Extending UIColor to Support Custom Styling

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Built community styling in the Reddit app

Passionate about app themes and design systems

u/MoarKelBell

reddit

Overview

Colors

Color Spaces

Color Components

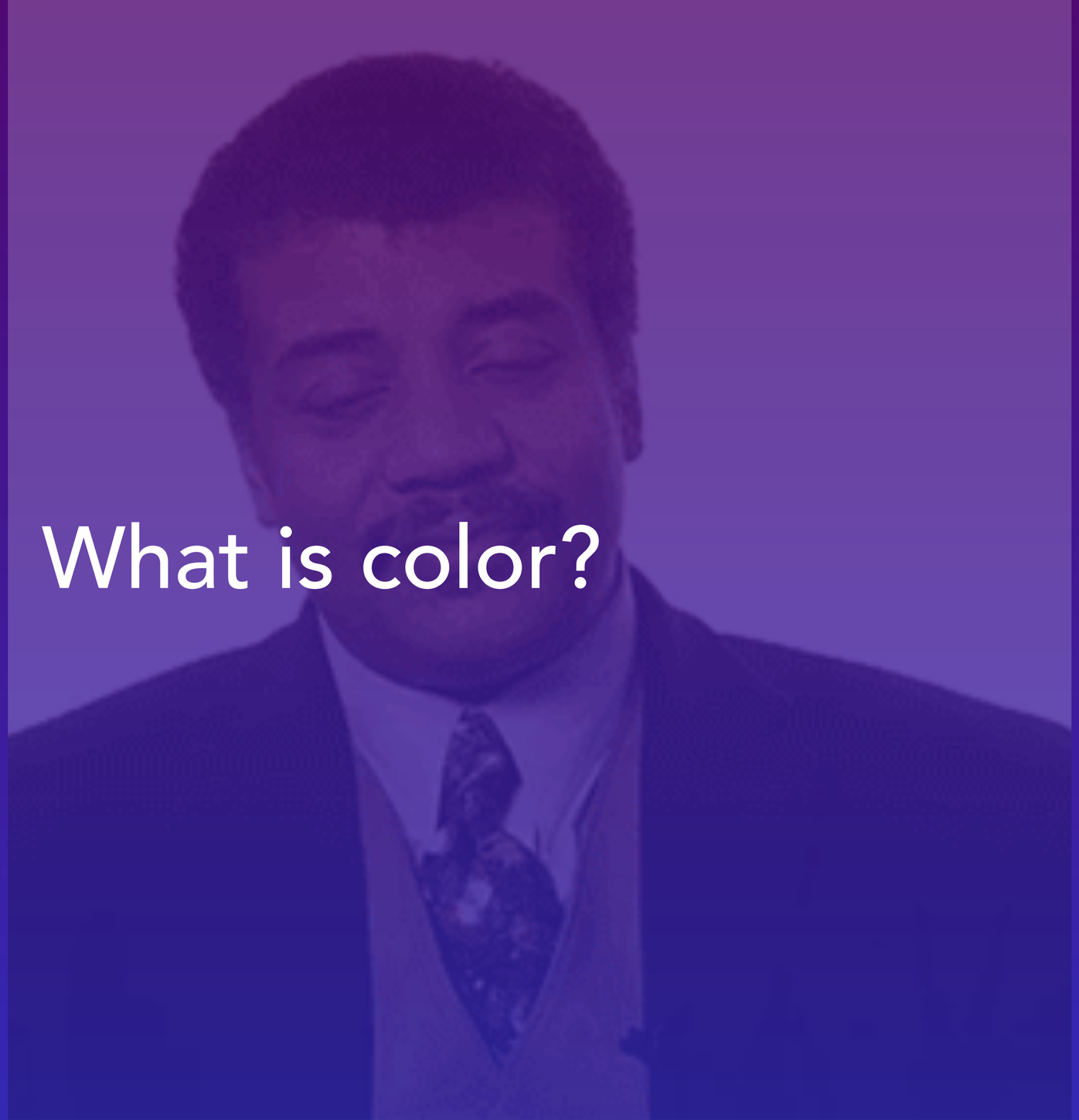
Contrast + Accessibility

Custom Colors + Themes

Dark Mode

Letting Users Choose Colors

Color Collisions + How to Handle Them



What is color?

What is Color?

