

**Lecture 3**

**DD 324:**

**Data Visualisation**

**Human Visual Perception**

28s Jan 2025 · Gyan Lakhwani · [gyanlakhwani@gmail.com](mailto:gyanlakhwani@gmail.com) · Department of Design, DTU

## Exercise

# Data Visualisation Tools

The screenshot shows a web browser window with the URL [gyani.com](https://gyani.com). The page title is "Data Visualization". In the top right corner, there are links for "About" and "Syllabus", along with a settings icon. The main heading is "Exercise - Data Visualisation Tools". Below this is a section titled "Activity Details" which contains two paragraphs of text. The first paragraph describes the task: selecting a tool from a list, preparing a 5-minute presentation, and covering its features and data preparation. The second paragraph notes that some tools require technical knowledge, while others do not, and that the course will focus on the non-technical aspects.

**Data Visualization** About [↗](#) Syllabus [↗](#) ⚙️

## Exercise - Data Visualisation Tools

### Activity Details

This page lists a number of Data Visualisation tools. Pick one of these tools using the signup sheet shared on the class group and prepare a 5 minute presentation on it. You can cover what it does, how to prepare your data, some examples of things you made with it. You can do this by yourself or in teams of 2.

Some of these tools will require some technical knowledge. If you know some programming or are willing to learn, go ahead and try out some tools like D3.js, Leaflet.js or Rshiny. Most other tools do not require programming knowledge, and this course will not focus on the technical aspect of data visualisation.

### No-Code / Low-Code Tools

# Exercise

# 3 Visualisations

The screenshot shows a web browser window with the URL [gyanl.com](http://gyanl.com). The page content includes a navigation menu with 'Data Visualization' and a hamburger menu icon. The main heading is 'Exercise - 3 Visualisations'. Under the 'Reference' section, there are two paragraphs of text. The first paragraph mentions 'The Data Viz Project' with a link icon. The second paragraph mentions '1 dataset. 100 visualizations.' with a link icon. Below the text is a table with four columns: 'Year', 'Norway', 'Denmark', and 'Sweden'. The table has two rows of data. The first row shows values for 2004: Norway (5), Denmark (4), and Sweden (13). The second row shows values for 2022: Norway (8), Denmark (10), and Sweden (15). Below the table is an 'Instructions' section with a paragraph of text.

Data Visualization

## Exercise - 3 Visualisations

### Reference

The [Data Viz Project](#) has a collection of data visualizations to get inspired and find the right type for your use case.

