Hacking with iOS - SwiftUI

# Project 01 – WeSplit

Some notes about creating a new SwiftUI project:

* Example of how to create a basic project:
* For Product Name please enter the name of the project, like “WeSplit”.
* For Organization Identifier you can enter whatever you want, but if you have a website you should enter it with the components reversed: “hackingwithswift.com” would be “com.hackingwithswift”. If you don’t have a domain, make one up – “me.yourlastname.yourfirstname” is perfectly fine.
* For Interface please select SwiftUI.
* For Language please make sure you have Swift selected.
* Make sure all the checkboxes at the bottom are not checked.
* When creating a new project, you can check the target iOS by selecting the project in the project navigation bar, the one at the top, select Project list, and you can see the iOS Deployment Target, also if you select the Targets list, you can see the minimum Deployments target.

These are some of the files that are created by default, following the example:

* The WeSplitApp.swift contains code for launching your app.
* ContentView.swift contains the initial user interface for your program.
* Assets.xcassets is an asset catalog.
* Preview Content is a group with preview assets, another catalog, for example, for images you want to use when you’re designing your UI, to have an idea of how they might look.

The ContentView.swift file has a default code like this:

**import** SwiftUI

**struct** ContentView: View {

**var** body: **some** View {

VStack {

Image(systemName: "globe")

.imageScale(.large)

.foregroundColor(.accentColor)

Text("Hello, world!")

}

.padding()

}

}

**struct** ContentView\_Previews: PreviewProvider {

**static** **var** previews: **some** View {

ContentView()

}

}

The View protocol has one requirement: to have a computed property called body that returns some View.

The padding method is also called a modifier. They are like regular methods but they return a new view that contains both your original data plus the extra modification you asked for.

The ContentView struct won’t be part of the final app that goes to the App Store, it is specifically for Xcode to use so it can show a preview of your UI design.

With the preview of the UI visible, press Option+Cmd+P to update the canvas.

If you need to add more than 10 elements in a Form you can use Groups. Groups don’t actually change the way your user interface looks, they just let us work around SwiftUI’s limitation of ten child views inside a parent.

If you want your form to look different when splitting items into chunks, you should use the Section view instead. This splits your form into discrete visual groups, just like the Settings app does.

## Navigation Bar

By default SwiftUI ensures components are placed in an area where they can’t be covered up by system UI or device rounded corners – an area known as the safe area.

If you have a Form and you swipe around in the simulator, you will find you can move the row up so it goes under the clock. You can fix this by using a navigation bar. Example:

**import** SwiftUI

**struct** ContentView: View {

**var** body: **some** View {

NavigationView {

Form {

Section {

Text("Hello, world!")

}

}

.navigationTitle("SwiftUI")

.navigationBarTitleDisplayMode(.inline)

}

}

}

navigationTitle: add a navigation title, this uses a large font.

navigationBarTitleDisplayMode allows you to get a small font for the navigation bar.

## Modifying Program State

SwiftUI’s views are a function of their state, that means that the way your user interface looks – the things people can see and what they can interact with – are determined by the state of your program. For example, they can’t tap Continue until they have entered their name in a text field.

When creating struct methods that want to change properties, we need to add the mutating keyword: **mutating func doSomeWork()**, for example. However, Swift doesn’t let us make mutating computed properties, which means we can’t write **mutating var body: some View** – it just isn’t allowed.

Fortunately, Swift gives us a special solution called a *property wrapper*: a special attribute we can place before our properties that effectively gives them super-powers. In the case of storing simple program state like the number of times a button was tapped, we can use a property wrapper from SwiftUI called **@State**, like this:

**struct** ContentView: View {

@State private **var** tapCount = 0

**var** body: **some** View {

Button("Tap Count: \(tapCount)") {

**self**.tapCount += 1

}

}

}

**@State** allows us to work around the limitation of structs: we know we can’t change their properties because structs are fixed, but **@State** allows that value to be stored separately by SwiftUI in a place that *can* be modified.

There are several ways of storing program state in SwiftUI, and you’ll learn all of them. **@State** is specifically designed for simple properties that are stored in one view. As a result, Apple recommends we add **private** access control to those properties, like this: **@State private var tapCount = 0**.

## Binding State to User Interface Controls

Views are a function of their state – that text field can only show something if it reflects a value stored in your program. What SwiftUI wants is a string property in our struct that can be shown inside the text field, and will also store whatever the user types in the text field.

In the case of a text field to handle a name, Swift needs to make sure whatever is in the text is also in the **name** property, so that it can fulfill its promise that our views are a function of their state – that everything the user can see is just the visible representation of the structs and properties in our code.

This is what’s called a *two-way binding*: we bind the text field so that it shows the value of our property, but we also bind it so that any changes to the text field also update the property.

In Swift, we mark these two-way bindings with a special symbol so they stand out: we write a dollar sign before them. This tells Swift that it should read the value of the property but also write it back as any changes happen.

**struct** ContentView: View {

@State **private** **var** name = ""

**var** body: **some** View {

TextField("Enter your name", text: $name)

Form {

Text("Hello, \(name)")

}

}

}

## Creating views in a loop

In SwiftUI you have the ForEach to loop over arrays and ranges , creating as many views as needed. Example:

Form {

ForEach(0..<100) { number in

Text("Row \(number)")

}

}

We can use shorthand syntax for the parameter name:

Form {

ForEach(0 ..< 100) {

Text("Row \($0)")

}

}

// 1. Has an array of possible student names.

// 2. Has an @State property storing the currently selected student.

// 3. Creates a Picker view asking users to select their favorite, using a two-way binding to the @State property.

// 4. Uses ForEach to loop over all possible student names, turning them into a text view.

//

**import** SwiftUI

**struct** ContentView: View {

**let** students = ["Harry", "Hermione", "Ron"]

@State **private** **var** selectedStudent = "Harry"

**var** body: **some** View {

NavigationView {

Form {

Picker("Select your student", selection: $selectedStudent){

ForEach(students, id: \.**self**){

Text($0)

}

}

}

}

}

}

## Reading text from the user in TextField

When you need to have text fields for double values, you can add a format to the TextField to use Locale (Locale is a massive struct built into iOS that is responsible for storing all the user’s region settings – what calendar they use, how they separate thousands digits in numbers, whether they use the metric system, and more). But you can also use the keyboardType with .decimalPad to limit the user to enter just numeric values:

Form {

Section{

TextField("Amount", value: $checkAmount,

format: .currency(code: Locale.current.currency?.identifier ?? "USD"))

.keyboardType(.decimalPad)

}

Section{

Text(checkAmount, format: .currency(code: Locale.current.currency?.identifier ?? "USD"))

}

}

One of the great things about the **@State** property wrapper is that it automatically watches for changes, and when something happens it will automatically re-invoke the **body** property.

This synchronization happens because:

1. Our text field has a two-way binding to the checkAmount property.

2. The checkAmount property is marked with @State, which automatically watches for

changes in the value.

3. When an @State property changes SwiftUI will re-invoke the body property (i.e., reload

our UI)

4. Therefore the text view will get the updated value of checkAmount.

## Creating pickers in a Form

SwiftUI’s pickers serve multiple purposes, and exactly how they look depends on which device you’re using and the context where the picker is used.

The value of a picker is in fact an index.

**struct** ContentView: View {

@State **private** **var** checkAmount = 0.0

@State **private** **var** numberOfPeople = 2

@State **private** **var** tipPercentage = 20

**let** tipPercentages = [10, 15, 20, 25, 0]

**var** body: **some** View {

VStack {

NavigationView {

Form {

Section{

TextField("Amount", value: $checkAmount,

format: .currency(code: Locale.current.currency?.identifier ?? "USD"))

.keyboardType(.decimalPad)

}

Picker("Number of people", selection: $numberOfPeople){

ForEach(2 ..< 100){

Text("\($0) people")

}

}

}

.navigationTitle("We Split")

}

}

.padding()

}

}

## Adding a segmented control for tip percentages

A segmented control is a specialized kind of picker that shows a handful of options in a horizontal list, and it works great when you have only a small selection to choose from.