Light

Object we see

Human Eye

Light

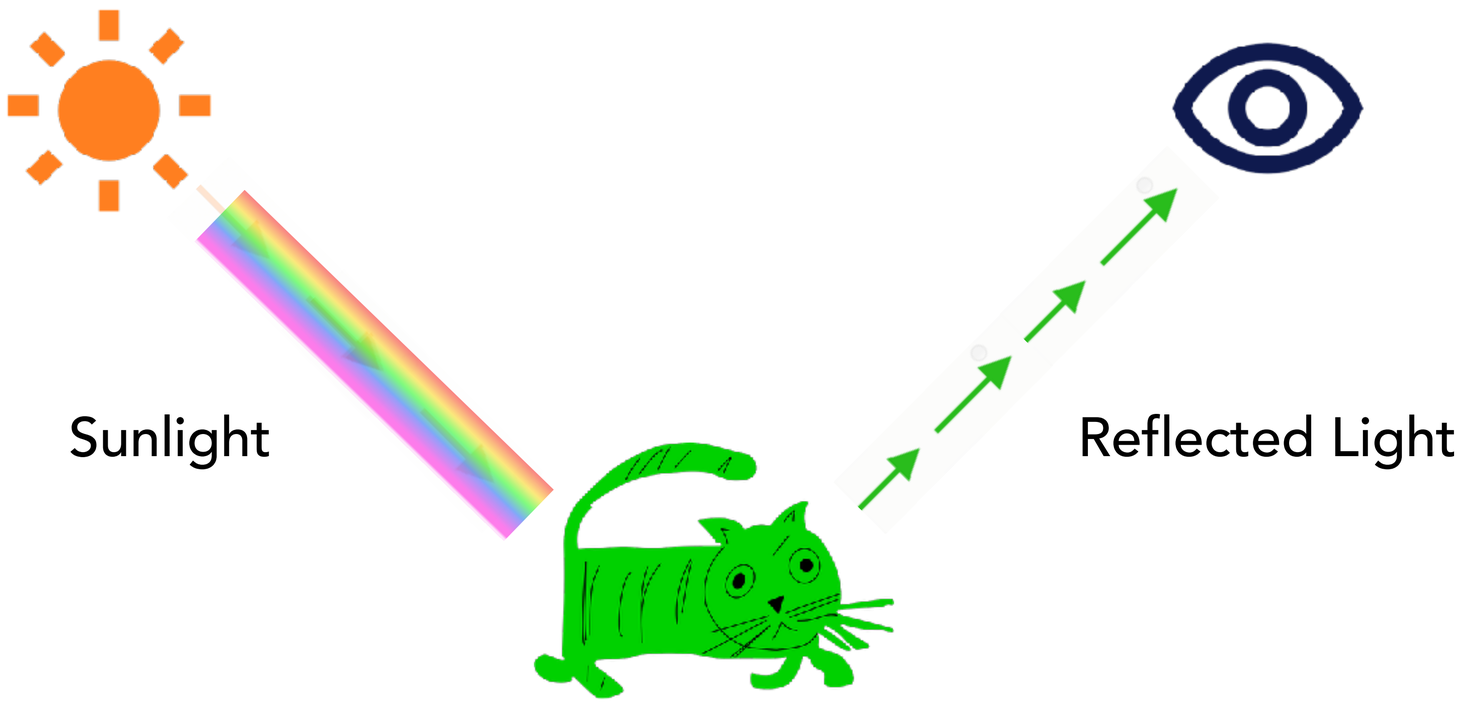
Main source of color

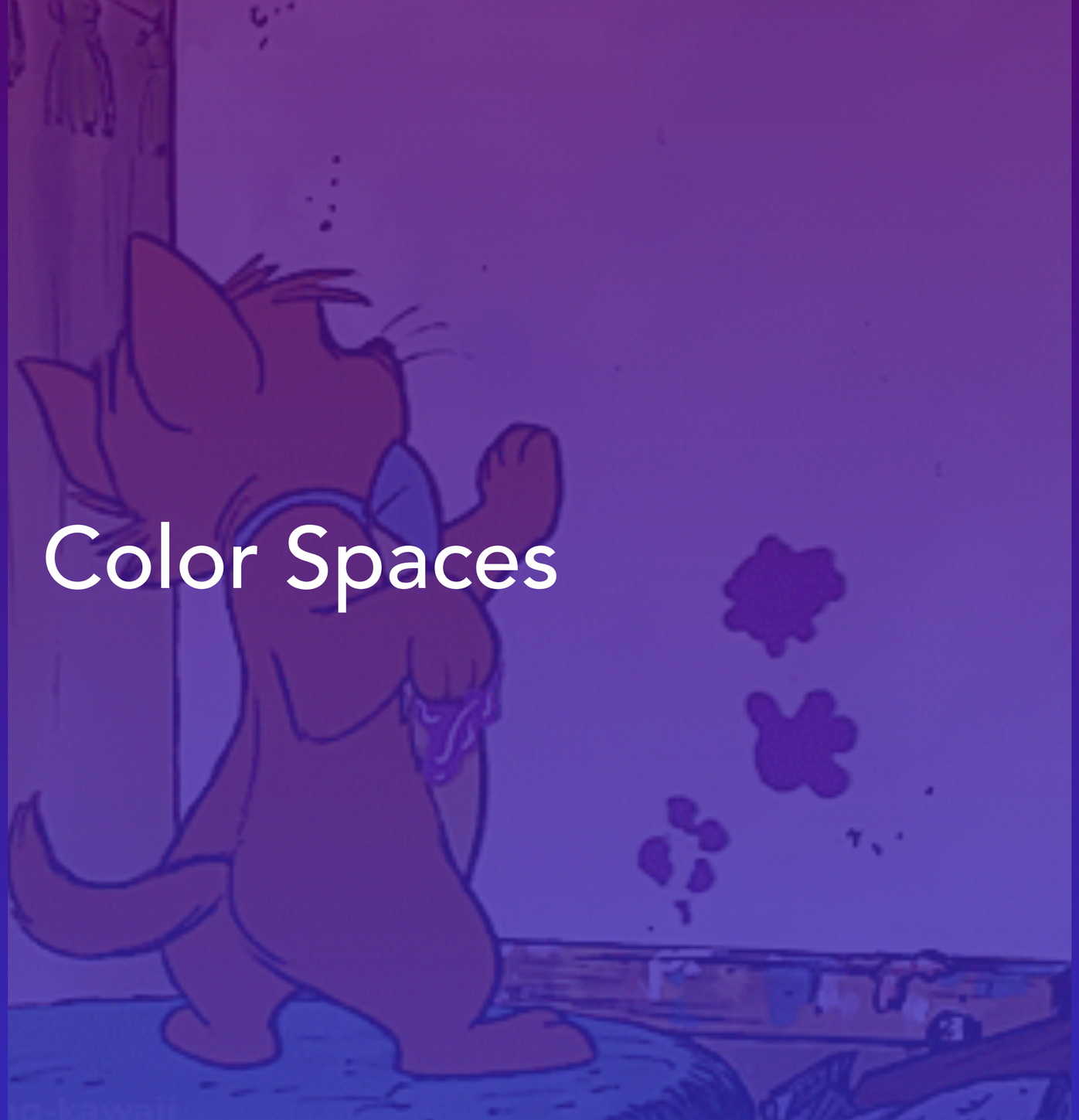
Objects react to light

Objects reflect or absorb colors

Eye perceives color

Light





Color Spaces

Color Spaces

Range of colors represented by tuple of color components

RGB

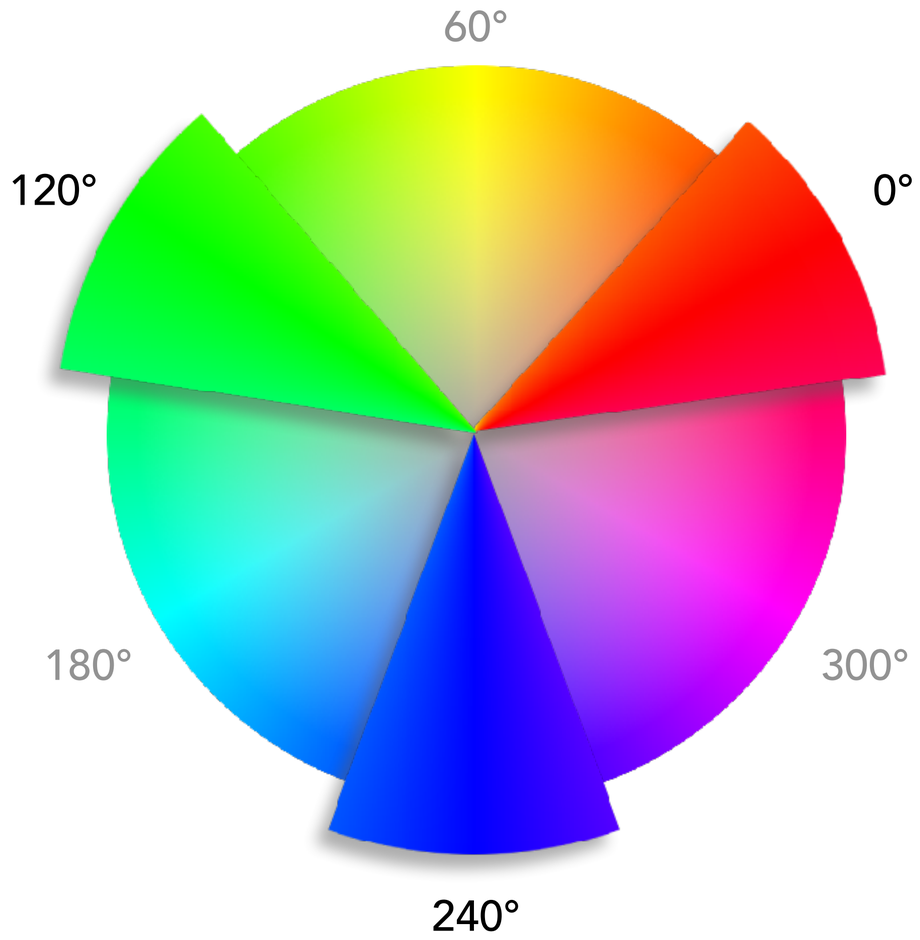
HSB

HSB

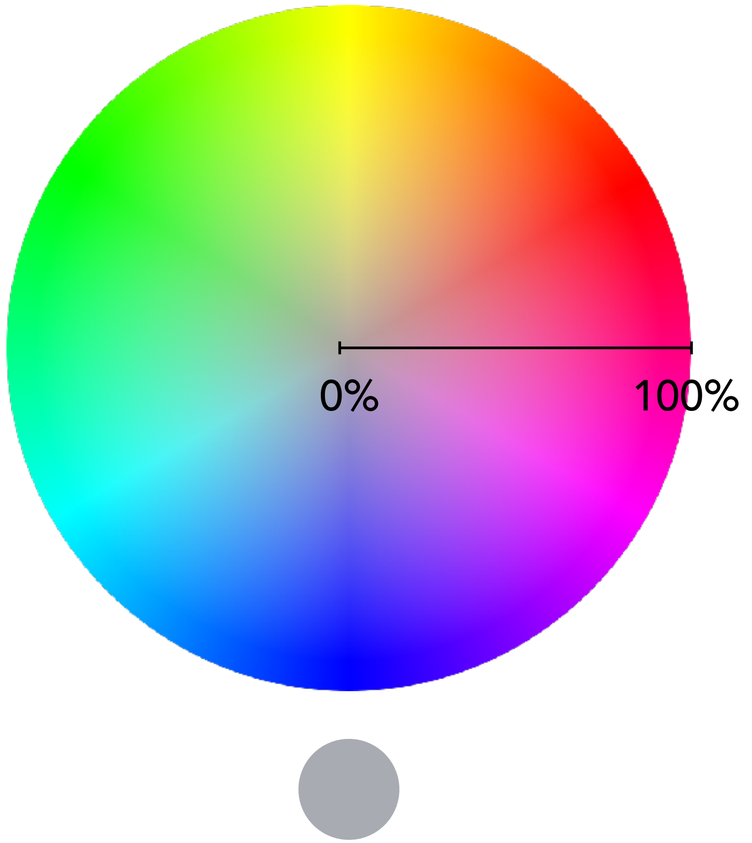
Hue, Saturation &

Brightness

Hue



Saturation



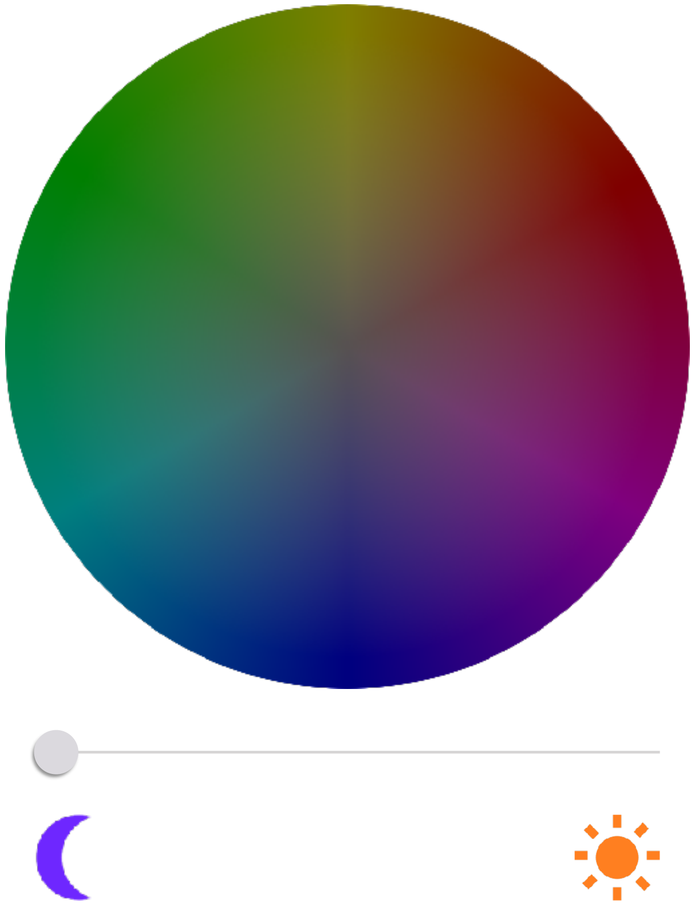
Saturation

Original

100%

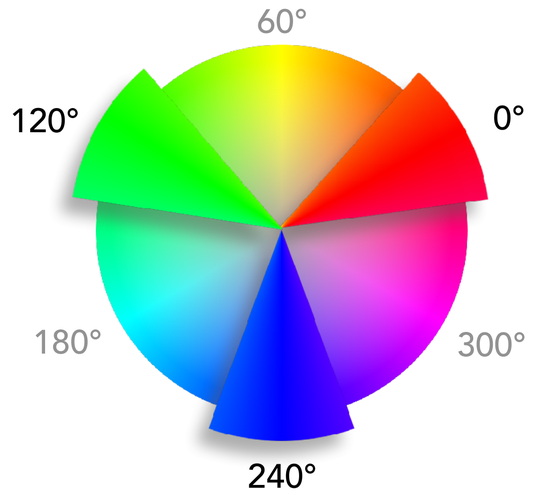
0%

Brightness



Brightness Example

Why HSB?

