Property Wrappers

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Property Wrappers

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  All of these `@Something` statements are property wrappers.

  A property wrapper is actually a `struct`.

  These `structs` encapsulate some "template" behavior applied to the `vars` they wrap.

  Examples ...

  - Making a `var` live in the heap (`@State`)
  - Making a `var` publish its changes (`@Published`)
  - Causing a `View` to redraw when a published change is detected (`@ObservedObject`)

  The property wrapper feature adds "syntactic sugar" to make these structs easy to create/use.

Property Wrappers

- Property Wrapper Syntactic Sugar

```
@Published var emojiArt: EmojiArt = EmojiArt()
```

Property Wrappers

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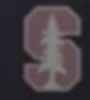
@Published var emojiArt: EmojiArt = EmojiArt()
```

… is really just this struct …

```
struct                {



}
```



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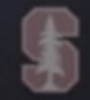

Property Wrappers

- Property Wrapper Syntactic Sugar

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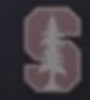
… is really just this struct …

```
struct Published {
    var wrappedValue

}
```



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@Published var emojiArt: EmojiArt = EmojiArt()
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… is really just this struct …

```
struct Published {
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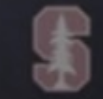
}
```

… and Swift (approximately) makes these vars available to you …

```
var _emojiArt
```



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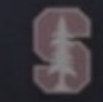

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    set { _emojiArt.wrappedValue = newValue }
}
```

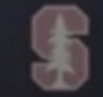

Property Wrappers

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struct Published {
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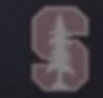
You access this var using $, e.g. `$emojiArt`.



Property Wrappers

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@Published var emojiArt: EmojiArt = EmojiArt()
```

… is really just this struct …

```
struct Published {
    var wrappedValue: EmojiArt
    var projectedValue: Publisher<EmojiArt, Never>
}
```

… and Swift (approximately) makes these vars available to you …

```
var _emojiArt: Published = Published(wrappedValue: EmojiArt())
var emojiArt: EmojiArt {
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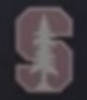
}
```

But wait! There's more. There's also another var inside Property Wrapper structs …

You access this var using $, e.g. `$emojiArt`.

Its type is up to the Property Wrapper. `Published`'s is a `Publisher<EmojiArt, Never>`.



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  So what does `Published` do when its `wrappedValue` is `set` (i.e. changes)?
  It publishes the change through its `projectedValue` (`$emojiArt`) which is a `Publisher`.
  We'll talk about what `Publishers` are later in the quarter.
  It also invokes `objectWillChange.send()` in its enclosing `ObservableObject`.

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  We'll talk about what `Publishers` are later in the quarter.
  It also invokes `objectWillChange.send()` in its enclosing `ObservableObject`.

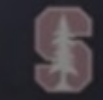
  Let's look at the actions and projected value of some other Property Wrappers we know ...

Property Wrappers

- `@State`

  The `wrappedValue` is: any value type.

  What it does: stores the `wrappedValue` in the heap; when it changes, invalidates the `View`.



Property Wrappers

- @State

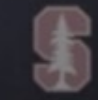
  The wrappedValue is: any value type.

  What it does: stores the wrappedValue in the heap; when it changes, invalidates the View.

  Projected value (i.e. $): a Binding (to that value in the heap).

  It's a bit tricky to initialize an @State in your View's init ...

```
@State private var foo: Int
init() {
    _foo = .init(initialValue: 5)
}
```



Property Wrappers

- `@StateObject`

  Like `@State`, but for `ObservableObjects` (aka ViewModels) instead of for value types.

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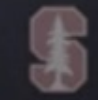

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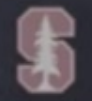
  An `@StateObject` is a "source of truth" (like `@State` is for `View`-local value types).
  Always create it with an initial value, e.g. `@StateObject var foo = SomeObservableObject()`.
  An `@ObservedObject` is not a source of truth (it's a reference to a source of truth).
  So you should never do `@ObservedObject var foo = SomeObservableObject()`.



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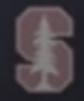
  So you should *never* do `@ObservedObject var foo = SomeObservableObject()`.

  Can be used in a `View` or in an `App` or in a `Scene` (which we'll cover later).

  If in a `View`, the *lifetime* of the ViewModel will be tied to that of the `View`.
  In other words, when the `View` goes off-screen, the `@StateObject` will get tossed.
  Sometimes you want this.
  e.g. a `FetchedImageView` (we want to dump the image bits when `View` goes off screen)
  Most times, it's *not what you want*.
  e.g. anytime you share a ViewModel with any other `View` *that is not your child*

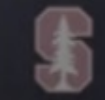


Property Wrappers

- `@StateObject` and `@ObservedObject`

  The `wrappedValue` is: `anything that implements the ObservableObject protocol` (ViewModels).

  What it does: invalidates the `View` when `wrappedValue` does `objectWillChange.send()`.

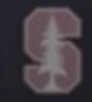


Property Wrappers

- `@StateObject` and `@ObservedObject`

  The `wrappedValue` is: anything that implements the `ObservableObject` protocol (ViewModels).
  What it does: invalidates the `View` when `wrappedValue` does `objectWillChange.send()`.
  Projected value (i.e. $): a `Binding` to the vars of the `wrappedValue` ViewModel.

  The projected value `Binding` can be to any `var` expression, including subscripts.
  e.g. `$myViewModel.data.stuff[3]` is legal
  But be careful if you bind to something that can disappear out from under the `Binding`.
  For example, if we shortened the `stuff` array to only have 2 items in it.



Property Wrappers

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  The `wrappedValue` is: a value that is bound to something else.

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  What it does: when the bound-to value changes, it invalidates the `View`.

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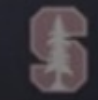
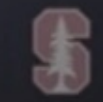


Property Wrappers

- Where do we use `Binding`s?
  - All over the freaking place ...



Property Wrappers

- Where do we use `Bindings`?
  - All over the freaking place …
  - Getting text out of a `TextField`, the choice out of a `Picker`, etc.
  - Using a `Toggle` or other state-modifying UI element.
  - Finding out which item in a `NavigationView` was chosen.
  - Finding out whether we're being targeted with a Drag (the `isTargeted` argument to `onDrop`).
  - Binding our gesture state to the `.updating` function of a gesture.
  - Knowing about (or causing) a modally presented `View`'s dismissal.
  - In general, breaking our `Views` into smaller pieces (and sharing data with them).
  - And so many more places.

Property Wrappers

- Where do we use Bindings?
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  - Knowing about (or causing) a modally presented View's dismissal.
  - In general, breaking our Views into smaller pieces (and sharing data with them).
  - And so many more places.
  - Bindings are all about having a single source of the truth!
  - We don't ever want to have state stored in, say, our ViewModel and also in @State in our View.
  - Instead, we would use a @Binding to the desired var in our ViewModel.
  - Nor do we want two different @State vars in two different Views be storing the same thing.
  - Instead, one of the two @State vars would want to be a @Binding to the other.

Property Wrappers

- Where do we use Bindings?