SwiftUI lets us add views to the header and footer of a section, which in this instance we can use to add a small explanatory prompt.

Section {

Picker("Tip percentage", selection: $tipPercentage) {

ForEach(tipPercentages, id: \.**self**) {

Text($0, format: .percent)

}

}

.pickerStyle(.segmented)

} header: {

Text("How much tip do you want to leave?")

}

## Calculating the total per person

We can create properties, for example, a property called totalPerPerson where we can calculate the amount to pay per person according to the values selected and entered in the other properties:

// Property that calculates the total per person

**var** totalPerPerson: Double {

// The picker starts with 2, so we need to add 2 to the value

**let** peopleCount = Double(numberOfPeople + 2)

**let** tipSelection = Double(tipPercentage)

**let** tipValue = checkAmount / 100 \* tipSelection

**let** grandTotal = checkAmount + tipValue

**let** amountPerPerson = grandTotal / peopleCount

**return** amountPerPerson

}

This one can be displayed in the Text view below:

Section{

Text(totalPerPerson,

format: .currency(code: Locale.current.currency?.identifier ?? "USD"))

}

## Hiding the keyboard

To hide the keyboard:

1. We need to give SwiftUI some way of determining whether the check amount box should currently have focus – should be receiving text input from the user.
2. We need to add some kind of button to remove that focus when the user wants, which will in turn cause the keyboard to go away.

To solve the first one you need to meet your second property wrapper: @FocusState. This is exactly like a regular @State property, except it’s specifically designed to handle input focus in our UI.

For example, you can create a property like this:

@FocusState **private** **var** amountIsFocused: Bool

And attach it to the text field with the modifier focused:

TextField("Amount", value: $checkAmount,

format: .currency(code: Locale.current.currency?.identifier ?? "USD"))

.keyboardType(.decimalPad)

.focused($amountIsFocused)

The second part of our solution is to add a toolbar to the keyboard when it appears, so we can place a Done button in there. To make this work really well you need to meet several new SwiftUI views:

.toolbar {

ToolbarItemGroup(placement: .keyboard) {

Button("Done") {

amountIsFocused = **false**

}

}

This is a modifier to be applied to the Form.

1. The toolbar() modifier lets us specify toolbar items for a view. These toolbar items might appear in various places on the screen – in the navigation bar at the top, in a special toolbar area at the bottom, and so on.
2. ToolbarItemGroup lets us place one or more buttons in a specific location, and this is where we get to specify we want a keyboard toolbar – a toolbar that is attached to the keyboard, so it will automatically appear and disappear with the keyboard.
3. The Button view we’re using here displays some tappable text, which in our case is “Done”. We also need to provide it with some code to run when the button is pressed, which in our case sets amountIsFocused to false so that the keyboard is dismissed.

The complete code looks like this:

**import** SwiftUI

**struct** ContentView: View {

@State **private** **var** checkAmount = 0.0

@State **private** **var** numberOfPeople = 2

@State **private** **var** tipPercentage = 20

@FocusState **private** **var** amountIsFocused: Bool

**let** tipPercentages = [10, 15, 20, 25, 0]

// Property that calculates the total per person

**var** totalPerPerson: Double {

// The picker starts with 2, so we need to add 2 to the value

**let** peopleCount = Double(numberOfPeople + 2)

**let** tipSelection = Double(tipPercentage)

**let** tipValue = checkAmount / 100 \* tipSelection

**let** grandTotal = checkAmount + tipValue

**let** amountPerPerson = grandTotal / peopleCount

**return** amountPerPerson

}

**var** body: **some** View {

VStack {

NavigationView {

Form {

Section{

TextField("Amount", value: $checkAmount,

format: .currency(code: Locale.current.currency?.identifier ?? "USD"))

.keyboardType(.decimalPad)

.focused($amountIsFocused)

Picker("Number of people", selection: $numberOfPeople){

ForEach(2 ..< 100){

Text("\($0) people")

}

}

}

Section {

Picker("Tip percentage", selection: $tipPercentage) {

ForEach(tipPercentages, id: \.**self**) {

Text($0, format: .percent)

}

}

.pickerStyle(.segmented)

} header: {

Text("How much tip do you want to leave?")

}

Section{

Text(totalPerPerson,

format: .currency(code: Locale.current.currency?.identifier ?? "USD"))

}

}

.navigationTitle("We Split")

.toolbar {

ToolbarItemGroup(placement: .keyboard) {

Spacer()

Button("Done") {

amountIsFocused = **false**

}

}

}

}

}

.padding()

}

}

**struct** ContentView\_Previews: PreviewProvider {

**static** **var** previews: **some** View {

ContentView()

}

}

# Project 02 – Guess the Flag

## Using stacks to arrange views

When we return some View for our body, SwiftUI expects to receive back some kind of view that can be displayed on the screen. That might be a navigation view, a form, a text view, a picker, or something else entirely, but it must conform to the View protocol so that it can be drawn on the screen.

If we want to return multiple things we have various options, but three are particularly useful. They are HStack, VStack, and ZStack, which handle horizontal, vertical, and, er, zepth.

The previous stacks allow a maximum of 10 views as well, so if you need to have more items, you will need to group them using other stacks. The VStack and HStack have some properties like spacing or alignment that allow you to modify the way the views inside are displayed. For Example:

**var** body: **some** View {

VStack (alignment: .leading, spacing: 20) {

Text("Hello, world!")

Text("This is another text view!")

}

}

You can also use Spacer(), that is a kind of view to add some space between other views.

In the ZStack, you don’t have spacing property, but you can use alignment.

## Colors and Frames

When using stacks, if you do something like this:

ZStack {

Text("Your content")

}

.background(.red)

You will see the are painted in red, is just the text, because the stacks take fit their content. You can use Color.red which will take the whole screen size and it is a view by itself, but you can also use a frame to limit the width and height.

ZStack {

Color.red

.frame(width: 200, height: 200)

Text("Your content")

}

You can also specify minimum and maximum widths and heights, depending on the layout you want. For example: we could say we want a color that is no more than 200 points high, but for its width must be at least 200 points wide but can stretch to fill all the available width that’s not used by other stuff:

ZStack {

Color.red

.frame(minWidth: 200, maxWidth: .infinity, maxHeight: 200)

Text("Your content")

}

Beyond red, green and other colors, you can use semantic color, like primary, secondary, that refers to the text color. You can also use custom colors:

Color.primary

Color(red: 1, green: 0.8, blue: 0)

By default, the colors don’t include the safe area (the top and bottom parts of the screen. You can indicate to ignore the safe area.

ZStack {

Color.red

Text("Your content")

}

.ignoresSafeArea()

Keep anything important inside the safe area.

SwiftUI gives us an alternative for the foreground color that provides a very slightly different effect: change the foregroundColor() modifier to foregroundStyle().

## Gradients

SwiftUI gives us three kinds of gradients to work with. Gradients are made up of several components:

• An array of colors to show

• Size and direction information

• The type of gradient to use

LinearGradient(gradient: Gradient(colors: [.white, .black]),

startPoint: .top, endPoint: .bottom)

You can use stoppers to specify both a color and how far along the gradient the color should be used:

LinearGradient(gradient: Gradient(stops: [

Gradient.Stop(color: .white, location: 0.45),

Gradient.Stop(color: .black, location: 0.55),

]), startPoint: .top, endPoint: .bottom)

As an alternative, radial gradients move outward in a circle shape, so instead of specifying a direction we specify a start and end radius – how far from the center of the circle the color should start and stop changing. For example:

RadialGradient(gradient: Gradient(colors: [.blue, .black]),

center: .center, startRadius: 20, endRadius: 200)

The last gradient type is called an angular gradient, although you might have heard it referred to elsewhere as a conic or conical gradient.

