#WWDC19

# Accessibility in SwiftUI

## Building the next generation of apps for everyone

John Nefulda, Accessibility Engineer
Michael Gorbach, Accessibility Engineer

# Introduction to Accessibility

Introduction to Accessibility

Automatic Accessibility with SwiftUI

Introduction to Accessibility

Automatic Accessibility with SwiftUI

SwiftUI Accessibility API

Introduction to Accessibility

Automatic Accessibility with SwiftUI

SwiftUI Accessibility API

Accessibility Tree

# Intro to Accessibility

# Make your app usable by **all** of your customers

VoiceOver Word Prediction AssistiveTouch Reduce Transparency On/Off Labels

Speak Screen Mono Audio Full Keyboard Access Subtitles Visible Alerts

Software TTY Button Shapes Dwell Support Reduce Motion

Gliding Cursor Speed Siri Sticky Keys Voice Control

Switch Control Larger Text Zoom Increase Contrast

Gestures Audio Descriptions Dictation Slow Keys Bold Text

Larger Cursor Magnifier Braille Support Cursor Color Invert Colors Grayscale

Vibrating Alerts Closed Captions Hover Text Display Filters Hearing Aids

**VoiceOver** Word Prediction AssistiveTouch Reduce Transparency On/Off Labels

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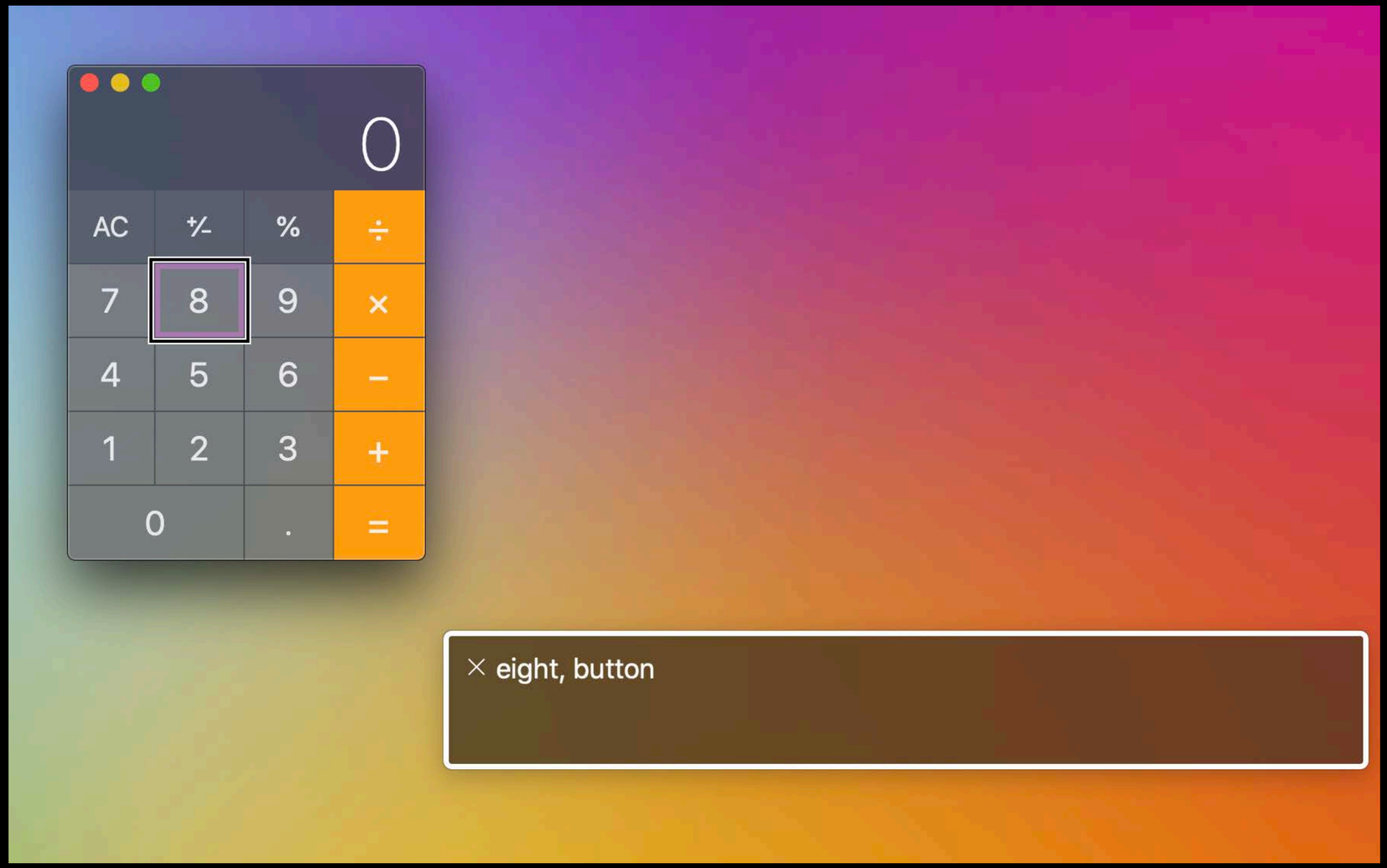
Larger Cursor Magnifier Braille Support Cursor Color Invert Colors Grayscale

Vibrating Alerts Closed Captions Hover Text Display Filters Hearing Aids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VoiceOver Word Prediction AssistiveTouch Reduce Transparency On/Off Labels

Speak Screen Mono Audio Full Keyboard Access Subtitles Visible Alerts

Software TTY Button Shapes Dwell Support Reduce Motion

Gliding Cursor Speed Siri Sticky Keys **Voice Control**

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Vibrating Alerts Closed Captions Hover Text Display Filters Hearing Aids


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VoiceOver Word Prediction AssistiveTouch Reduce Transparency On/Off Labels

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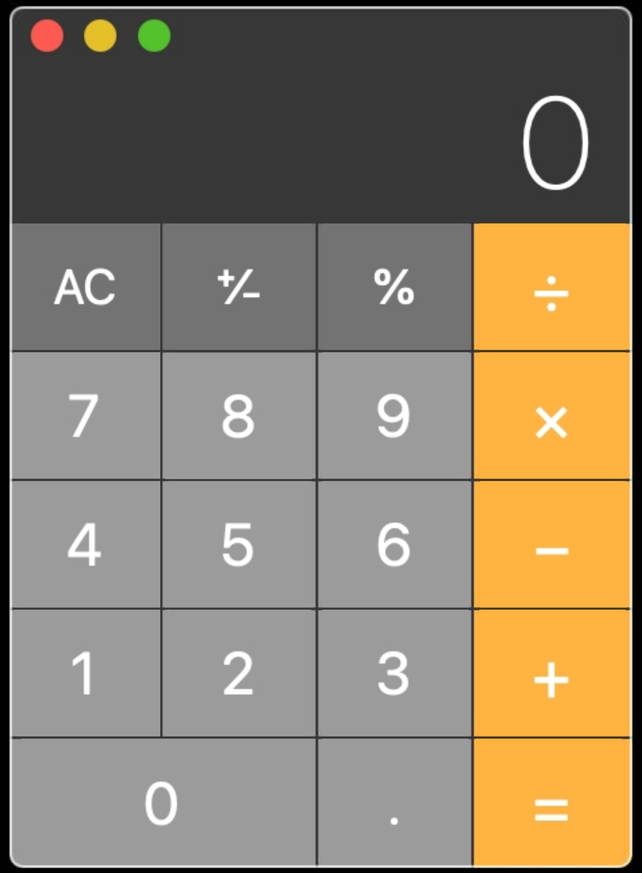
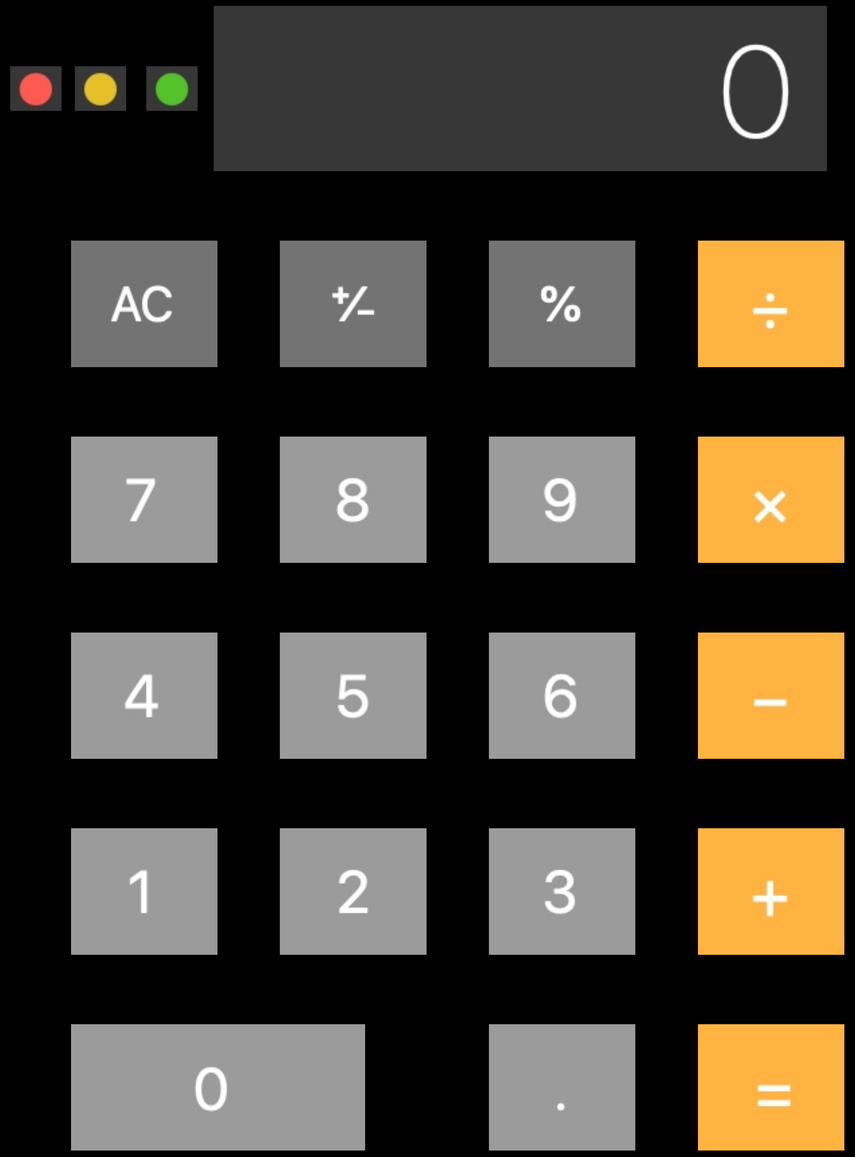
# Accessibility User Interface

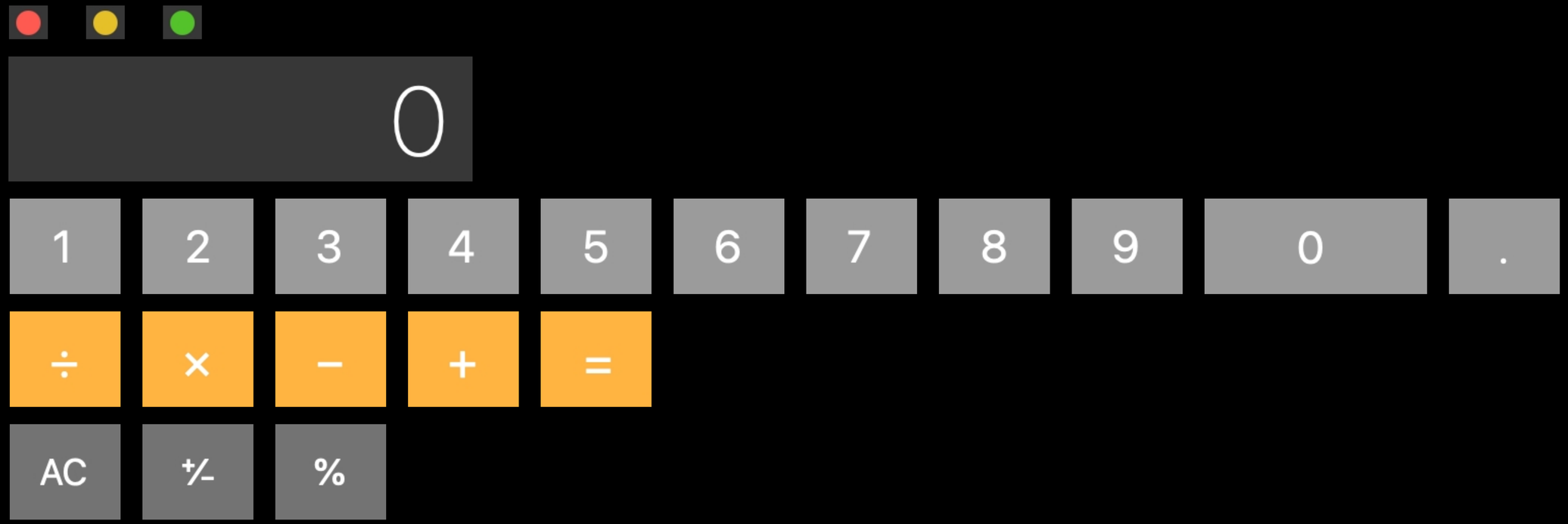
# Accessibility User Interface



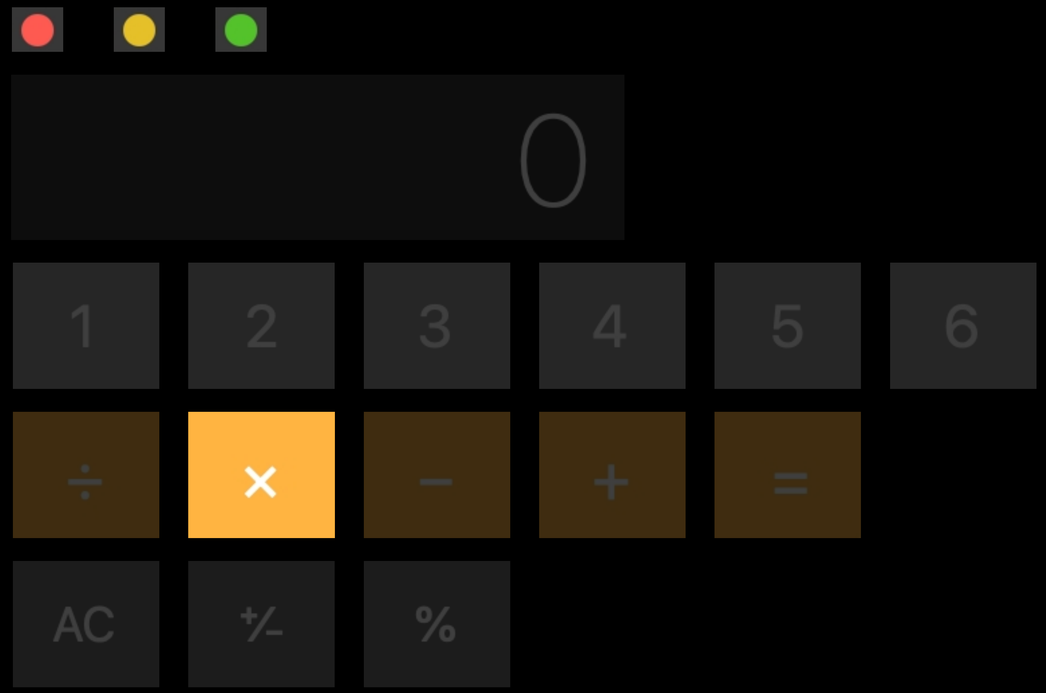
# Accessibility User Interface



# Accessibility User Interface



# Accessibility User Interface

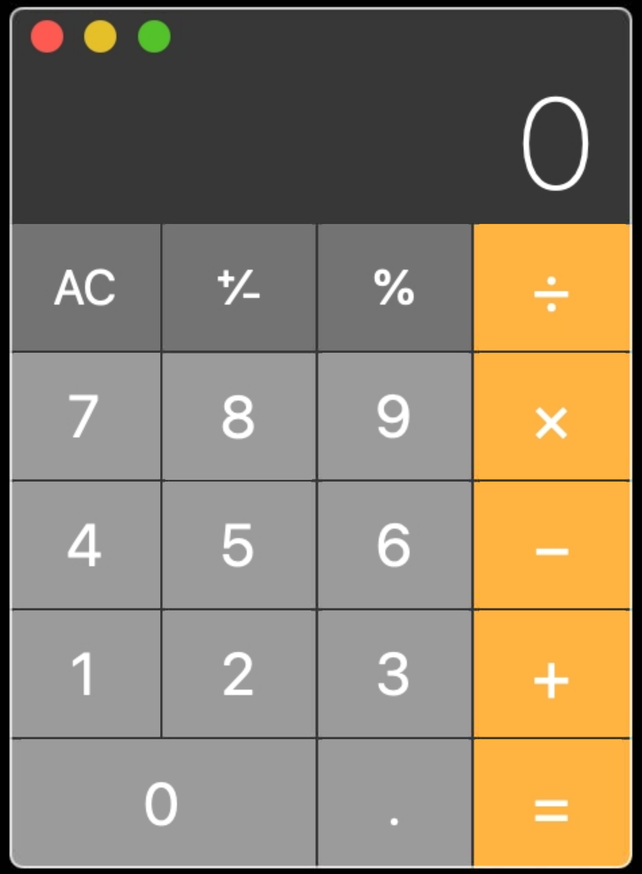



**Label:** “Multiply”
**Trait/Role:** Button
**Default Action:** Press/Tap

# Accessibility User Interface


**Label:** “Main Display”
**Value:** “0"
**Trait/Role:** Static Text
**Default Action:** None
**Custom Action:** “Clear”

# Accessibility User Interface



# Accessibility User Interface

# Accessibility User Interface

Make sure your app’s Accessibility is:

# Accessibility User Interface

Make sure your app’s Accessibility is:

1. Understandable: Labels

# Accessibility User Interface

Make sure your app’s Accessibility is:

1. Understandable: Labels
2. Interactable: Actions

# Accessibility User Interface

Make sure your app’s Accessibility is:

1. Understandable: Labels
2. Interactable: Actions
3. Navigable: Ordering and Grouping

# Accessibility User Interface

| | |
|---|---|
| Accessibility Lessons | WWDC 2019 |
| Deliver an Exceptional Accessibility Experience | WWDC 2018 |
| What's New in Accessibility | WWDC 2017 |

# Automatic Accessibility with SwiftUI

```swift
// SwiftUI makes accessibility elements
automatically for you

var body: some View {
    VStack {
        Text("Top Text")
        Button(action: { print("Pressed!") }) {
            Text("Middle Button")
        }
        Text("Bottom Text")
    }
}
```

```
// SwiftUI makes accessibility elements
automatically for you

var body: some View {
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        }
        Text("Bottom Text")
    }
}
```

**Label:** “Top Text”
**Trait/Role:** Static Text

**Label:** “Bottom Text”
**Trait/Role:** Static Text

```swift
// SwiftUI makes accessibility elements
automatically for you

var body: some View {
    VStack {
        Text("Top Text")
        Button(action: { print("Pressed!") }) {
            Text("Middle Button")
        }
        Text("Bottom Text")
    }
}
```

**Label:** “Top Text”
**Trait/Role:** Static Text

**Label:** “Middle Button”
**Trait/Role:** Button
**Default Action:** Press/Tap

**Label:** “Bottom Text”
**Trait/Role:** Static Text

```swift
// SwiftUI makes accessibility elements
automatically for you

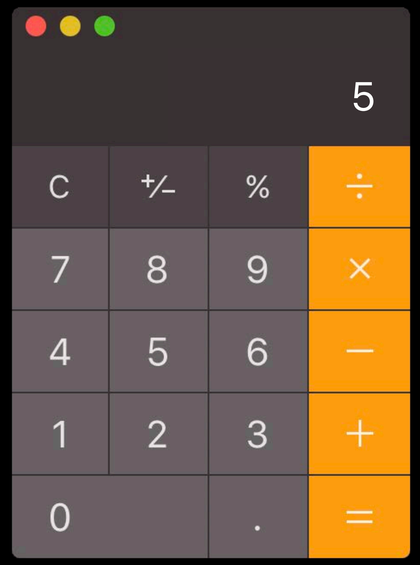
var body: some View {
    VStack {
        Text("Top Text")
        Button(action: { print("Pressed!") }) {
            Text("Middle Button")
        }
        Text("Bottom Text")
    }
}
```

**Label:** “Top Text”
**Trait/Role:** Static Text

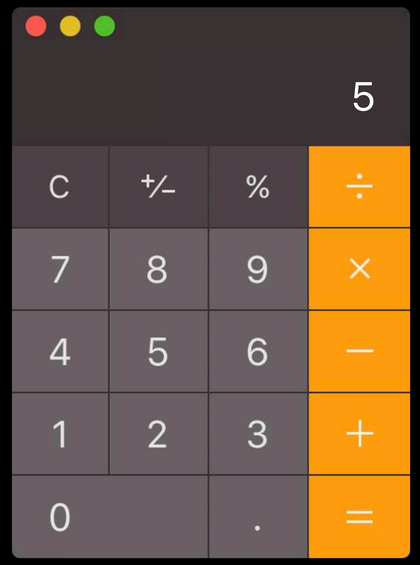
**Label:** “Middle Button”
**Trait/Role:** Button
**Default Action:** Press/Tap

**Label:** “Bottom Text”
**Trait/Role:** Static Text

# Accessibility Notifications

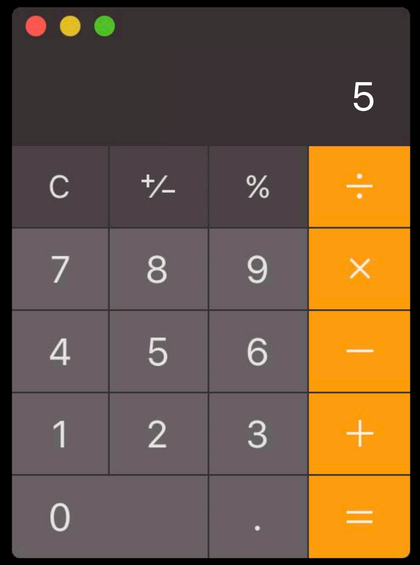



# Accessibility Notifications




Elements?

