# Beautiful & Balanced Using Color Theory in Data Visualization

Laura Fisher · PyConUS · May 16, 2025



• live in Los Angeles



- live in Los Angeles
- studied at the University of Michigan

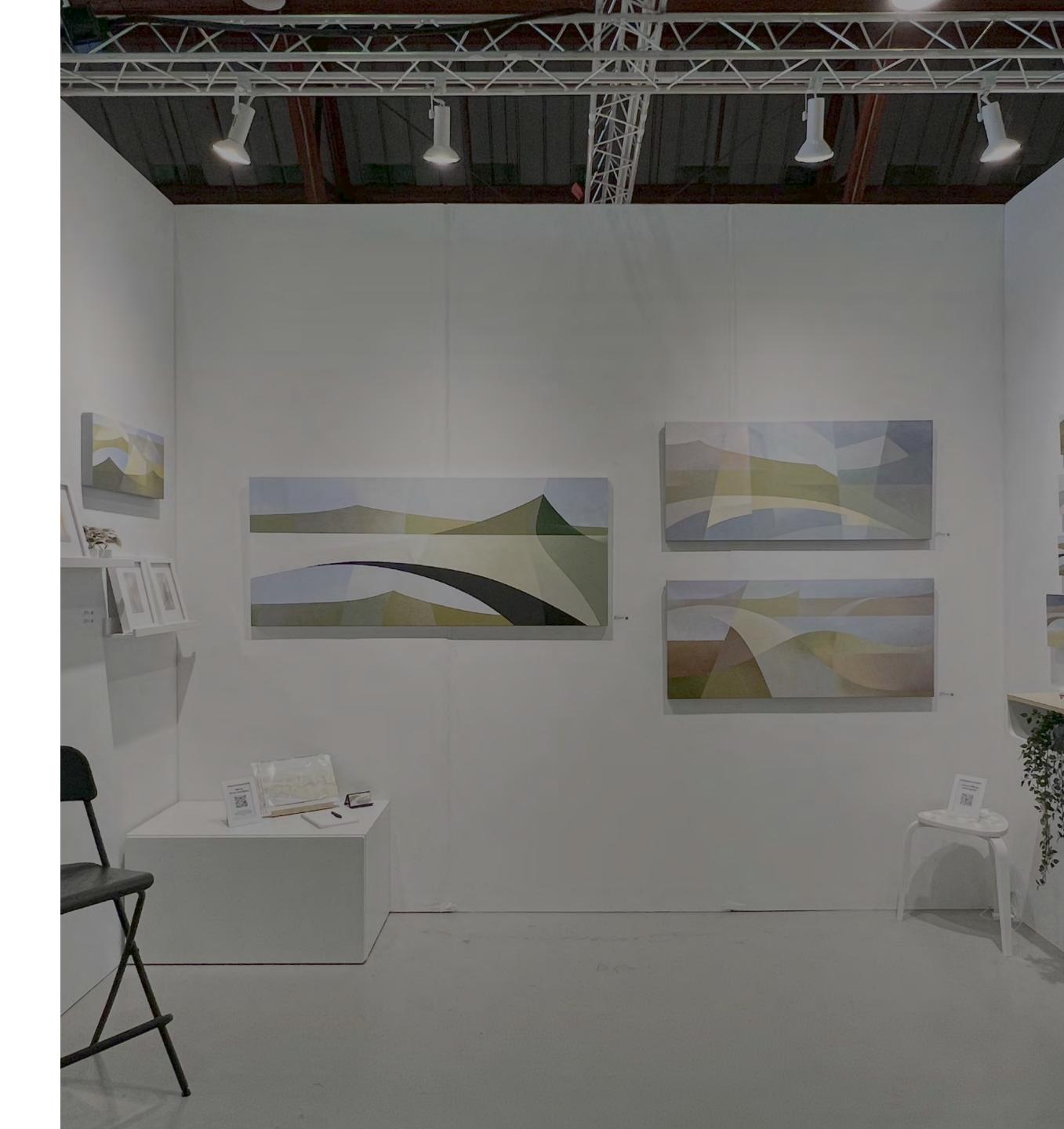




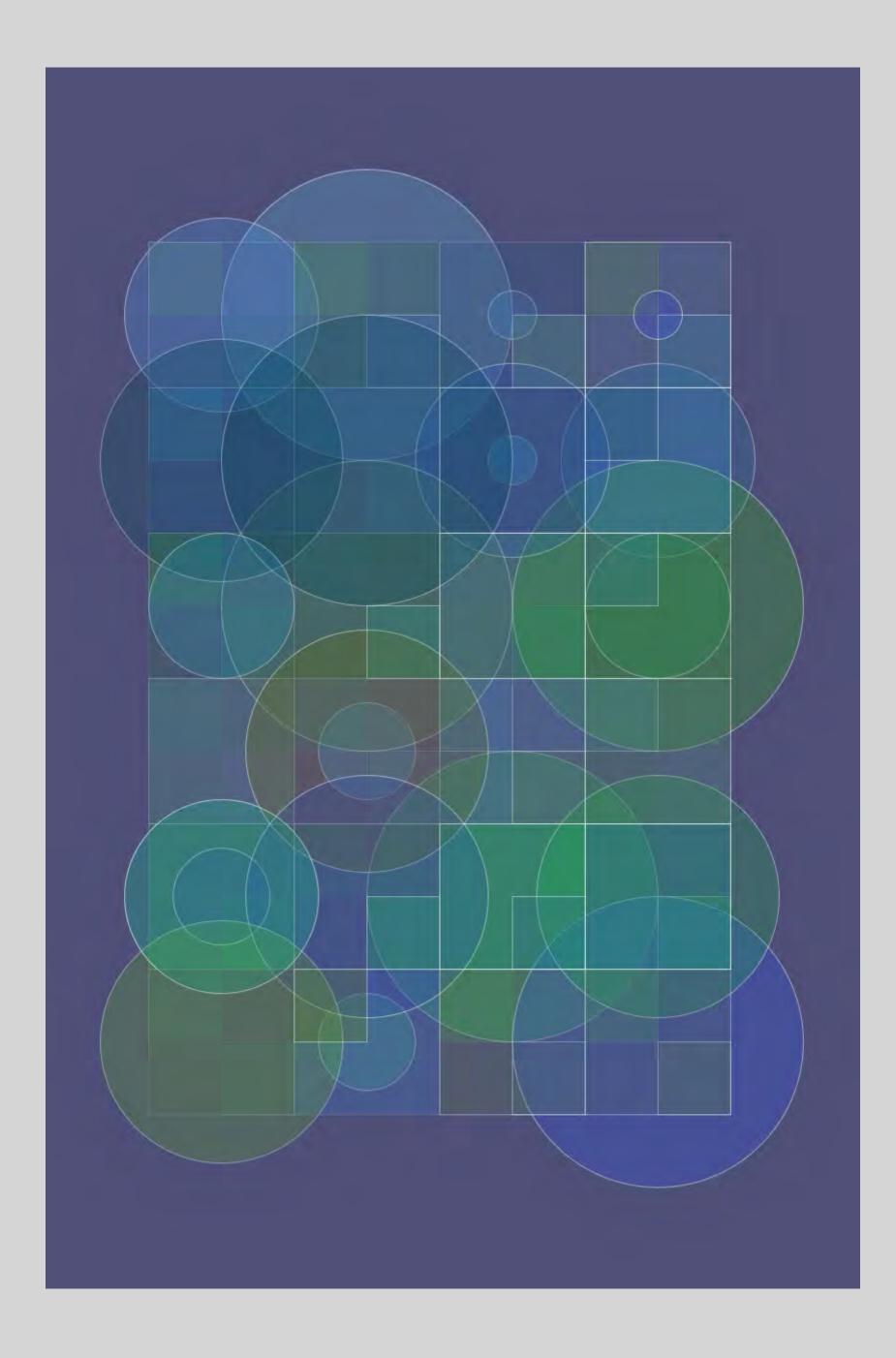
- live in Los Angeles
- studied at the University of Michigan



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- studied at the University of Michigan
- paint and draw



- live in Los Angeles
- studied at the University of Michigan
- paint and draw
- make computational art