AngularGradient(gradient: Gradient(colors: [.red, .yellow, .green, .blue, .purple, .red]), center: .center)

## Buttons and Images

The buttons allow you to execute some actions in different ways, for example:

**struct** ContentView: View {

**var** body: **some** View {

VStack{

Button("Delete selection") {

print("Now deleting...")

}

//Call a function when click the button

Button("Delete Items", action: executeDelete)

}

}

**func** executeDelete(){

print("Now deleting...")

}

}

You can also give some style to the buttons with some predefined properties, like buttonStyle and role:

VStack {

Button("Button 1") { }

.buttonStyle(.bordered)

Button("Button 2", role: .destructive) { }

.buttonStyle(.bordered)

Button("Button 3") { }

.buttonStyle(.borderedProminent)

.tint(.mint)

Button("Button 4", role: .destructive) { }

.buttonStyle(.borderedProminent)

}

You can customize the button, like this, showing a label with different properties:

Button {

print("Button was tapped")

} label: {

Text("Tap me!")

.padding()

.foregroundColor(.white)

.background(.red)

}

You can add images using some built-in assets catalog images. For example:

Image(systemName: "pencil")

You can use them as decorative images for the buttons.

Button {

print("Button was tapped")

} label: {

Label("Edit", systemImage: "pencil")

}

## Showing Alert Messages

In SwiftUI you create the alert and set the conditions under which it should be shown.

A basic SwiftUI alert has a title and a button that dismisses it, but the more interesting part is how we present that alert: we don’t assign the alert to a variable then write something like myAlert.show(), because that would be back to the old “series of events” way of thinking.

Instead, we create some state that tracks whether our alert is showing, like this:

@State private var showingAlert = false

We then attach our alert somewhere to our user interface, telling it to use that state to determine whether the alert is presented or not. SwiftUI will watch showingAlert, and as soon as it becomes true it will show the alert.

**struct** ContentView: View {

@State **private** **var** showingAlert = **false**

**var** body: **some** View {

VStack {

Button ("Show Alert"){

showingAlert = **true**

}.alert("Important message", isPresented: $showingAlert){

Button("OK"){ }

}

}

}

}

In the previous example, the isPresented property is bound to the showingAlert property, this way, when the value of the showingAlert changes, it will present the alert.

Any button insider the alert will dismiss the alert.

You can add as many buttons as you need and user roles for them:

@State **private** **var** showingAlert = **false**

**var** body: **some** View {

VStack {

Button ("Show Alert"){

showingAlert = **true**

}.alert("Important message", isPresented: $showingAlert){

Button("Delete", role: .destructive){ }

Button("Cancel", role: .cancel) {}

} message: {

Text("Please read this")

}

}

}

## Notes from Project

When you have several asset images, you just need to select the Assets.xcassets in the project and drag and drop the images there.

.shuffled() method can be used in an array to shuffle or re-arranged the items.

The **renderingMode(.original)** modifier tells SwiftUI to render the original image pixels rather than trying to recolor them as a button.

We can control the size and style of text using the font() modifier, which lets us select from one of the built-in font sizes on iOS. As for adjusting the weight of fonts – whether we want super-thing text, slightly bold text, etc – we can get fine-grained control over that by adding a weight() modifier to whatever font we ask for.

For the flags, and for any other view you can give a number of modifiers to affect the way views are presented, and we’re going to use two here: one to change the shape of flags, and one to add a shadow.

Making our image capsule shaped is as easy as adding the .clipShape(Capsule()) modifier, like this:

.clipShape(Capsule())

The final code is this:

**import** SwiftUI

**struct** ContentView: View {

@State **private** **var** showingScore = **false**

@State **private** **var** scoreTitle = ""

@State **private** **var** userScore = 0

@State **private** **var** questionsCount = 1

@State **private** **var** countries = ["Estonia", "France", "Germany", "Ireland", "Italy", "Nigeria",

"Poland", "Russia", "Spain", "UK", "US"].shuffled()

@State **private** **var** correctAnswer = Int.random(in: 0...2)

@State **private** **var** showingAlert = **false**

@State **private** **var** showingResultAlert = **false**

**var** body: **some** View {

ZStack {

RadialGradient(stops: [

.init(color: Color(red: 0.1, green: 0.2, blue: 0.45), location: 0.3),

.init(color: Color(red: 0.76, green: 0.15, blue: 0.26), location: 0.3)

], center: .top, startRadius: 200, endRadius: 700)

.ignoresSafeArea()

VStack{

Spacer()

Text("Guess the Flag")

.font(.largeTitle.weight(.bold))

.foregroundColor(.white)

VStack(spacing: 15){

VStack {

Text("Tap the flag of")

.foregroundStyle(.secondary)

.font(.subheadline.weight(.heavy))

Text(countries[correctAnswer])

.font(.largeTitle.weight(.semibold))

}

ForEach(0..<3){number **in**

Button {

flagTapped(number)

} label: {

Image(countries[number])

.renderingMode(.original)

.clipShape(Capsule())

.shadow(radius: 5)

}

}

}

.frame(maxWidth: .infinity)

.padding(.vertical, 20)

.background(.regularMaterial)

.clipShape(RoundedRectangle(cornerRadius: 20))

Spacer()

Spacer()

Text("Score: \(userScore)")

.foregroundColor(.white)

.font(.title.bold())

Spacer()

}

.padding()

}

.alert(scoreTitle, isPresented: $showingScore){

Button("Continue", action: askQuestion)

} message: {

Text("Your score is \(userScore)")

}

.alert("Results", isPresented: $showingResultAlert){

Button("Restart the Game", action: resetGame)

} message: {

Text("Your final score is \(userScore)")

}

}

**func** flagTapped(\_ number: Int){

**if** number == correctAnswer {

scoreTitle = "Correct"

userScore += 1

} **else** {

scoreTitle = "Wrong! That's the flag of \(countries[number])"

}

showingScore = **true**

questionsCount += 1

**if** questionsCount == 9 {

showingResultAlert = **true**

}

}

**func** askQuestion() {

countries.shuffle()

correctAnswer = Int.random(in: 0...2)

}

**func** resetGame(){

userScore = 0

questionsCount = 1

showingScore = **false**

askQuestion()

}

}

**struct** ContentView\_Previews: PreviewProvider {

**static** **var** previews: **some** View {

ContentView()

}

}

Some important things to remember:

* The Spacers allow you to add spaces to segment the elements in a VStack or HStack
* There are some predefined modifiers for the text elements, like foregroundStyle(.secondary) of .subheadline.bold()
* A button can have an image that fits the entire button or just a part along with a text.
* To keep the original color of the image in a button, use .renderingMode(.original)
* You can give different shapes to a view using clipShape
* You can use different properties to modify how to display a view, like .frame or .padding and .background.
* An alert uses the isPresented to know when it should be displayed.
* An Alert can have as many buttons as you need.
* You can define methods inside a Struct

# Project 03 – Views and Modifiers

## Why does SwiftUI use structs for views?

There are several reasons why in SwiftUI we use structs instead of classes:

1. Performance: Structs are simpler and faster than classes. In UIKit, every view descended from a class called UIView that had many properties and methods. There were lots of these, and every UIView and UIView subclass had to have them, because that’s how inheritance works. As structs cannot inherit, they contain what you see and nothing more, it doesn’t load anything more.
2. Structs forces us to think about isolating state in a clean way. SwiftUI encourages us to move to a more functional design approach: our views become simple, inert things that convert data into UI, rather than intelligent things that can grow out of control.

## What’s behind the main SwiftUI view?

This if the starting code you see when working with SwiftUI:

struct ContentView: View {

var body: some View {

Text("Hello, world!")

.padding()

}

}

You should try to get into the mindset that there is nothing behind our view – that what you see is all we have.

