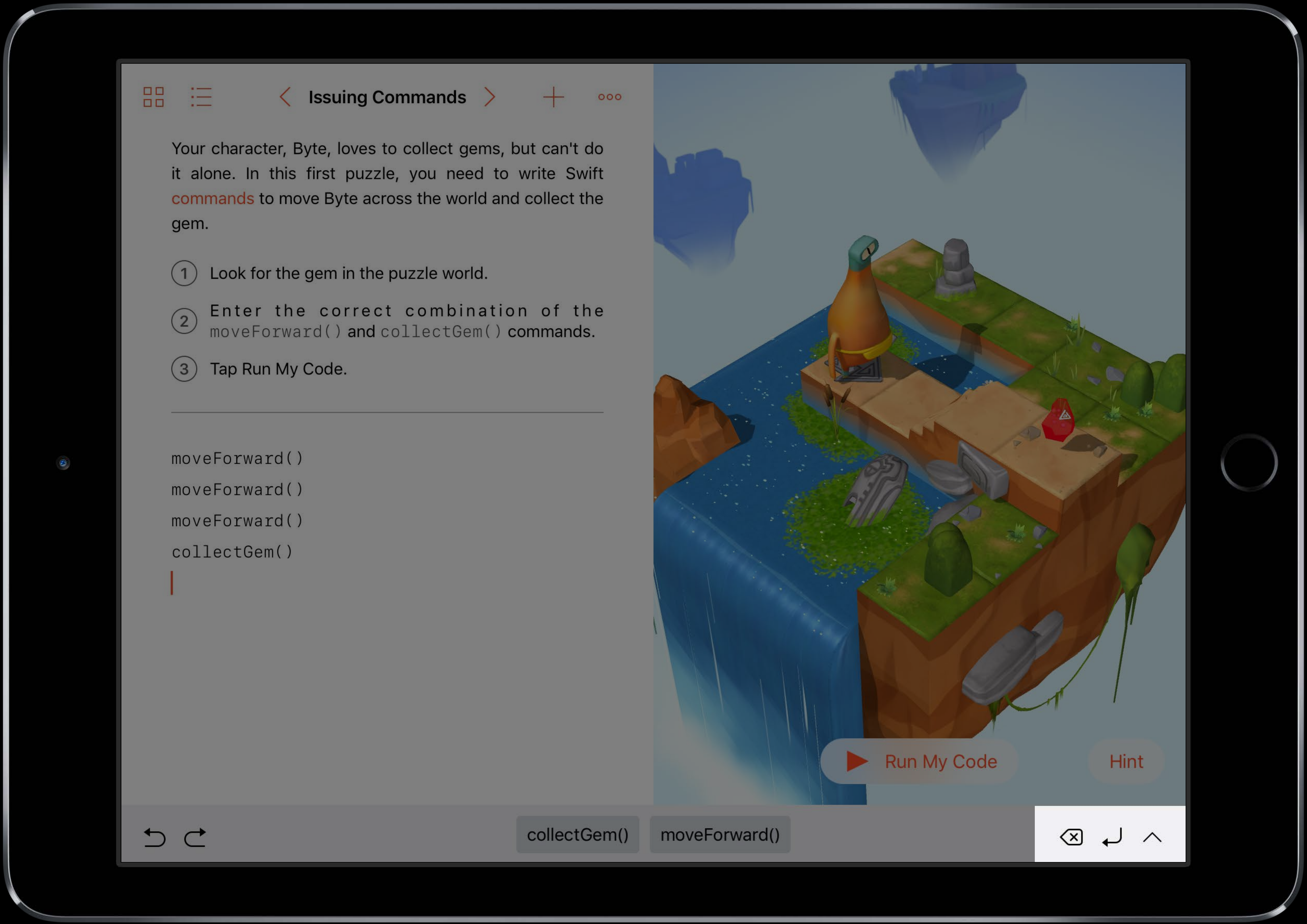
Undo/Redo



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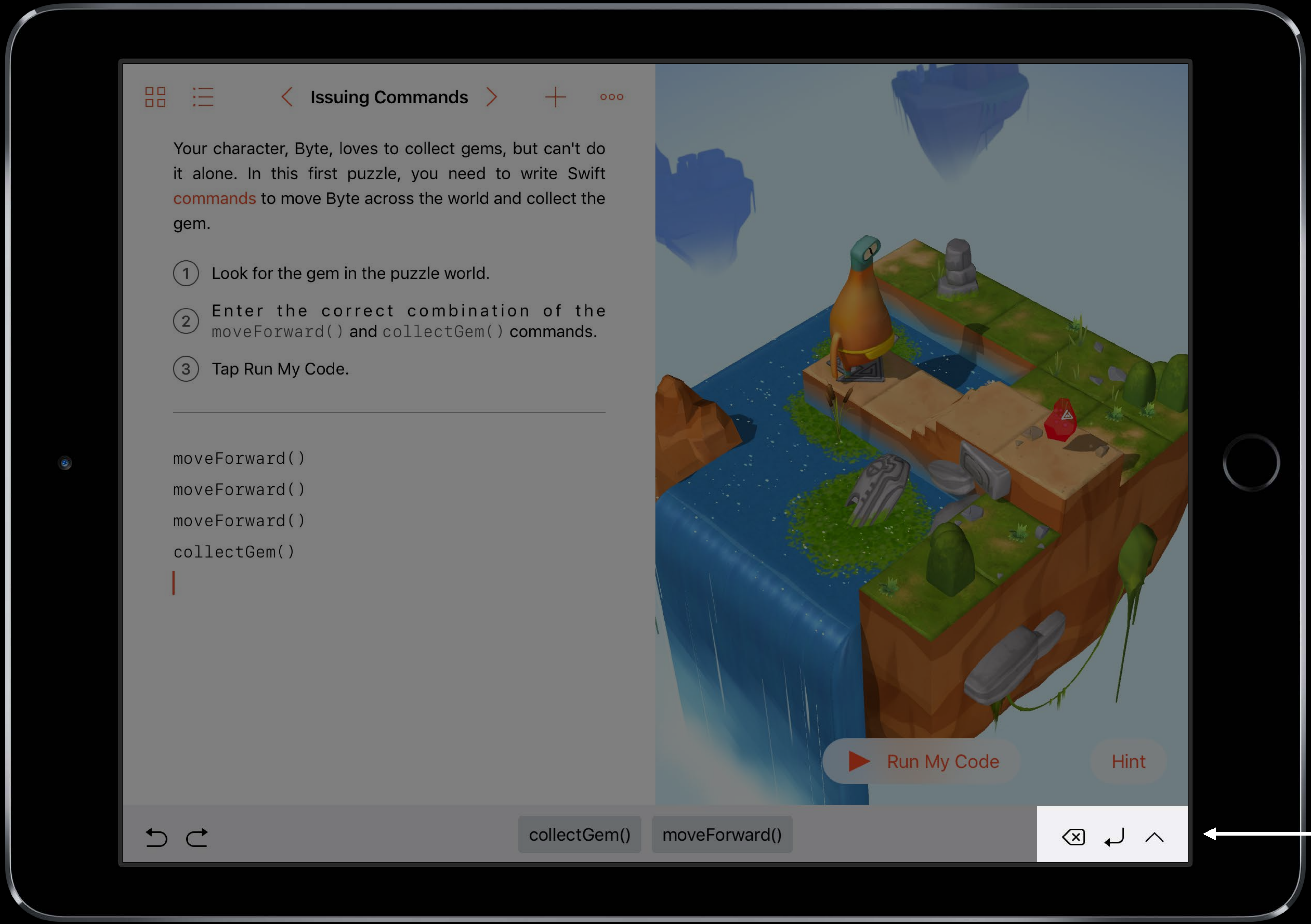

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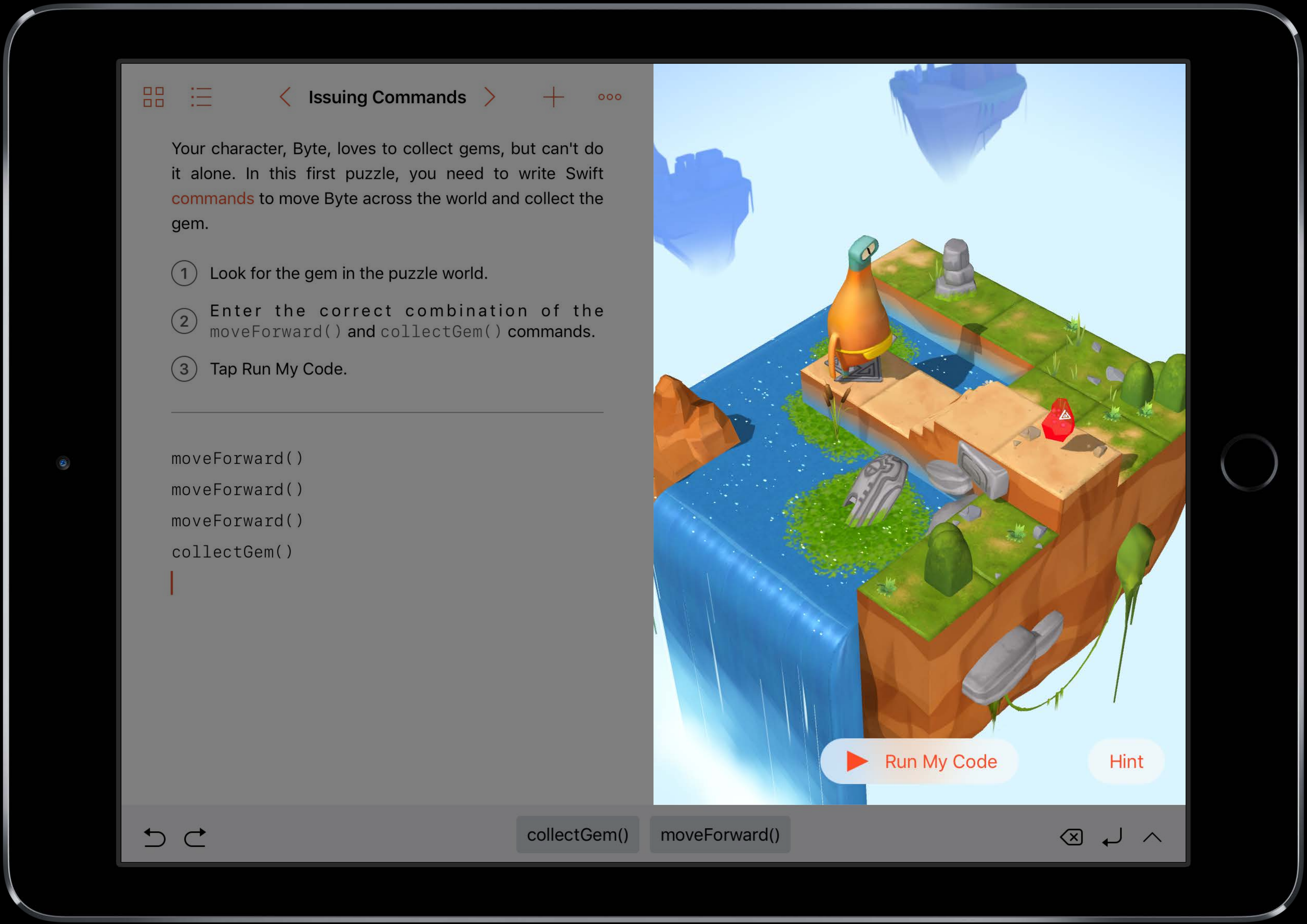
Shortcuts



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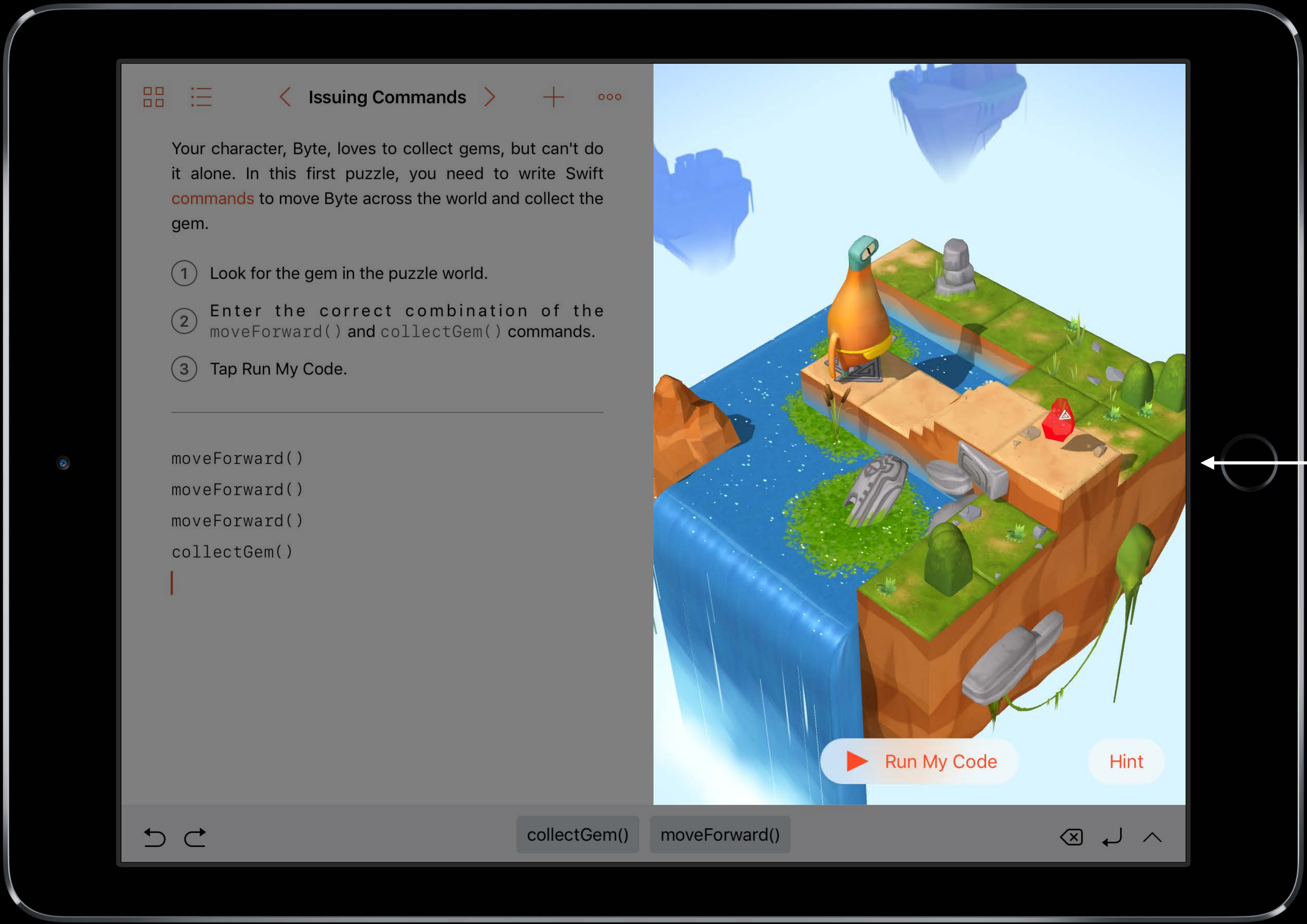

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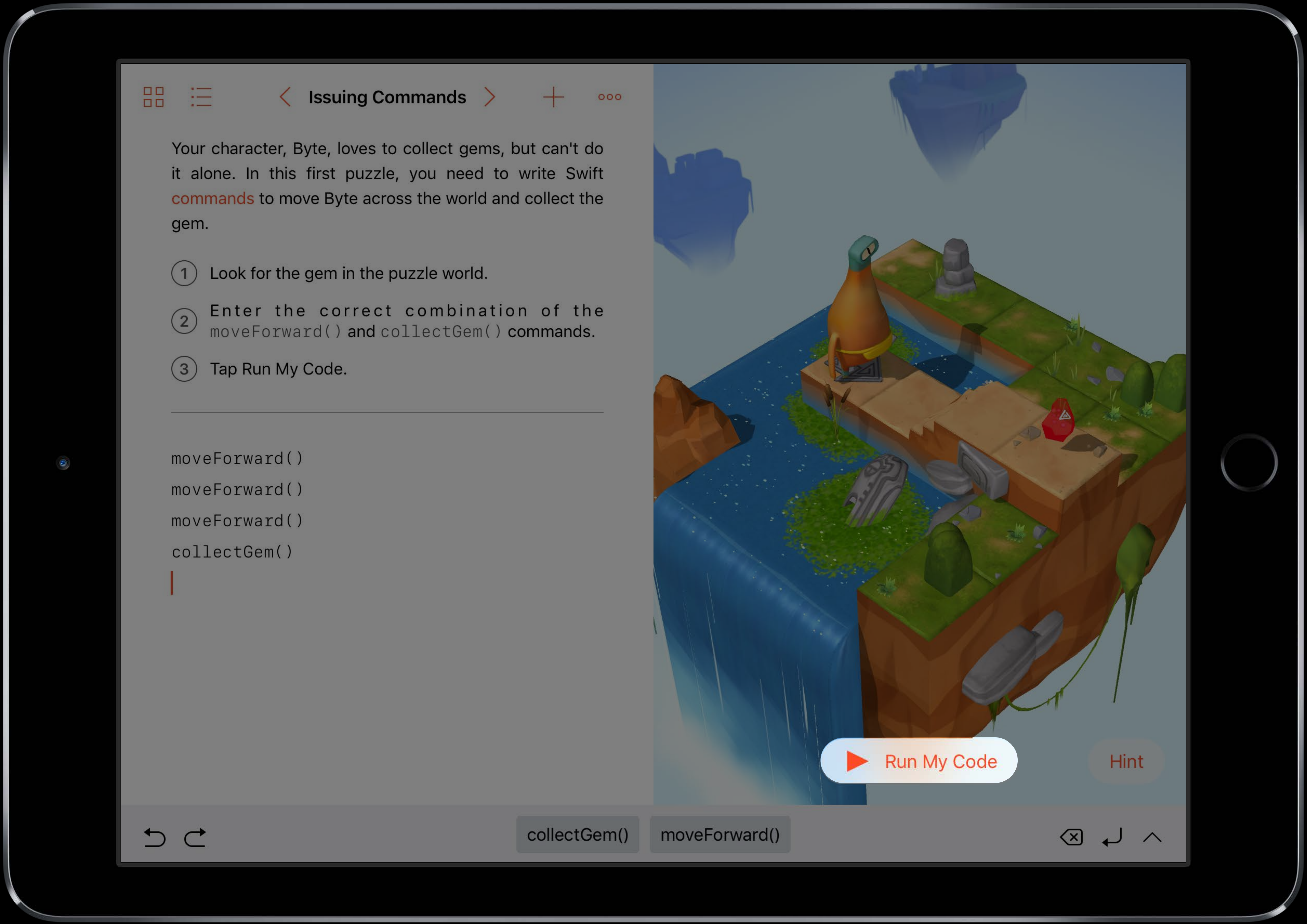
Live View



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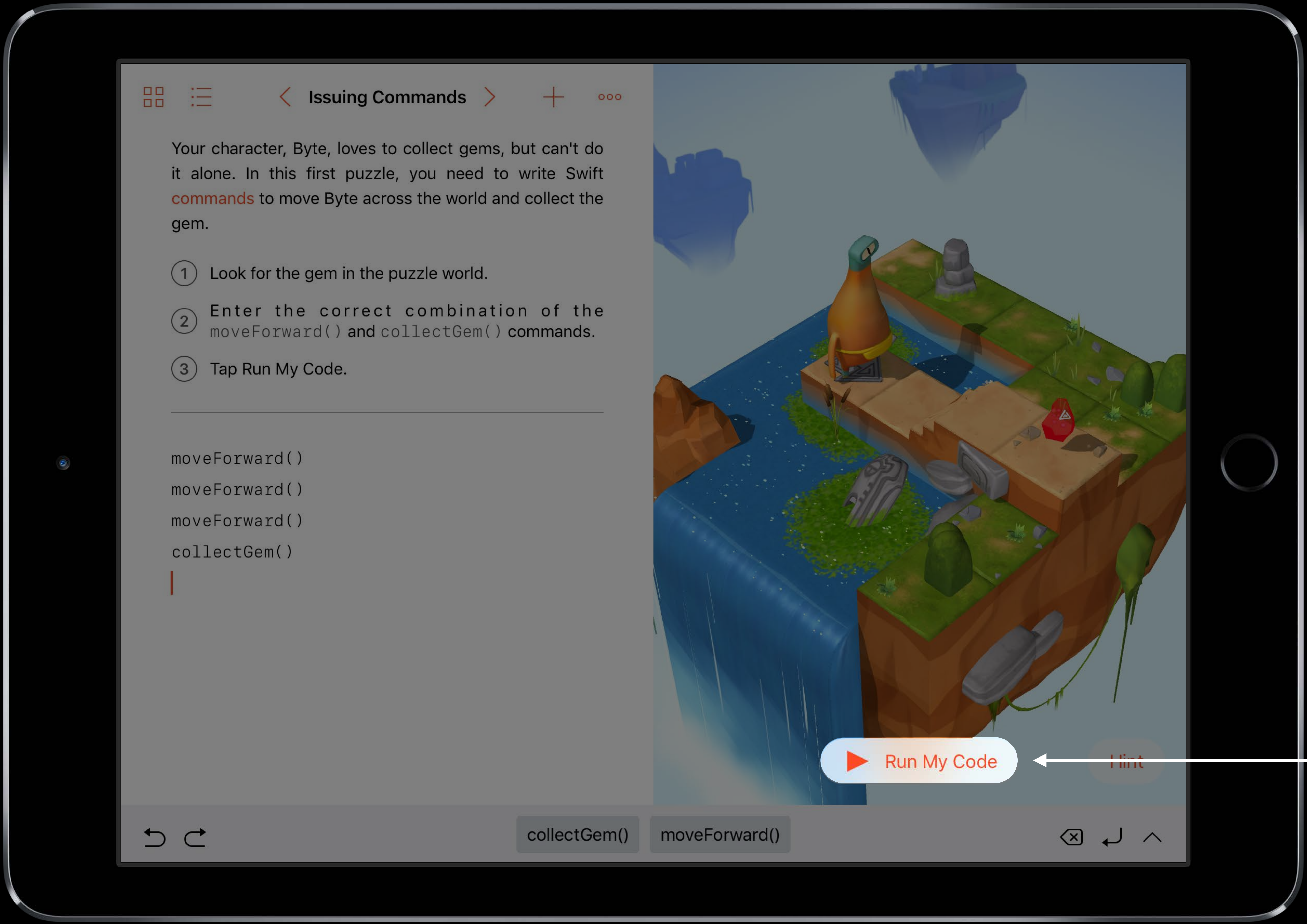

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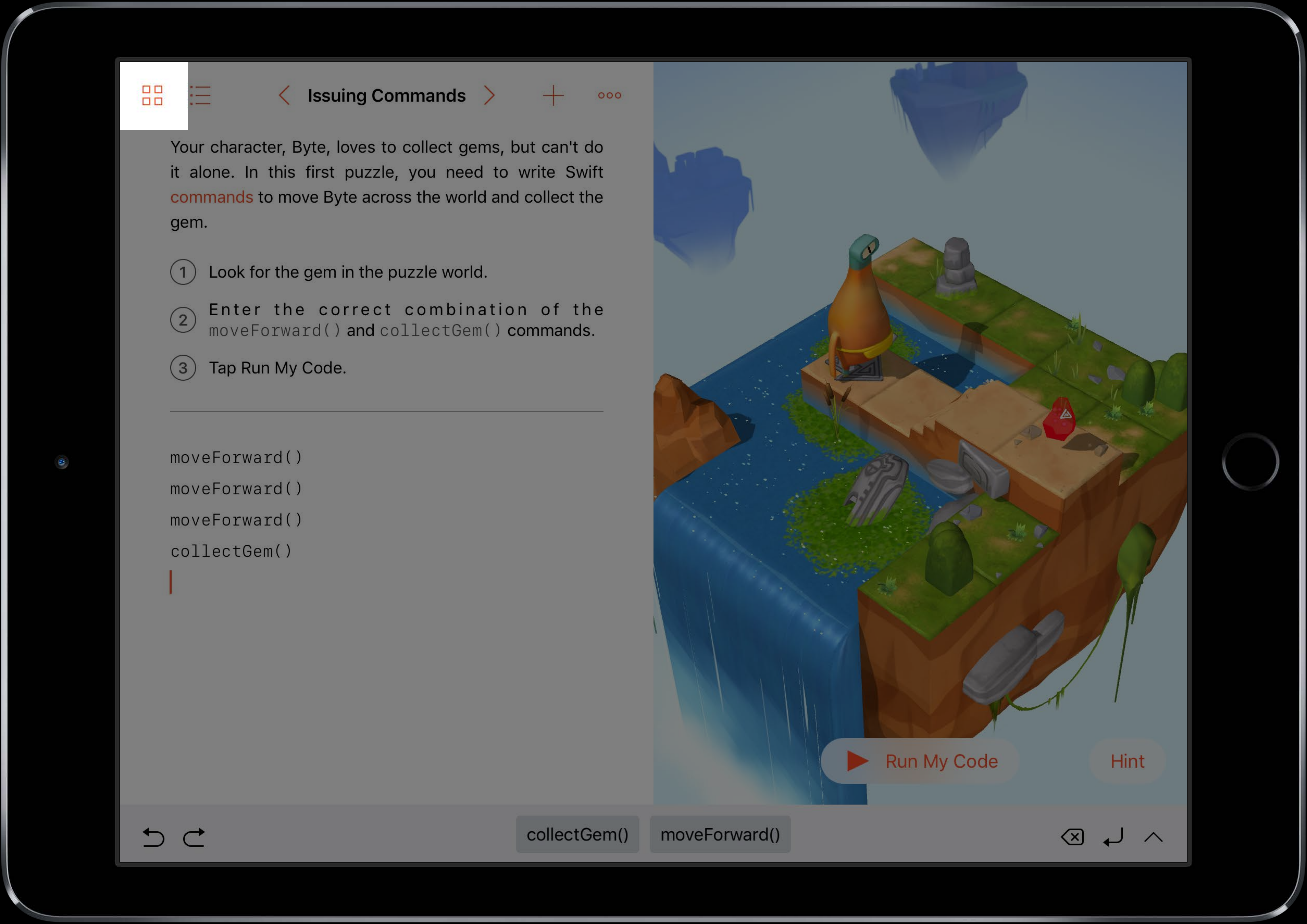
Run Button



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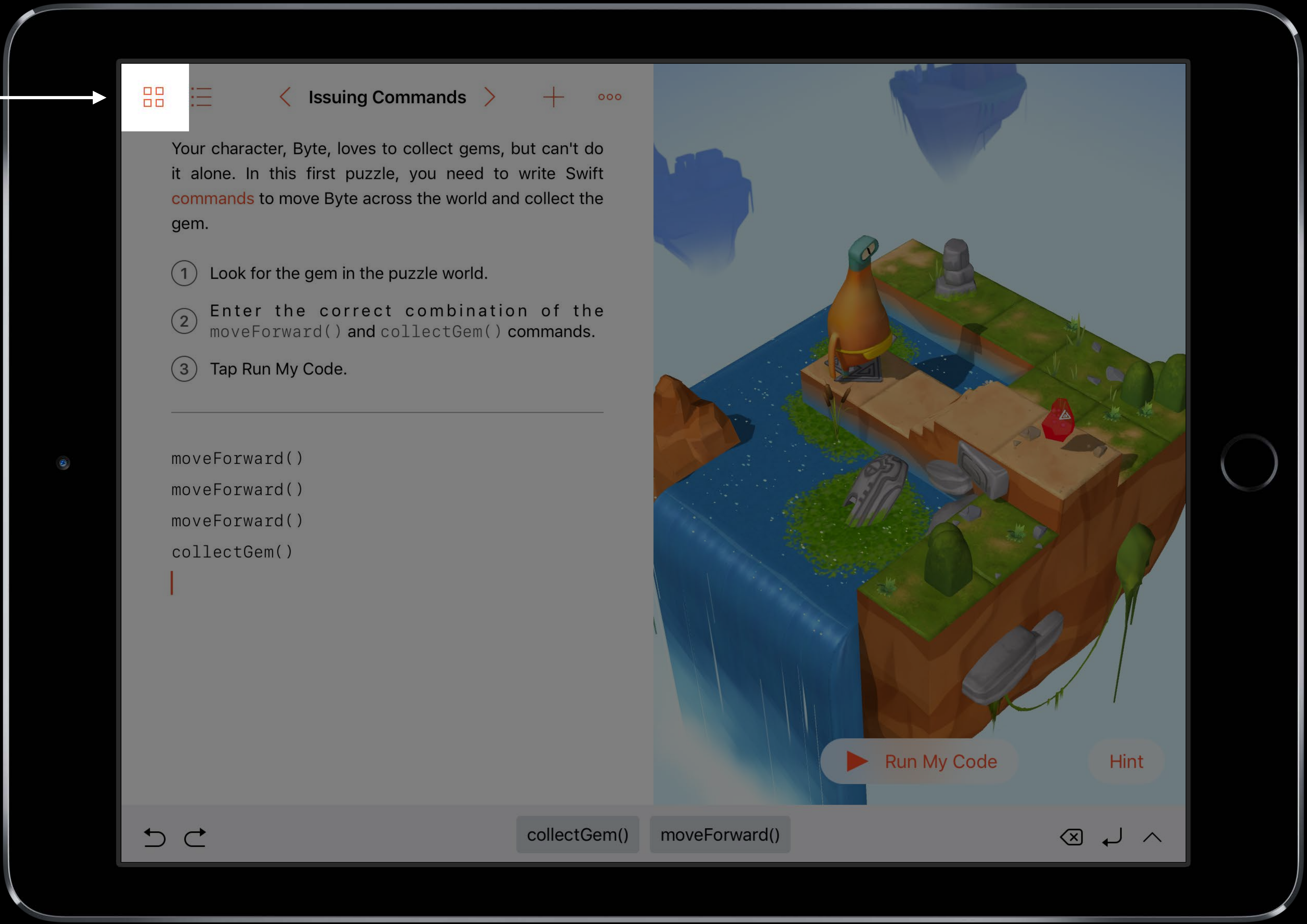
Documents



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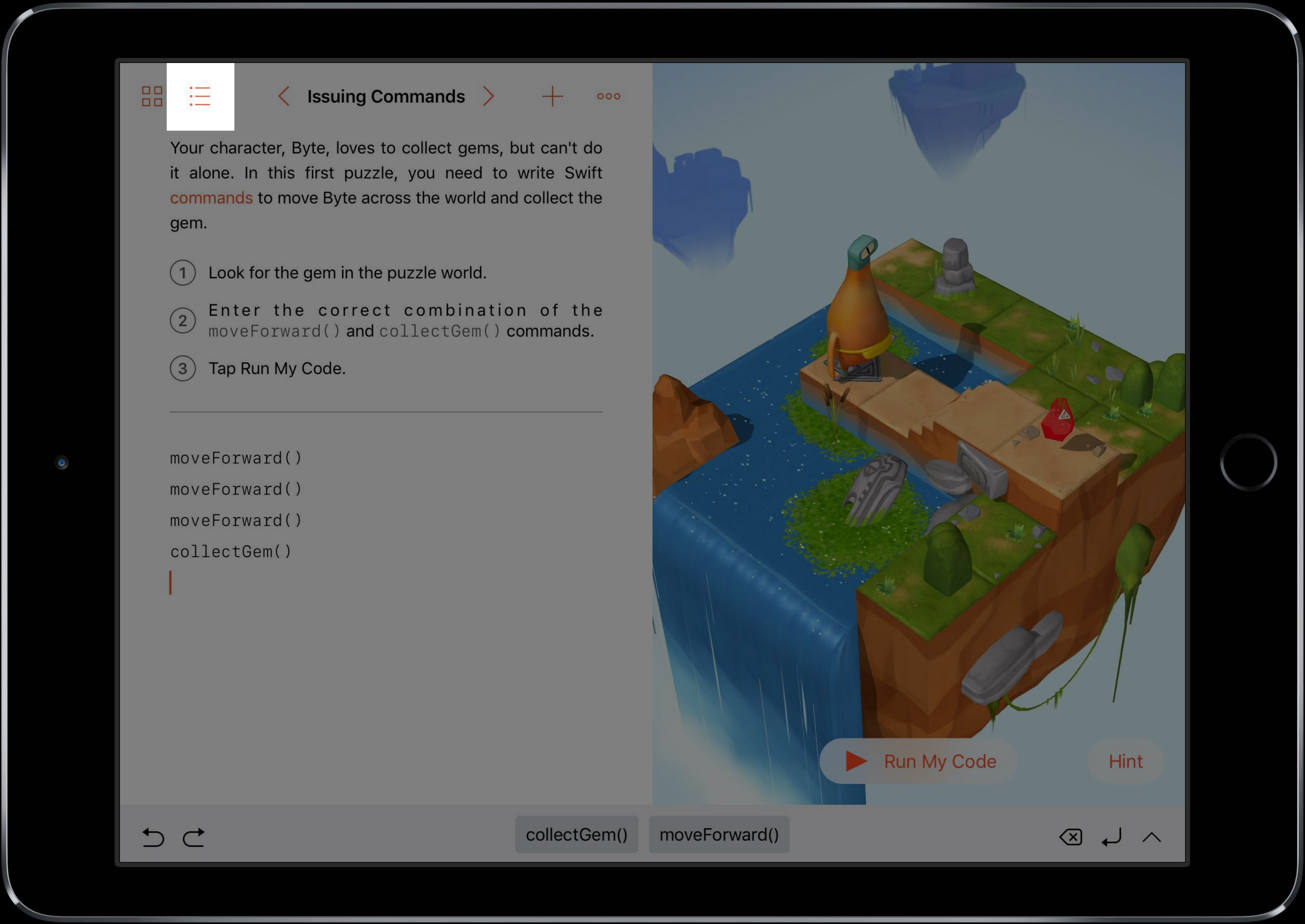
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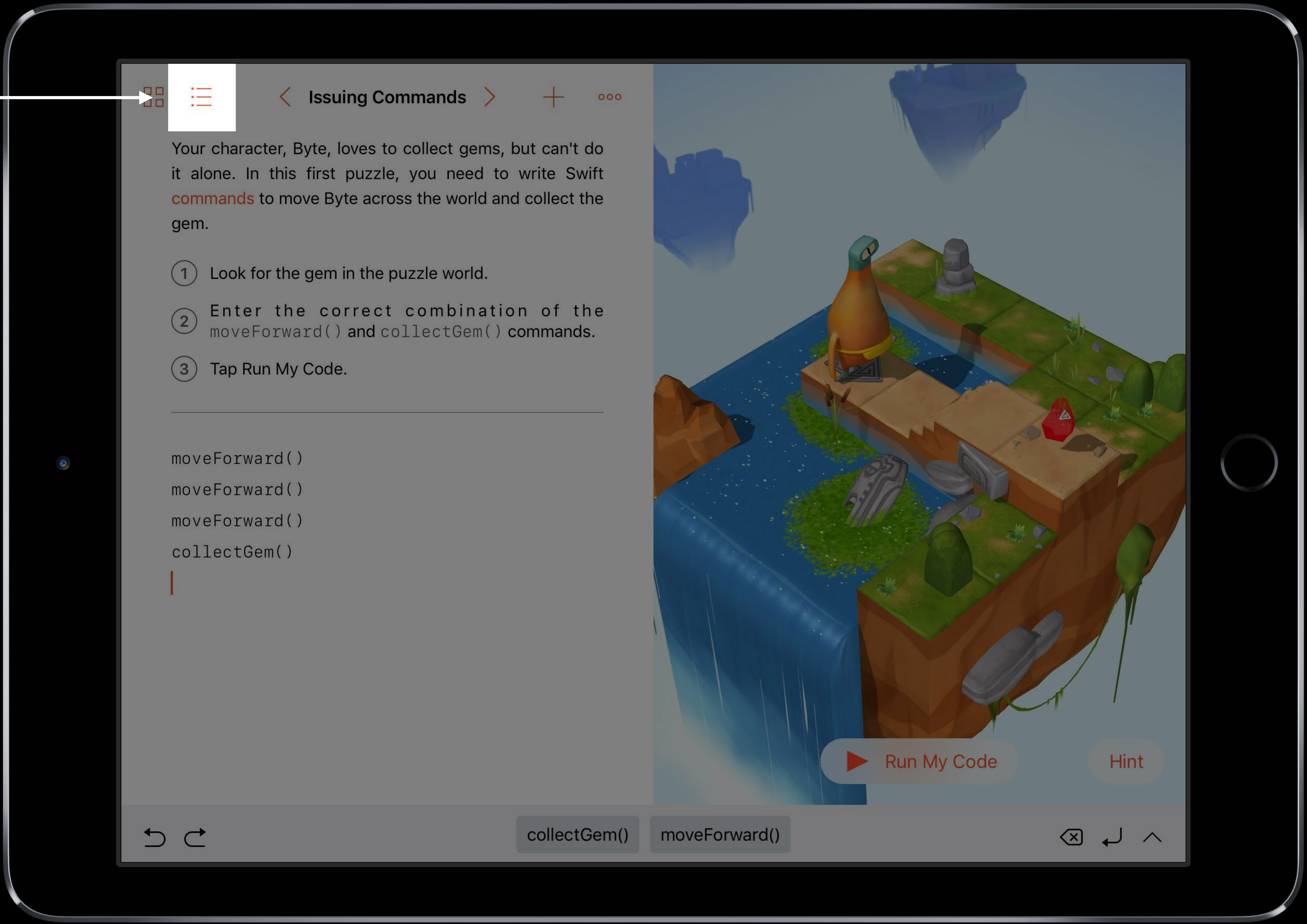

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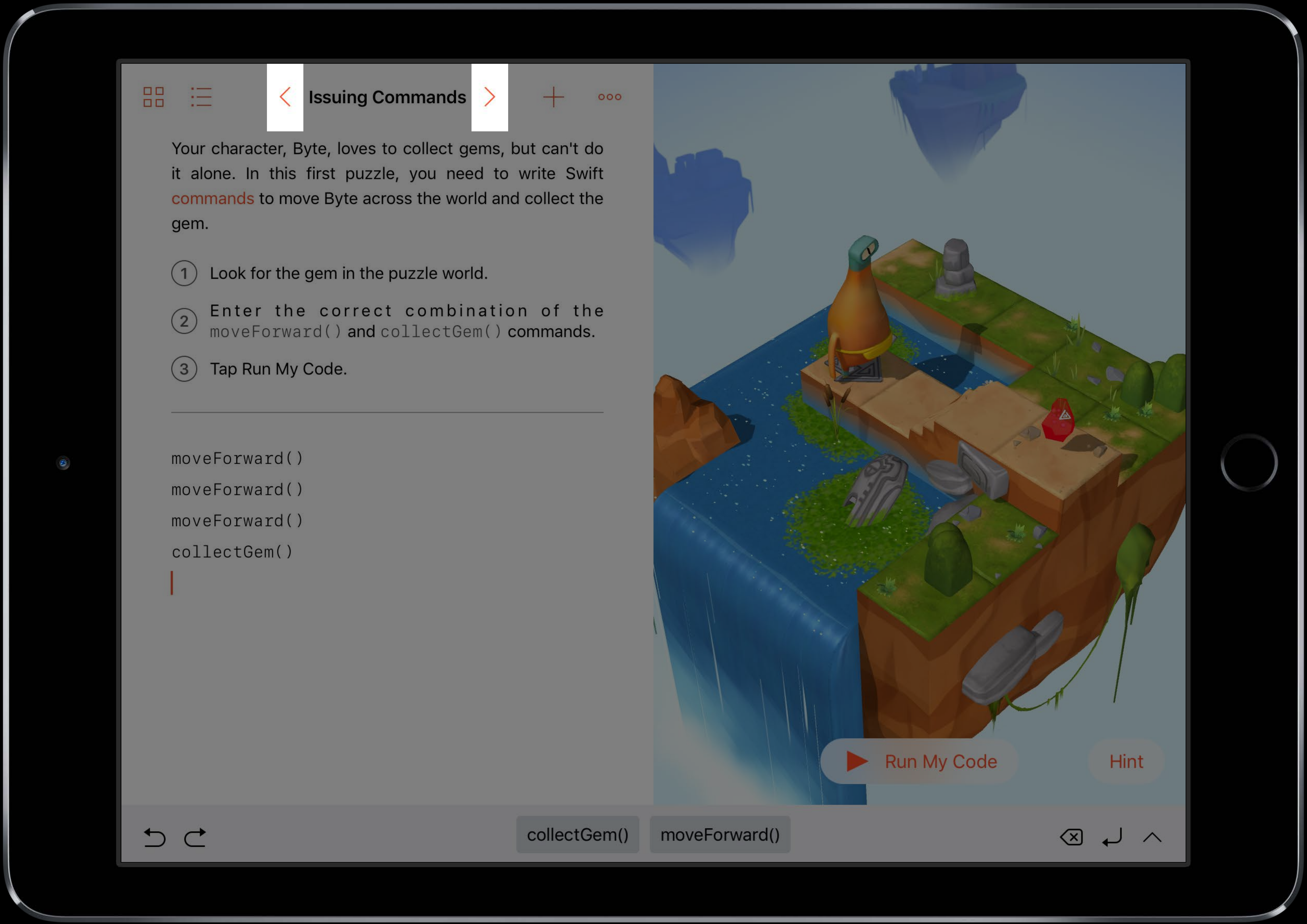

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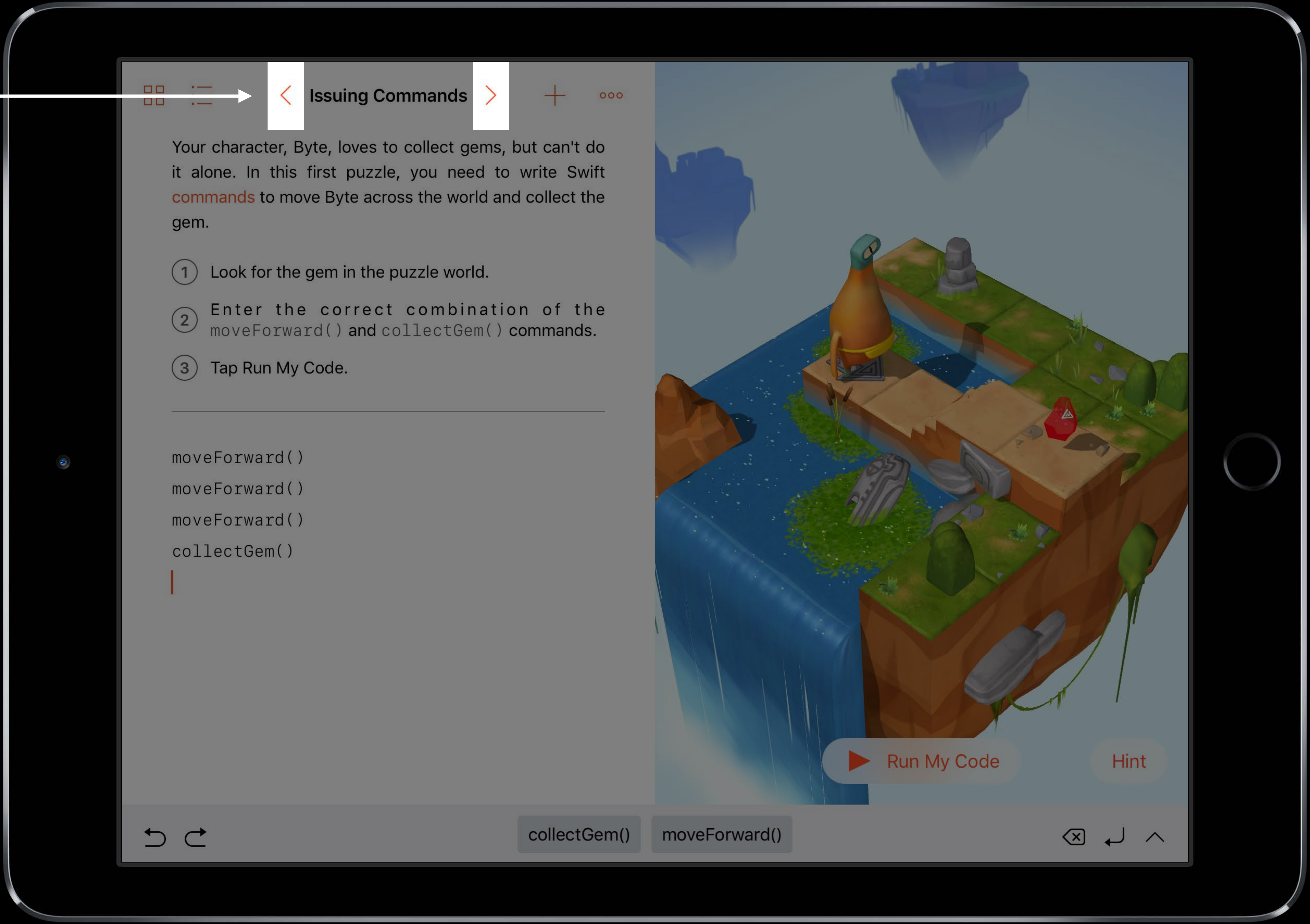
Page Navigation



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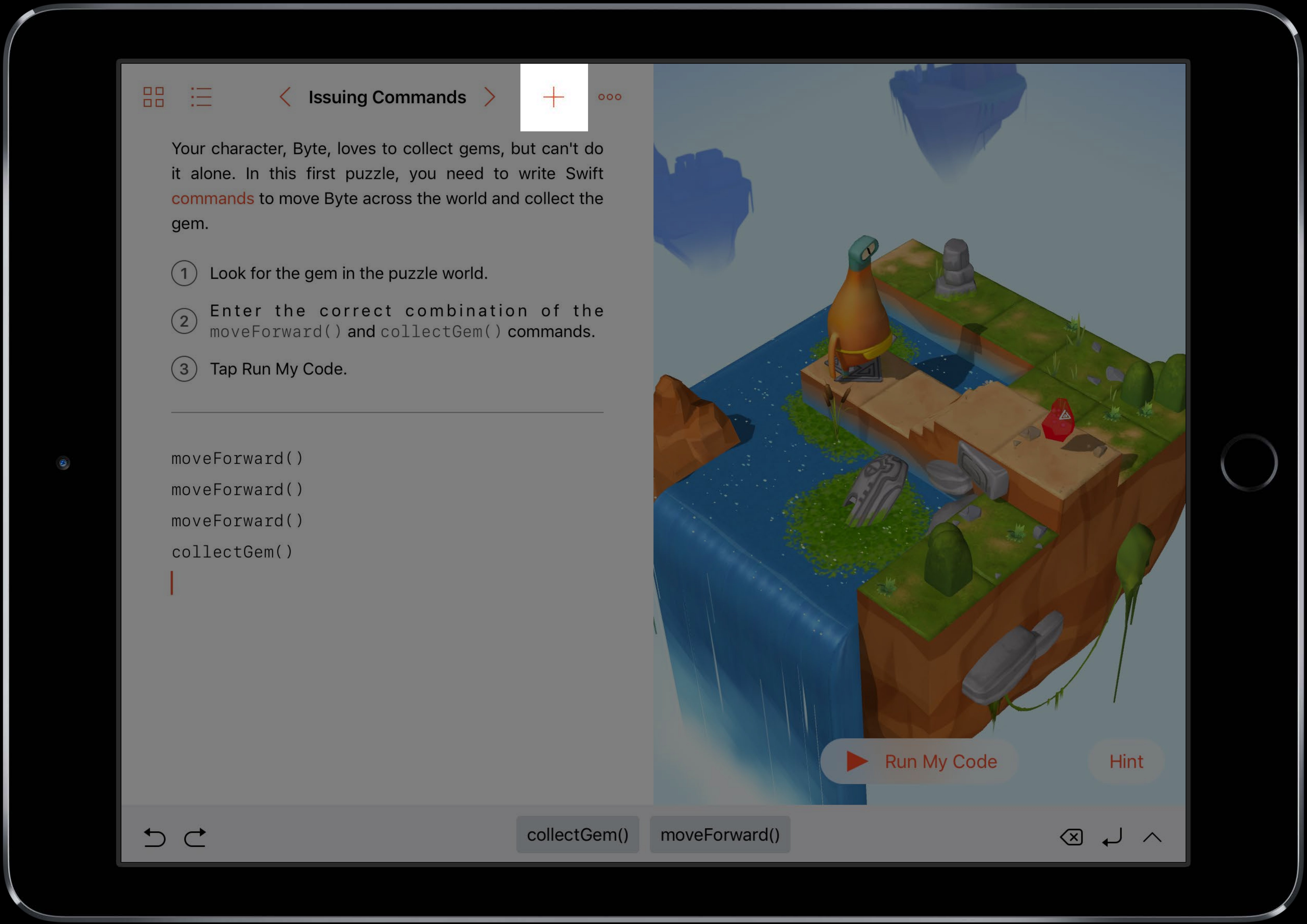