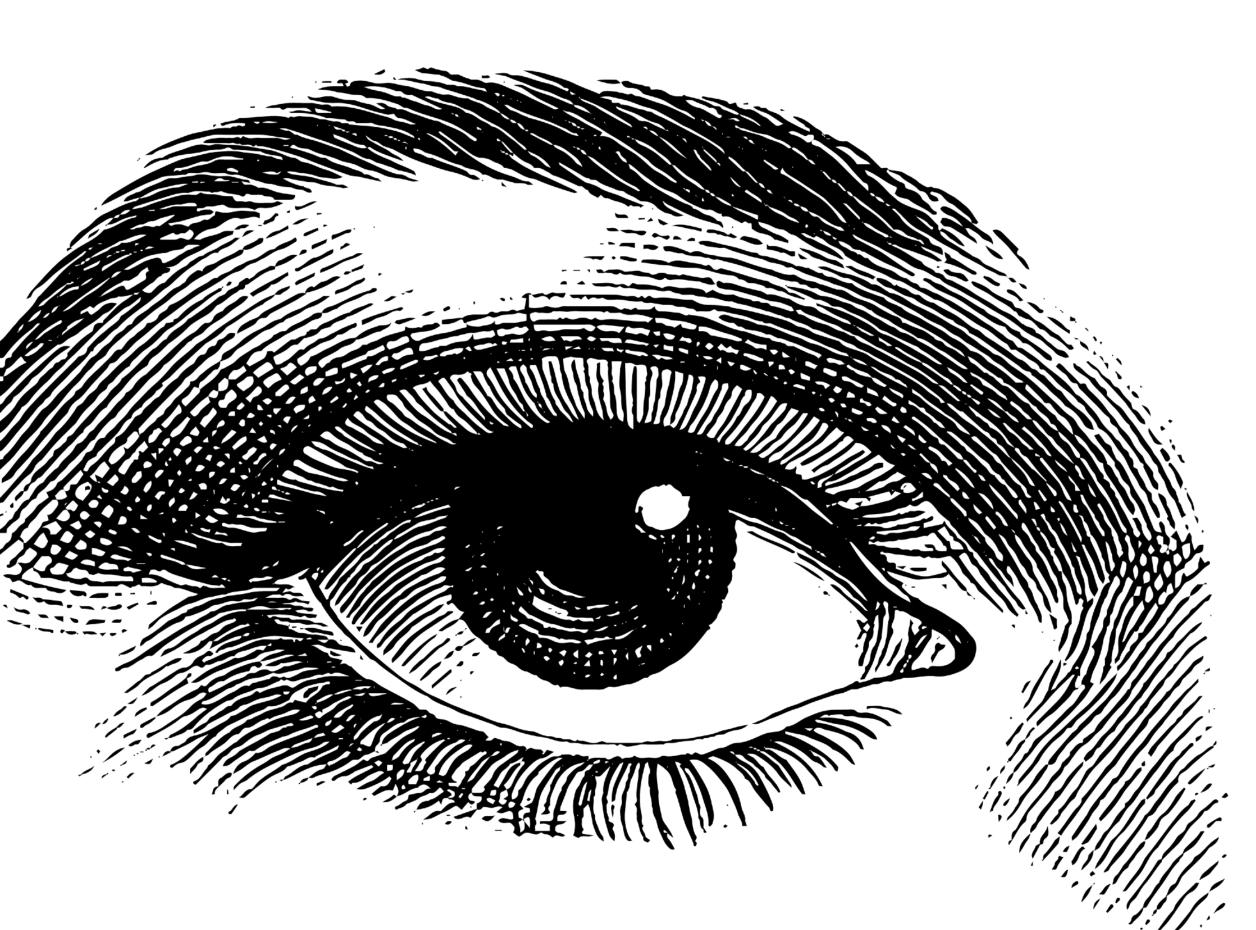
## Where to Find Me

#### mitten.lol/pycon2025

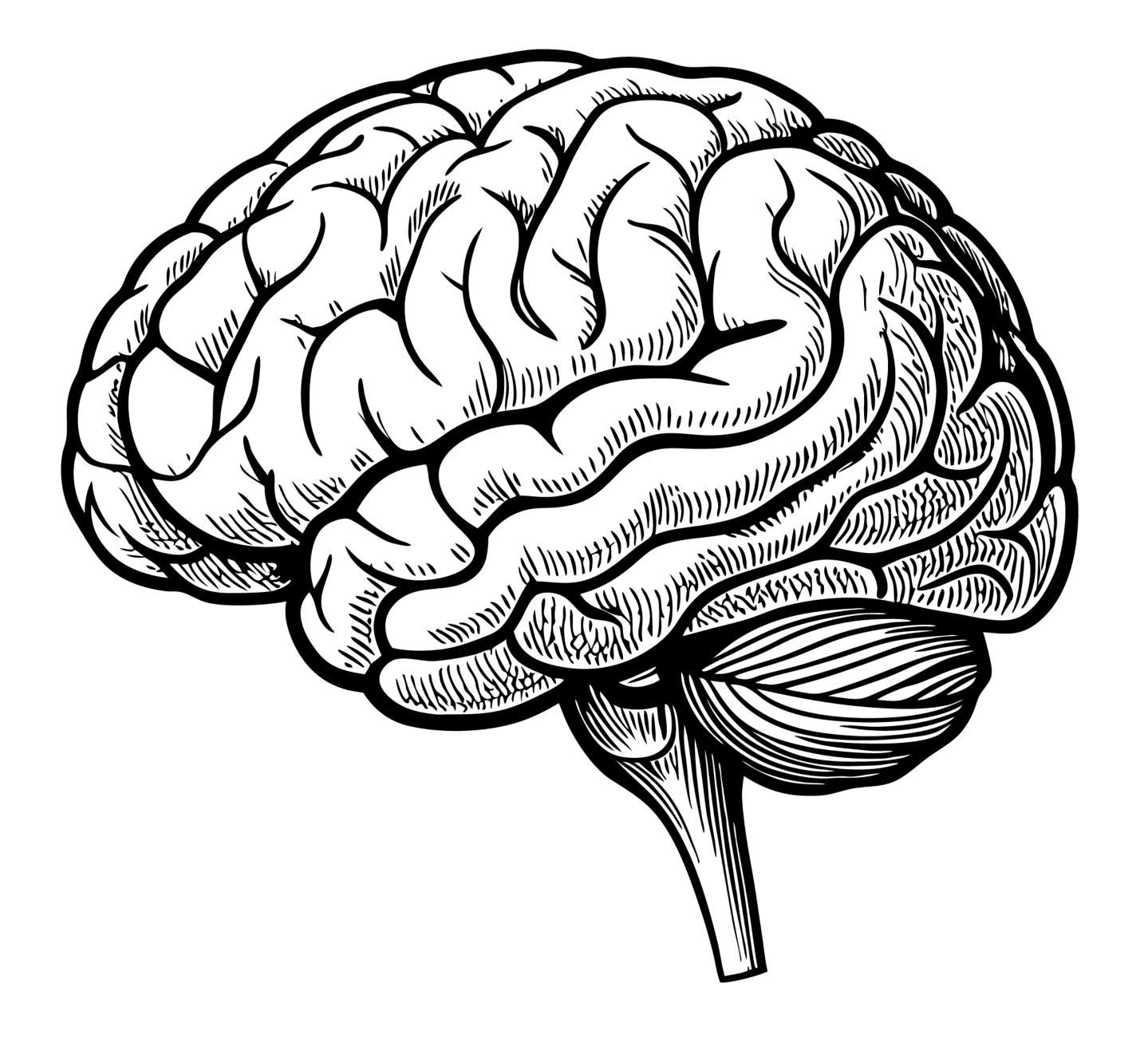
# @ @mitten@social.lol

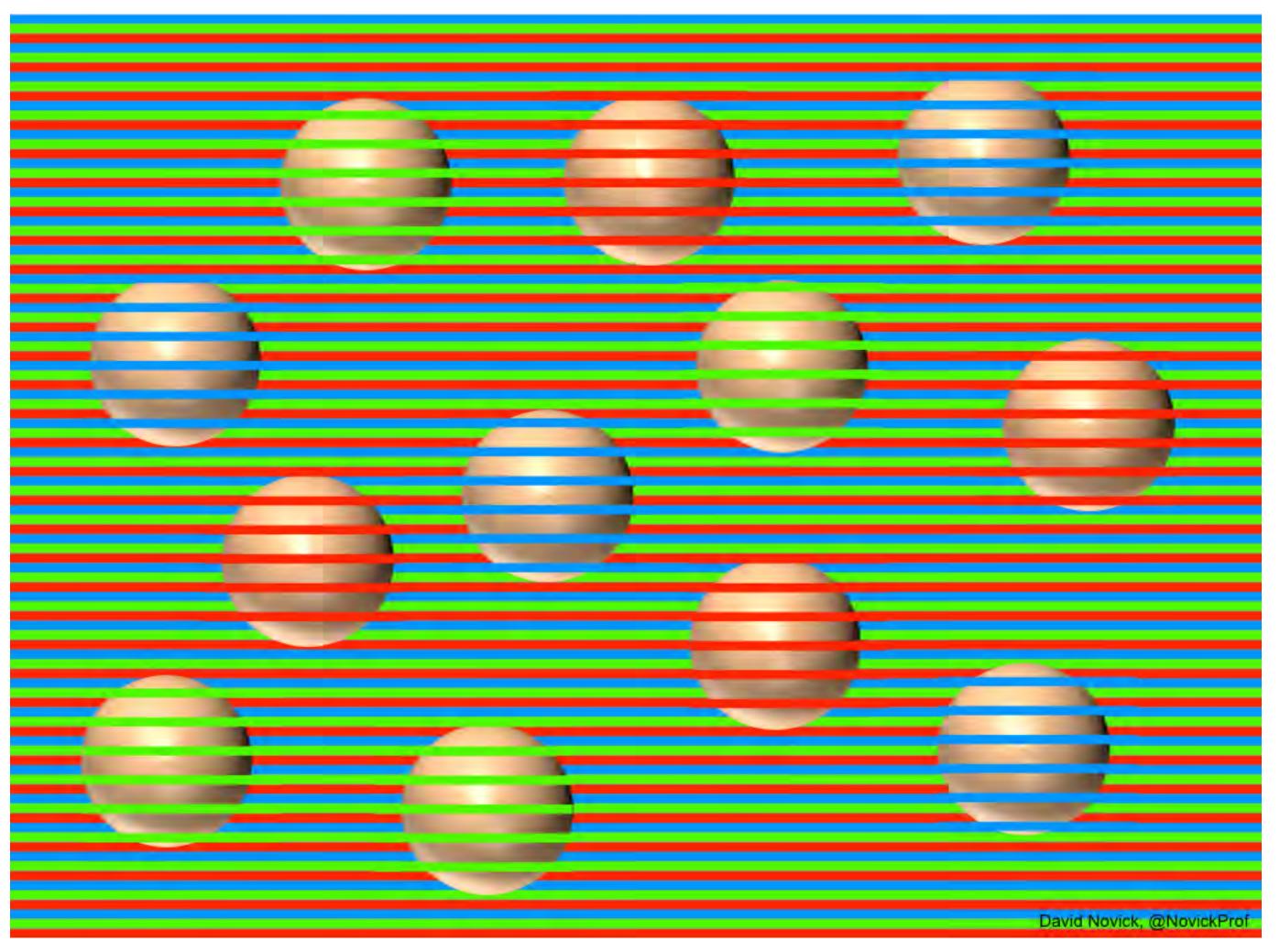
## Poster Session: Sunday 10:00a - 1:00p