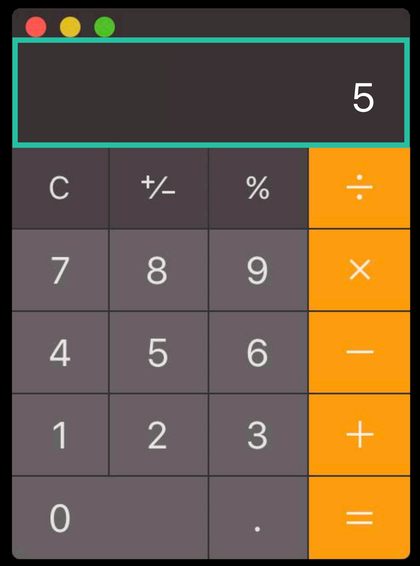
# Accessibility Notifications




Elements?

Elements: 1, 2, 3, 4, 5 ...

# Accessibility Notifications

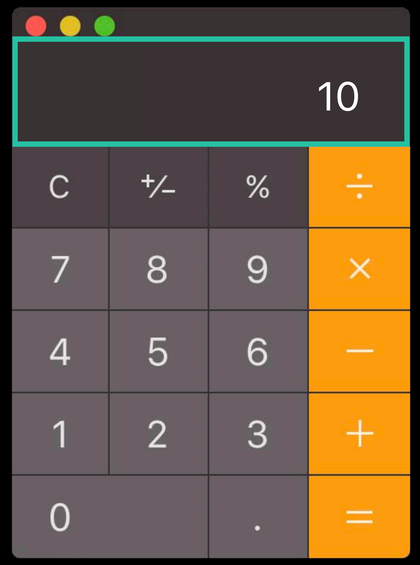



Elements?

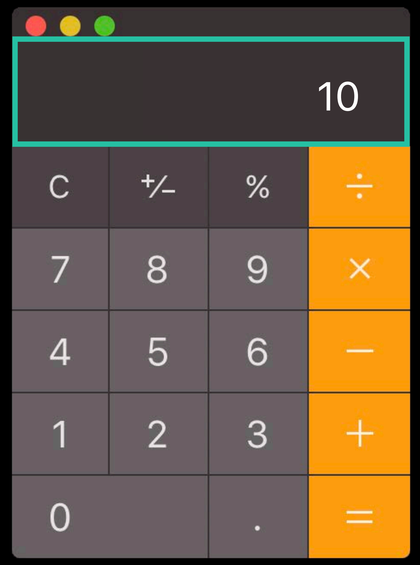
Elements: 1, 2, 3, 4, 5 ...

Main Display Value: 5

# Accessibility Notifications




# Accessibility Notifications



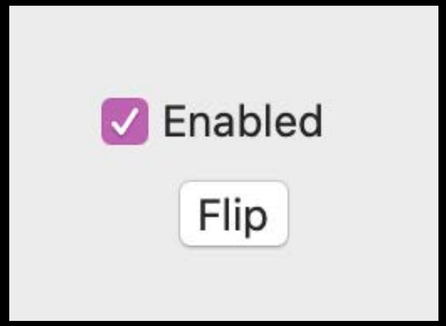

Notification

Main Display Value Changed: 10

```
// SwiftUI automatically sends
accessibility notifications

@State private var enabled = false

var body: some View {
    VStack {
        Toggle(isOn: $enabled) {
            Text("Enabled")
        }
        Button(action: { enabled.toggle() }) {
            Text("Flip")
        }
    }
}
```



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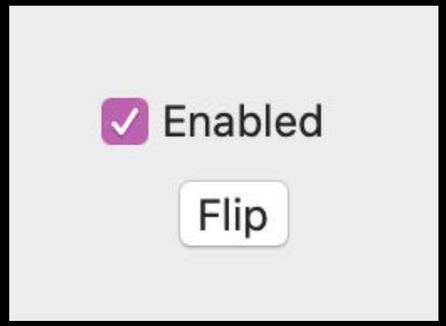
        }
        Button(action: { enabled.toggle() }) {
            Text("Flip")
        }
    }
}
```

**Label:** “Enabled”
**Trait/Role:** Checkbox
**Value:** “1”

**Label:** “Flip”
**Trait/Role:** Button



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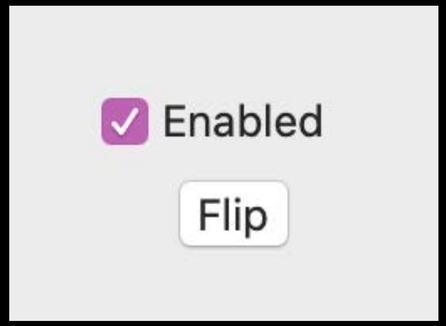
            Text("Enabled")
        }
        Button(action: { enabled.toggle() }) {
            Text("Flip")
        }
    }
}
```

**Label:** “Enabled”
**Trait/Role:** Checkbox
**Value:** “1”

**Label:** “Flip”
**Trait/Role:** Button



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            Text("Enabled")
        }
        Button(action: { enabled.toggle() }) {
            Text("Flip")
        }
    }
}
```

**Label**: “Enabled”
**Trait/Role**: Checkbox
**Value**: “1”

```
// SwiftUI automatically sends
accessibility notifications

@State private var enabled = false

var body: some View {
    VStack {
        Toggle(isOn: $enabled) {
            Text("Enabled")
        }
        Button(action: { enabled.toggle() }) {
            Text("Flip")
        }
    }
}
```

**Label**: “Enabled”
**Trait/Role**: Checkbox
**Value**: “1”

**Notification**

Toggle Value Changed: 1

# Accessible Custom Controls

```swift
// With SwiftUI, you can easily customize button drawing

struct CustomButtonStyle : ButtonStyle {
    func body(configuration: Button<Label>, isPressed: Bool)
        -> some View
    {
        configuration.label
            .font(size: 18)
            .foregroundColor(isPressed ? .black : .white)
            .padding(8)
            .background(
                RoundedRectangle(cornerRadius: 5)
                    .fill(isPressed ? Color.red : Color.blue)
            )
    }
}
```

```swift
// With SwiftUI, you can easily customize button drawing

struct CustomButtonStyle : ButtonStyle {
    func body(configuration: Button<Label>, isPressed: Bool)
        -> some View
    {
        configuration.label
            .font(size: 18)
            .foregroundColor(isPressed ? .black : .white)
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    }
}
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    }
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```

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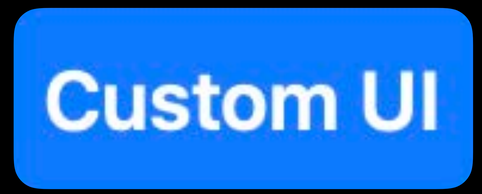
            .background(
                RoundedRectangle(cornerRadius: 5)
                    .fill(isPressed ? Color.red : Color.blue)
            )
    }
}
```

```swift
// Create a custom-styled button with SwiftUI

var body: some View {
    Button(action: {}) { Text("Custom UI") }
        .buttonStyle(.init(CustomButtonStyle()))
}
```

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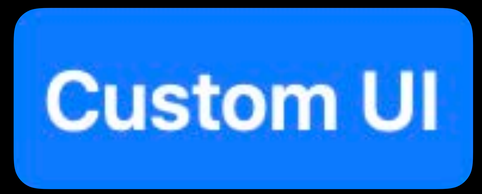
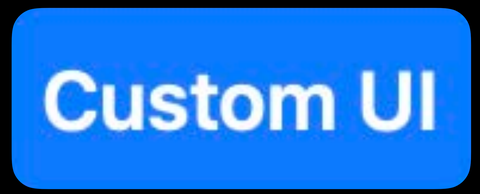


```swift
// Create a custom-styled button with SwiftUI

var body: some View {
    Button(action: {}) { Text("Custom UI") }
        .buttonStyle(.init(CustomButtonStyle()))
}
```

**Label**: “Custom UI”
**Trait/Role**: Button
**Default Action**: Press/Tap

```swift
// Image accessibility in SwiftUI

struct SignupCompleteView : View {
    var body: some View {
        VStack {
            Image("CheckmarkGlyph")
        }
    }
}
```

```swift
// Image accessibility in SwiftUI

struct SignupCompleteView : View {
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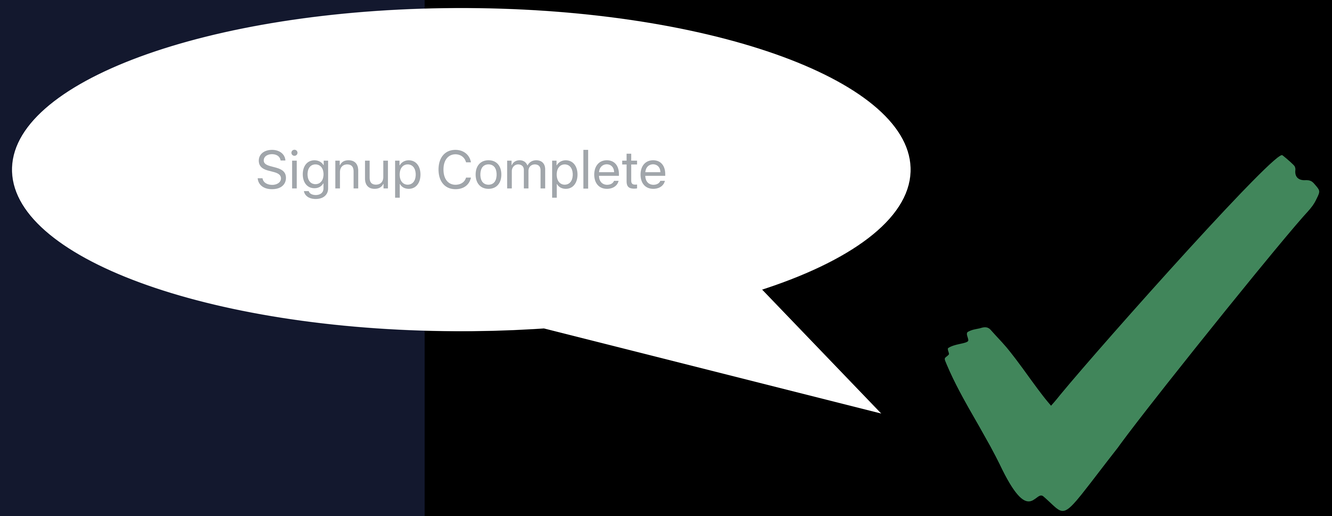
```swift
// Image accessibility in SwiftUI

struct SignupCompleteView : View {
    var body: some View {
        VStack {
            Image("CheckmarkGlyph")
        }
    }
}
```

**Trait/Role**: Image
**Label:** None

```swift
// Image accessibility in SwiftUI

struct SignupCompleteView : View {
    var body: some View {
        VStack {
            Image("CheckmarkGlyph",
                label: Text("Signup Complete!"))
        }
    }
}
```

**Trait/Role**: Image
**Label:** “Signup Complete!”



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struct SignupCompleteView : View {
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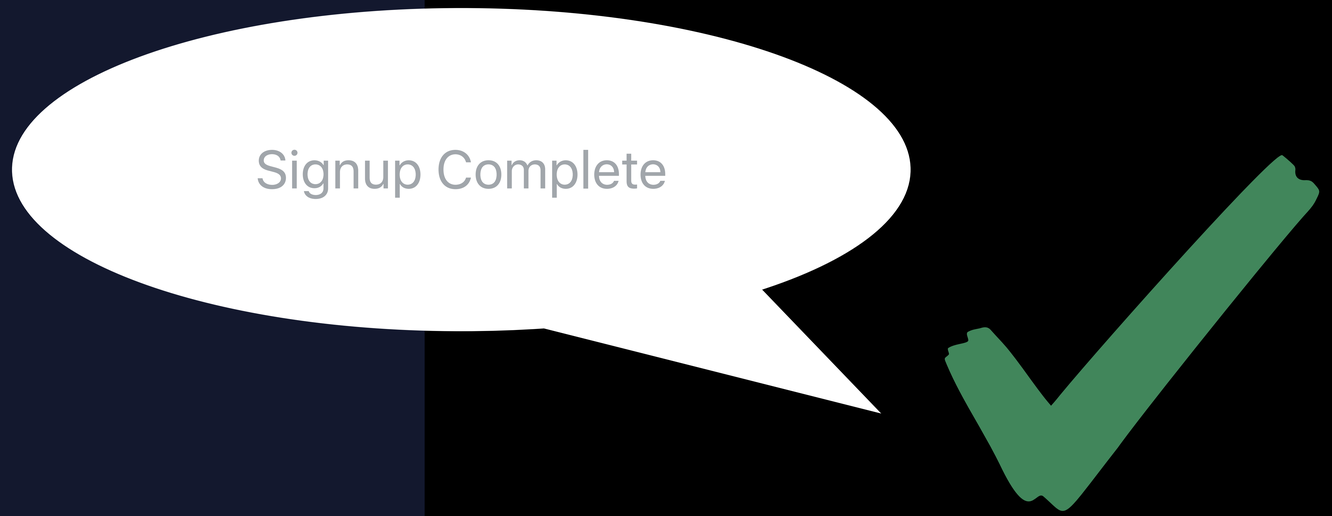
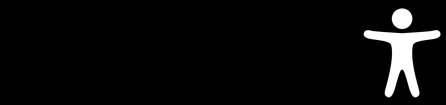
        }
    }
}
```

**Trait/Role**: Image
**Label:** “Signup Complete!”



```swift
// Image accessibility in SwiftUI

struct SignupCompleteView : View {
    var body: some View {
        VStack {
            Image(decorative: "CheckmarkGlyph")
            Text("Signup Complete!")
            Text("Thank you for signing up!")
        }
    }
}
```



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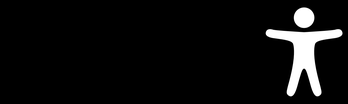

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        VStack {
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            Text("Signup Complete!")
            Text("Thank you for signing up!")
        }
    }
}
```

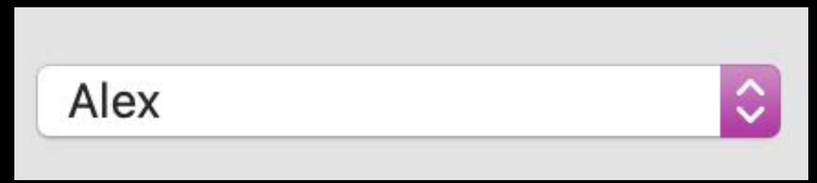
**Label:** “Signup Complete!”
**Trait/Role:** Static Text

**Label:** “Thank you for signing up!”
**Trait/Role:** Static Text

Signup Complete!
Thank you for signing up!

**Label**: None
**Value**: “Alex”
**Trait/Role**: PopUp Button

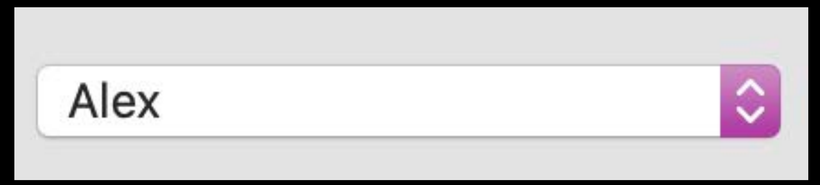
Alex, pop up button



```swift
// Control labels for accessibility in SwiftUI

static let voices = [ "Alex", "Fred", "Victoria" ]
@State var selectedVoice = Self.voices.first!

var body: some View {
    Picker(selection: $selectedVoice,
           label: Text("System Voice")) {
            ForEach(Self.voices.identified(by: \.self)) {
                Text(verbatim: $0)
            }
    }
}
```



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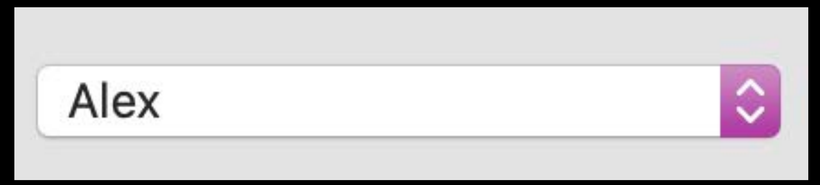

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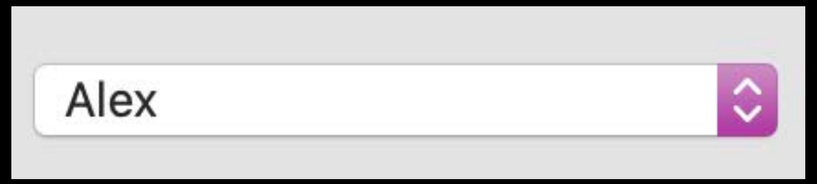
    Picker(selection: $selectedVoice,
           label: Text("System Voice")) {
            ForEach(Self.voices.identified(by: \.self)) {
                Text(verbatim: $0)
            }
    }
}
```

**Label**: “System Voice”
**Value**: “Alex”
**Trait/Role**: PopUp Button



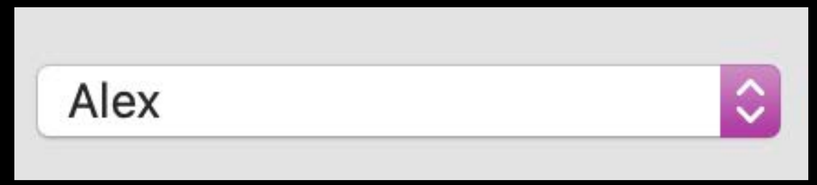
```swift
// Control labels for accessibility in SwiftUI

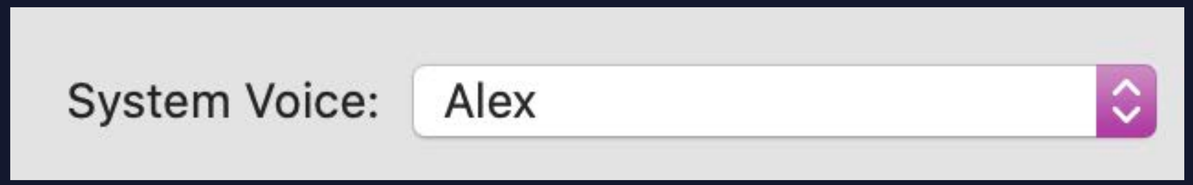
static let voices = [ "Alex", "Fred", "Victoria" ]
@State var selectedVoice = Self.voices.first!