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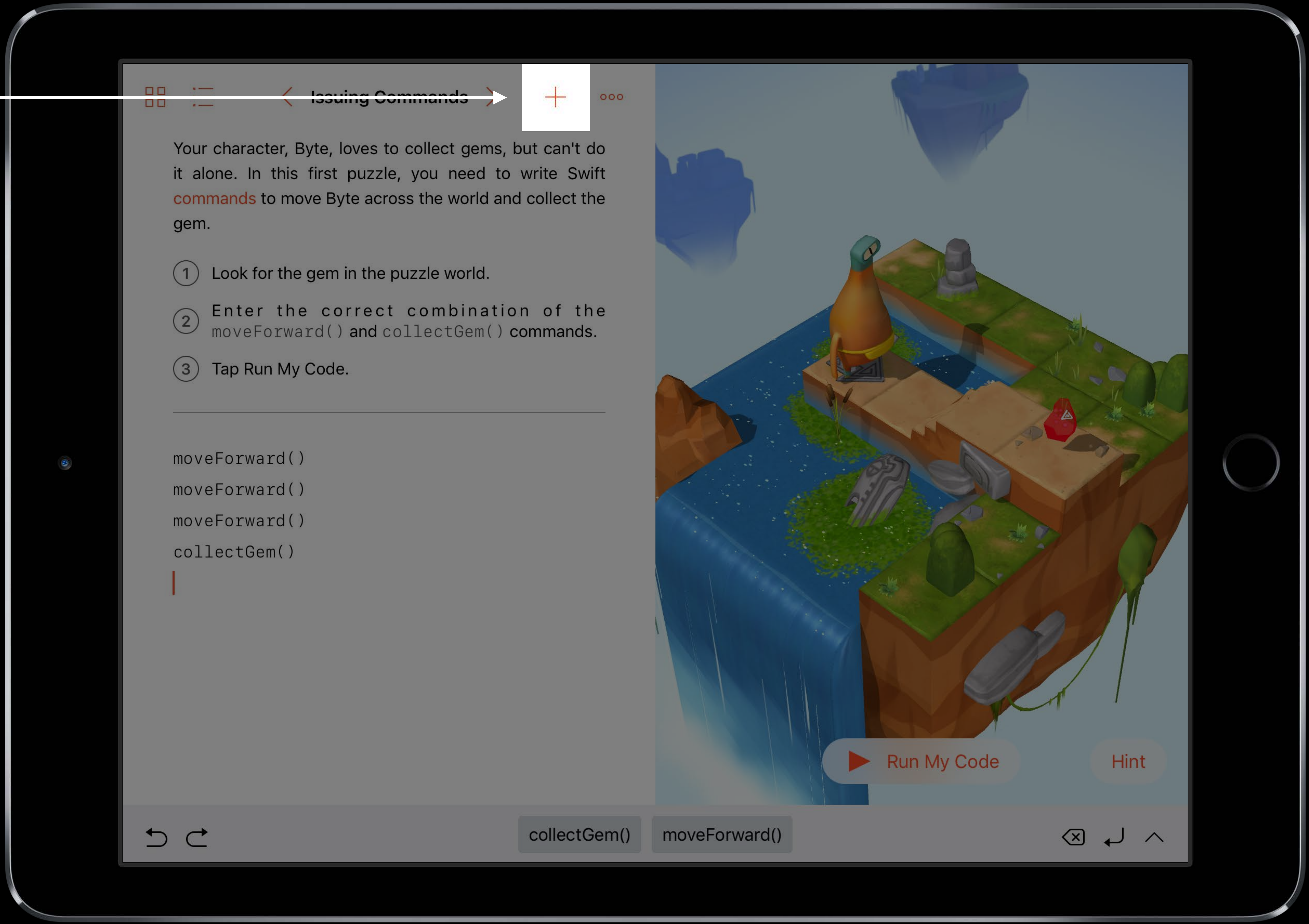

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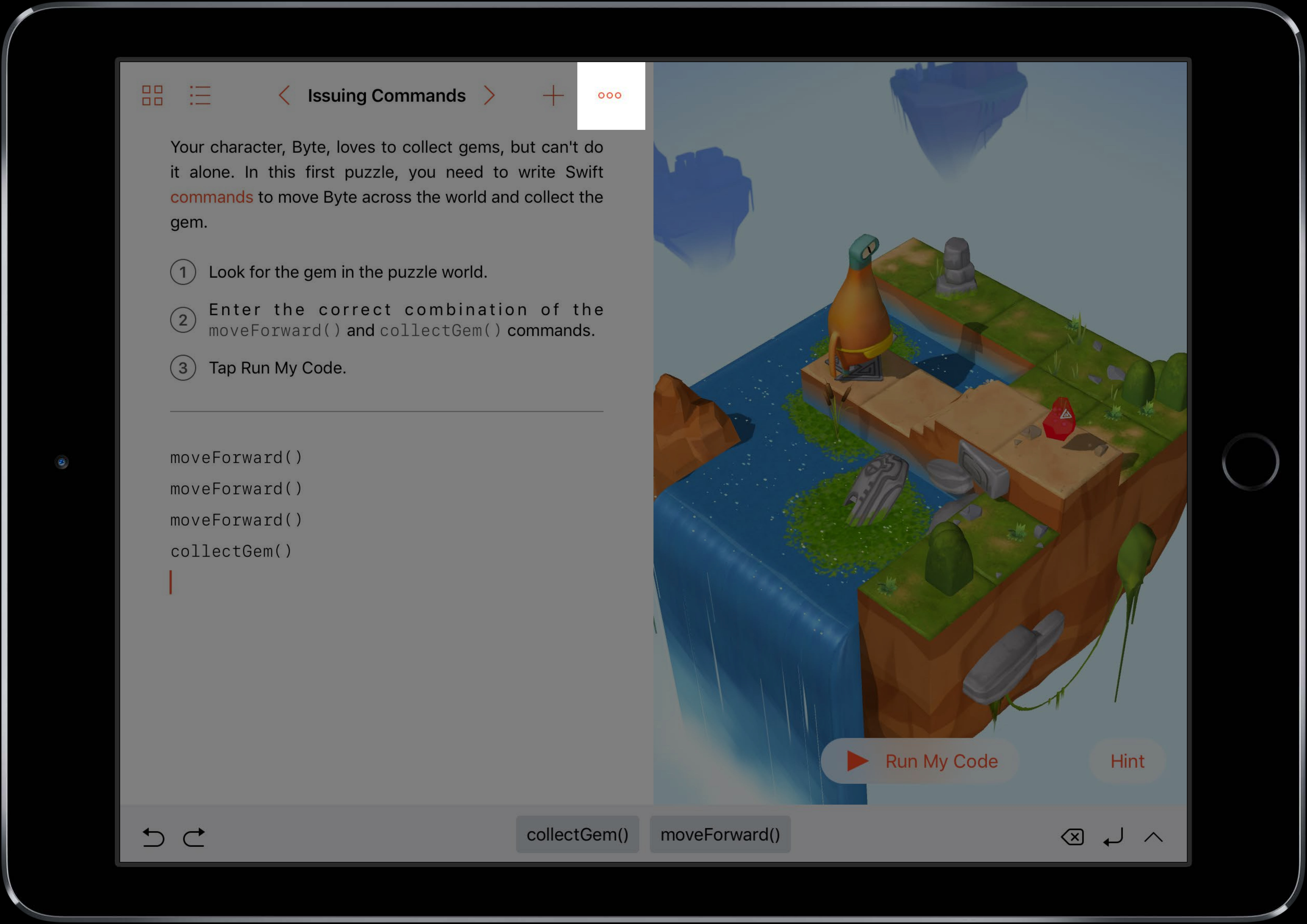

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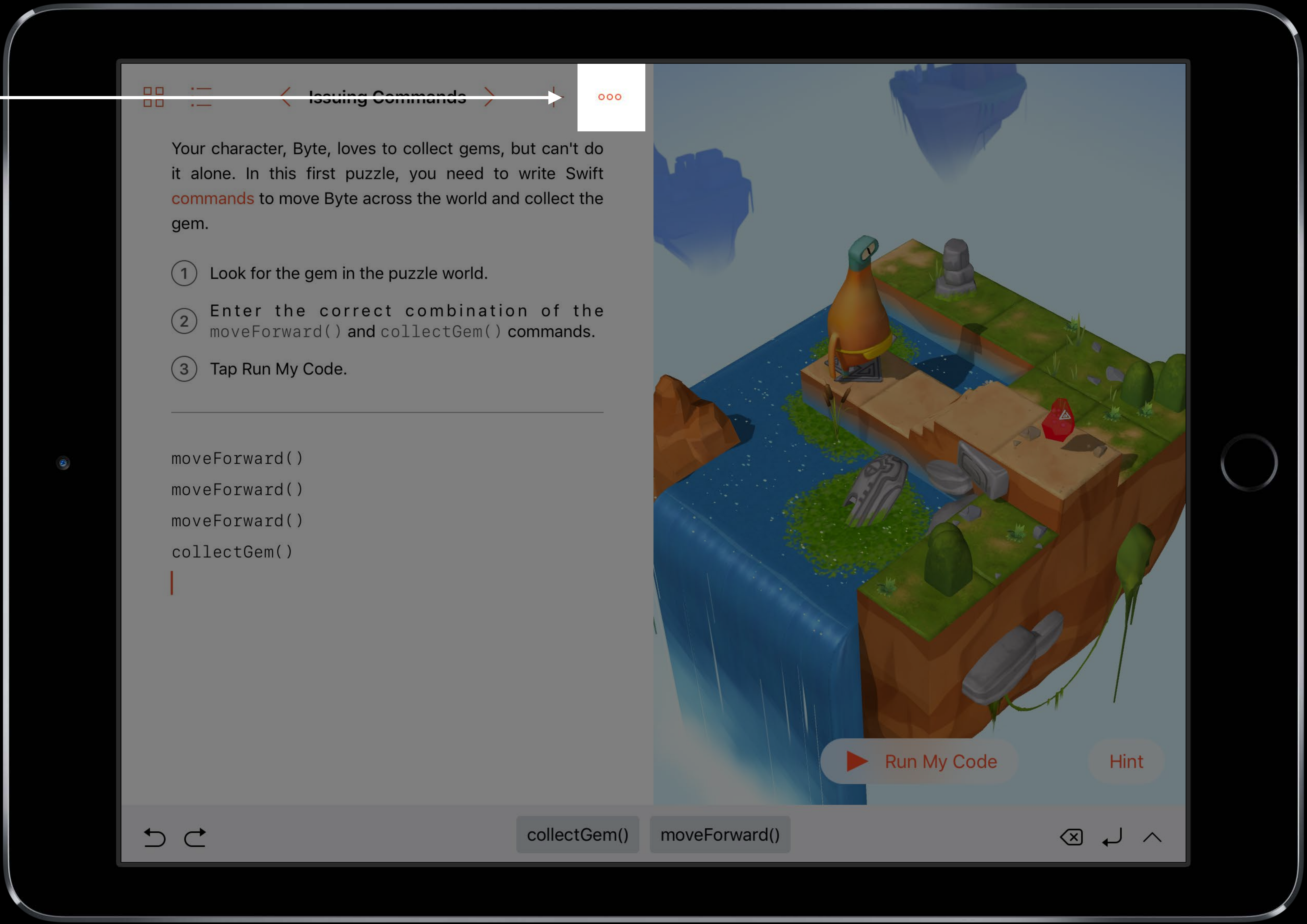
Tools Menu



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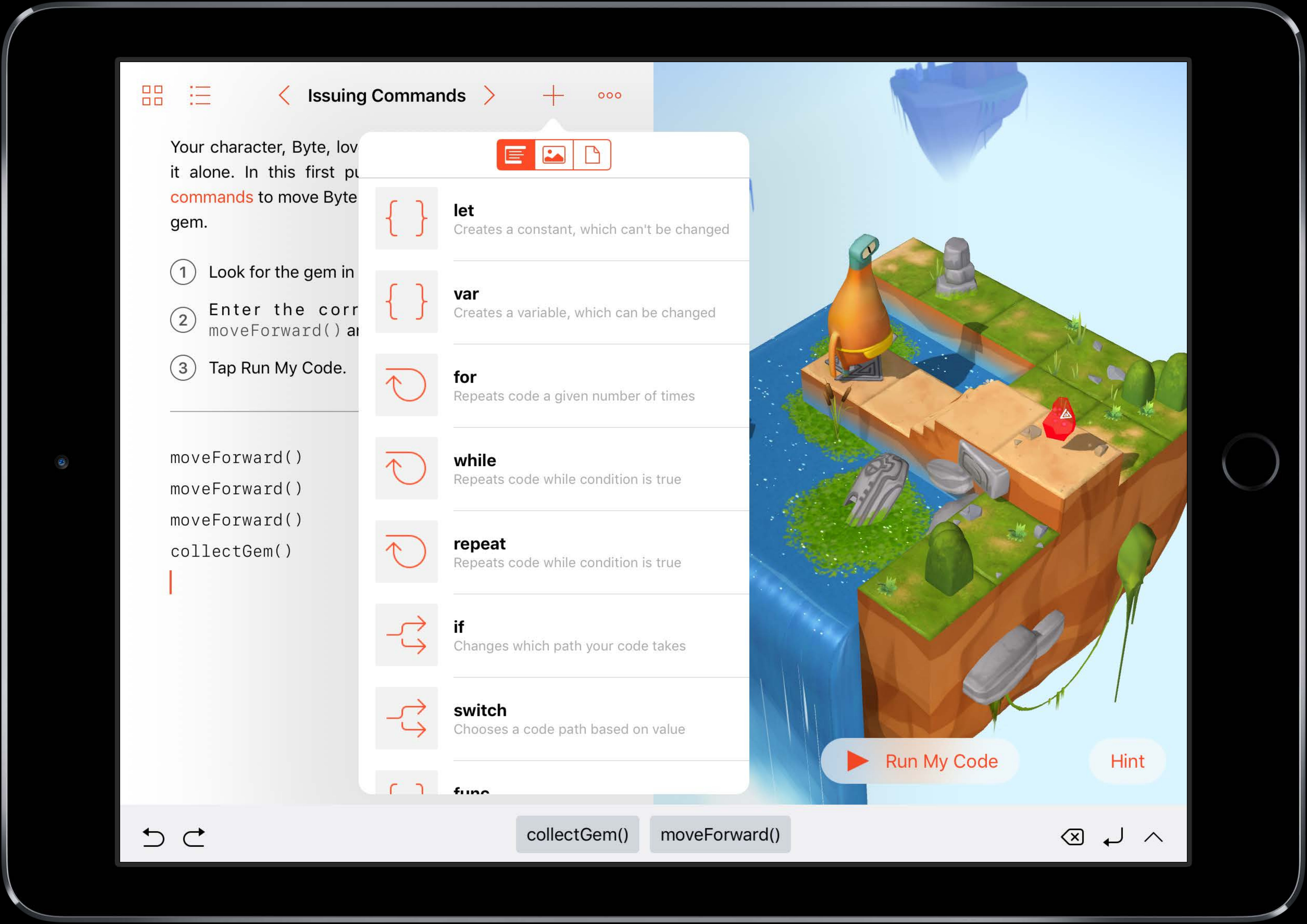

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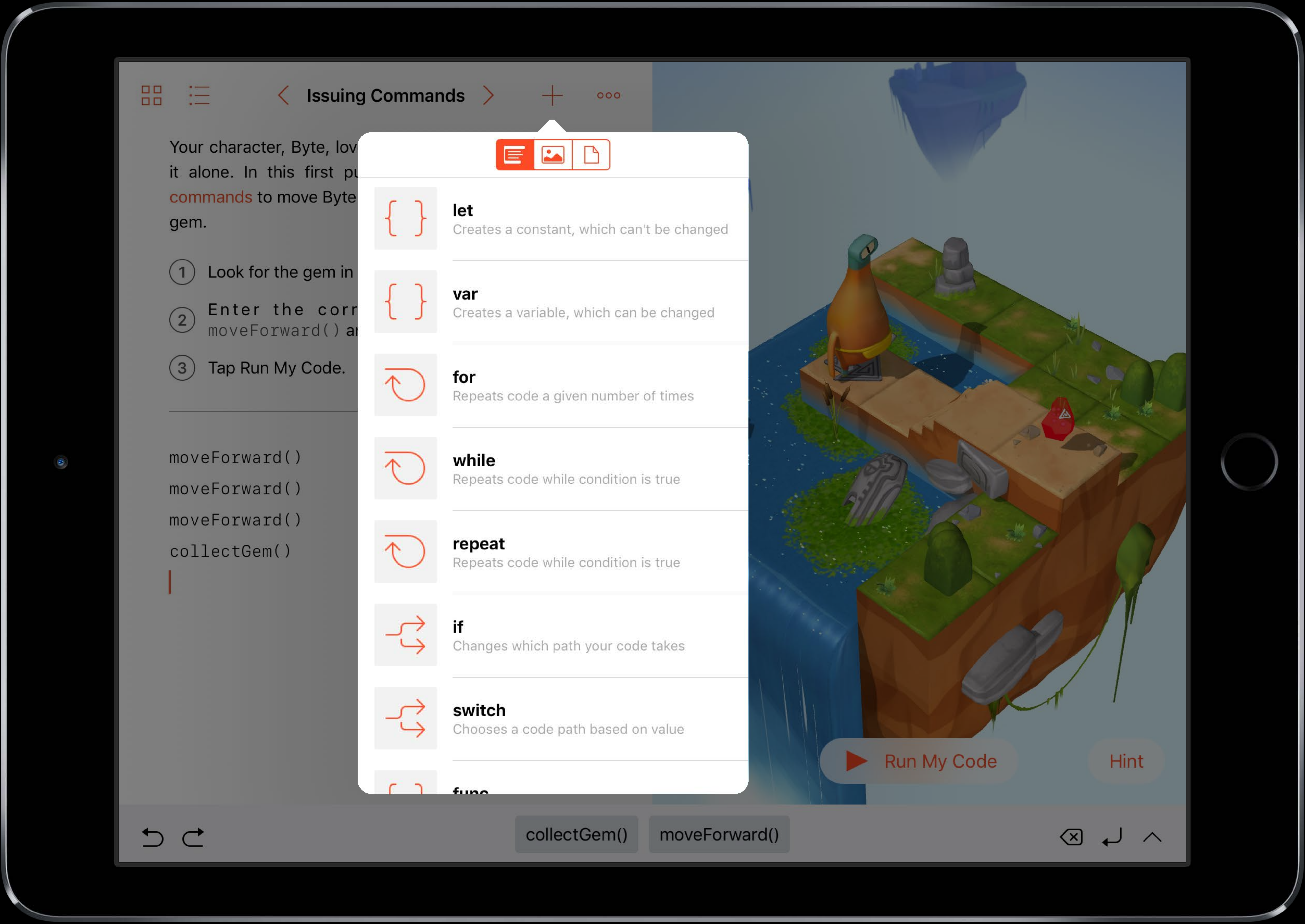
let	Creates a constant, which can't be changed
var	Creates a variable, which can be changed
for	Repeats code a given number of times
while	Repeats code while condition is true
repeat	Repeats code while condition is true
if	Changes which path your code takes
switch	Chooses a code path based on value
func	



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moveForward() ar
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Creates a constant, which can't be changed

var
Creates a variable, which can be changed

for
Repeats code a given number of times

while
Repeats code while condition is true

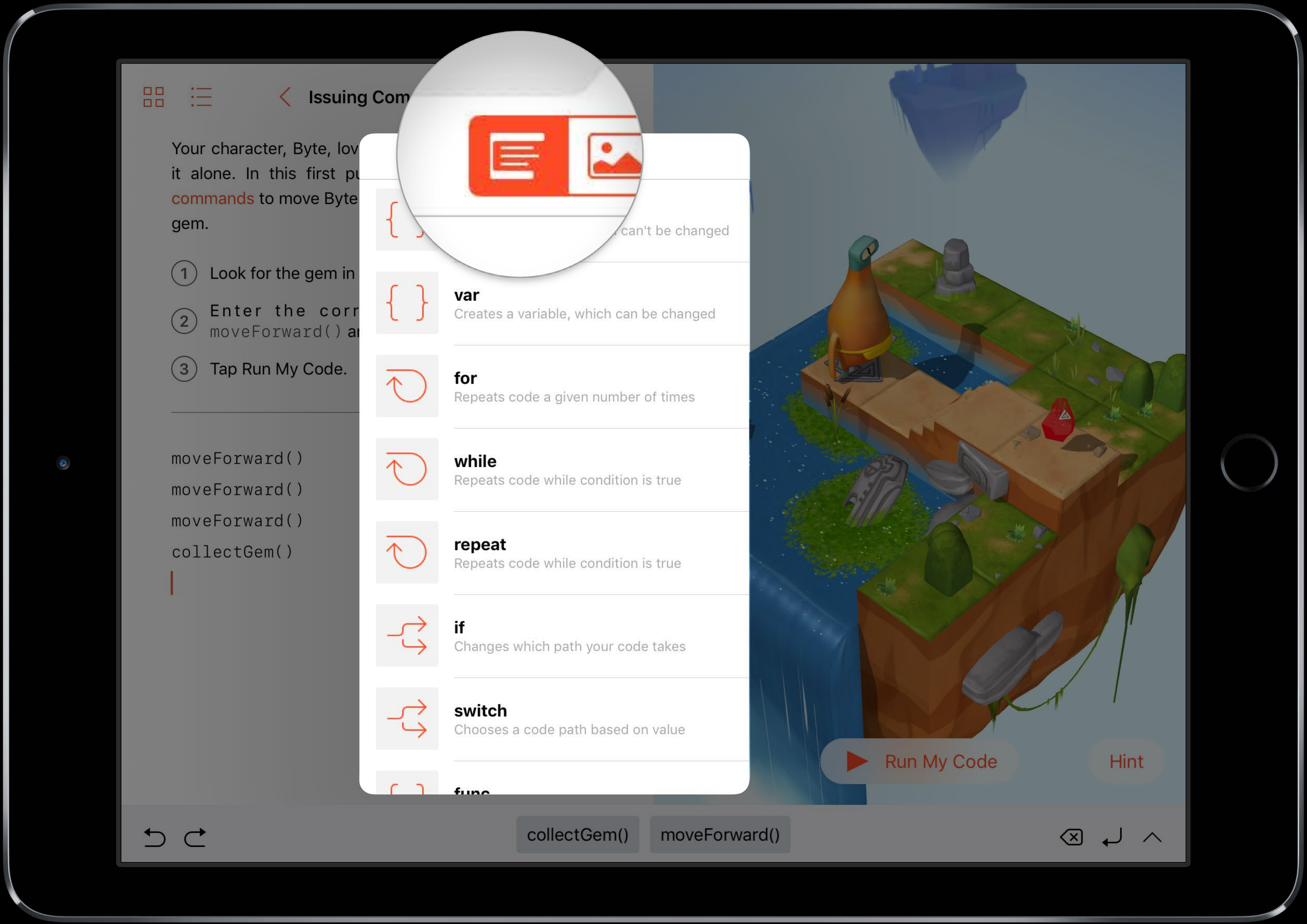
repeat
Repeats code while condition is true

if
Changes which path your code takes

switch
Chooses a code path based on value

func

Snippets



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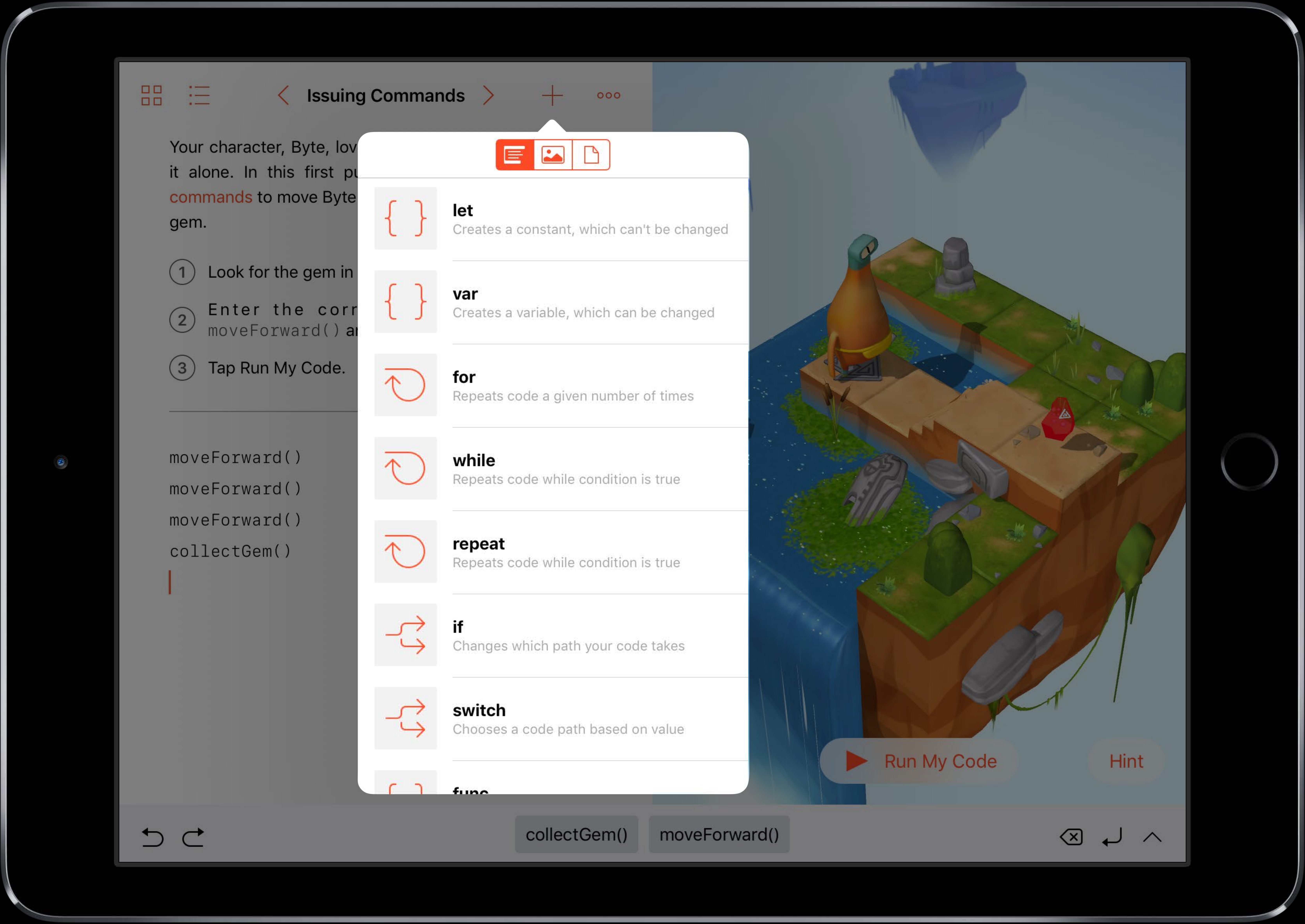

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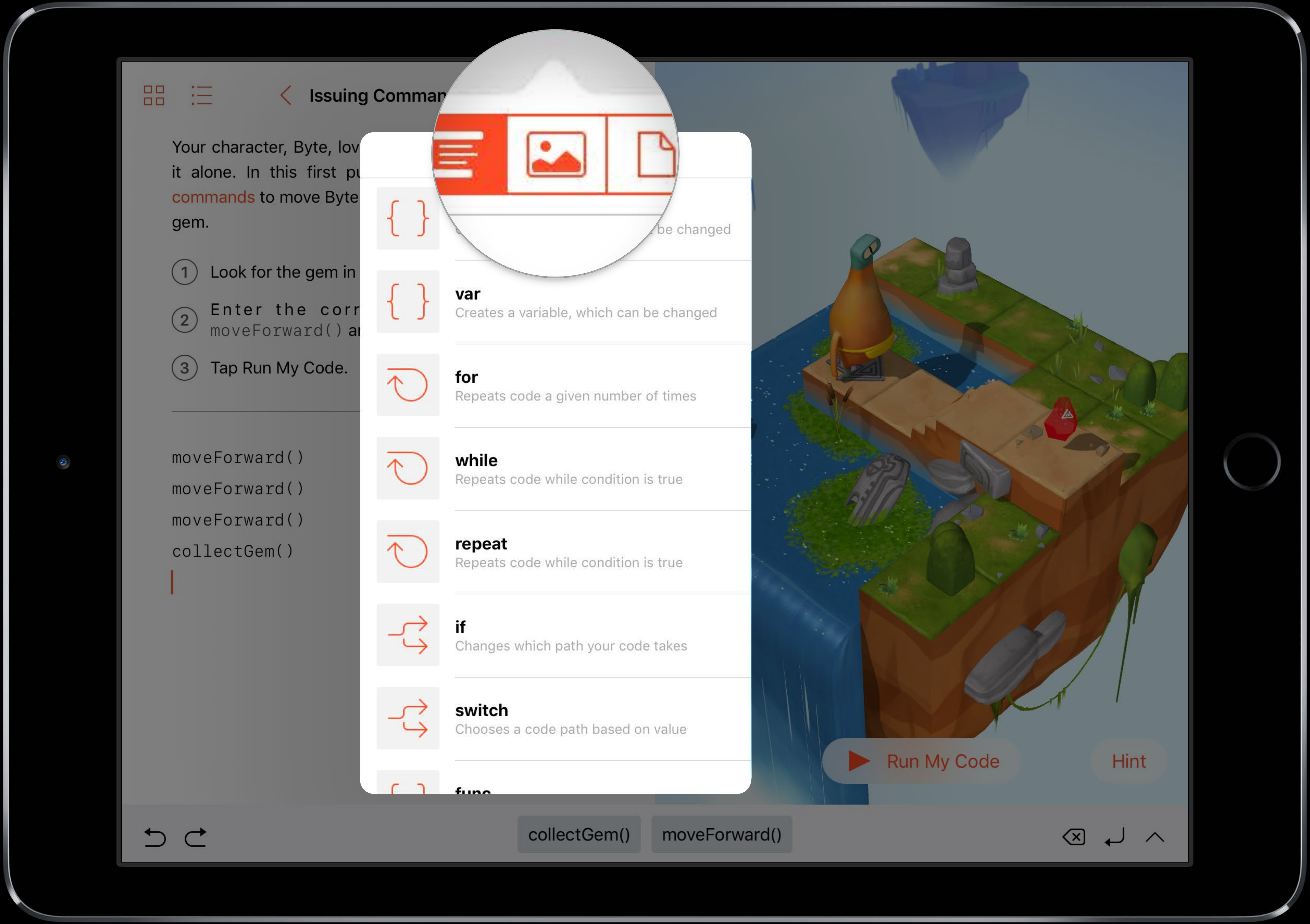
Images



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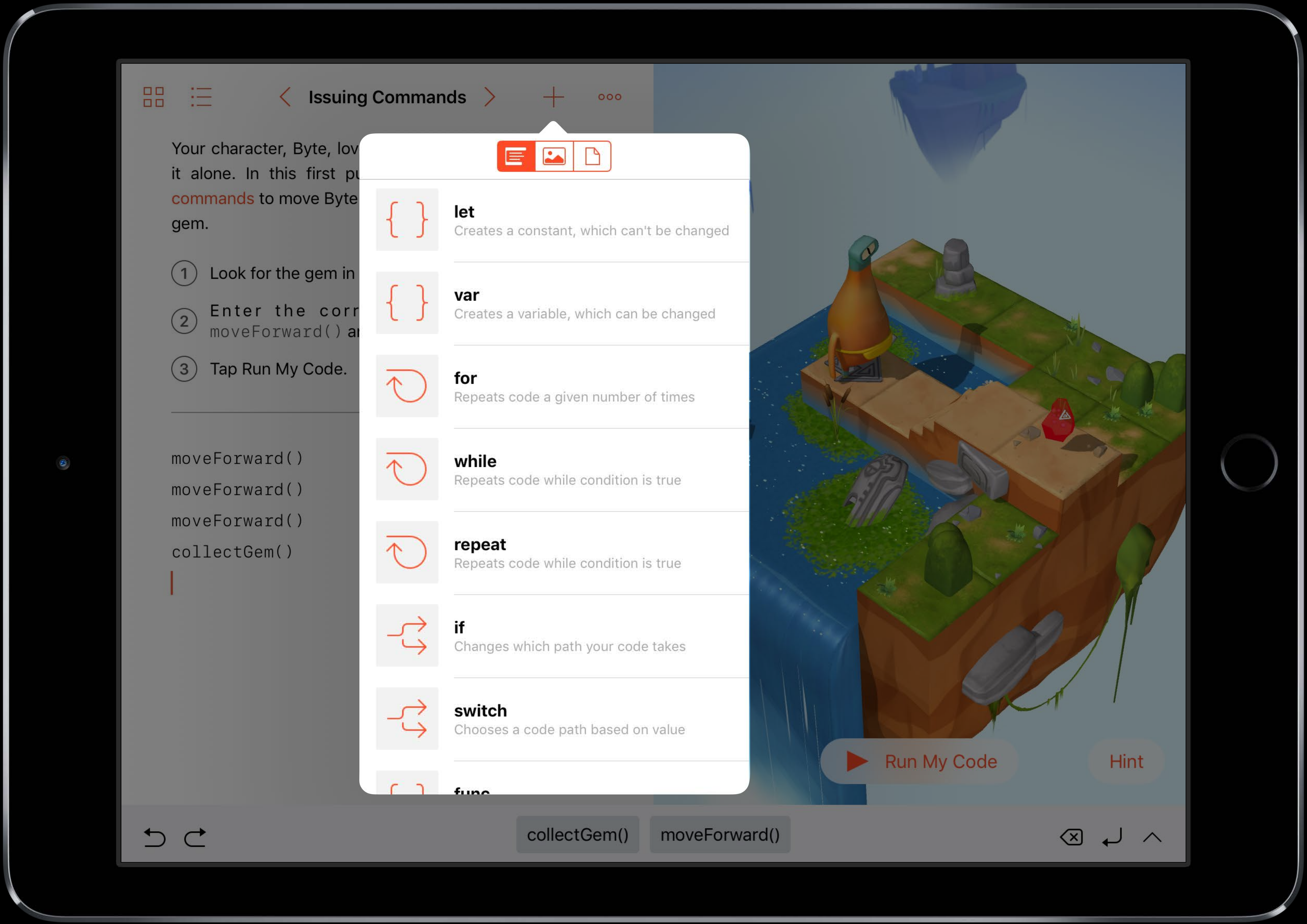

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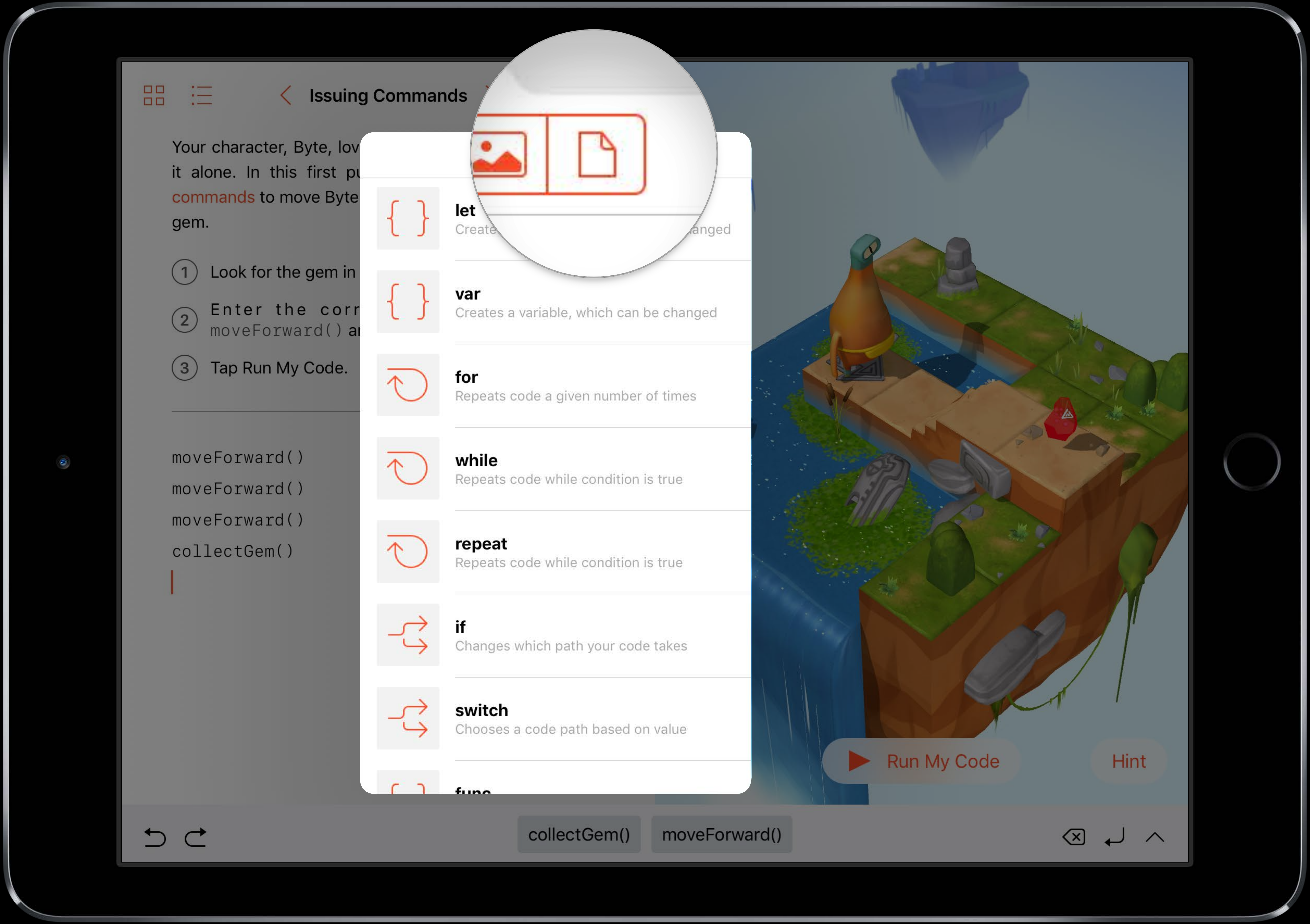

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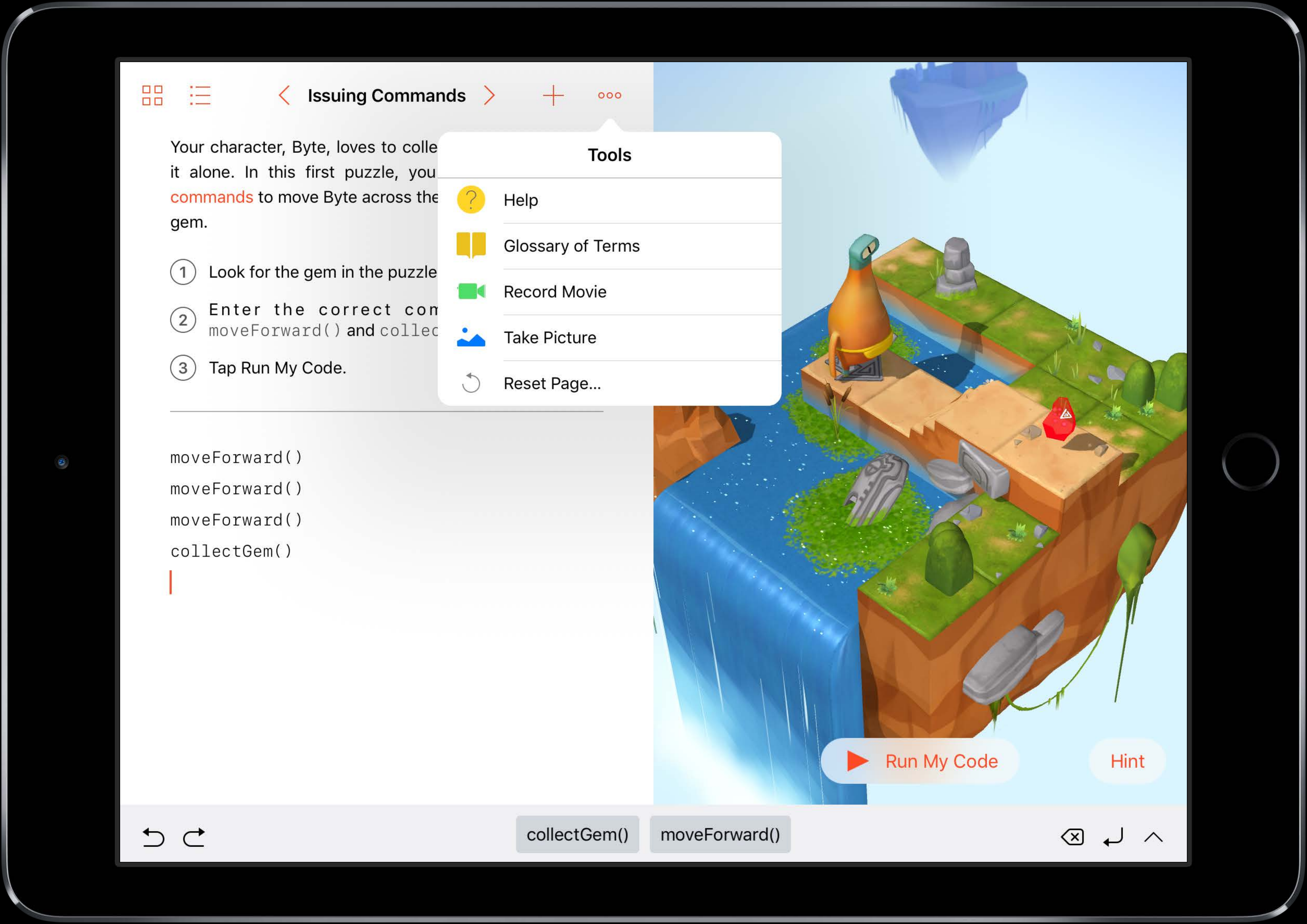

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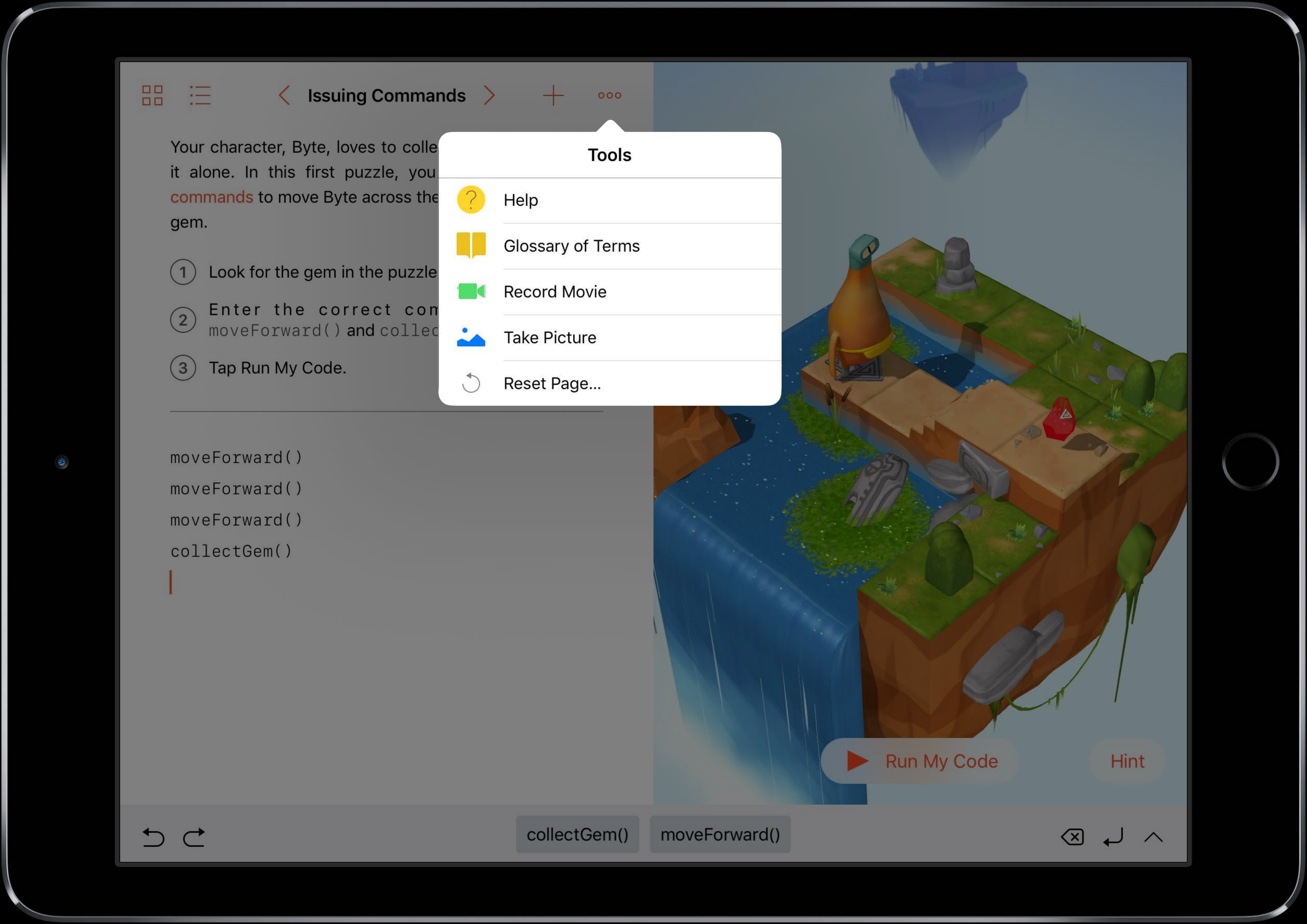

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Demo

Using Swift Playgrounds

Authoring for Swift Playgrounds

Jonathan Penn
Playgrounds Engineer

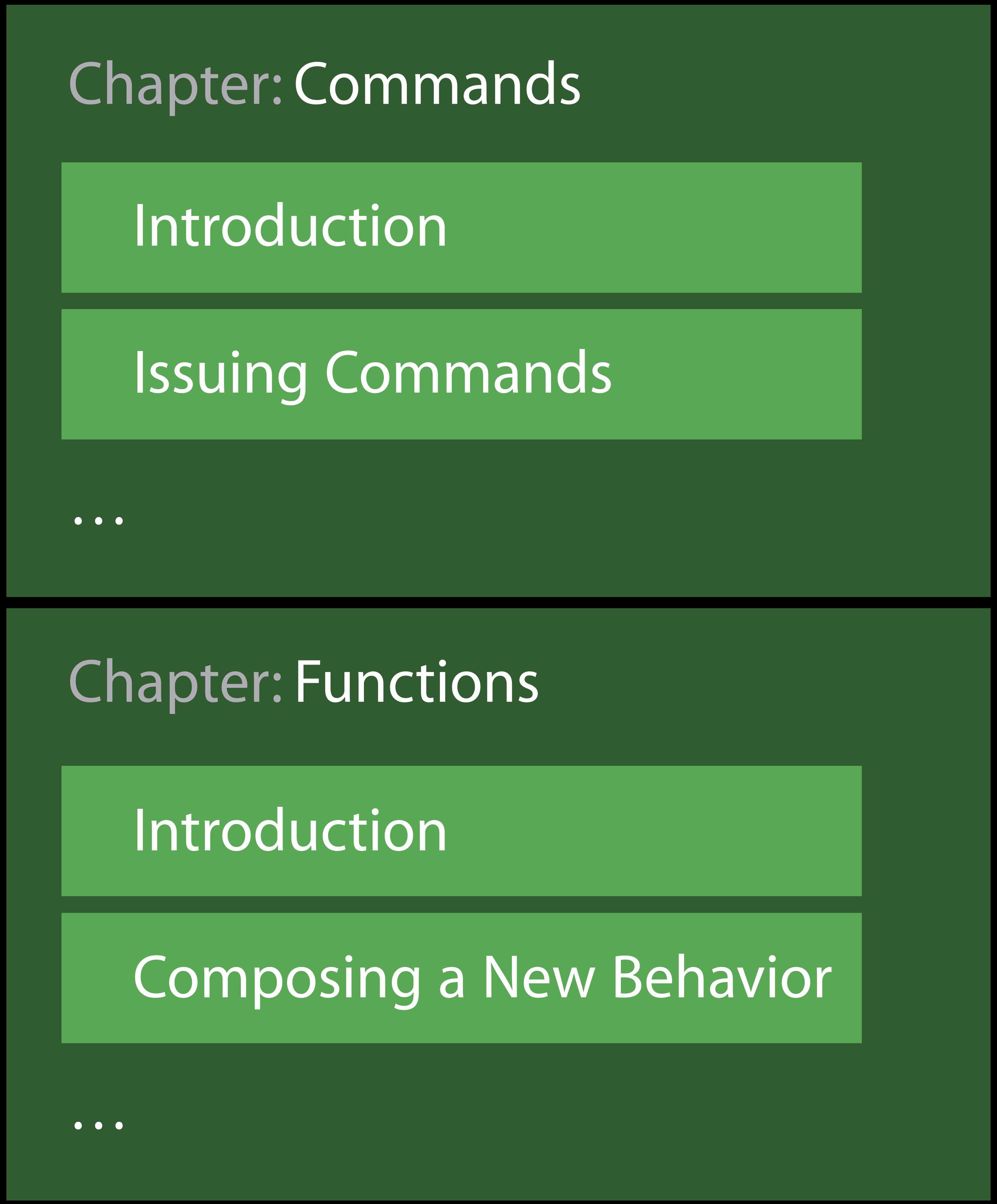
PLAYGROUND

PLAYGROUND

PLAYGROUND

BOOK

Chapters / Pages



Chapters / Pages

Chapter: Commands

Introduction

Issuing Commands

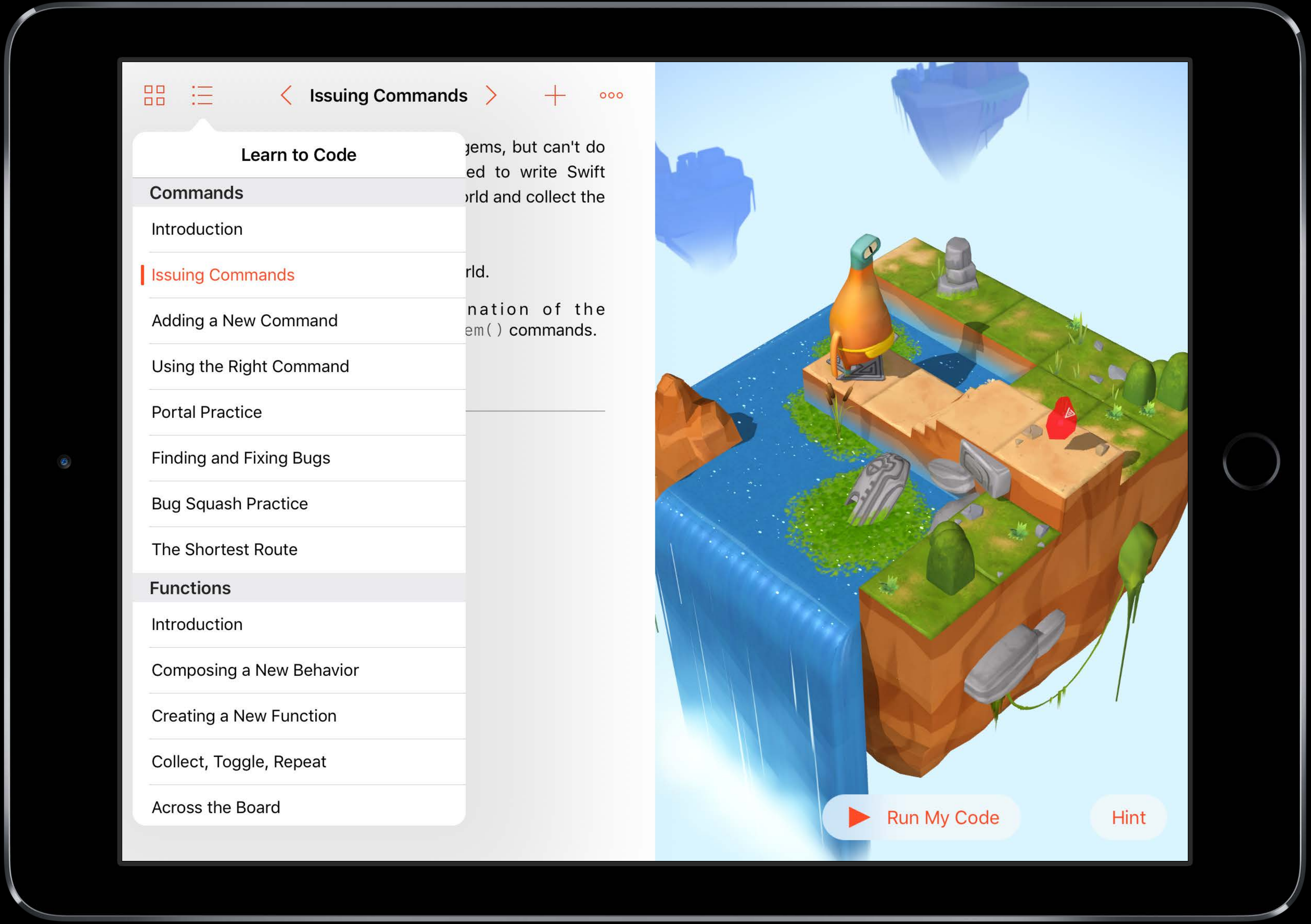
...