## How Does Color Work?

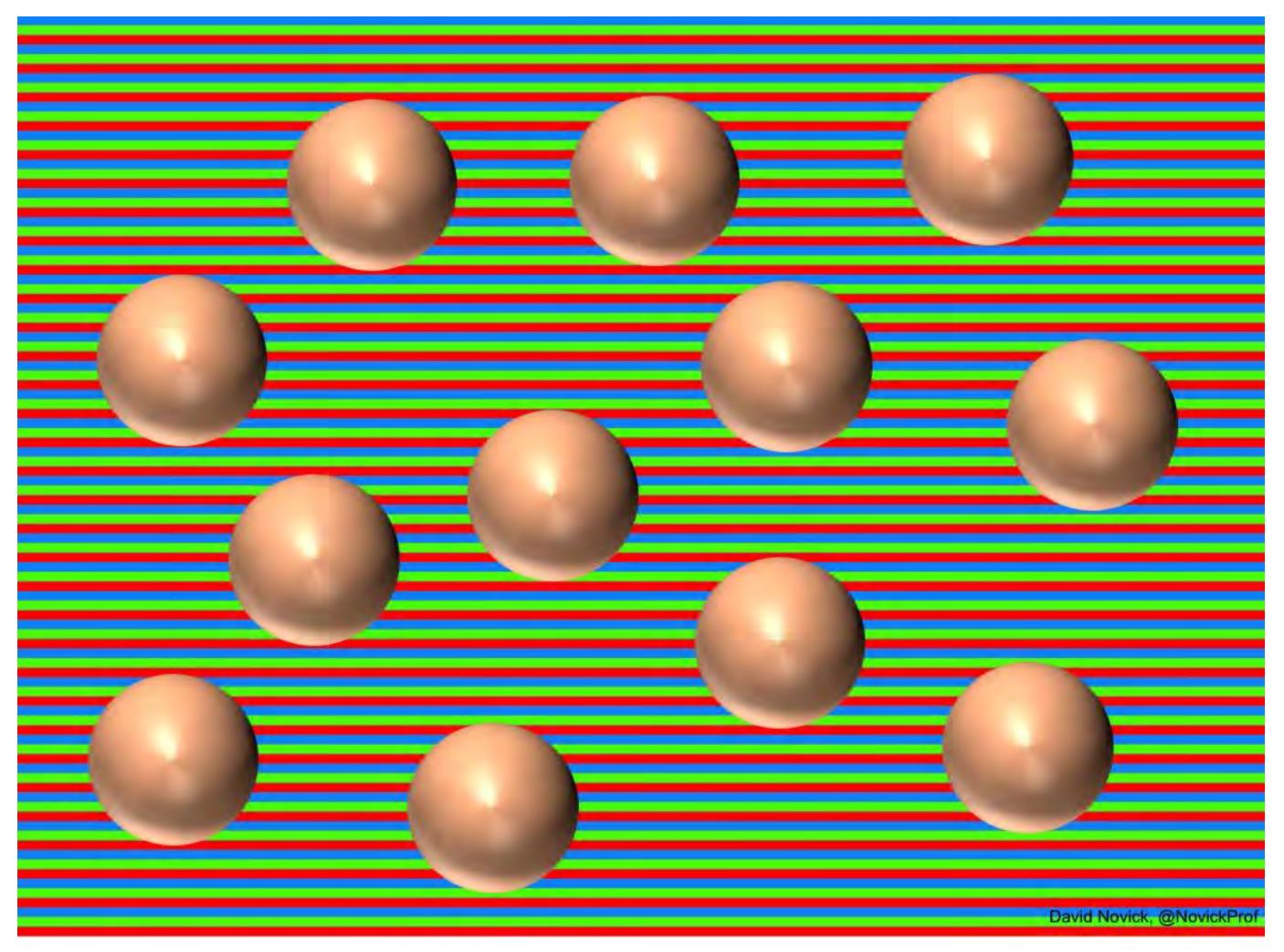




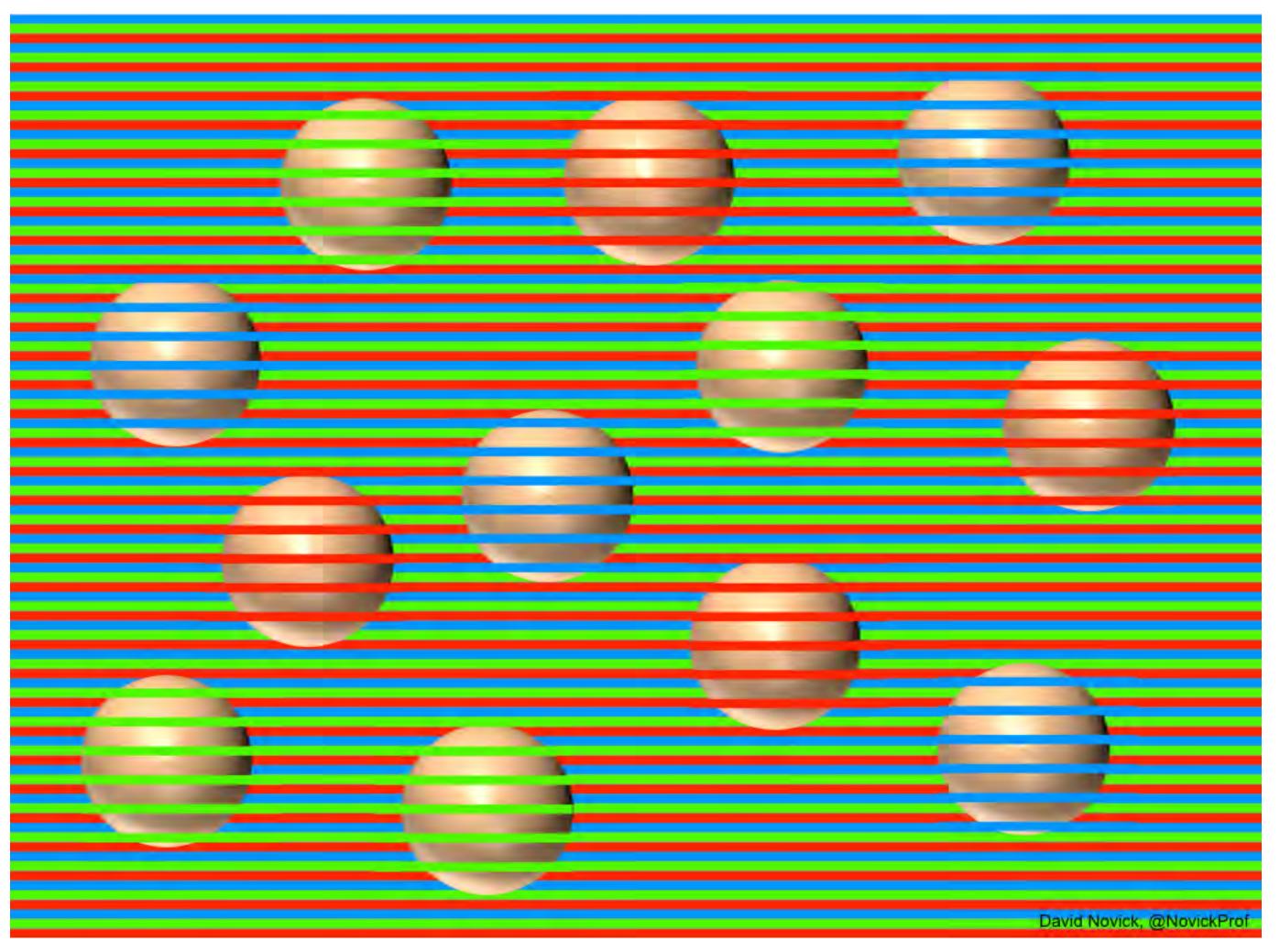




Confetti, by David Novick



Confetti, by David Novick



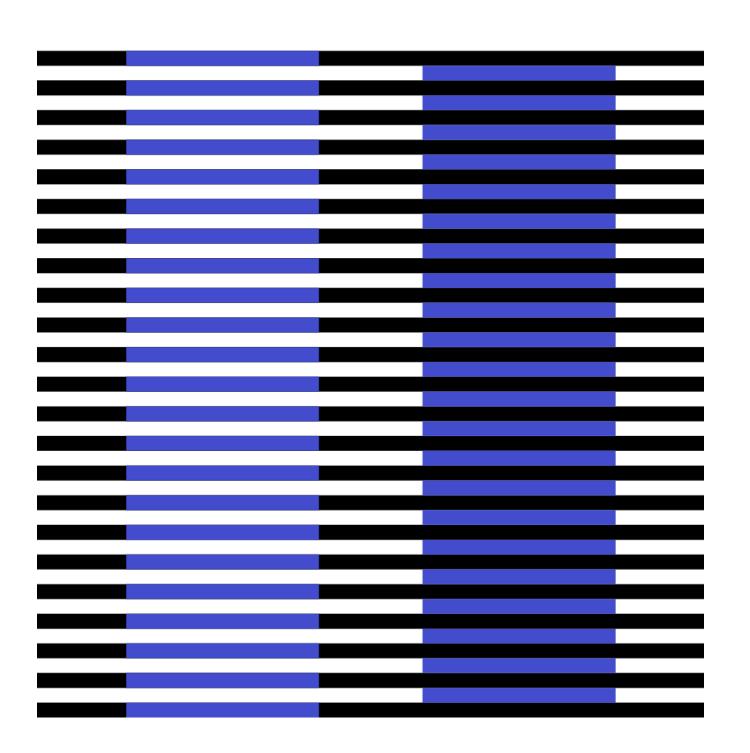
Confetti, by David Novick

### Color is all in your head.

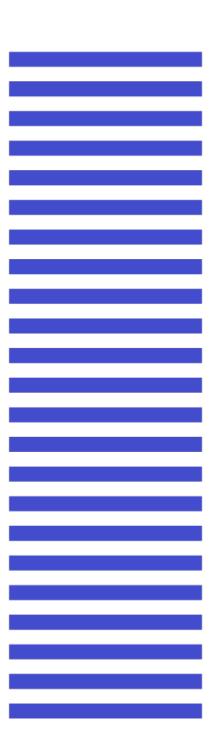
## Color is all in your

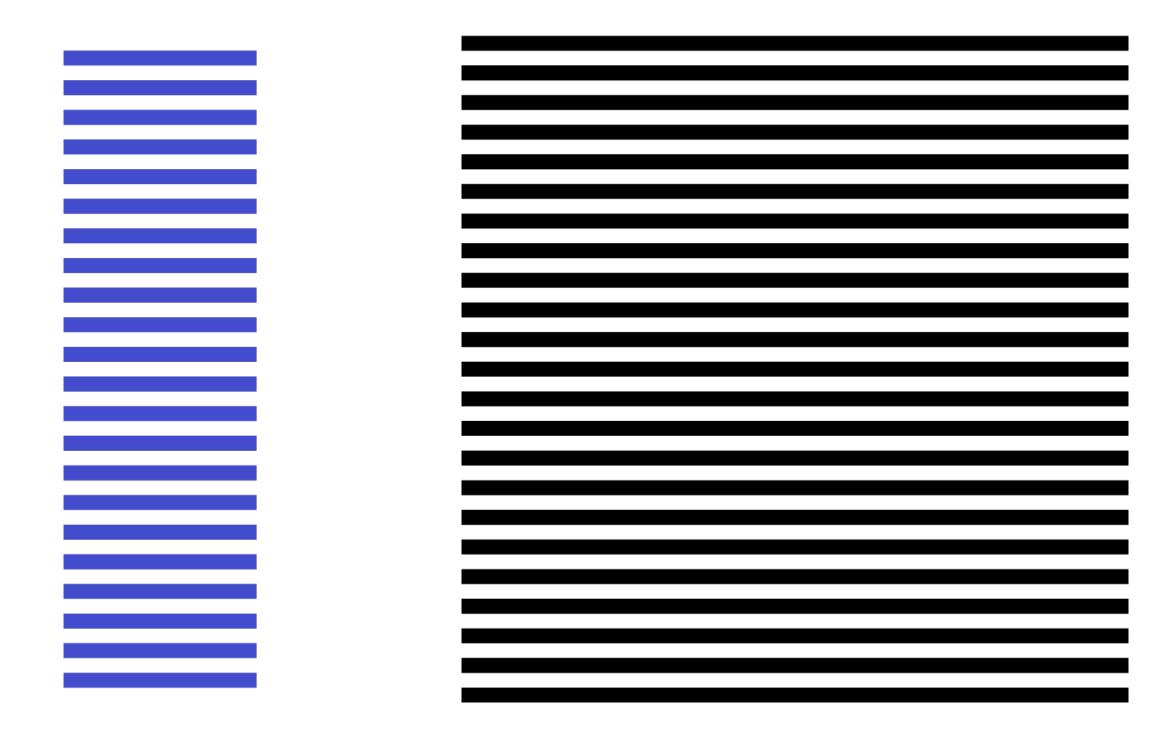


## Color is Contextual

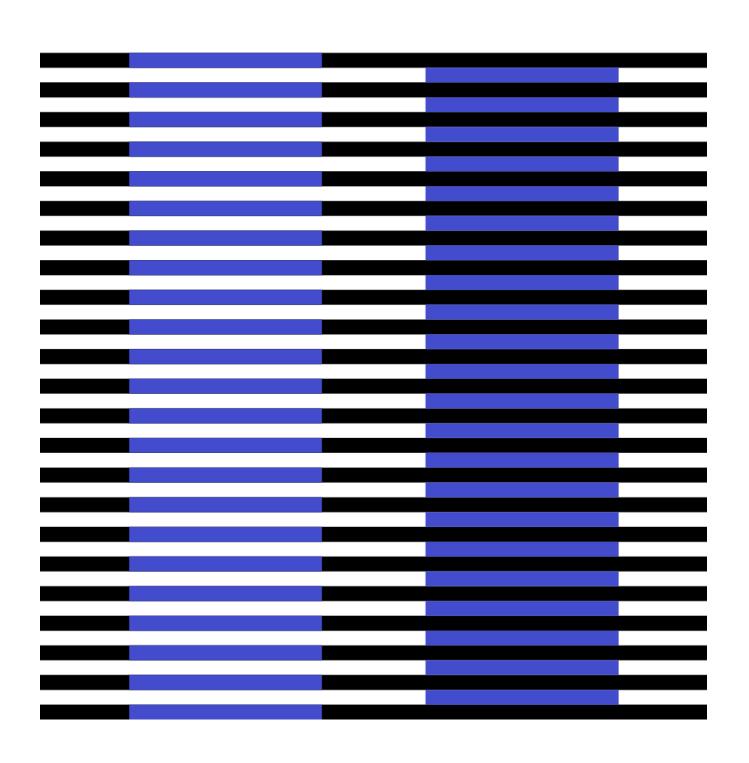


## Color is Contextual

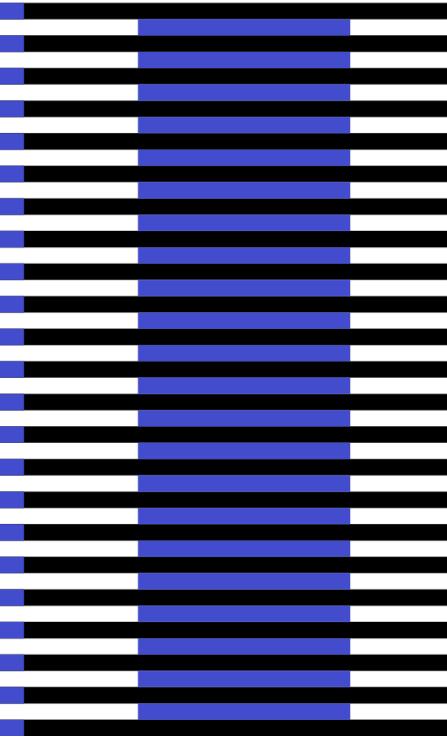




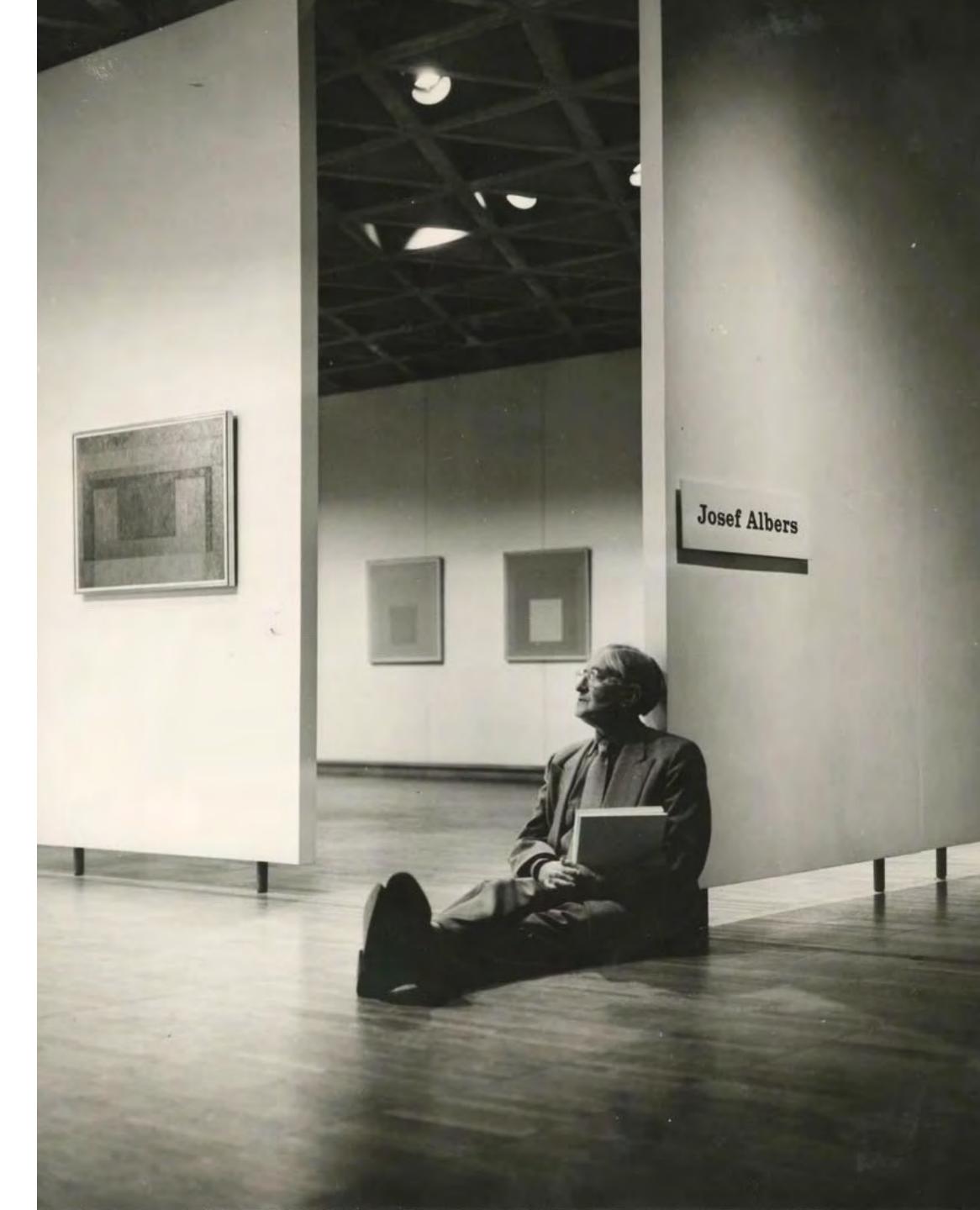
## Color is Contextual Munker White Illusion







• A pioneer in Color Theory

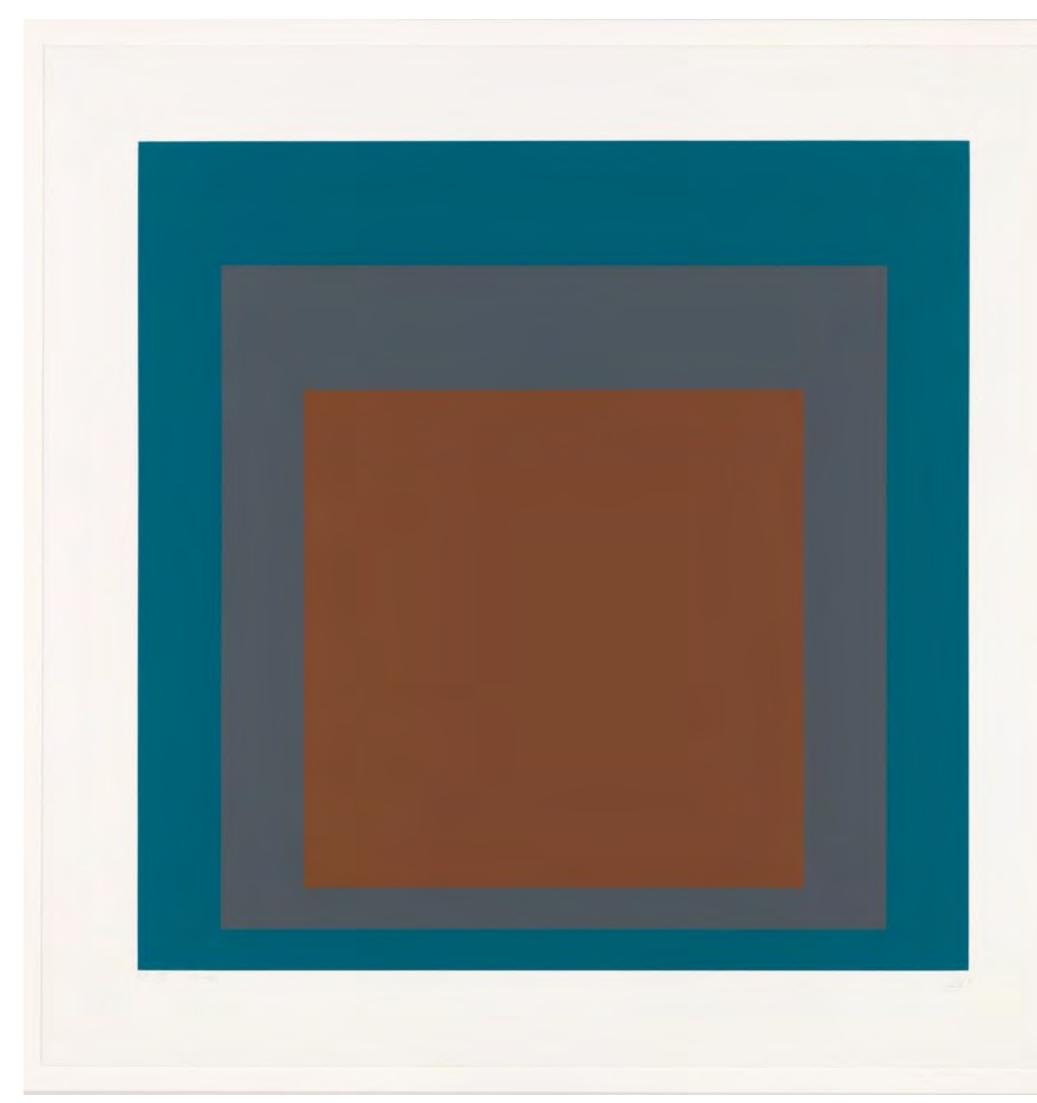




- A pioneer in Color Theory
- Taught at Bauhaus School, Black Mountain College, and Yale University