var body: some View {
    Picker(selection: $selectedVoice,
           label: Text("System Voice")) {
            ForEach(Self.voices.identified(by: \.self)) {
                Text(verbatim: $0)
            }
    }
}
```

**Label**: “System Voice”
**Value**: “Alex”
**Trait/Role**: PopUp Button

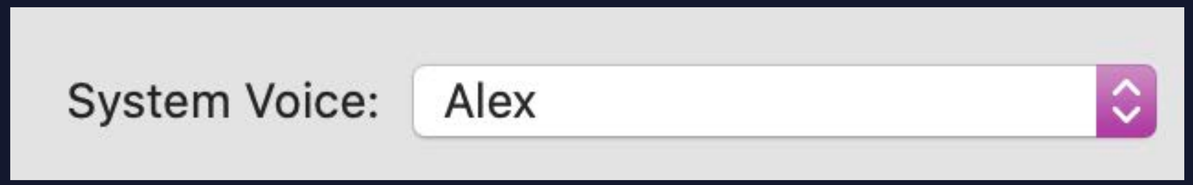
Alex, System Voice,
pop up button




System Voice:
Alex

**Label**: “System Voice”
**Trait/Role**: Static Text

**Label**: Linked
**Value**: “Alex”
**Trait/Role**: PopUp Button



**Label**: “System Voice”
**Trait/Role**: Static Text

**Label**: Linked
**Value**: “Alex”
**Trait/Role**: PopUp Button

Alex, System Voice,
pop up button

# Automatic Accessibility with SwiftUI

Standard controls accessible by default

Accessibility Notifications are automatic

Custom controls are automatically accessible

Accessible and decorative images

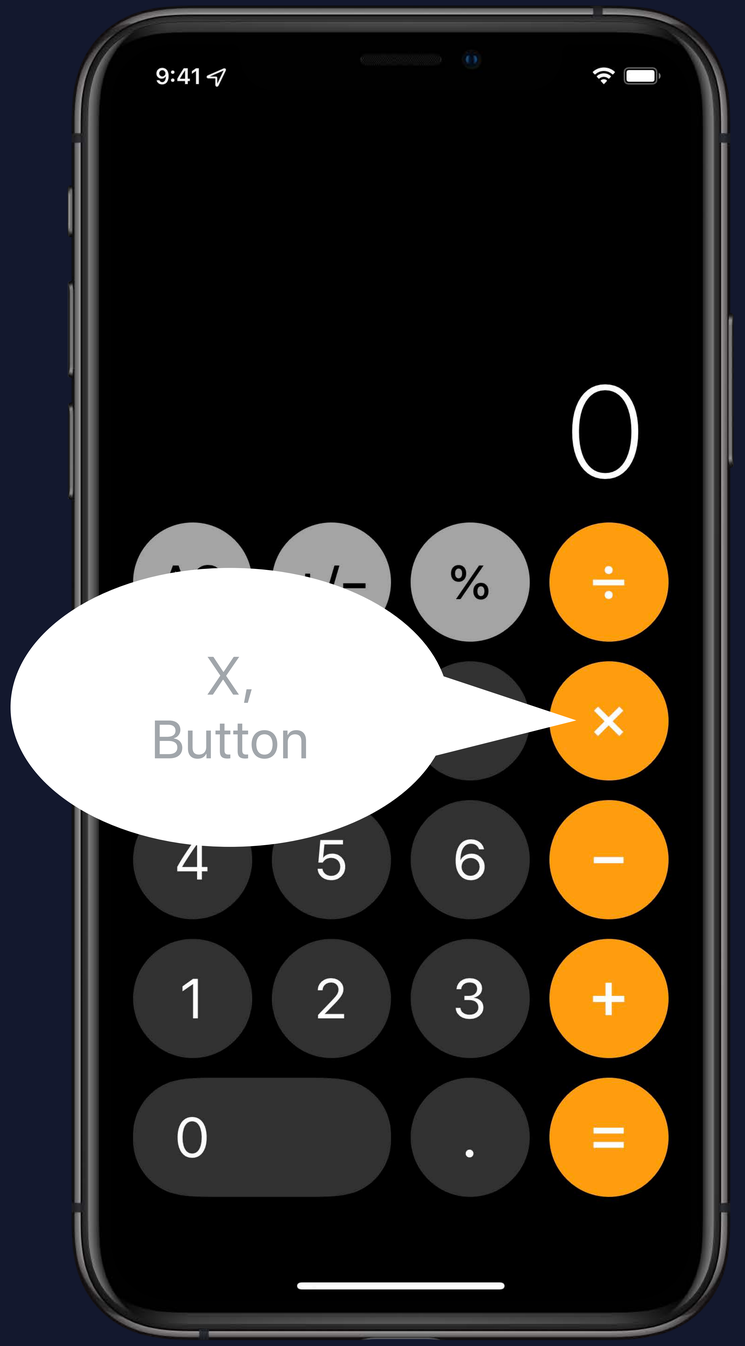
Built-in, accessible labels for all controls

# SwiftUI Accessibility API

John Nefulda, Accessibility Engineer

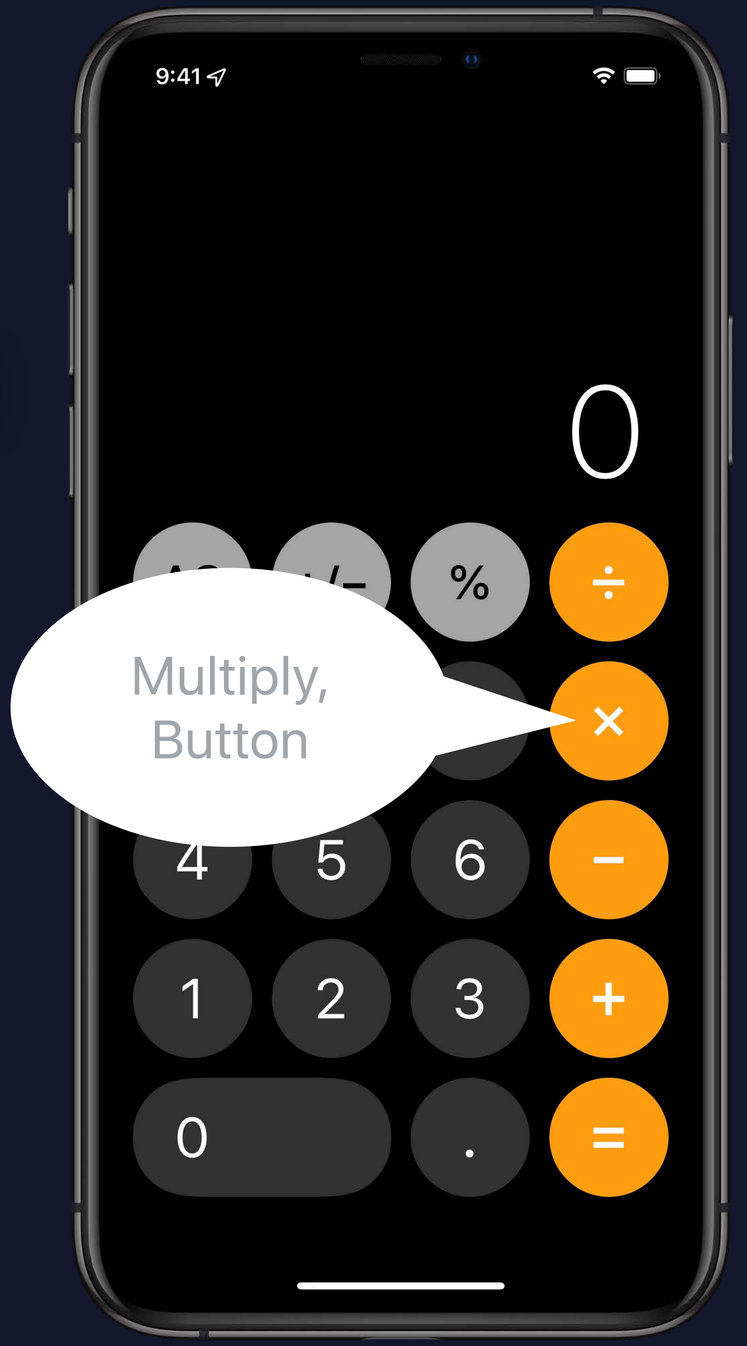
# SwiftUI Accessibility API

```
CalculatorButton(.multiply)
```



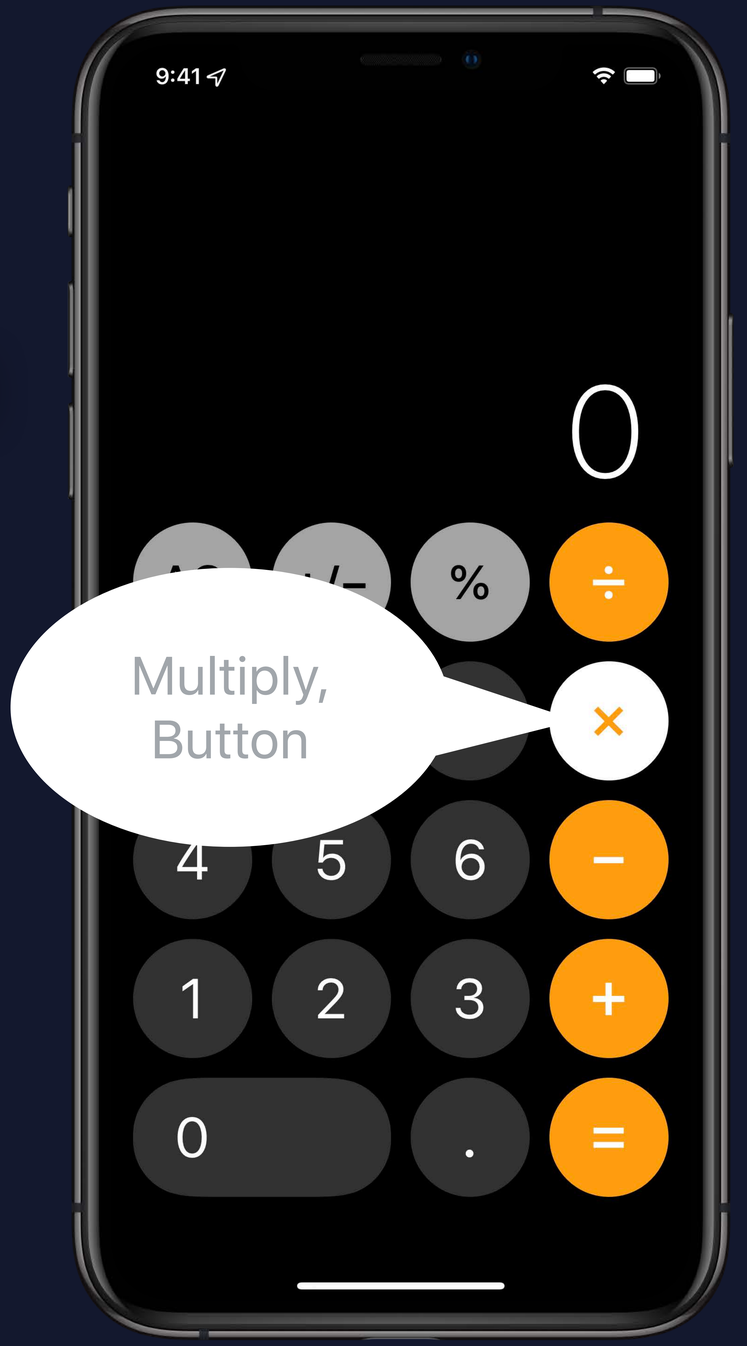
# SwiftUI Accessibility API

```
CalculatorButton(.multiply)
.accessibility(label: Text("Multiply"))
```



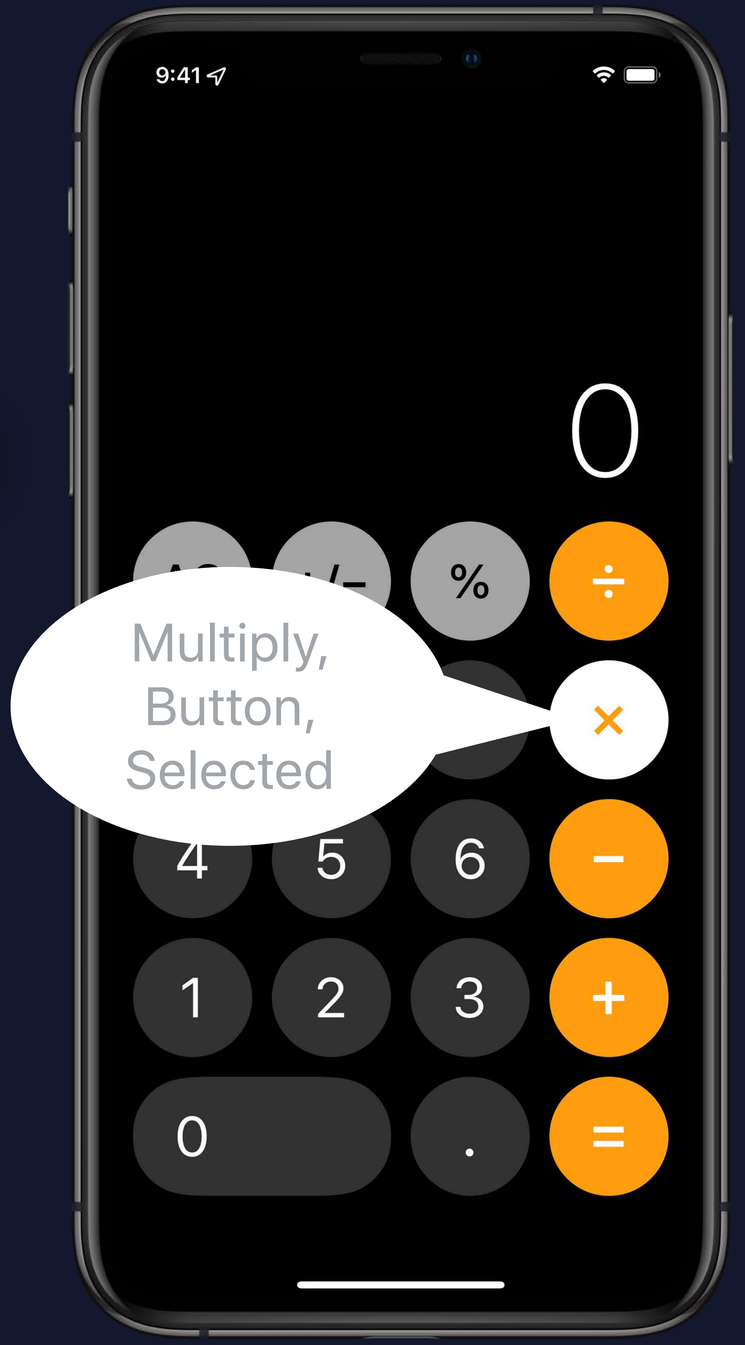
# SwiftUI Accessibility API

```
CalculatorButton(.multiply)
.accessibility(label: Text("Multiply"))
```



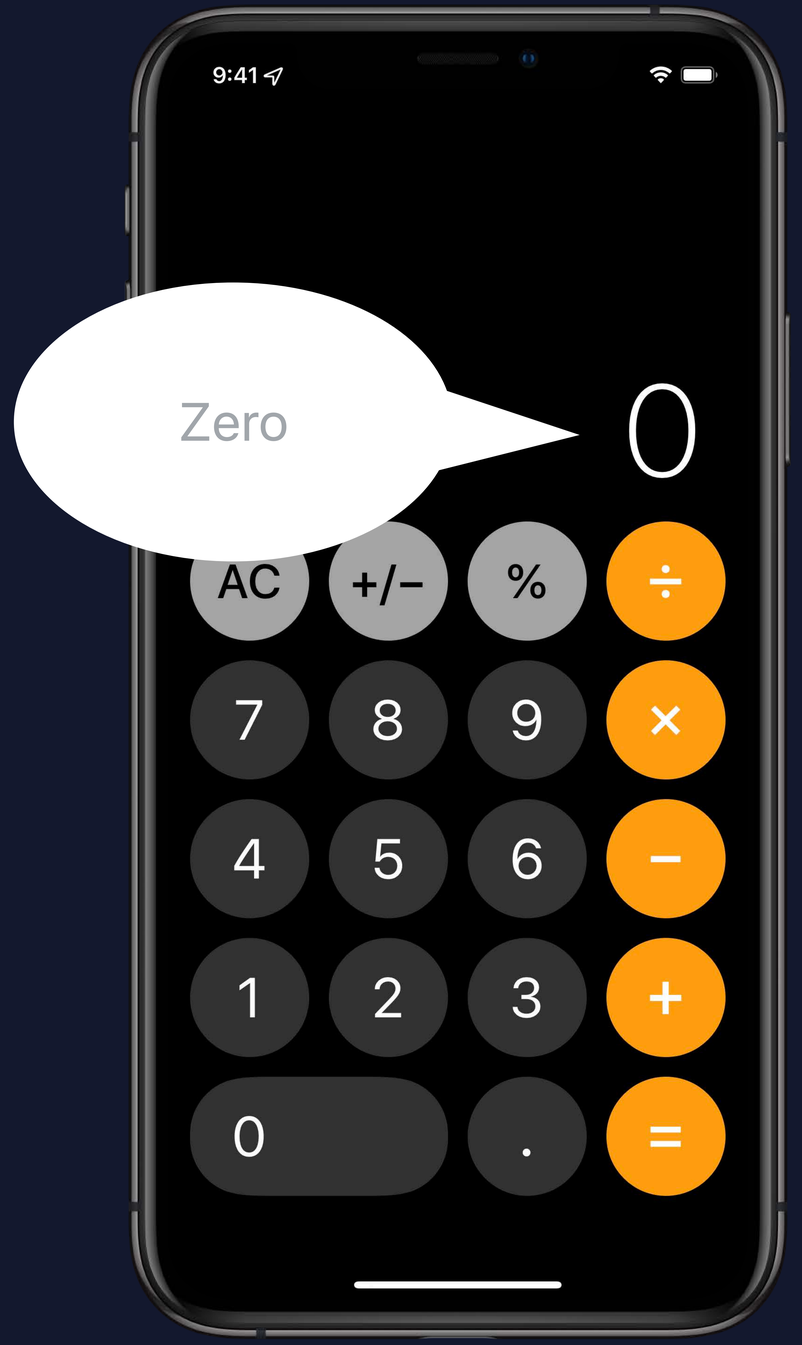
# SwiftUI Accessibility API

```
CalculatorButton(.multiply)
.accessibility(label: Text("Multiply"))
.accessibility(addTraits: selected ? .isSelected : [])
```



# SwiftUI Accessibility API

```
ResultView()
```

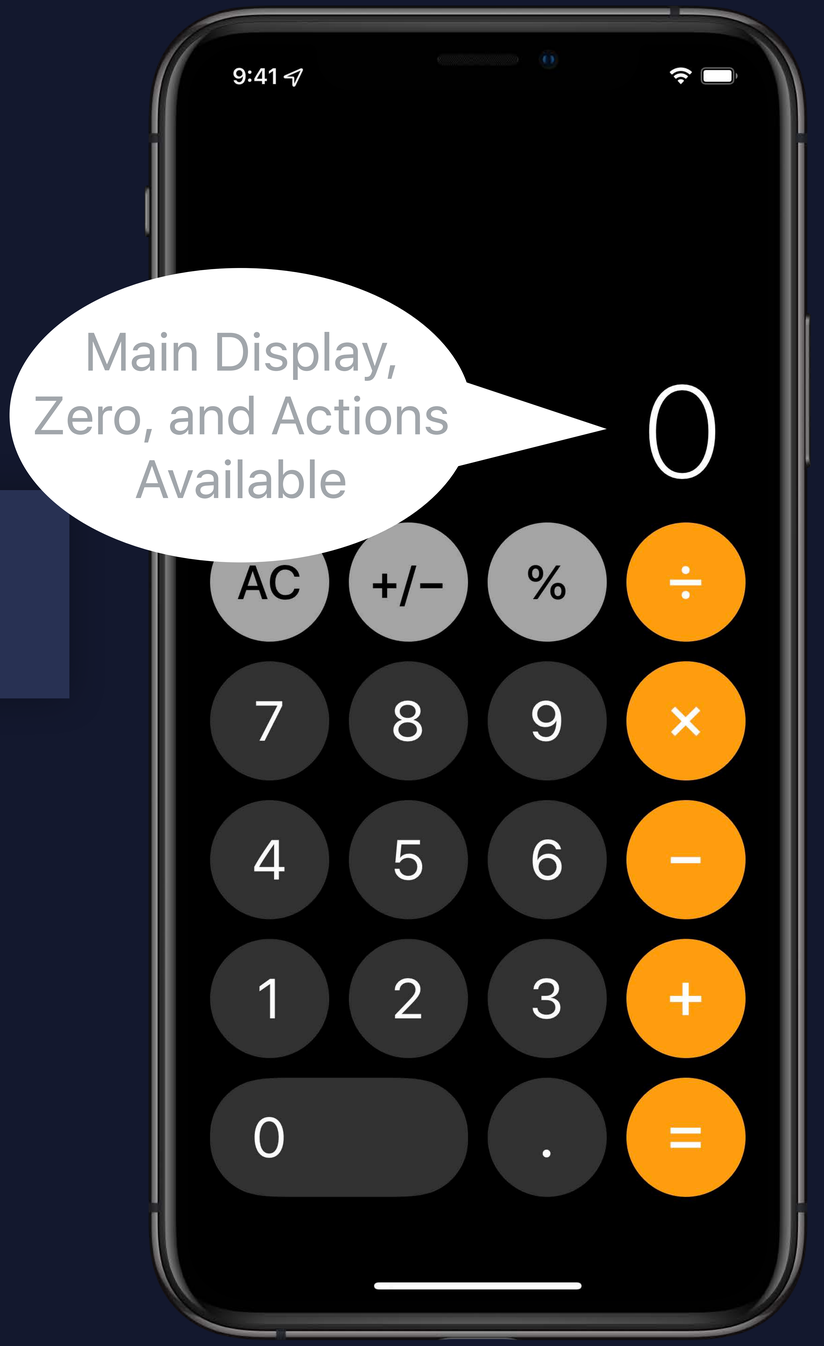


# SwiftUI Accessibility API