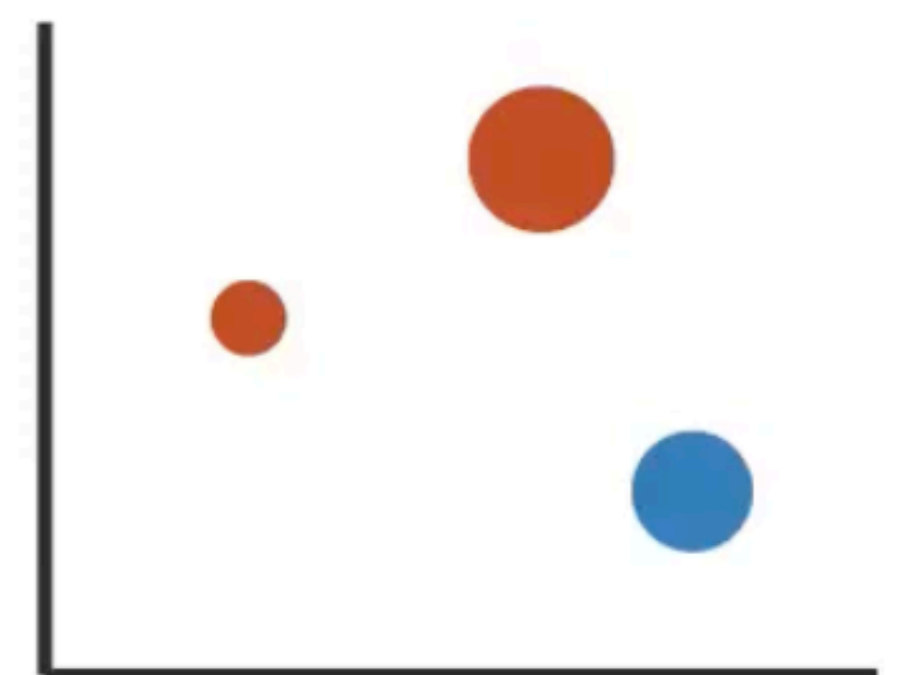
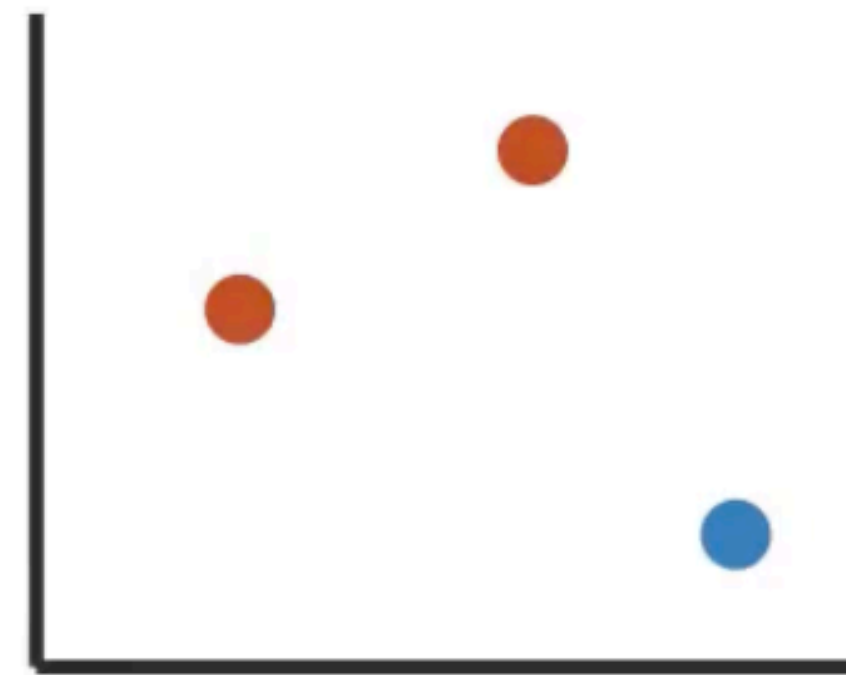
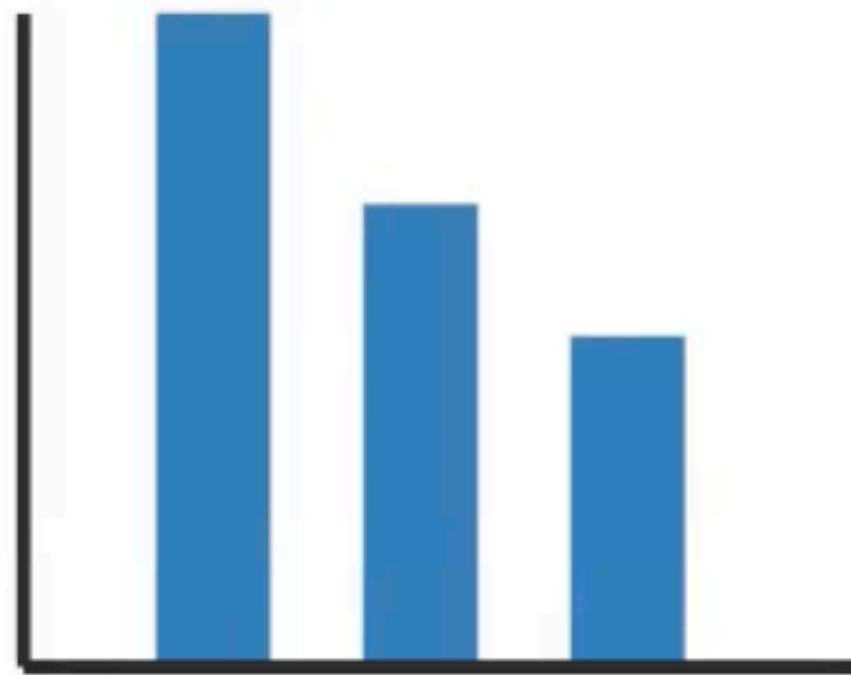
They also have a project called [1 dataset. 100 visualizations.](#) which visualises a small table in 100 different ways.