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- Homage to the Square



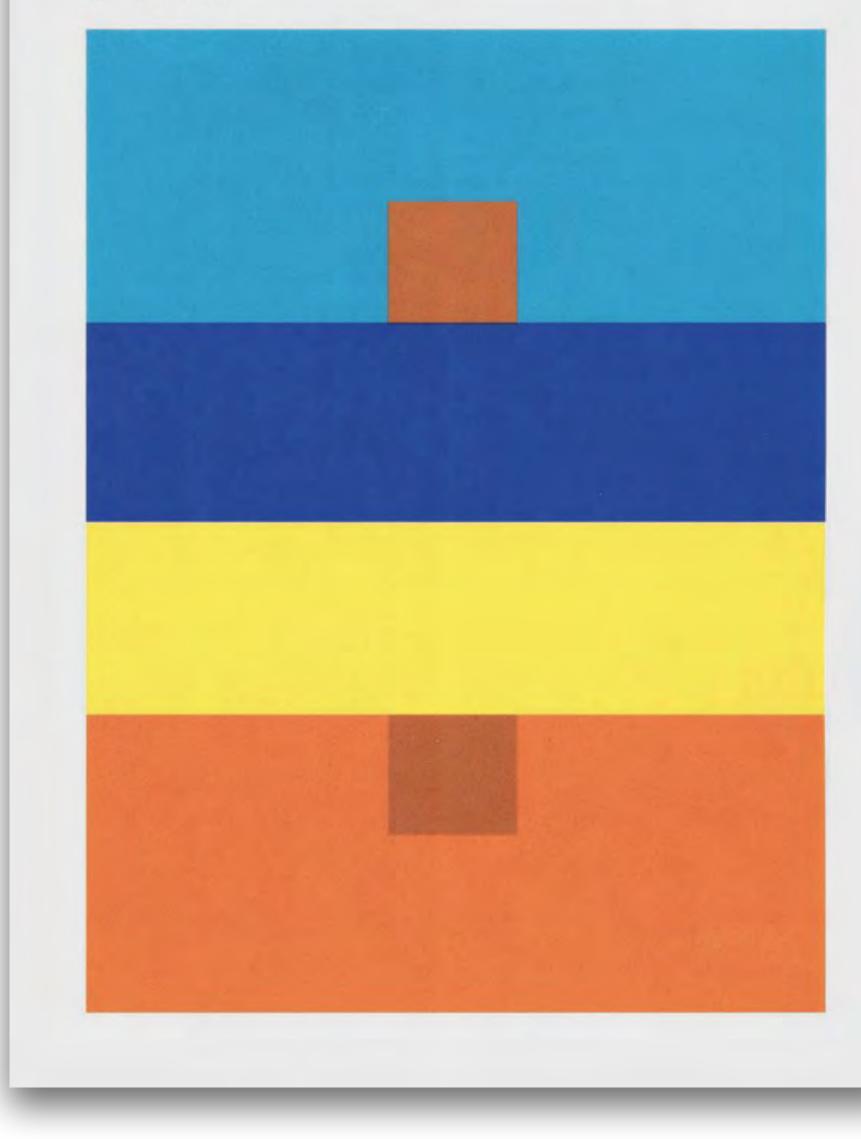


- A pioneer in Color Theory
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- Homage to the Square
- Interaction of Color

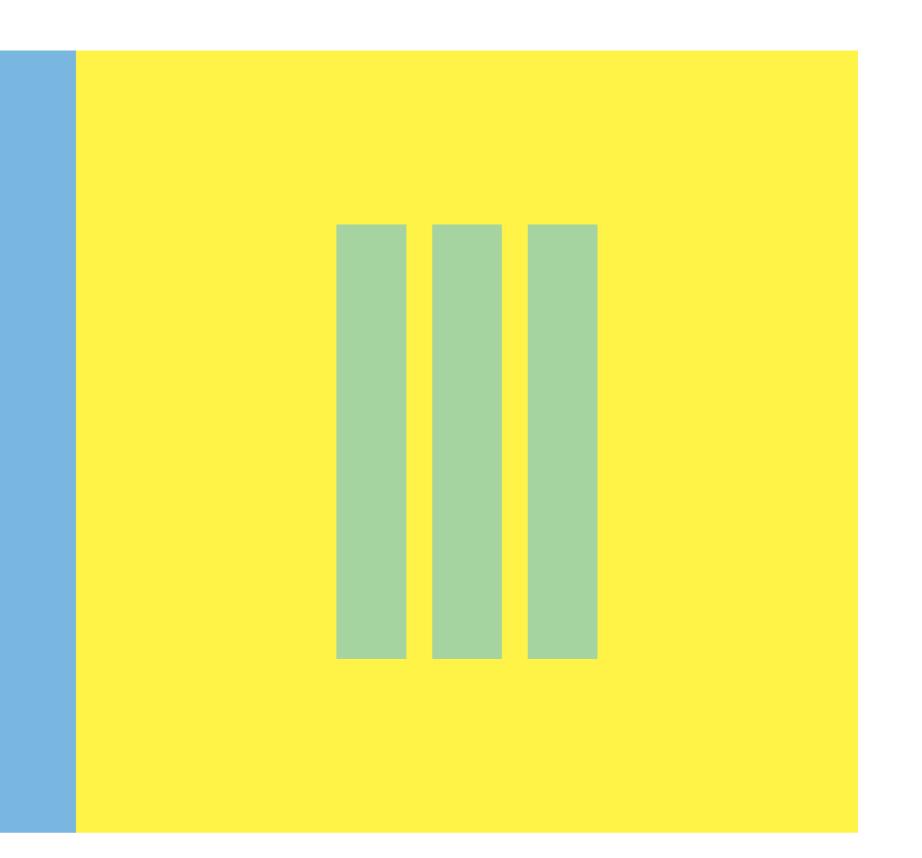
#### Interaction of Color

#### **Josef Albers**

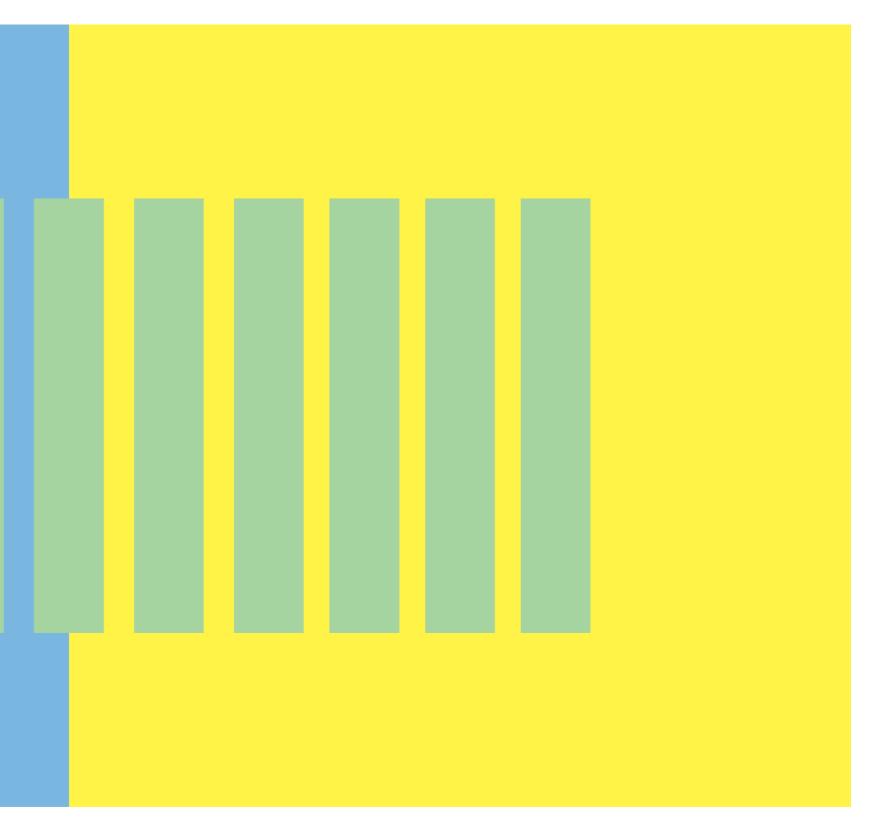
Unabridged text and selected plates Revised edition