Now, right now at least there is something behind our content view called a UIHostingController: it is the bridge between UIKit (Apple’s original iOS UI framework) and SwiftUI. However, if you start trying to modify that you’ll find that your code no longer works on Apple’s other platforms, and in fact might stop working entirely on iOS at some point in the future.

One way, for example, to make the Text view to use all the available space and color it red, is this:

Text("Hello, world!")

.frame(maxWidth: .infinity, maxHeight: .infinity)

.background(.red)

## Why modifiers order matters?

Whenever we apply a modifier to a SwiftUI view, we actually create a new view with that change applied – we don’t just modify the existing view in place.

You can peek into the underbelly of SwiftUI by asking for the type of our view’s body. Modify the button to this:

Button("Hello, world!") {

print(type(of: self.body))

}

.background(.red)

.frame(width: 200, height: 200)

Swift’s type(of:) method prints the exact type of a particular value, and in this instance it will print the following:

ModifiedContent<ModifiedContent<Button<Text>, \_BackgroundStyleModifier<Color>>, \_FrameLayout>

So, if you have a code like this:

Text("Hello, world!")

.padding()

.background(.red)

.padding()

.background(.blue)

.padding()

.background(.green)

.padding()

.background(.yellow)

You will see how every color is stack up over the color defined before.

## Why SwiftUI use “some View” for its type?

The “some View” allow us to define whatever view we want inside, otherwise, we should define the exact type to return having in mind the modifiers applied to the view to return.

First, using some View is important for performance: SwiftUI needs to be able to look at the views we are showing and understand how they change, so it can correctly update the user interface. If SwiftUI didn’t have this extra information, it would be really slow for SwiftUI to figure out exactly what changed.

1. How does VStack work – it conforms to the View protocol, but how does it fill the “what kind of content does it have?” hole if it can contain lots of different things inside it?

2. What happens if we send back two views directly from our body property, without wrapping them in a stack?

To answer the first question first, if you create a VStack with two text views inside, SwiftUI silently creates a TupleView to contain those two views – a special type of view that holds exactly two views inside it.

As for the second question, Swift silently applies a special attribute to the body property called @ViewBuilder. This has the effect of silently wrapping multiple views in one of those TupleView containers, so that even though it looks like we’re sending back multiple views they get combined into one TupleView.

## Conditional modifiers

You can use a ternary conditional operator in the properties of a View, for example:

struct ContentView: View {

@State private var useRedText = false

var body: some View {

Button("Hello World") {

// flip the Boolean between true and false

useRedText.toggle()

}

.foregroundColor(**useRedText ? .red : .blue**)

}

}

You can often use regular if conditions to return different views based on some state, but this actually creates more work for SwiftUI – rather than seeing one Button being used with different colors, it now sees two different Button views, and when we flip the Boolean condition it will destroy one to create the other rather than just recolor what it has. So, this kind of code might look the same, but it’s actually less efficient:

var body: some View {

if useRedText {

Button("Hello World") {

useRedText.toggle()

}

.foregroundColor(.red)

} else {

Button("Hello World") {

useRedText.toggle()

}

.foregroundColor(.blue)

}

}

## Environment modifiers

Many modifiers can be applied to containers, which allows us to apply the same modifier to many views at the same time. For example:

VStack {

Text("Gryffindor")

Text("Hufflepuff")

Text("Ravenclaw")

Text("Slytherin")

}

.font(.title)

The font title will be applied to all the Text elements. This is called an environment modifier and is different from a regular modifier that is applied to a view. However, you can use font property in one of the Text views and this last one will have the priority over the container property.

However, not all the modifiers work the same way.

## Views as properties

There are several ways to create complex views:

We could create two text views like this as properties, then use them inside a VStack:

struct ContentView: View {

let motto1 = Text("Draco dormiens")

let motto2 = Text("nunquam titillandus")

var body: some View {

VStack {

motto1

motto2

} }

}

You can even apply modifiers to the properties.

You can create computed properties if you want, like this:

var motto1: some View {

Text("Draco dormiens")

}

This is often a great way to carve up your complex views into smaller chunks, but be careful: unlike the body property, Swift won’t automatically apply the @ViewBuilder attribute here, so if you want to send multiple views back you have three options.

First, you can place them in a stack, like this

var spells: some View {

VStack {

Text("Lumos")

Text("Obliviate")

}

}

If you don’t specifically want to organize them in a stack, you can also send back a Group. When this happens, the arrangement of your views is determined by how you use them elsewhere in your code:

var spells: some View {

Group {

Text("Lumos")

Text("Obliviate")

}

}

The third option is to add the @ViewBuilder attribute yourself,

@ViewBuilder var spells: some View {

Text("Lumos")

Text("Obliviate")

}

## View composition

SwiftUI lets us break complex views down into smaller views without incurring much if any performance impact.

struct CapsuleText: View {

var text: String

var body: some View {

Text(text)

.font(.largeTitle)

.padding()

.foregroundColor(.white)

.background(.blue)

.clipShape(Capsule())

}

}

We can then use that CapsuleText view inside our original view, like this:

struct ContentView: View {

var body: some View {

VStack(spacing: 10) {

CapsuleText(text: "First")

CapsuleText(text: "Second")

} }

}

And you can use more properties to the CapsuleText views inside the body view.

## Custom modifiers

To create a custom modifier, create a new struct that conforms to the **ViewModifier** protocol. This has only one requirement, which is a method called body that accepts whatever content it’s being given to work with, and must return **some View**. For Example:

struct Title: ViewModifier {

func body(content: Content) -> some View {

content

.font(.largeTitle)

.foregroundColor(.white)

.padding()

.background(.blue)

.clipShape(RoundedRectangle(cornerRadius: 10))

}

}

We can now use that with the modifier() modifier – yes, it’s a modifier called “modifier”, but it lets us apply any sort of modifier to a view, like this:

Text("Hello World")

.modifier(Title())

When working with custom modifiers, it’s usually a smart idea to create extensions on View that make them easier to use. For example, we might wrap the Title modifier in an extension such as this:

extension View {

Text("Hello World")

.modifier(Title())

}

We can now use the modifier like this:

Text("Hello World")

.titleStyle()

Custom modifiers can do much more than just apply other existing modifiers – they can also create new view structure, as needed. Remember, modifiers return new objects rather than modifying existing ones, so we could create one that embeds the view in a stack and adds another view:

struct Watermark: ViewModifier {

var text: String

func body(content: Content) -> some View {

ZStack(alignment: .bottomTrailing) {

content

Text(text)

.font(.caption)

.foregroundColor(.white)

.padding(5)

.background(.black)

}

}

}

extension View {

func watermarked(with text: String) -> some View {

modifier(Watermark(text: text))

}

}

With that in place, we can now add a watermark to any view like this:

Color.blue

.frame(width: 300, height: 200)

.watermarked(with: "Hacking with Swift")

## Custom containers

You can create custom containers using a stack called GridStack. What we want to say is that there is a new struct called GridStack that conforms to the View protocol and has a set number of rows and columns, and that inside the grid will be lots of content cells that themselves must conform to the View protocol.

struct GridStack<Content: View>: View {

let rows: Int

let columns: Int

let content: (Int, Int) -> Content

var body: some View {

VStack {

ForEach(0..<rows, id: \.self) { row in

HStack {

ForEach(0..<columns, id: \.self) { column in

content(row, column)

}

}

}

}

}

}

The first line – struct GridStack<Content: View>: View – uses a more advanced feature of Swift called generics, which in this case means “you can provide any kind of content you like, but whatever it is it must conform to the View protocol.” After the colon we repeat View again to say that GridStack itself also conforms to the View protocol.

Take particular note of the let content line – that defines a closure that must be able to accept two integers and return some sort of content we can show.