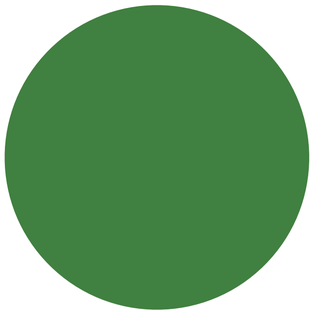


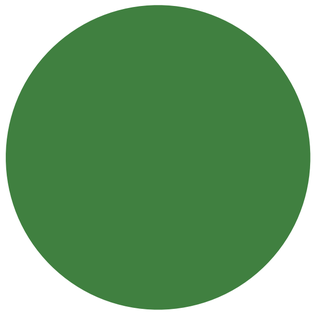
Best for human consumption

More intuitive and easier predict the color

Hue:	**120°**
Saturation:	50%
Brightness:	50%

Red:	64
Green:	128
Blue:	64





Contrast & Accessibility

Color Contrast

The difference in brightness between two colors measured as a ratio between 1 and 21.

Accessibility

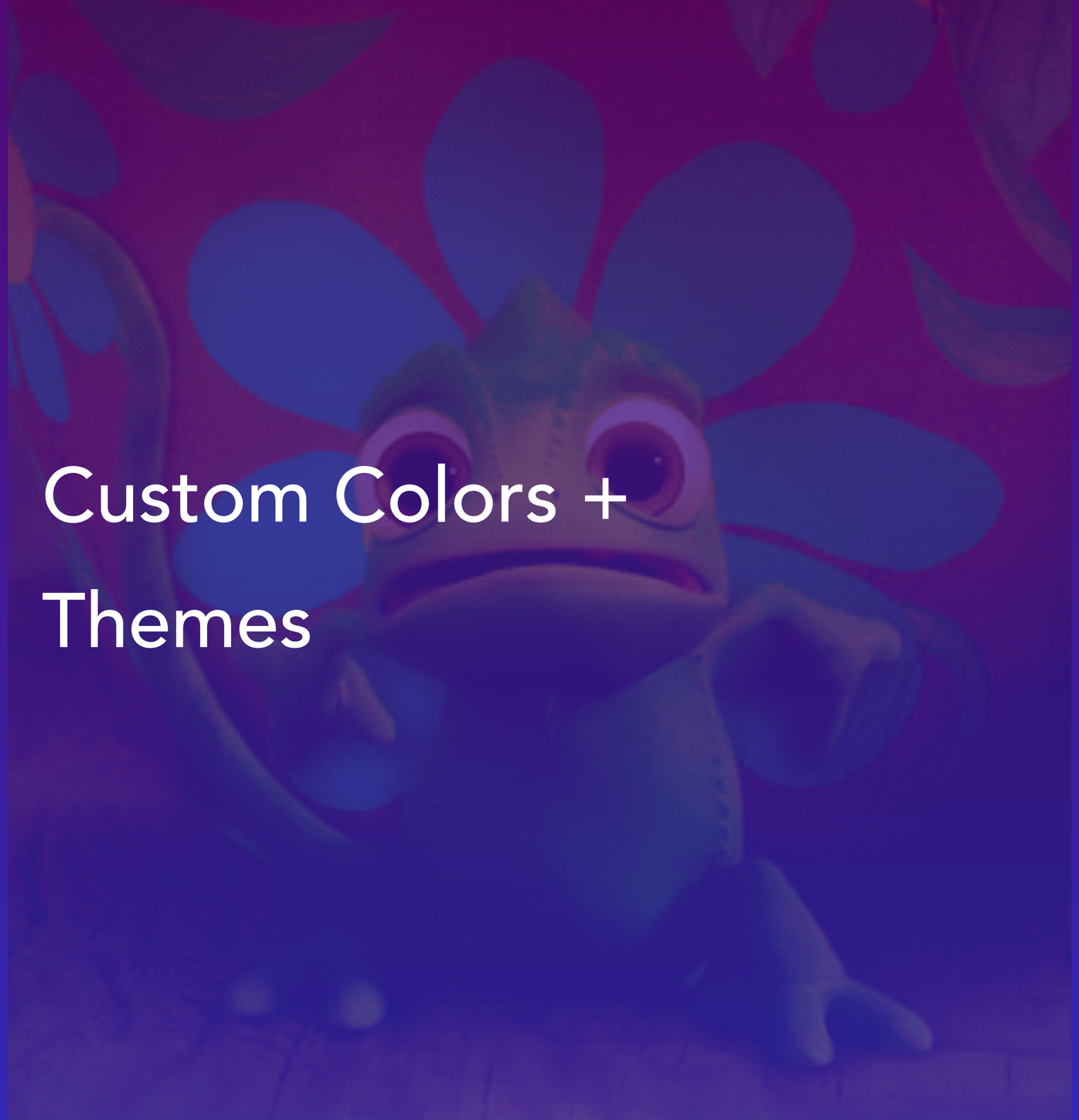
Web Content Accessibility Guidelines

Recommended contrast ratio >= 7.0

Contrast Ratio Formula

(B1 + 0.05) / (B2 + 0.05)

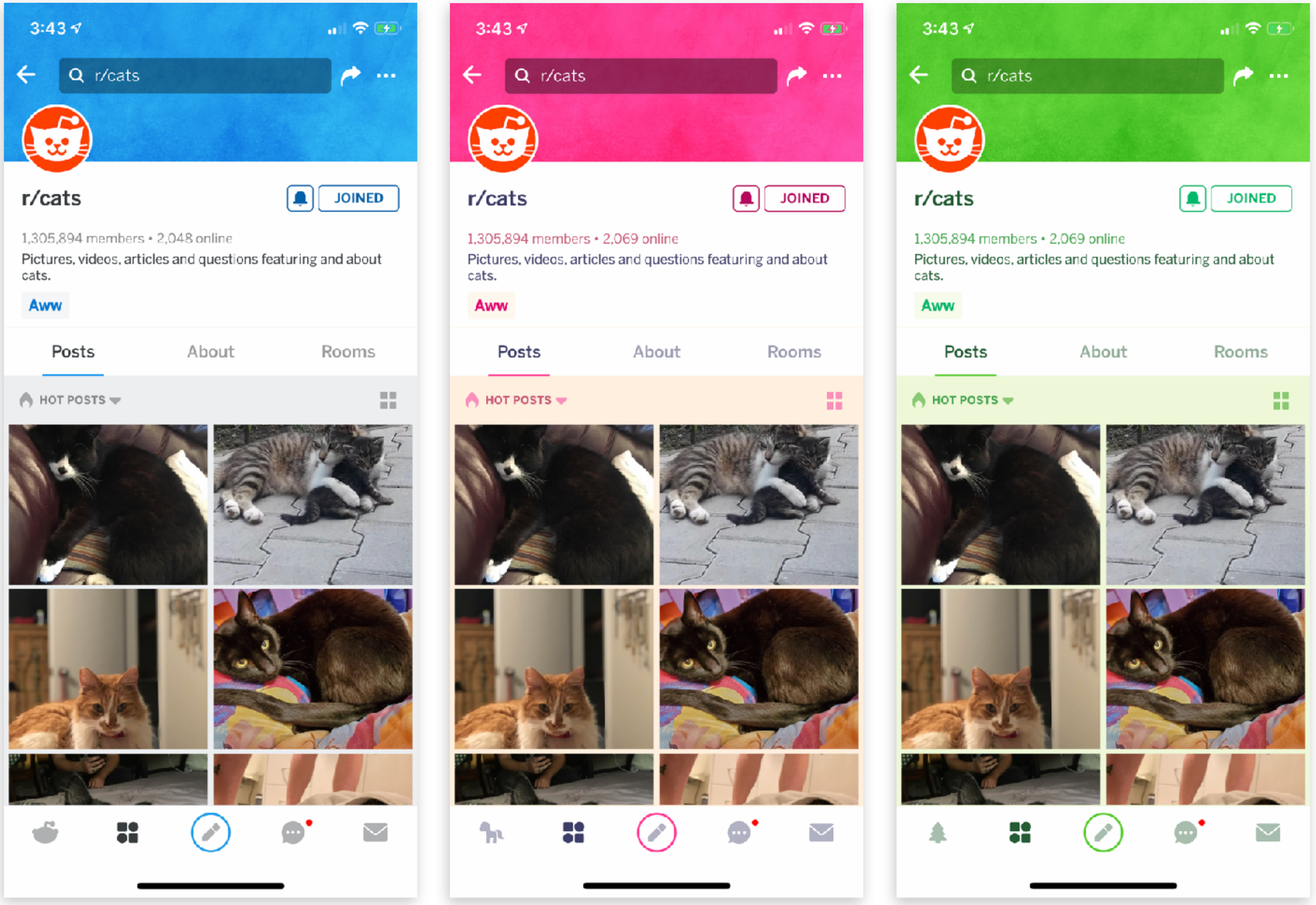
B1 = brightness of the lighter color
B2 = brightness of the darker color