Chapter: Functions

Introduction

Composing a New Behavior

...



Issuing Commands

Learn to Code

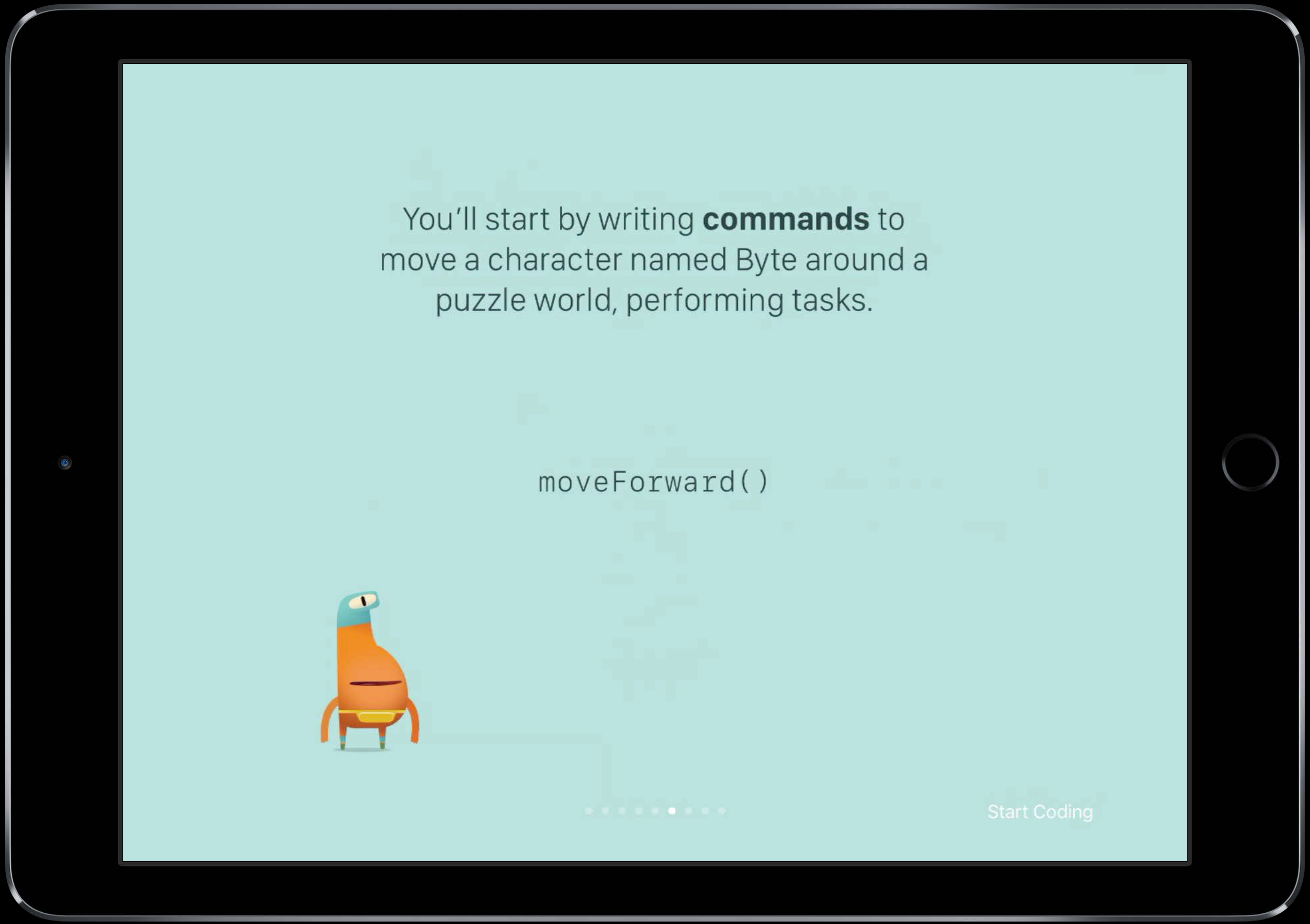
Commands

- Introduction
- Issuing Commands
- Adding a New Command
- Using the Right Command
- Portal Practice
- Finding and Fixing Bugs
- Bug Squash Practice
- The Shortest Route

Functions

- Introduction
- Composing a New Behavior
- Creating a New Function
- Collect, Toggle, Repeat
- Across the Board

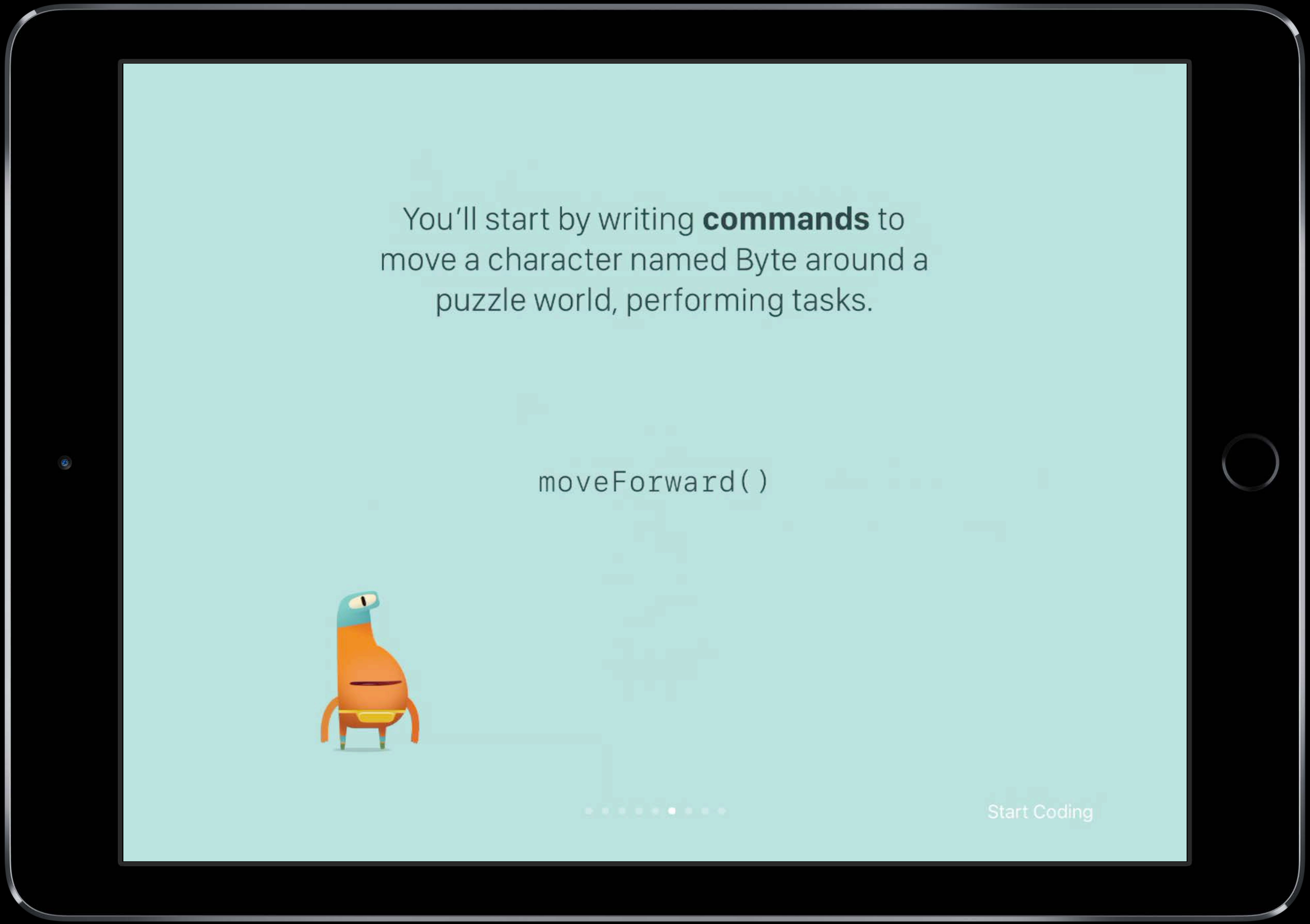
Cutscenes



You'll start by writing **commands** to move a character named Byte around a puzzle world, performing tasks.

```
moveForward()
```

Cutscenes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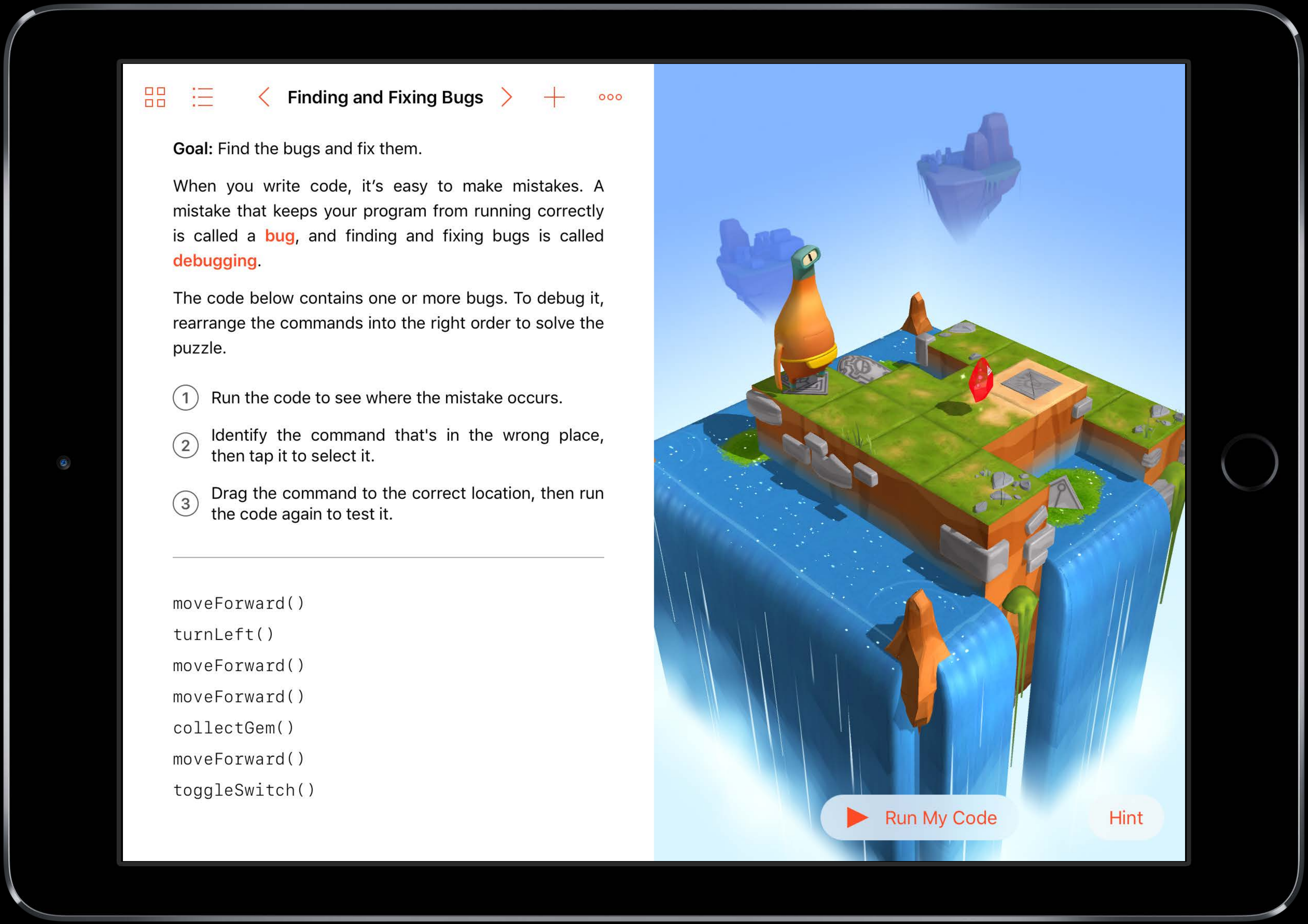
Glossary



Goal: Find the bugs and fix them.

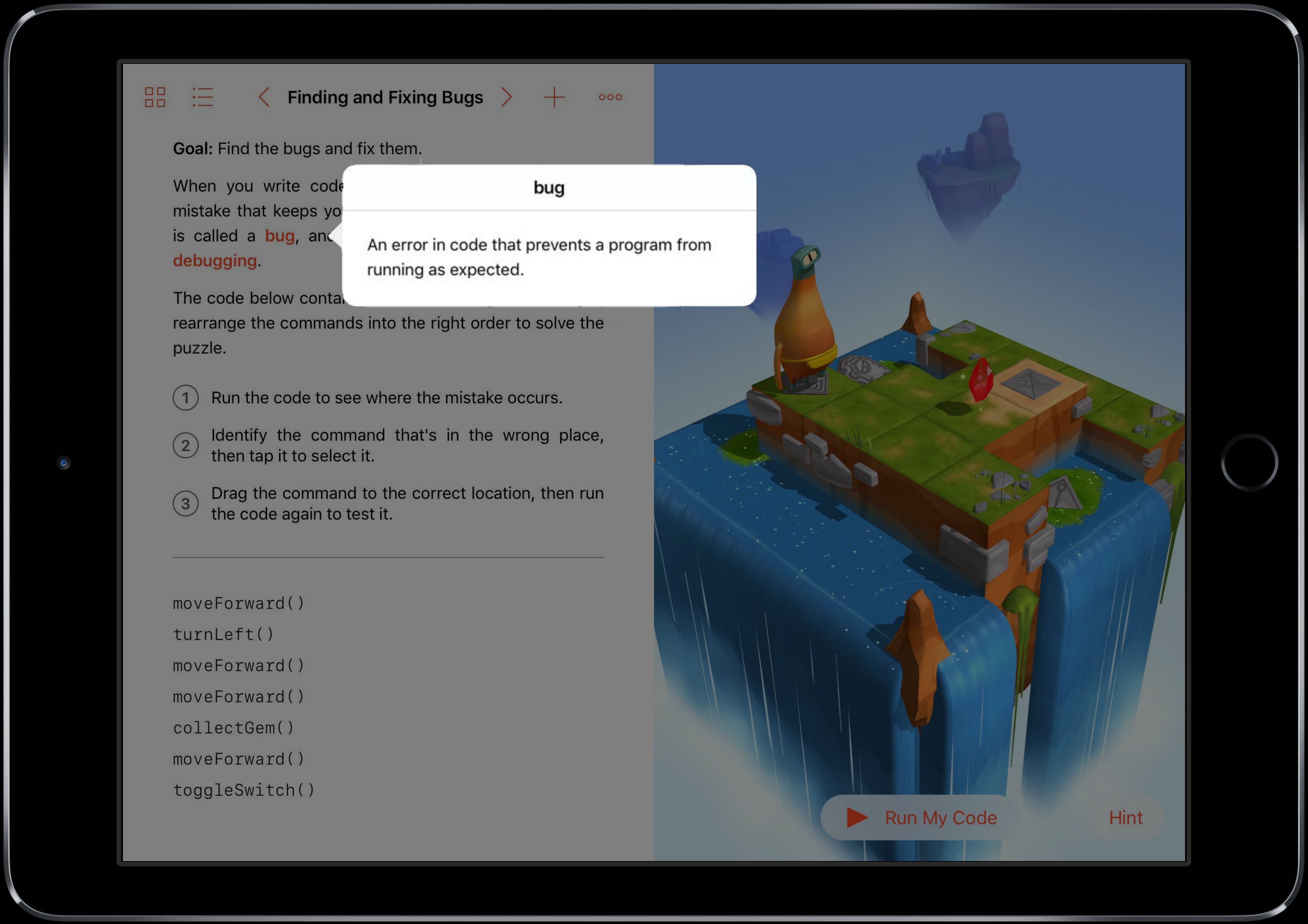
When you write code, it's easy to make mistakes. A mistake that keeps your program from running correctly is called a bug, and finding and fixing bugs is called debugging.

The code below contains one or more bugs. To debug it, rearrange the commands into the right order to solve the puzzle.

1. Run the code to see where the mistake occurs.
2. Identify the command that's in the wrong place, then tap it to select it.
3. Drag the command to the correct location, then run the code again to test it.

```
moveForward()
turnLeft()
moveForward()
moveForward()
collectGem()
moveForward()
toggleSwitch()
```

Glossary



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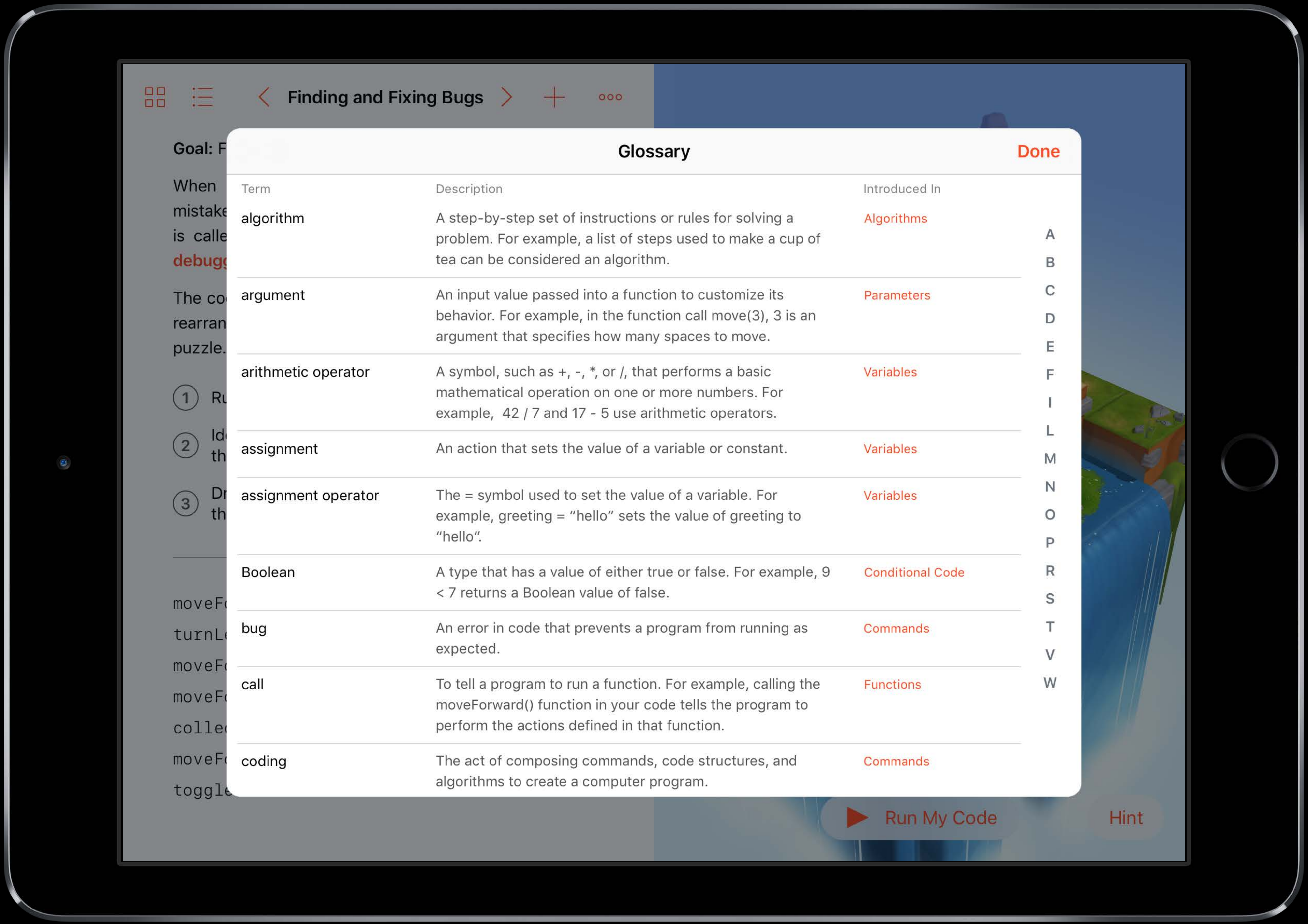
bug

An error in code that prevents a program from running as expected.

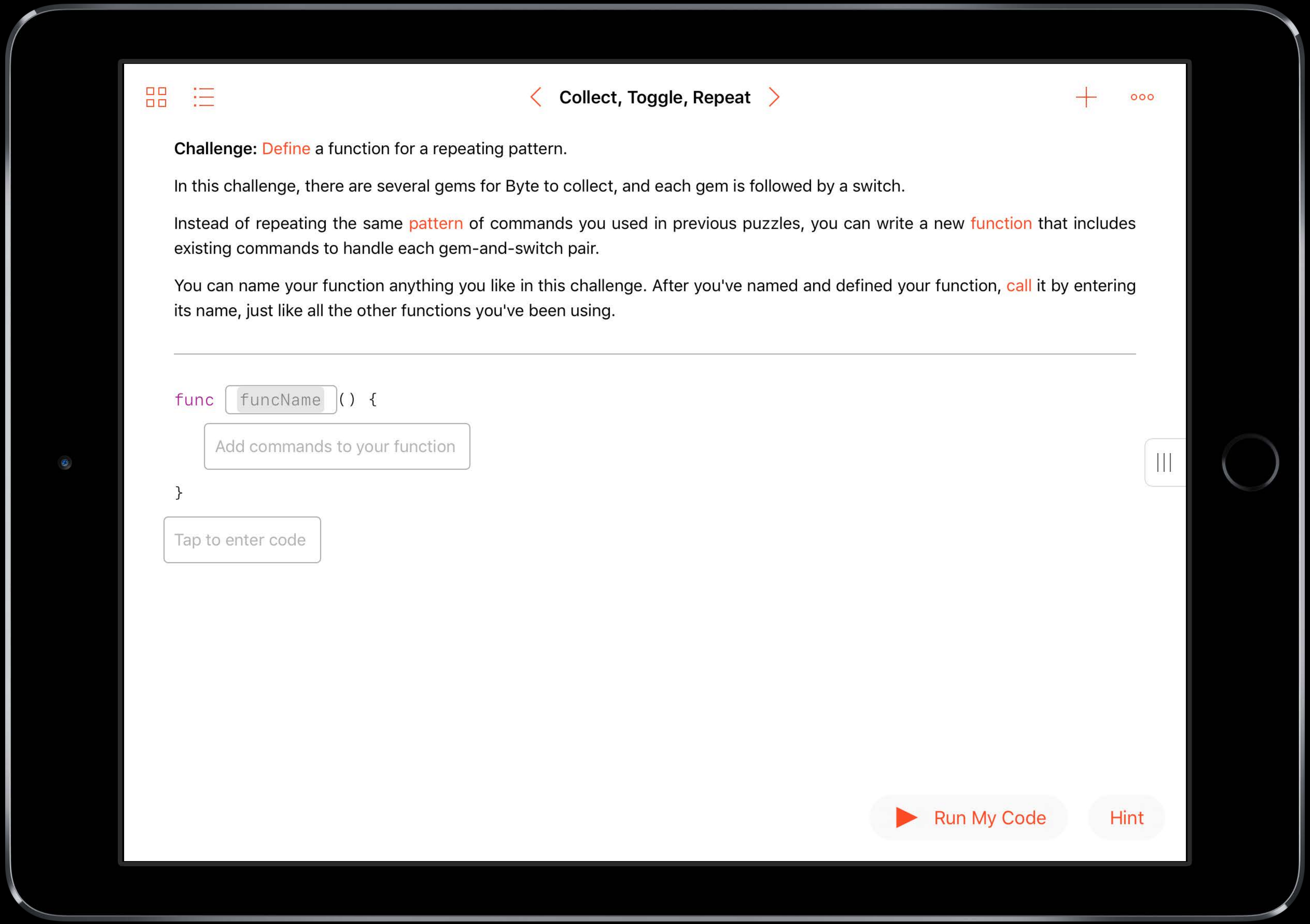
Glossary



Glossary

Term	Description	Introduced In
algorithm	A step-by-step set of instructions or rules for solving a problem. For example, a list of steps used to make a cup of tea can be considered an algorithm.	Algorithms
argument	An input value passed into a function to customize its behavior. For example, in the function call move(3), 3 is an argument that specifies how many spaces to move.	Parameters
arithmetic operator	A symbol, such as +, -, *, or /, that performs a basic mathematical operation on one or more numbers. For example, 42 / 7 and 17 - 5 use arithmetic operators.	Variables
assignment	An action that sets the value of a variable or constant.	Variables
assignment operator	The = symbol used to set the value of a variable. For example, greeting = "hello" sets the value of greeting to "hello".	Variables
Boolean	A type that has a value of either true or false. For example, 9 < 7 returns a Boolean value of false.	Conditional Code
bug	An error in code that prevents a program from running as expected.	Commands
call	To tell a program to run a function. For example, calling the moveForward() function in your code tells the program to perform the actions defined in that function.	Functions
coding	The act of composing commands, code structures, and algorithms to create a computer program.	Commands

Editable Regions



Challenge: Define a function for a repeating pattern.

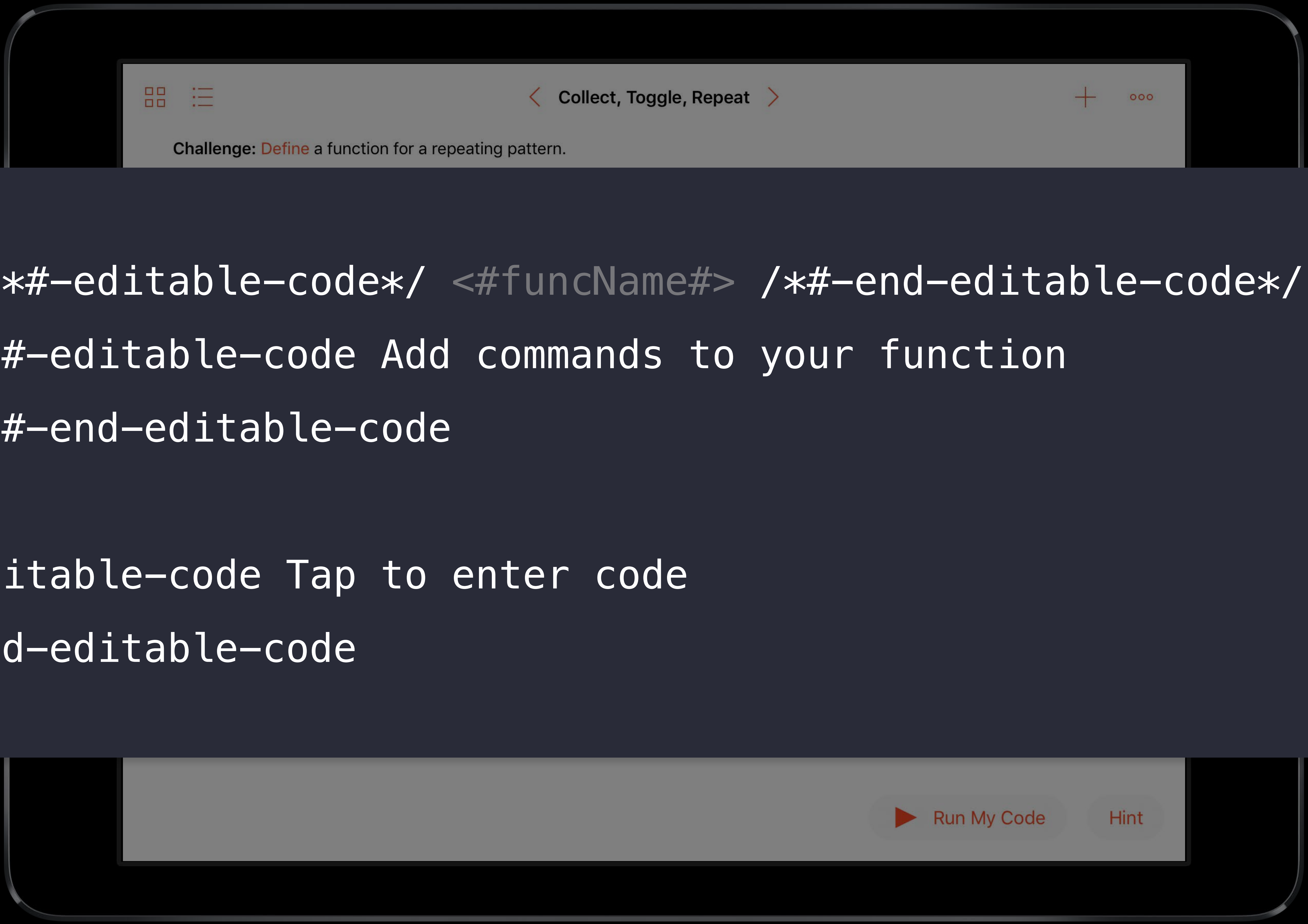
In this challenge, there are several gems for Byte to collect, and each gem is followed by a switch.

Instead of repeating the same pattern of commands you used in previous puzzles, you can write a new function that includes existing commands to handle each gem-and-switch pair.

You can name your function anything you like in this challenge. After you've named and defined your function, call it by entering its name, just like all the other functions you've been using.

```
func funcName() {
    Add commands to your function
}
Tap to enter code
```

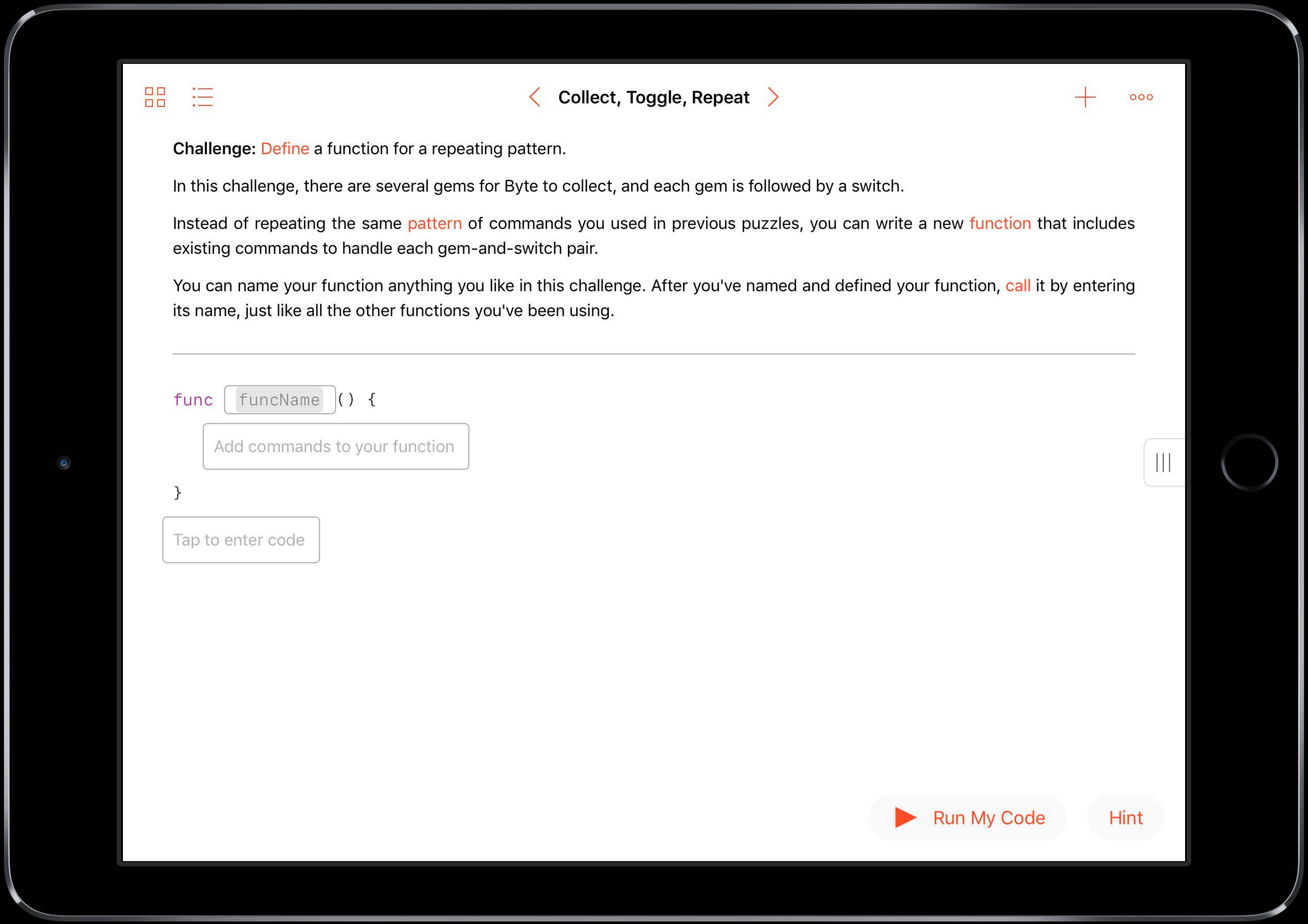
Editable Regions



Challenge: Define a function for a repeating pattern.

```
func /*#-editable-code*/ <#funcName#> /*#-end-editable-code*/() {
    //#-editable-code Add commands to your function
    //#-end-editable-code
}
//#-editable-code Tap to enter code
//#-end-editable-code
```

Hidden Code



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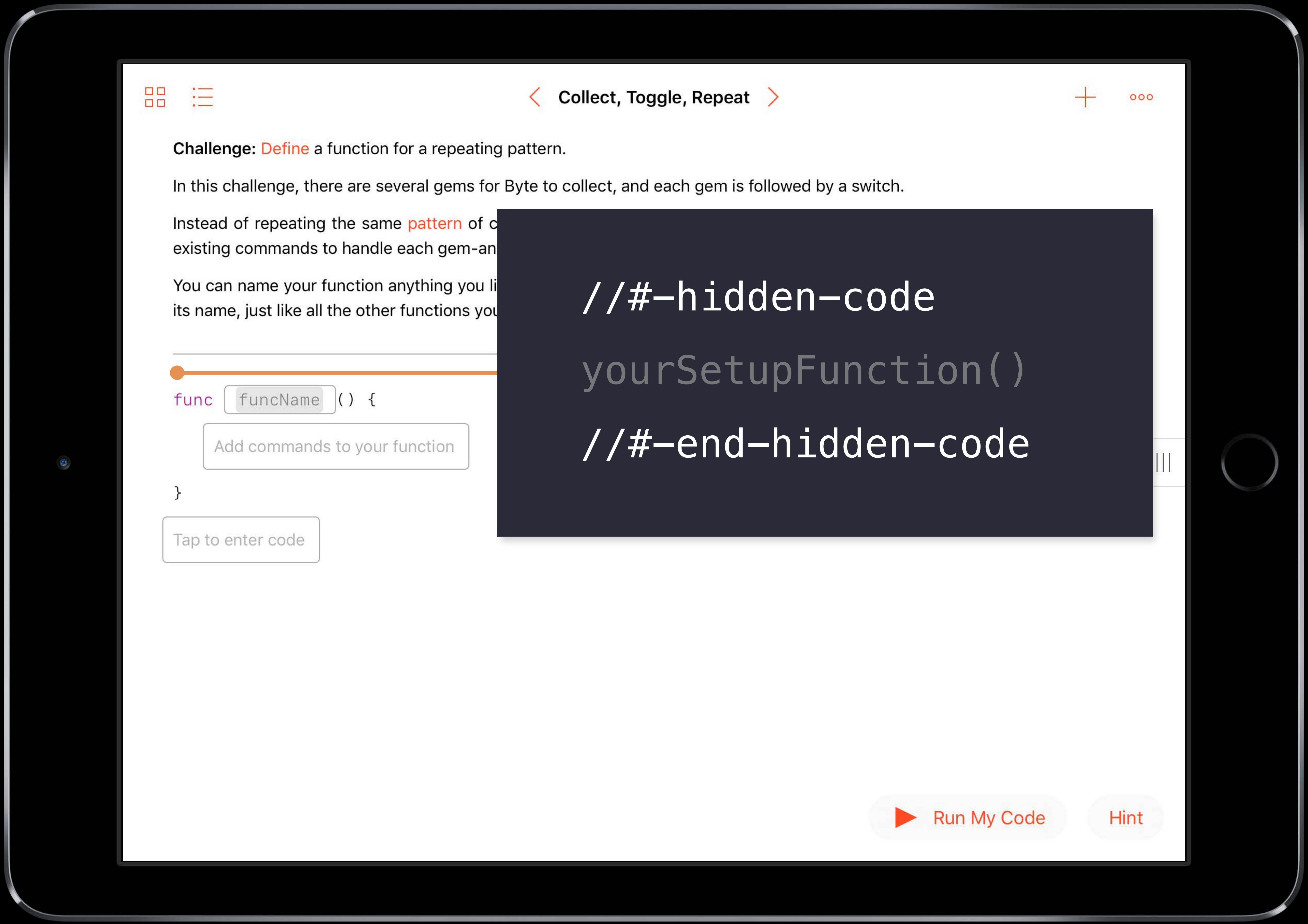

Collect, Toggle, Repeat

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You can name your function anything you li
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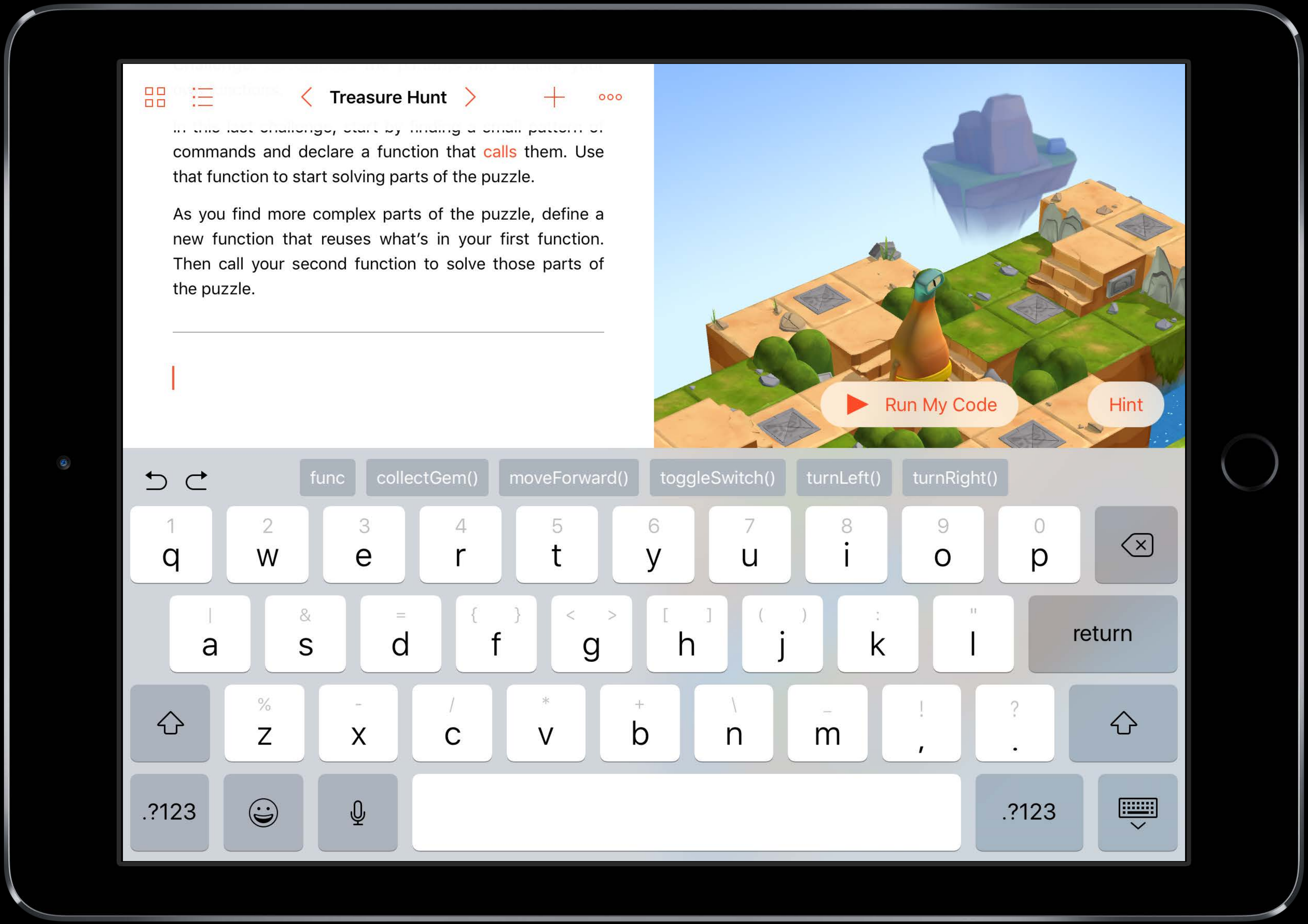
```
func funcName() {
    Add commands to your function
}
Tap to enter code
```

```
//#-hidden-code
yourSetupFunction()
//#-end-hidden-code
```

Configurable Code Completion



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As you find more complex parts of the puzzle, define a new function that reuses what's in your first function. Then call your second function to solve those parts of the puzzle.