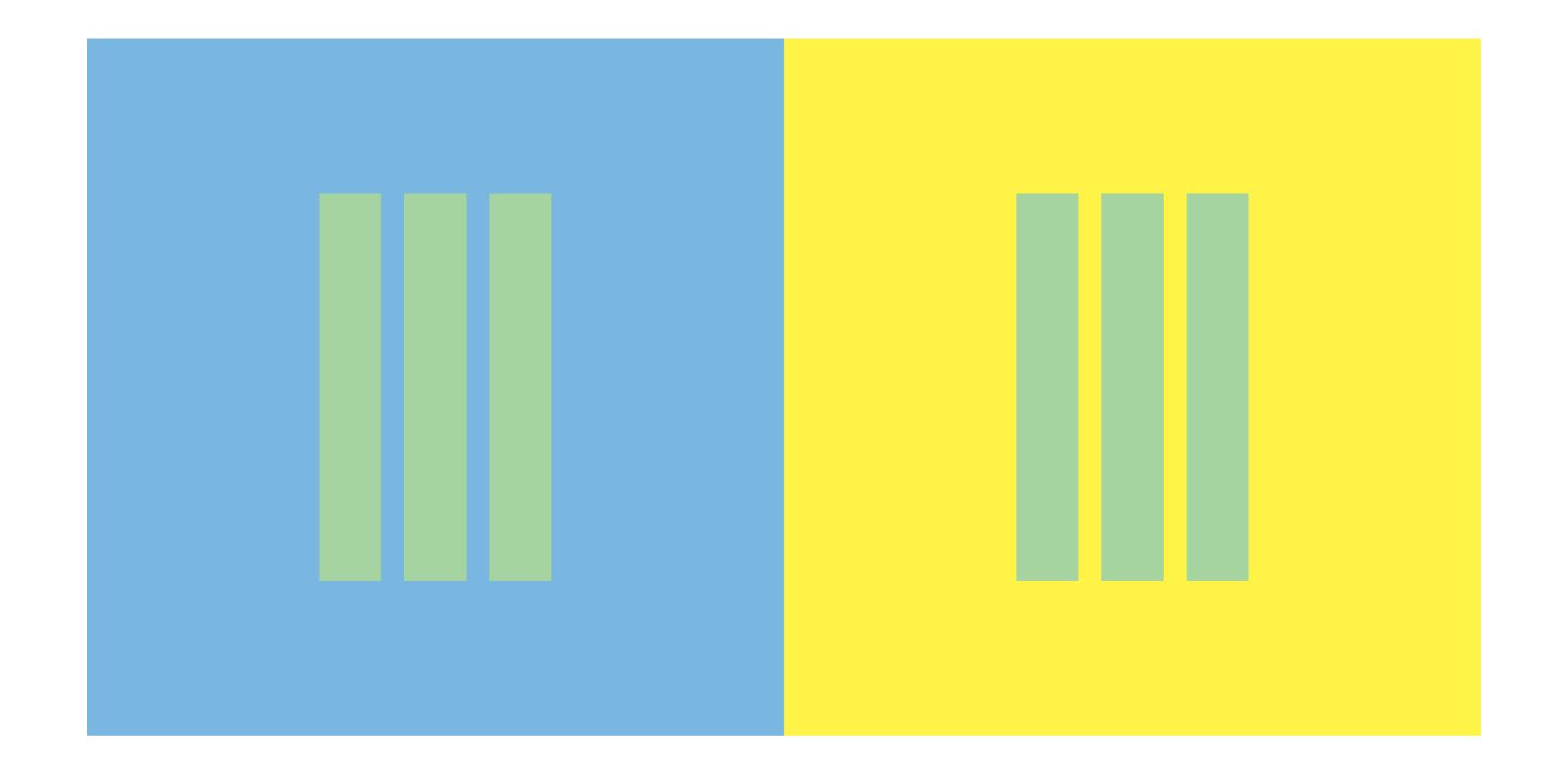


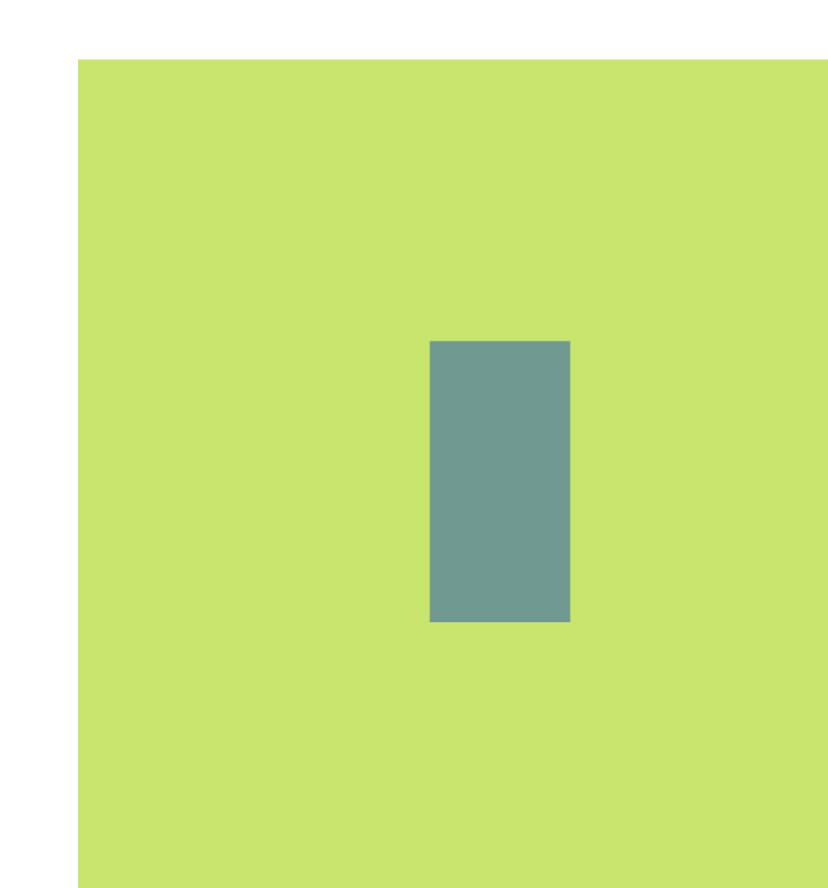


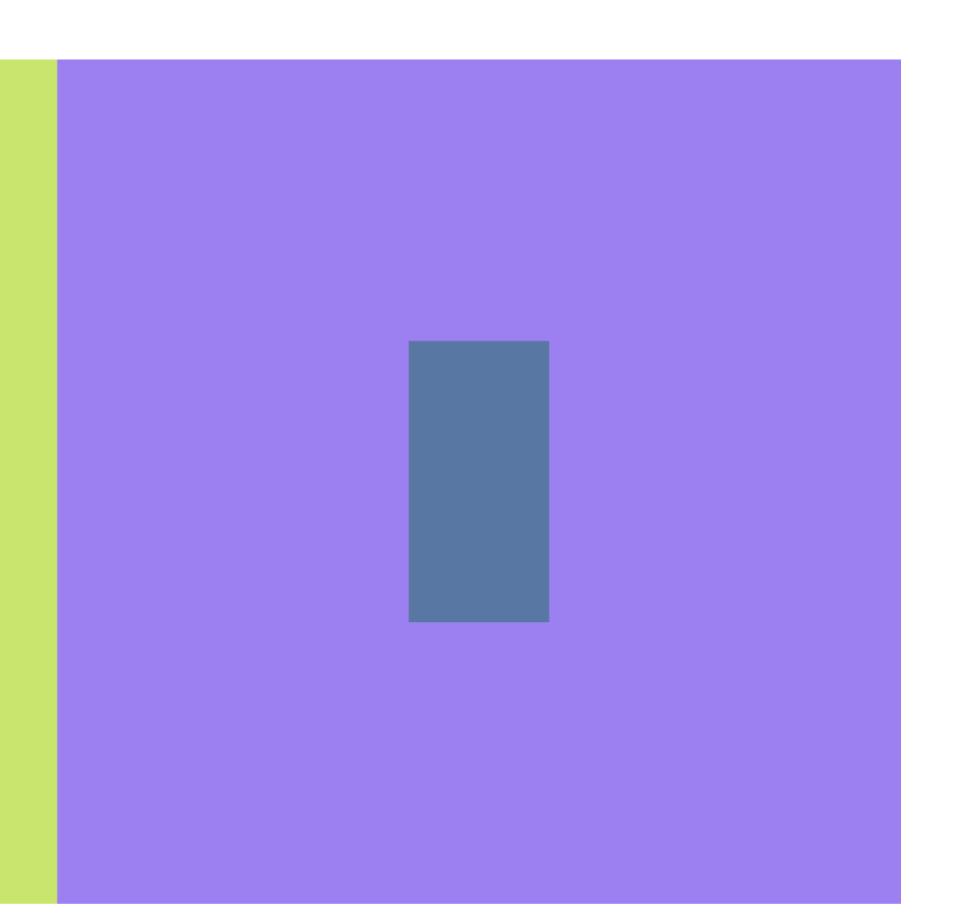




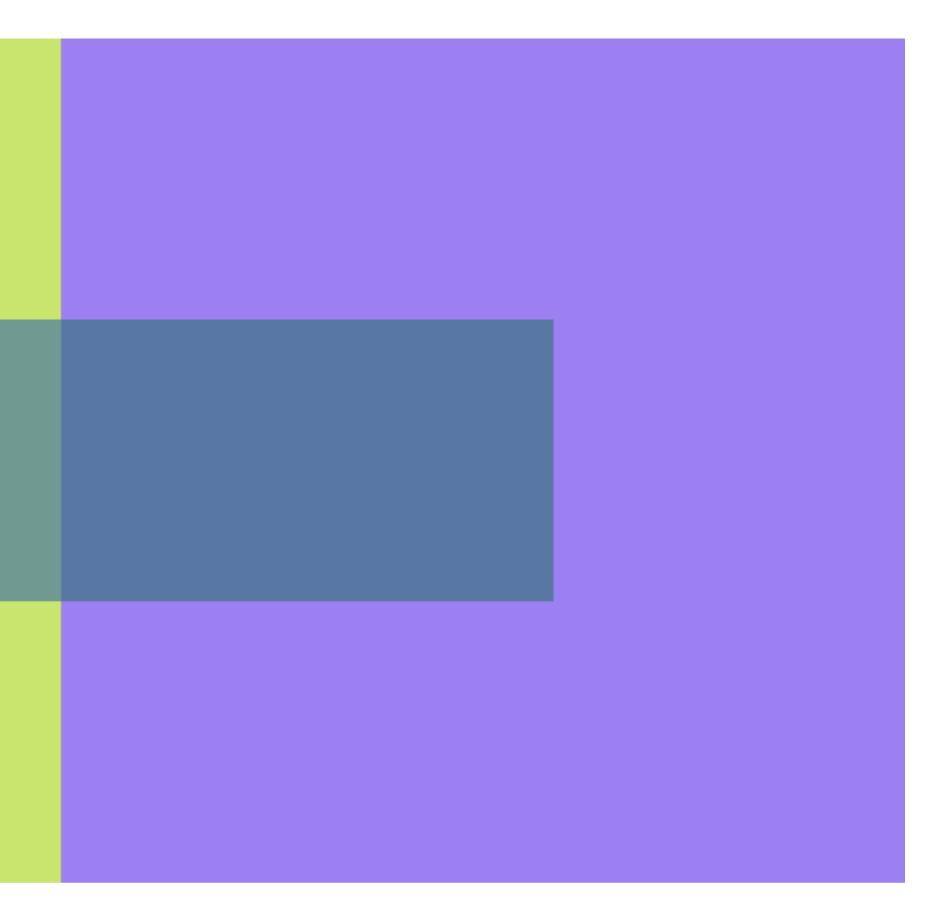
#### One Color Looking Like Two Colors











#### Two Colors Looking Like One Color



## Why Color Choices Matter in Data Visualization

Information should not be

# displayed in a way that distorts or misrepresents the underlying data.

Edward Tufte, statistician, writer, and artist

color deceives continually.

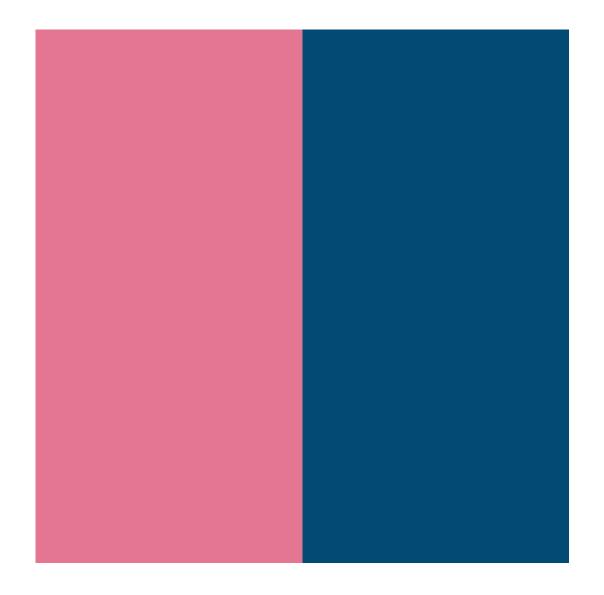
# In order to use color effectively, it is necessary to recognize that