Custom Colors + Themes

Universal App Themes

- 🎨 Common color palette
- 🌎 Universal look and feel
- 💁‍♀️ Customization for users


3:43
r/cats
r/cats
JOINED
1,305,894 members • 2,048 online
Pictures, videos, articles and questions featuring and about cats.
Aww
Posts
About
Rooms
HOT POSTS
3:43
r/cats
r/cats
JOINED
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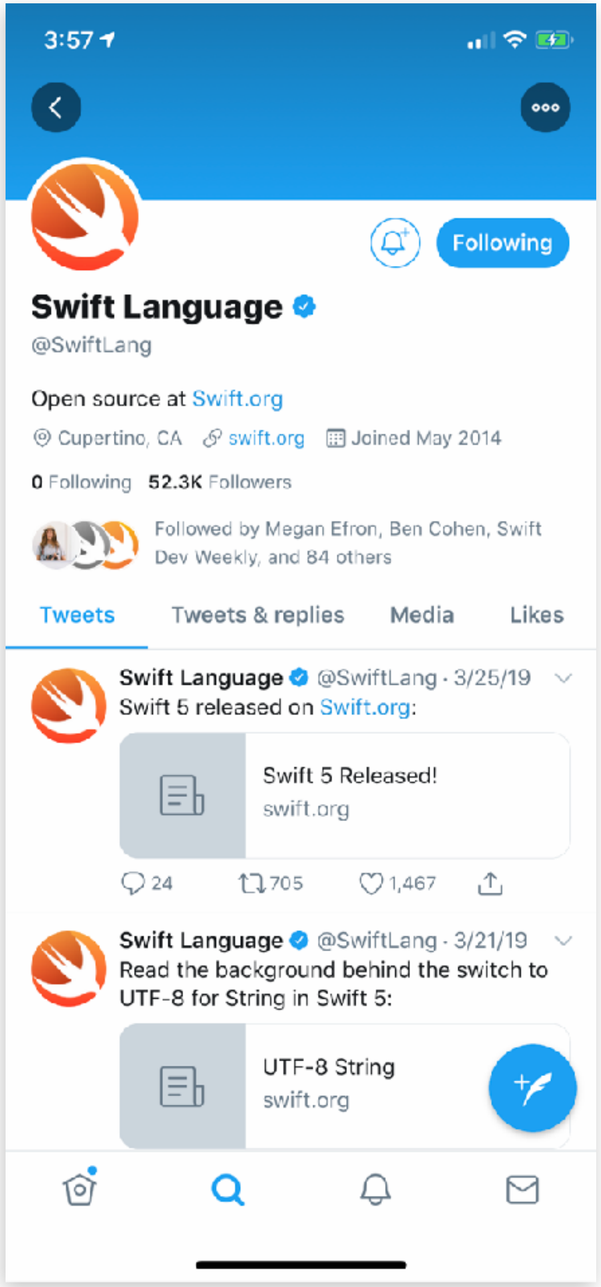
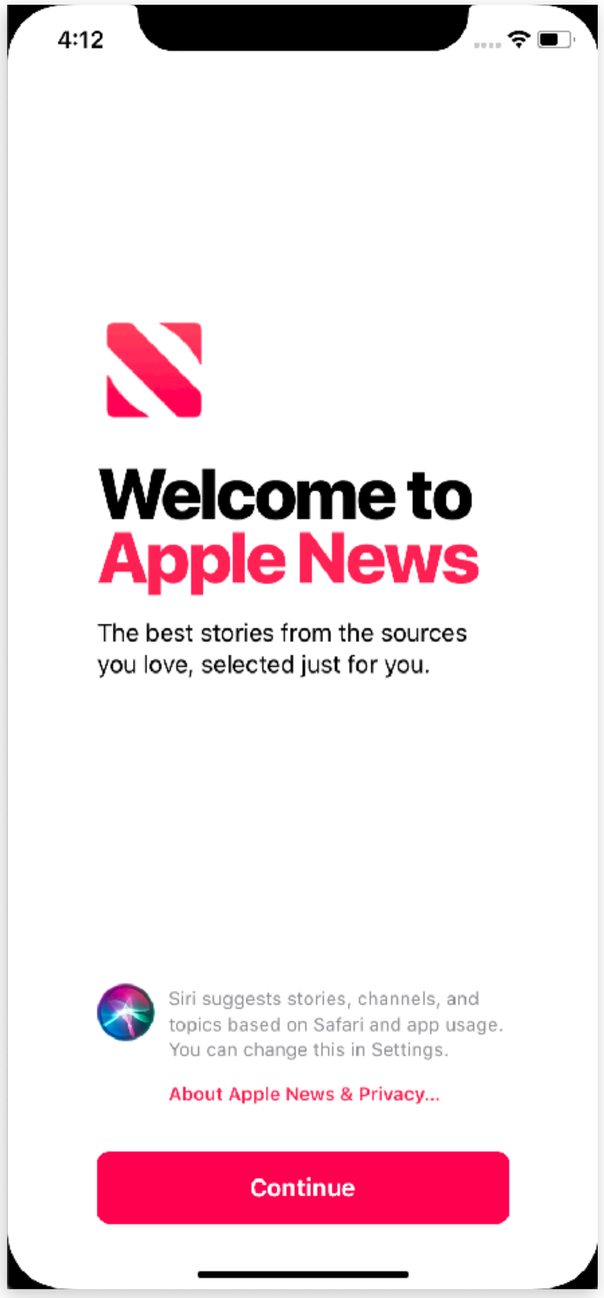