Configurable Code Completion

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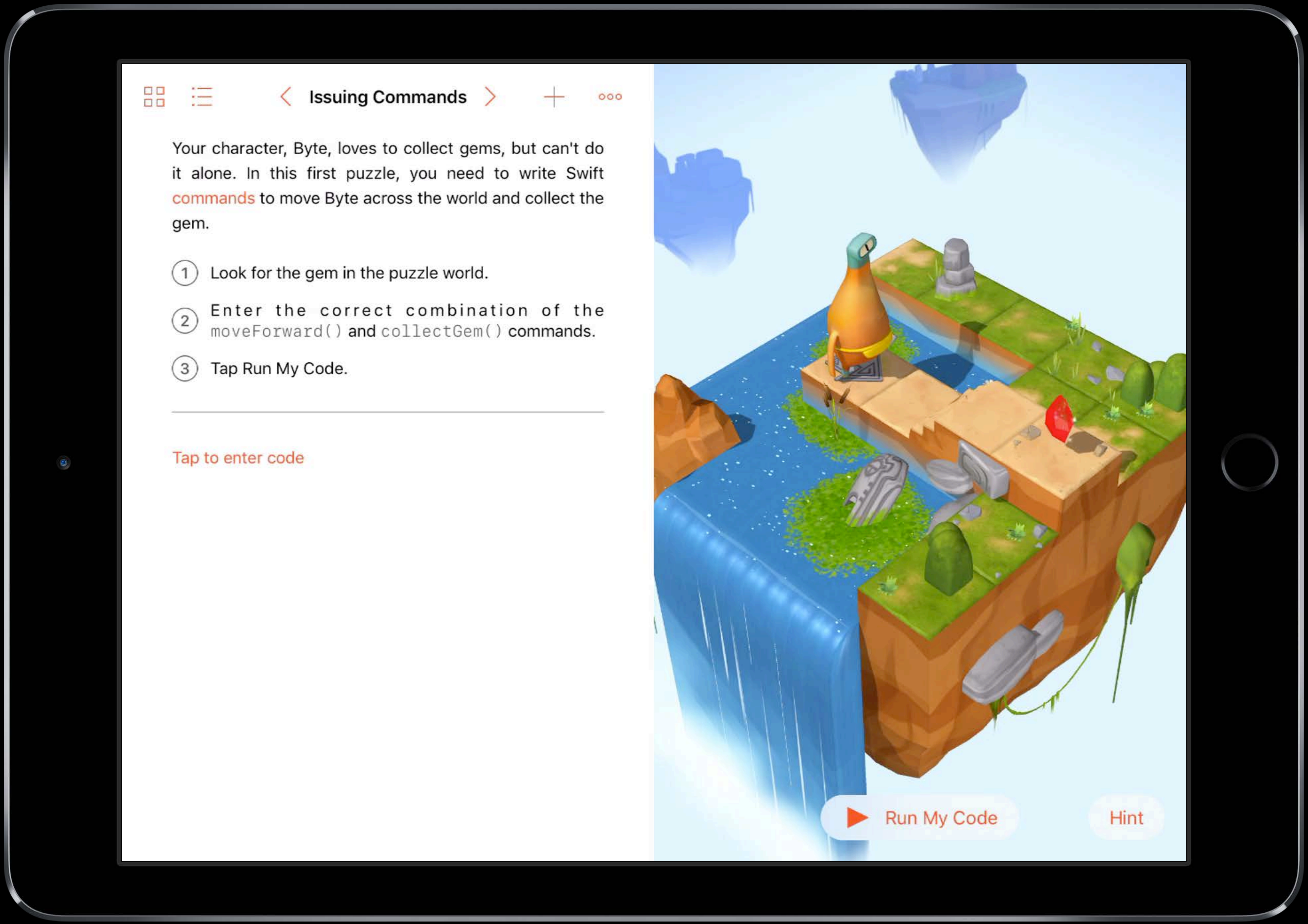
```
//#-code-completion(everything, hide)
//#-code-completion(currentmodule, show)
//#-code-completion(identifier, show, moveForward(), turnLeft())
```

“Always-On” Live View



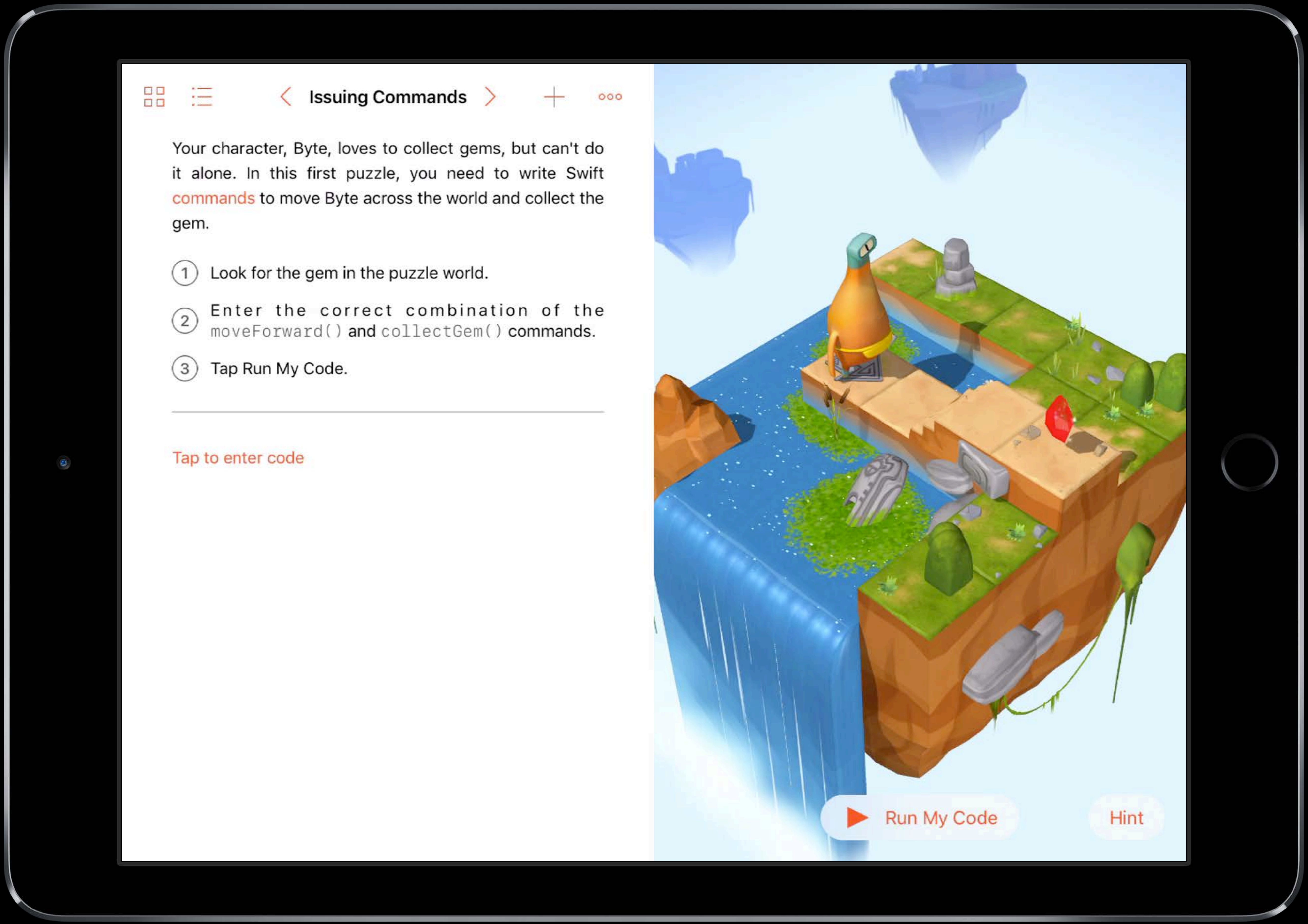
Issuing Commands

Your character, Byte, loves to collect gems, but can't do it alone. In this first puzzle, you need to write Swift commands to move Byte across the world and collect the gem.

1. Look for the gem in the puzzle world.
2. Enter the correct combination of the `moveForward()` and `collectGem()` commands.
3. Tap Run My Code.

Tap to enter code

"Always-On" Live View



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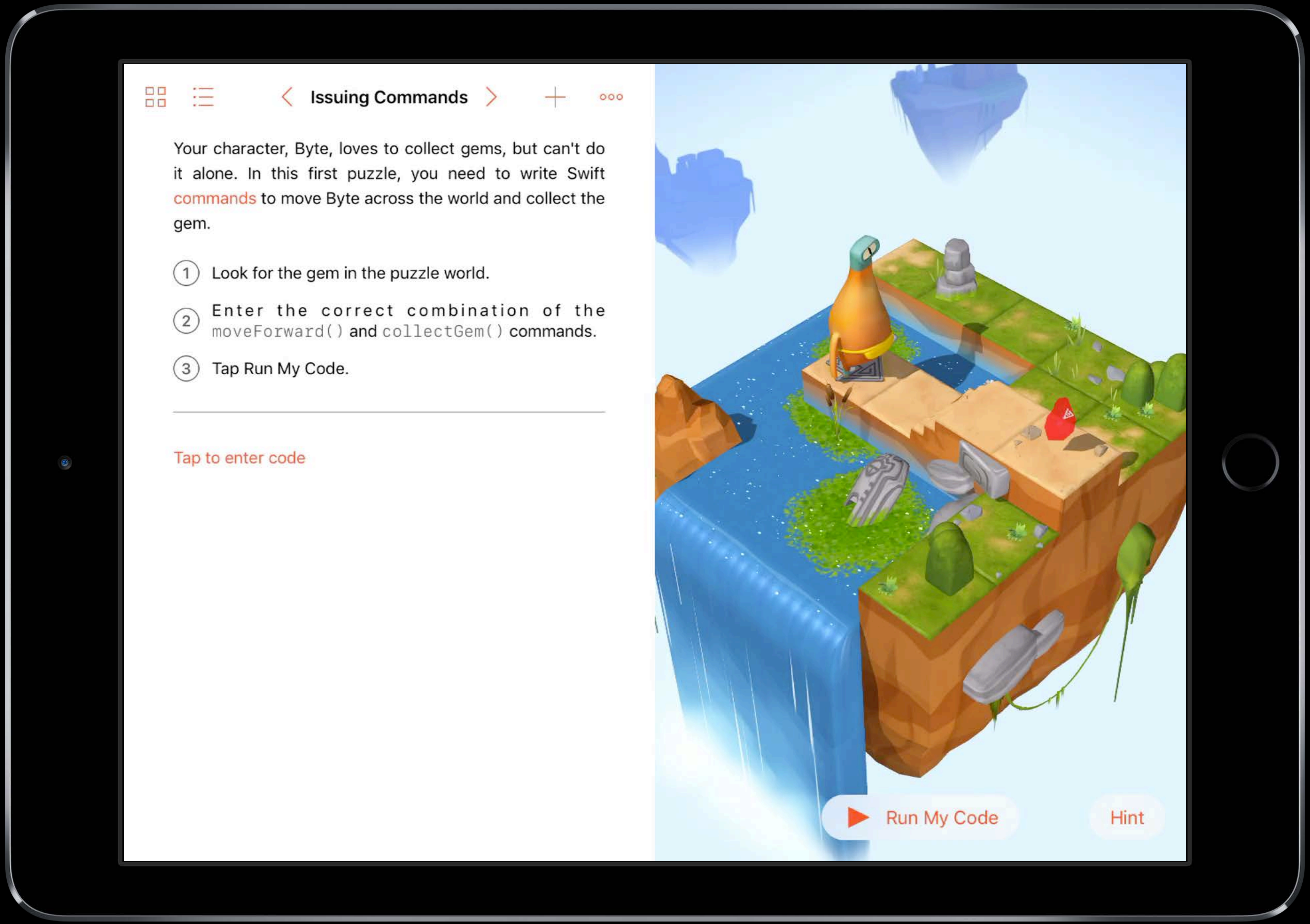
Hints



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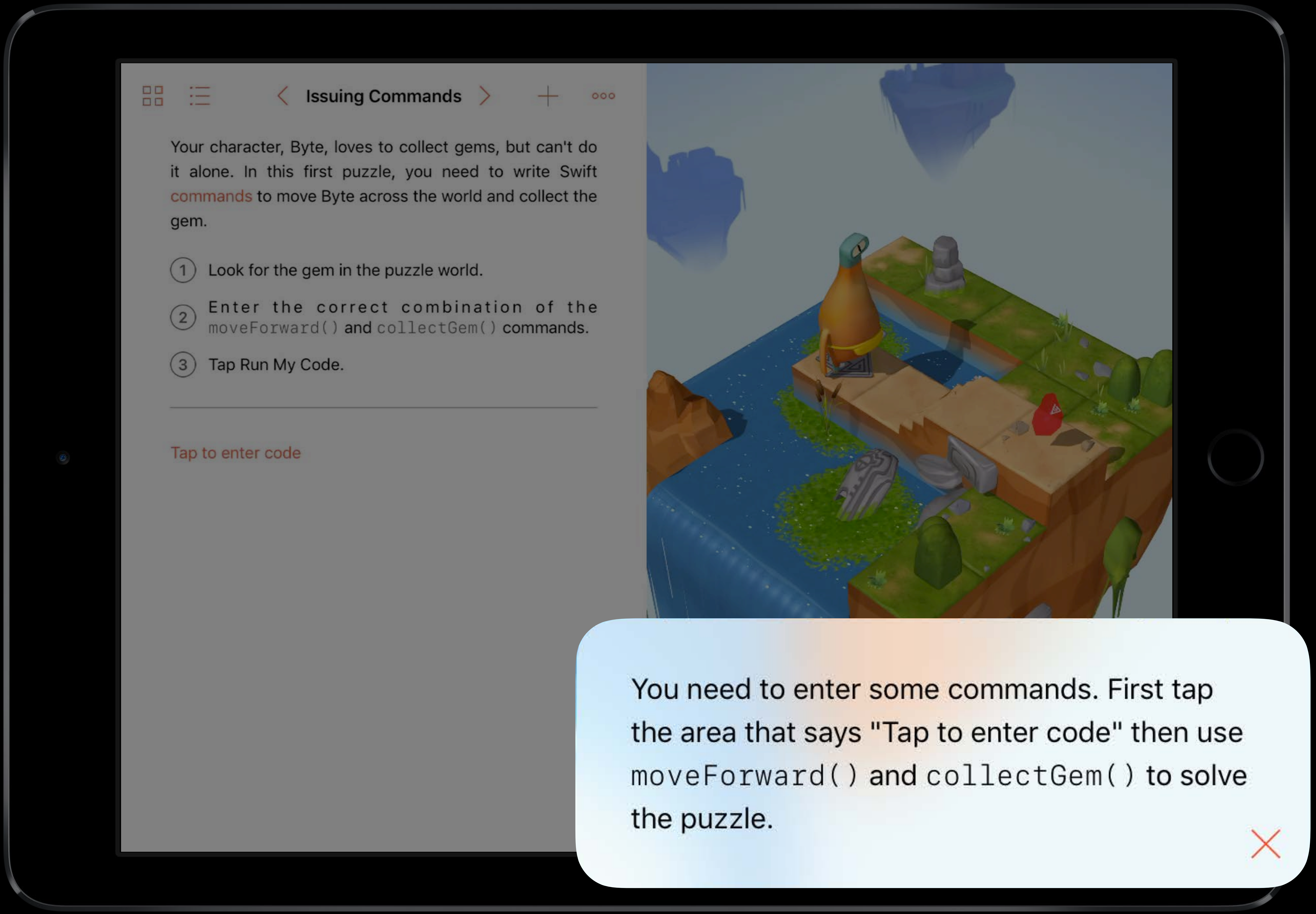
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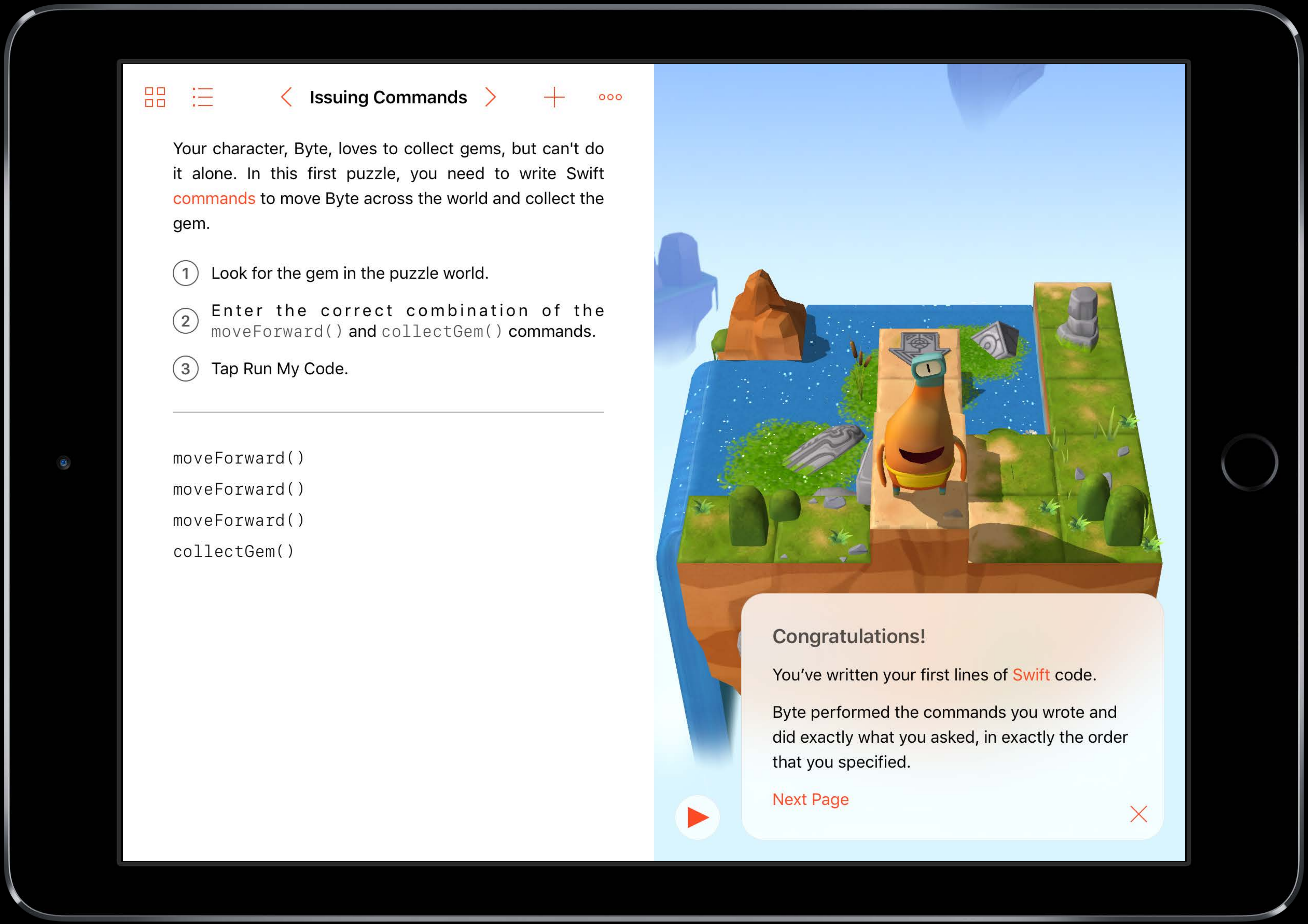
Tap to enter code

You need to enter some commands. First tap the area that says "Tap to enter code" then use `moveForward()` and `collectGem()` to solve the puzzle.

Assessment



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Congratulations!

You've written your first lines of Swift code.

Byte performed the commands you wrote and did exactly what you asked, in exactly the order that you specified.

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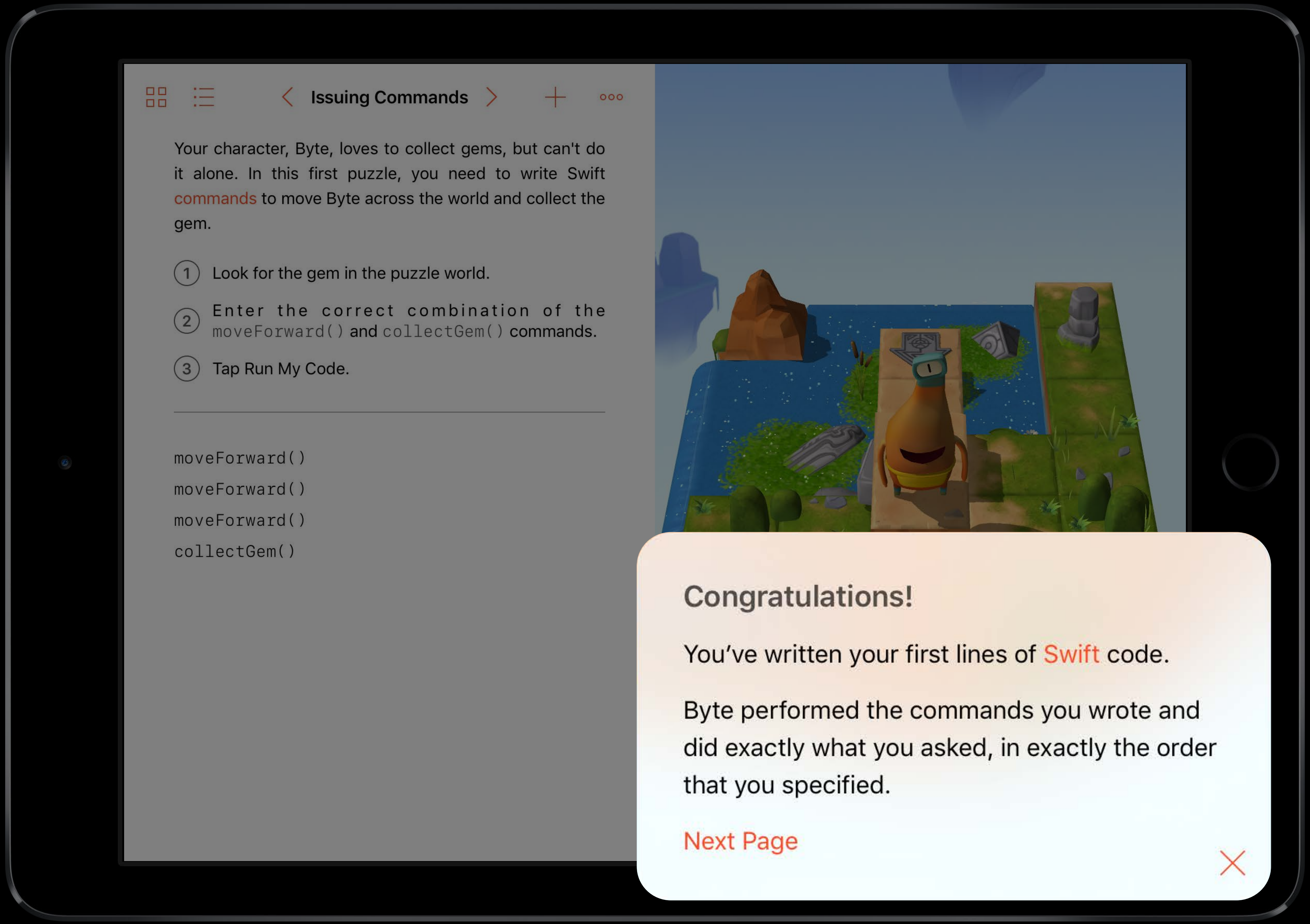

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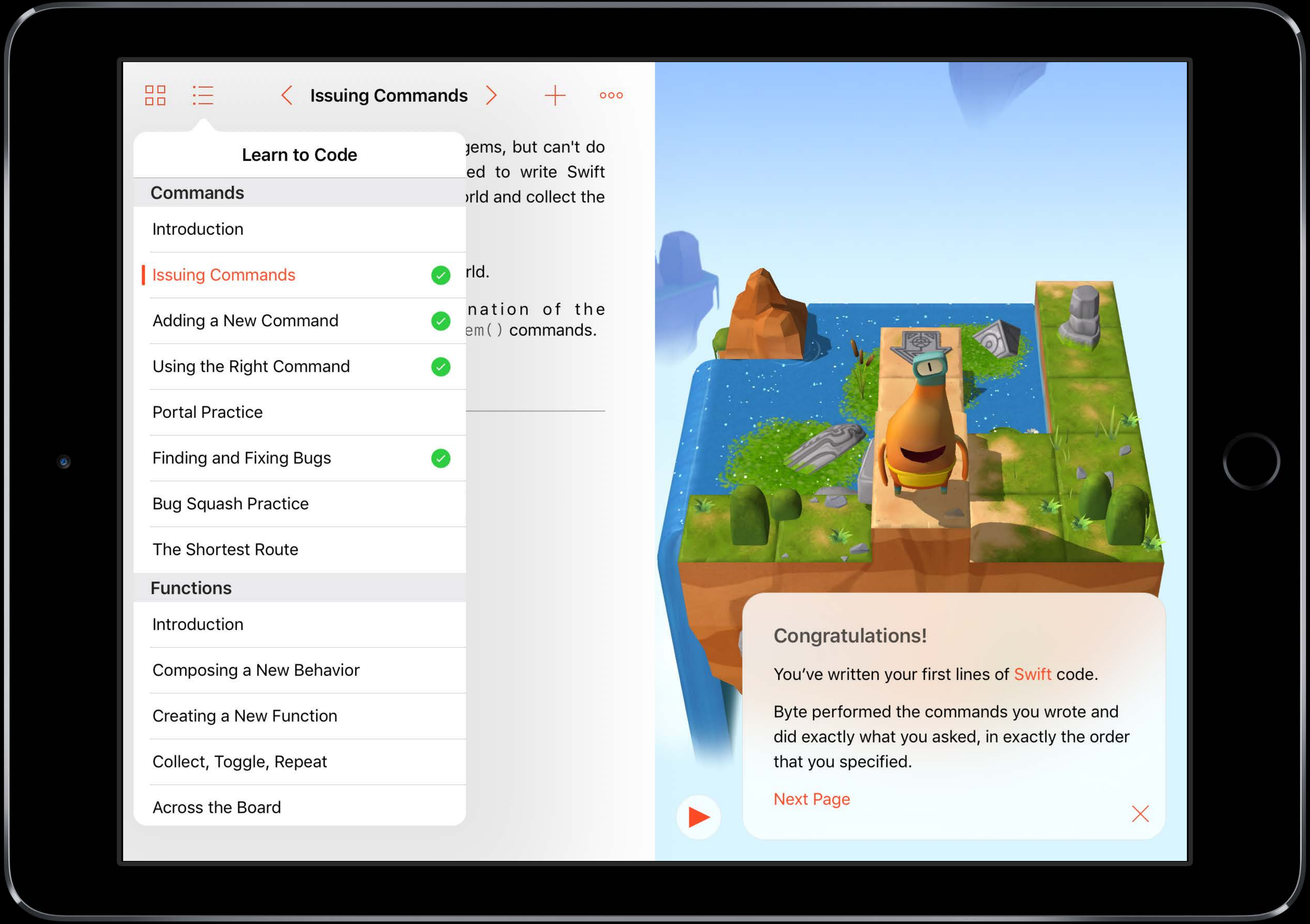

Issuing Commands

Learn to Code

Commands
- Introduction
- Issuing Commands ✓
- Adding a New Command ✓
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- Bug Squash Practice
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Next Page

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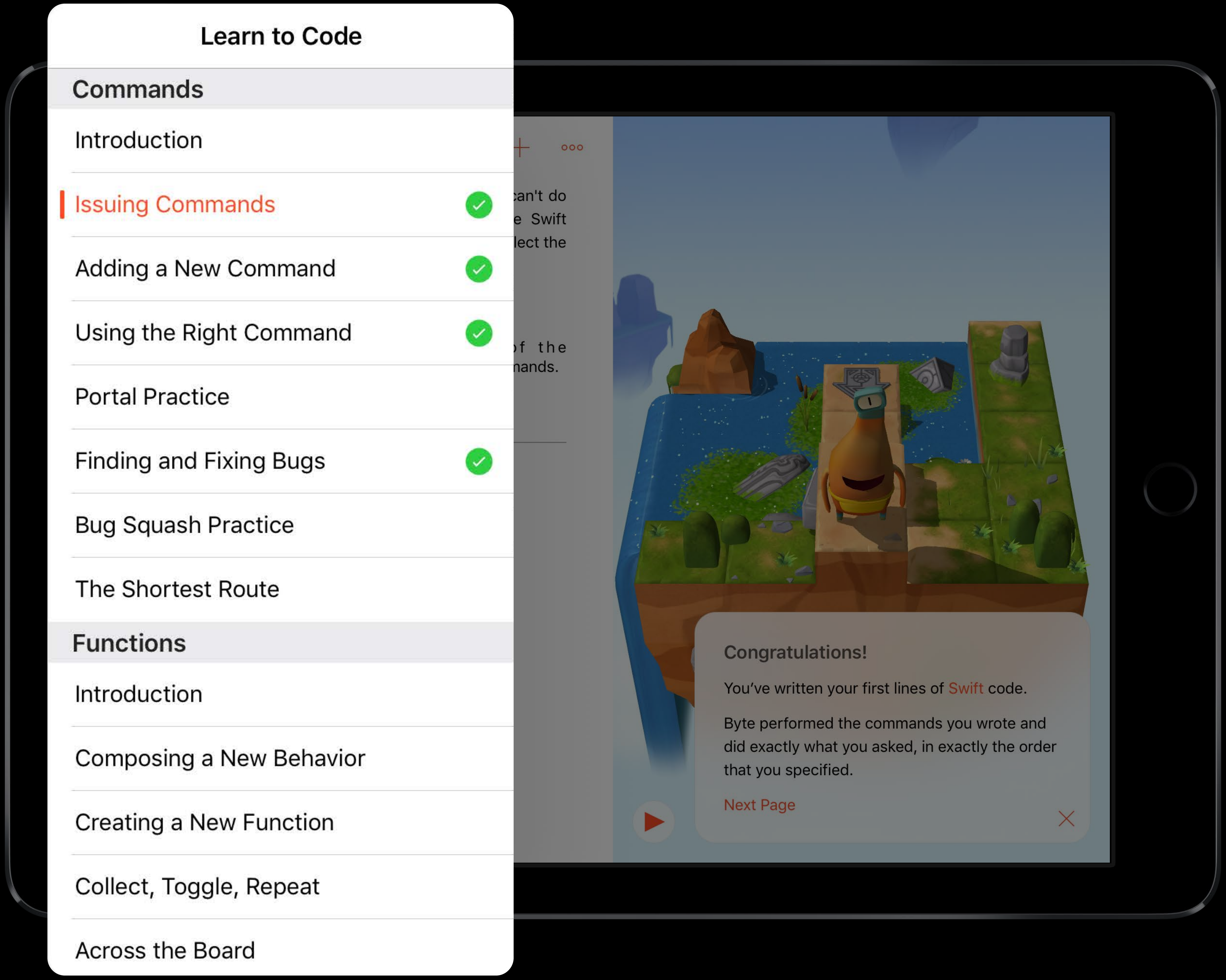

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Next Page

```swift
// Key/Value Store

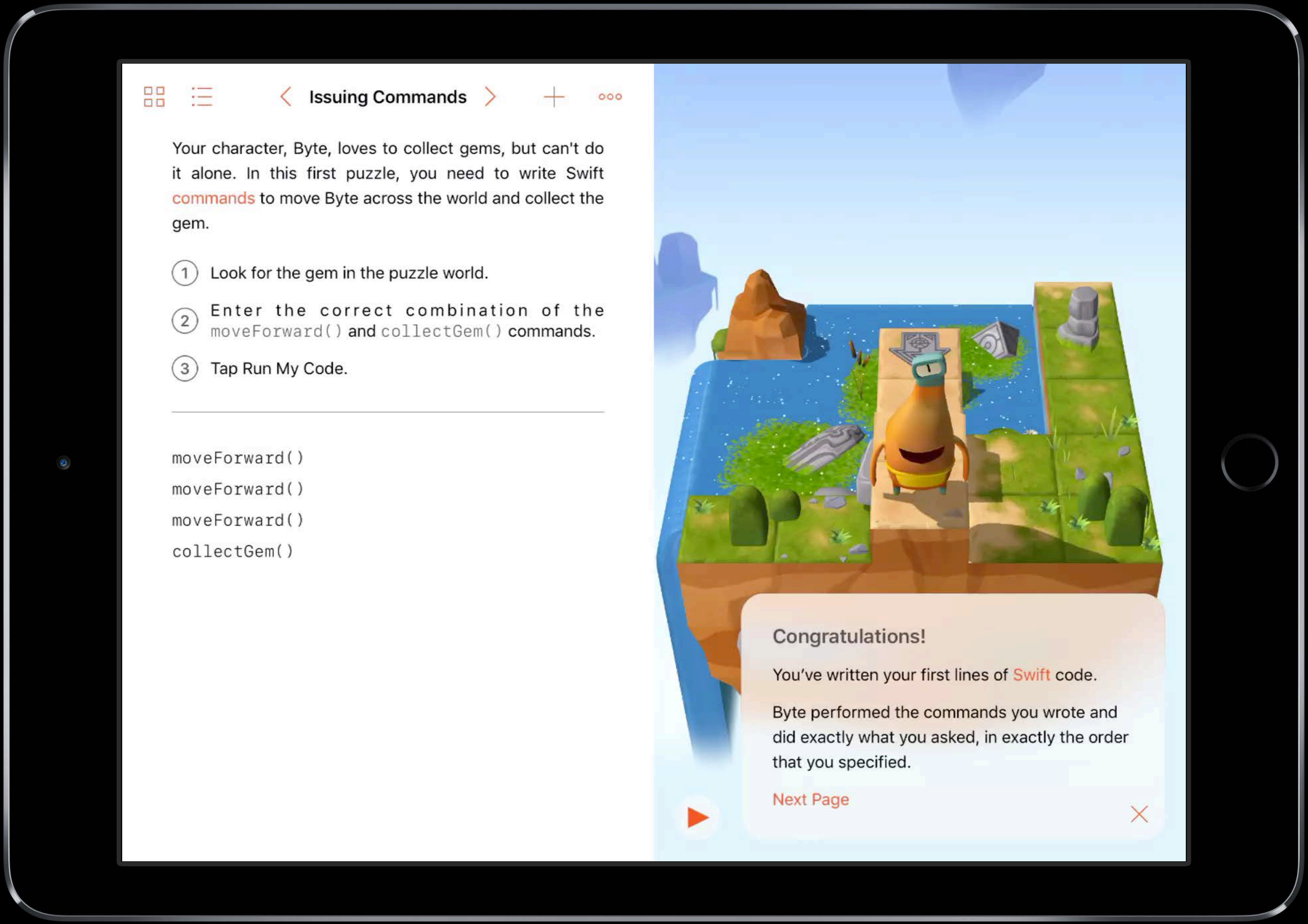
import PlaygroundSupport

let store = PlaygroundPage.current.keyValueStore

store["Greeting"] = .string("Hello, WWDC!")

if case let .string(greeting)? = store["Greeting"] {
    print(greeting)     // "Hello, WWDC!"
}
```

Resettable



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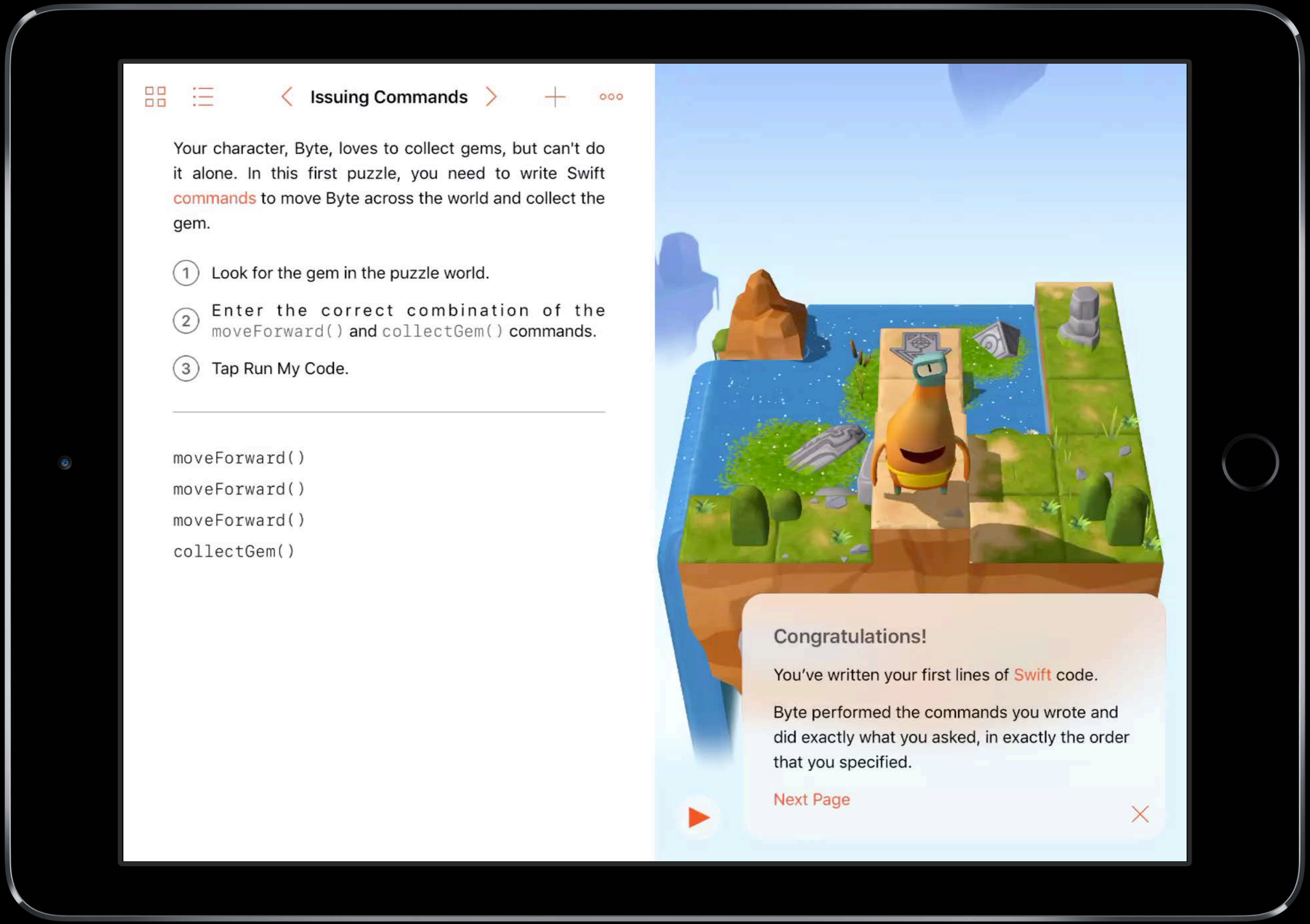

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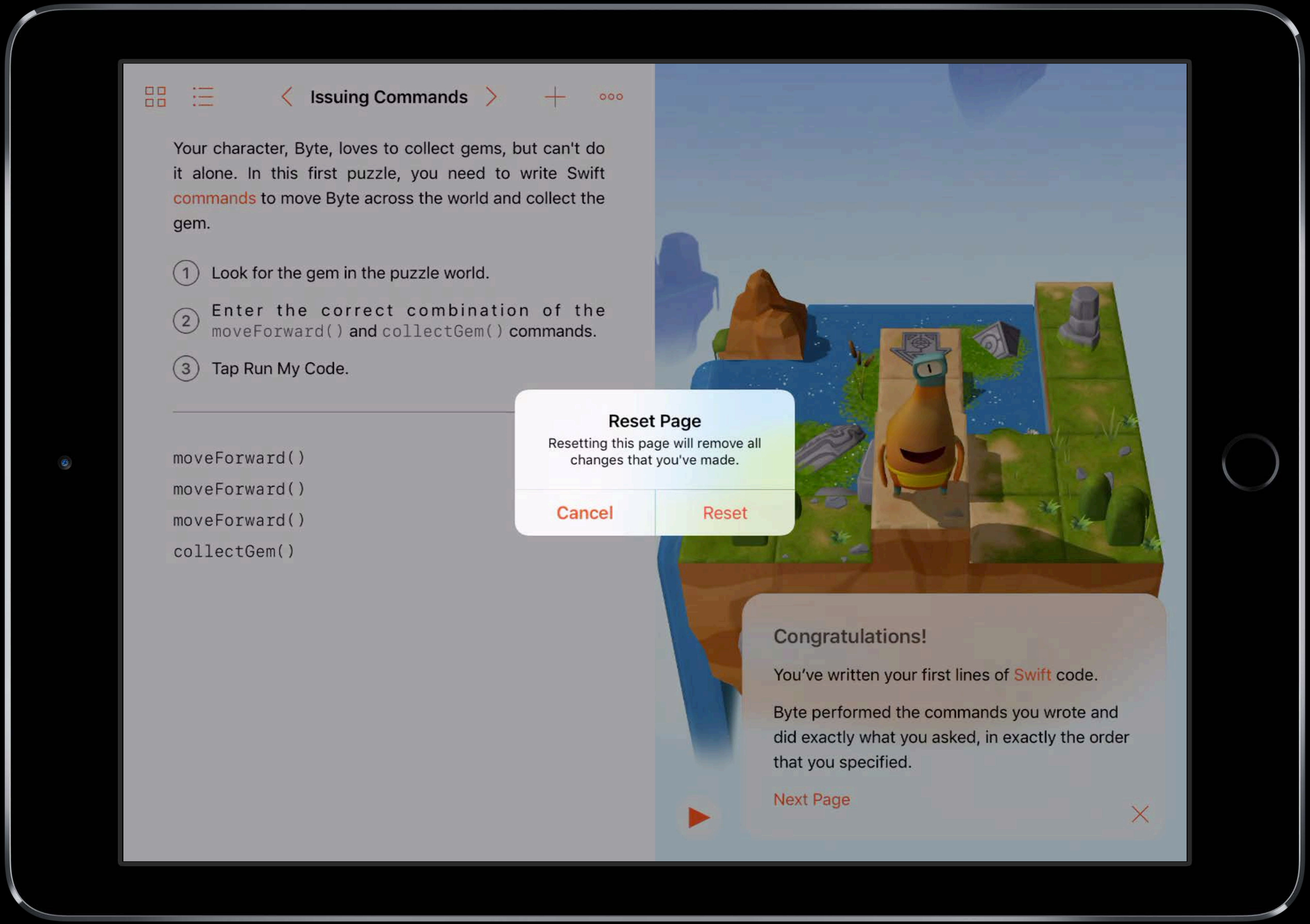

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Reset Page

Resetting this page will remove all changes that you've made.

Cancel | Reset

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Next Page

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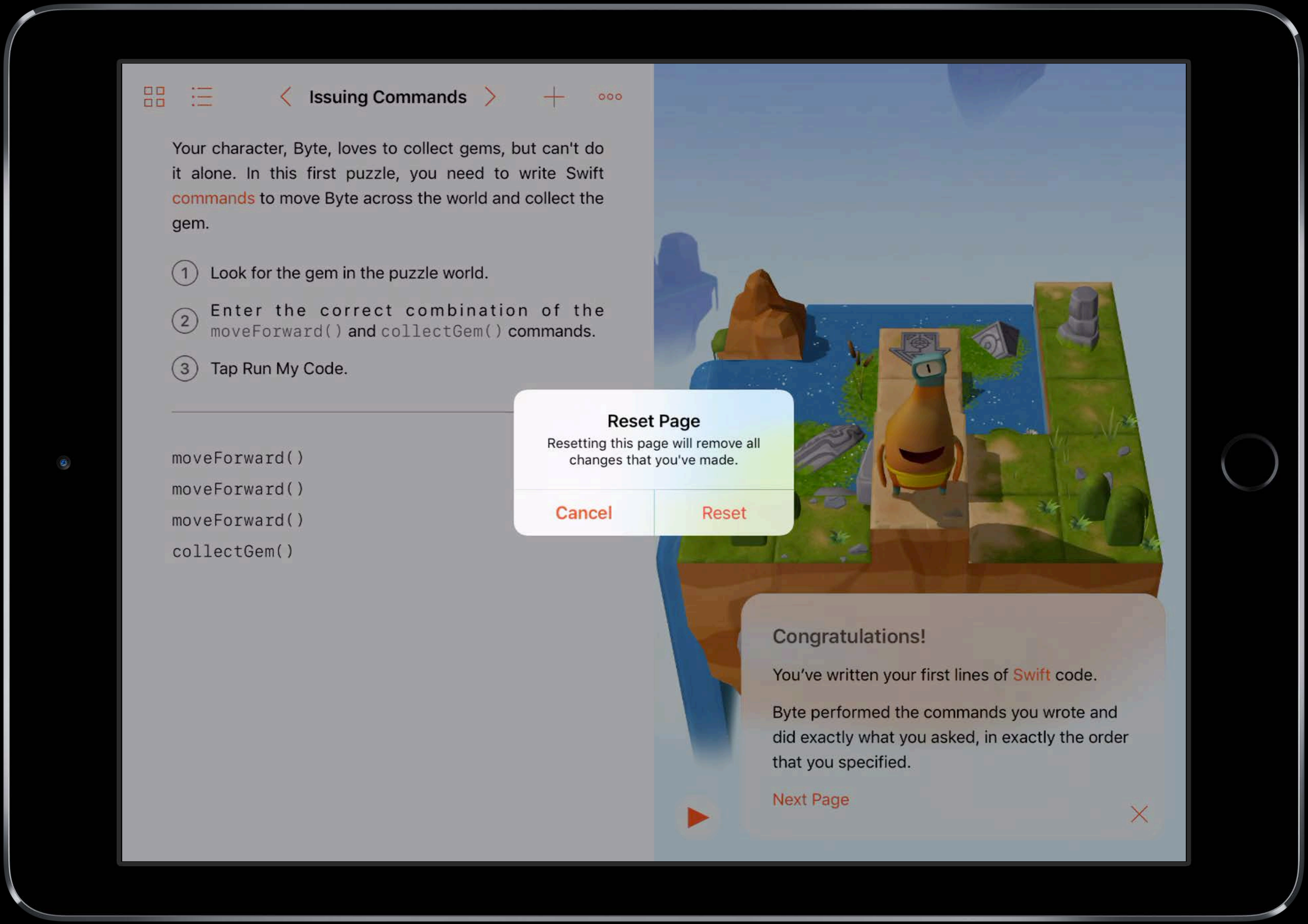