Year	Norway	Denmark	Sweden
2004	5	4	13
2022	8	10	15

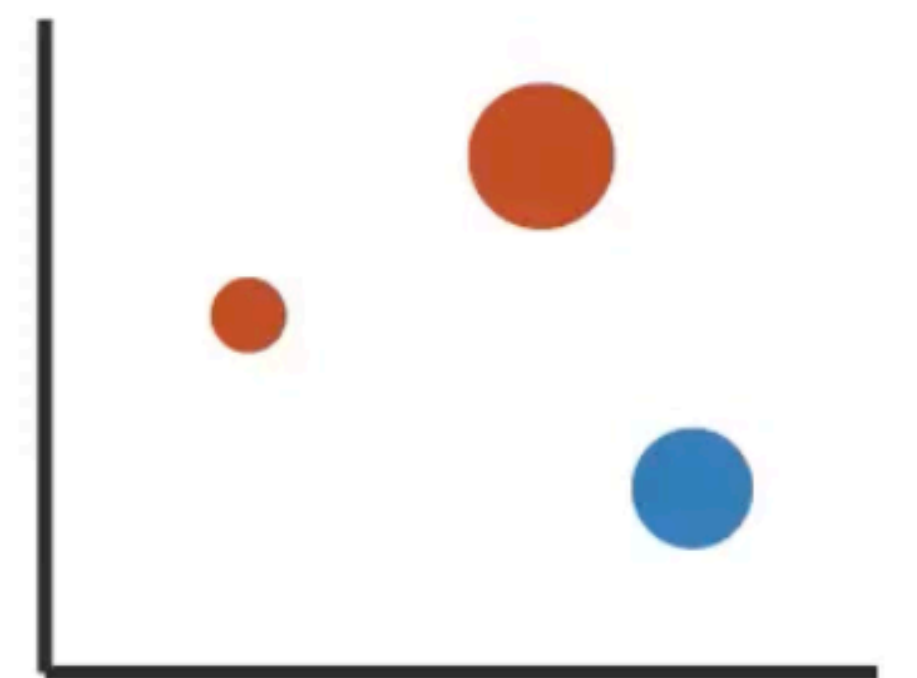
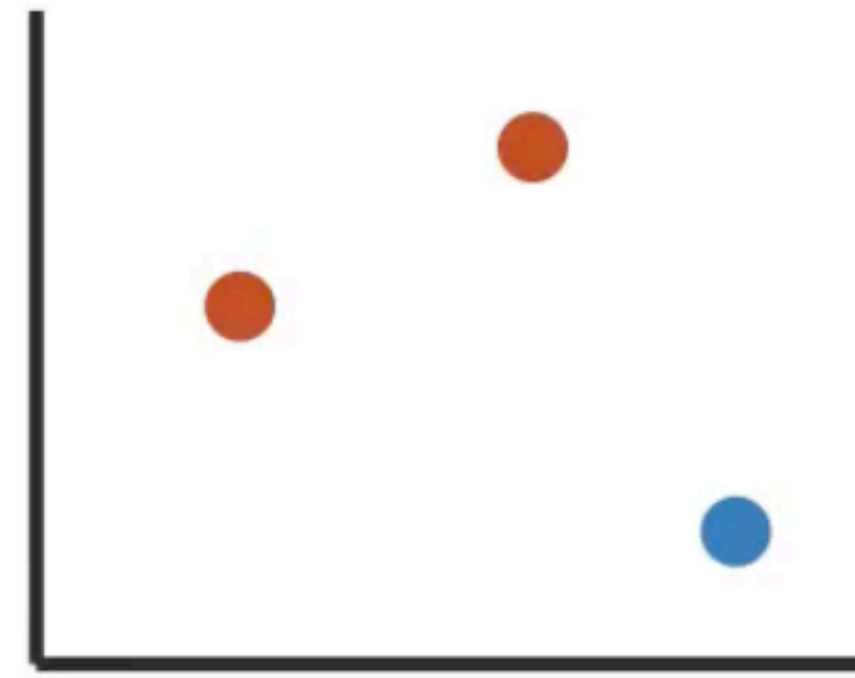
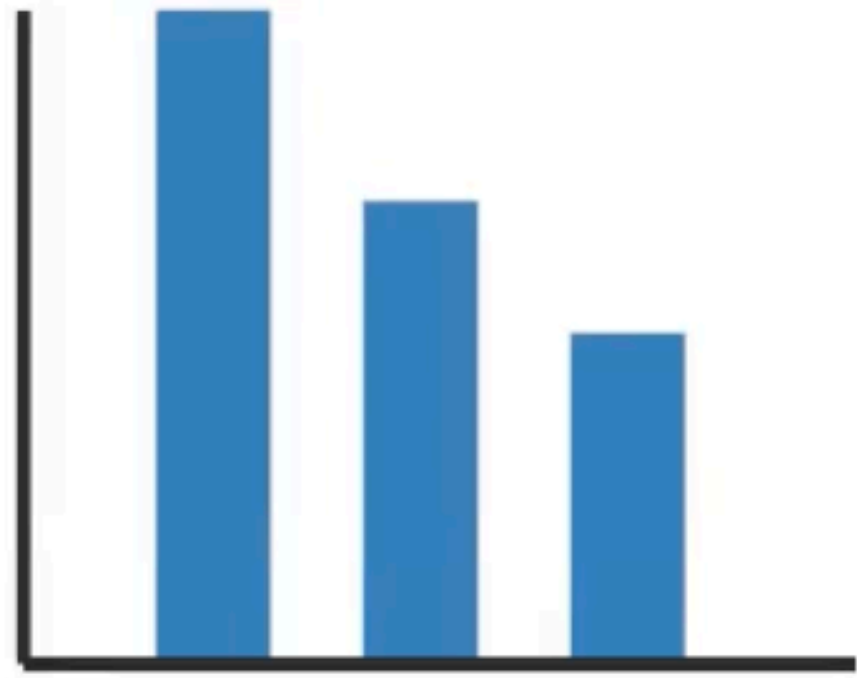
### Instructions