```
ResultView()
.accessibility(label: Text("Result"))
.accessibility(value: Text("\(value)"))
```

# SwiftUI Accessibility API

```
ResultView()
.accessibility(label: Text("Result"))
.accessibility(value: Text("\(value)"))
.accessibilityAction(named: Text("Clear")) {
    clear()
}
```



# Accessibility API

# Accessibility API

Understandable

# Accessibility API

Understandable

Interactable

# Accessibility API

Understandable

Interactable

Navigable

Do the displayed strings
provide enough information?

Will a custom action
simplify the interaction?

# Can you speed up navigation?

# Accessibility API

Understandable

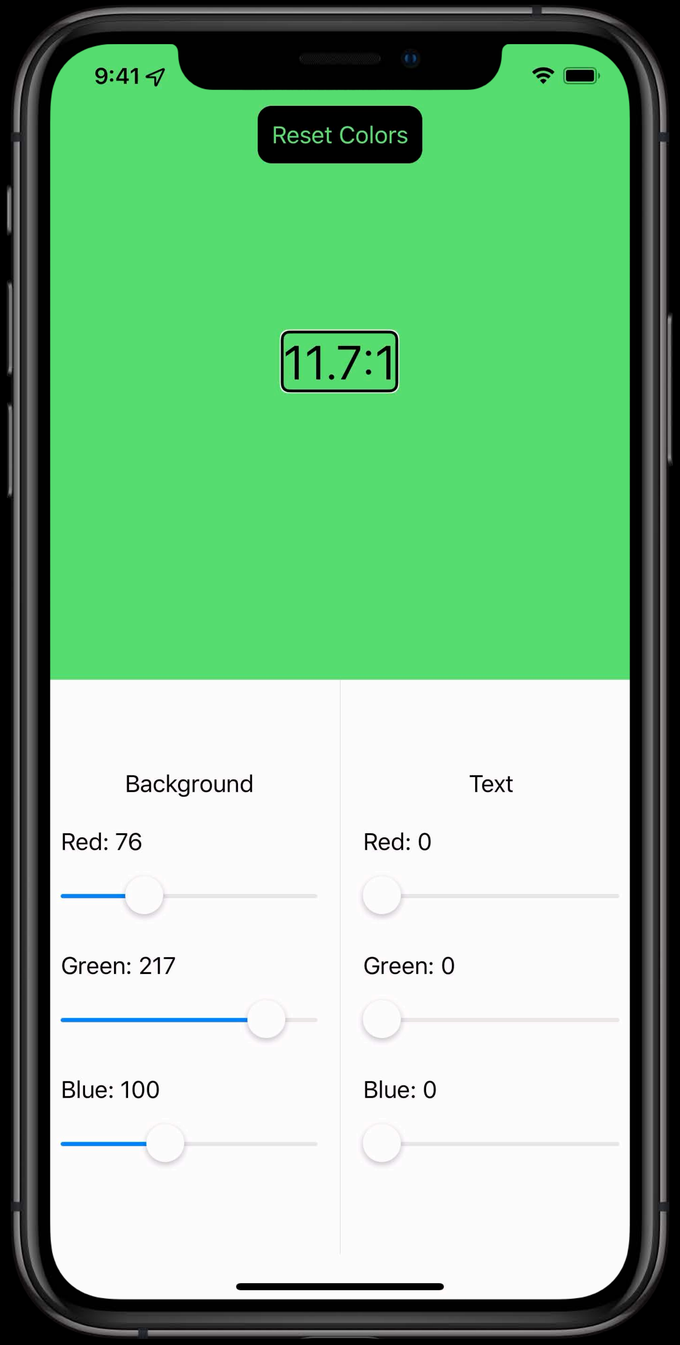
- Do the displayed strings provide enough information?

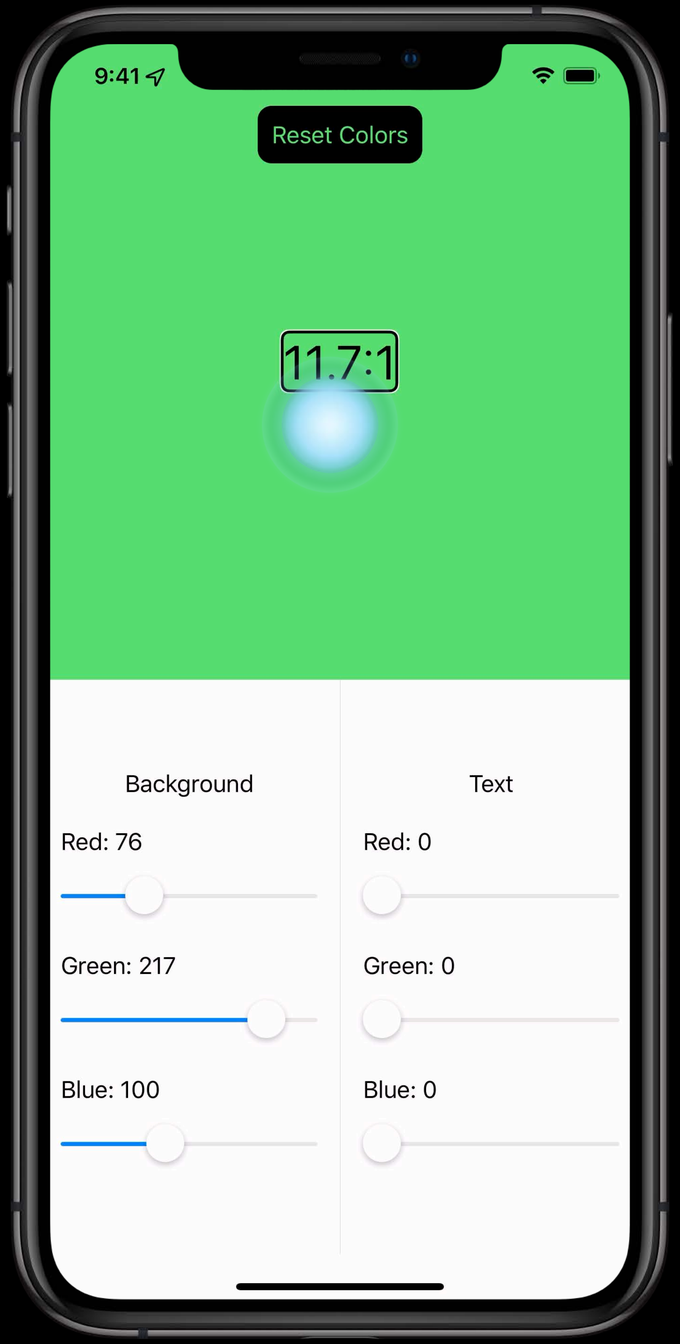
Interactable

- Will a custom action simplify the interaction?

Navigable

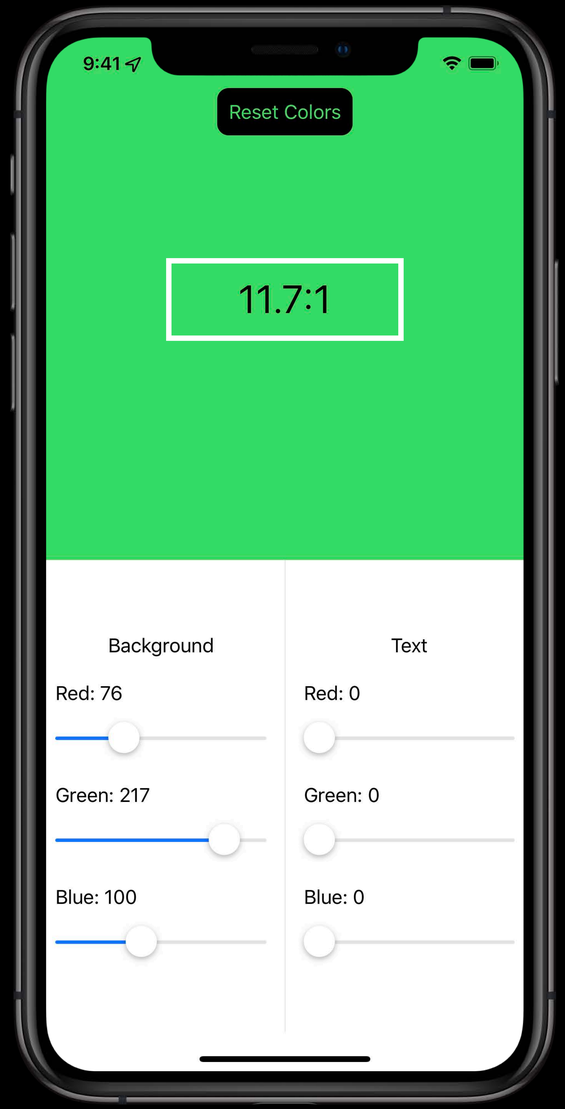
- Can you speed up navigation?


9:41
Reset Colors
11.7:1
Background
Red: 76
Green: 217
Blue: 100
Text
Red: 0
Green: 0
Blue: 0


9:41
Reset Colors
11.7:1
Background
Red: 76
Green: 217
Blue: 100
Text
Red: 0
Green: 0
Blue: 0

# Understandable

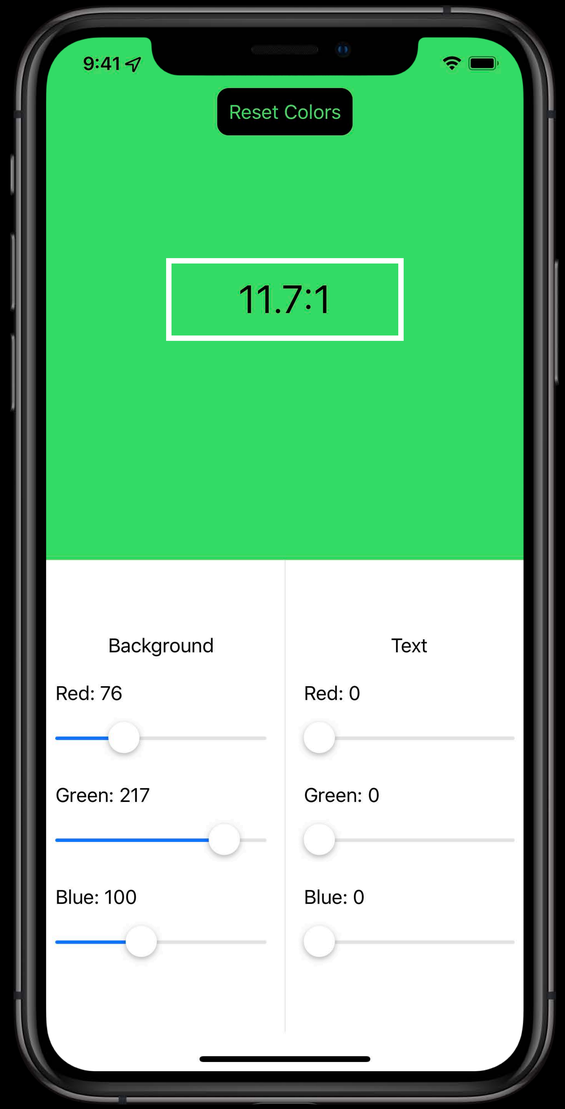
Do the displayed strings provide enough information?



# Understandable

Do the displayed strings provide enough information?

Symbols should be spoken correctly

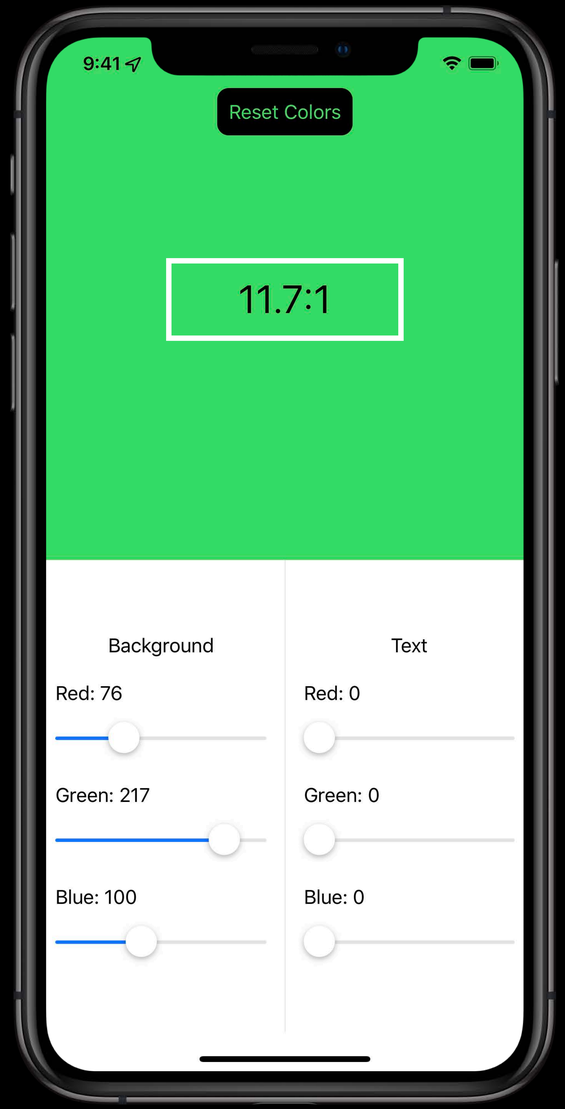


# Understandable

Do the displayed strings provide enough information?

Symbols should be spoken correctly

- “11.7, 1” → “11.7 to 1”



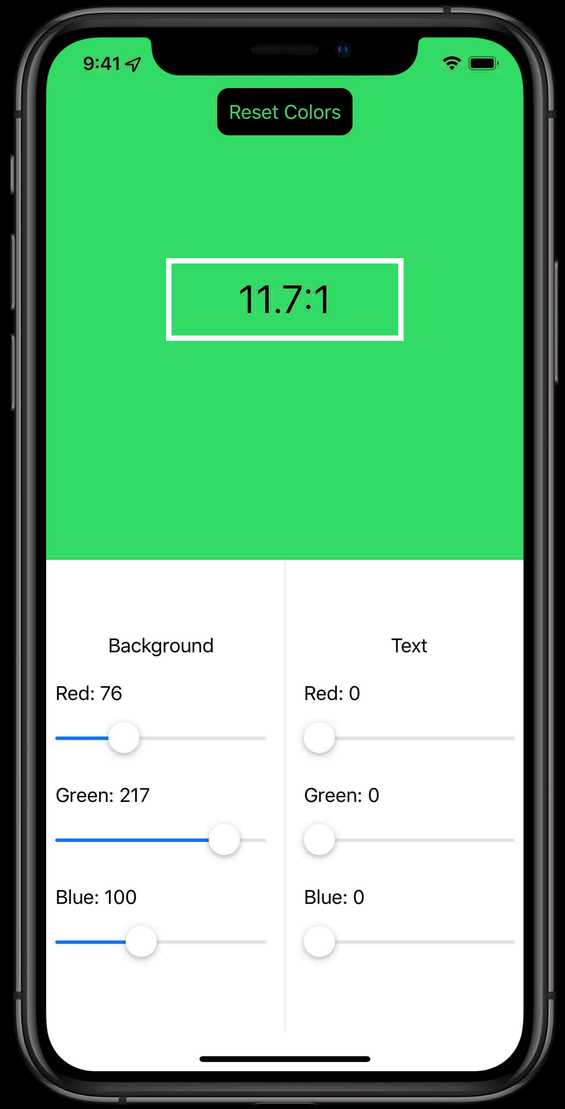
# Understandable

Do the displayed strings provide enough information?

Symbols should be spoken correctly

- “11.7, 1” → “11.7 to 1”

Context can be spoken if appropriate



# Understandable

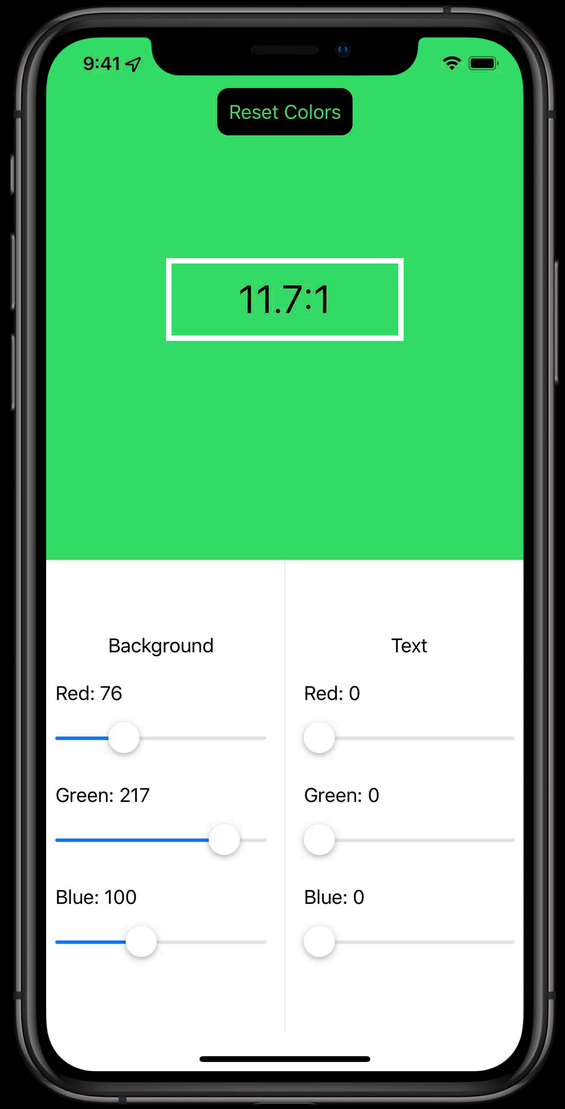
Do the displayed strings provide enough information?

Symbols should be spoken correctly

- “11.7, 1” → “11.7 to 1”

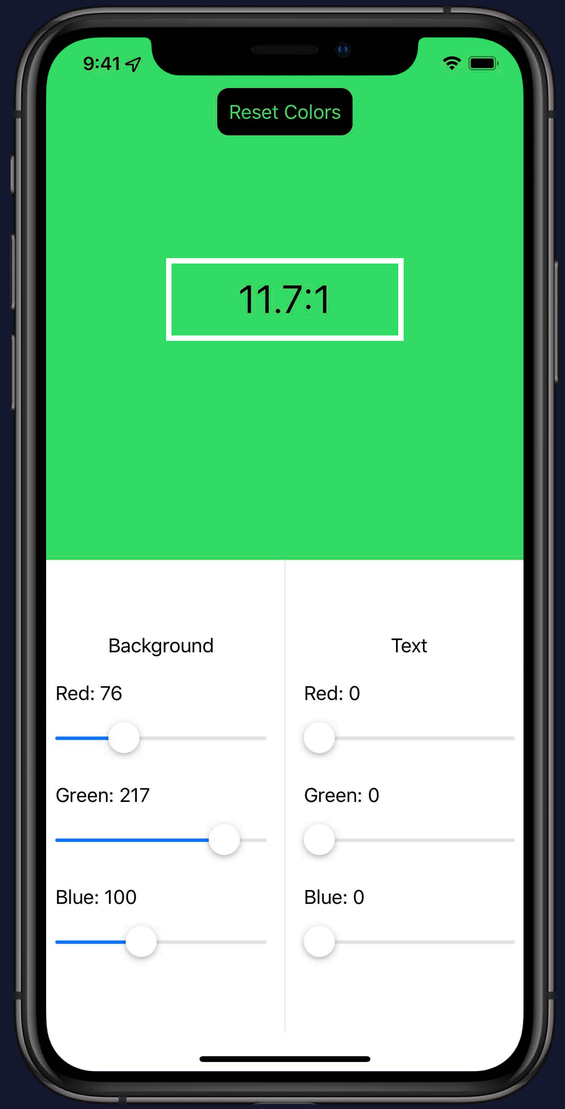
Context can be spoken if appropriate

- “11.7, 1” → “Contrast Ratio, 11.7 to 1”



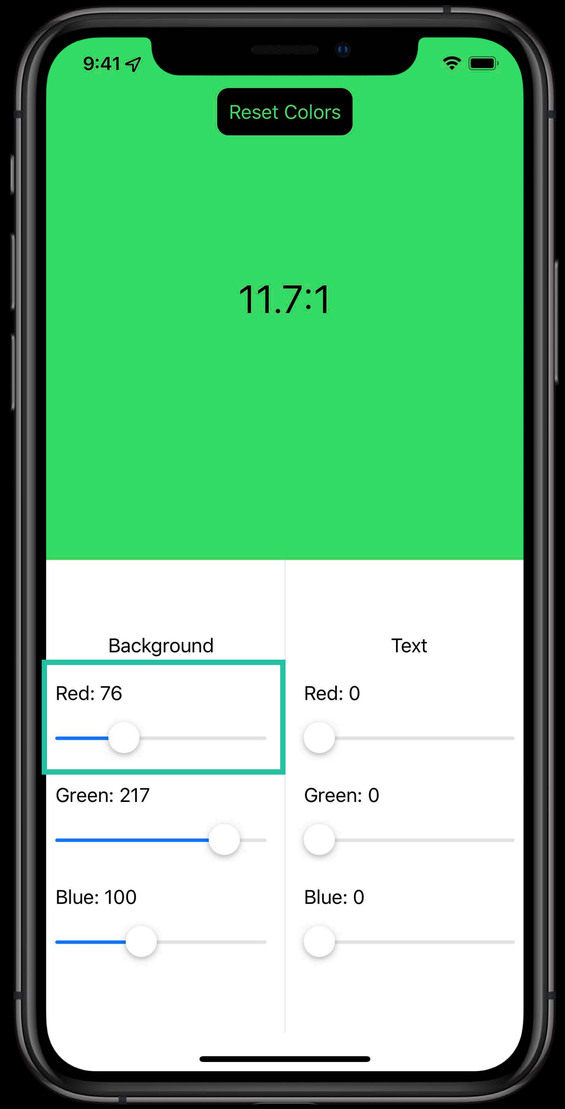
```
// Setting a label and a value