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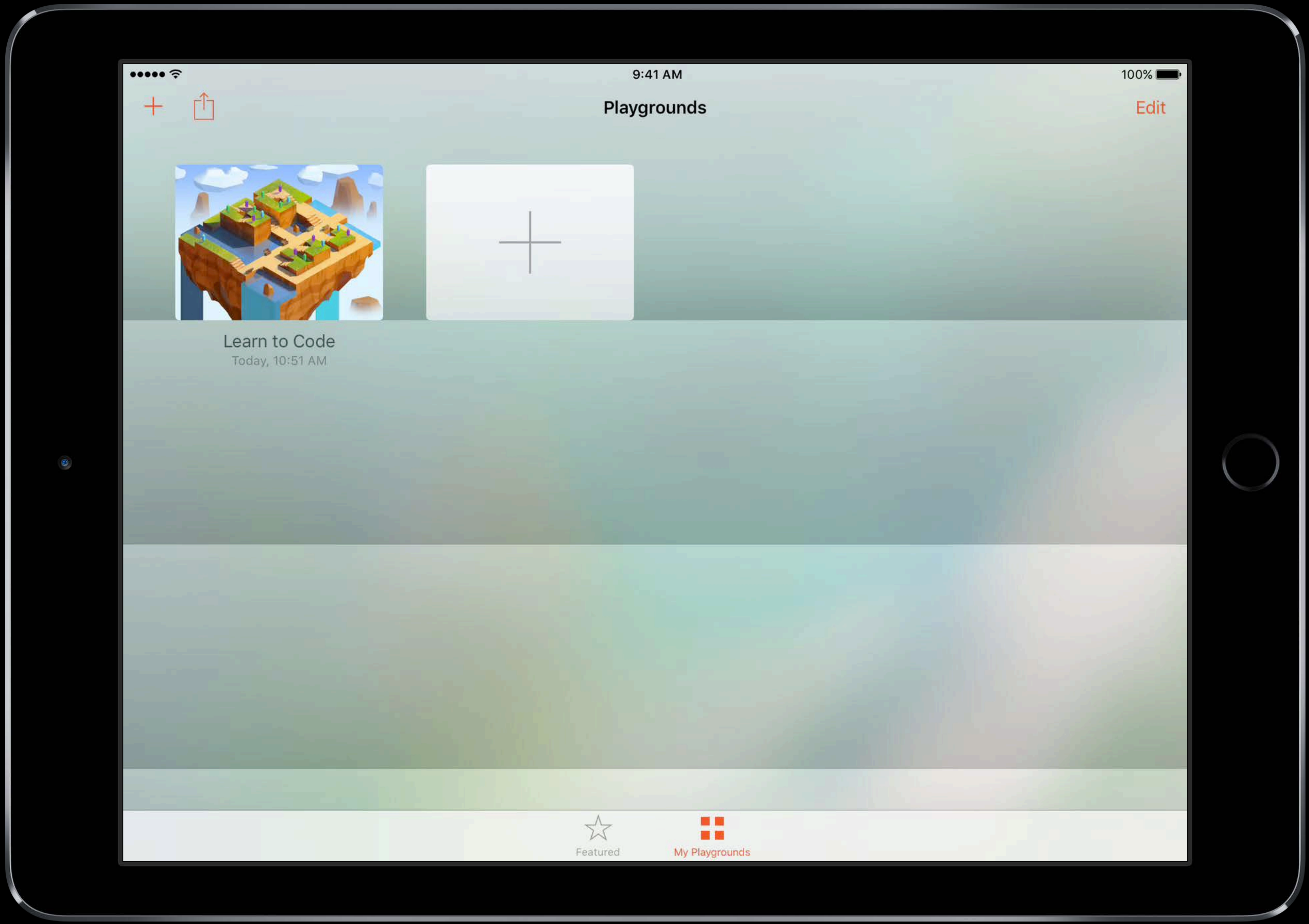
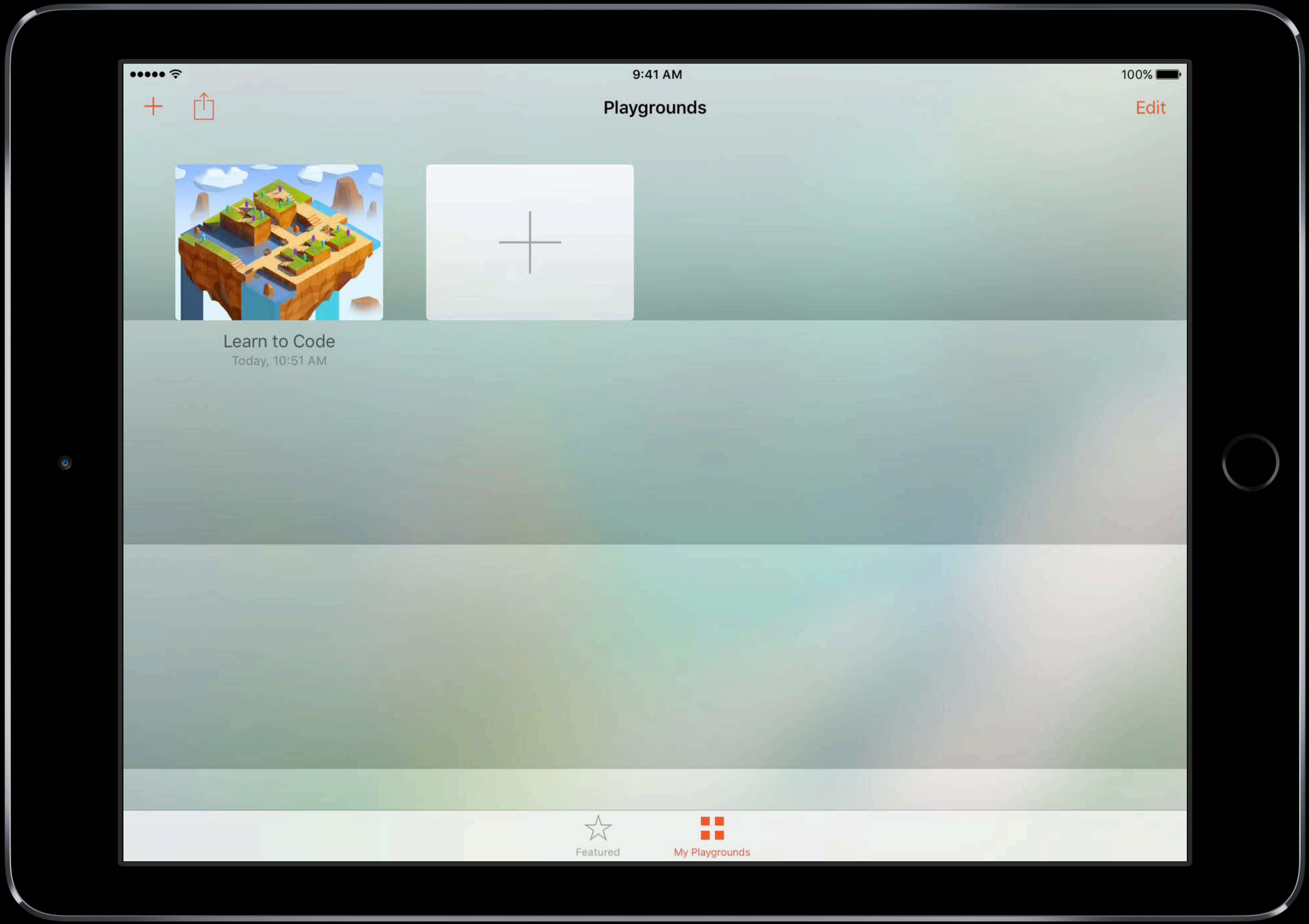
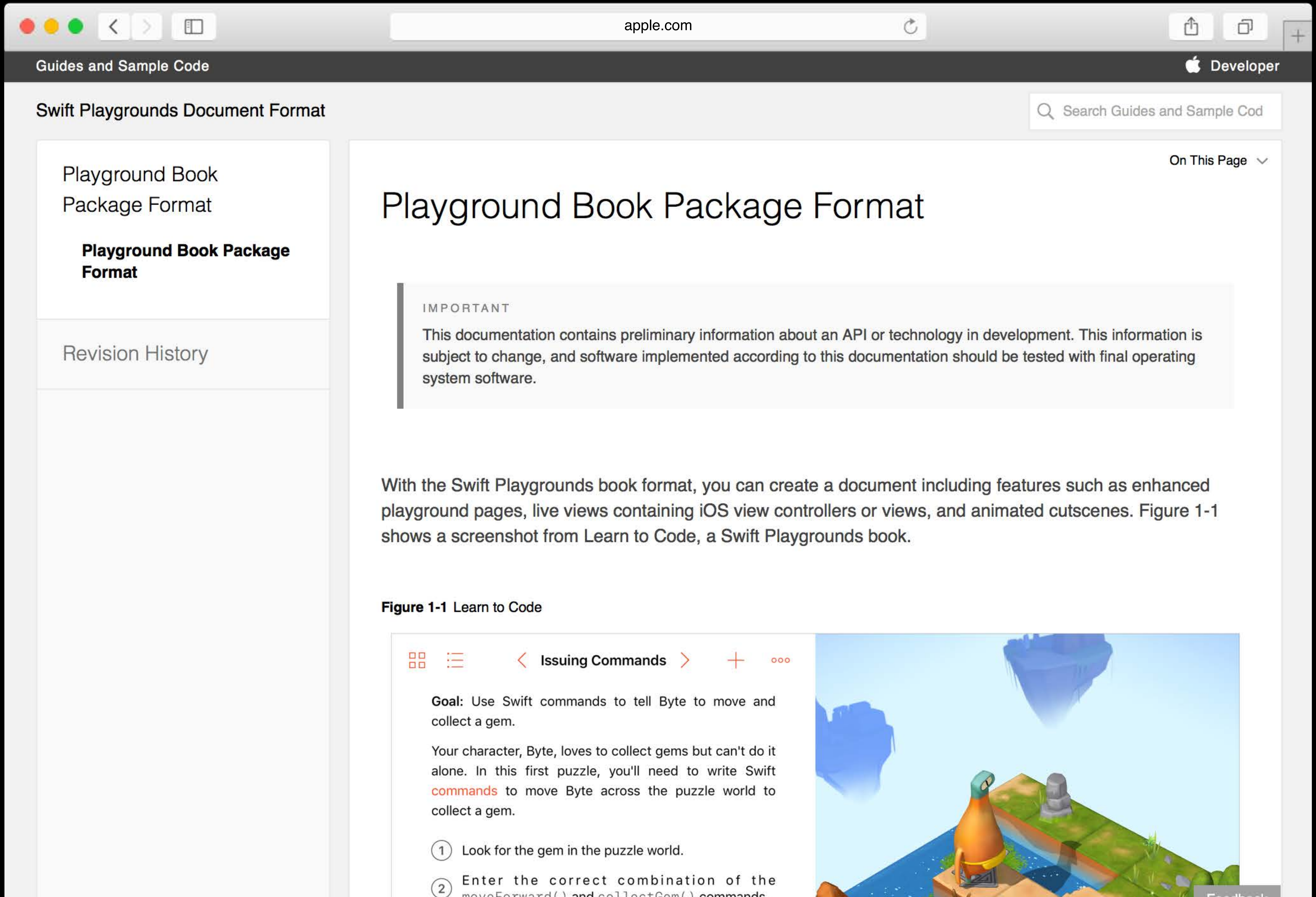

9:41 AM
100%
Playgrounds
Edit
Learn to Code
Today, 10:51 AM
Featured
My Playgrounds

Resettable


9:41 AM
100%
Playgrounds
Edit
Learn to Code
Today, 10:51 AM
Featured
My Playgrounds

Documented



Swift Playgrounds Document Format

Playground Book Package Format

Playground Book Package Format

Revision History

Playground Book Package Format

IMPORTANT

This documentation contains preliminary information about an API or technology in development. This information is subject to change, and software implemented according to this documentation should be tested with final operating system software.

With the Swift Playgrounds book format, you can create a document including features such as enhanced playground pages, live views containing iOS view controllers or views, and animated cutscenes. Figure 1-1 shows a screenshot from Learn to Code, a Swift Playgrounds book.

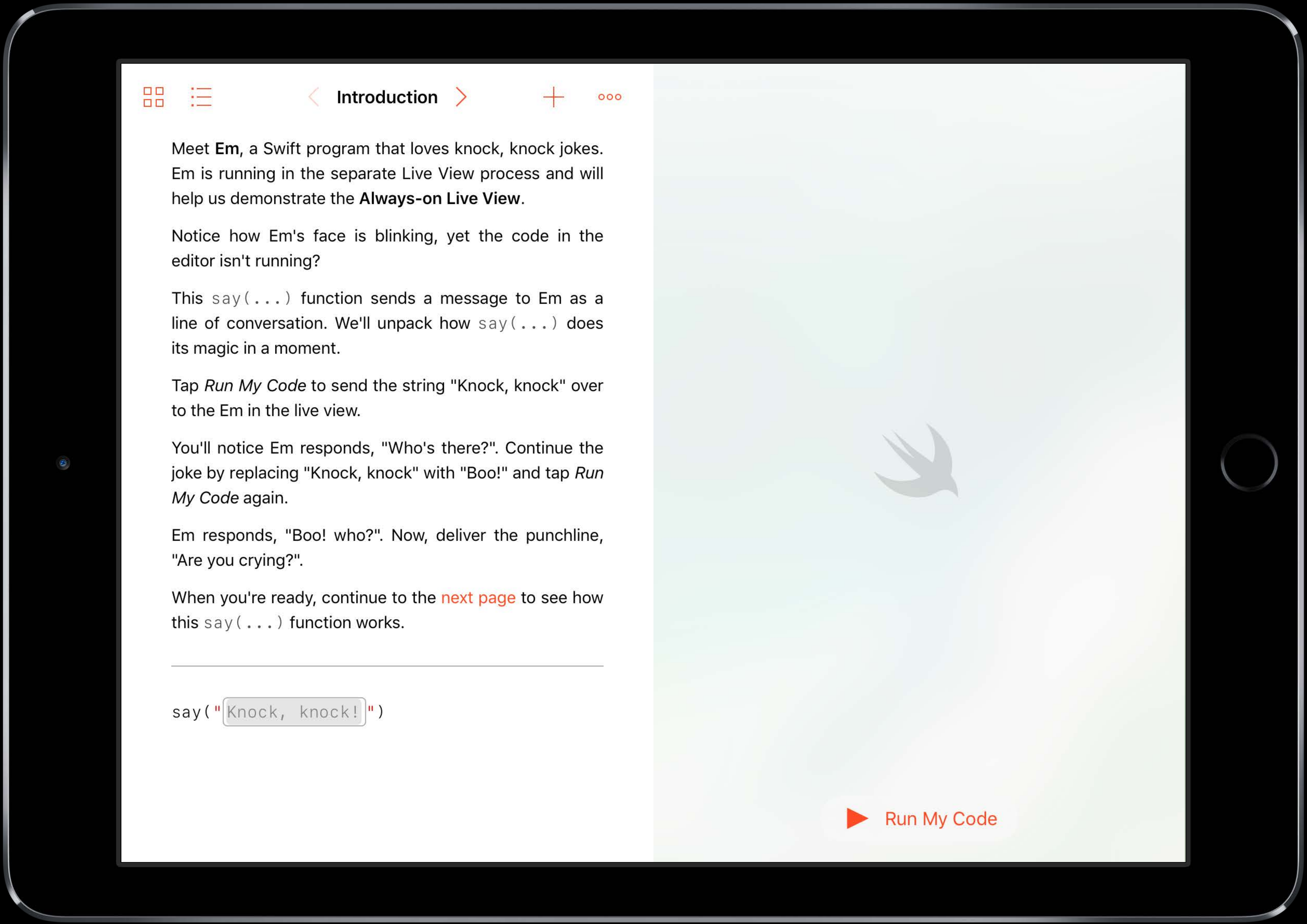
Figure 1-1 Learn to Code

Goal: Use Swift commands to tell Byte to move and collect a gem.

Your character, Byte, loves to collect gems but can't do it alone. In this first puzzle, you'll need to write Swift commands to move Byte across the puzzle world to collect a gem.

1. Look for the gem in the puzzle world.
2. Enter the correct combination of the `moveForward()` and `collectGem()` commands.

BOOK



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say("Knock, knock!")
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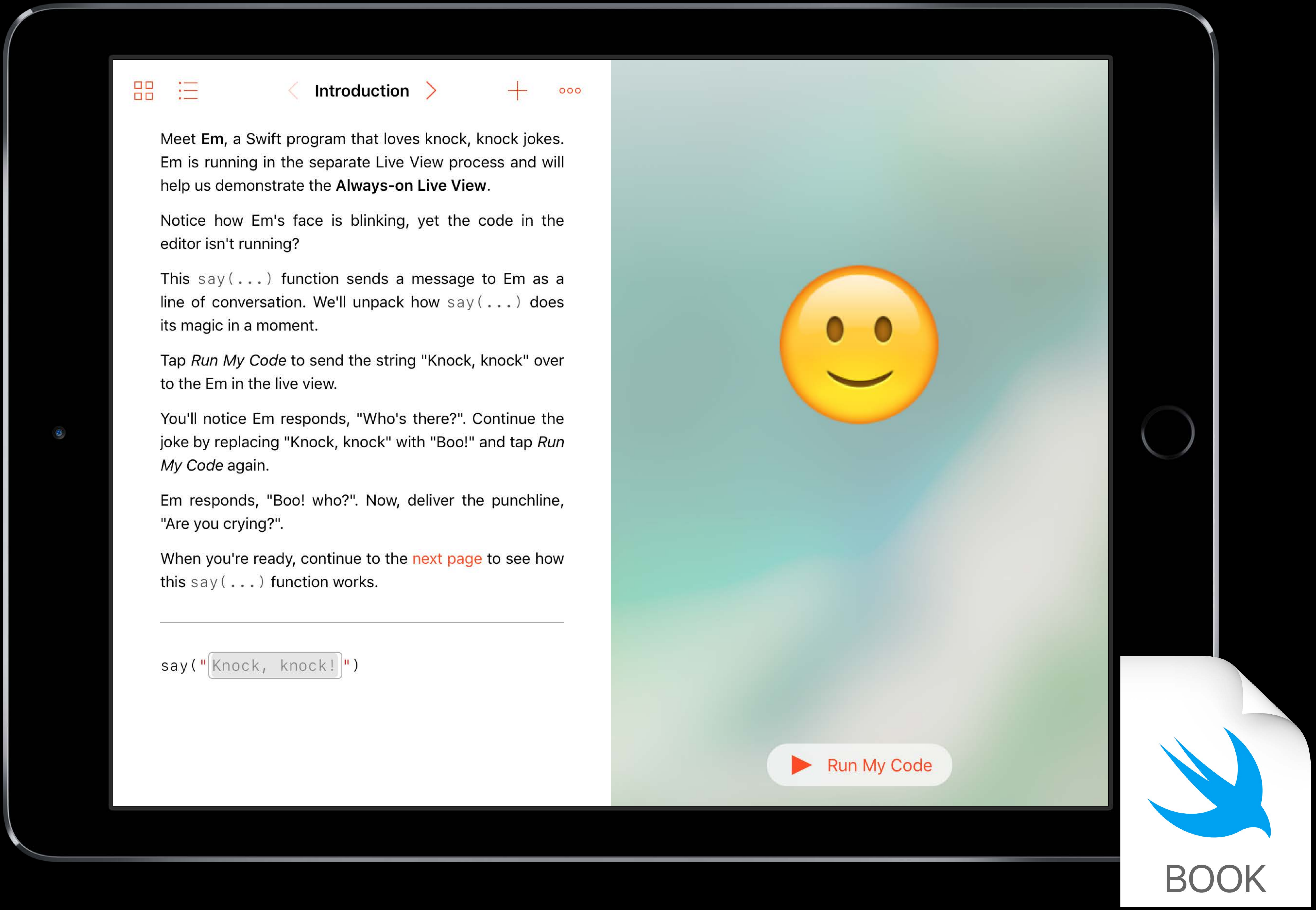
Demo

Authoring for Swift Playgrounds



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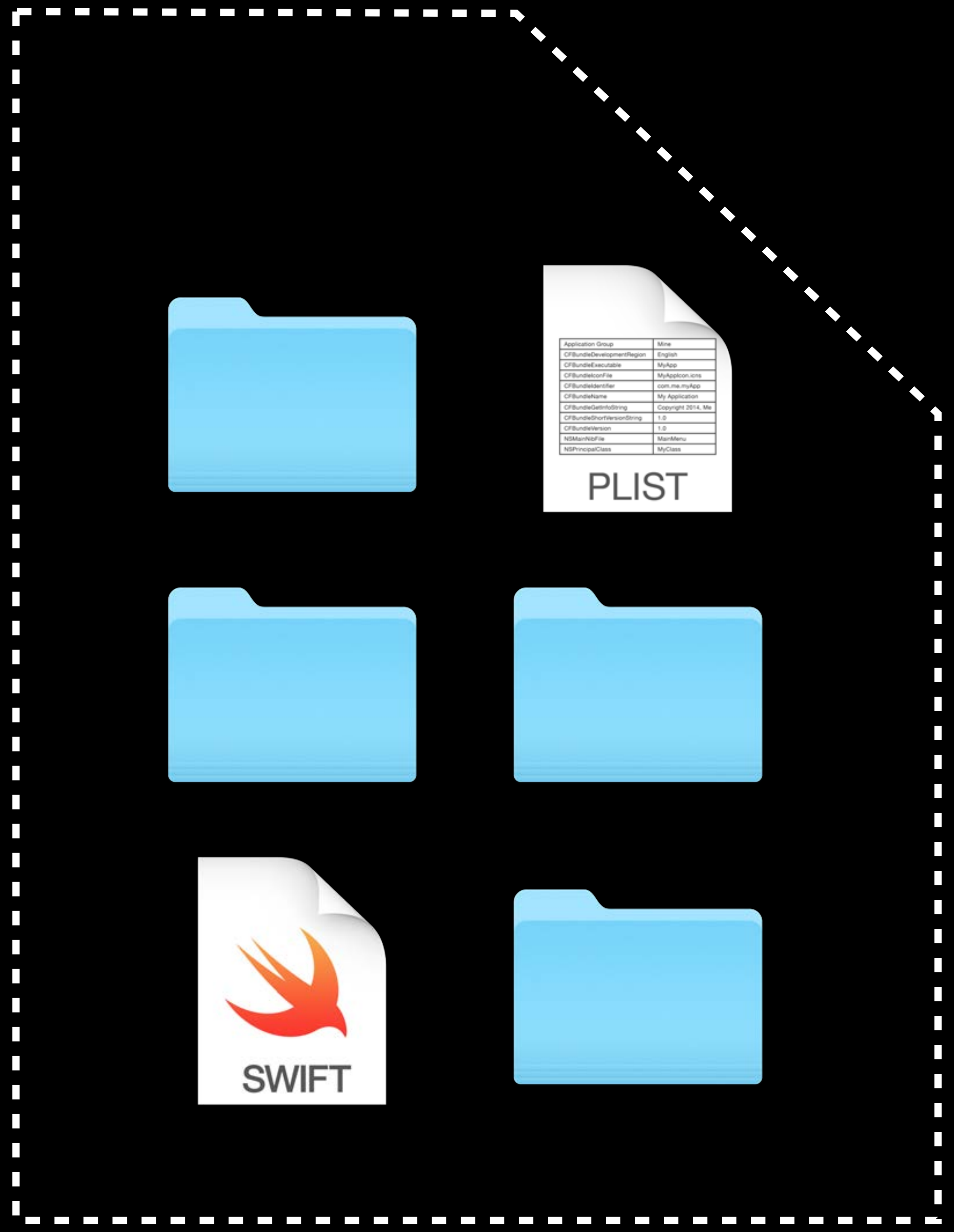
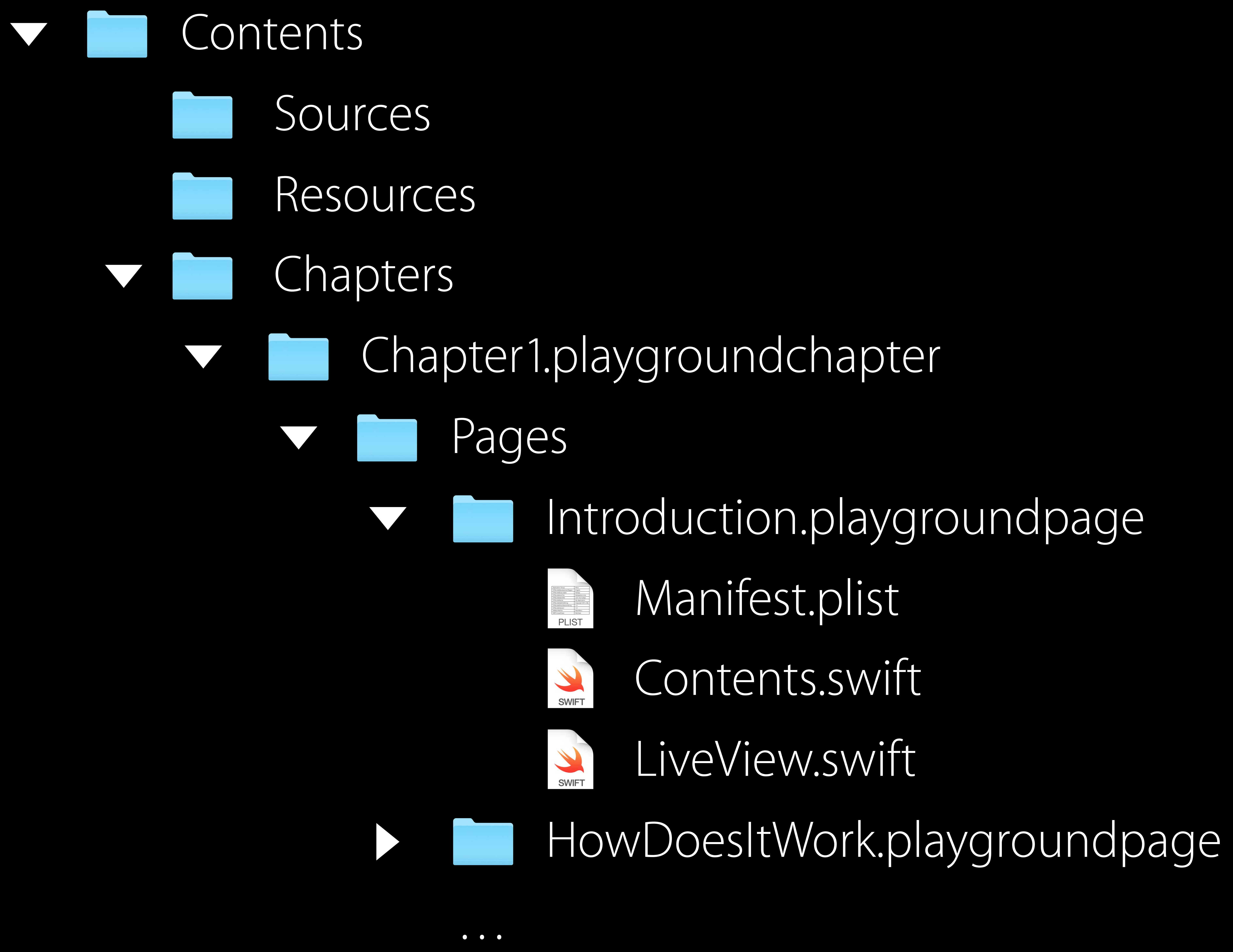
BOOK

MyFirst.playgroundbook


PLIST
SWIFT



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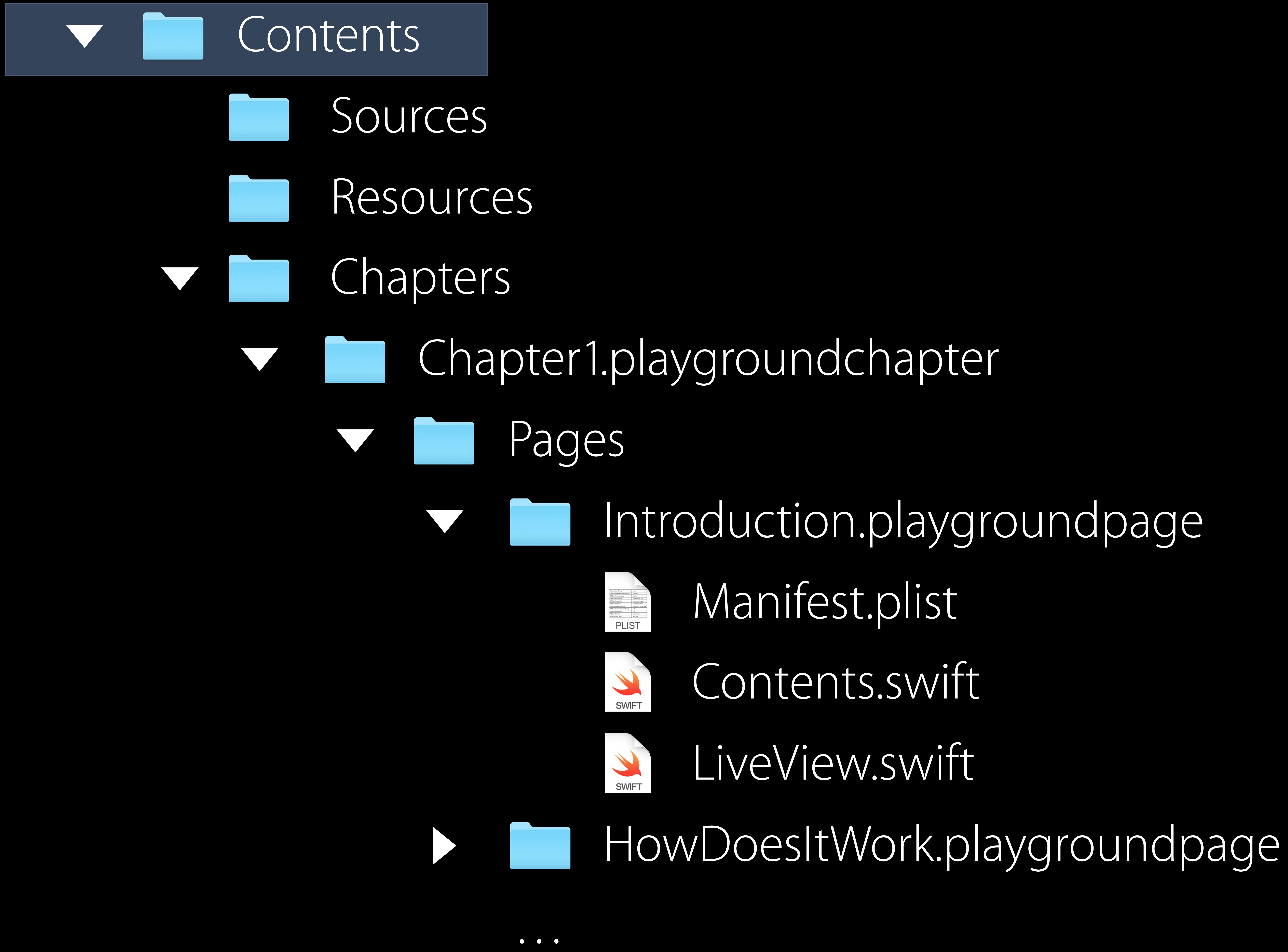

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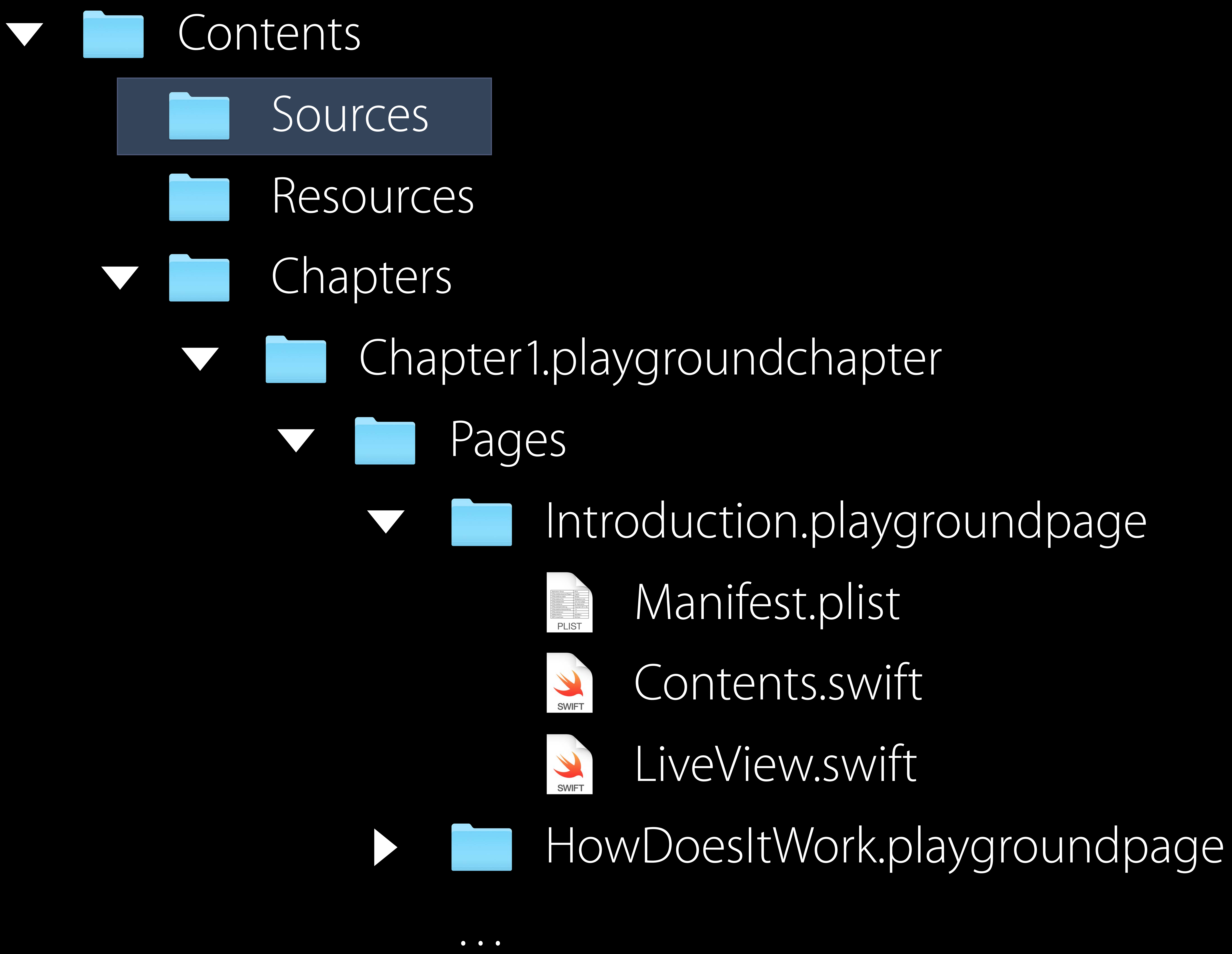

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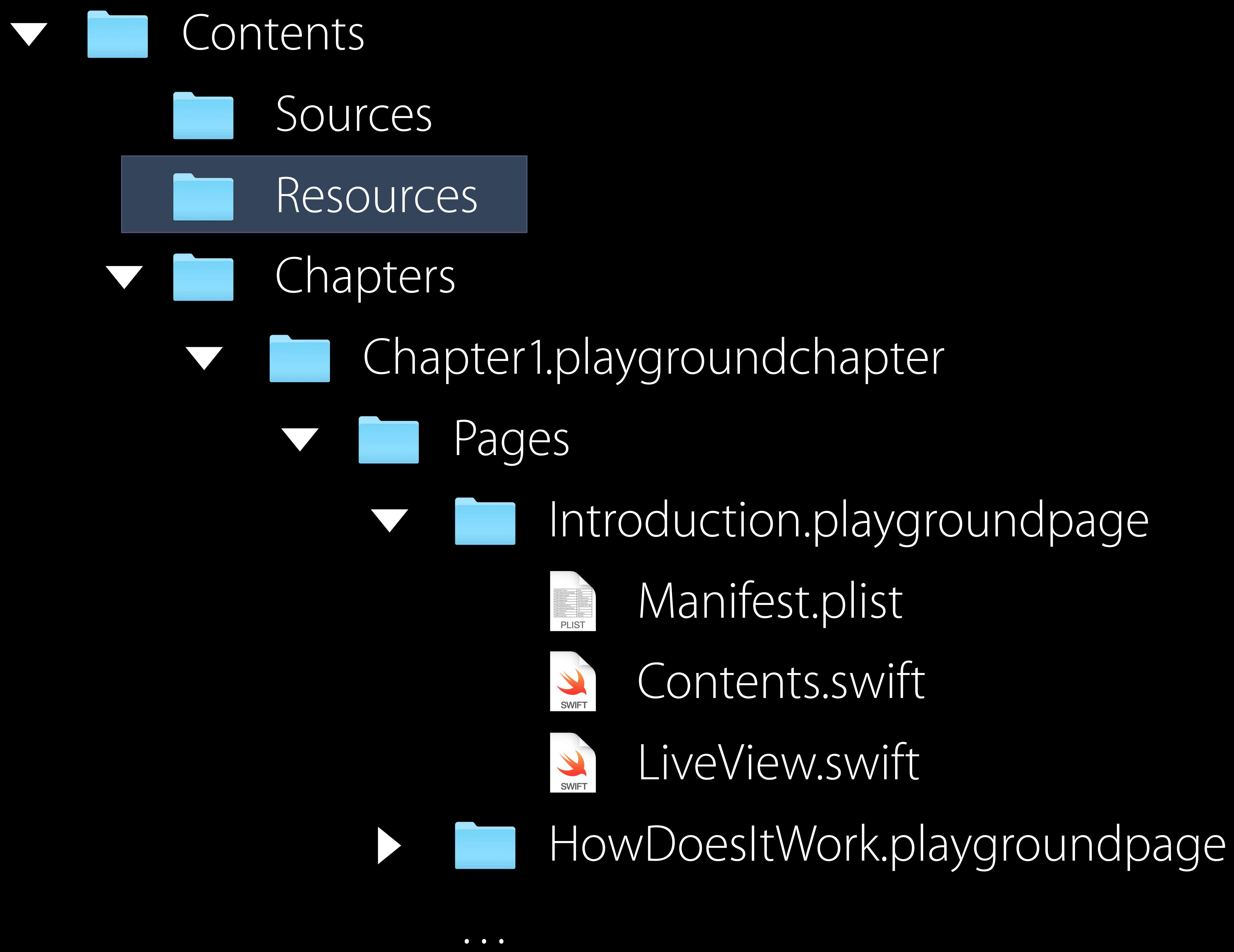

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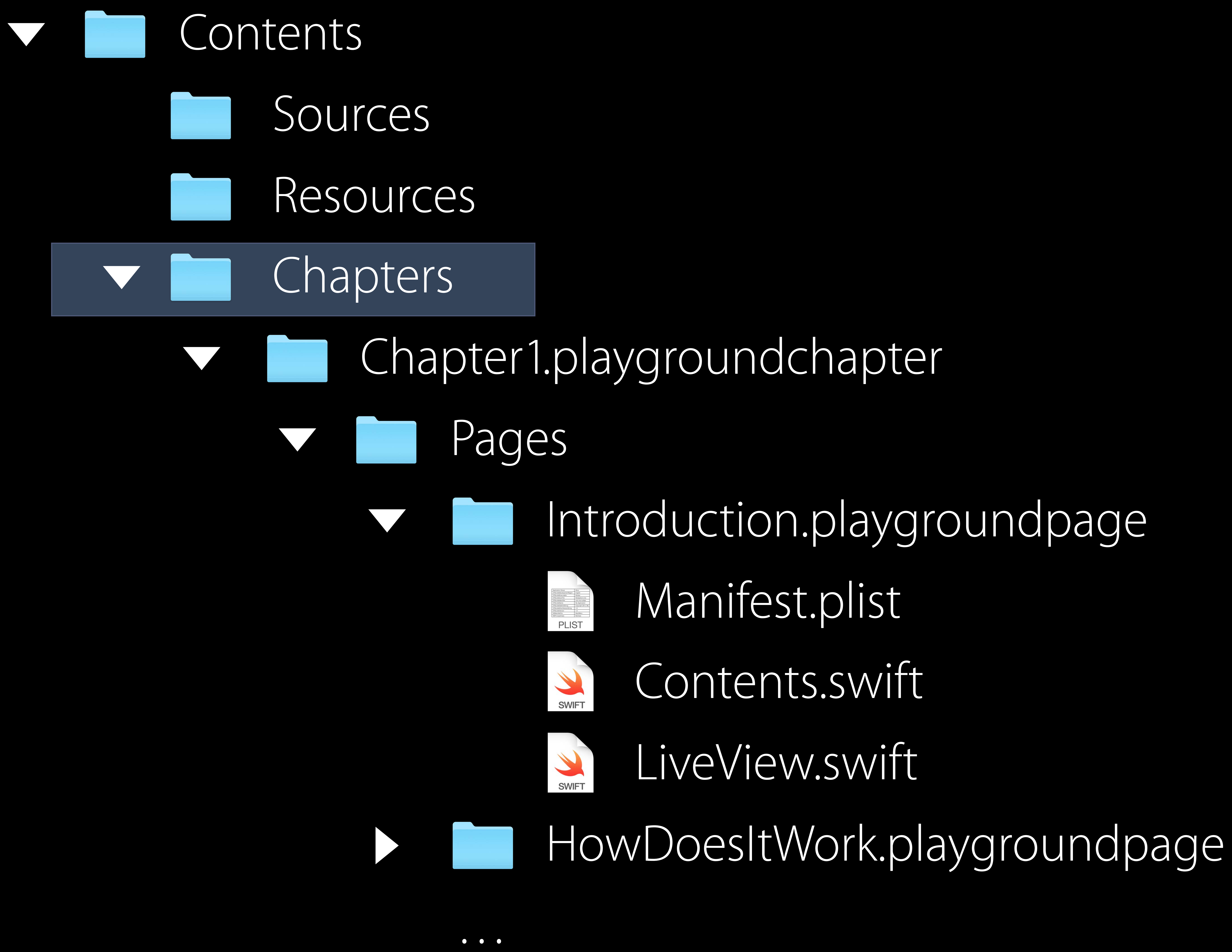

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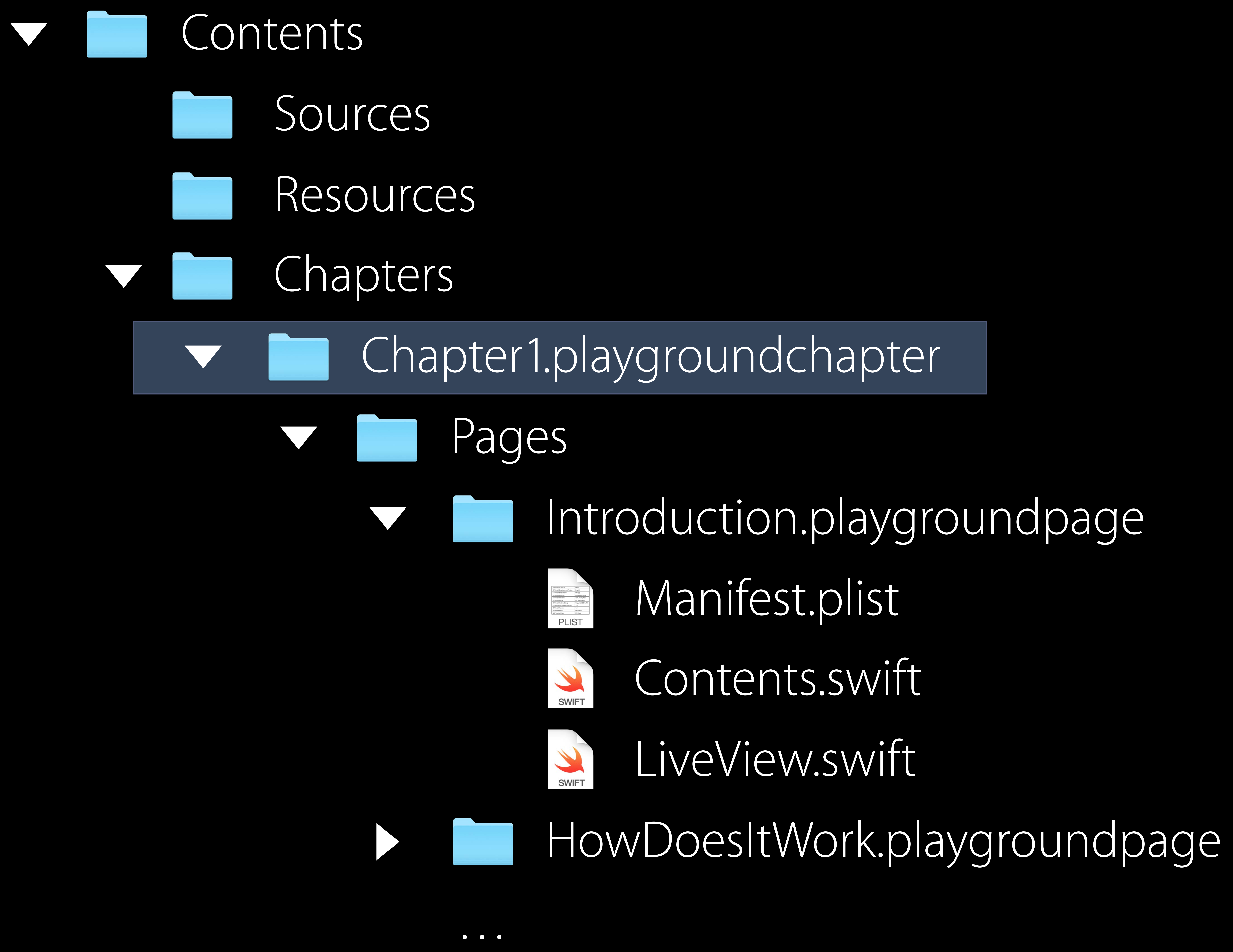

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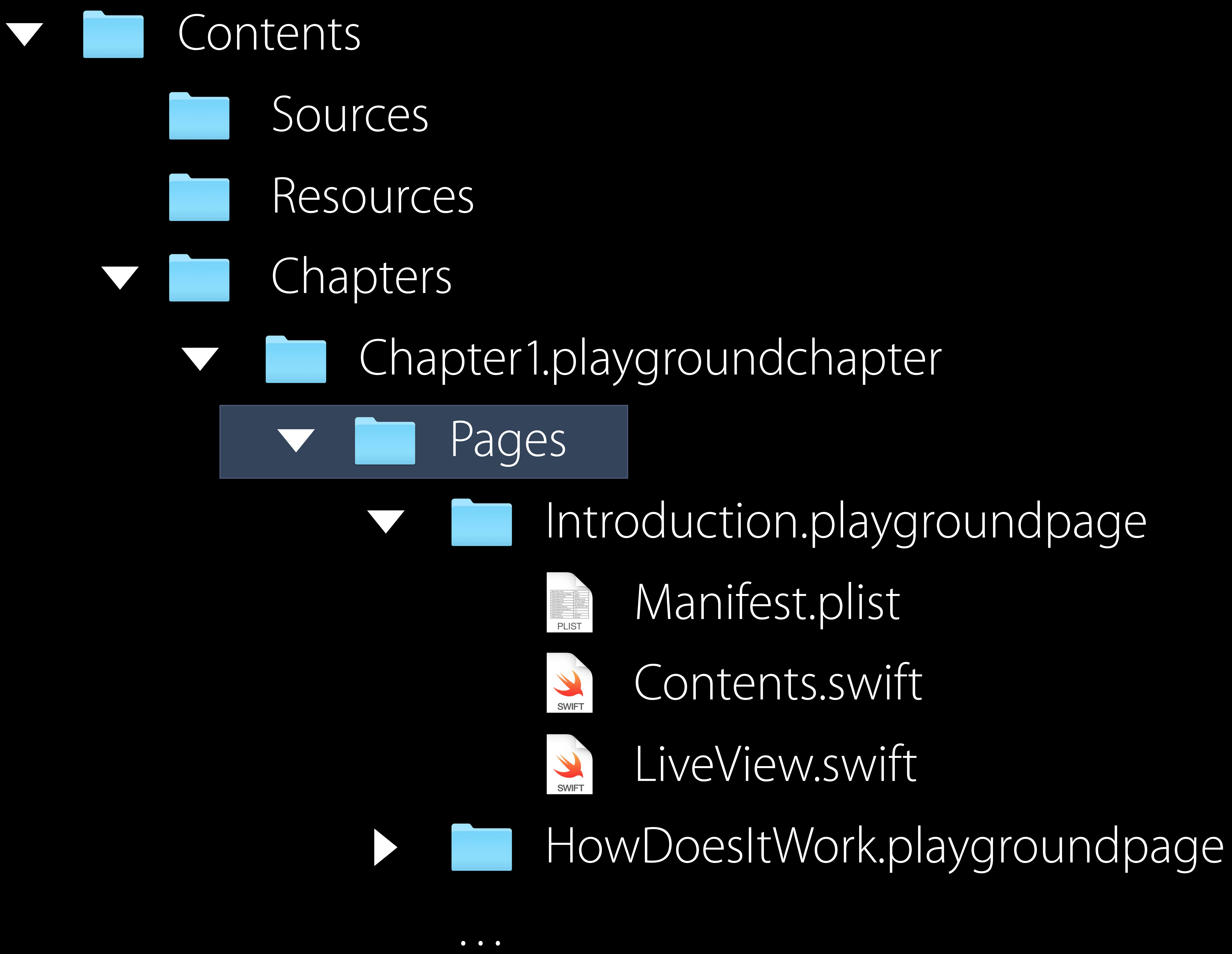

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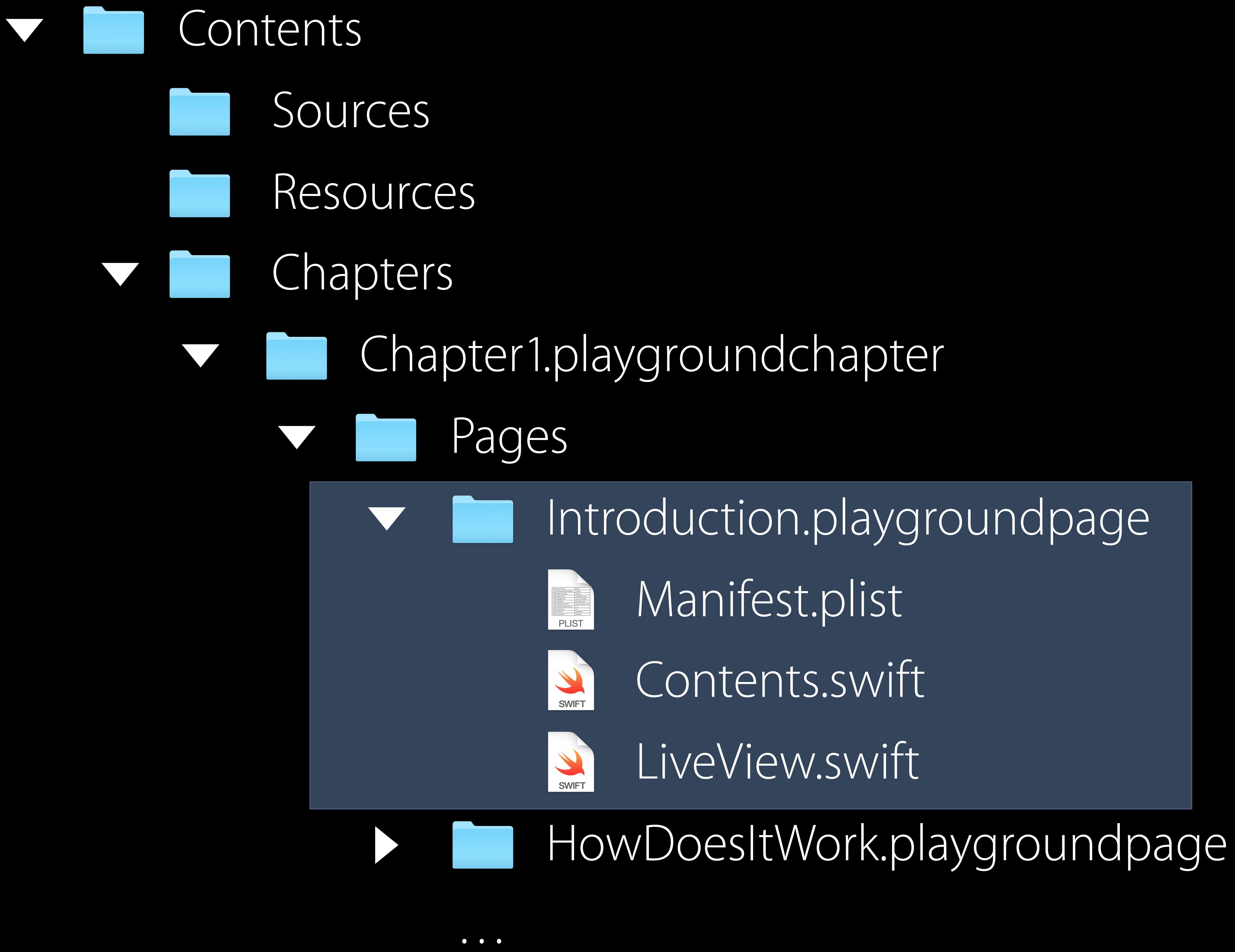