Tip: When looping over ranges, SwiftUI can use the range directly only if we know for sure the values in the range won’t change over time.

struct ContentView: View {

var body: some View {

GridStack(rows: 4, columns: 4) { row, col in

Text("R\(row) C\(col)")

} }

# Project 04 – Better Rest

All iPhones come with a technology called Core ML built right in, which allows us to write code that makes predictions about new data based on previous data it has seen. We’ll start with some raw data, give that to our Mac as training data, then use the results to build an app able to make accurate estimates about new data – all on device, and with complete privacy for users.

Using a technique called regression analysis we can ask the computer to come up with an algorithm able to represent all our data. This in turn allows it to apply the algorithm to fresh data it hasn’t seen before, and get accurate results.

## Entering numbers with Stepper

A stepper is a control with a – and a + button you can tap to select a specific number. You can use a Stepper with Int, double and more.

In the following example, we create a numeric variable that will be bound to a Stepper and we set some optional parameters to define things like, a range of numbers the user can select, the step to increase or decrease the values and we also show the value in a formatted way, to avoid a lot of zeros after the number.

**struct** ContentView: View {

@State **private** **var** sleepAmount = 8.0

**var** body: **some** View {

Stepper("\(sleepAmount.formatted()) hours",

value: $sleepAmount,

in: 4...12,

step: 0.25)

}

}

## Selecting dates and times with DatePicker

In SwiftUI you can have DatePicker too, for example:

**struct** ContentView: View {

@State **private** **var** wakeUp = Date.now

**var** body: **some** View {

DatePicker("Please enter a date", selection: $wakeUp)

.labelsHidden()

}

}

The labelsHidden is to hide the label in case you need it, which is better than just leaving a blank space in the first parameter.

You can also specify that you only want to see the date part or the hour and minutes like this:

**var** body: **some** View {

DatePicker("Please enter a date", selection: $wakeUp,

displayedComponents: .date)

}

You can work with date ranges, too. For example, you could define a function to have a range of dates from today to tomorrow:

**func** exampleDates() {

// create a second Date instance set to one day in seconds from now

**let** tomorrow = Date.now.addingTimeInterval(86400)

// create a range from those two

**let** range = Date.now...tomorrow

}

You can define a date range from today on, so the user cannot select past dates:

**var** body: **some** View {

DatePicker("Please enter a date", selection: $wakeUp,

in: Date.now...

)

}

## Working with Dates

When working with dates, you must try to use the Apple’s framework to do calculations, instead of doing your own calculations, like for example:

let now = Date.now

let tomorrow = Date.now.addingTimeInterval(86400)

let range = now...tomorrow

In the previous example, we are getting now and tomorrow by adding 86400 seconds, which is what you have in 24 hours, but you must try to avoid using this kind of calculous.

There are some challenges when working with dates like:

1. Choosing a sensible default “wake up” time.

2. Reading the hour and minute they want to wake up.

3. Showing their suggested bedtime neatly formatted.

For first challenge, we can use DateComponents, a special type that allows you read or write different parts of the date instead the whole thing:

var components = DateComponents()

components.hour = 8

components.minute = 0

let date = Calendar.current.date(from: components) ?? Date.now

In the previous example, we say, we want a date with 8 hours and 0 minutes, and if getting that date fails, give me the current date.

For the second challenge, to get a date or hours from a DatePicker or the current date, we can use DateComponents too:

let components =

Calendar.current.dateComponents([.hour, .minute], from:

someDate)

let hour = components.hour ?? 0

let minute = components.minute ?? 0

someDate can be a DatePicker or Date.now, for example.

For the third challenge, for example, if we just wanted the time from a date, we would write this:

Text(Date.now, format: .dateTime.hour().minute())

When we write day().month().year() we’re asking for that data, not arranging it, and iOS will automatically format that data using the user’s preferences.

As an alternative, we can use the formatted() method directly on dates, passing in configuration options for how we want both the date and the time to be formatted, like this:

Text(Date.now.formatted(date: .long, time: .shortened))

## Training a model with Create ML

iOS 11 came with a Machine Learning framework called Core ML, a second framework was introduced 1 year later called Create ML.

Core ML is capable of handling a variety of training tasks, such as recognizing images, sounds, and even motion, but in this instance we’re going to look at tabular regression.

Machine learning is done in two steps: we train the model, then we ask the model to make predictions. Training is the process of the computer looking at all our data to figure out the relationship between all the values we have, and in large data sets it can take a long time – easily hours, potentially much longer. Prediction is done on device: we feed it the trained model, and it will use previous results to make estimates about new data.

To start training the model, open Create ML by going to the Xcode menu and choosing Open Developer Tool > Create ML. The first thing Create ML app will do is ask you to create a project or open a previous one.

With a sample file called BetterRest.csv, where we have 4 columns (wake, estimatedSleep, coffee and actualSleep), we select this file (to load it) in the Training Data box, for the target we define the actualSleep, which is the value we want to predict and to do this, we will use select the other 3 columns.

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Description automatically generated

In the Algorithm field, there are several options, but for this example, we will use Automatic and click on the Train button.

Once the training has finished, you can go to the Evaluation tab and click on the Validation tab to see some result metrics. The value Root Mean Square Error means on average the model was able to predict suggested accurate sleep time with an error of only 170 seconds, or three minutes.

Even better, if you go to the Output tab you’ll see an our finished model has a file size of 544 bytes or so. Create ML has taken 180KB of data, and condensed it down to just 544 bytes – almost nothing.

To export the trained model, go to the Output tab and click on Get button to save the model and use it on Xcode.

## Building a basic layout

**struct** ContentView: View {

@State **private** **var** wakeUp = Date.now

@State **private** **var** sleepAmount = 8.0

@State **private** **var** coffeeAmount = 1

**var** body: **some** View {

NavigationView{

VStack {

Text("When do you want to wake up?")

.font(.headline)

DatePicker("Please enter a time", selection: $wakeUp,

displayedComponents: .hourAndMinute)

.labelsHidden()

Text("Desired amount of sleep")

.font(.headline)

Stepper("\(sleepAmount.formatted()) hours", value: $sleepAmount, in: 4...12,

step: 0.25)

Text("Daily coffee intake")

.font(.headline)

Stepper(coffeeAmount == 1 ? "1 cup" : "\(coffeeAmount) cups", value:

$coffeeAmount, in: 1...20)

}

.navigationTitle("BetterRest")

.toolbar{

Button("Calculate", action: calculateBedtime)

}

}

}

**func** calculateBedtime(){

}

}

## Connecting SwiftUI to Core ML

To use the model you have created and trained, first you need to add it to the project. To do this, just drag and drop the mlmodel file in the project navigation bar, where the other files are:

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Description automatically generated

Make sure you select “Copy files if needed” and finish.

Xcode will create a class (that you don’t see in the project) with the same name as the file.

In the example, the model receives 3 arguments, all of them are double values.

So the function calculateBedtime will make an instance of the MLModelConfiguration to pass it to the instance of SleepCalculator (the model we have created and we have renamed to this).

We will get the wake up time, which is in the sum of hours and minutes taken from the wakeup calendar. To get this values, we use the Calendar.current.dateComponents and convert them to seconds multiplying by 60.

To get the prediction, we use the object model.prediction and pass the values we have. The prediction will have the actualSleep time in seconds. We use this time to calculate the time the user should go to bed, by subtracting this value from the wakeUp value. Then we give it a format and display the value in an alert.