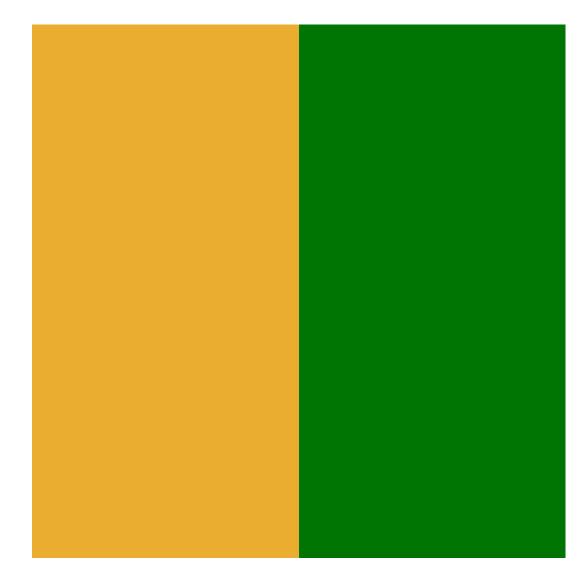
Josef Albers, artist and educator

# Influential FactorsColor WeightColor Temperature

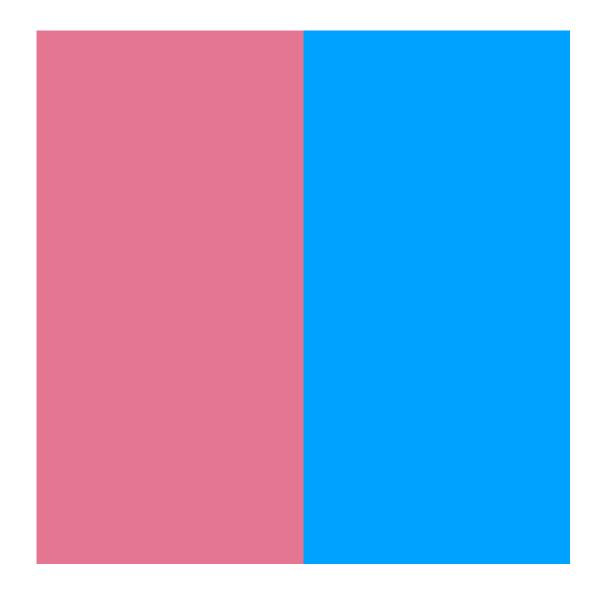


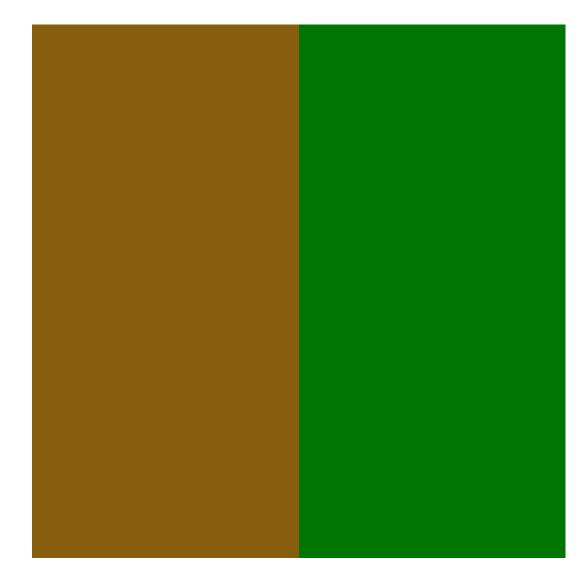
## Color Weight



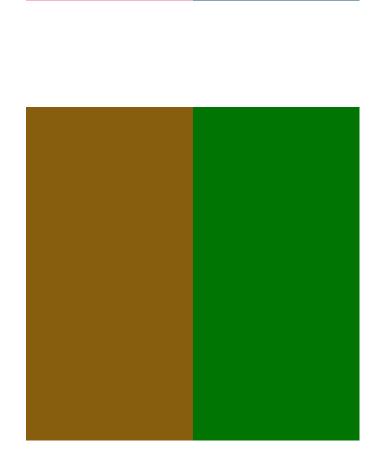


## Color Weight





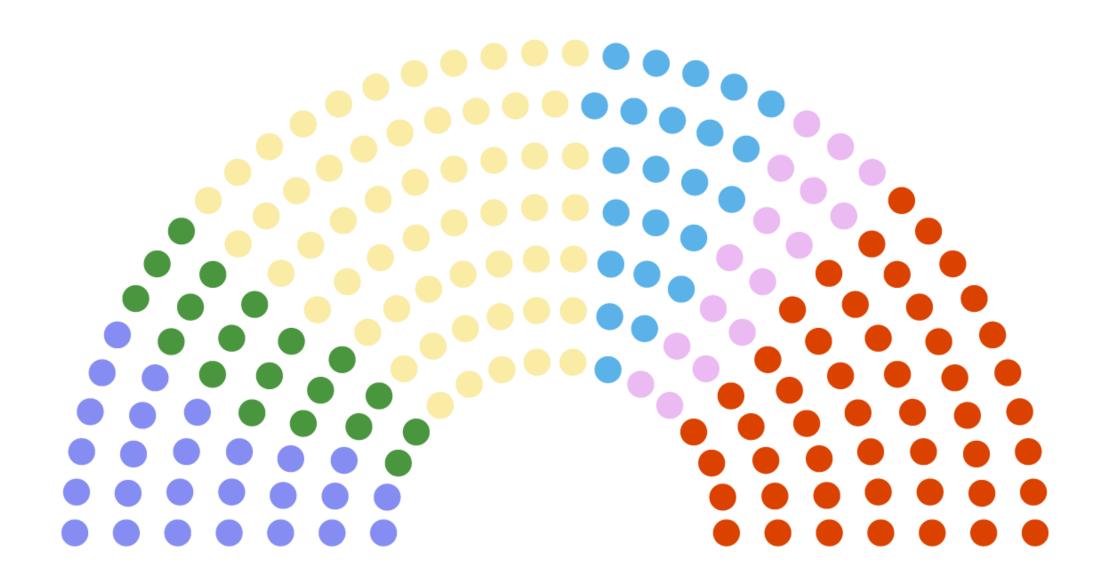
#### high contrast = uneven weight



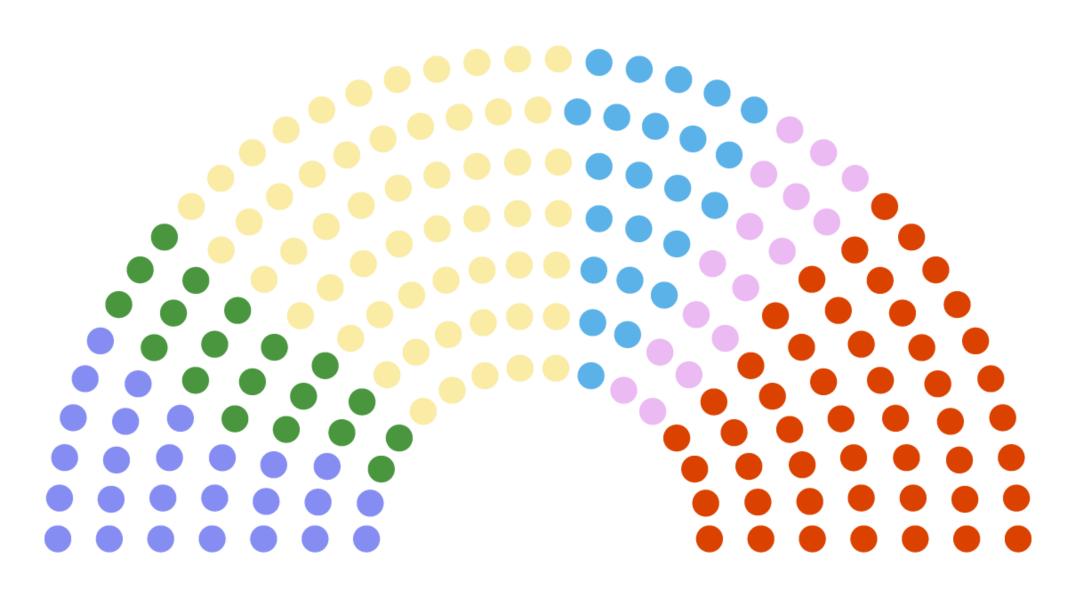
#### low contrast = even weight



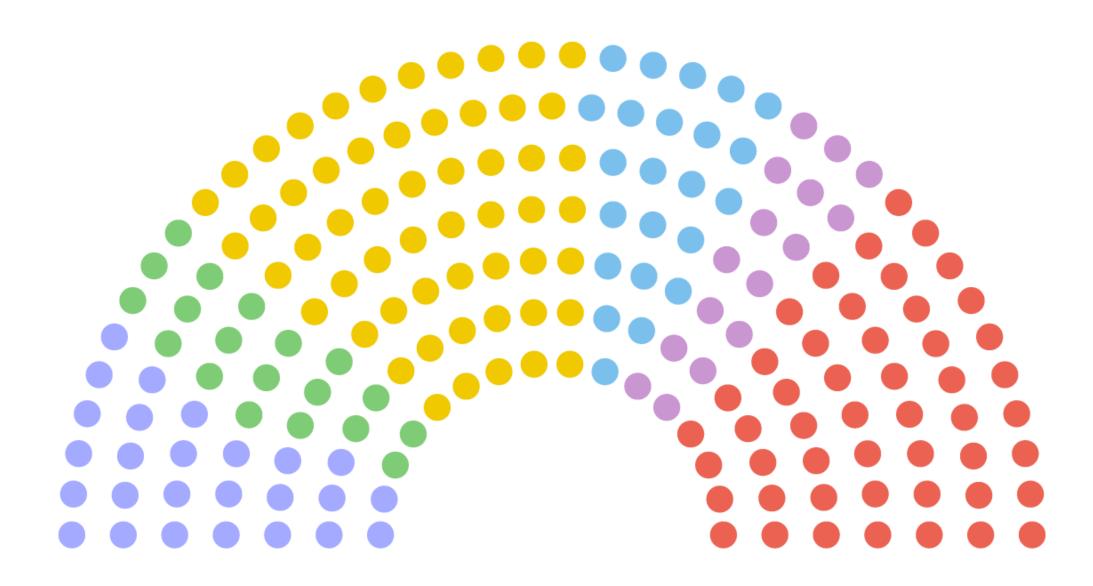
### Banana Party Tomato Party

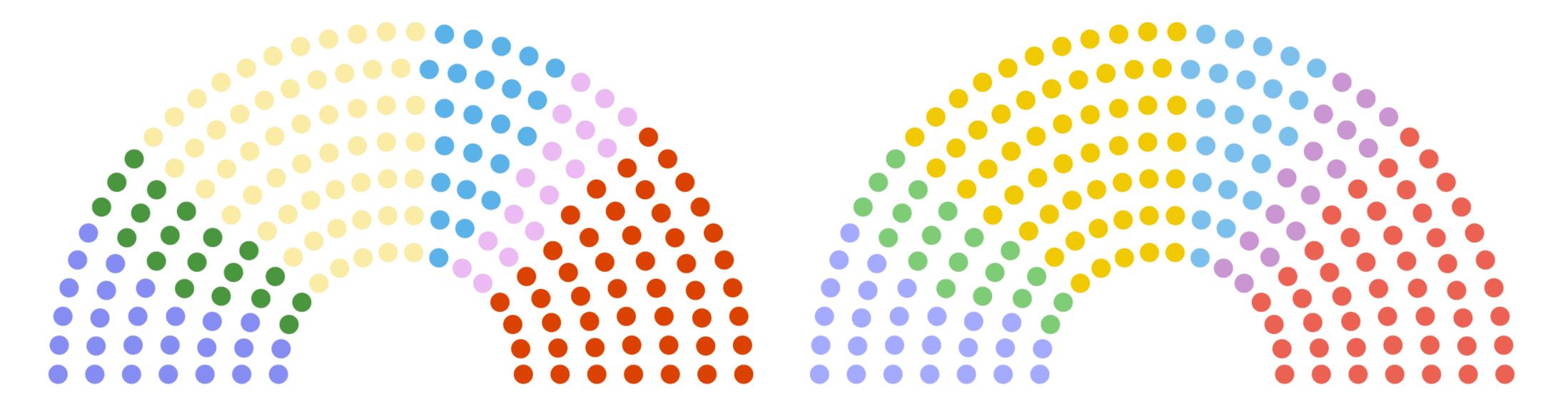


#### Banana: 56



#### Tomato: 49



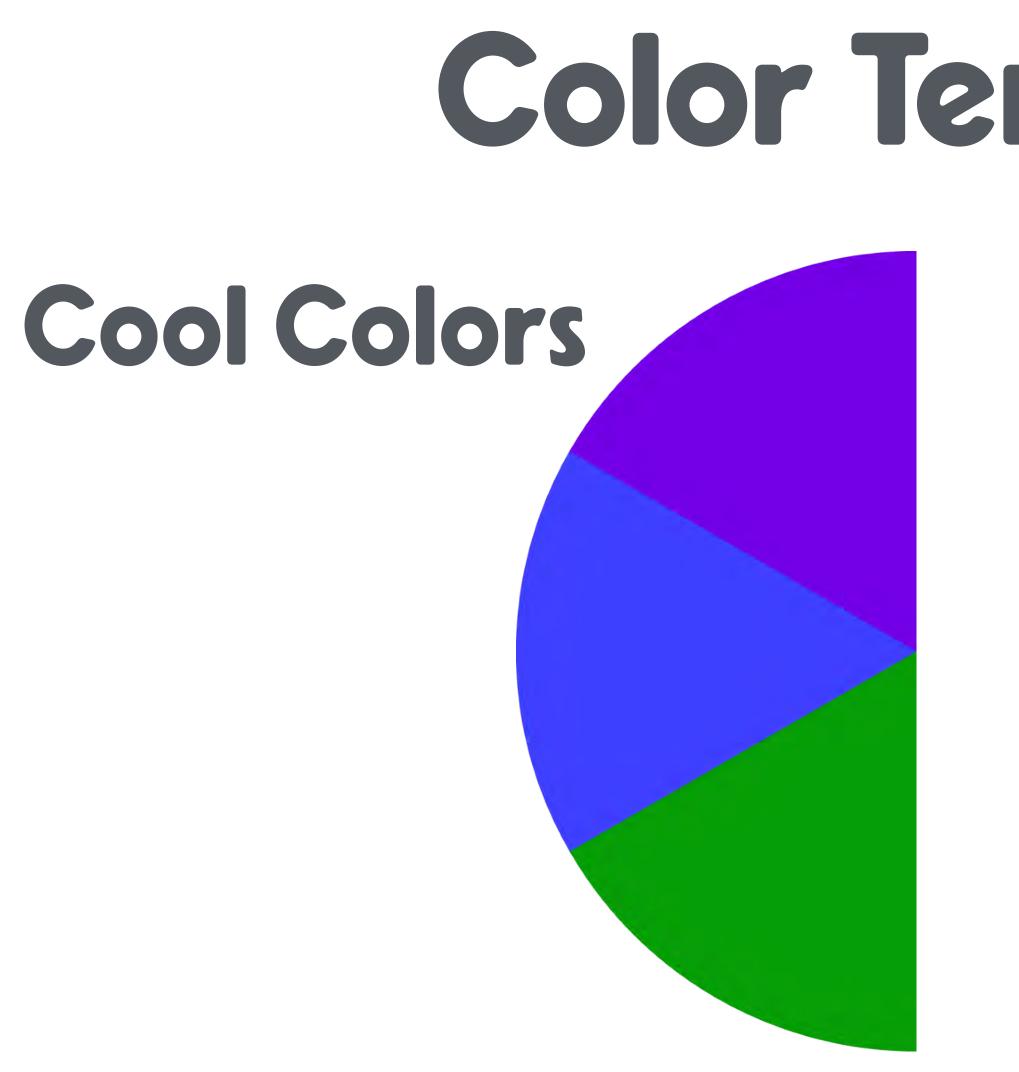


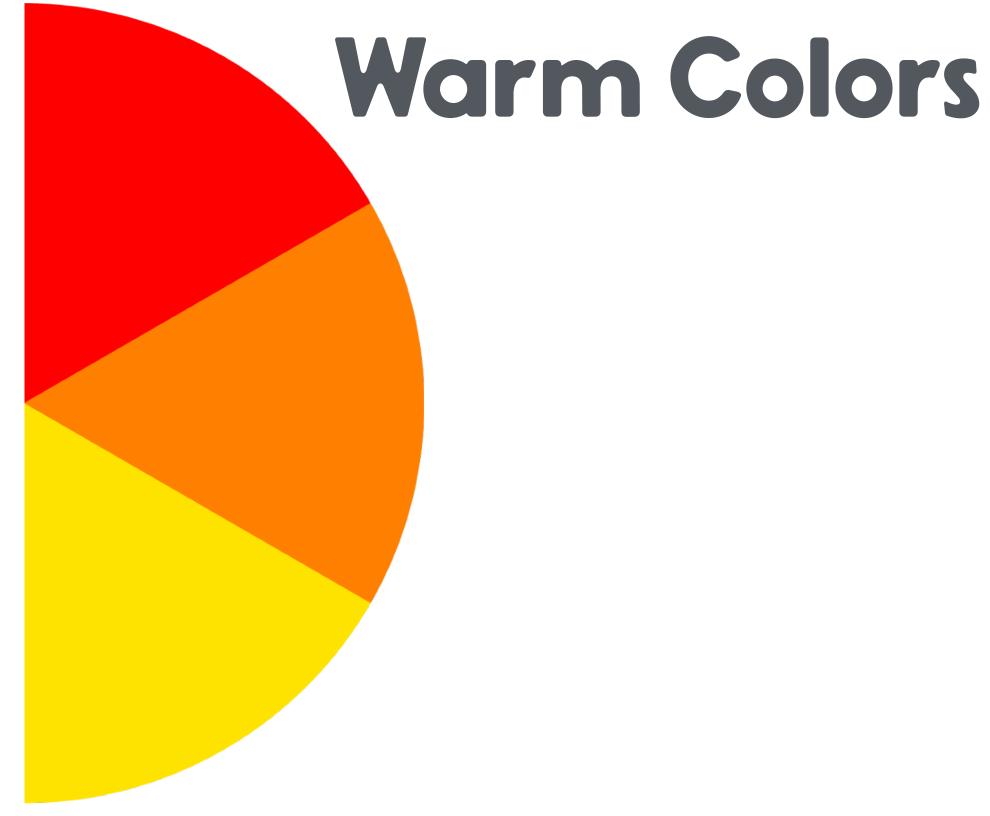
#### 

#### less balanced

more balanced

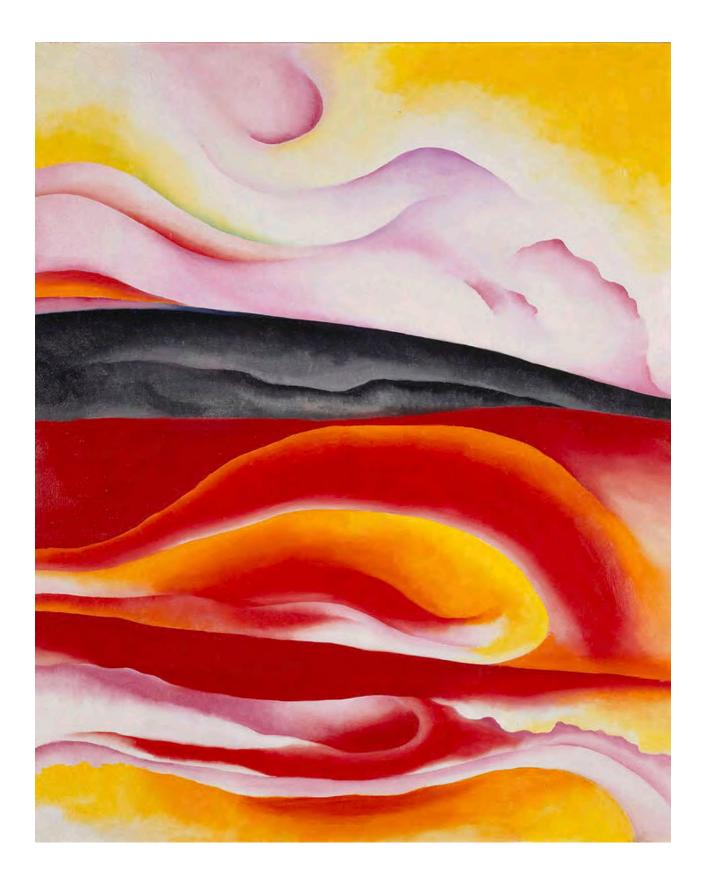






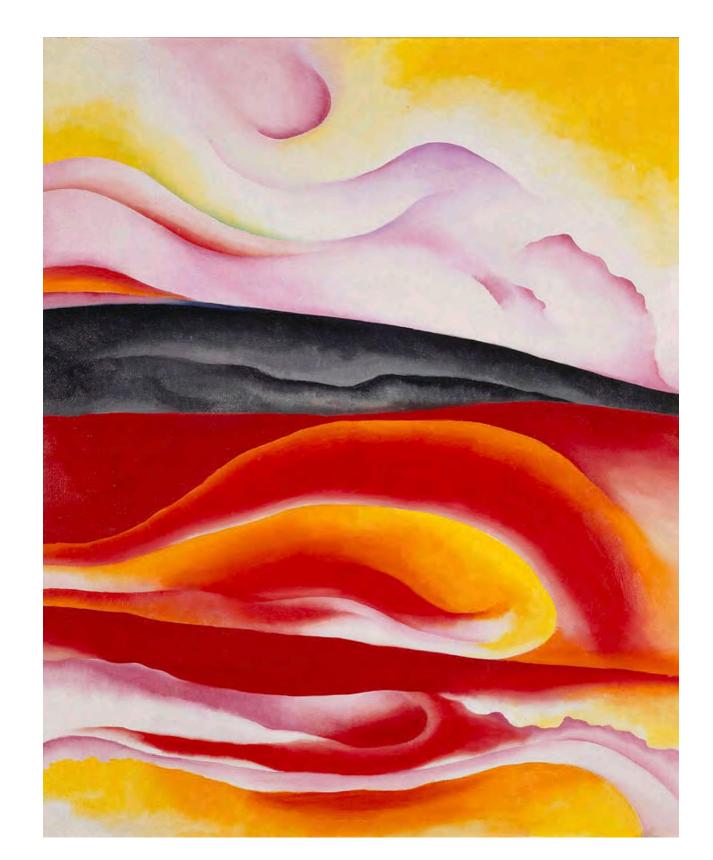








#### Georgia O'Keeffe, Abstraction Blue



Georgia O'Keeffe, Red, Yellow and Black Streak













### Choosing a Color Palette

## **Conventional Advice**



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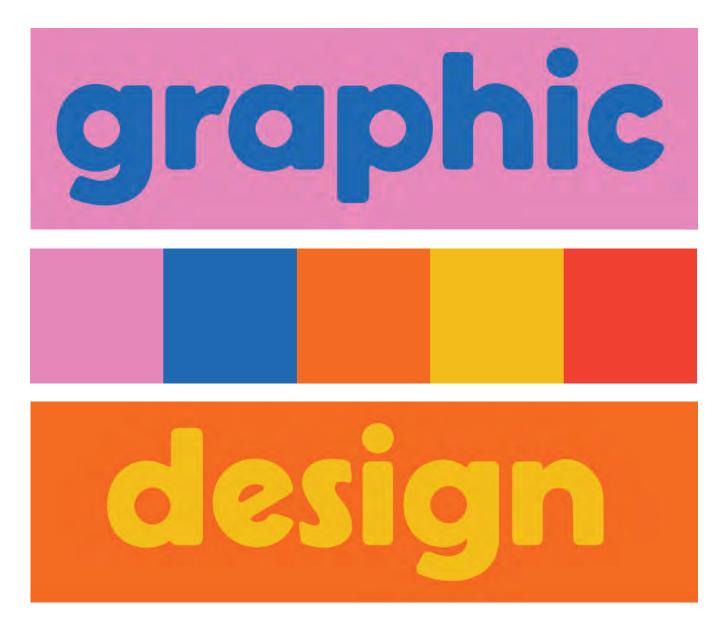