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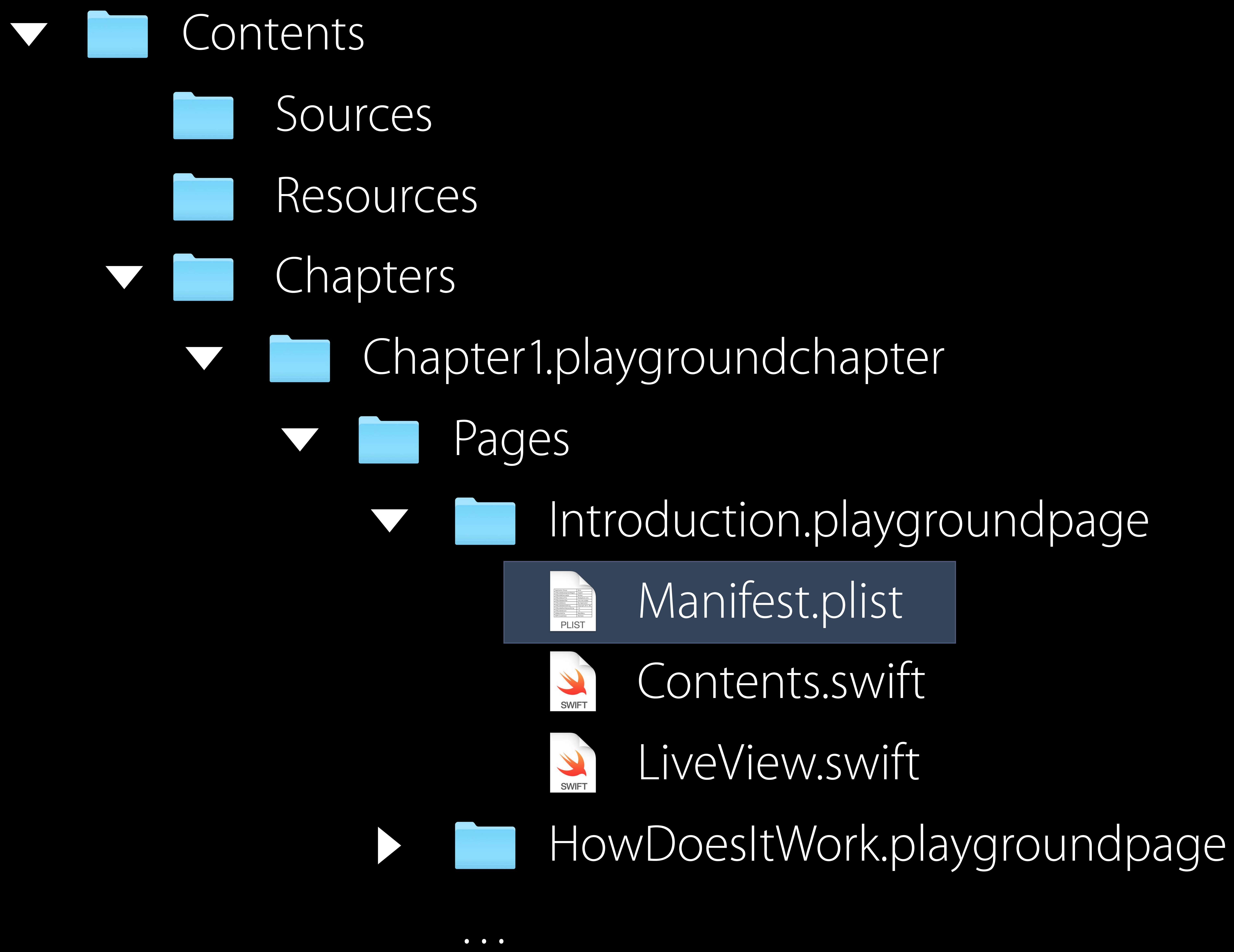

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```

Page Manifest

Key	Type	Value
▼ Root	Dictionary	
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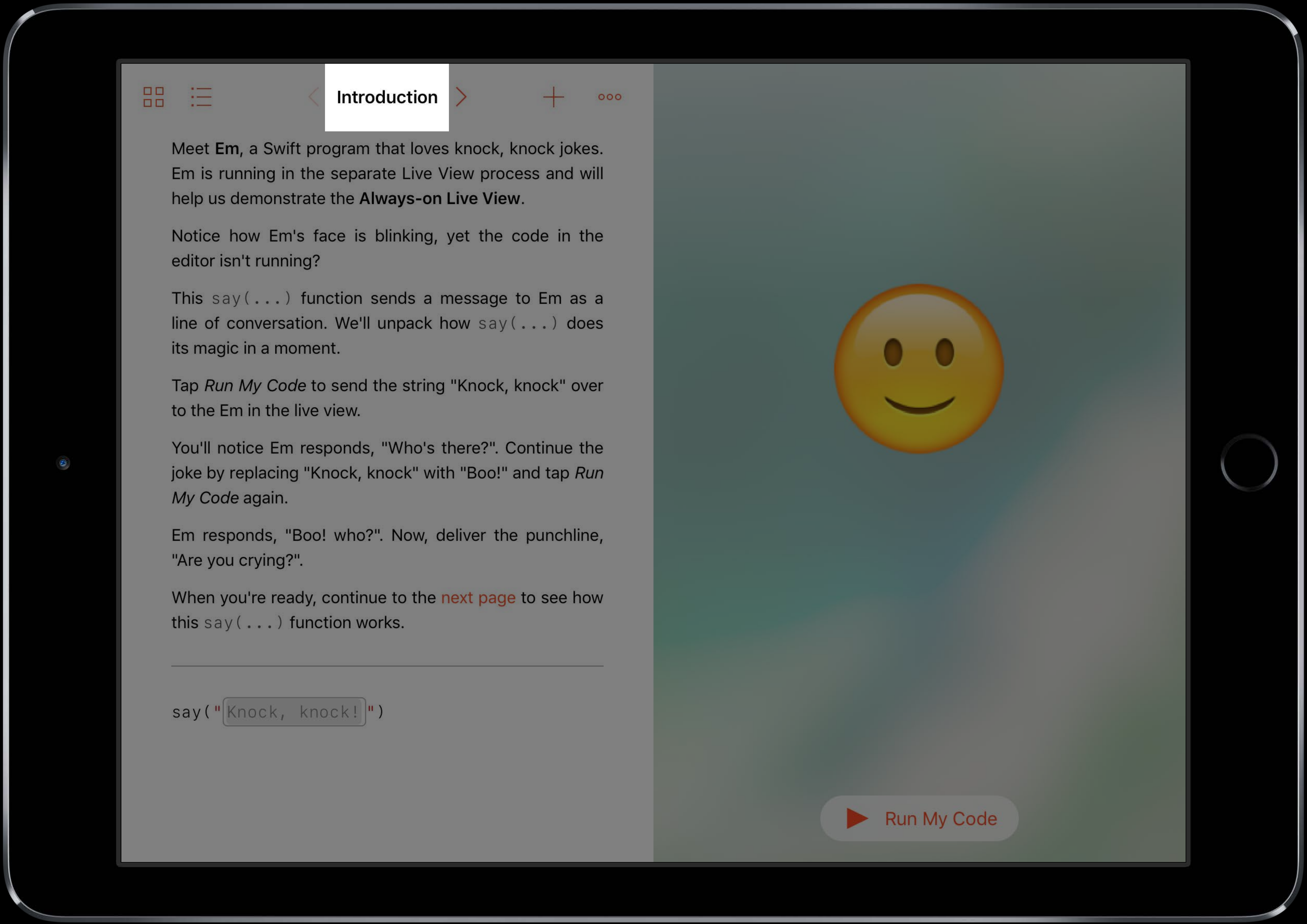
LiveViewMode	String	VisibleByDefault
PosterReference	String	LiveViewPoster.png
LiveViewEdgeToEdge	Boolean	YES
PlaygroundLoggingMode	String	Off



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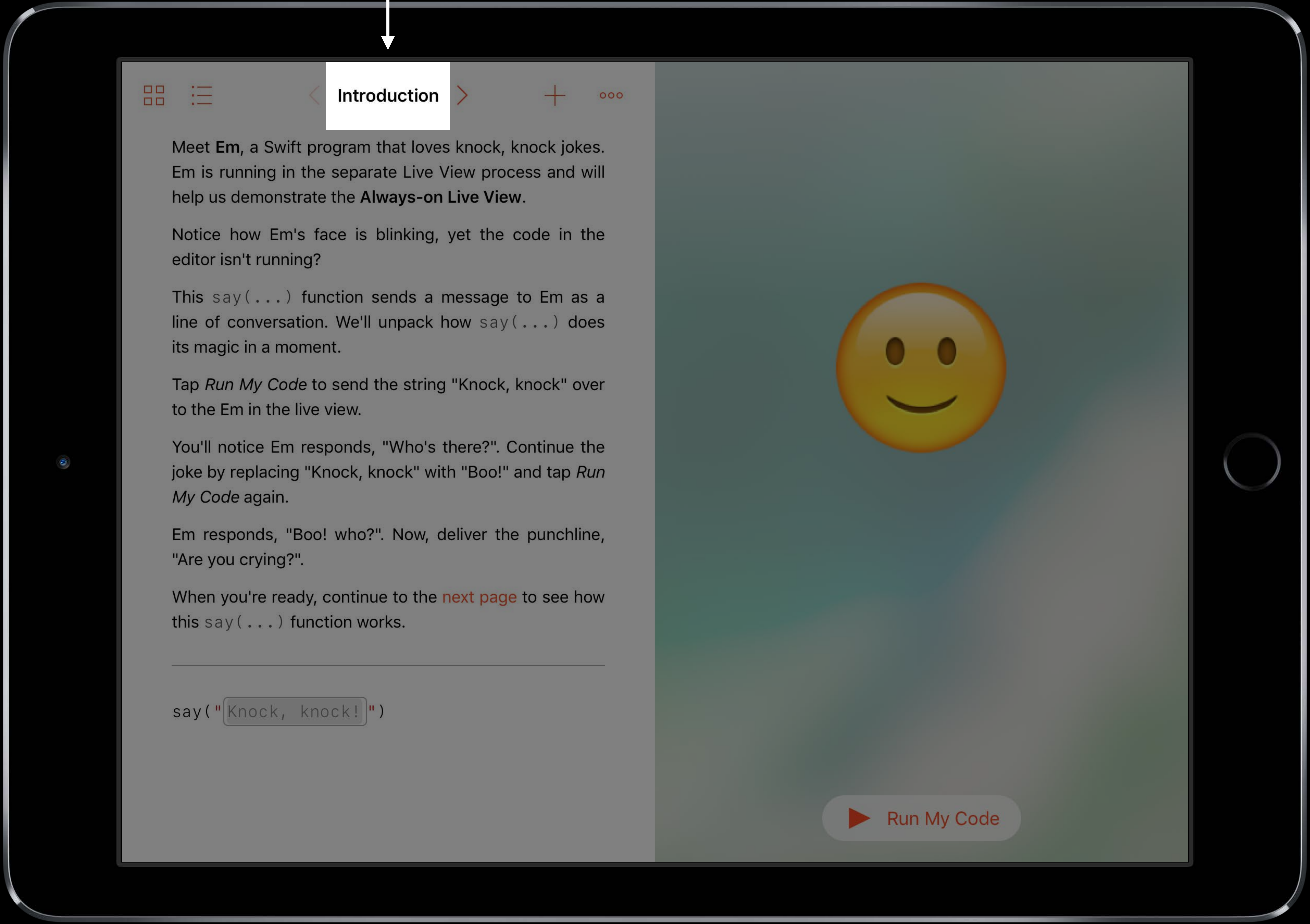
Name = "Introduction"



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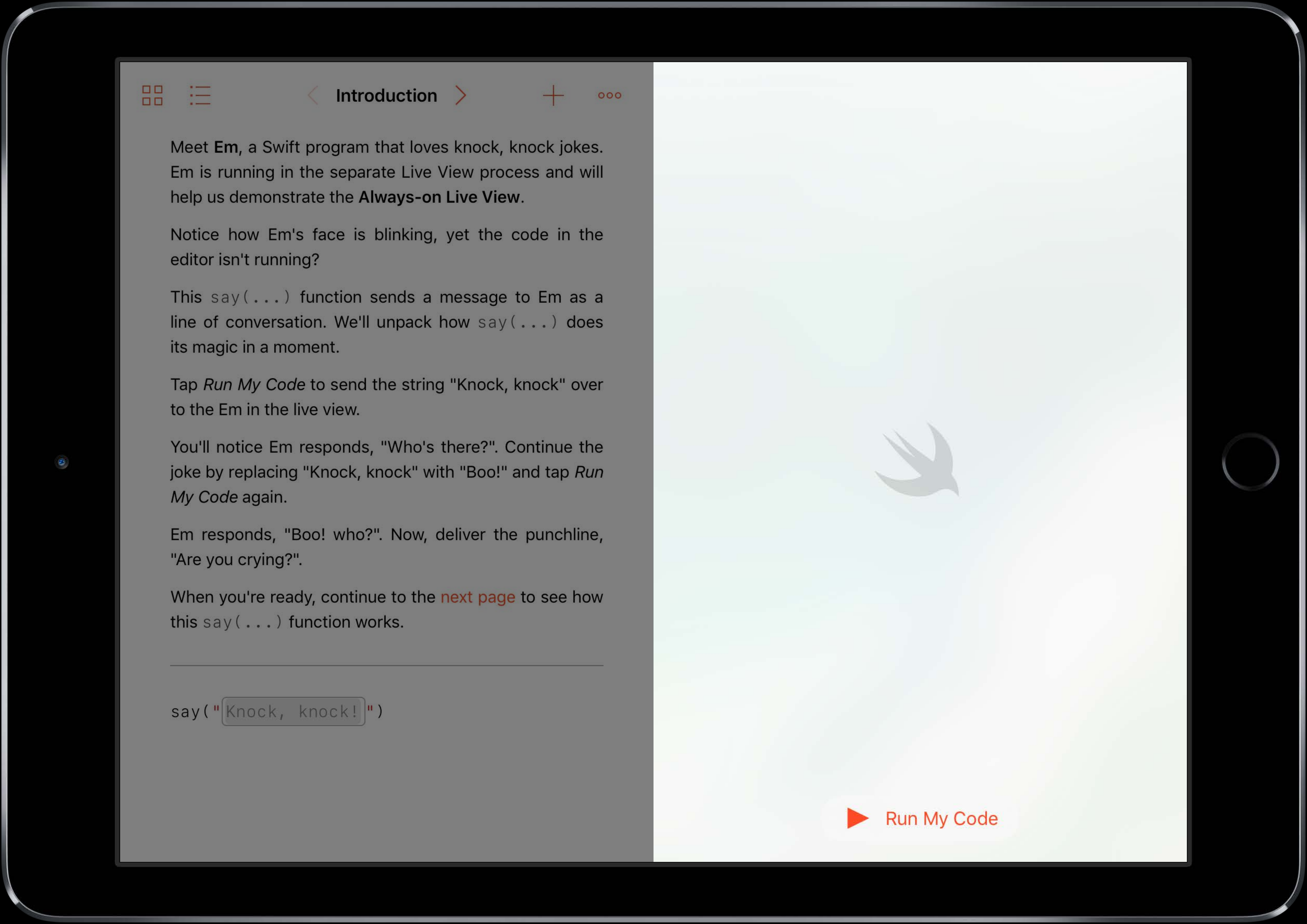

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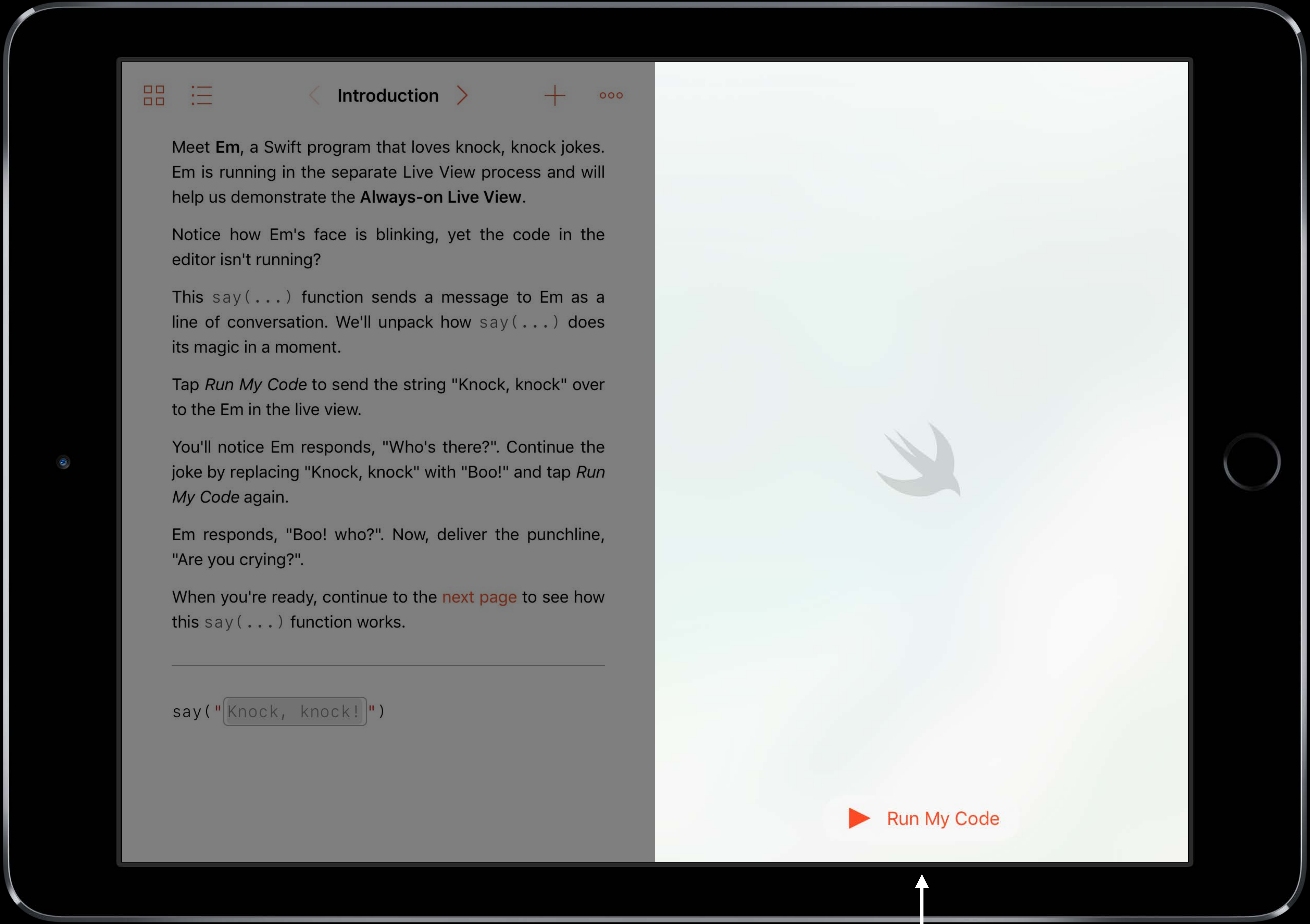

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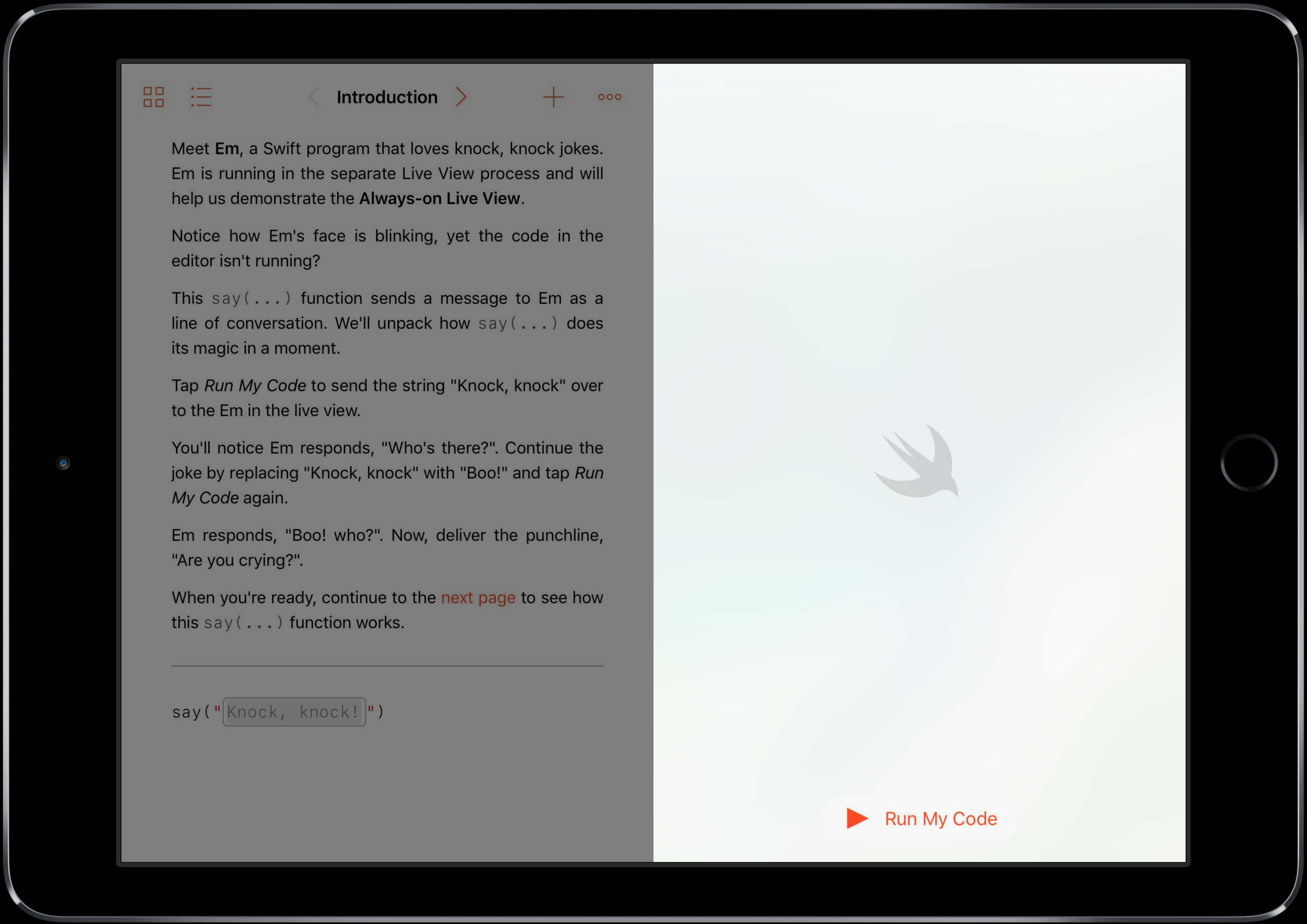

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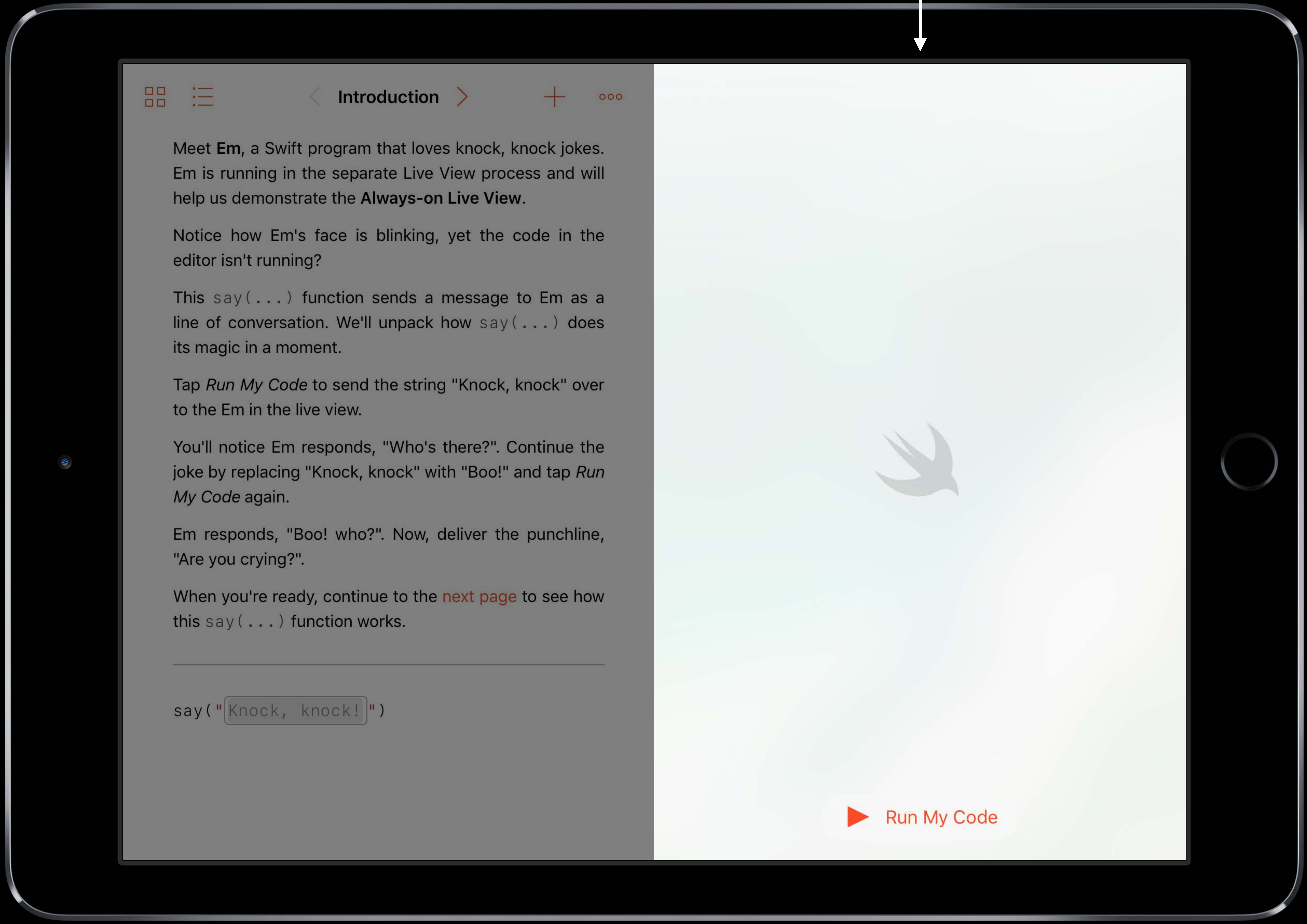

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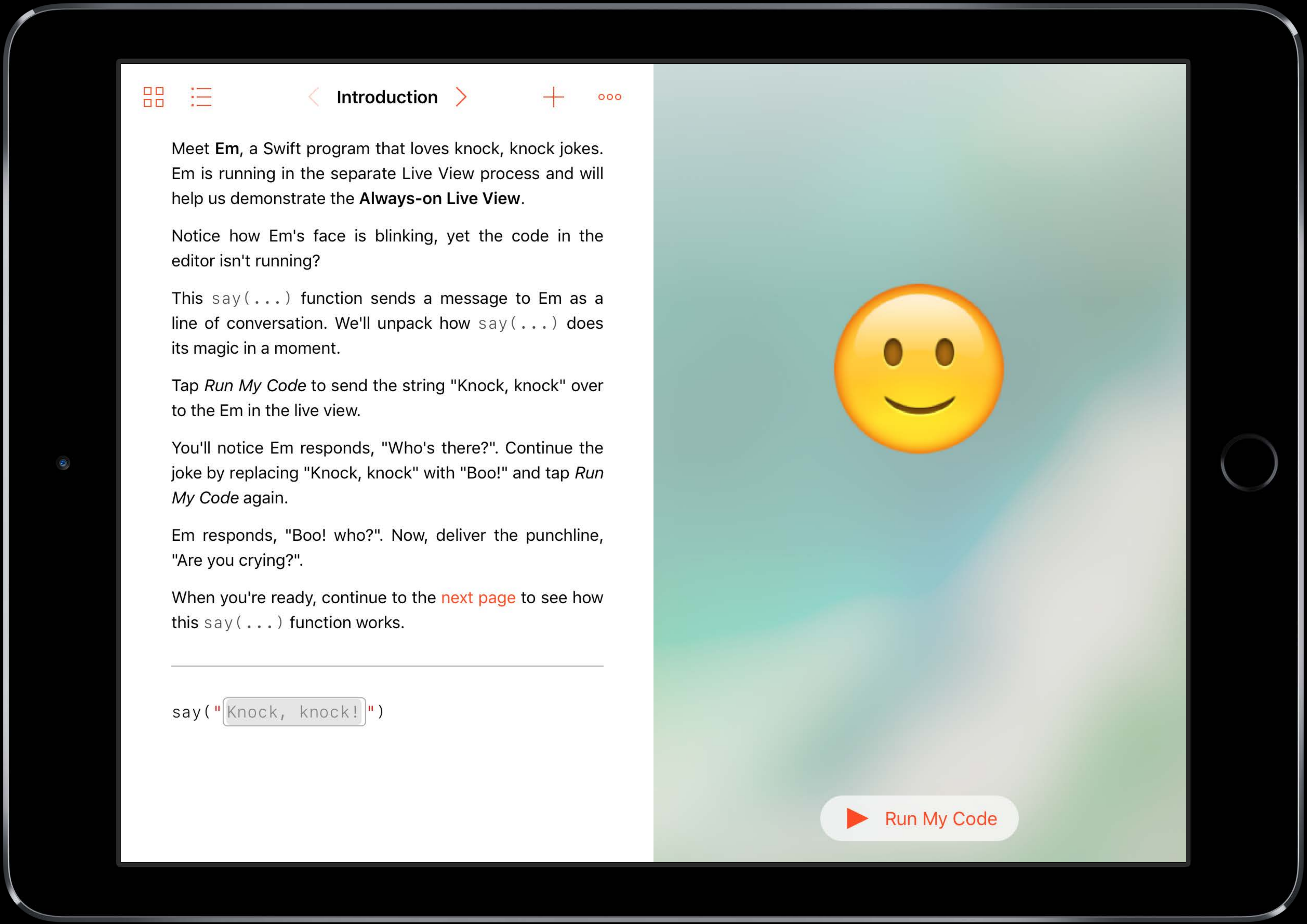

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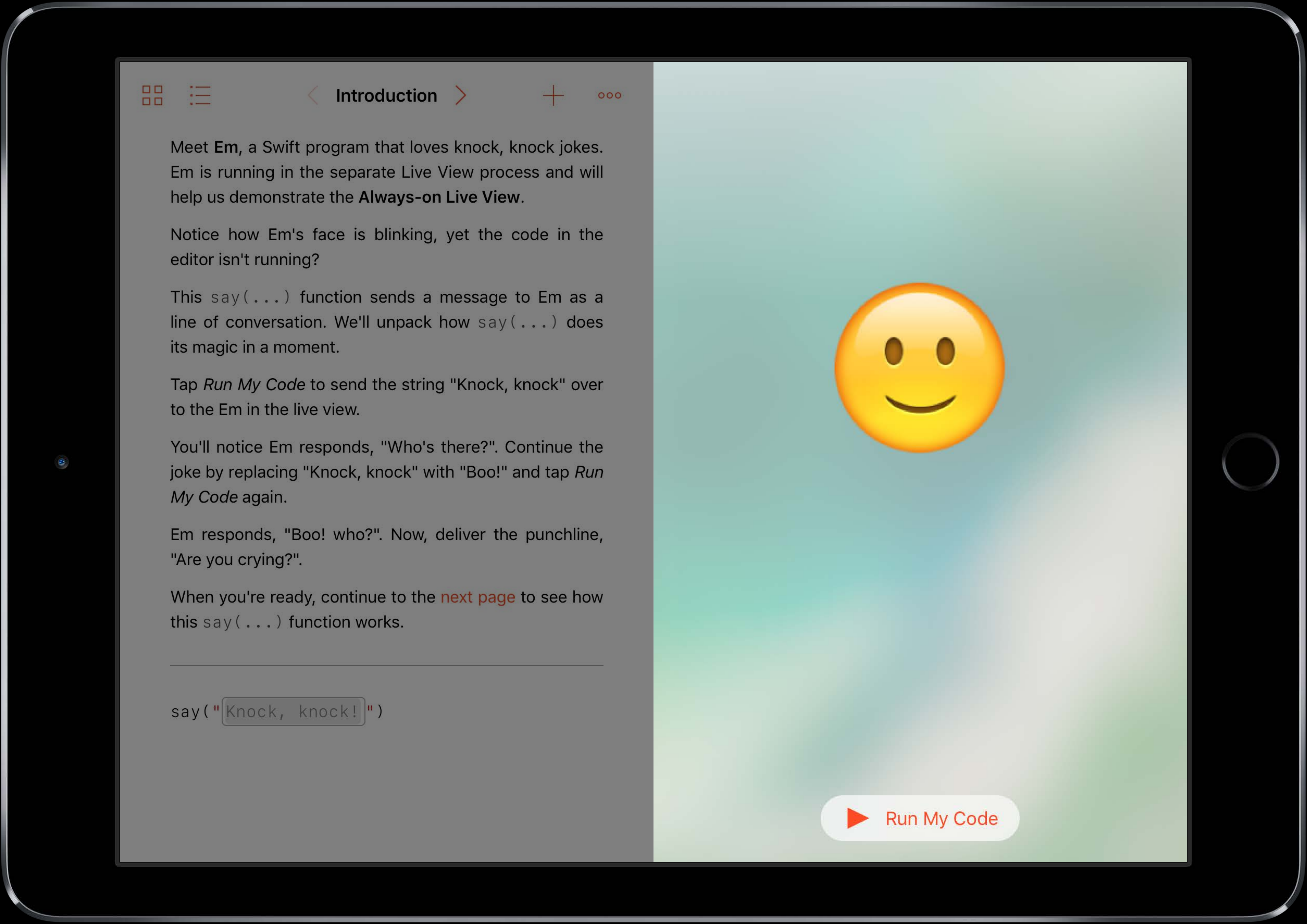

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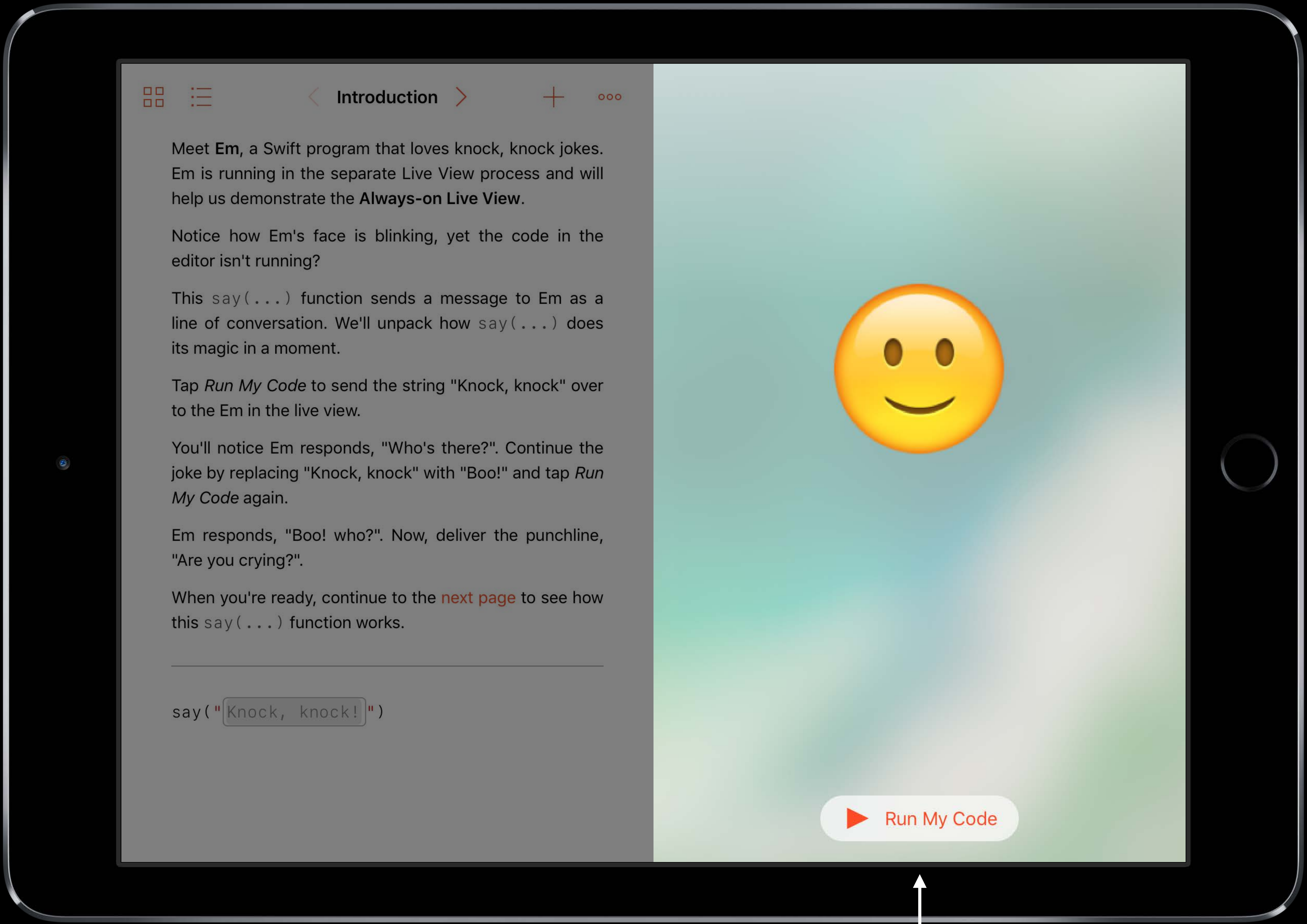

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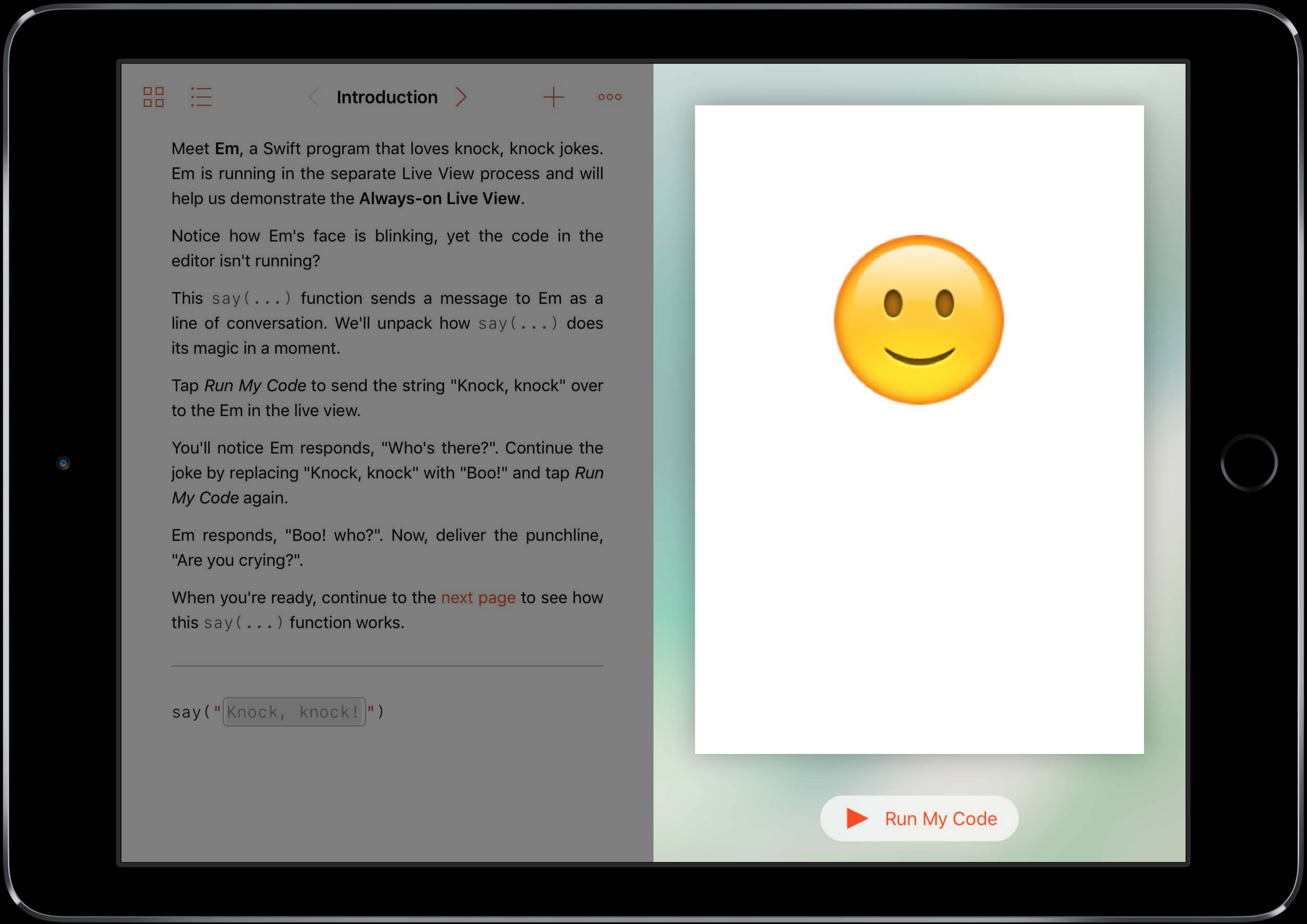

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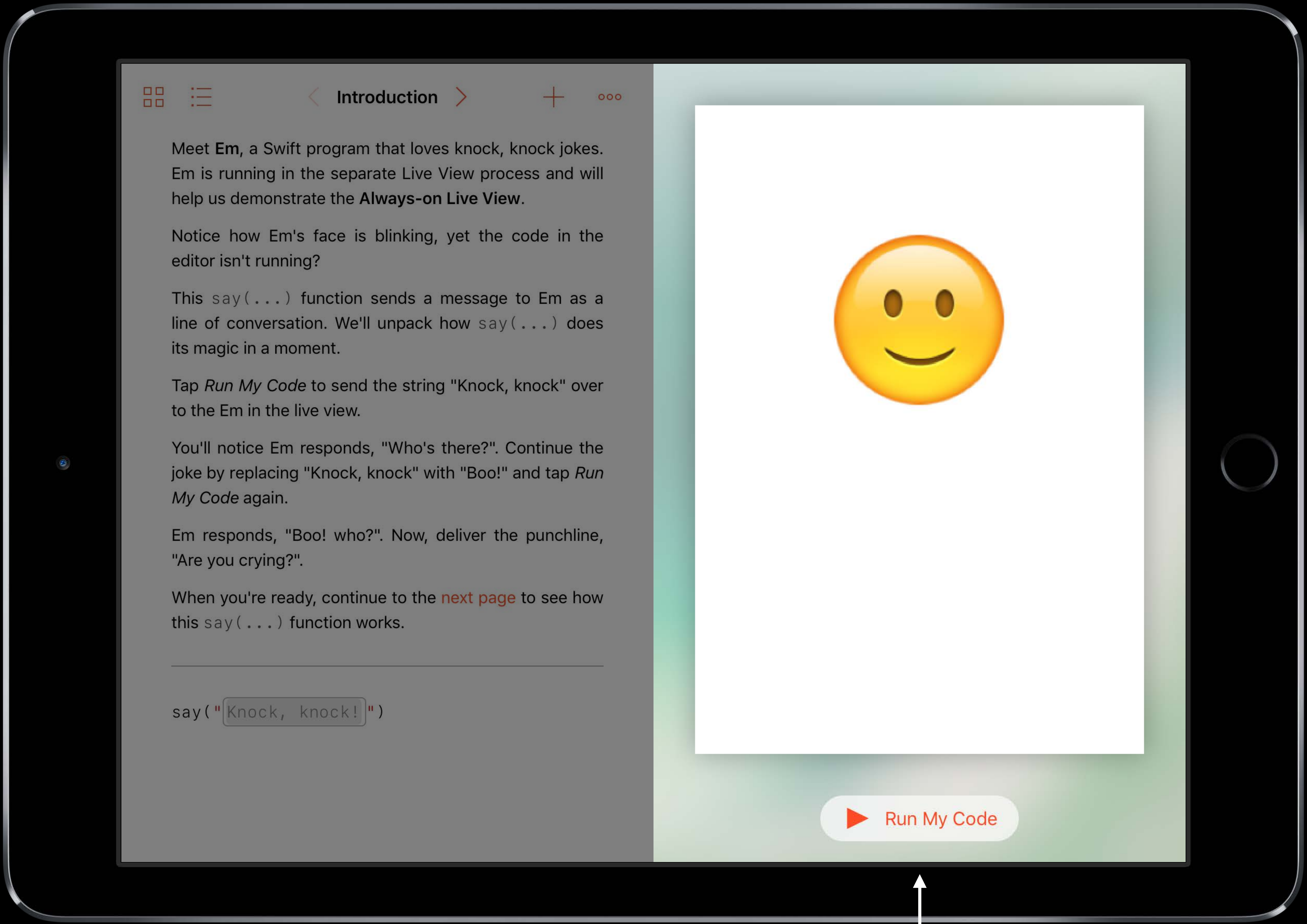