**func** calculateBedtime(){

**do**{

**let** config = MLModelConfiguration()

**let** model = **try** SleepCalculator(configuration: config)

// Get the hour and minutes from the wake up time selected by the user

**let** components = Calendar.current.dateComponents([.hour, .minute], from: wakeUp)

// Get the hour and minutes in seconds

**let** hour = (components.hour ?? 0) \* 60 \* 60

**let** minute = (components.minute ?? 0) \* 60

// Feed the values to the CoreML module

**let** prediction = **try** model.prediction(wake: Double(hour + minute),

estimatedSleep: sleepAmount, coffee: Double(coffeeAmount))

// Get the time the user needs to go to sleep by substracting the actualSleep from the wakeup value

// The actualSleep is in seconds

**let** sleepTime = wakeUp - prediction.actualSleep

alertTitle = "Your ideal bedtime is..."

alertMessage = sleepTime.formatted(date: .omitted, time: .shortened)

} **catch** {

alertTitle = "Error"

alertMessage = "Sorry, there was a problem calculating your bedtime"

}

showAlert = **true**

}

## Cleaning up the UI

In the example, we add a computed property to the ContentView struct, that contains a Date value referencing 7am of the current day:

**static** **var** defaultWakeTime: Date {

**var** components = DateComponents()

components.hour = 7

components.minute = 0

**return** Calendar.current.date(from: components) ?? Date.now

}

So, the wakeUp property, now looks like this:

@State **private** **var** wakeUp = defaultWakeTime

The defaultWakeTime property is static to avoid accessing one property from inside another one. In other words, it belongs to the ContentView struct itself instead a single instance of that struct.

For the style, we can use a Form instead the VStack and separate every title and data field into a VStack:

**var** body: **some** View {

NavigationView{

Form {

VStack(alignment: .leading, spacing: 0) {

Text("When do you want to wake up?")

.font(.headline)

DatePicker("Please enter a time", selection: $wakeUp,

displayedComponents: .hourAndMinute)

.labelsHidden()

}

VStack(alignment: .leading, spacing: 0) {

Text("Desired amount of sleep")

.font(.headline)

Stepper("\(sleepAmount.formatted()) hours", value: $sleepAmount, in: 4...12,

step: 0.25)

}

VStack(alignment: .leading, spacing: 0) {

Text("Daily coffee intake")

.font(.headline)

Stepper(coffeeAmount == 1 ? "1 cup" : "\(coffeeAmount) cups", value:

$coffeeAmount, in: 1...20)

}

}

.navigationTitle("BetterRest")

.toolbar{

Button("Calculate", action: calculateBedtime)

}

.alert(alertTitle, isPresented: $showAlert){

Button("OK") { }

} message: {

Text(alertMessage)

}

}

}

# Project 05 – Word Scramble

The next project will show players a random eight-letter word and ask them to make words out of it. Along the way you’ll meet List, onAppear(), Bundle, fatalError(), and more – all useful skills that you’ll use for years to come. You’ll also get some practice with @State, NavigationView, and more.

## Introduction to List

The job of **List** is to provide a scrolling table of data. Just like Form, you can provide List a selection of static and dynamic views:

List {

Section("Section 1") {

Text("Static row 1")

Text("Static row 2")

}

Section("Section 2") {

ForEach(0..<5) {

Text("Dynamic row \($0)")

}

}

Section("Section 3") {

Text("Static row 3")

Text("Static row 4")

}

}

You’ll notice that this list looks similar to the form we had previously, but we can adjust how the list looks using the **listStyle()** modifier, like this:

.listStyle(.grouped)

One thing List can do that Form can’t is to generate its rows entirely from dynamic content without needing a ForEach. Example:

List(0..<5) {

Text("Dynamic row \($0)")

}

Lists work well with arrays because SwiftUI can identify each row uniquely based on its position in the range. When working with an array of data, SwiftUI still needs to know how to identify each row uniquely, so if one gets removed it can simply remove that one rather than having to redraw the whole list. This is where the id parameter comes in, and it works identically in both List and ForEach – it lets us tell SwiftUI exactly what makes each item in the array unique.

When working with arrays of strings and numbers, the only thing that makes those values unique is the values themselves. When working with this kind of list data, we use id: \.self like this:

**struct** ContentView: View {

**let** people = ["Finn", "Leia", "Luke", "Rey"]

**var** body: **some** View {

List(people, id: \.**self**) {

Text($0) }

}

}

## Loading resources from your app bundle

When Xcode builds your iOS app, it creates something called a “bundle”. It allows the system to store all the files for a single app in one place – the binary code.

When you want to look in a bundle for a file you placed there, you can use a new data type called URL. If we want to read the URL for a file in our main app bundle, we use Bundle.main.url(). If the file exists, it will be sent back, otherwise, we’ll get nil.

What’s inside the URL doesn’t really matter, because iOS uses paths that are impossible to guess – our app lives in its own sandbox, and we shouldn’t try to read outside of it.

**func** loadFile(){

**if** **let** fileURL = Bundle.main.url(forResource: "some-file", withExtension: "txt"){

**if** **let** fileContents = **try**? String(contentsOf: fileURL){

//fileContents is a String

}

}

}

Once we have a URL, we can load it into a string with a special initializer: **String(contentsOf:)**. We give this a file URL, and it will send back a string containing the contents of that file if it can be loaded. If it *can’t* be loaded it throws an error, so you you need to call this using **try** or **try?**

## Working with Strings

Swift gives us a method called **components(separatedBy:)** that can converts a single string into an array of strings by breaking it up wherever another string is found. For example, this will create the array **["a", "b", "c"]**:

let input = "a b c"

let letters = input.components(separatedBy: " ")

Once you have created the array with the components function, you can get a random element from it by using randomElement():

let letter = letters.randomElement()

This method returns an optional string, so you must either unwrap or use it with nil coalescing.

Another useful string method is **trimmingCharacters(in:)**, which asks Swift to remove certain kinds of characters from the start and end of a string. This uses a new type called **CharacterSet**, but most of the time we want one particular behavior: removing whitespace and new lines – this refers to spaces, tabs, and line breaks, all at once.

let trimmed =

letter?.trimmingCharacters(in: .whitespacesAndNewlines)

Another string functionality we can use is the spell checker, provided by the class UITextChecker. The class comes from UIKit and it is written in Objective-C.

**func** testCheckSpell(){

// 1. You must crete a word to check and an instance of UITextChecker

**let** word = "swift"

**let** checker = UITextChecker()

// 2. Tell the checker ow much of our string we want to check

**let** range = NSRange(location: 0, length: word.utf16.count)

// 3. Ask our text checker to report where it found any misspellings in our word

**let** misspelledRange = checker.rangeOfMisspelledWord(in: word, range: range, startingAt: 0, wrap: **false**, language: "en")

// 4. Check that there are no spelling mistake

**let** allGood = misspelledRange.location == NSNotFound

}

## Adding to a list of Words

In the following code, we have a method called addNewWord that will:

1. Lowercase newWord and remove any whitespace
2. Check that it has at least 1 character, otherwise exit.
3. Insert that word at position 0 in the usedWords array.
4. Set newWord back to be an empty string

**struct** ContentView: View {

@State **private** **var** usedWords = [String]()

@State **private** **var** rootWord = ""

@State **private** **var** newWord = ""

**var** body: **some** View {

List {

Section {

TextField("Enter your word", text: $newWord)

// Do not allow capitalization for the word

.autocapitalization(.none)

}

Section{

ForEach(usedWords, id: \.**self**) { word **in**

HStack{

// This line allows you to show the count of letters of the word in a circle

Image(systemName: "\(word.count).circle")

Text(word)

}

}

}

}

.navigationTitle(rootWord)

// This modifier adds an action to perform when the user submits a value to this view.

.onSubmit(addNewWord)

}

**func** addNewWord(){

// Lowercase and trim the word, to make sure we don't add duplicate words with case differences

**let** answer = newWord.lowercased().trimmingCharacters(in: .whitespacesAndNewlines)

// exit if the remaining string is empty

**guard** answer.count > 0 **else** { **return** }

// Extra validation

withAnimation{

usedWords.insert(answer, at: 0)

}

newWord = ""

}

}

A couple of notes about the previous code:

* The modifier autocapitalization can be used when you need to autocapitalice a sentence or word, or avoid it by using the .none value.
* The .onSubmit adds an action to perform when the user submits a value. In the example is added to the List, but it can be added to the TextField or in any other element in the screen.
* The withAnimation block allows you to add an animation to the action of inserting the new word to the usedWord which eventually, will update the list.