ContrastRatioView()
.accessibility(label: Text("Contrast Ratio"))
.accessibility(value: Text("\(ratio) to 1"))
```



# Understandable

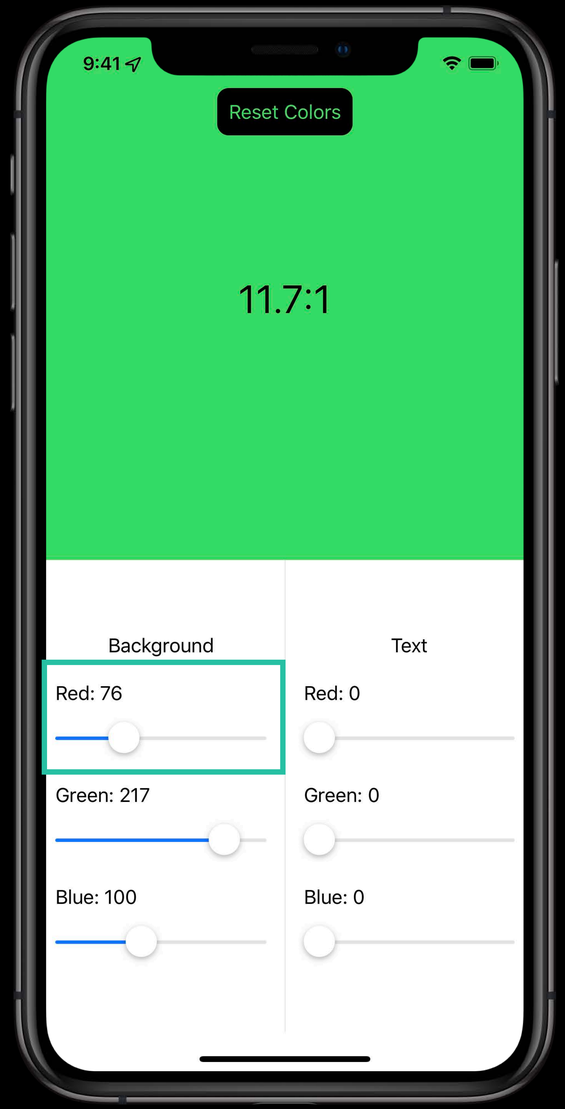
Do the displayed strings provide enough information?



# Understandable

Do the displayed strings provide enough information?

Color slider doesn’t convey the right value

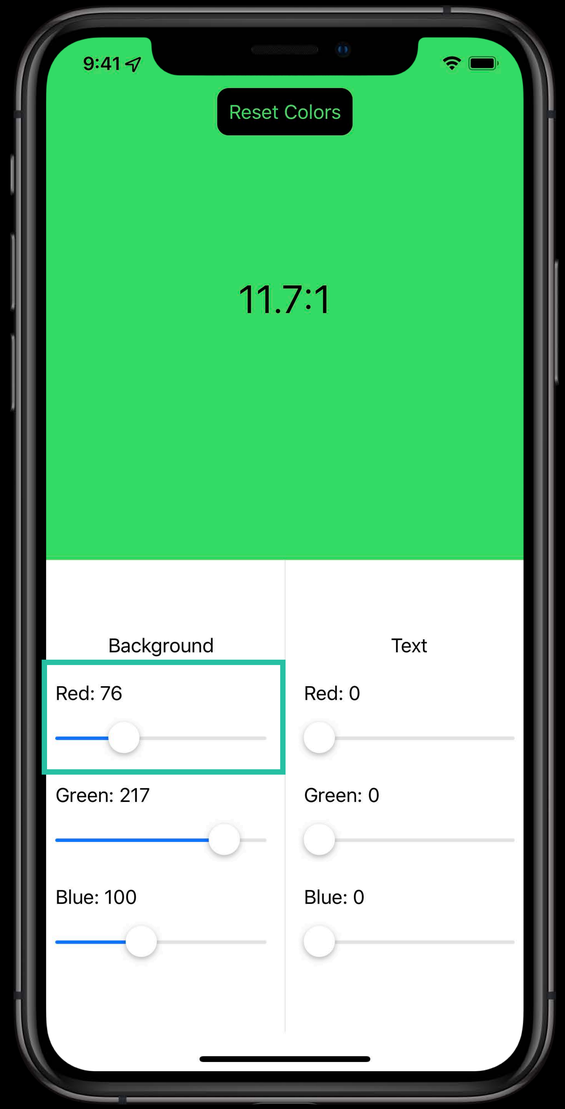


# Understandable

Do the displayed strings provide enough information?

Color slider doesn’t convey the right value

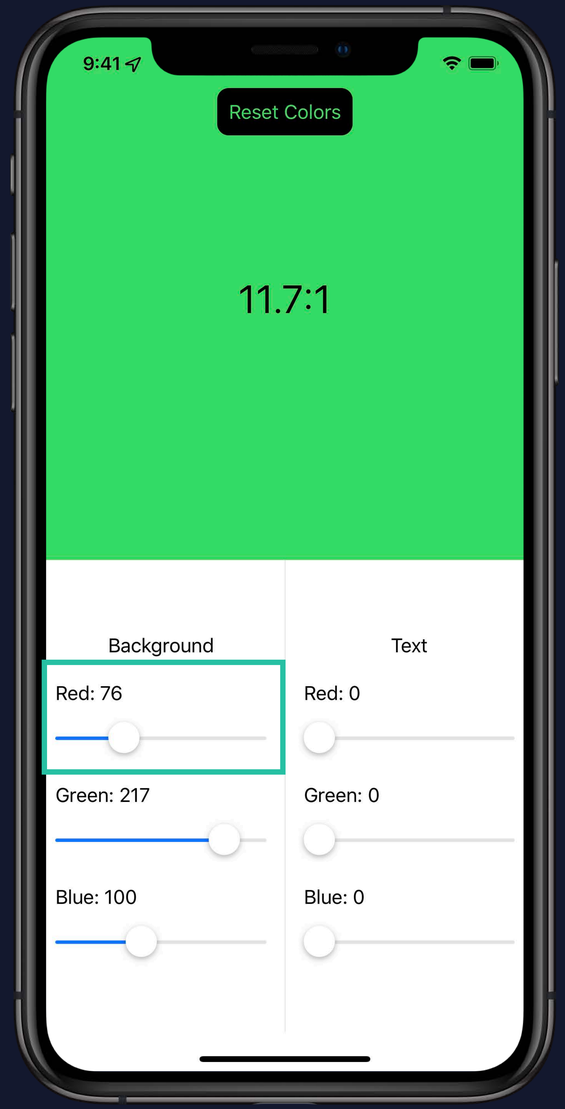
- “27%” → “Red, 76”



```
// Setting a label and a value

VStack(alignment: .leading) {
    Text(verbatim: String(format: "Red: %.0f", red))
    .accessibility(visibility: .hidden)

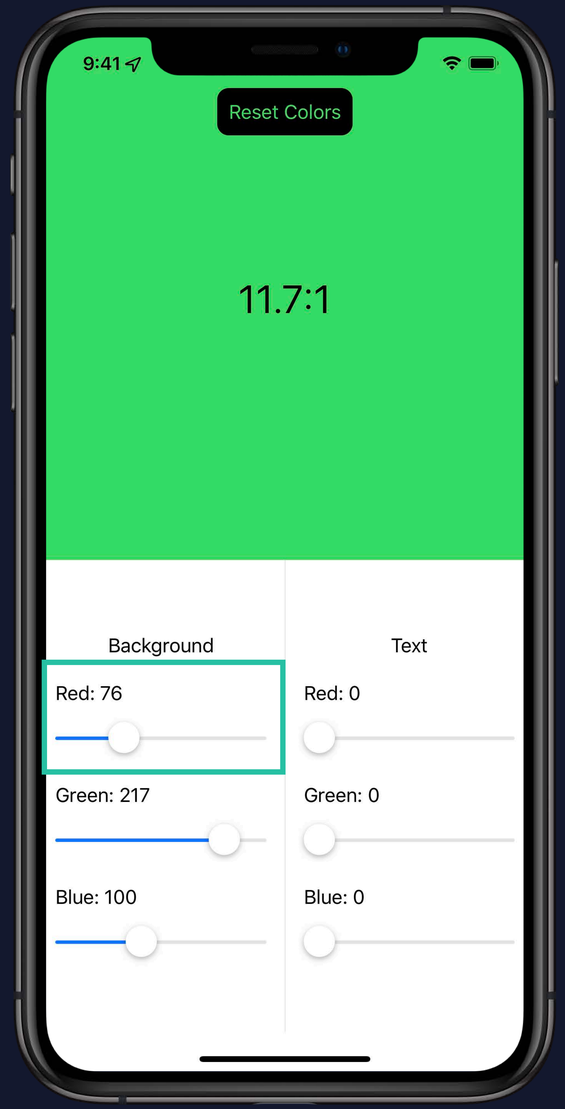
    Slider(value: $red, from: 0, through: 255.0)
}
```



```
// Setting a label and a value

VStack(alignment: .leading) {
    Text(verbatim: String(format: "Red: %.0f", red))
    .accessibility(visibility: .hidden)

    Slider(value: $red, from: 0, through: 255.0)
    .accessibility(label: Text("Red"))
    .accessibility(value:
        Text(verbatim: String(format: "%.0f", red)))
}
```

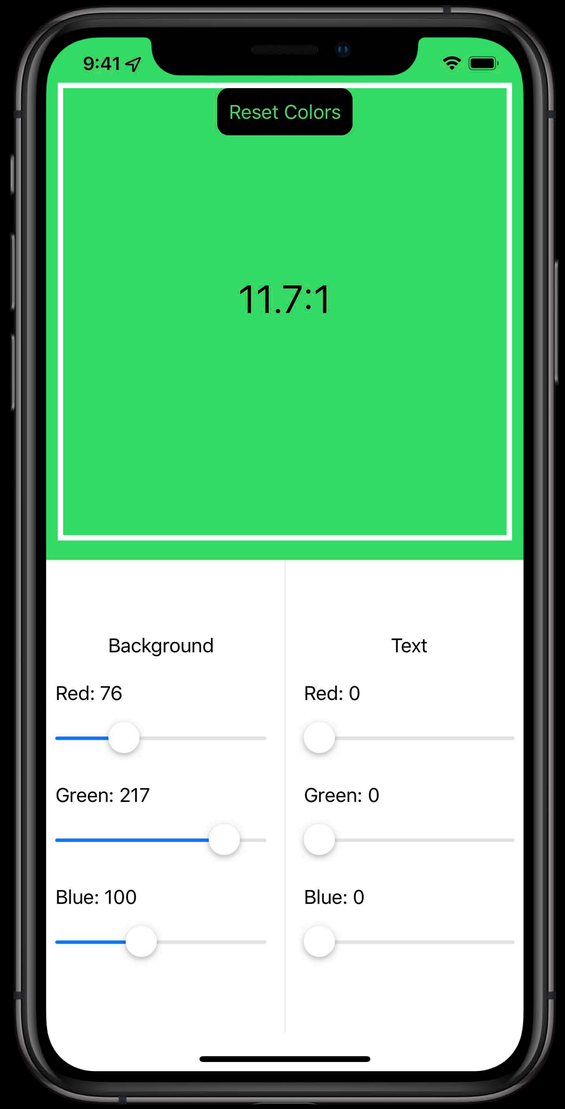


# Interactable

Does a custom action simplify the interaction?

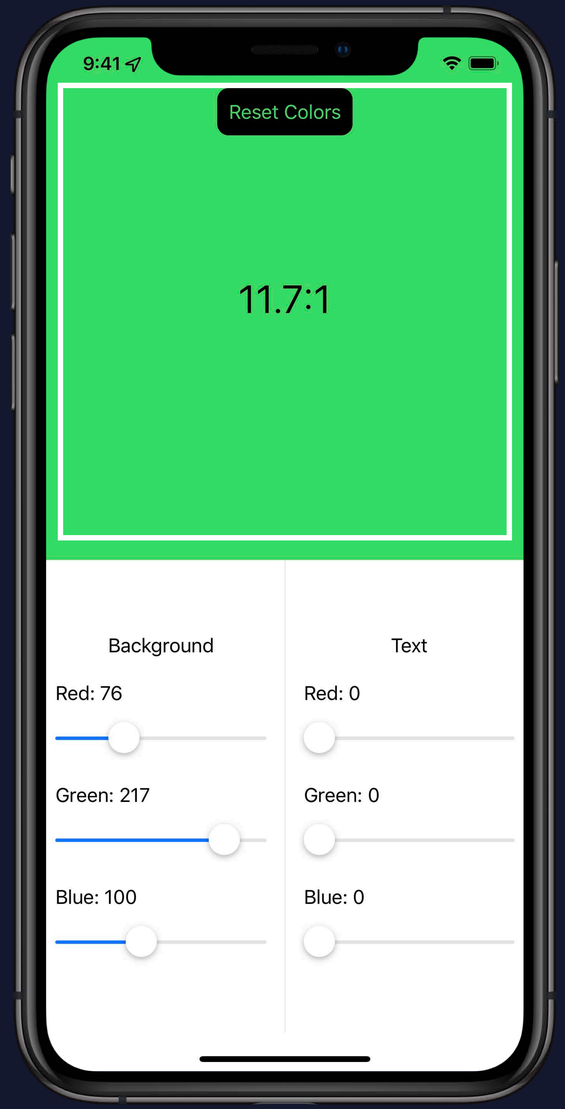
Double-tap to swap background and text colors

- “Swap Colors” custom action



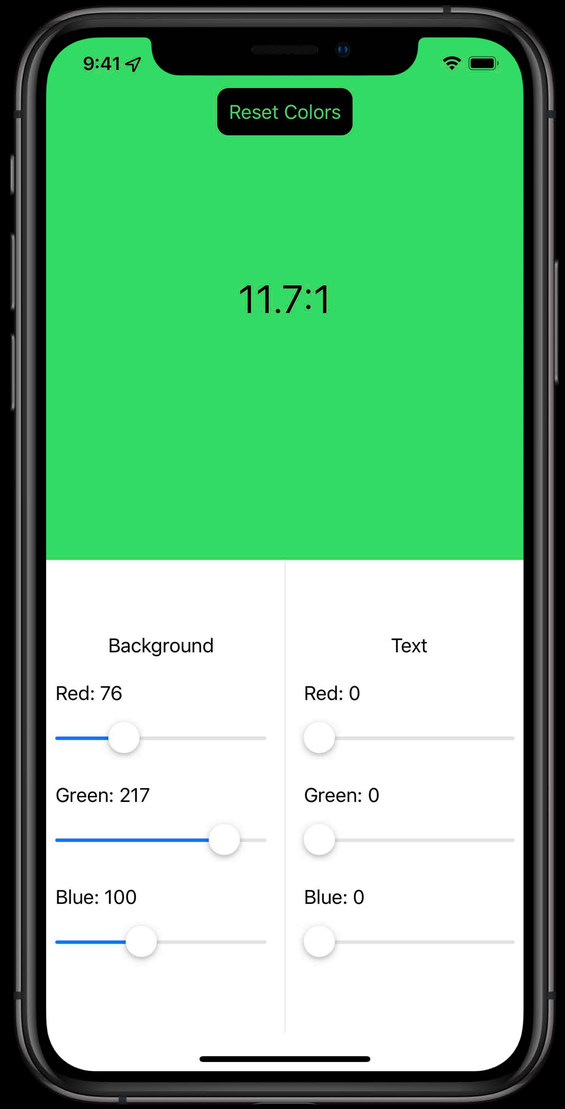
```
// Creating custom actions