```
struct MyView: View {
    @State var myString = "Hello"
    var body: View {
        OtherView(sharedText: $myString)
    }
}
struct OtherView: View {
    @Binding var sharedText: String
    var body: View {
        Text(sharedText)
        TextField("Shared", text: $sharedText)
    }
}
```

OtherView's sharedText is bound to MyView's myString.
Changing sharedText changes myString (and vice versa).

Property Wrappers

- Binding to a Constant Value

  You can create a `Binding` to a constant value with `Binding.constant(value)`.

  e.g. `OtherView(sharedText: .constant("Howdy"))` will always show Howdy in `OtherView`.

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- Binding to a Constant Value

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- Computed Binding

  You can even create your own "computed Binding".

  We won't go into detail here, but check out `Binding(get:, set:)`.

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  ```
  let myView = MyView().environmentObject(theViewModel)
  ```

  … vs …

  ```
  let myView = MyView(viewModel: theViewModel)
  ```

  Inside the View …

  ```
  @EnvironmentObject var viewModel: ViewModelClass
  ```

  … vs …

  ```
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  Otherwise the code inside the Views would be the same.

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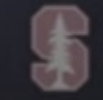
  Biggest difference between the two?

  Environment objects are visible to all Views in your body (and thus to their body's Views).

  So it is sometimes used when a number of Views are going to share the same ViewModel.

  When presenting modally (more on that later), you will want to use @EnvironmentObject.



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  When presenting modally (more on that later), you will want to use @EnvironmentObject.

  Can only use one @EnvironmentObject wrapper per ObservableObject type per View.

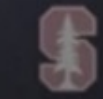
Property Wrappers

- @EnvironmentObject

  The wrappedValue is: ObservableObject obtained via .environmentObject() sent to the View.

  What it does: invalidates the View when wrappedValue does objectWillChange.send().

  Projected value (i.e. $): a Binding to the vars of the wrappedValue ViewModel.



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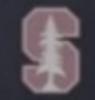
  You can pass values to set these other vars using `()` when you use the Property Wrapper.
  e.g. `@Environment(\.colorScheme) var colorScheme`
  In `Environment`'s case, the value that you're passing (e.g. `\.colorScheme`) is a key path.
  It specifies which instance variable to look at in an `EnvironmentValues` `struct`.
  See the documentation of `EnvironmentValues` for what's available (there are many).



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  e.g. `@Environment(\.colorScheme) var colorScheme`
  In `Environment`'s case, the value that you're passing (e.g. `\.colorScheme`) is a key path.
  It specifies which instance variable to look at in an `EnvironmentValues` `struct`.
  See the documentation of `EnvironmentValues` for what's available (there are many).

  Notice that the `wrappedValue`'s type is internal to the `Environment` Property Wrapper.
  Its type will depend on which key path you're asking for.
  In our example above, the `wrappedValue`'s type will be `ColorScheme`.
  `ColorScheme` is an `enum` with values `.dark` and `.light`.
  So this is how you know whether your `View` is drawing in dark mode or light mode right now.

Property Wrappers

- `@Environment`

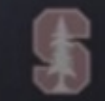
  Unrelated to `@EnvironmentObject`. Totally different thing.

  Property Wrappers can have yet more variables than `wrappedValue` and `projectedValue`.
  They are just normal `structs`.

  You can pass values to set these other vars using `()` when you use the Property Wrapper.
  e.g. `@Environment(\.colorScheme) var colorScheme`
  In `Environment`'s case, the value that you're passing (e.g. `\.colorScheme`) is a key path.
  It specifies which instance variable to look at in an `EnvironmentValues` `struct`.
  See the documentation of `EnvironmentValues` for what's available (there are many).

  Notice that the `wrappedValue`'s type is internal to the `Environment` Property Wrapper.
  Its type will depend on which key path you're asking for.
  In our example above, the `wrappedValue`'s type will be `ColorScheme`.
  `ColorScheme` is an `enum` with values `.dark` and `.light`.
  So this is how you know whether your `View` is drawing in dark mode or light mode right now.

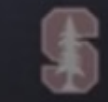
  ```
  view.environment(\.colorScheme, .dark)
  ```



Property Wrappers

- `@Environment`

  The `wrappedValue` is: the `value of some var in EnvironmentValues`.

  What it does: gets a value of some var in `EnvironmentValues`.

  Projected value (i.e. $): `none`.