## Running code when our app launches

For this project, once you have downloaded the start.txt file, drag it to the project pane, and use the following options:

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Description automatically generated

In the following function, we define the behavior for the start of the game:

**func** startGame(){

**if** **let** startWordsURL = Bundle.main.url(forResource: "start", withExtension: "txt"){

// Load start text into a string

**if** **let** startWords = **try**? String(contentsOf: startWordsURL){

// Get all words by spliting starWords

**let** allWords = startWords.components(separatedBy: "\n")

// Get a random word from the array

rootWord = allWords.randomElement() ?? "silkworm"

**return**

}

}

// If the start file was not found or cannot be loaded, a fatal error should

// have happened

fatalError("Could not load start.txt from bundle")

}

In the previous function:

* We find the start.txt with the Bundle.main.url method.
* Load the file into a string.
* Split that string into array of strings, where each element is a word.
* Pick one random word to the assigned as rootWord or use a default word if array is empty.

In the last part of the function, if the file was not found or there was an error loading it, we show a fatalError which will crash the app.

To call this function from the start, we make use of the onAppear function as a modifier for the List, to start the game:

.onAppear(perform: startGame)

## Validating words with UITextChecker

In the project, we will include 4 more functions:

* isOriginal will validate the word has not been used
* isPossible, will validate the word sent is possible to use based on the letter from the rootWord.
* isReal, will validate that the word exists or is not misspelled using UITextChecker. If there are no misspells in the word, it exists.
* A function to show the alert with the error title and error message.

Finally, we use these function from the addNewWord function.

This is the full code:

@State **private** **var** usedWords = [String]()

@State **private** **var** rootWord = ""

@State **private** **var** newWord = ""

@State **private** **var** errorTitle = ""

@State **private** **var** errorMessage = ""

@State **private** **var** showingError = **false**

**var** body: **some** View {

NavigationStack{

List {

Section {

TextField("Enter your word", text: $newWord)

// Do not allow capitalization for the word

.autocapitalization(.none)

}

Section{

ForEach(usedWords, id: \.**self**) { word **in**

HStack{

// This line allows you to show the count of letters of the word in a circle

Image(systemName: "\(word.count).circle")

Text(word)

}

}

}

}

.navigationTitle(rootWord)

// This modifier adds an action to perform when the user submits a value to this view.

.onSubmit(addNewWord)

// This modifier performs a function before the view appears

.onAppear(perform: startGame)

.alert(errorTitle, isPresented: $showingError){

Button("OK", role: .cancel) {}

} message: {

Text(errorMessage)

}

}

}

**func** addNewWord(){

// Lowercase and trim the word, to make sure we don't add duplicate words with case differences

**let** answer = newWord.lowercased().trimmingCharacters(in: .whitespacesAndNewlines)

// exit if the remaining string is empty

**guard** answer.count > 0 **else** { **return** }

**guard** isOriginal(word: answer) **else** {

wordError(title: "Word used already", message: "Be more original")

**return**

}

**guard** isPossible(word: answer) **else** {

wordError(title: "Word not possible", message: "You can't spell that word from '\(rootWord)'!")

**return**

}

**guard** isReal(word: answer) **else** {

wordError(title: "Word not recognized", message: "You can't just make them up, you know!")

**return**

}

withAnimation{

usedWords.insert(answer, at: 0)

}

newWord = ""

}

**func** startGame(){

**if** **let** startWordsURL = Bundle.main.url(forResource: "start", withExtension: "txt"){

// Load start text into a string

**if** **let** startWords = **try**? String(contentsOf: startWordsURL){

// Get all words by spliting starWords

**let** allWords = startWords.components(separatedBy: "\n")

// Get a random word from the array

rootWord = allWords.randomElement() ?? "silkworm"

**return**

}

}

// If the start file was not found or cannot be loaded, a fatal error should

// have happened

fatalError("Could not load start.txt from bundle")

}

// This function validates if the word has been already used

**func** isOriginal(word: String) -> Bool{

!usedWords.contains(word)

}

// This function validates if the word passed uses all letter available in the rootWord

**func** isPossible(word: String) -> Bool {

**var** tempWord = rootWord

**for** letter **in** word {

**if** **let** pos = tempWord.firstIndex(of: letter){

tempWord.remove(at: pos)

} **else** {

**return** **false**

}

}

// Every letter in the word was found

**return** **true**

}

// This function will validates if the word entered is real

**func** isReal(word: String) -> Bool {

**let** checker = UITextChecker()

**let** range = NSRange(location: 0, length: word.utf16.count)

**let** misspelledRange = checker.rangeOfMisspelledWord(in: word, range: range, startingAt: 0, wrap: **false**, language: "en")

// If the word is not misspelled, then is a real word

**return** misspelledRange.location == NSNotFound

}

// This will show the alert with the error message passed as parameters

**func** wordError(title: String, message: String){

errorTitle = title

errorMessage = message

showingError = **true**

}

}

# Project 06 - Animation

## Implicit Animations

An implicit animation is the simplest type in SwiftUI, you tell the view, if someone wants to animate you, here’s how you should respond. In the following example, we define a rounded button, and we will use the scaleEffect along with a state property to increase the size of the button. The value in this scaleEffect goes from 0 to 1.0 which represents the 100% of the normal size of the button.

To make this size increasing process to be animated, we use animation modifier. The implicit animation takes effect on all properties of the view that change, so by adding another animation modifier, like the blur, you will see how the button scales and blurs smoothly.

**struct** ContentView: View {

@State **private** **var** animationAmount = 1.0

**var** body: **some** View {

Button("Tap me"){

animationAmount += 1

}

.padding(50)

.background(.red)

.foregroundColor(.white)

.clipShape(Circle())

.scaleEffect(animationAmount)

.blur(radius: (animationAmount - 1) \* 3)

.animation(.default, value: animationAmount)

}

}

## Customizing Animations

We can control the type of animation used by passing in different values to the modifier. For example, we could use **.easeOut** to make the animation start fast then slow down to a smooth stop:

.animation(.easeOut, value: animationAmount)

Remember that implicit animations always need to watch a particular value, otherwise they will be triggered for every small change, even rotating the device.

There are even spring animations, that cause the movement to overshoot then return to settle at its target. You can control the initial stiffness of the spring (which sets its initial velocity when the animation starts), and also how fast the animation should be “damped”

.animation(.interpolatingSpring(stiffness: 50, damping: 1),

value: animationAmount)

You can also specify the number of seconds for the animation’s duration:

.animation(.easeInOut(duration: 2), value: animationAmount)

You can also use the modifier .delay to set a specific time before the animation starts.

For continuous animations, there is a **repeatForever()** modifier that can be used like this

.animation(

.easeInOut(duration: 1)

.repeatForever(autoreverses: true),

value: animationAmount

)

We can use these **repeatForever()** animations in combination with **onAppear()** to make animations that start immediately and continue animating for the life of the view.

struct ContentView: View {

@State private var animationAmount = 1.0

var body: some View {

Button("Tap me"){

//animationAmount += 1

}

.padding(50)

.background(.red)

.foregroundColor(.white)

.clipShape(Circle())

.overlay(

Circle()

.stroke(.red)

.scaleEffect(animationAmount)

.opacity(2 - animationAmount)

.animation(

.easeInOut(duration: 1)

.repeatForever(autoreverses: false),

value: animationAmount

)

)

.onAppear{

animationAmount = 2

}

}

}

That makes a stroked red circle over our button, using an opacity value of **2 - animationAmount** so that when **animationAmount** is 1 the opacity is 1 (it’s opaque) and when **animationAmount** is 2 the opacity is 0 (it’s transparent).