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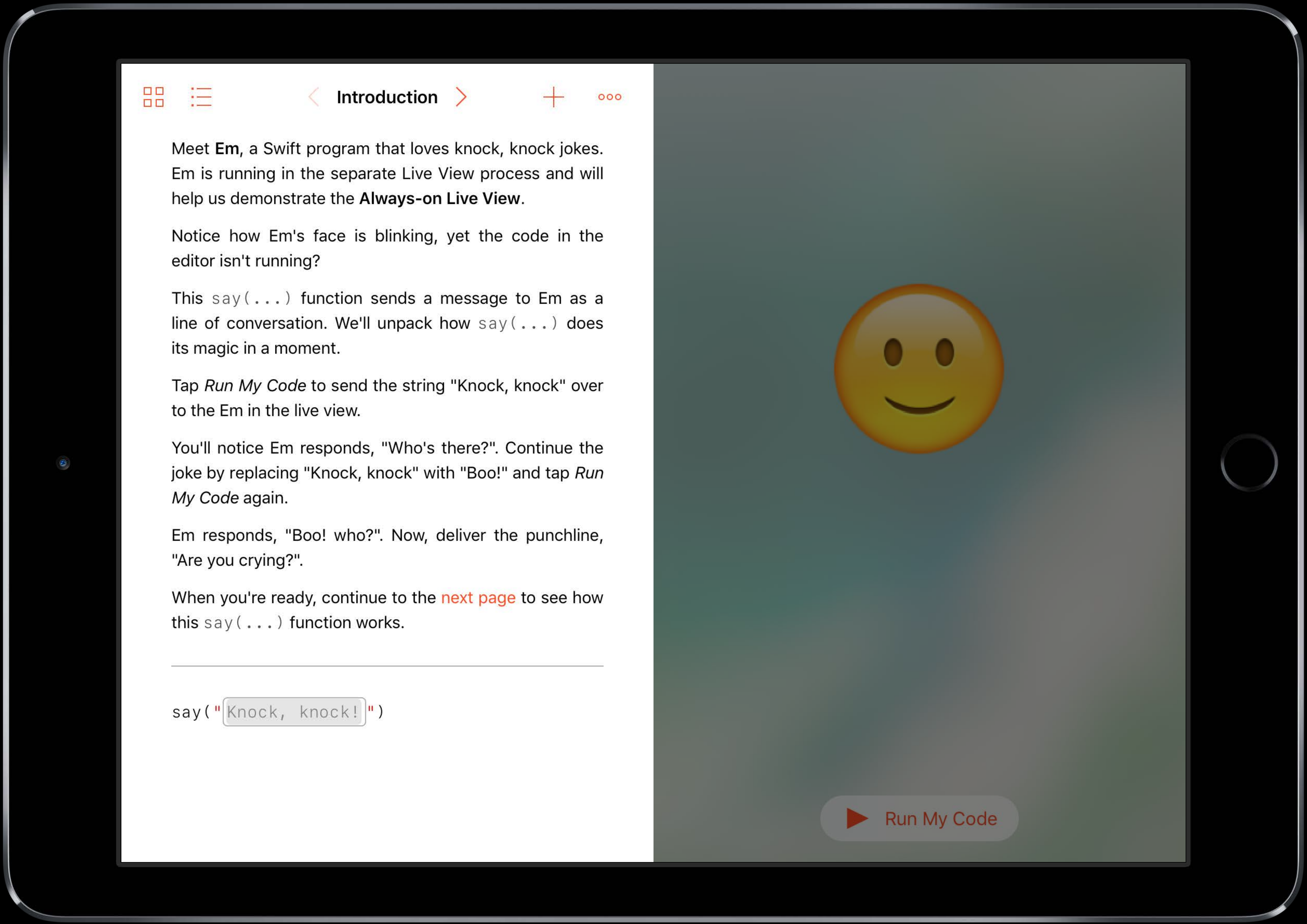

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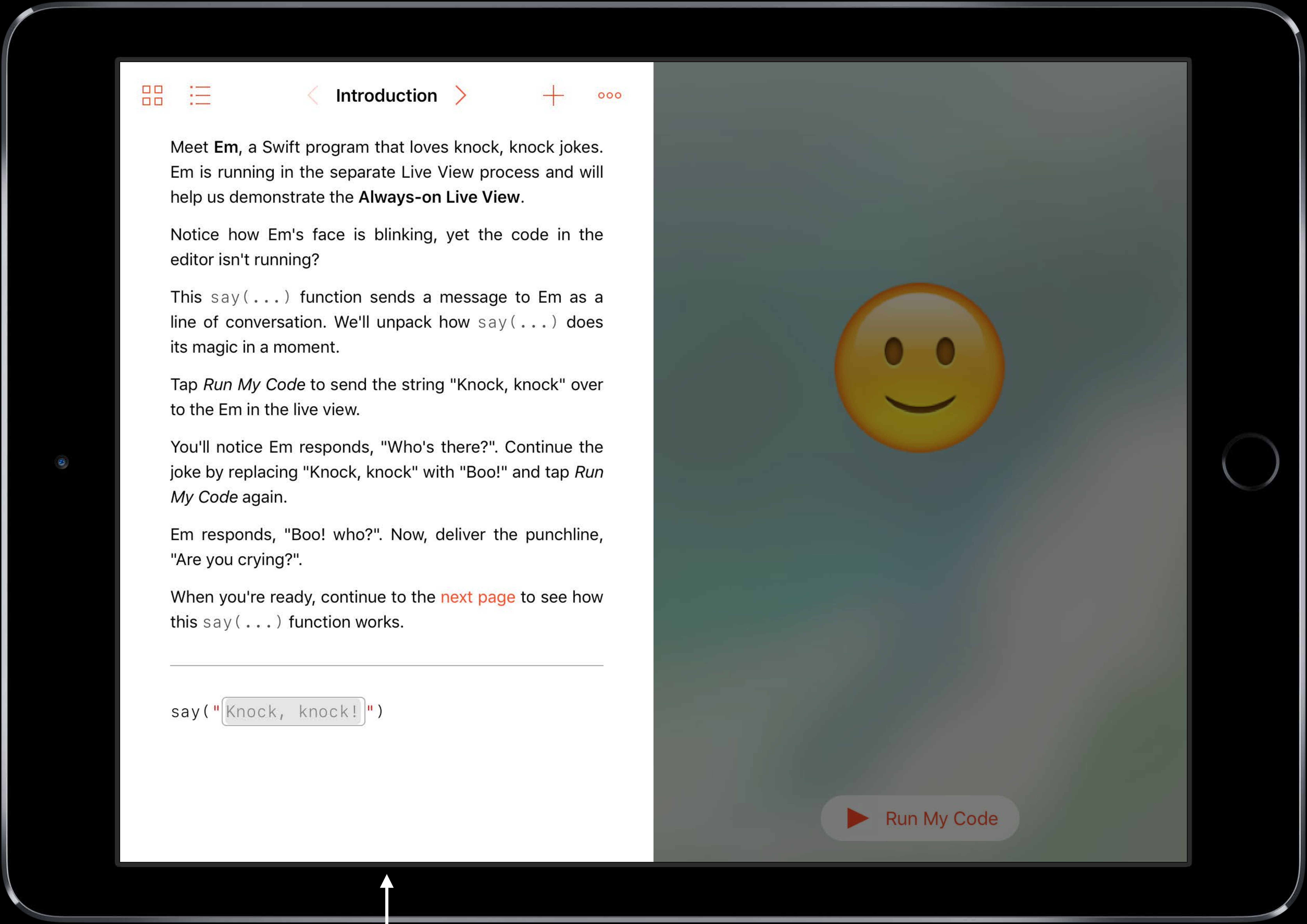

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PlaygroundLoggingMode = "Off"

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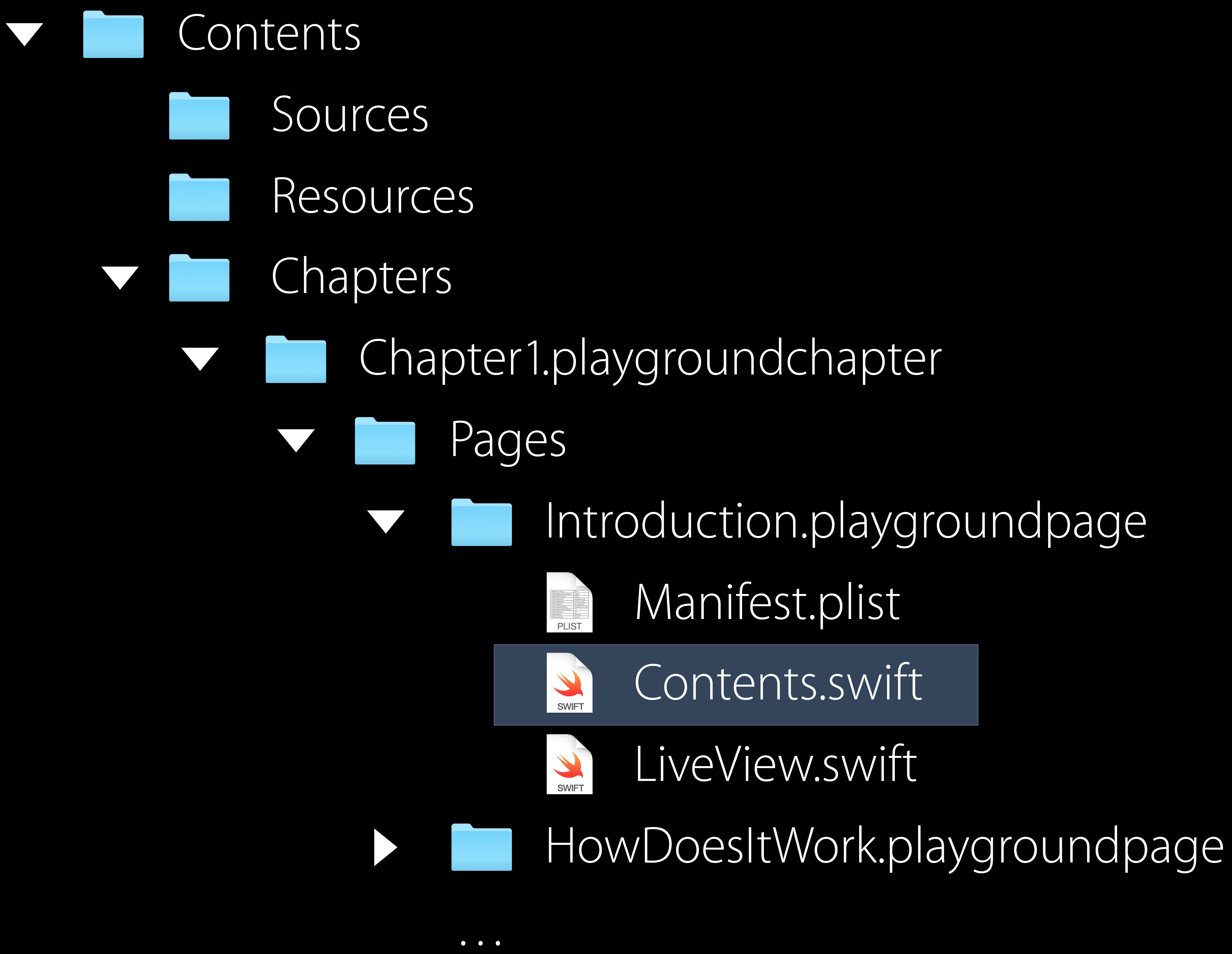

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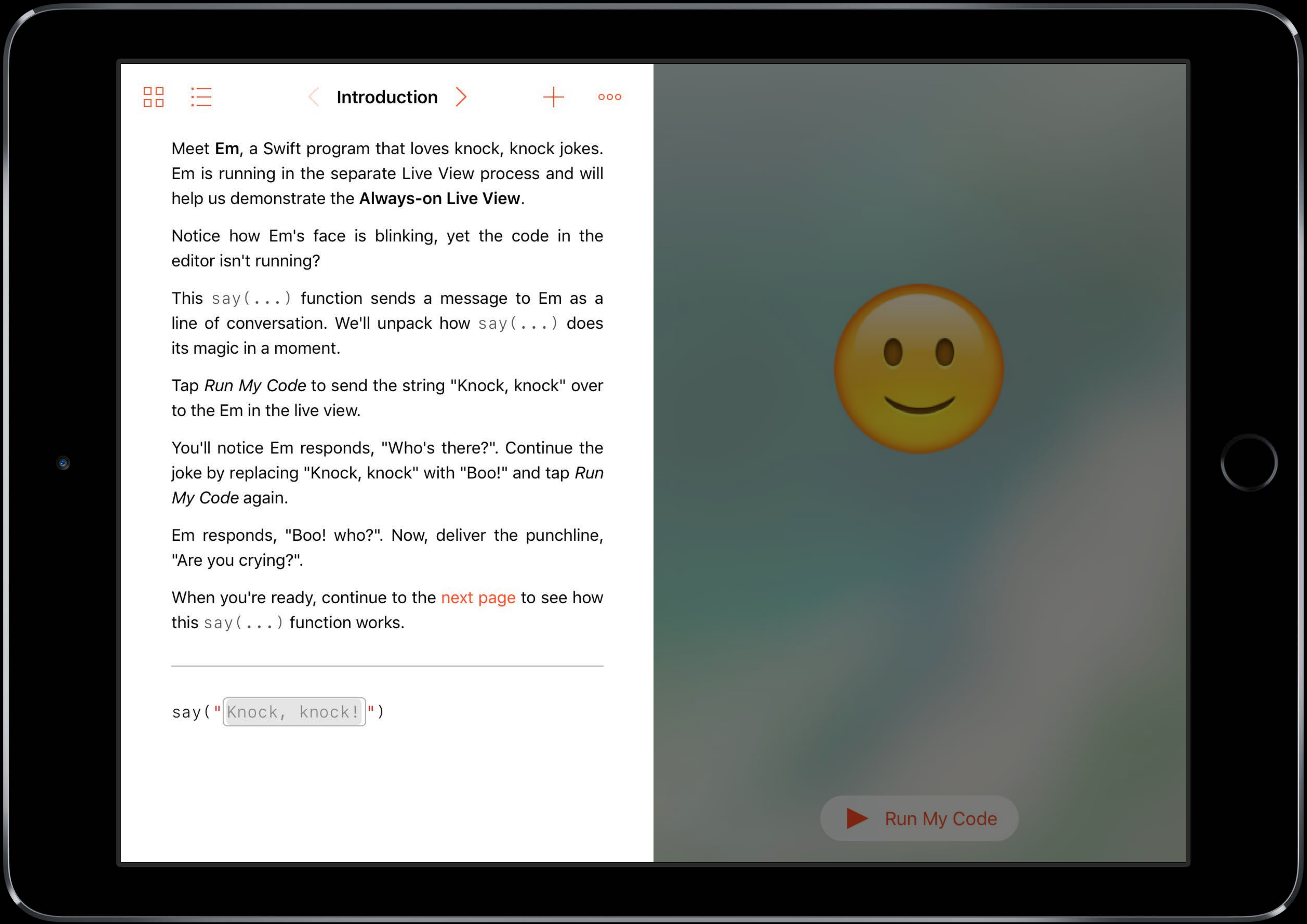

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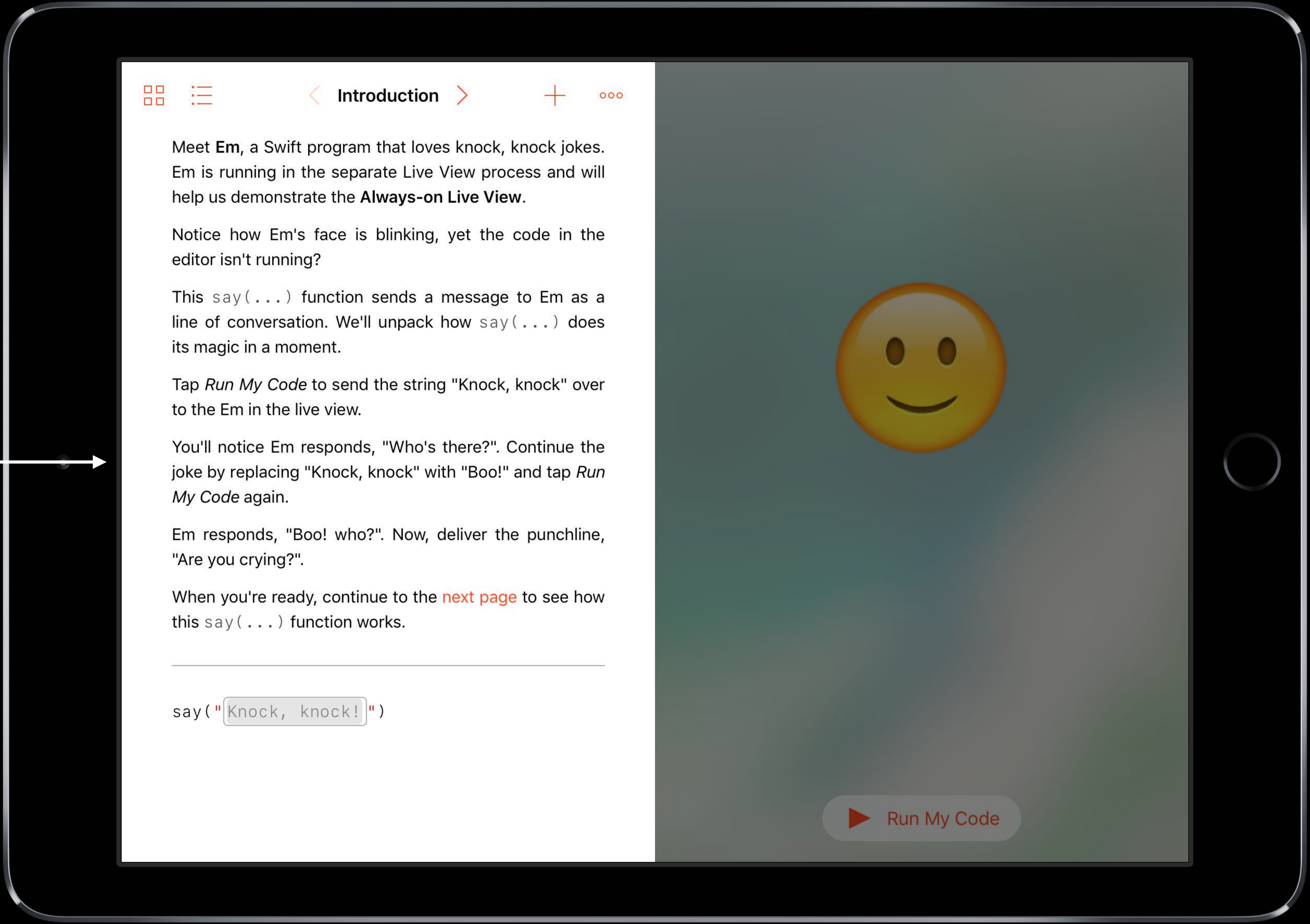
Contents.swift



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say("Knock, knock!")
```

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// Contents.swift

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 Instructions about the page...
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import PlaygroundSupport
func say(_ message: String) {
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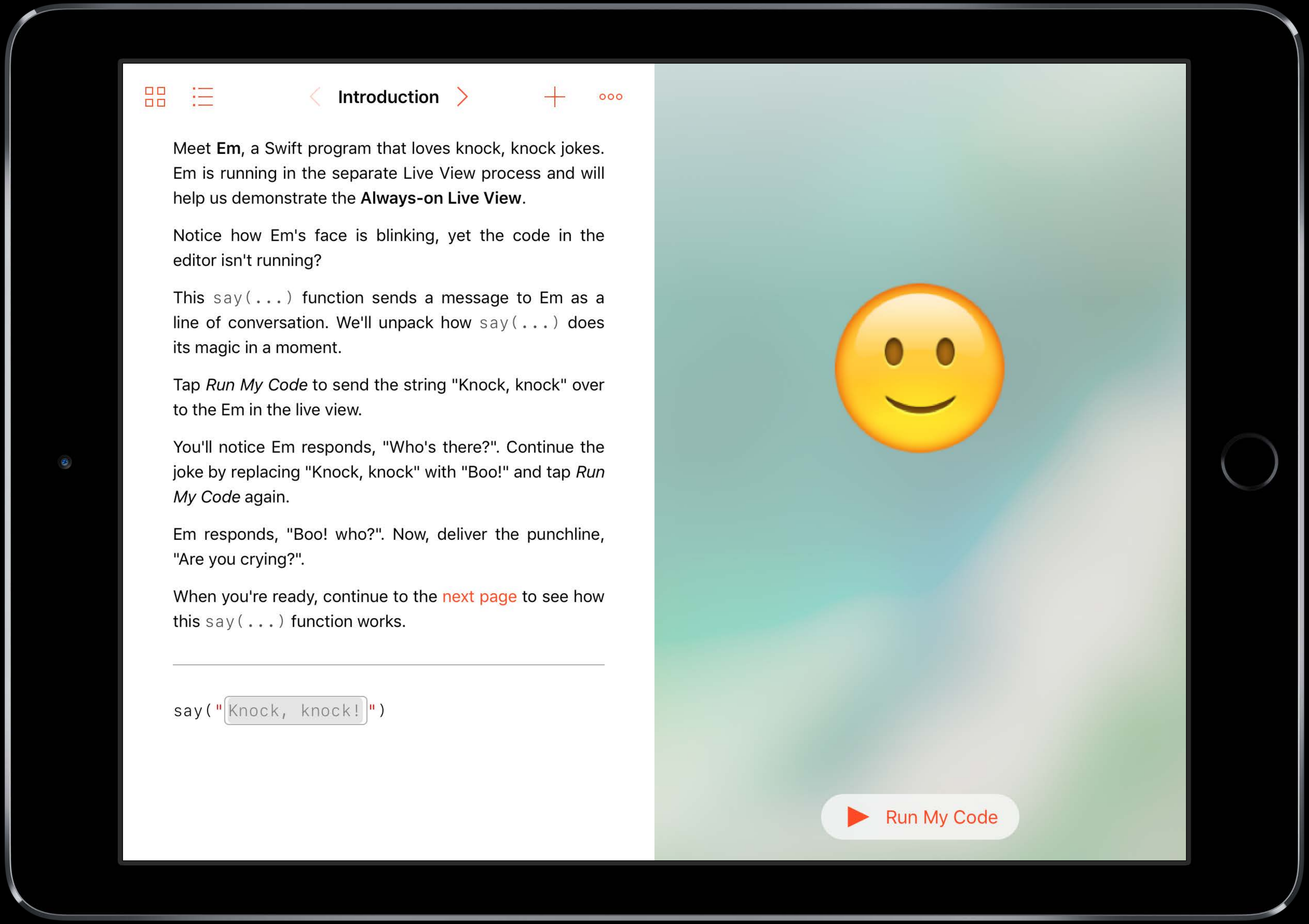

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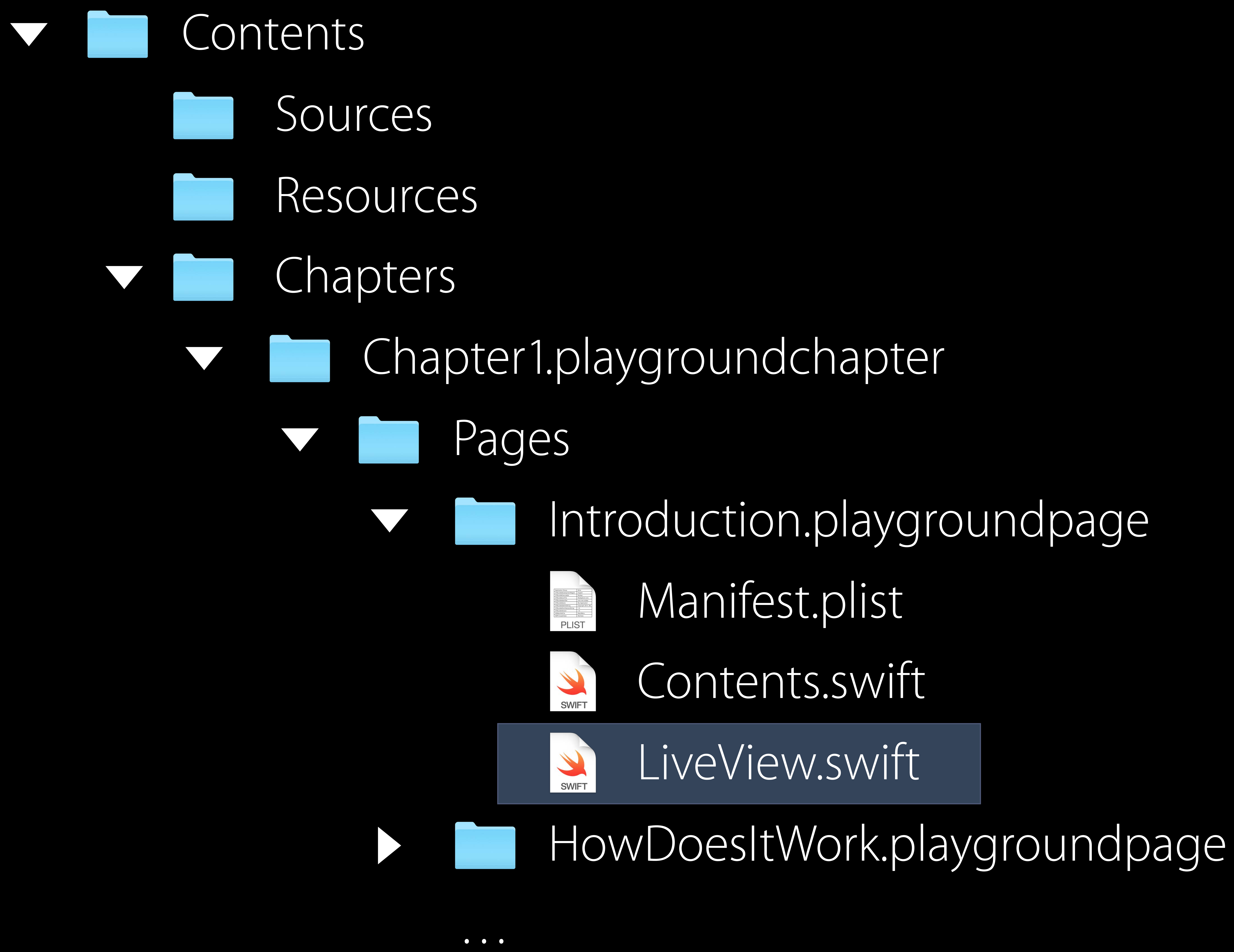

```
Contents
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    Chapters
        Chapter1.playgroundchapter
            Pages
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                    Manifest.plist
                    Contents.swift
                    LiveView.swift
                HowDoesItWork.playgroundpage
                ...
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// LiveView.swift

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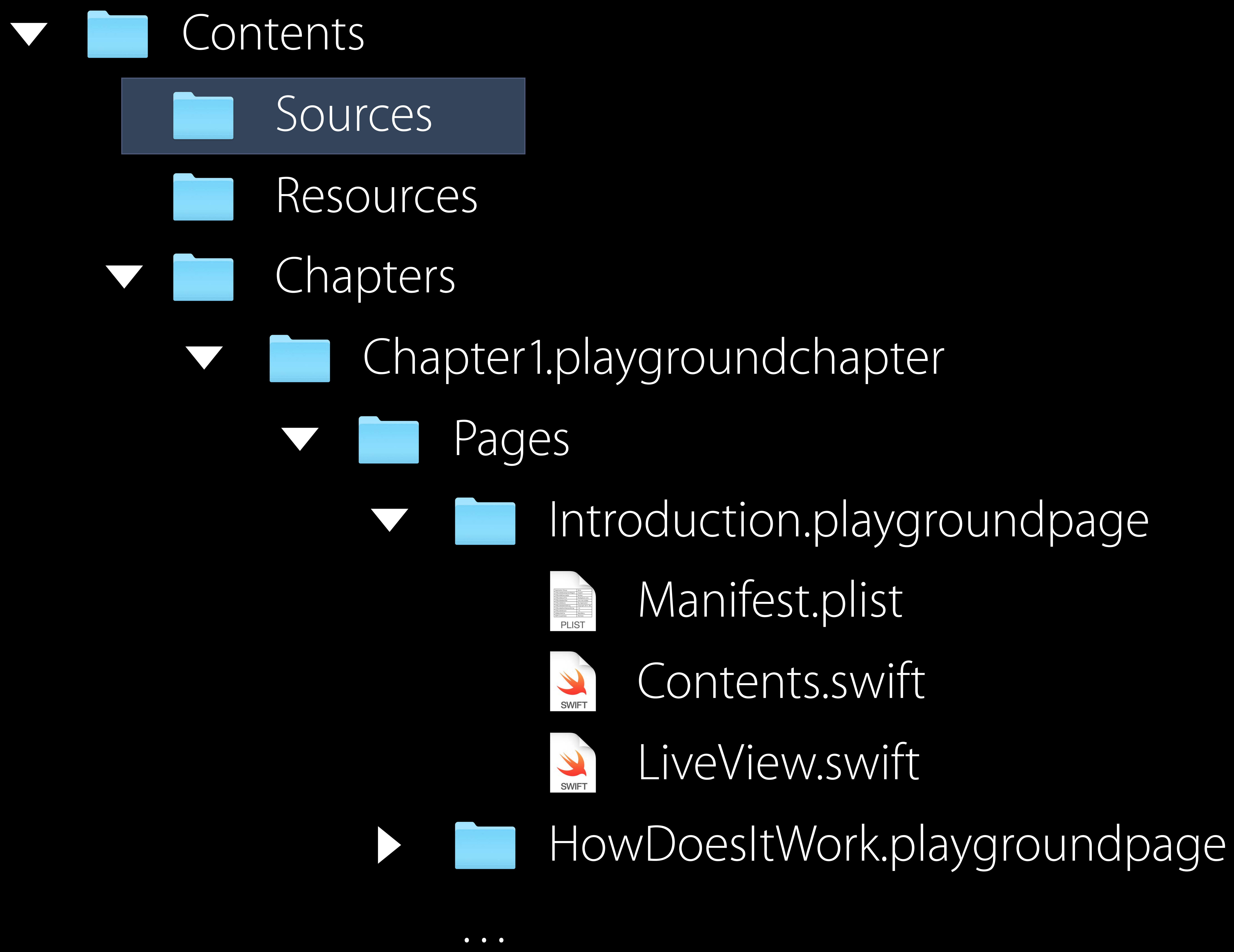

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Separate process

Contents.swift

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In main process

Only active while running

LiveView.swift

```swift
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let page = PlaygroundPage.current
page.liveView = FaceViewController()
```

Separate process

Running all the time

Main Process (Contents.swift)

```swift
import PlaygroundSupport
let page = PlaygroundPage.current
if let proxy = page.liveView as? PlaygroundRemoteLiveViewProxy {
    let message: PlaygroundValue = .string("Knock, knock!")
    proxy.send(message)
}
```

Main Process (Contents.swift)

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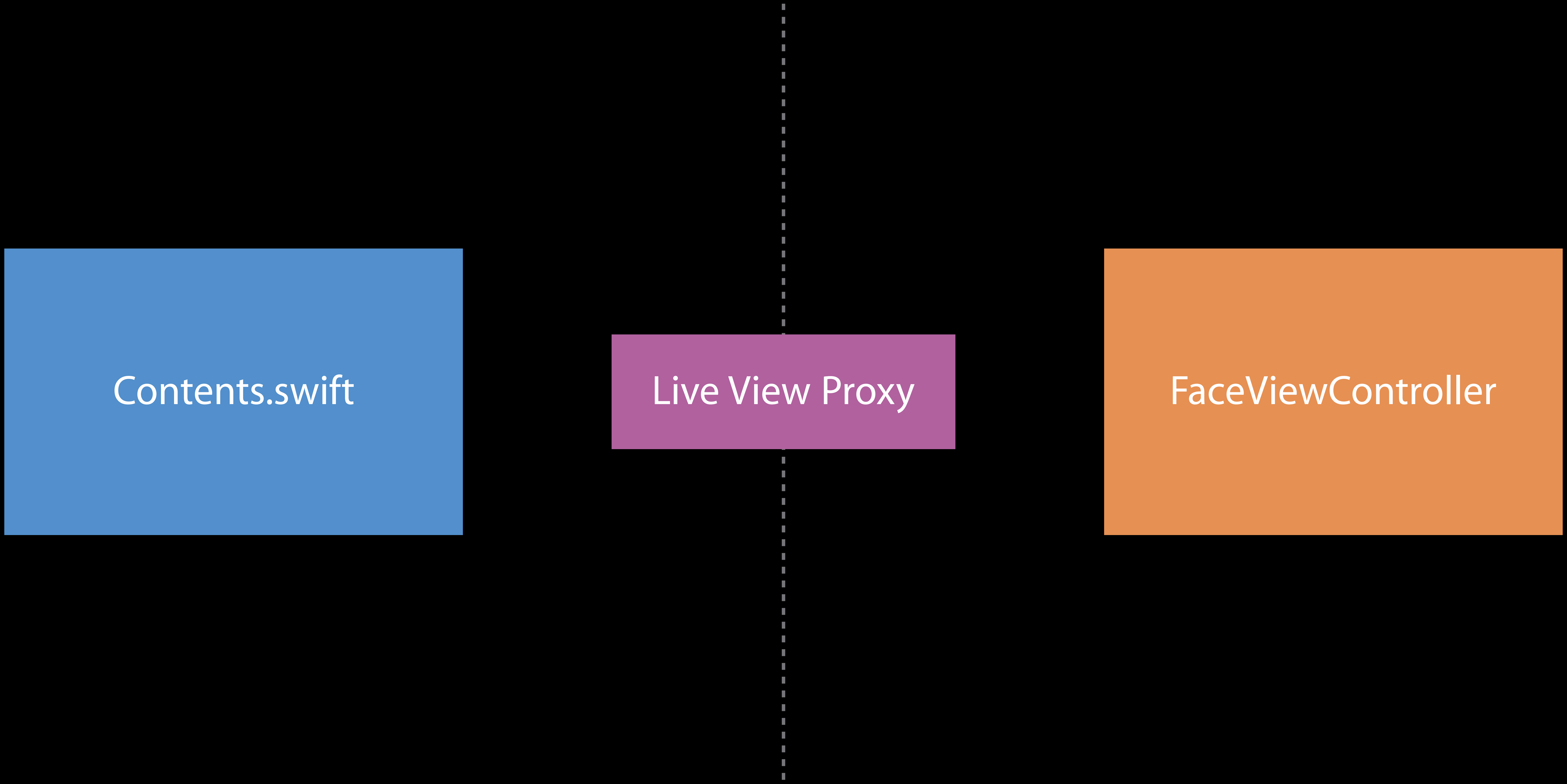

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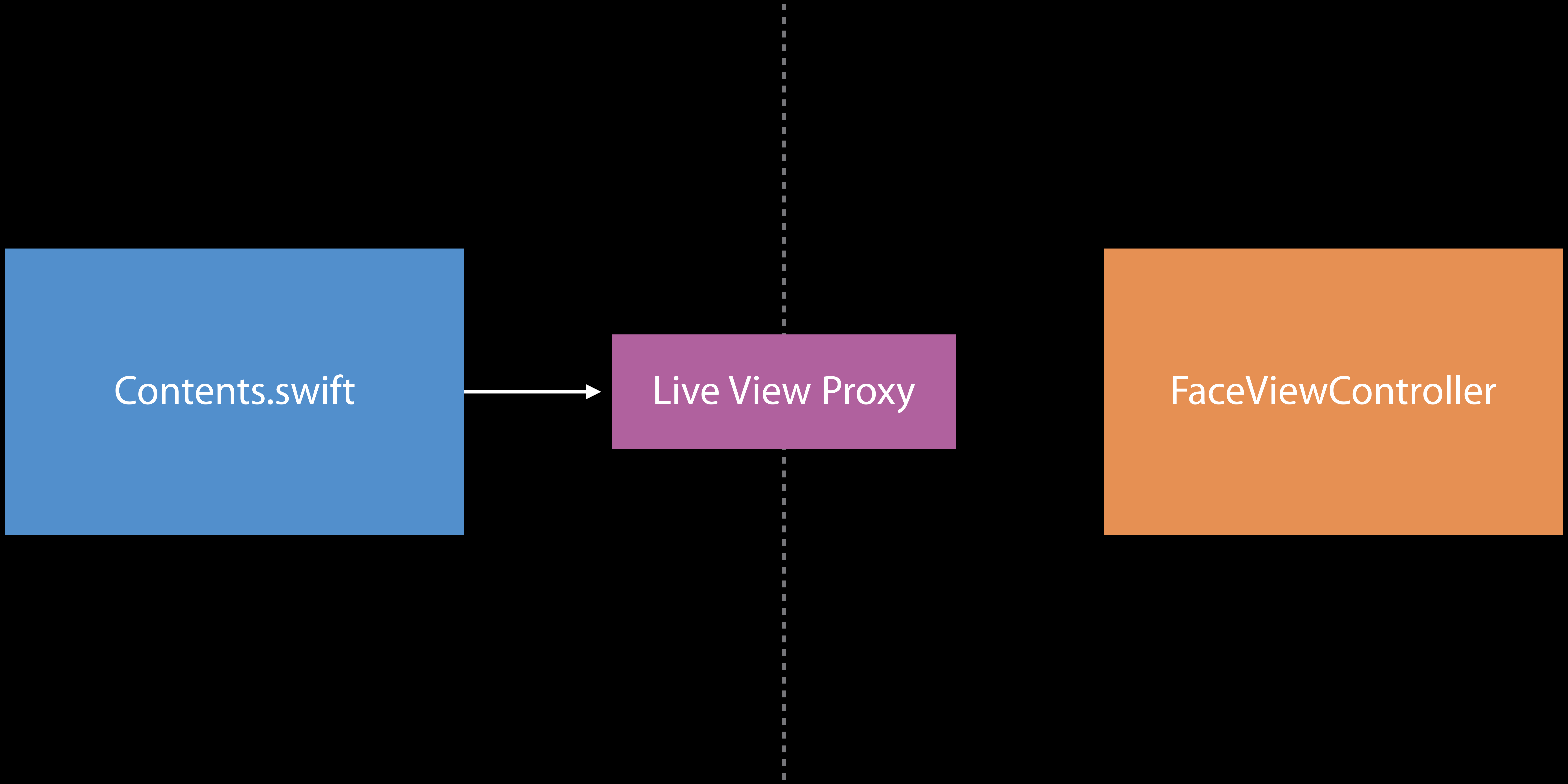

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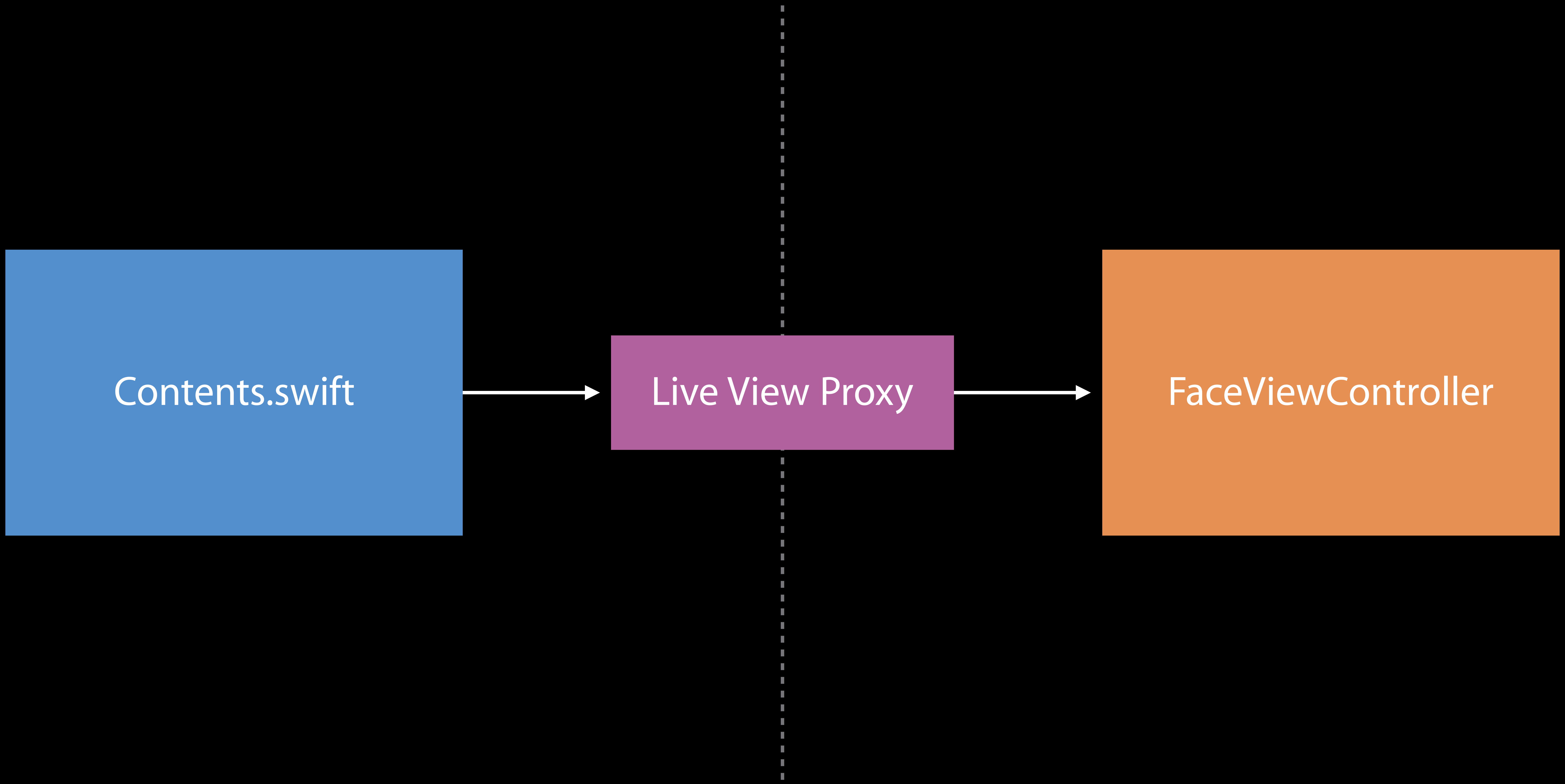

Live View Process (LiveView.swift)

```swift
extension FaceViewController: PlaygroundLiveViewMessageHandler {
   public func receive(_ message: PlaygroundValue) {
        if case let .string(text) = message {
            processConversationLine(text)
        }
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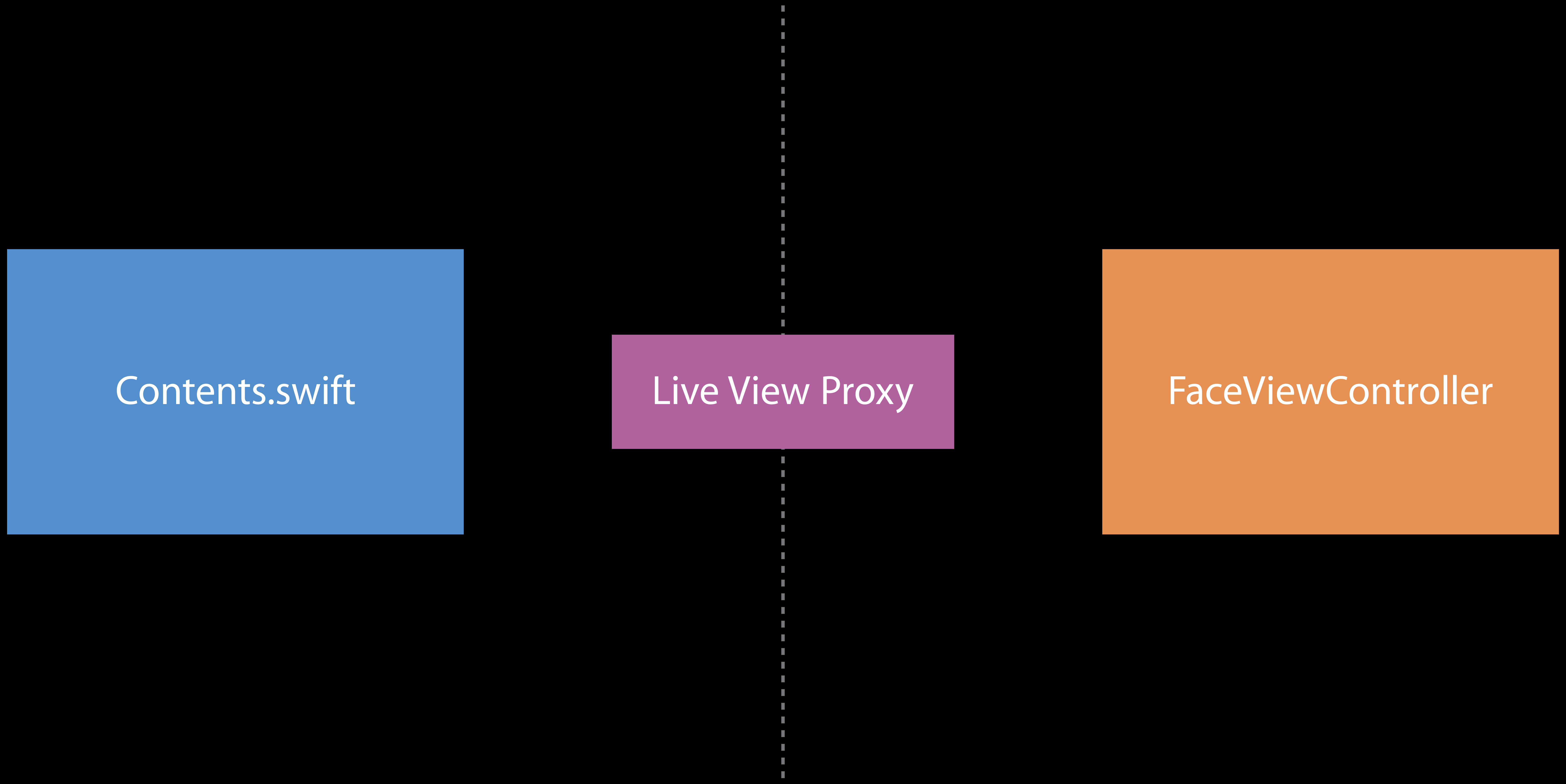

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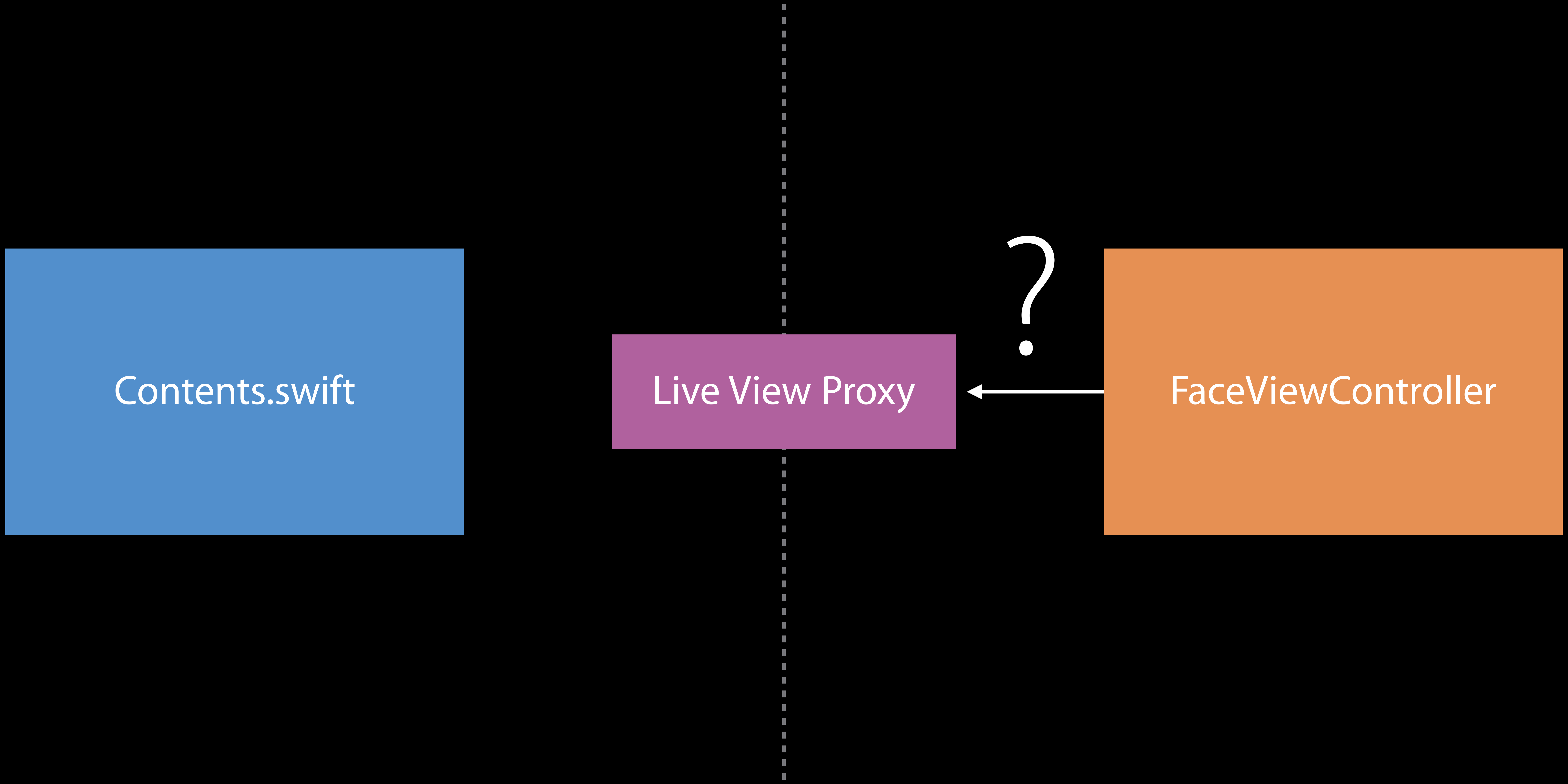

Live View Process (LiveView.swift)