ContrastRatioView()
...
.accessibilityAction(named: Text(verbatim: "Swap Colors")) {
    /* swap the colors */
}
```



# Navigable

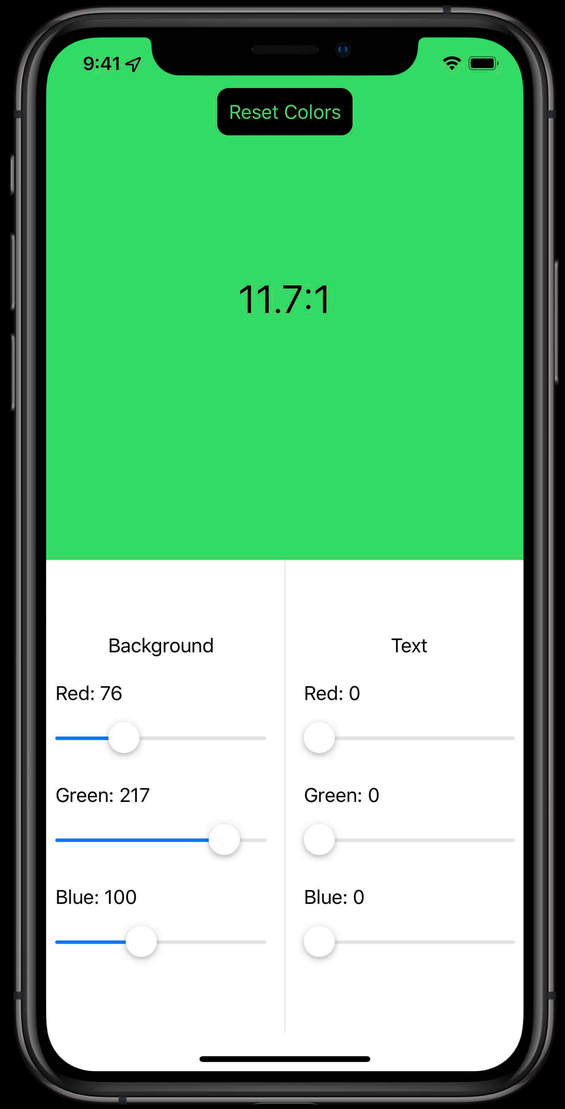
Can you speed up navigation?



# Navigable

Can you speed up navigation?

This app can be divided into three main spaces

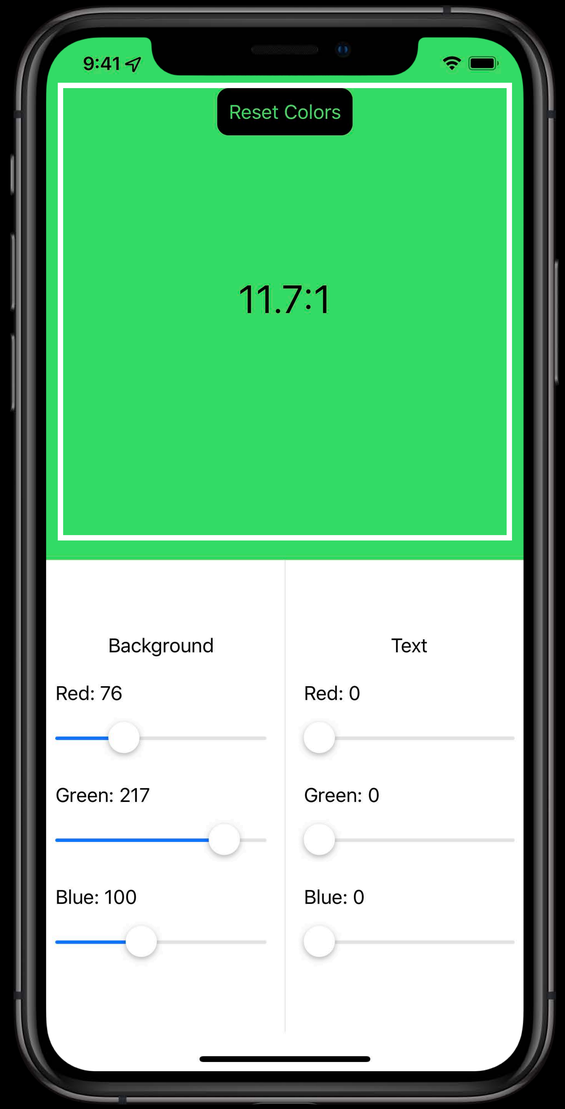


# Navigable

Can you speed up navigation?

This app can be divided into three main spaces

- Contrast ratio

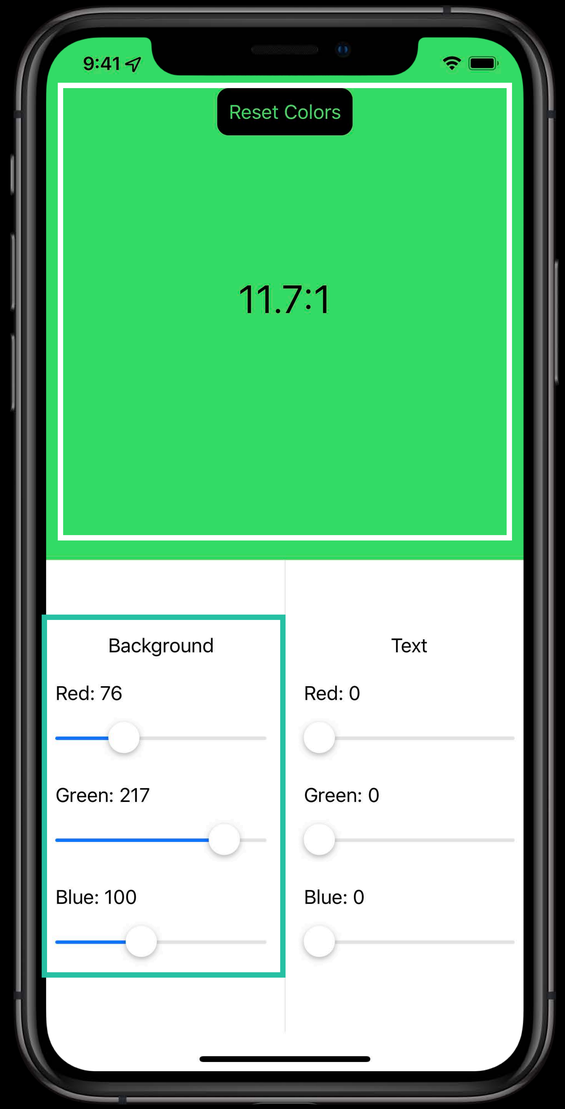


# Navigable

Can you speed up navigation?

This app can be divided into three main spaces

- Contrast ratio
- Background color

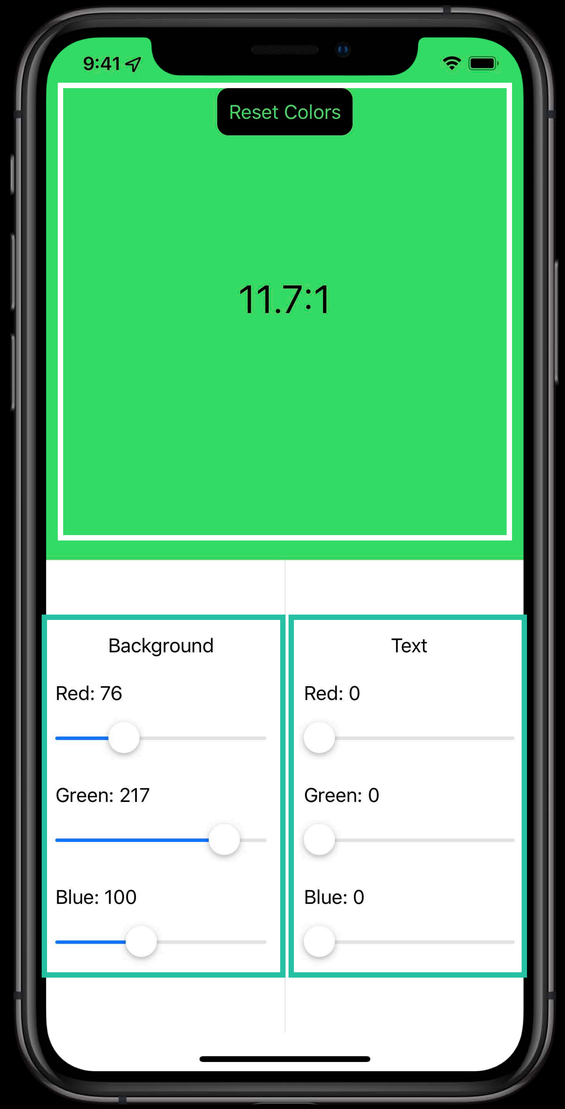


# Navigable

Can you speed up navigation?

This app can be divided into three main spaces

- Contrast ratio
- Background color
- Text color

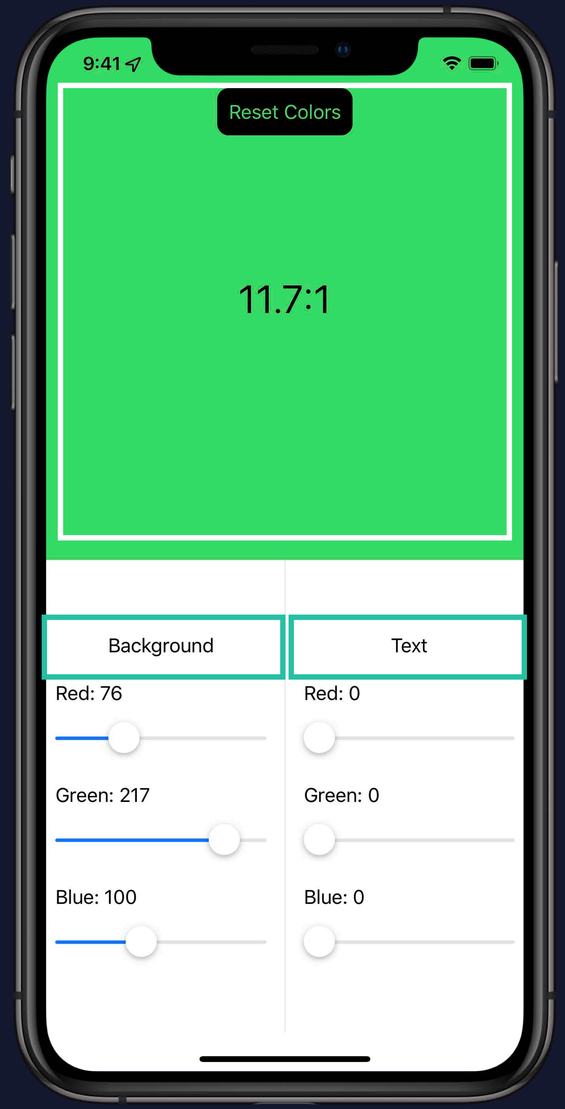


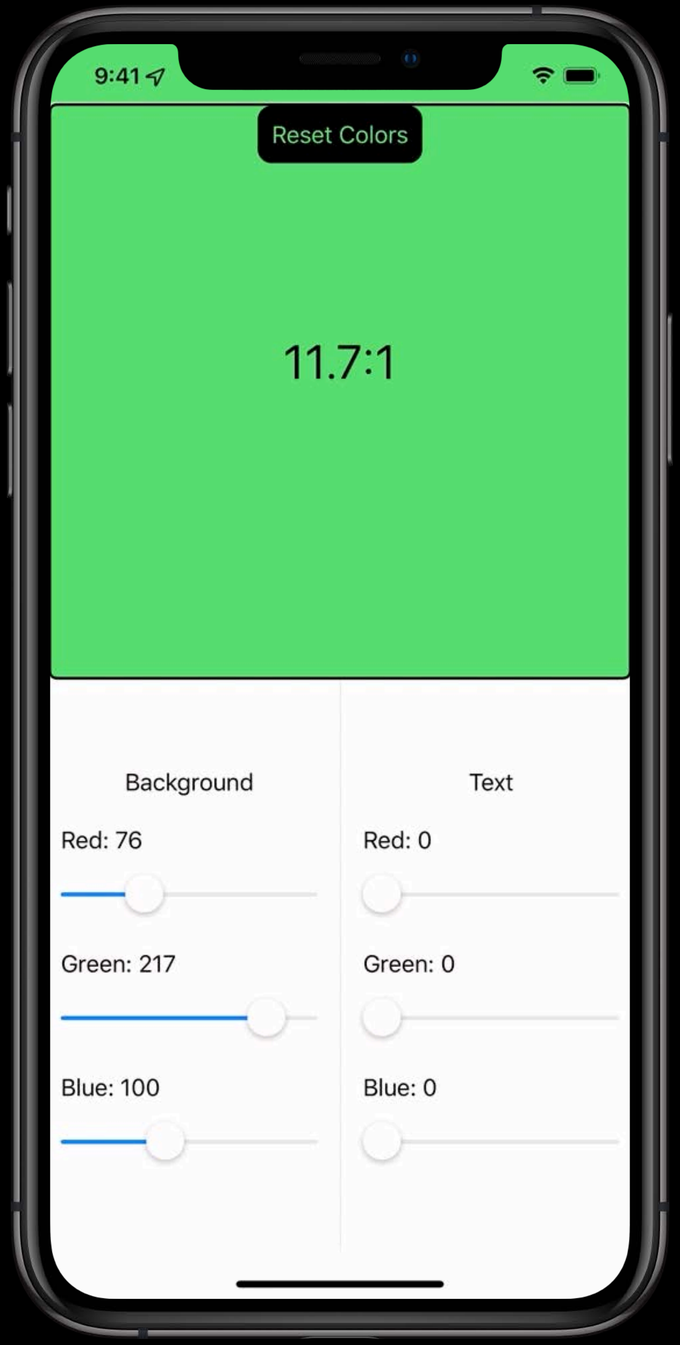
```
// Setting a header trait

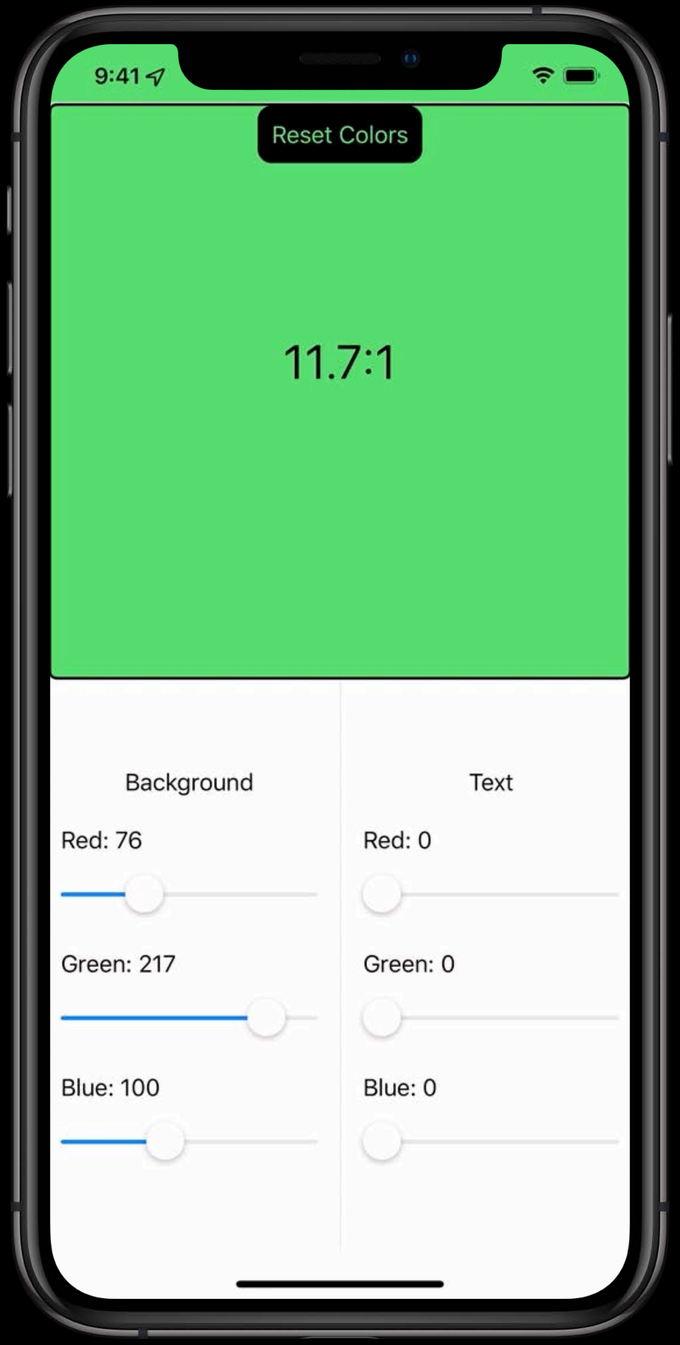
ContrastRatioView()
...
.accessibility(addTraits: .isHeader)

Text("Background")
.accessibility(addTraits: .isHeader)