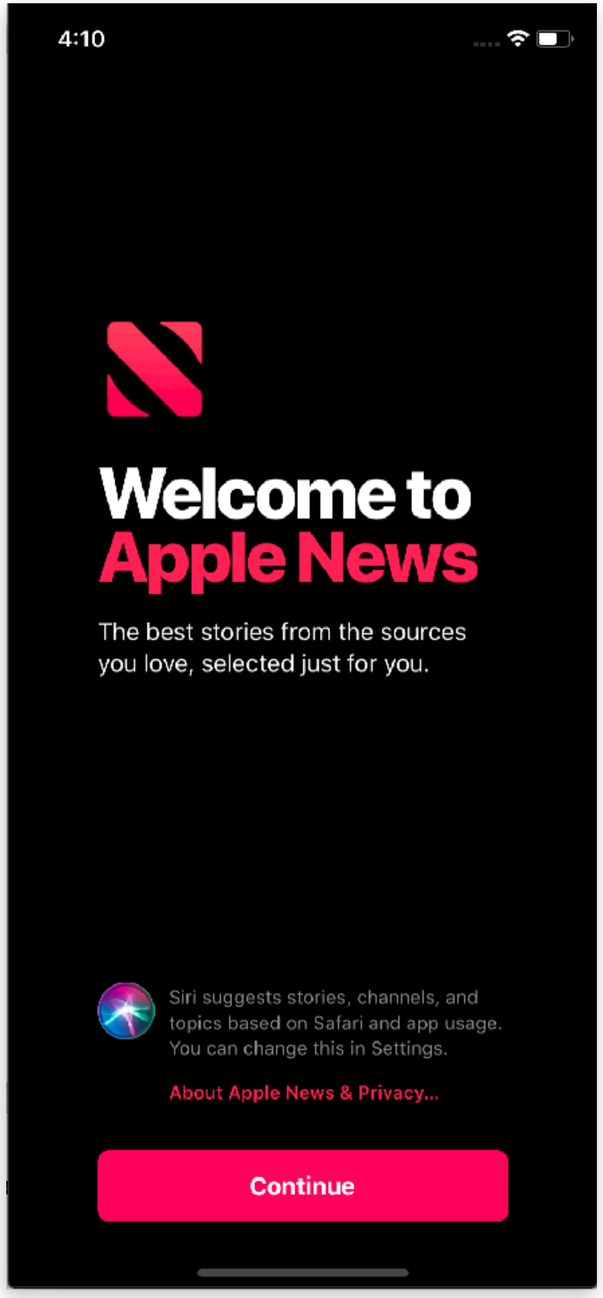
Light Mode

Dark Mode

Dark Mode

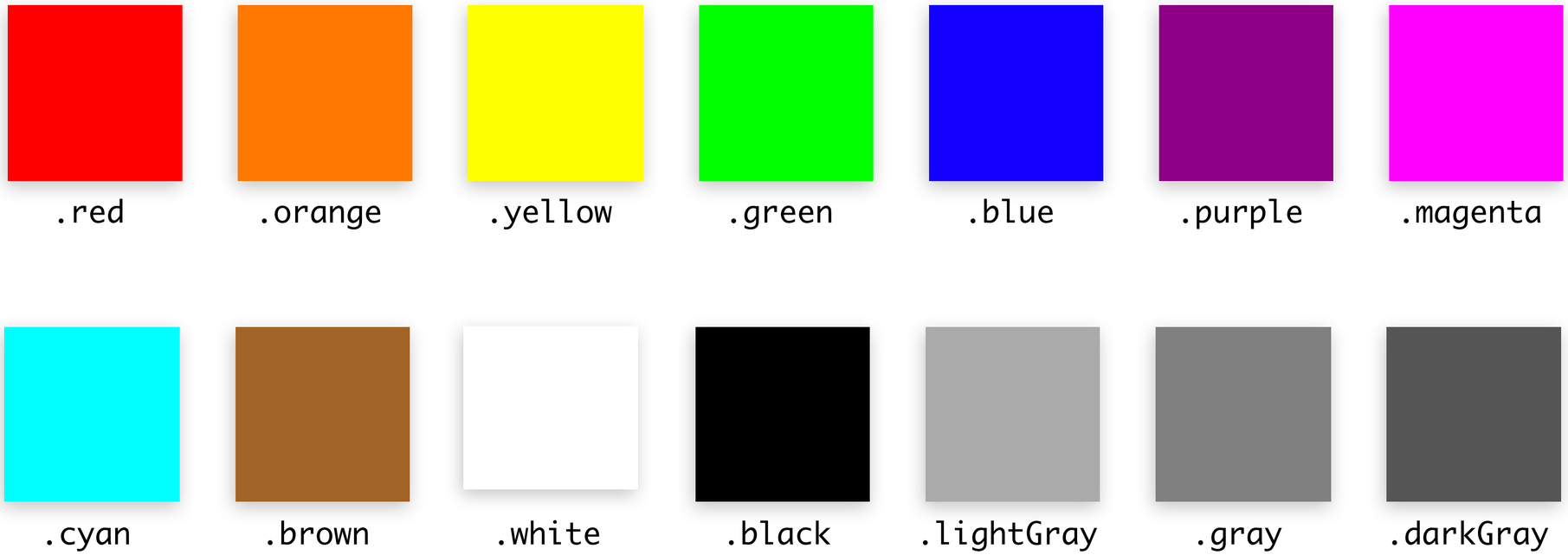


Light Mode



Dark Mode

Static UIColors



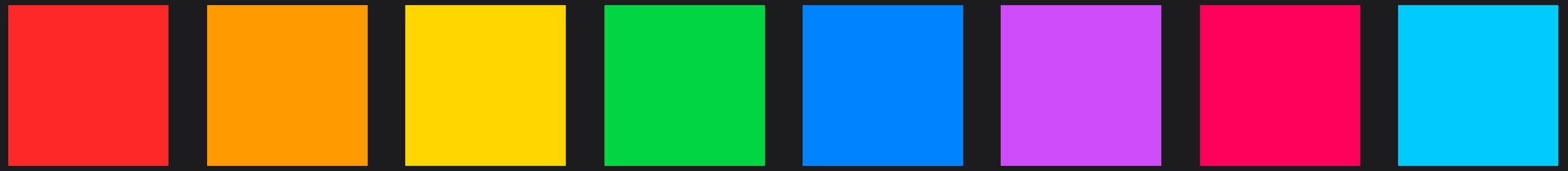
Dynamic System UIColors

Named after the color they represent

Automatically adapts to the current UITraitEnvironment

- Light mode
- Dark mode
- High contrast mode

Dynamic System UIColors

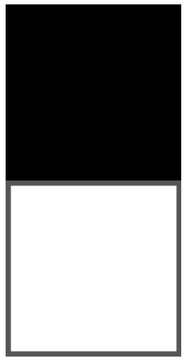


.systemRed .systemOrange .systemYellow .systemGreen .systemBlue .systemPurple .systemPink .systemTeal

Dynamic Semantic UIColors

Light Mode

Dark Mode

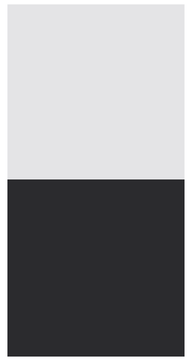


`.label`

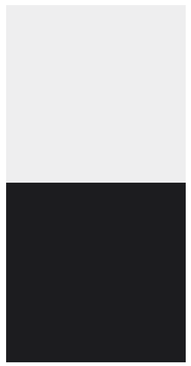
`.secondary Label`

`.tertiary Label`

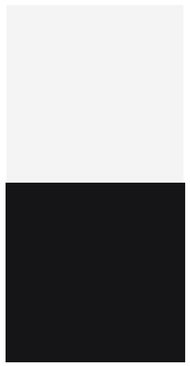
`.quaternary Label`



`.systemFill`

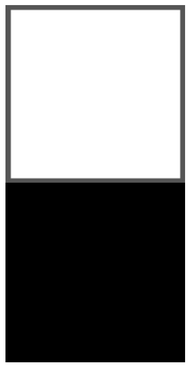


`.tertiarySystem Fill`

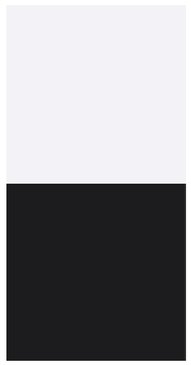


`.quaternary SystemFill`

`.placeholder Text`



`.systemBackground`



`.secondarySystem Background`

Custom Dynamic Colors

Define in the asset catalog

Light Appearance Light mode

Dark Appearance Dark mode

Any Appearance iOS 12 & earlier

Custom Dynamic Colors

```
let dynamicColor = UIColor { (traitCollection:
UITraitCollection) -> UIColor in

 if traitCollection.userInterfaceStyle == .dark {
    return .white
  } else {
    return .black
  }
}
```

Accessing System Colors

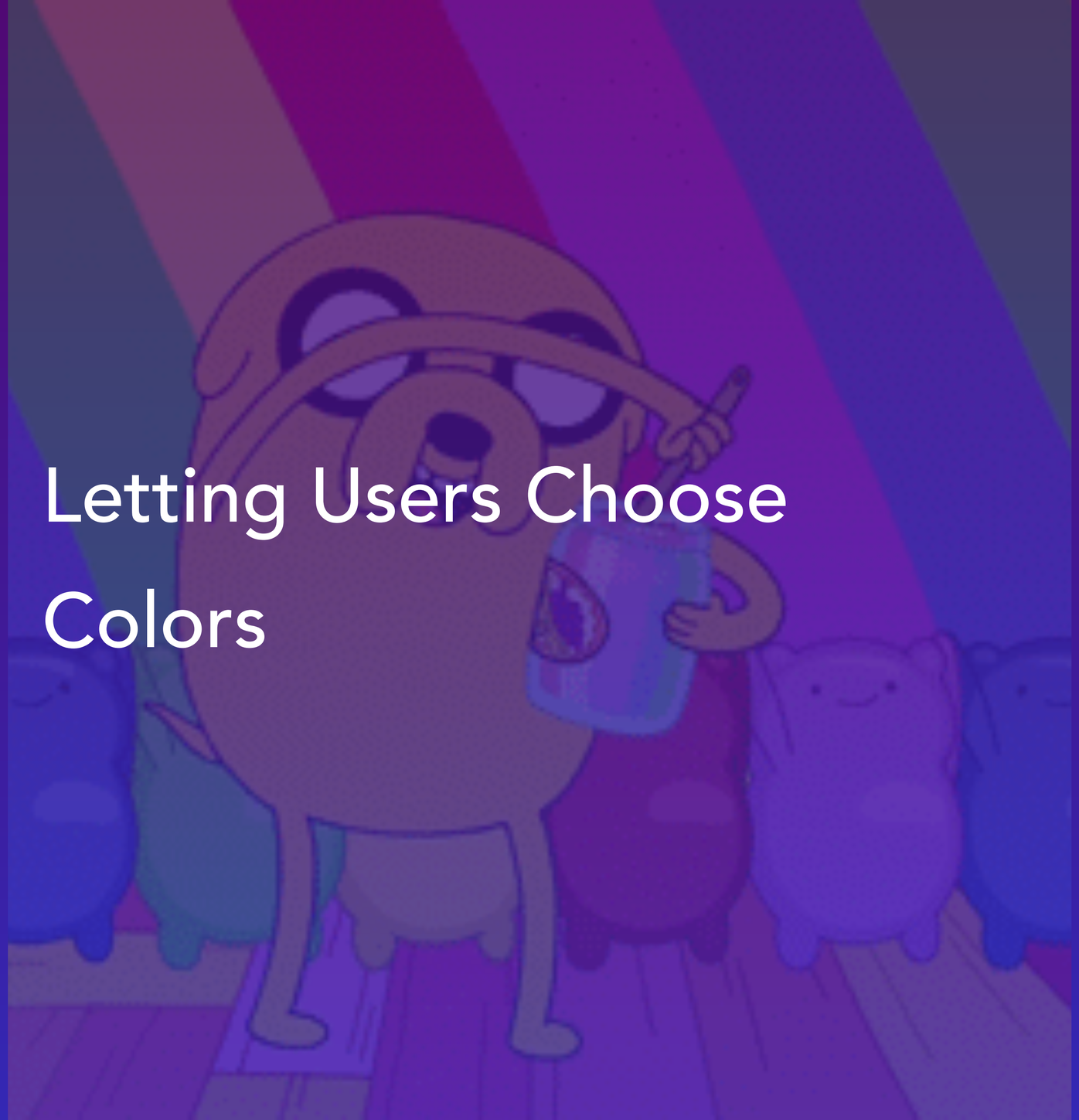
```
let dynamicColor = UIColor.systemBackground

let traitCollection = view.traitCollection

let resolvedColor = dynamicColor.resolvedColor(with:
traitCollection)


let layer = CALayer()

layer.borderColor = resolvedColor.cgColor
```