## Animation Bindings

The **animation()** modifier can be applied to any SwiftUI binding, which causes the value to animate between its current and new value. This also applies to Boolean data. For example:

**struct** ContentView: View {

@State **private** **var** animationAmount = 1.0

**var** body: **some** View {

VStack {

Stepper("Scale amount", value: $animationAmount.animation(), in: 1...10)

Spacer()

Button("Tap me"){

animationAmount += 1

}

.padding(50)

.background(.red)

.foregroundColor(.white)

.clipShape(Circle())

.scaleEffect(animationAmount)

}

}

}

As you can see, the stepper can move **animationAmount** up and down, and tapping the button will add 1 to it – they are both tied to the same data, which in turn causes the size of the button to change. However, tapping the button changes **animationCount** immediately, so the button will just jump up to its larger size. In contrast, the stepper is bound to **$animationAmount.animation()**, which means SwiftUI will automatically animate its changes.

SwiftUI is examining the state of our view before the binding changes, examining the target state of our views *after* the binding changes, then applying an animation to get from point A to point B.

This is why we can animate a Boolean changing: Swift isn’t somehow inventing new values between false and true, but just animating the view changes that occur as a result of the change.

These binding animations use a similar **animation()** modifier that we use on views, so you can go to town with animation modifiers if you want to:

Stepper("Scale amount", value: $animationAmount.animation(

.easeInOut(duration: 1)

), in: 1...10)

**Tip:** With this variant of the **animation()** modifier, we don’t need to specify which value we’re watching for changes – it’s literally attached to the value it should watch!

## Creating explicit animations

You can also use 3D animation with some modifiers SwiftUI offers, like rotation3DEffct():

* If we skewer the view through the X axis (horizontally) then it will be able to spin forwards and backwards.
* If we skewer the view through the Y axis (vertically) then it will be able to spin left and right.
* If we skewer the view through the Z axis (depth) then it will be able to rotate left and right.

**struct** ContentView: View {

@State **private** **var** animationAmount = 0.0

**var** body: **some** View {

Button("Tap Me") {

withAnimation(.interpolatingSpring(stiffness: 5, damping: 1)){

animationAmount += 360

}

}

.padding(50)

.background(.red)

.foregroundColor(.white)

.clipShape(Circle())

.rotation3DEffect(.degrees(animationAmount), axis: (x: 0, y: 1,

z: 0))

}

}

Along with the rotation3DEffect modifier, we need to use withAnimation at the moment of changing the value for the animationAmount, if not, the change will happen immediately.

The interpolatingSpring add another effect to use a spring animation.

## Controlling the animation stack

It is important to remember that the order of modifiers matters, and it also applies to animation modifiers.

Besides that, you can have as many animation modifiers as you want, and the order of these modifiers will matter.

Now for the fun part: if we apply multiple **animation()** modifiers, each one controls everything before it up to the next animation. This allows us to animate state changes in all sorts of different ways rather than uniformly for all properties.

**struct** ContentView: View {

@State **private** **var** enabled = **false**

**var** body: **some** View {

Button("Tap Me") {

enabled.toggle()

}

.frame(width: 200, height: 200)

.background(enabled ? .blue : .red)

.animation(.default, value: enabled)

.foregroundColor(.white)

.clipShape(RoundedRectangle(cornerRadius: enabled ? 60 : 0))

.animation(.interpolatingSpring(stiffness: 10, damping: 1), value: enabled)

}

}

For even more control, it’s possible to disable animations entirely by passing **nil** to the modifier.

Button("Tap Me") {

enabled.toggle()

}

.frame(width: 200, height: 200)

.background(enabled ? .blue : .red)

.animation(nil, value: enabled)

.foregroundColor(.white)

.clipShape(RoundedRectangle(cornerRadius: enabled ? 60 : 0))

.animation(.interpolatingSpring(stiffness: 10, damping: 1),

value: enabled)

## Animating gestures

SwiftUI allows you to add and animate gestures, like the drag gesture in the following example:

**struct** ContentView: View {

@State **private** **var** dragAmount = CGSize.zero

**var** body: **some** View {

LinearGradient(gradient: Gradient(colors: [.yellow, .red]), startPoint: .topLeading, endPoint: .bottomTrailing)

.frame(width: 300, height: 200)

.clipShape(RoundedRectangle(cornerRadius: 10))

.offset(dragAmount)

.gesture(

DragGesture()

.onChanged { dragAmount = $0.translation }

.onEnded { \_ **in** dragAmount = .zero }

)

.animation(.spring(), value: dragAmount)

}

}

In the previous example, besides adding the drag gesture to the “card”, the object is animated with a spring animation.

You can also animate just the onEnded method:

LinearGradient(gradient: Gradient(colors: [.yellow, .red]), startPoint: .topLeading, endPoint: .bottomTrailing)

.frame(width: 300, height: 200)

.clipShape(RoundedRectangle(cornerRadius: 10))

.offset(dragAmount)

.gesture(

DragGesture()

.onChanged { dragAmount = $0.translation }

**.onEnded { \_ in**

**withAnimation{**

**dragAmount = .zero**

**}**

**}**

)

You can also add a delay to the animations:

struct ContentView: View {

let letters = Array("Hello, SwiftUI")

@State private var enabled = false

@State private var dragAmount = CGSize.zero

var body: some View {

HStack(spacing: 0){

ForEach(0..<letters.count) { num in

Text(String(letters[num]))

.padding(5)

.font(.title)

.background(enabled ? .blue : .red)

.offset(dragAmount)

.animation(

**.default.delay(Double(num) / 20),**

value: dragAmount)

}

}

.gesture(

DragGesture()

.onChanged{ dragAmount = $0.translation }

.onEnded{ \_ in

dragAmount = .zero

enabled.toggle()}

)

}

}

## Showing and hiding Views with transitions

You can animate when a view is hiding or showing by using the withAnimation modifier along with the transition modifier. This transition allows simple like .scale or asymmetric transitions when you define the type of transition when it is inserting the element and when it is removing it:

**struct** ContentView: View {

@State **private** **var** isShowingRed = **false**

**var** body: **some** View {

VStack{

Button("Tap Me") {

withAnimation{

isShowingRed.toggle()

}

}

**if** isShowingRed {

Rectangle()

.fill(.red)

.frame(width: 200, height: 200)

.transition(.asymmetric(insertion: .scale, removal: .opacity))

}

}

}

}

## Building custom transitions using ViewModifier

SwiftUI allows you to create new transitions by adding or removing views using custom animations. This can be made by using the .modifier transition, which accepts any view modifier we want, but we need to instantiate the modifier, in other words, we need to create it.

So, in the following example, we will be using a custom modifier, by creating a CornerRotateModifier struct that has an anchor point to control where the rotation should take place, and an amount to control how much rotation should be applied.

The .clipped means that when the view rotates the parts that are lying outside the natural rectangle won’t get drawn.

The use of the CornerRotateModifier is made using an extension to AnyTransition, and making it to rotate from -90 to 0 on its top leading corner.

The pivot animation is attached to any view using the .transition modifier.

**struct** CornerRotateModifier: ViewModifier {

**let** amount: Double

**let** anchor: UnitPoint

**func** body(content: Content) -> **some** View {

content

.rotationEffect(.degrees(amount), anchor: anchor)

.clipped()

}

}

**extension** AnyTransition {

**static** **var** pivot: AnyTransition{

.modifier(active: CornerRotateModifier(amount: -90, anchor: .topLeading),

identity: CornerRotateModifier(amount: 0, anchor: .topLeading))

}

}

**struct** ContentView: View {

@State **private** **var** isShowingRed = **false**

**var** body: **some** View {

ZStack{

Rectangle()

.fill(.blue)

.frame(width: 200, height: 200)

**if** isShowingRed {

Rectangle()

.fill(.red )

.frame(width: 200, height: 200)

.transition(.pivot)

}

}

.onTapGesture {

withAnimation{

isShowingRed.toggle()

}

}

}

}