Text("Text")
.accessibility(addTraits: .isHeader)
```




9:41
Reset Colors
11.7:1
Background
Red: 76
Green: 217
Blue: 100
Text
Red: 0
Green: 0
Blue: 0


9:41
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Background
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Text
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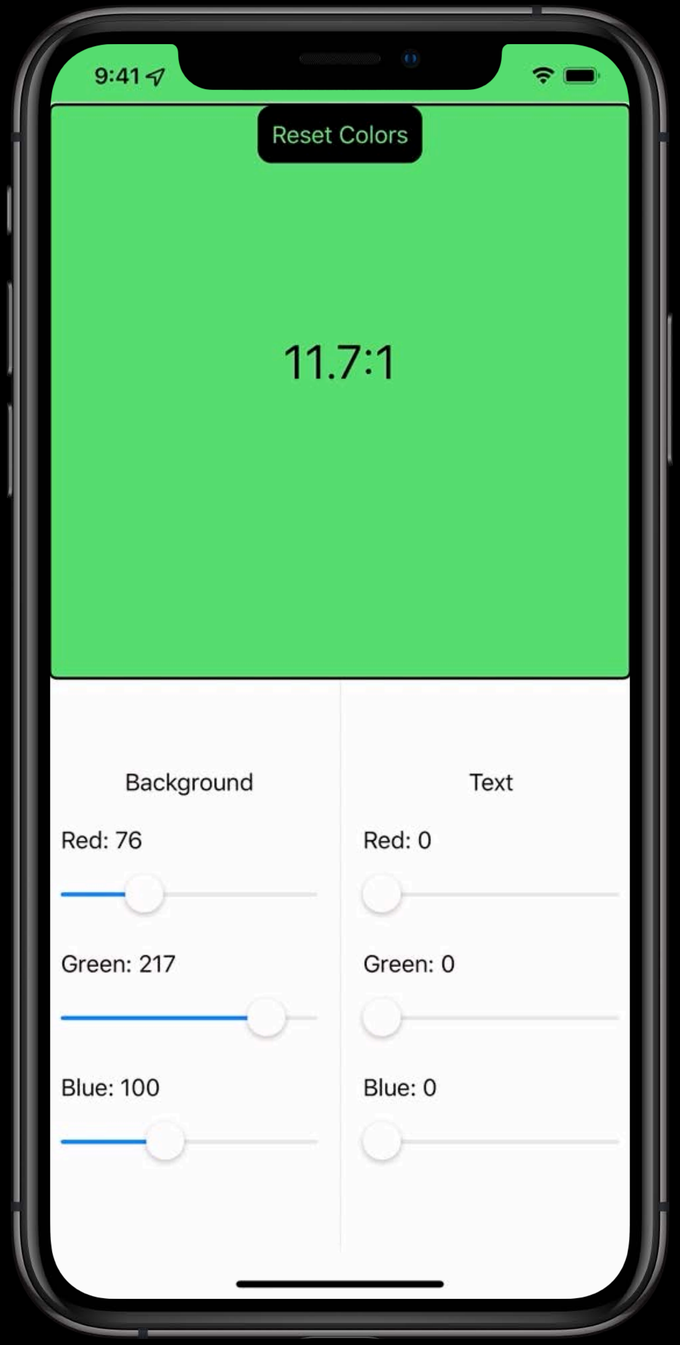
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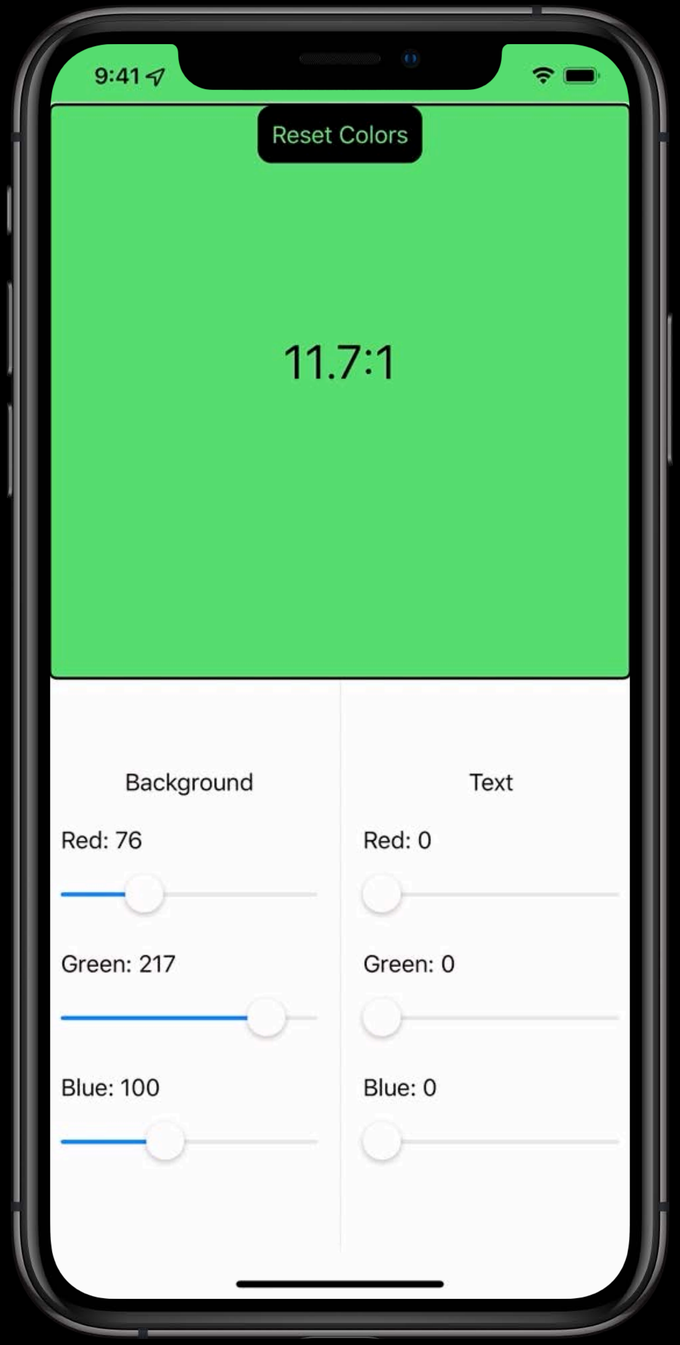
Reset Colors
11.7:1
Background
Red: 76
Green: 217
Blue: 100
Text
Red: 0
Green: 0
Blue: 0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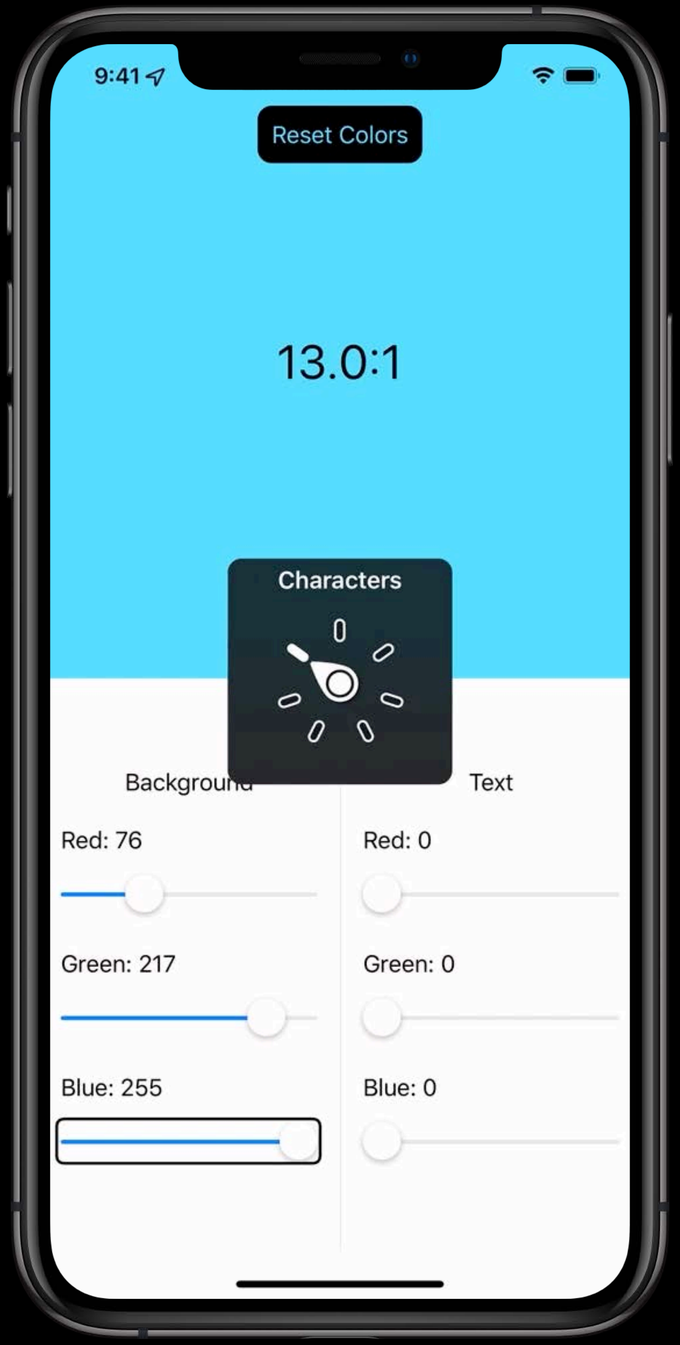
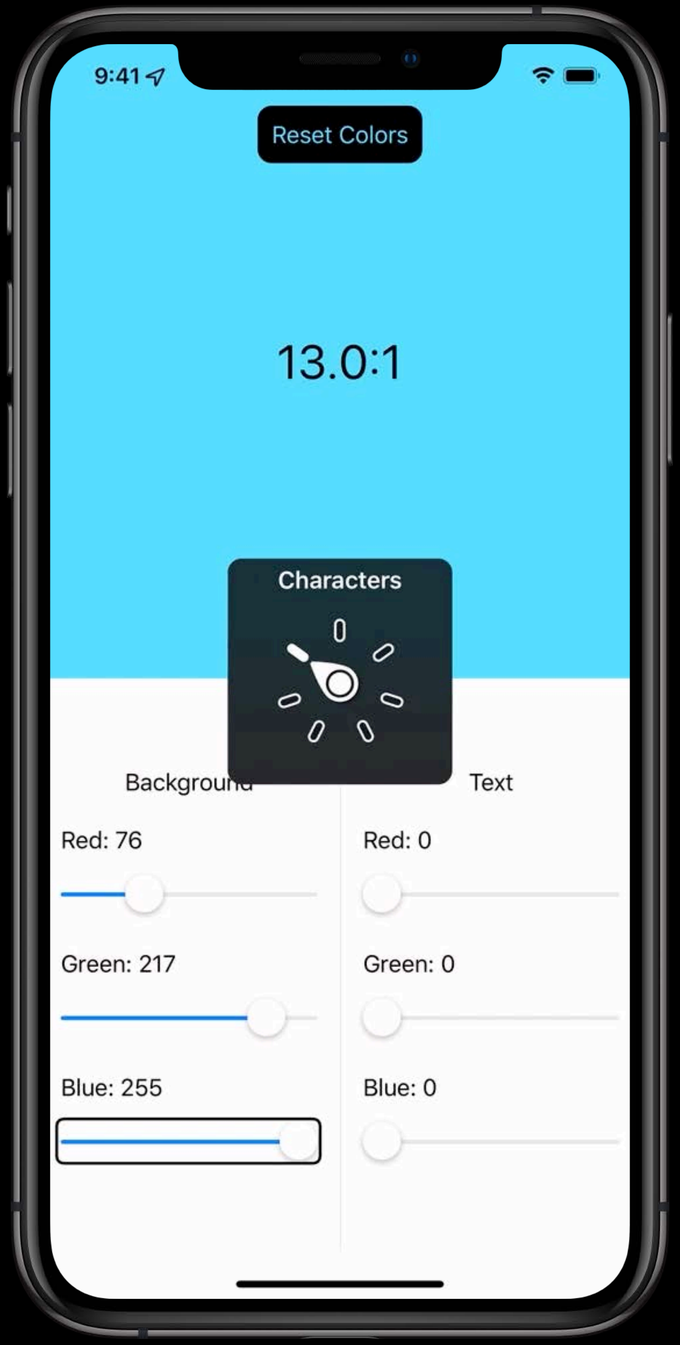
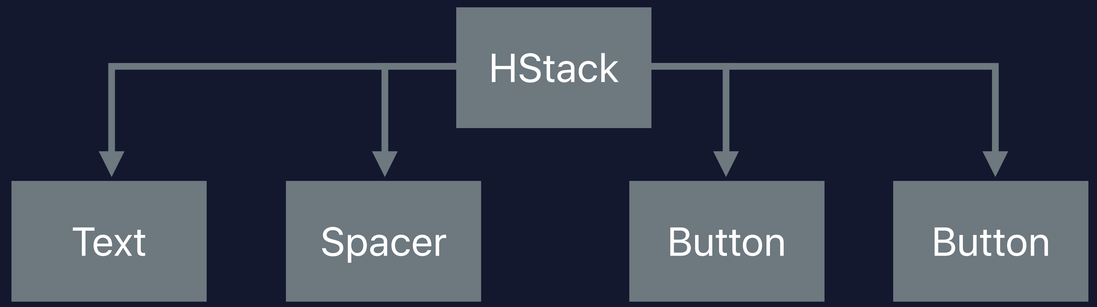

9:41
Reset Colors
13.0:1
Characters
Background
Text
Red: 76
Red: 0
Green: 217
Green: 0
Blue: 255
Blue: 0


9:41
Reset Colors
13.0:1
Characters
Background
Text
Red: 76
Red: 0
Green: 217
Green: 0
Blue: 255
Blue: 0

# Accessibility Tree

```
// Accessibility Tree

struct TableCell : View {
    let person: Person
    var body: some View {
        HStack {
            Text(verbatim: person.name)
            Spacer()
            Button(action: { /* Follow */ }) {
                Text("Follow")
            }
            Button(action: { /* Share */ }) {
                Text("Share")
            }
        }
    }
}
```



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    let person: Person
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        HStack {
            Text(verbatim: person.name)
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            Button(action: { /* Follow */ }) {
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            }
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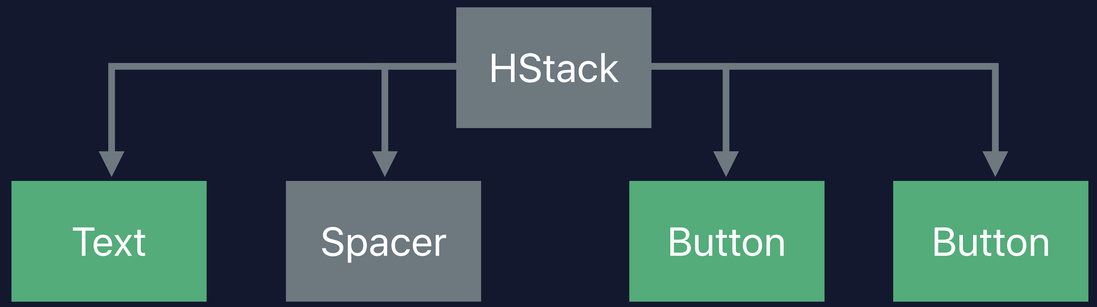
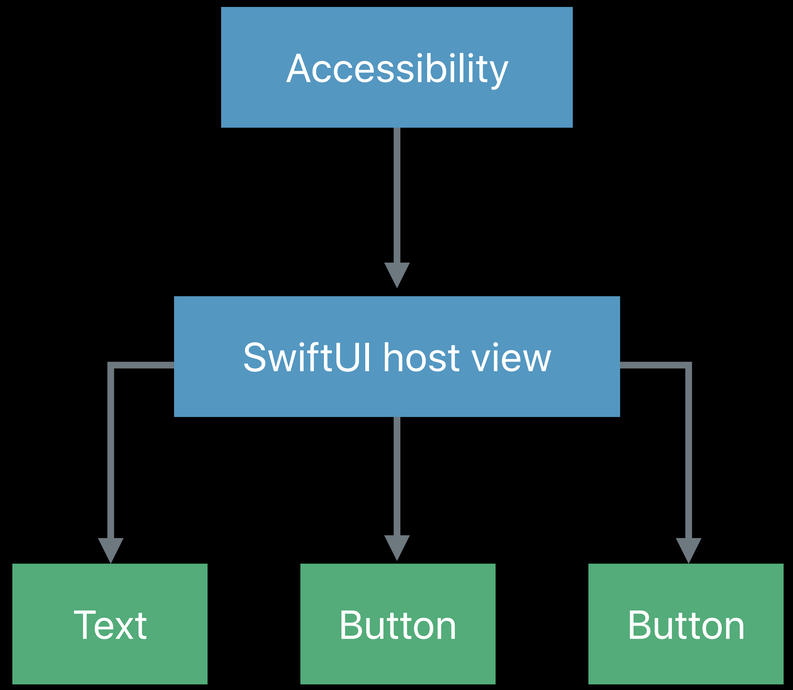
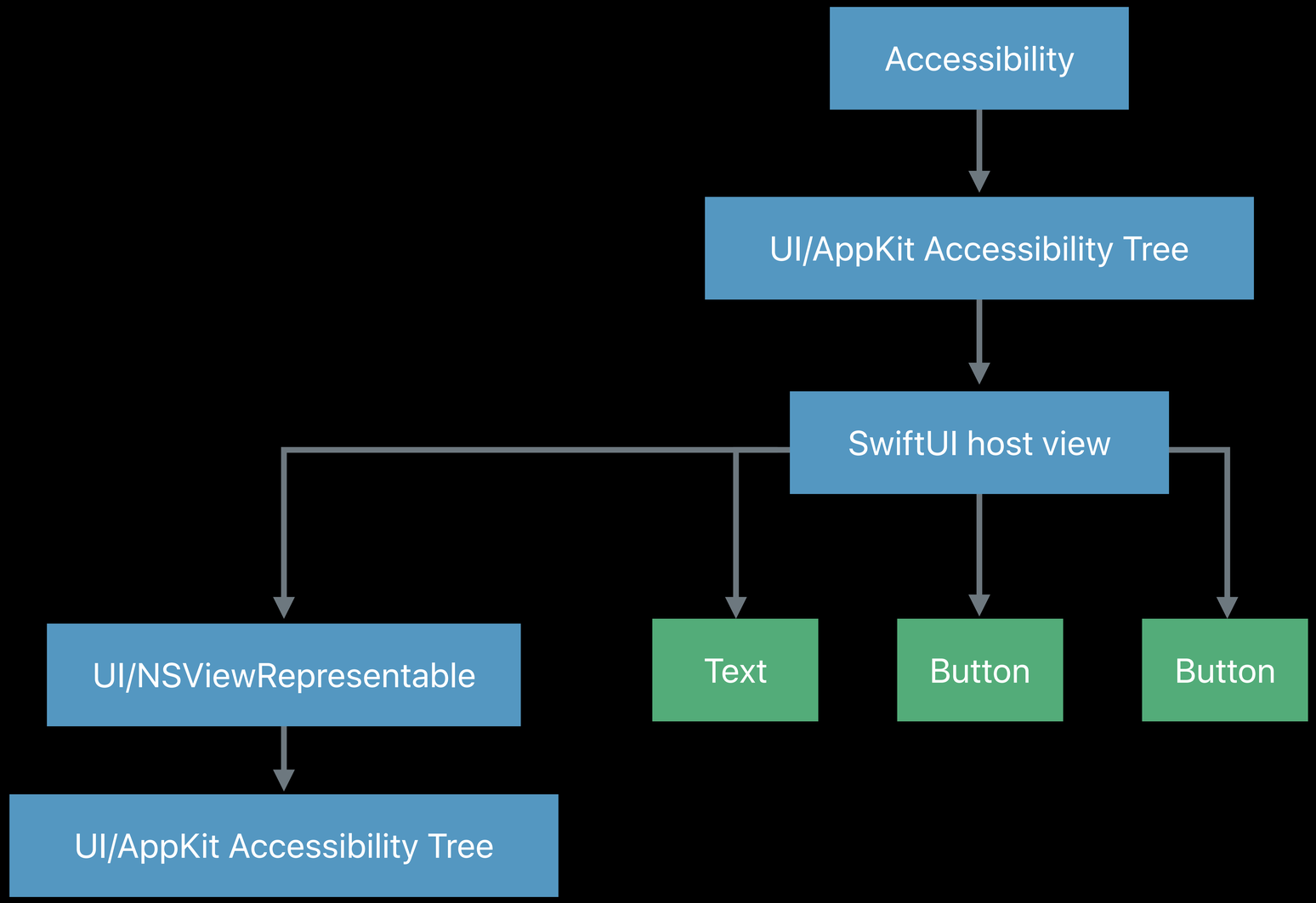
            }
        }
    }
}
```



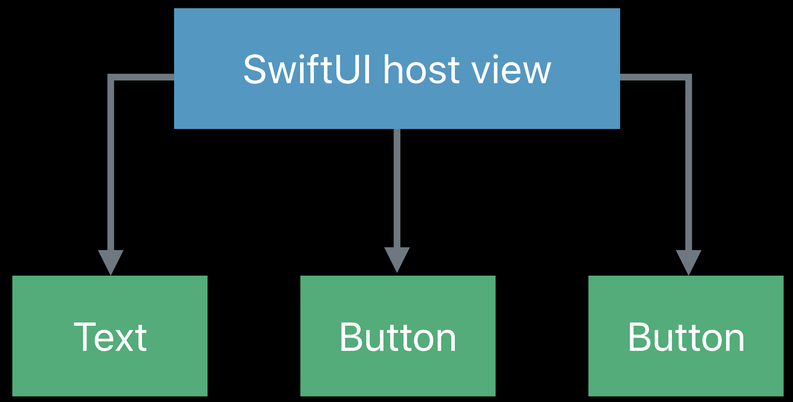
# Accessibility Tree



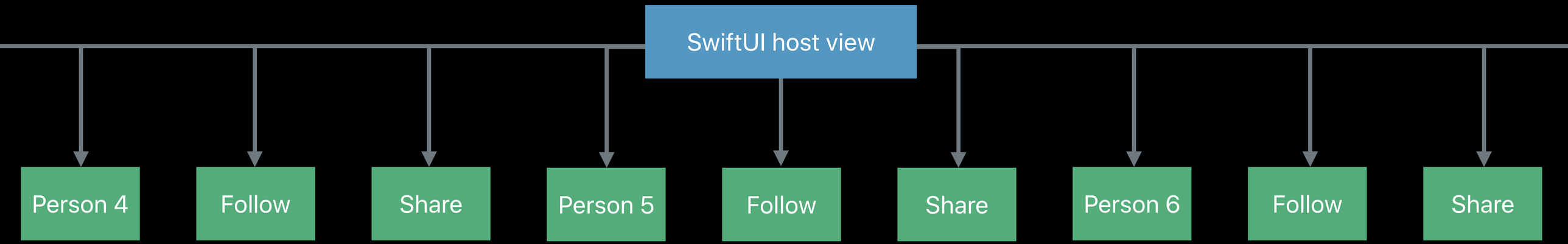
# Accessibility Tree



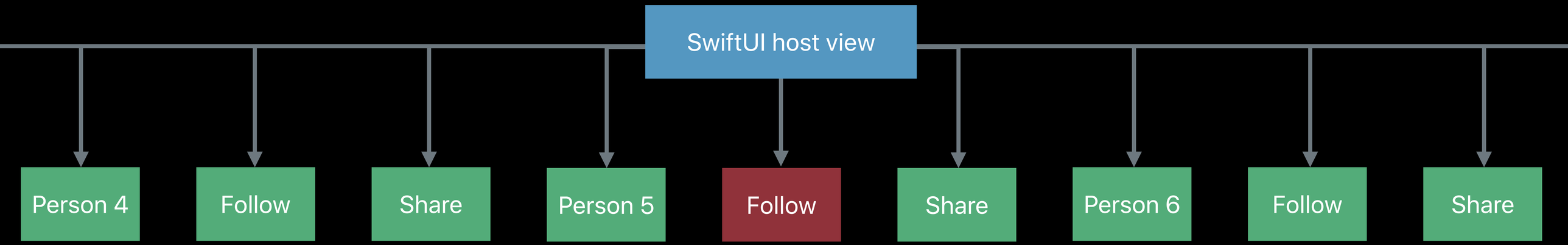
# Accessibility Tree



# Accessibility Tree



# Accessibility Tree



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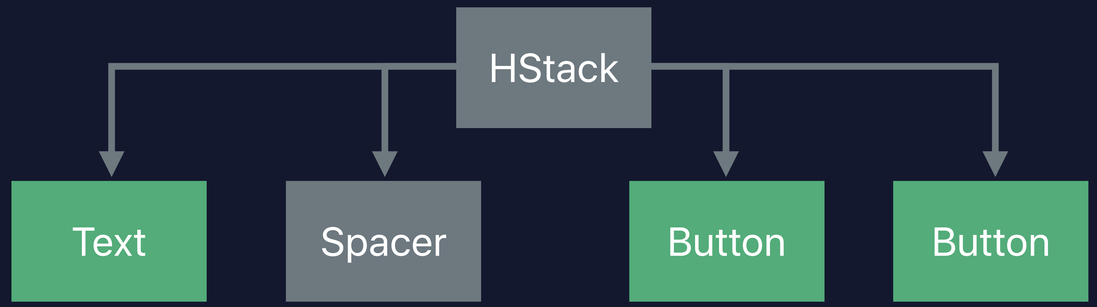
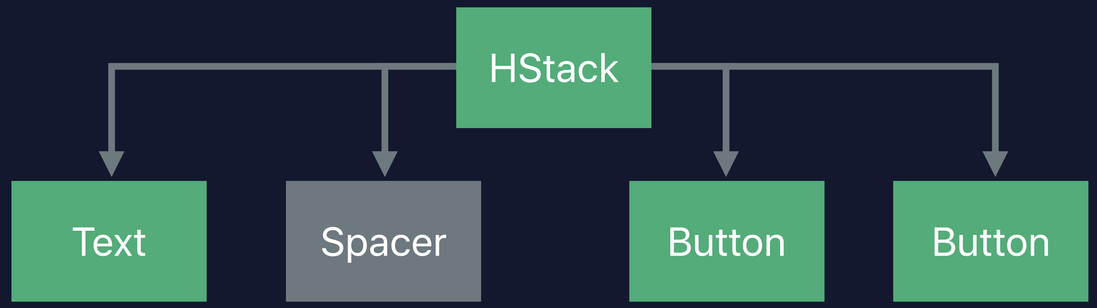
            Text(verbatim: person.name)
            Spacer()
            Button(action: { /* Follow */ }) {
                Text("Follow")
            }
            Button(action: { /* Share */ }) {
                Text("Share")
            }
        }
    }
}
```