Letting Users Choose Colors

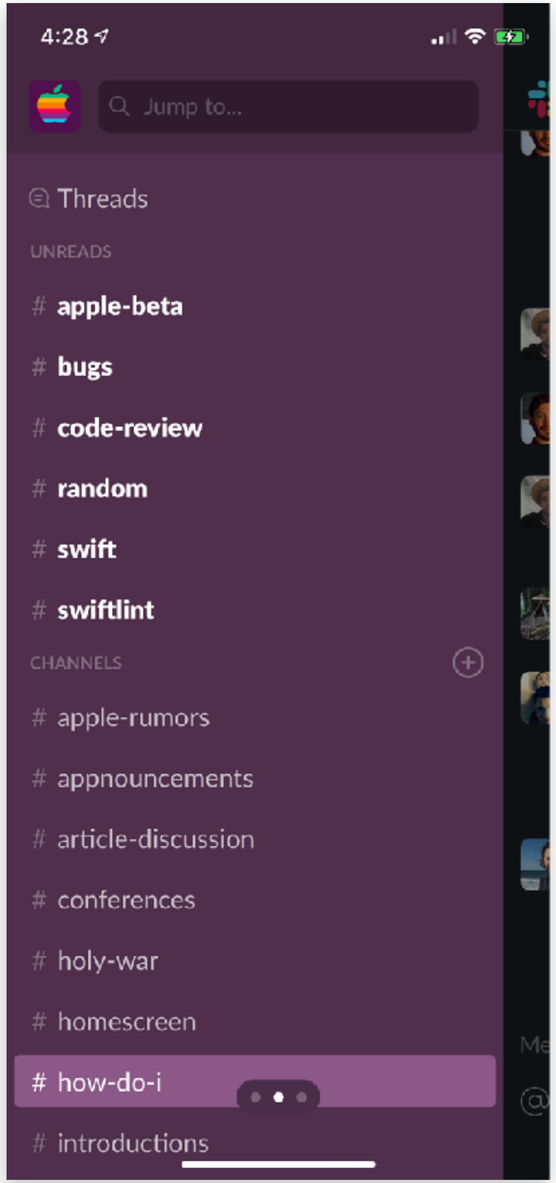
Color Customization

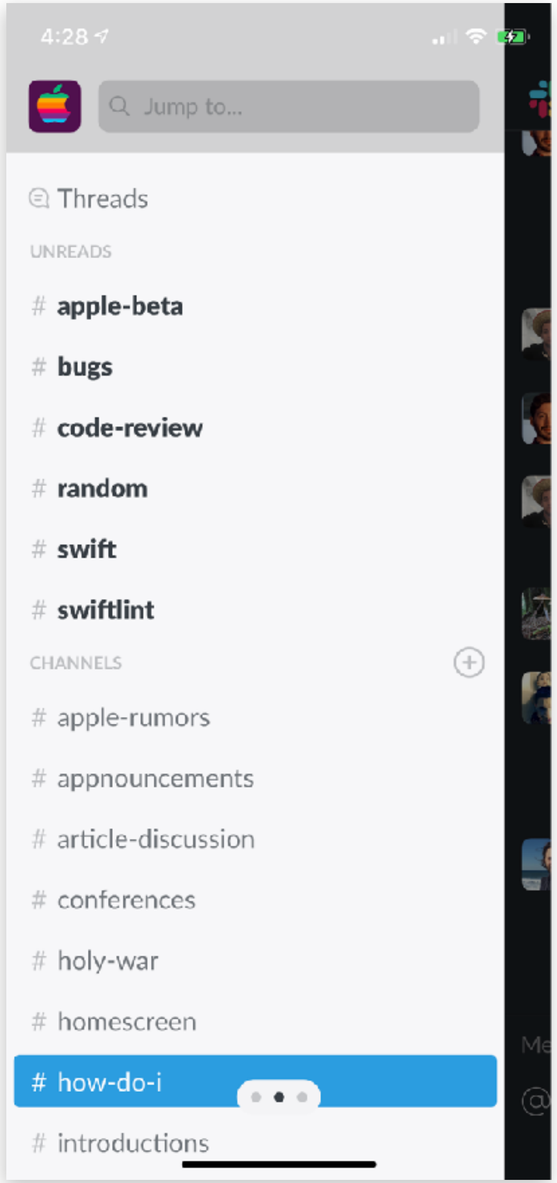
User selected colors

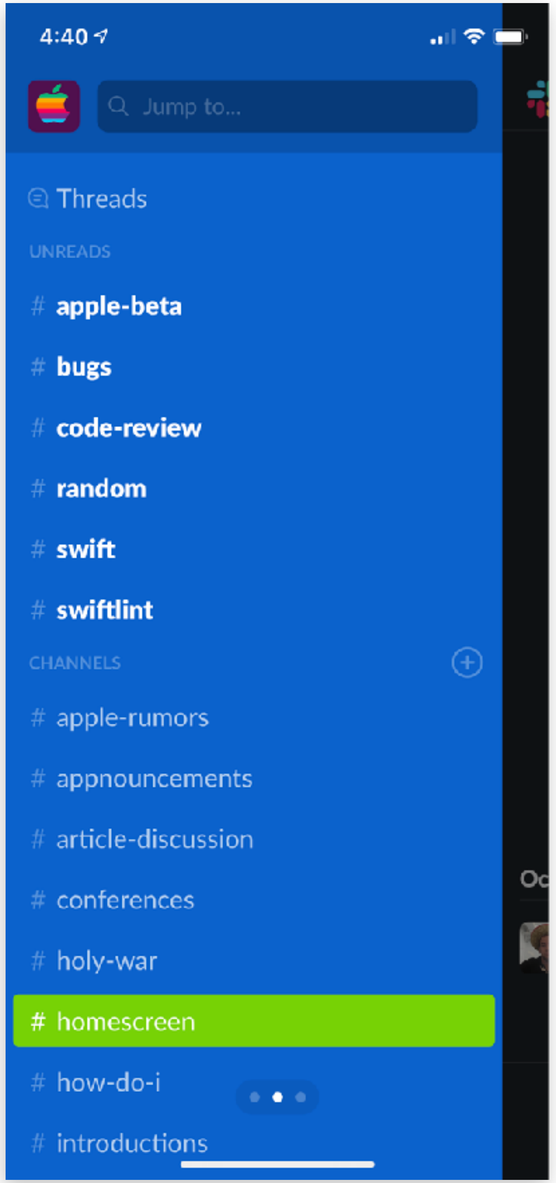
Usually stored on the backend and fetched by client