Find a small table of data that has at least 2x3 cells of data. Use the types of visualisations listed in the Data Viz Project to find 3 different ways to visualise this data. Try and use unusual ways to represent the data. If you can come up with something that's not in the website that's a

## Recap



**What's being represented here?**



# Marks & Channels

Represent items or links

Change appearance of marks  
based on attributes

# Marks

Represent **items** or links

**0D - Points**



**1D - Lines**



**2D - Area**



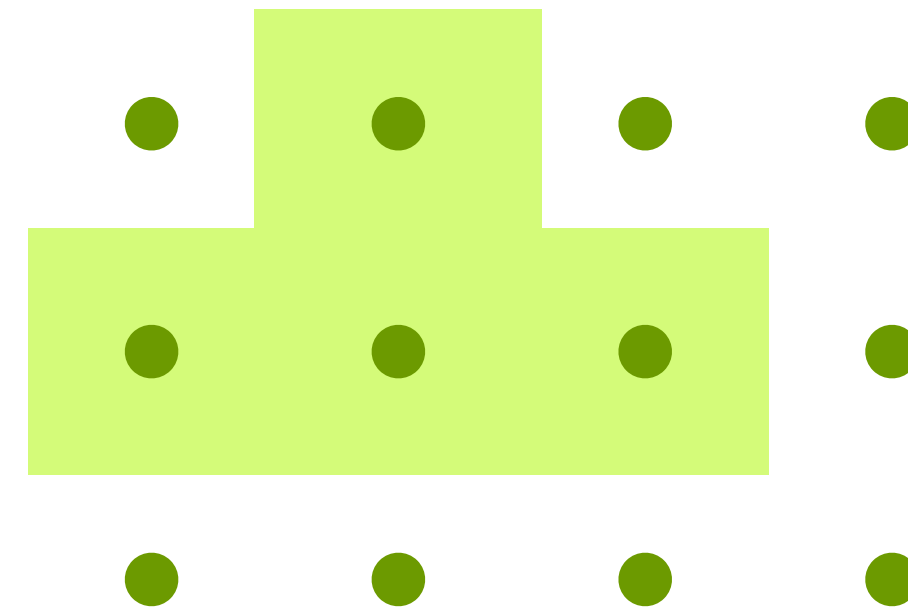
**3D - Volume**



# Marks

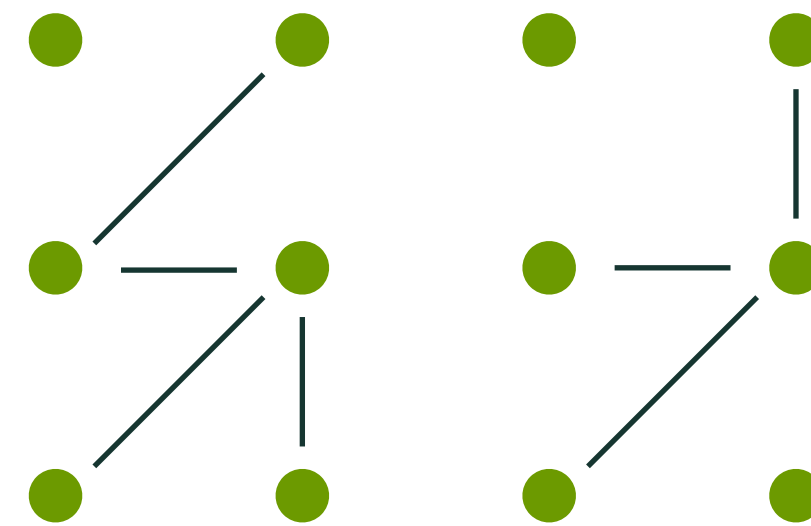
Represent items or links

## Containment



Represent items or links

## Connection



# Channels

Change appearance of marks based on attributes

Nominal Ordinal Interval Ratio



Categorical

## → Identity Channels: Categorical Attributes

Spatial region



Color hue