Palettes used by graphic designers are, by necessity, unbalanced.





### **Conventional Advice**

Palettes used by graphic designers are, by necessity, unbalanced.

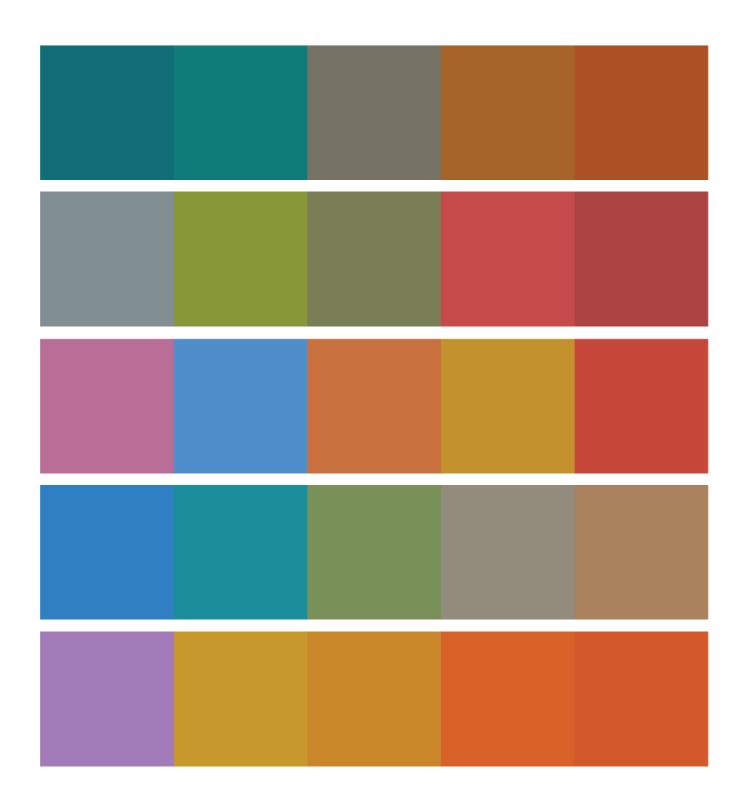




# Start with a Designer Palette

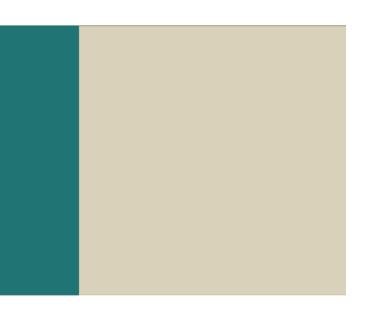


### and make it balanced





## Adjusting Color Pairs



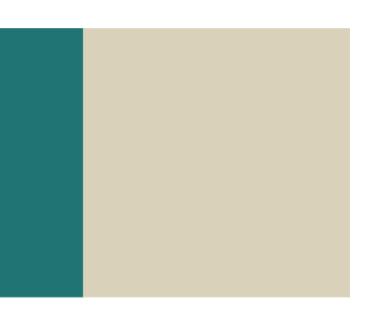




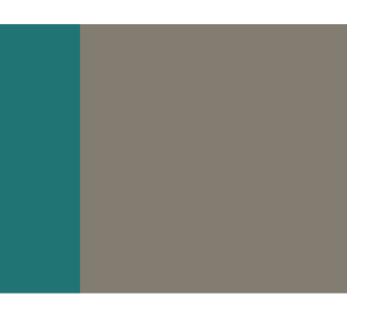




## Adjusting Color Pairs









# Four Strategies for Balancing Your Color Palette

# 1. Use an Intuitive Color Space

# OKLCH or HSL Chroma Lightness



# 1. Use an Intuitive Color Space

# $\triangle$ oklch or HSL $\triangle$

### 2. Use a Contrast Checker in Reverse





#### Contrast ratio: 1.05

#### Contrast ratio: 1.12



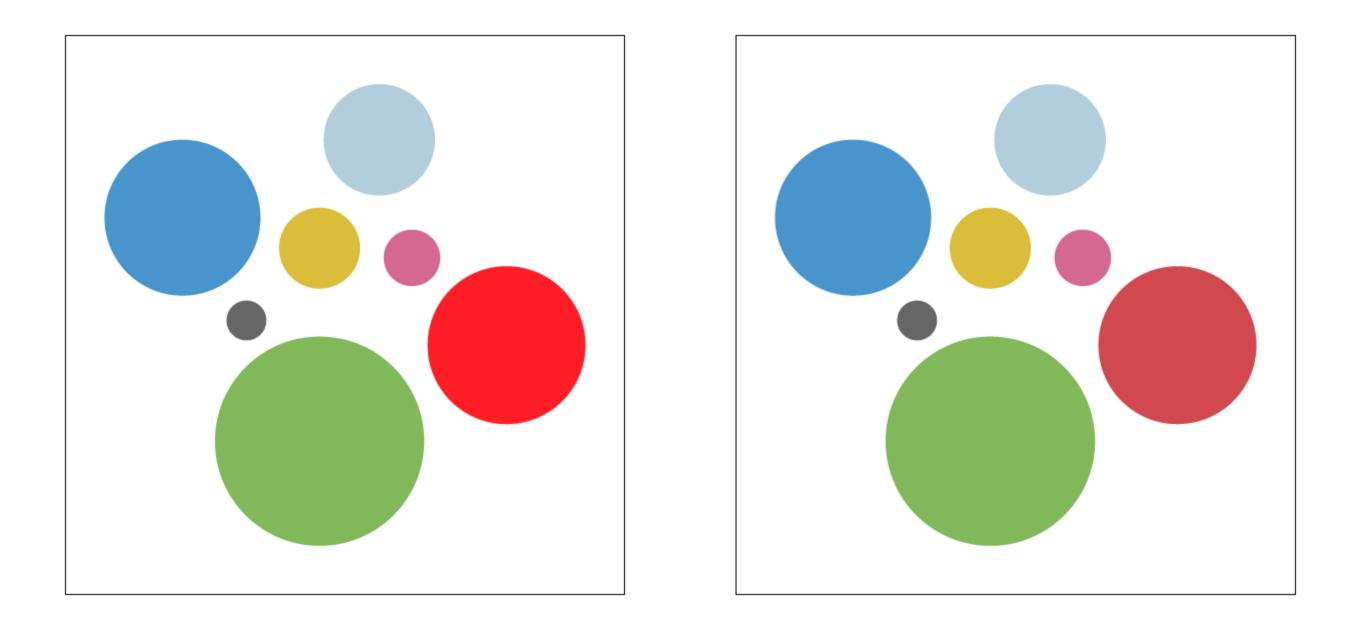
#### original



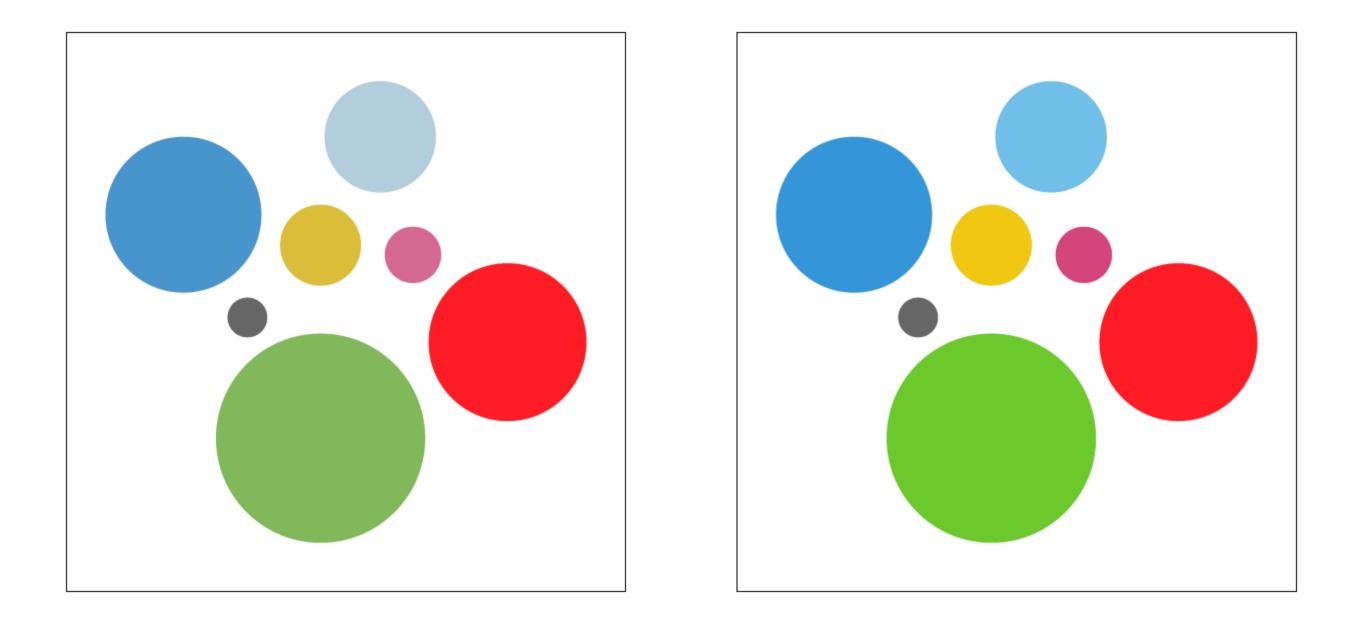
#### balanced



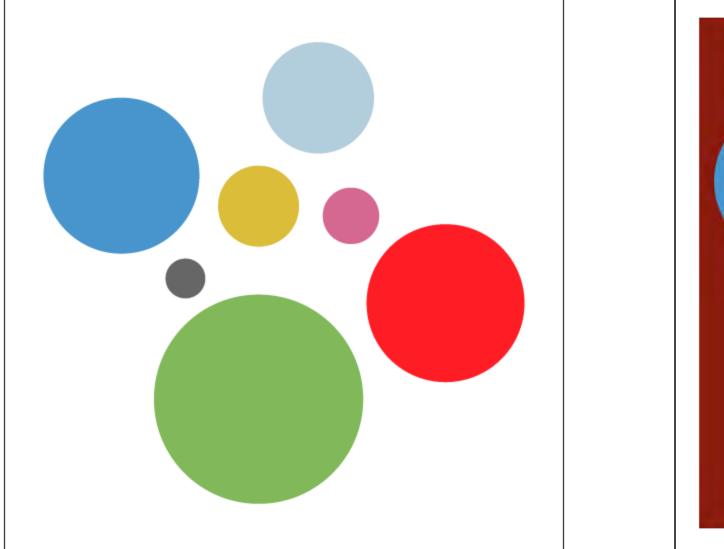


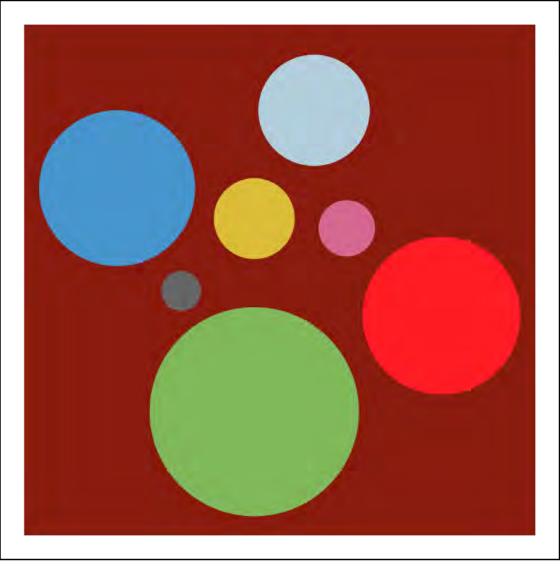


Desaturate them



- Desaturate them
- Saturate other colors





- Desaturate them
- Saturate other colors
- Change the background to counter their influence