Unique to one user or one page of an app

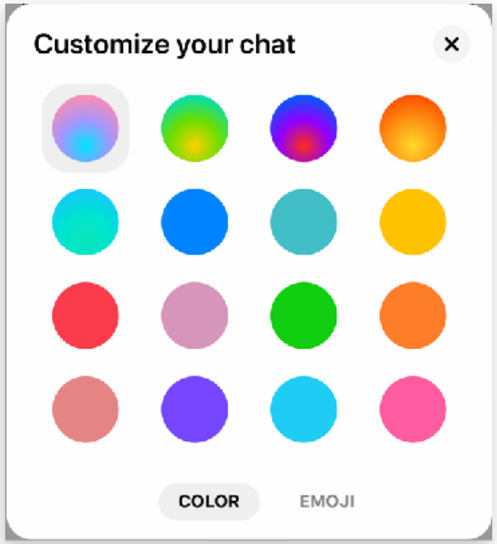
Color Customization

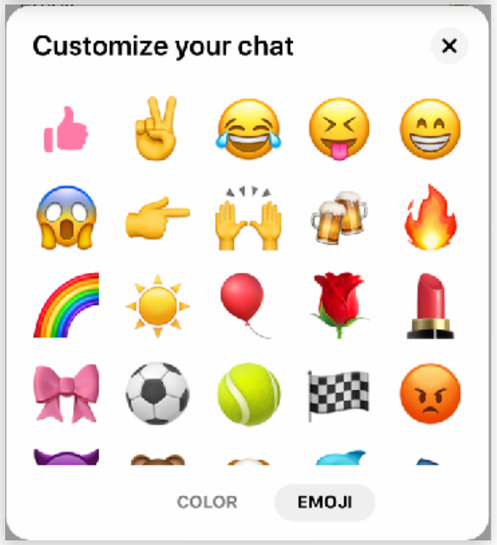


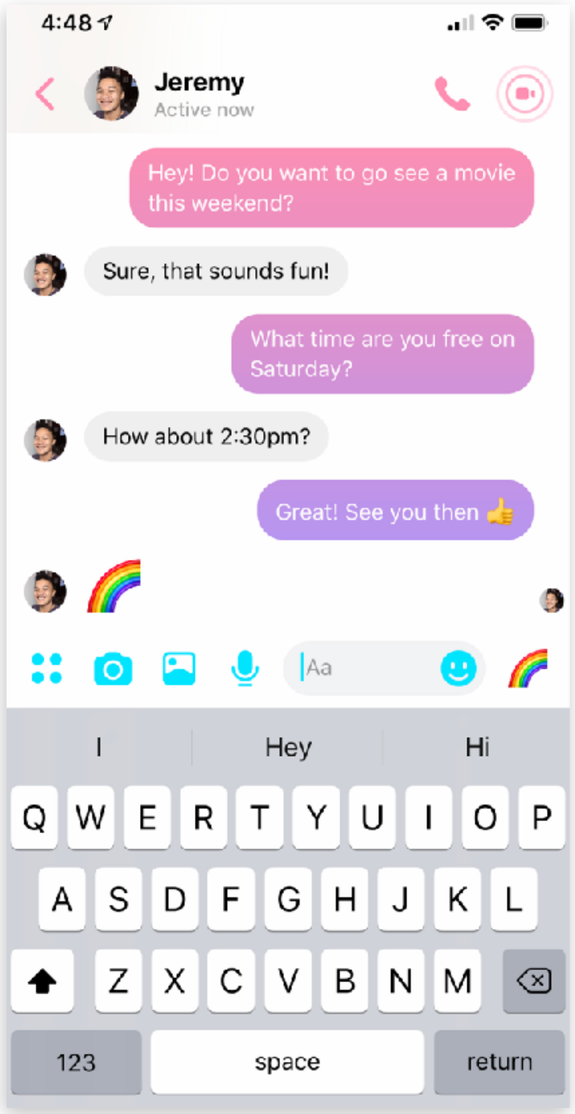


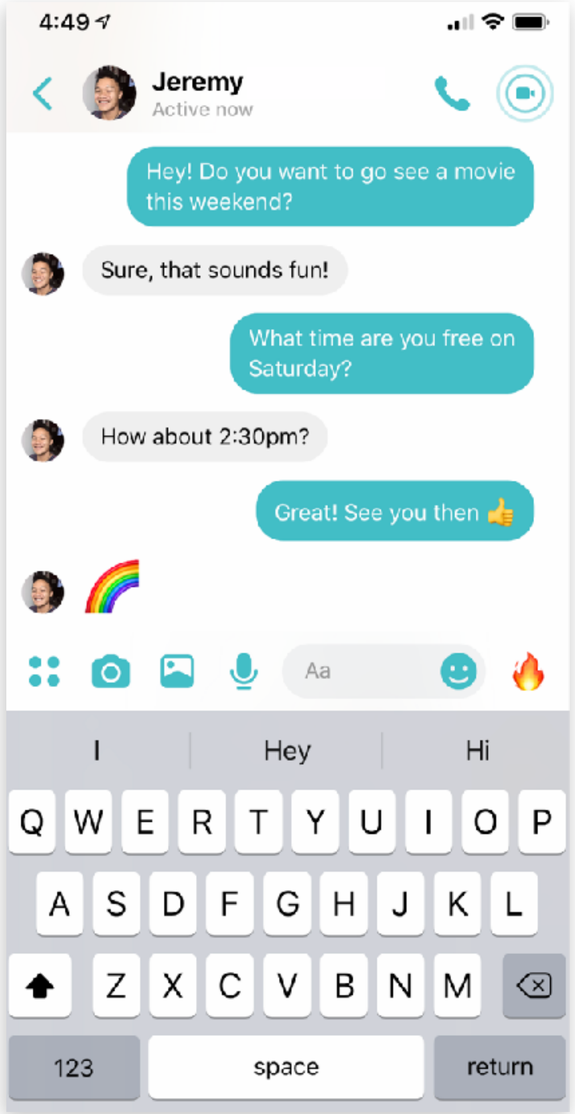


Color Customization

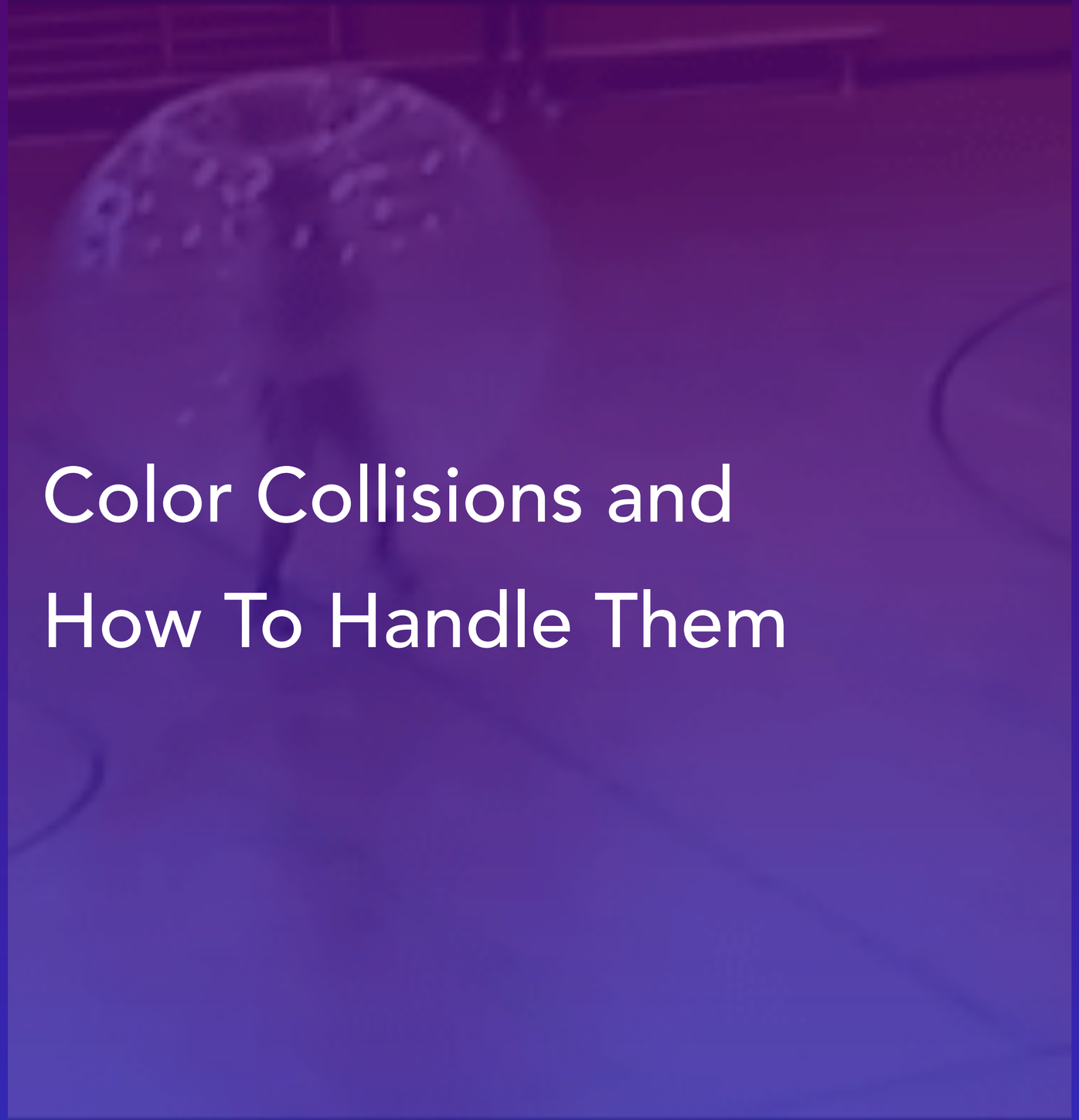









“I’m feeling
anxious now.”
- Designer



Color Collisions and How To Handle Them

Problem

Colors provided from the backend

Can’t use Apple’s dynamic color system

Contrast issues in Dark Mode

Solution

Let users choose from a predefined palette

Guaranteed to pass accessibility standards

Let users choose from RGB color picker

Adjust colors client-side to ensure visibility and contrast

Example

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Contrast Ratio: 1

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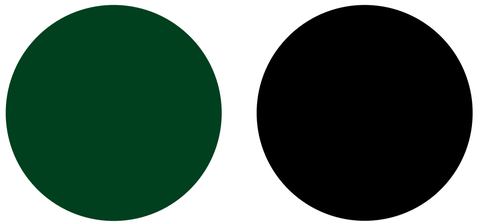
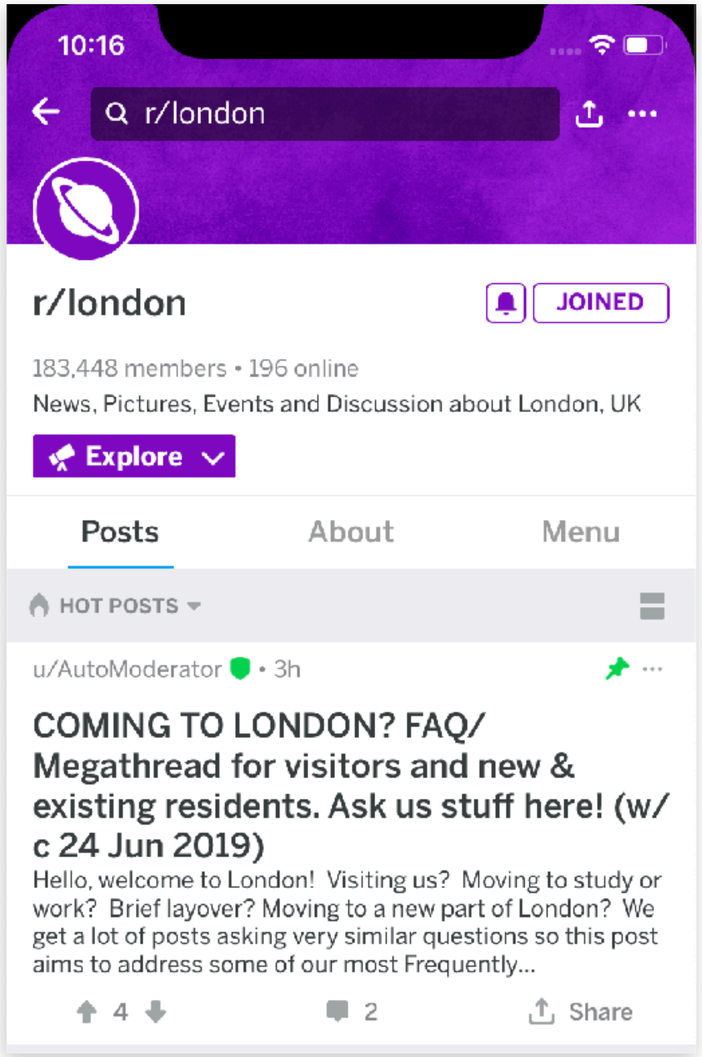