```swift
extension FaceViewController: PlaygroundLiveViewMessageHandler {
   public func tapped() {
        let message: PlaygroundValue = .string("Hello!")
        send(message)
    }
}
```

Live View Process (LiveView.swift)

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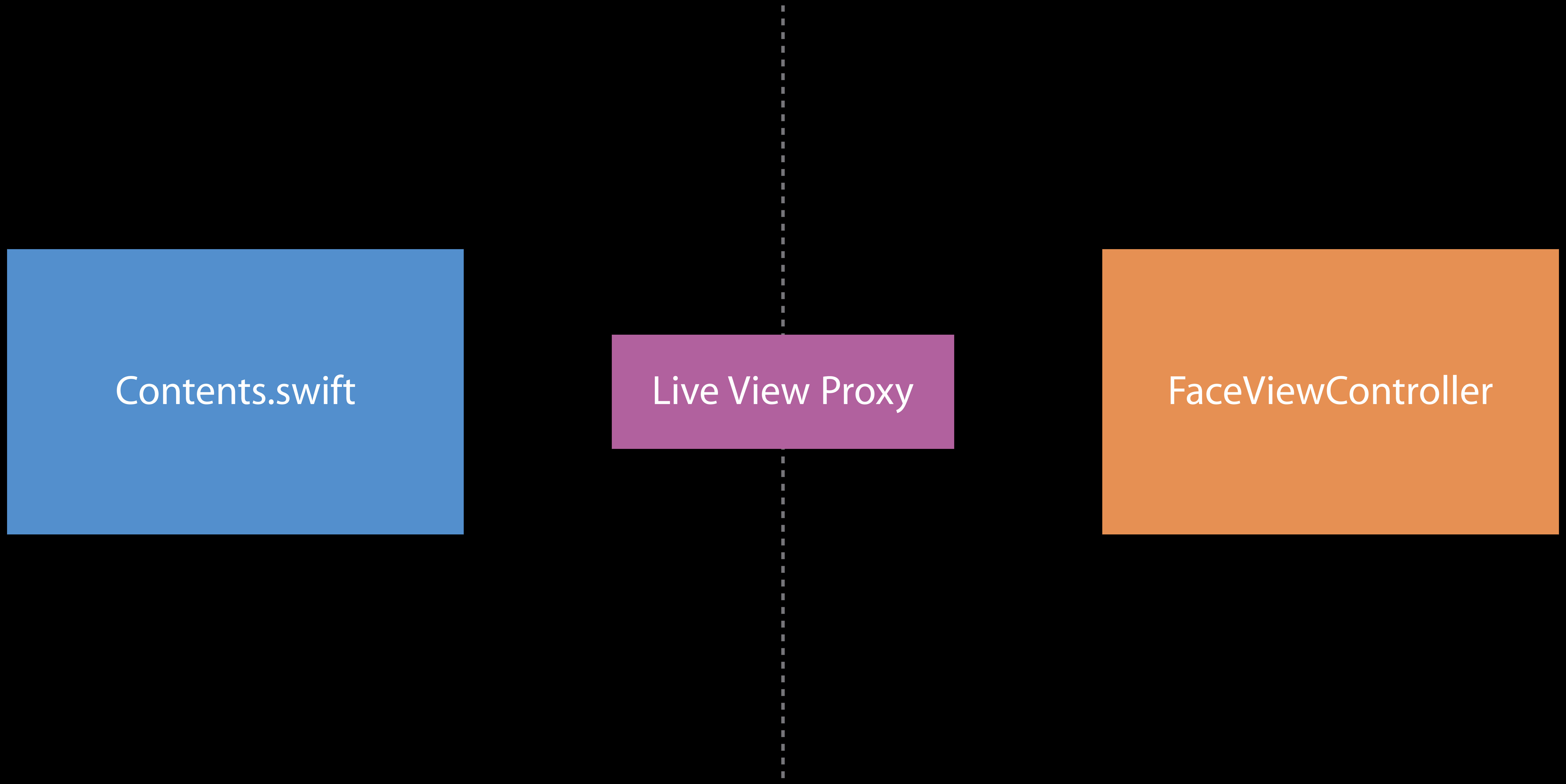

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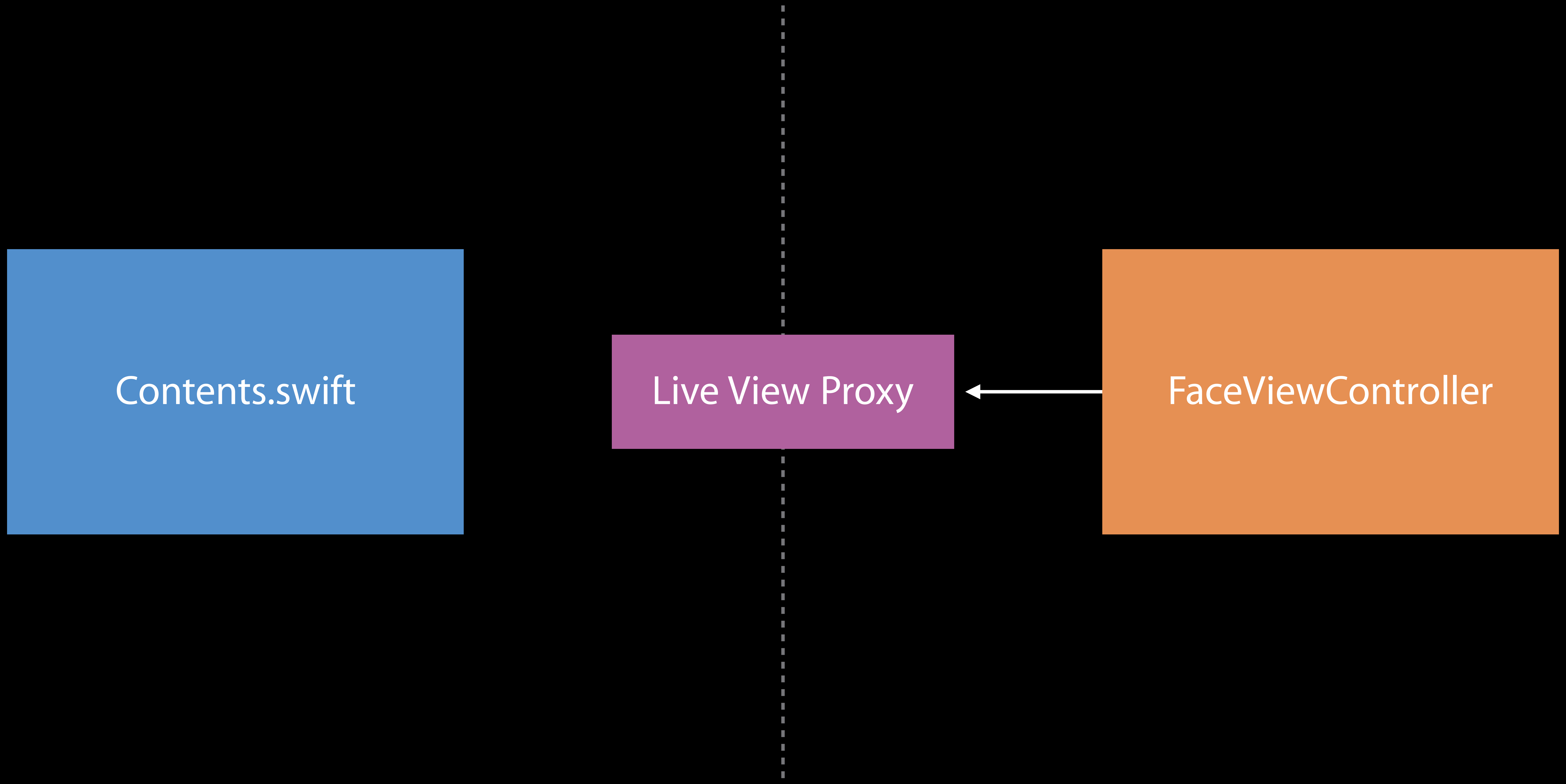

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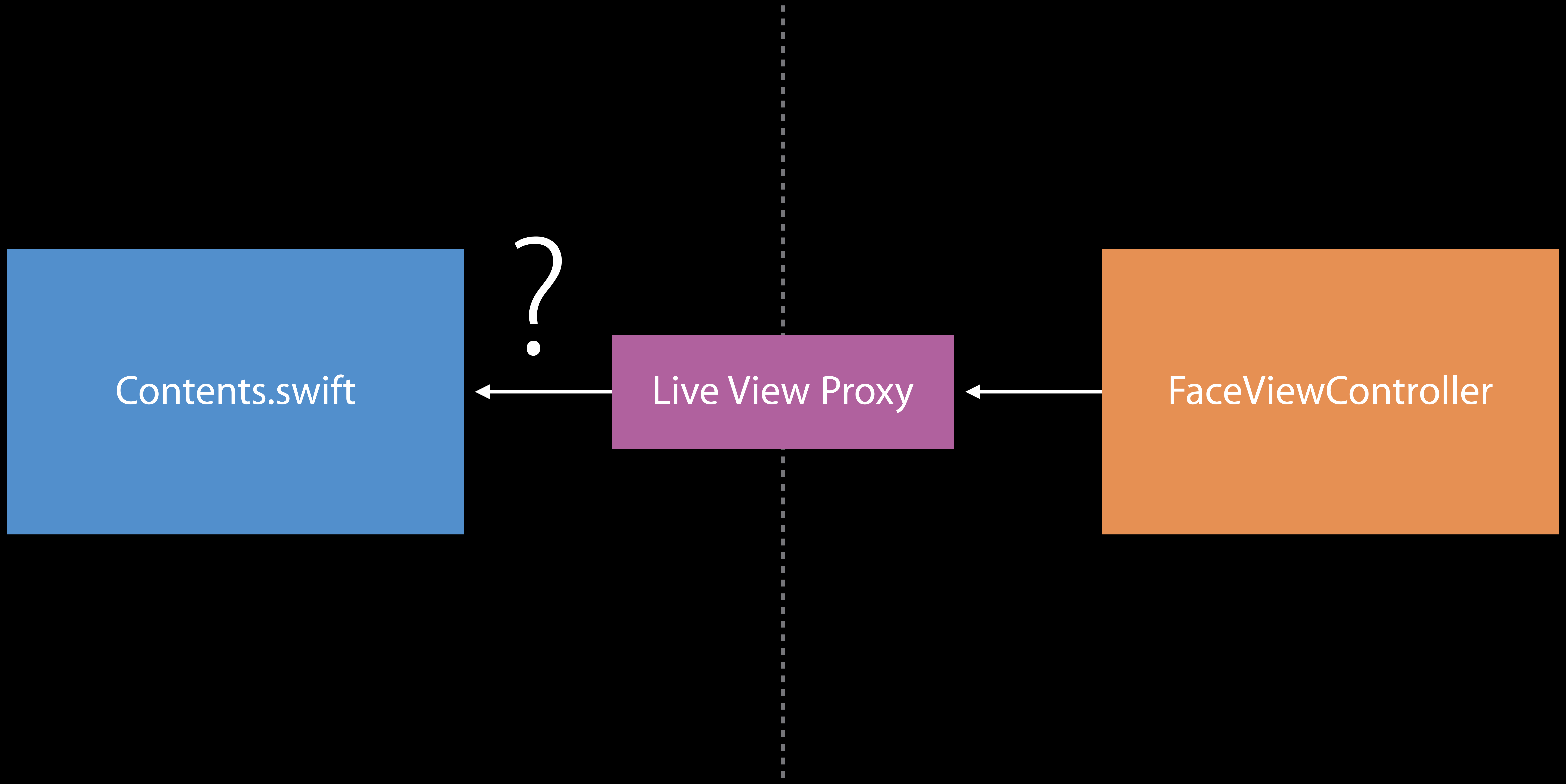

Main Process (Contents.swift)

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let page = PlaygroundPage.current
page.needsIndefiniteExecution = true
let proxy = page.liveView as? PlaygroundRemoteLiveViewProxy
class MyClassThatListens: PlaygroundRemoteLiveViewProxyDelegate {
   func remoteLiveViewProxy(_ remoteLiveViewProxy: PlaygroundRemoteLiveViewProxy,
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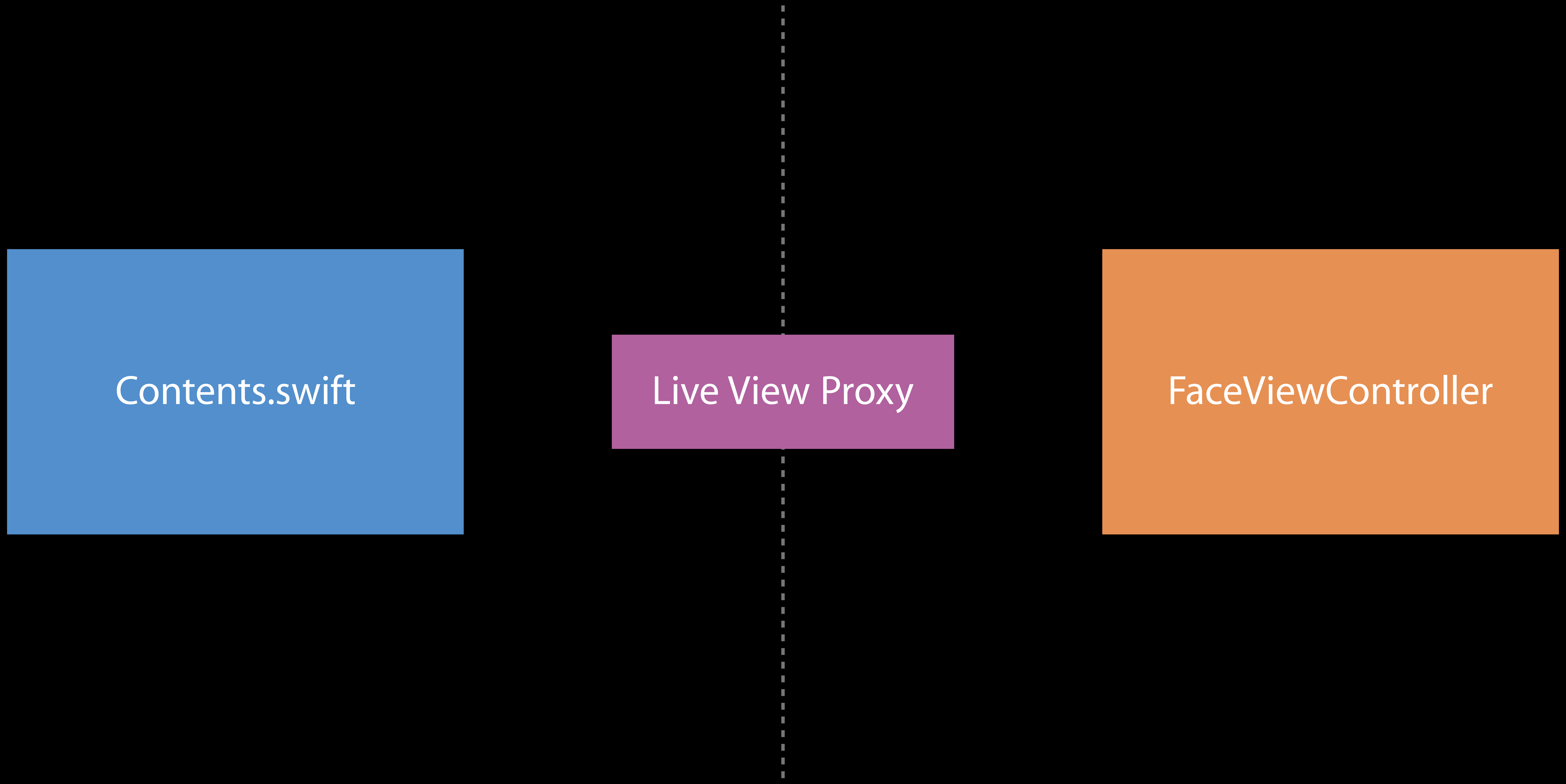

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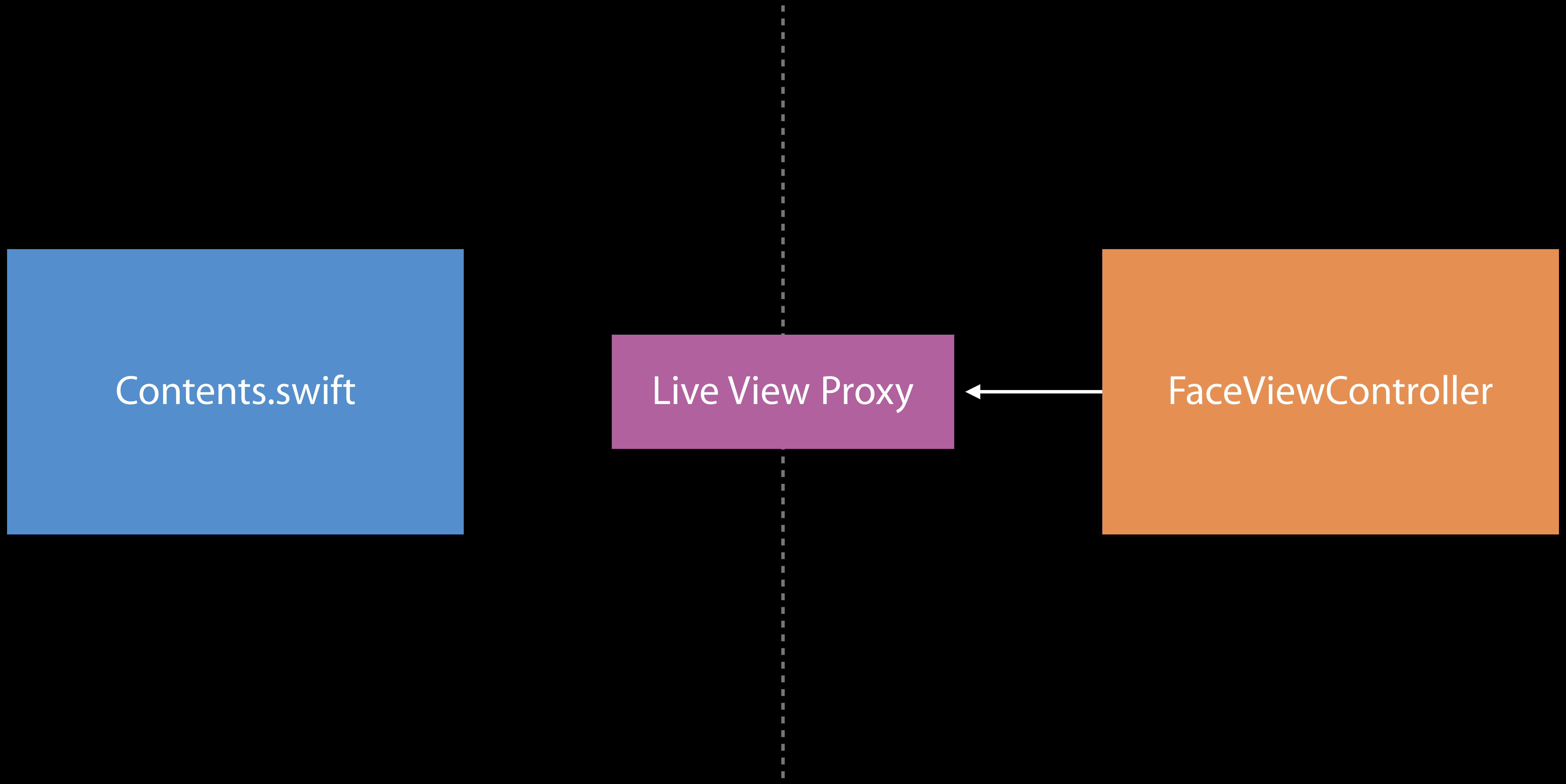

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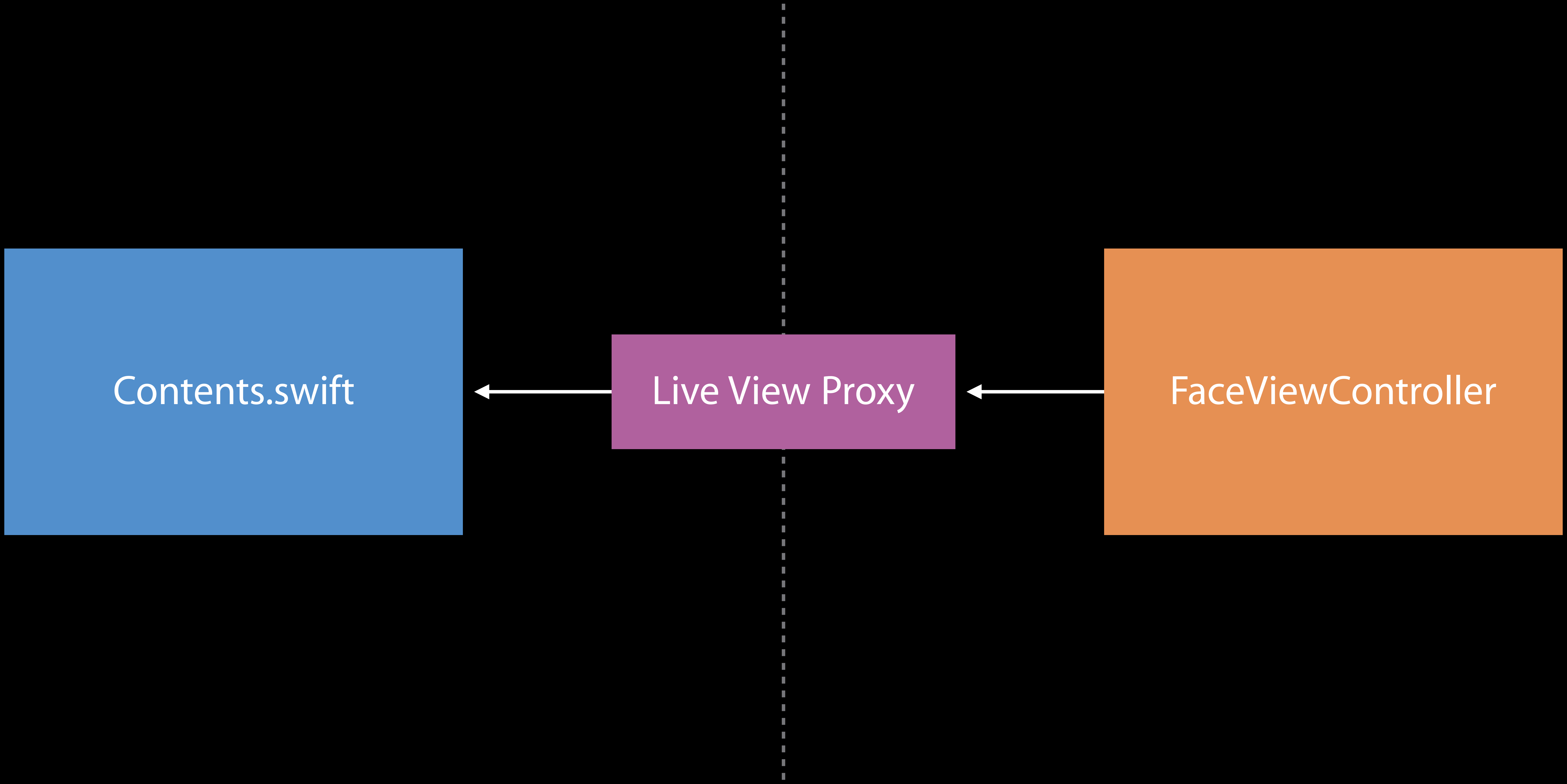
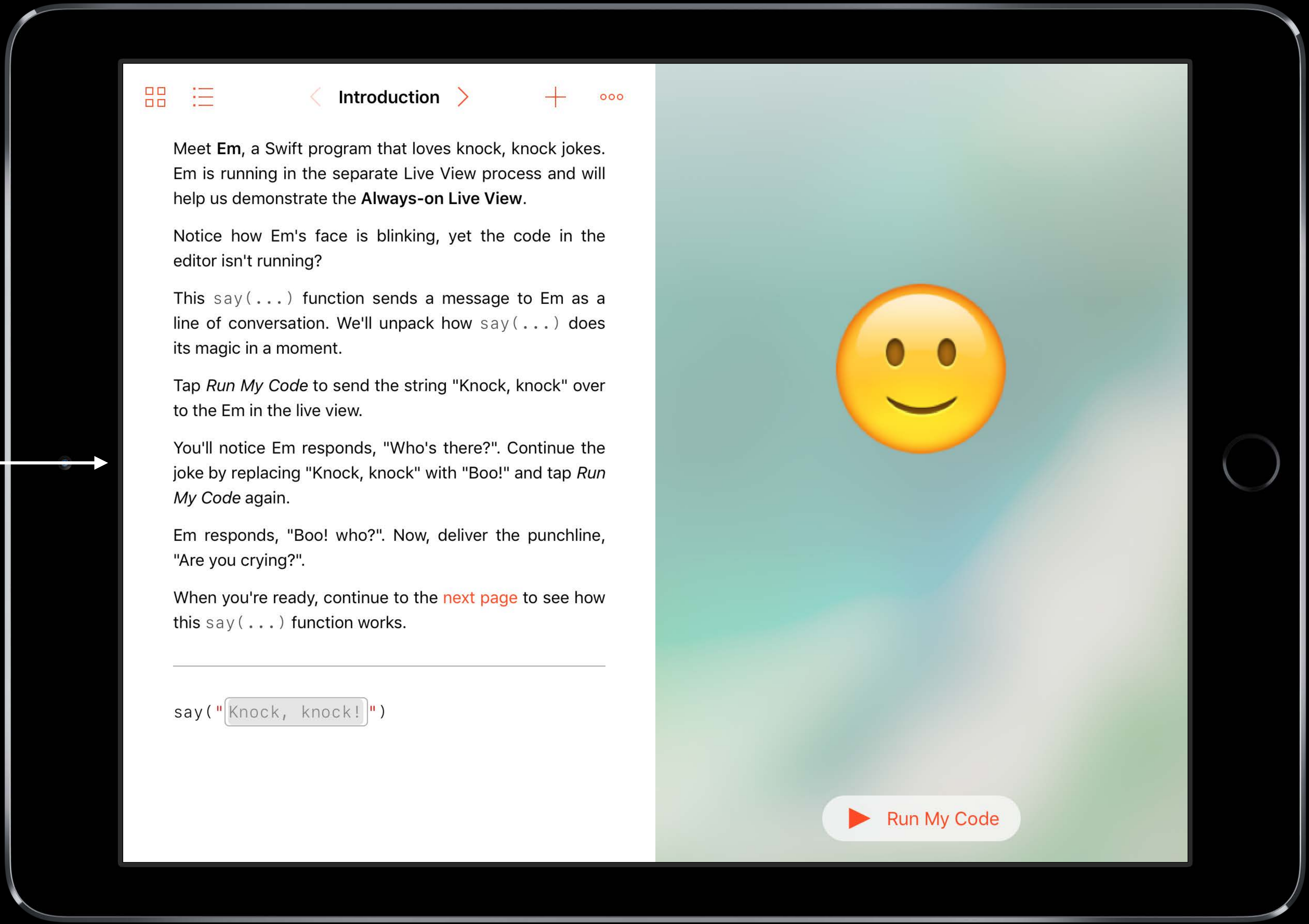


```swift
// Playground Values

public enum PlaygroundValue {
    case array([PlaygroundValue])
    case dictionary([String: PlaygroundValue])
    case string(String)
    case data(Data)
    case date(Date)
    case integer(Int)
    case floatingPoint(Double)
    case boolean(Bool)
}
```

```swift
// Key/Value Store

import PlaygroundSupport

let store = PlaygroundPage.current.keyValueStore

store["Greeting"] = .string("Hello, WWDC!")

if case let .string(greeting)? = store["Greeting"] {
    print(greeting)     // "Hello, WWDC!"
}
```

Contents.swift



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say("Knock, knock!")
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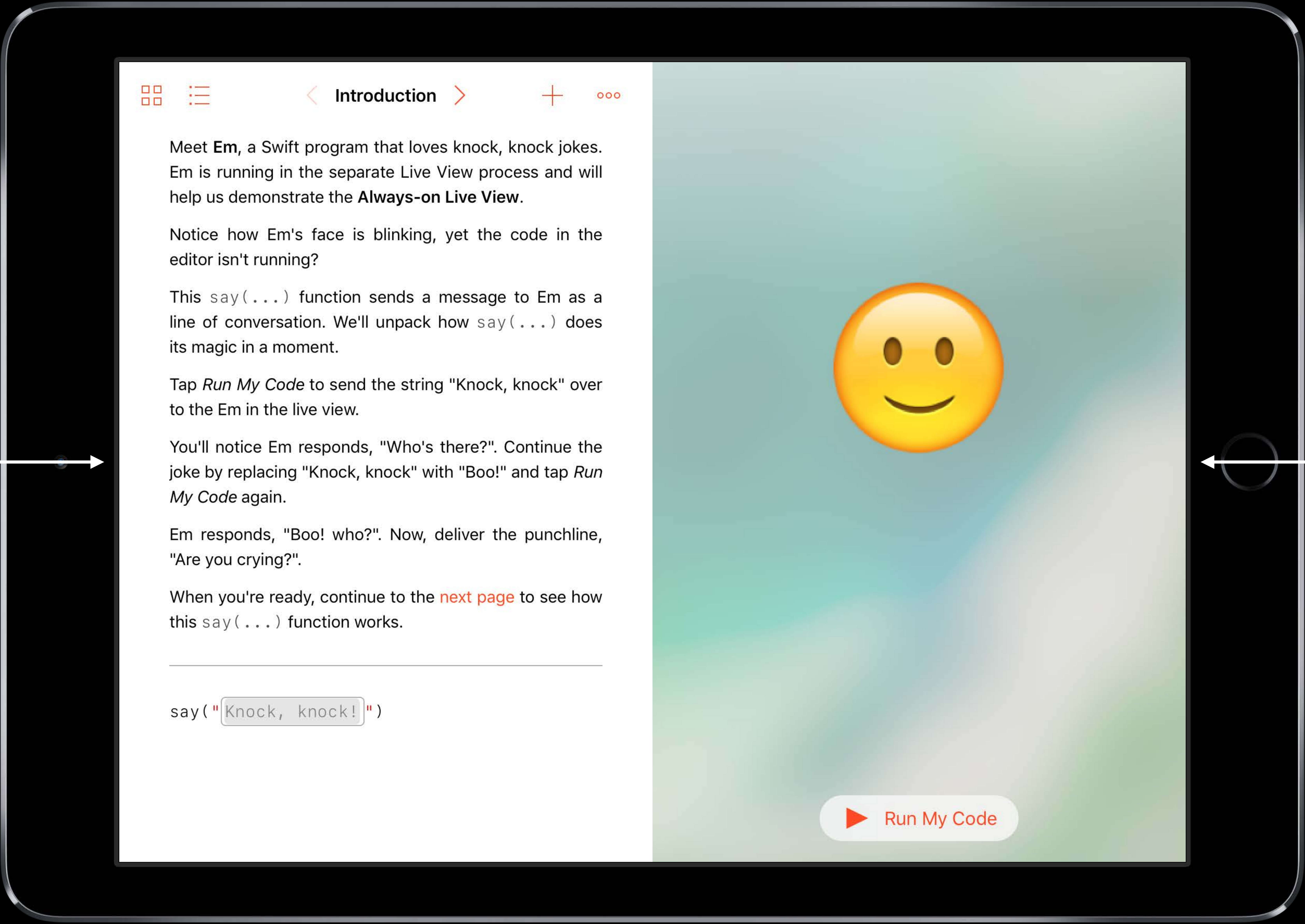

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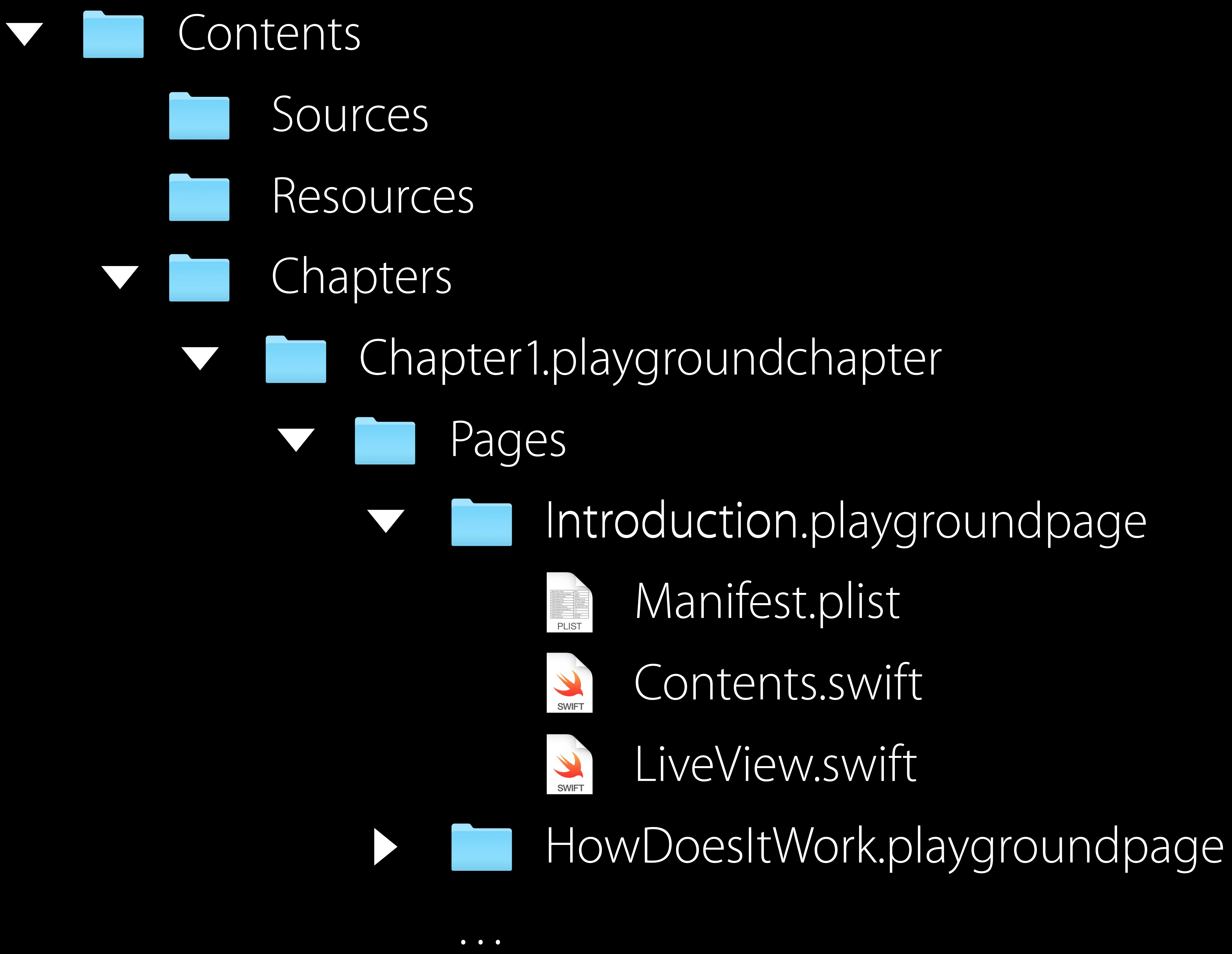

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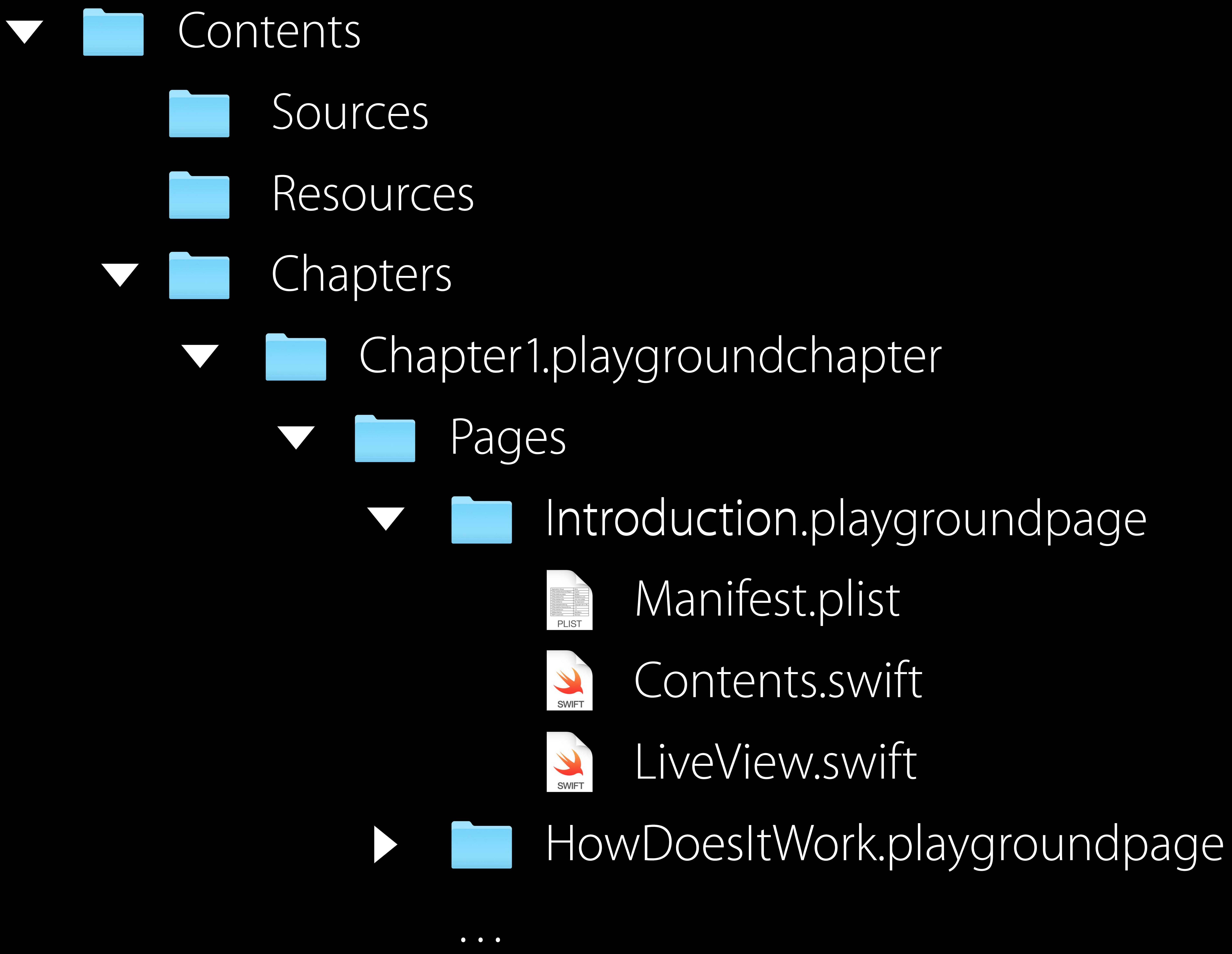

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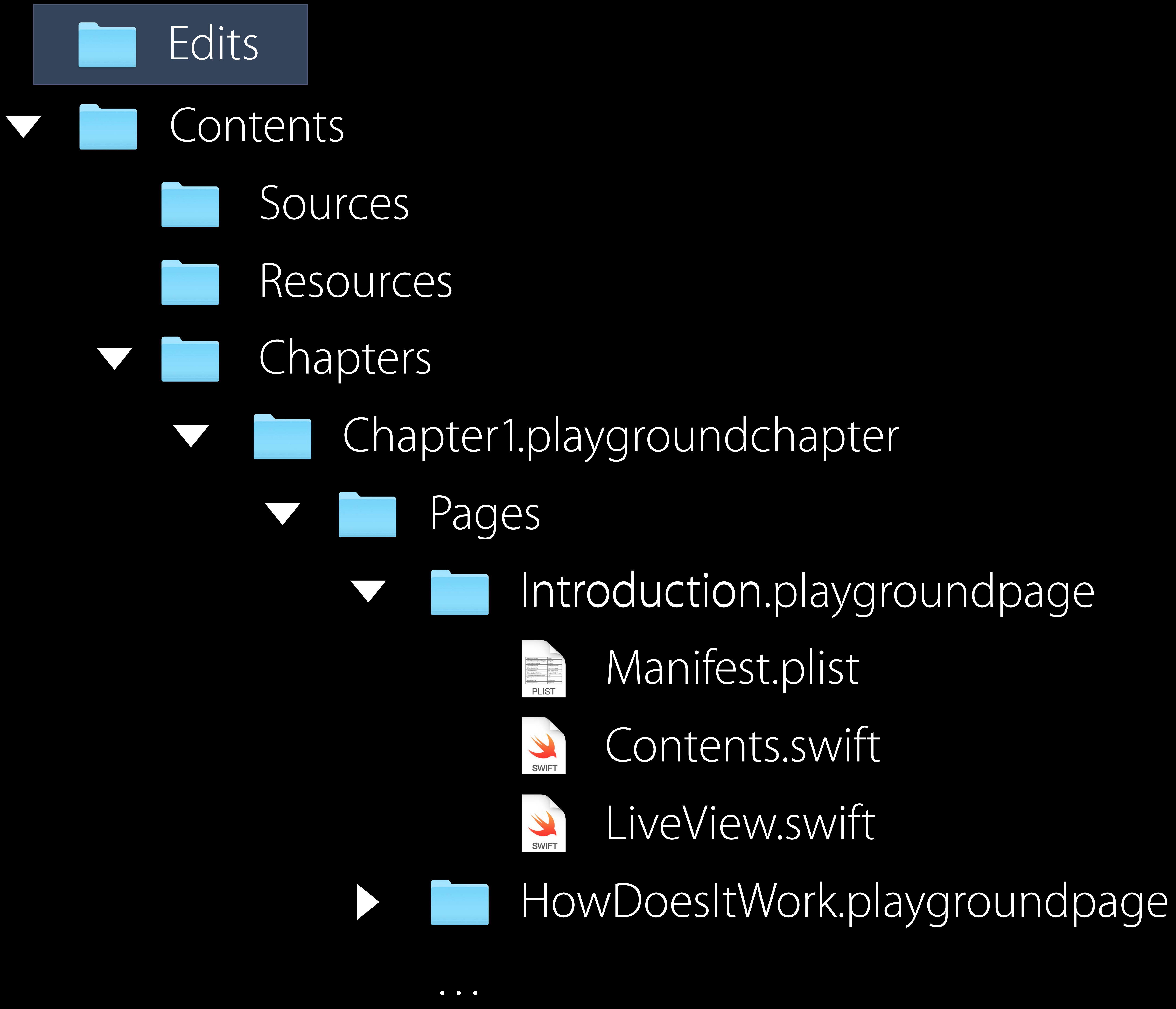

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BOOK

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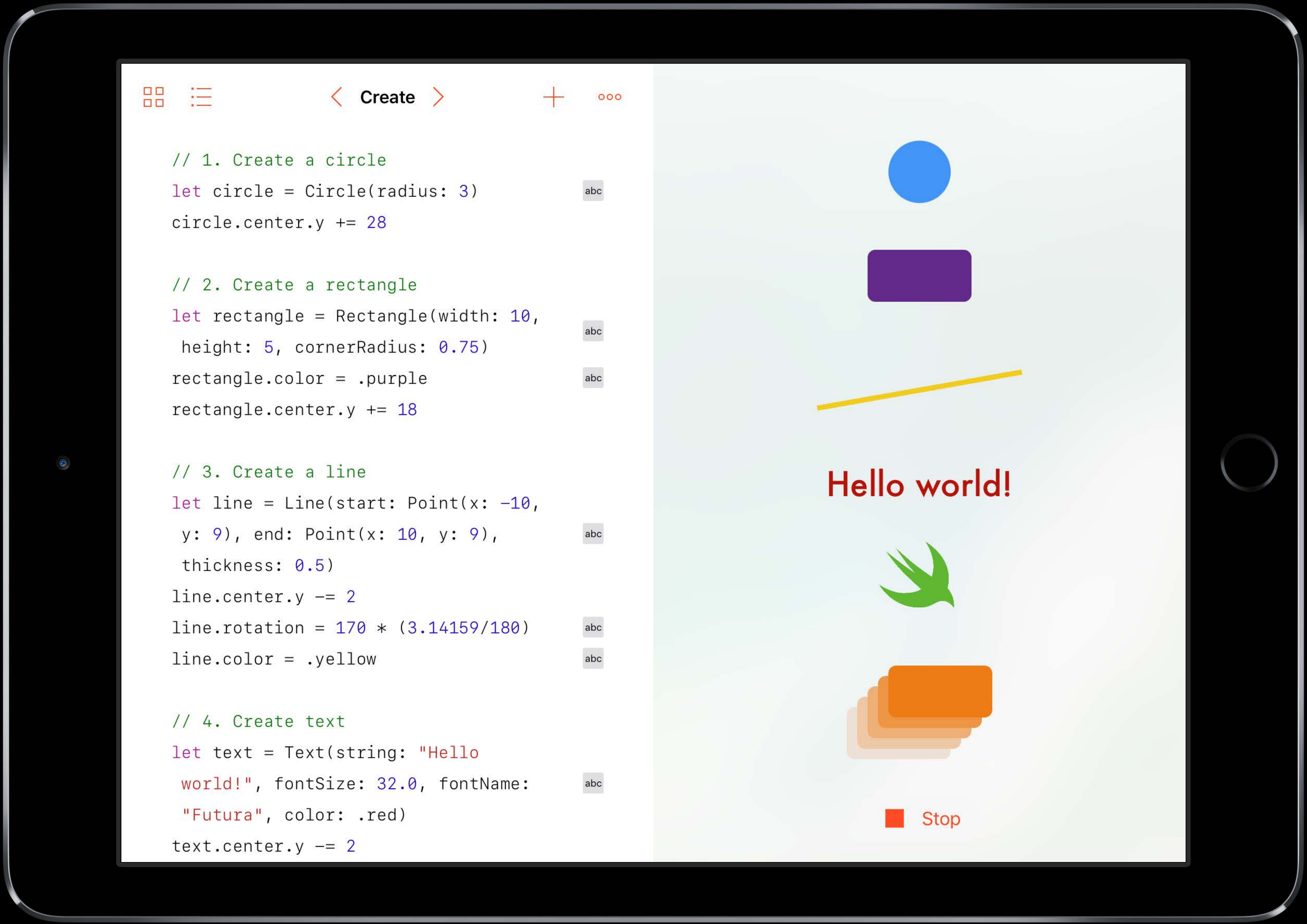
BOOK



```
// 1. Create a circle
let circle = Circle(radius: 3)
circle.center.y += 28

// 2. Create a rectangle
let rectangle = Rectangle(width: 10,
 height: 5, cornerRadius: 0.75)
rectangle.color = .purple
rectangle.center.y += 18

// 3. Create a line
let line = Line(start: Point(x: -10,
 y: 9), end: Point(x: 10, y: 9),
 thickness: 0.5)
line.center.y -= 2
line.rotation = 170 * (3.14159/180)
line.color = .yellow

// 4. Create text
let text = Text(string: "Hello
 world!", fontSize: 32.0, fontName:
 "Futura", color: .red)
text.center.y -= 2
```

Hello world!

Demo

Growing and Exploring

Izzy Fraimow

Playgrounds Engineer

Swift Playgrounds

Summary

Swift Playgrounds

Summary

Touch-focused experience for experimenting with Swift

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Touch-focused experience for experimenting with Swift

Rich new document format for creating engaging content

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Rich new document format for creating engaging content

Powerful access to iOS SDK

Playgrounds

More Information

https://developer.apple.com/wwdc16/408

Related Sessions

Keynote	Bill Graham	Monday 10:00AM
Platforms State of the Union	Bill Graham	Monday 2:30PM
What’s New in Swift	Presidio	Tuesday 9:00AM

Labs

Swift Open Hours	Developer Tools Lab A	Tuesday 12:00PM
Swift Open Hours	Developer Tools Lab A	Wednesday–Friday 9:00AM
Creating Content for Swift Playgrounds	Dev Tools Lab C	Wednesday 12:00PM
Xcode Open Hours	Developer Tools Labs B	Wednesday 3:00PM
Xcode Open Hours	Developer Tools Labs C	Thursday 9:00AM
Creating Content for Swift Playgrounds	Dev Tools Lab C	Friday 12:00PM

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