Restricted Color Choice



- Restricted Color Choice
- Accessibility



- Restricted Color Choice
- Accessibility
- Ethics



- Restricted Color Choice
- Accessibility
- Ethics
- Practice





### Learning More Physical Resources

 Interaction of Color by Josef Albers



### Learning More Physical Resources

- Interaction of Color by Josef Albers
- Interacting with Color by Fritz Horstman

#### FRITZ HORSTMAN

#### Interacting with Color

A Practical Guide to Josef Albers's Color Experiments



### Learning More Physical Resources

- Interaction of Color by Josef Albers
- Interacting with Color by Fritz Horstman
- Color-aid Paper



 Yale "Interaction of Color" <u>interactionofcolor.com</u>

#### Previou

IV. A color has ...

Next

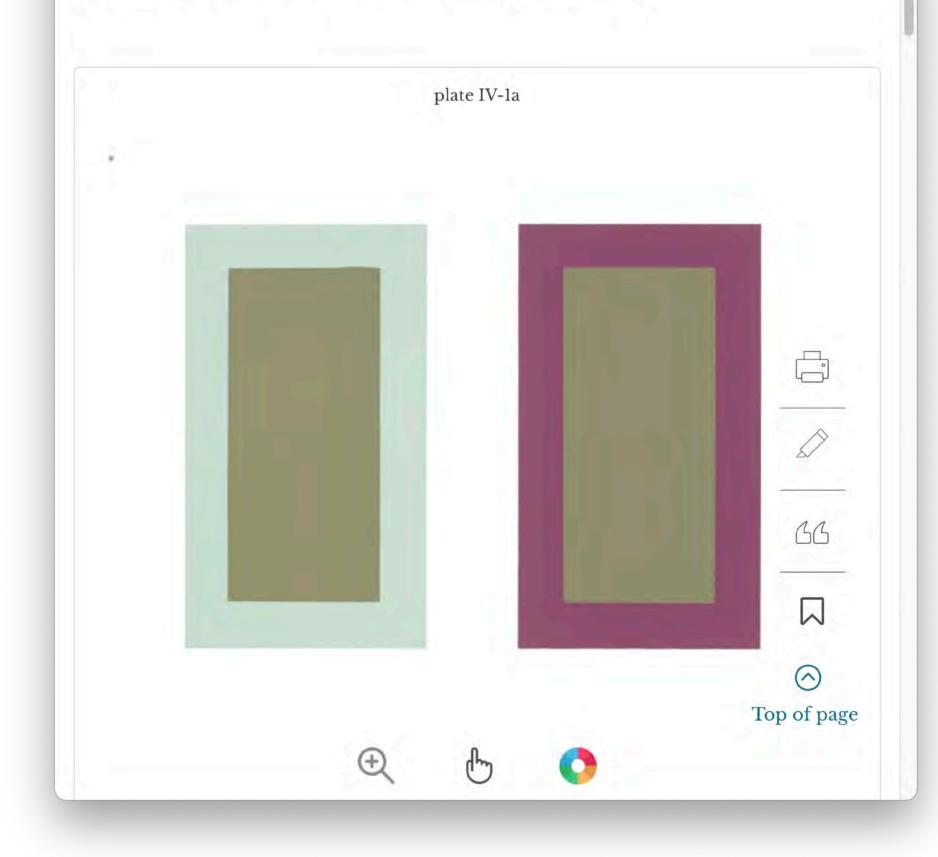
#### PLATES & COMMENTARY

#### 1 color looks like 2

In our demonstrations that a color has many faces, the first problem is to make one and the same color appear as 2 colors, as different colors; the more unbelievably different, the more valuable and instructive the exercise.

#### IV-la

No one is able to see the 2 centered and framed olive greys as of the same color, which is what they really, physically, are.





- Yale "Interaction of Color" <u>interactionofcolor.com</u>
- Other Tools

#### Previou

IV. A color has ...

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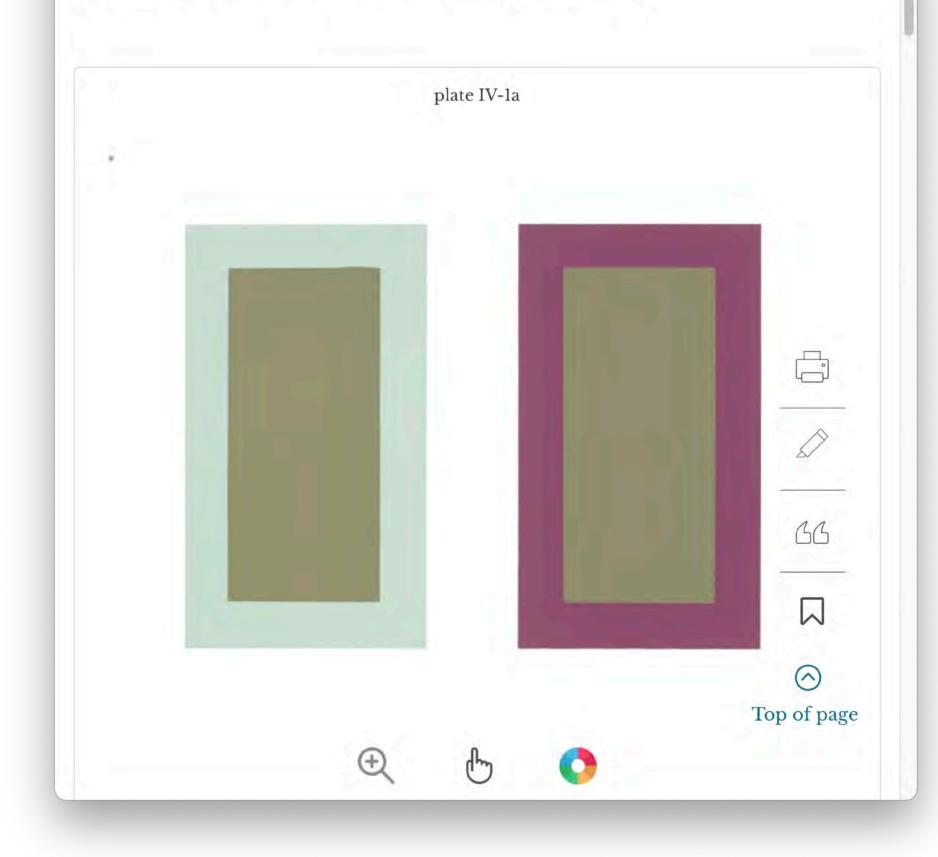
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- Yale "Interaction of Color" <u>interactionofcolor.com</u>
- Other Tools
  - Color IQ Hue Test <u>www.xrite.com/hue-test</u>

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X-rite PANTONE®	Q	8 Ë =
Home   The X-Rite Color Challenge		
Share <b>f in Y</b>		

#### The X-Rite Color Challenge and Hue Test

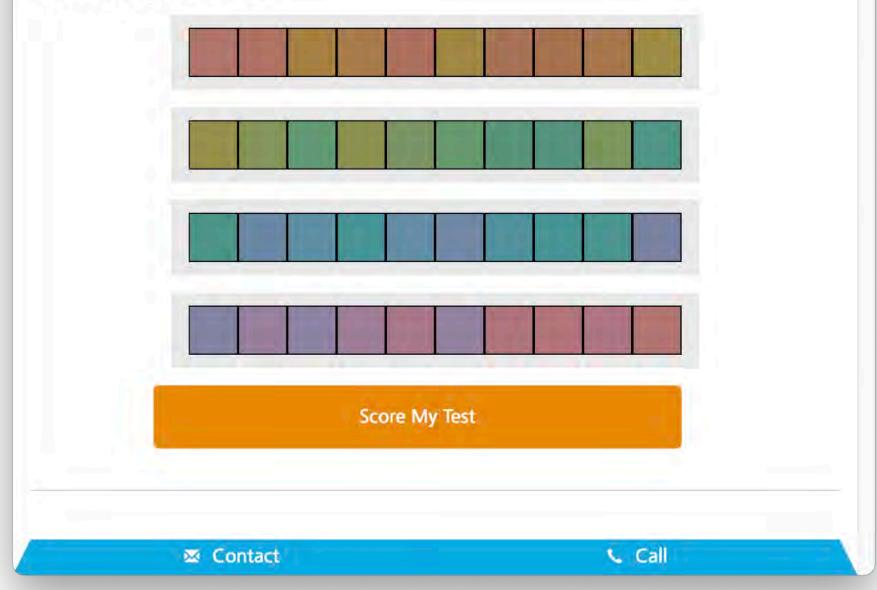
Are you among the 1 in 255 women and 1 in 12 men who have some form of color vision deficiency? If you work in a field where color is important, or you're just curious about your color IQ, take our online challenge to find out. Based on the Farnsworth Munsell 100 Hue Test, this online challenge is a fun, quick way to better understand your color vision acuity.

Just remember, this is not a replacement for the full test!

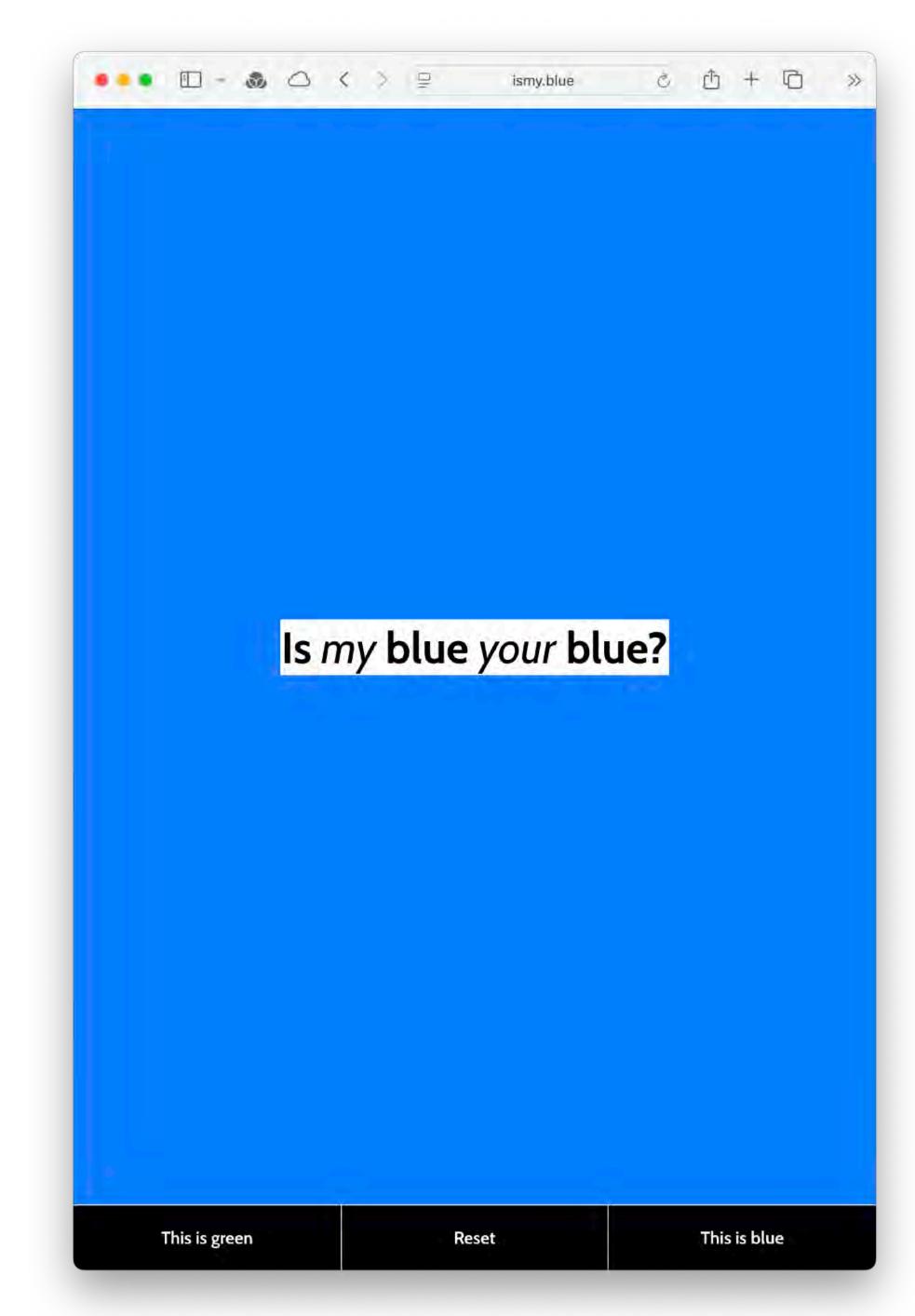
#### Directions:

- 1. The first and last color chips are fixed.
- 2. Drag and drop the colors in each row to arrange them by hue color.
- 3. Complete all four color tests.
- 4. Click 'Score My Test' to review results.

#### What's My Color IQ?



- Yale "Interaction of Color"
  <u>interactionofcolor.com</u>
- Other Tools
  - Color IQ Hue Test www.xrite.com/hue-test
  - Is My Blue Your Blue ismy.blue





## Final Thoughts

The commonality between seeing and showing.

# science and art is in trying to see profoundly: to develop strategies of

Edward Tufte, statistician, writer, and artist

### https://mitten.lol

# Mamitten@social.lol

### Poster Session: Sunday 10:00a - 1:00p

## Thank You!