```
// Accessibility Tree

struct TableCell : View {
    let person: Person
    var body: some View {
        HStack {
            Text(verbatim: person.name)
            Spacer()
            Button(action: { /* Follow */ }) {
                Text("Follow")
            }
            Button(action: { /* Share */ }) {
                Text("Share")
            }
        }
        .accessibilityElement(children: .combine)
    }
}
```



```
// Accessibility Tree

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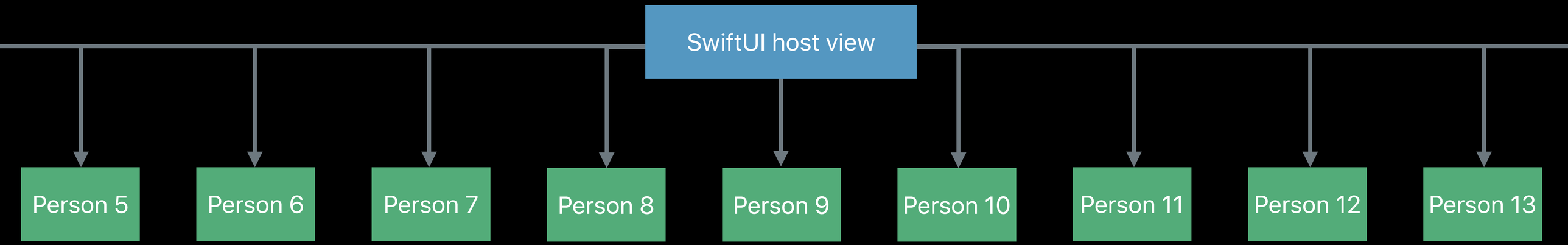
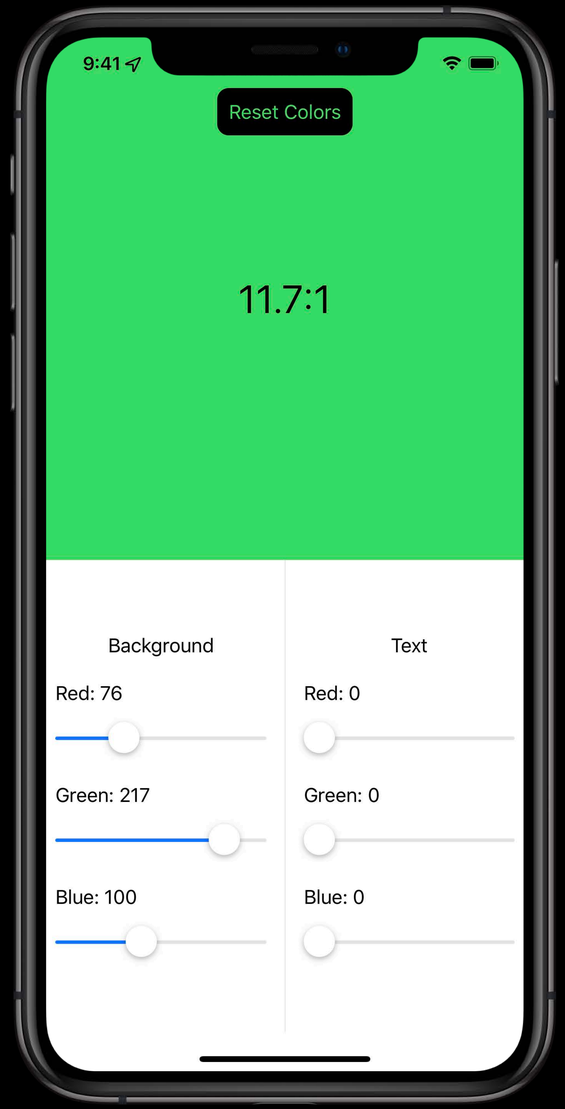
# Accessibility Tree



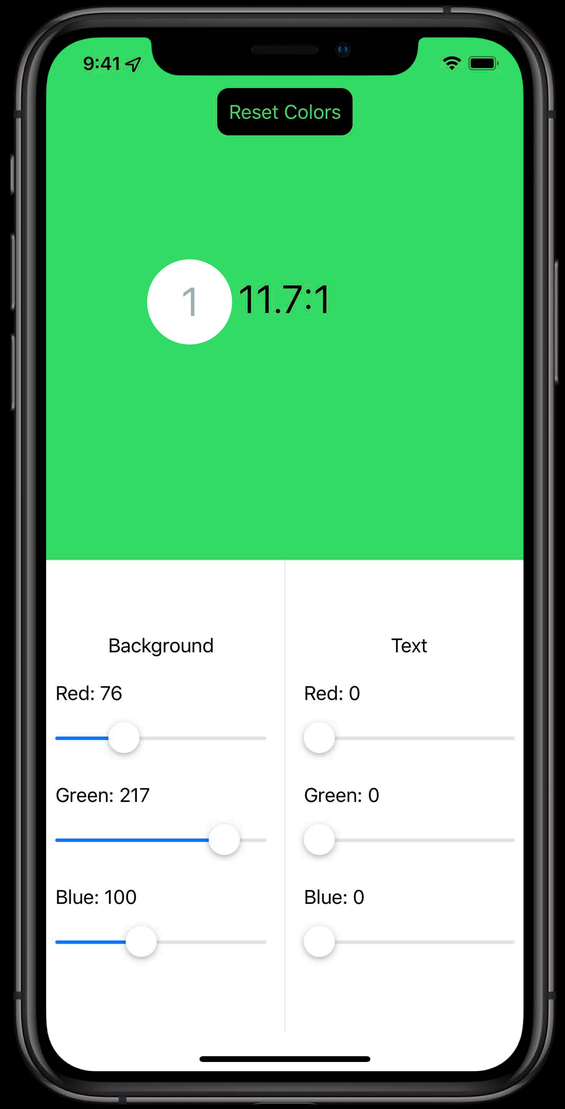
# Accessibility Tree

## Ordering



# Accessibility Tree

## Ordering



# Accessibility Tree

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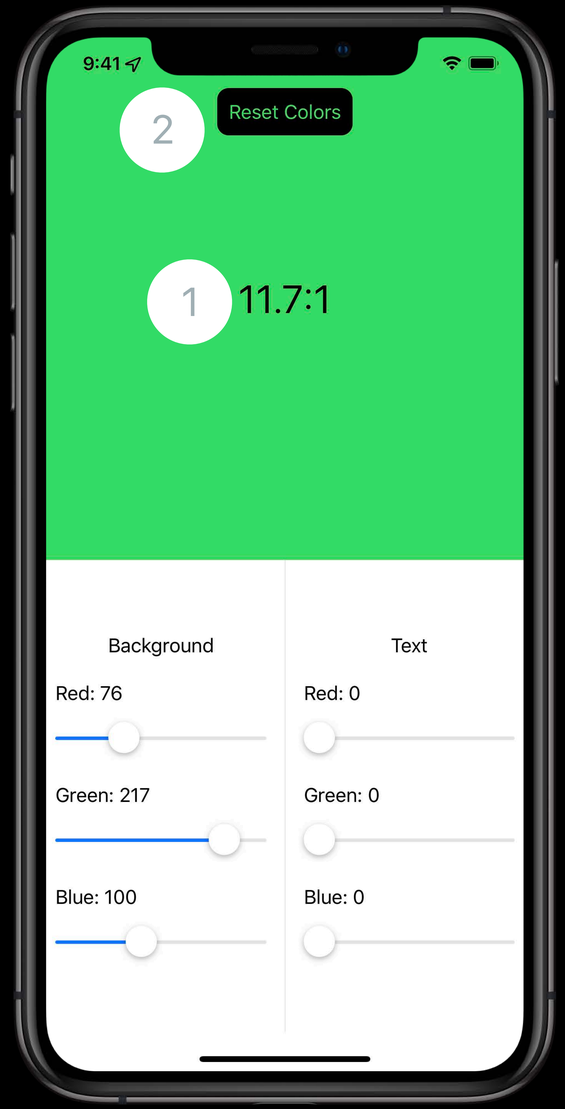
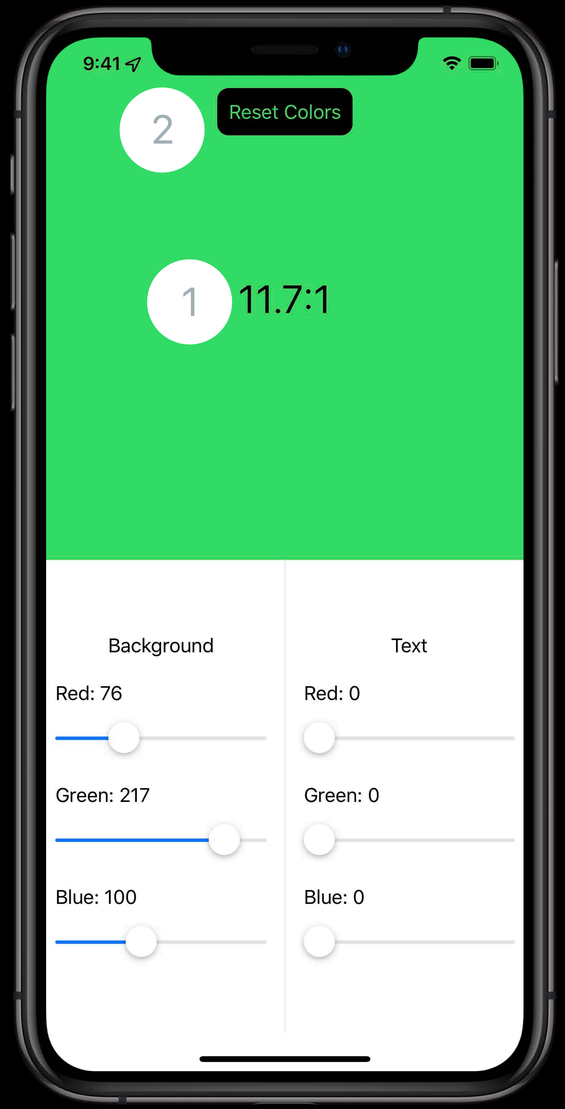


# Accessibility Tree

## Ordering

ZStack orders from back to front

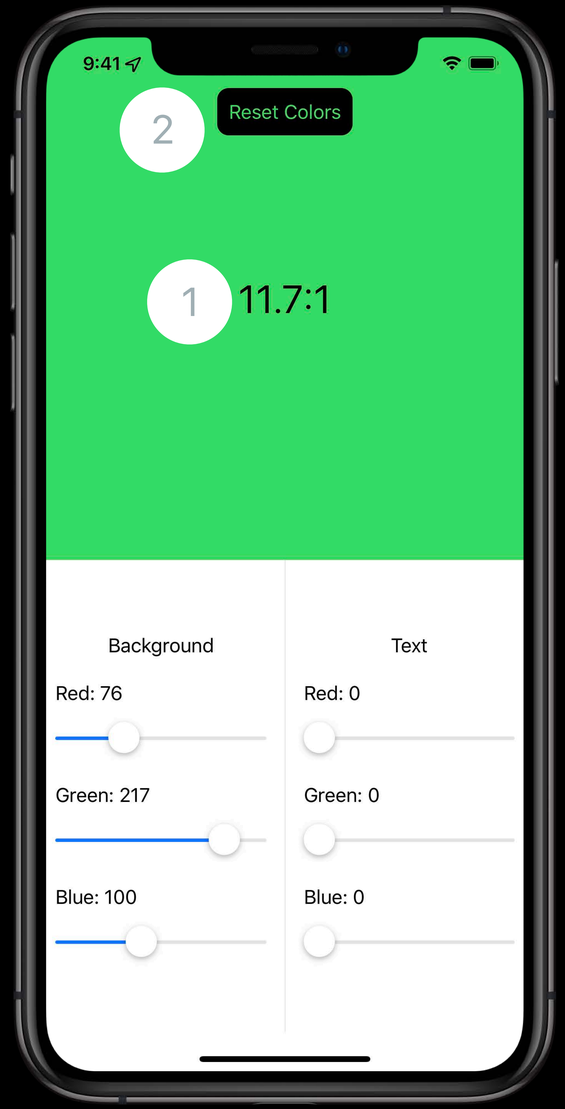


# Accessibility Tree

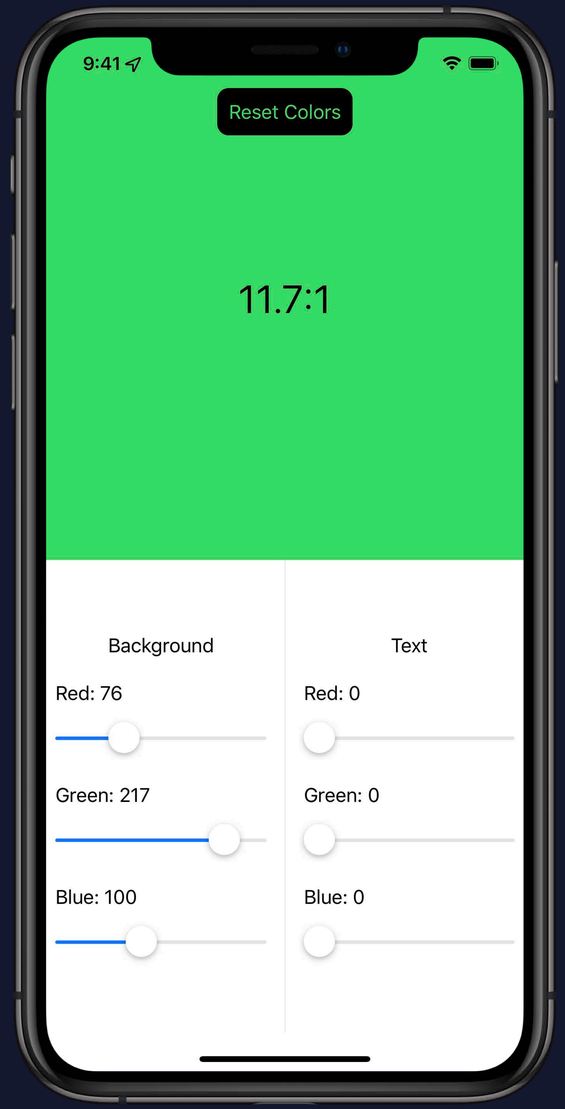
## Ordering

ZStack orders from back to front

- Customize ordering using sortPriority



```
Button(action: {
    resetColors()
}) {
    Text("Reset Colors")
    .foregroundColor(backgroundStorage.color)
}
.accessibility(sortPriority: 1)
```



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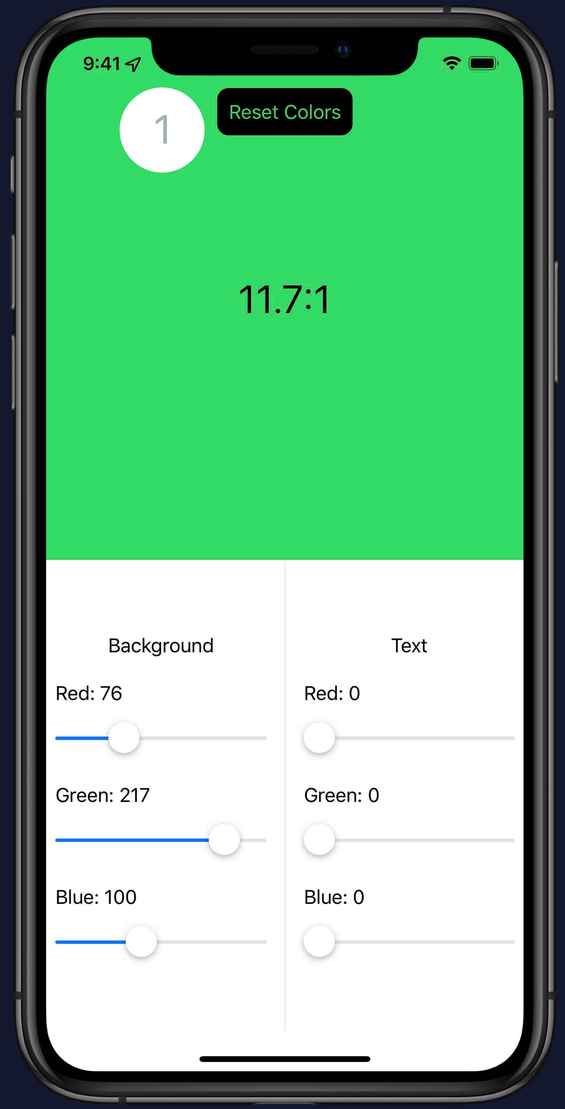

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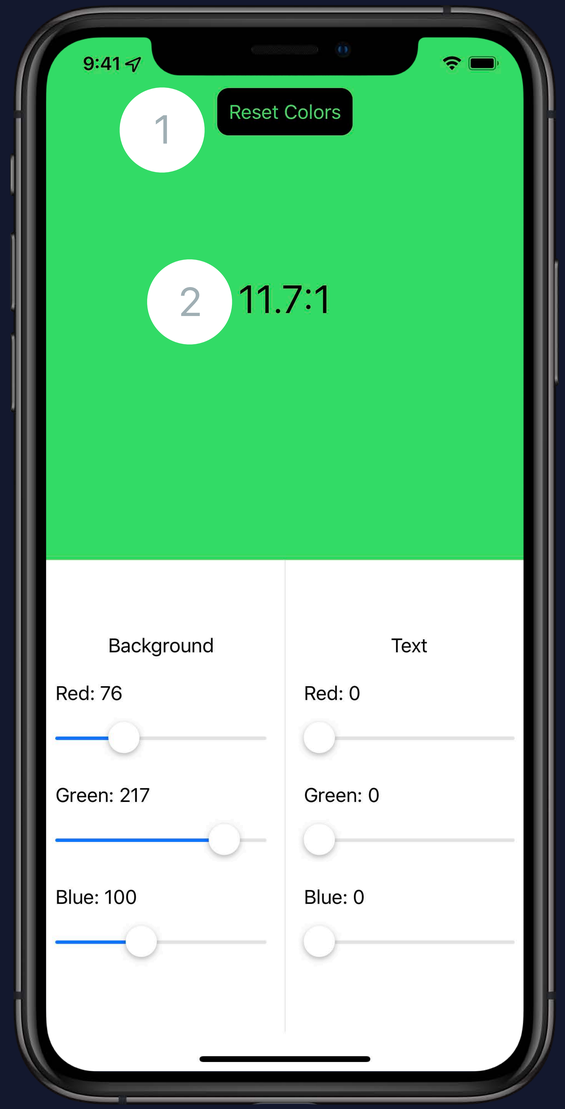

# Accessibility API Summary

Understandable

- Provide context by adding labels, values, and hints

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# Summary

# Evaluating Accessibility

Use your app with

- VoiceOver
- Full Keyboard Access
- Voice Control

# Accessibility Inspector

Explore, test, and debug your app’s Accessibility

| | |
|---|---|
| Accessibility Lessons: Inspector | WWDC 2019 |
| Auditing Your Apps for Accessibility | WWDC 2016 |

# Summary

# Summary

Automatically accessible SwiftUI apps

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Automatically accessible SwiftUI apps

Understandable, interactable, and navigable

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Automatically accessible SwiftUI apps

Understandable, interactable, and navigable

Powerful SwiftUI Accessibility API

# Summary

Automatically accessible SwiftUI apps

Understandable, interactable, and navigable

Powerful SwiftUI Accessibility API

Unified across all platforms

# More Information

developer.apple.com/wwdc19/238

Accessibility Lab

Friday, 11:00


WWDC19