Contrast Ratio: 6

Example


10:16
r/london
r/london
JOINED
183,448 members • 196 online
News, Pictures, Events and Discussion about London, UK
Explore
Posts
About
Menu
HOT POSTS
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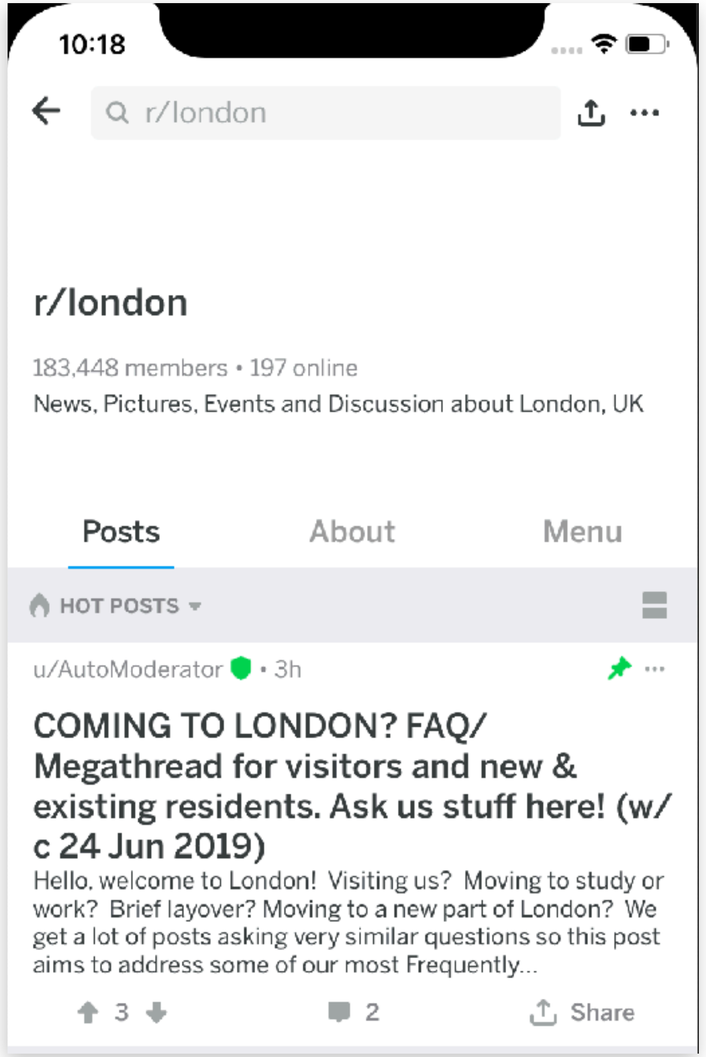
COMING TO LONDON? FAQ/ Megathread for visitors and new & existing residents. Ask us stuff here! (w/ c 24 Jun 2019)
Hello, welcome to London! Visiting us? Moving to study or work? Brief layover? Moving to a new part of London? We get a lot of posts asking very similar questions so this post aims to address some of our most Frequently...
4
2
Share


10:18
r/london
r/london
183,448 members • 197 online
News, Pictures, Events and Discussion about London, UK
Posts
About
Menu
HOT POSTS
u/AutoModerator • 3h
COMING TO LONDON? FAQ/ Megathread for visitors and new & existing residents. Ask us stuff here! (w/ c 24 Jun 2019)
Hello, welcome to London! Visiting us? Moving to study or work? Brief layover? Moving to a new part of London? We get a lot of posts asking very similar questions so this post aims to address some of our most Frequently...
3
2
Share

UIColor Extension

```
extension UIColor {

  static let minContrastRatio: CGFloat = 7.0

}
```

UIColor Extension

```
extension UIColor {

  func brightnessValue() -> CGFloat? {

    var h: CGFloat = 0
    var s: CGFloat = 0
    var b: CGFloat = 0
    var a: CGFloat = 0

    if self.getHue(&h, saturation: &s, brightness: &b, alpha: &a) {
       return b
    }

    return nil
  }
}
```

UIColor Extension

```
extension UIColor {
  /// Contrast ratio formula: (b1 + 0.05) / (b2 + 0.05)
  /// b1 and b2 are the brightness values of two colors, b1 > b2
  func contrastRatio(withColor otherColor: UIColor) -> CGFloat? {
    guard let b1 = self.brightnessValue(),
          let b2 = otherColor.brightnessValue() else {
      return nil
    }
    if b1 > b2 {
     return (b1 + 0.05) / (b2 + 0.05)

    } else {
     return (b2 + 0.05) / (b1 + 0.05)
   }
  }
}
```

UIColor Extension

```
let color1 = UIColor.white
```

White: 1.0
Alpha: 1.0

```
let color2 = UIColor.black
```

White: 0.0
Alpha: 1.0

```
color1.contrastRatio(withColor: color2)
```

21.0

```
let color1 = UIColor.purple
```

Red: 0.5
Green: 0.0
Blue: 0.5
Alpha: 1.0

```
let color2 = UIColor.black
```

White: 0.0
Alpha: 1.0

```
color1.contrastRatio(withColor: color2)
```

11.0

```
let color1 = UIColor.yellow
```

Red: 1.0
Green: 1.0
Blue: 0.0
Alpha: 1.0

```
let color2 = UIColor.white
```

White: 1.0
Alpha: 1.0

```
color1.contrastRatio(withColor: color2)
```

1.0

UIColor Extension

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Contrast Ratio: 7

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Contrast Ratio: 2

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Contrast Ratio: 2.3

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Contrast Ratio: 1

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Contrast Ratio: 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Contrast Ratio: 1.5

UIColor Extension

```
extension UIColor {

  /// Determine new brightness needed on receiver to meet minContrastRatio with
  /// otherColor
  func brightnessToMeetMinContrast(withColor otherColor: UIColor) -> CGFloat? {
    guard let b1 = self.brightnessValue(),
          let b2 = otherColor.brightnessValue() else {

      return nil
    }

    if b1 > b2 {
      return UIColor.minContrastRatio * (b2 + 0.05) - 0.05

   } else {

      return ((b2 + 0.05) / UIColor.minContrastRatio) + 0.05
    }
  }
}
```

UIColor Extension

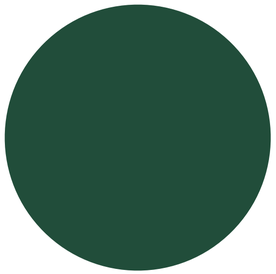
```
extension UIColor {

  /// Change receiver’s brightness component to match the passed in value
  private func adjustedColor(withNewBrightness brightness: CGFloat) -> UIColor {

    var h: CGFloat = 0
    var s: CGFloat = 0
    var b: CGFloat = 0
    var a: CGFloat = 0

    if self.getHue(&h, saturation: &s, brightness: &b, alpha: &a) {
      return UIColor(hue: h, saturation: s, brightness: b, alpha: a)
    }

    return self;
  }
}
```

UIColor Extension

```
extension UIColor {

  /// Adjusts the receiver (if needed) to have minContrastRatio with otherColor
  func adjustedColorForBestContrast(withColor otherColor: UIColor) -> UIColor {

    guard let contrastRatio = self.contrastRatio(withColor: otherColor),
              contrastRatio < UIColor.minContrastRatio else {
      return self
    }

    guard let adjustedBrightness =
      self.brightnessToMeetMinContrast(withColor: otherColor) else {

      return self
    }

    return self.adjustedColor(withNewBrightness: adjustedBrightness)

  }
}
```

Demo

Before



Hue: 155°
Saturation: 57%
Brightness: 30%
Contrast: 2.33

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After

Hue: 155°
Saturation: 57%
Brightness: 100%
Contrast: 7

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Demo

Before

Hue: 60°

Saturation: 100%

Brightness: 100%

Contrast: 1

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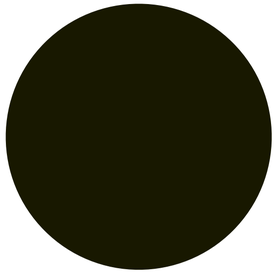
After



Hue: 60°

Saturation: 100%

Brightness: 10%

Contrast: 7

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Demo

Before

Hue:	60°
Saturation:	100%
Brightness:	100%
Contrast:	1

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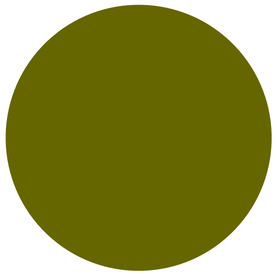
After



Hue:	60°
Saturation:	100%
Brightness:	40%
Contrast:	2.3

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Download the Playground

bit.ly/2Kx3iKR

Recap

- Color Spaces
- Color Components
  - Hue, Saturation & Brightness
- Contrast + Accessibility
- How to Adopt Dark Mode in iOS 13
- Themes + Color Customization
- Handling Color Collisions

Thank You <3

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u/MoarKelBell