Motion



Shape



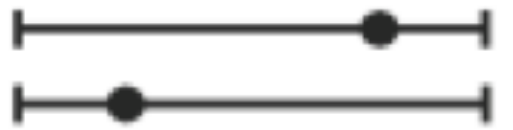


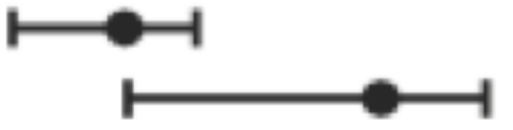
# Channels

Change appearance of marks based on attributes

Nominal Ordinal **Interval Ratio**  
Magnitude

## ➔ Magnitude Channels: Ordered Attributes


Position on common scale 

Position on unaligned scale 

Length (1D size) 

Tilt/angle 

Area (2D size) 

Depth (3D position) 

Color luminance 

Color saturation 

Curvature 

Volume (3D size) 





Area



More than 1 channel  
can be used at the same  
time

Area (2D size)



More than 1 channel  
can be used at the same  
time



Area



Color Saturation

Area (2D size)



Color saturation



More than 1 channel  
can be used at the same  
time



Area



Color Saturation



Area and Color Saturation

Area (2D size)



Color saturation



Lecture 4

**DD 324:**

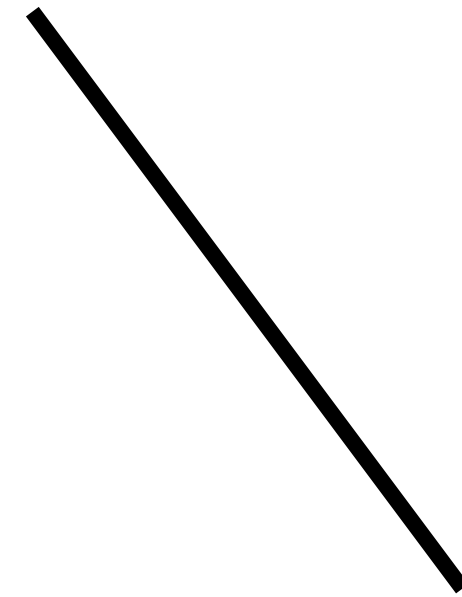
**Data Visualisation**

Human Visual Perception

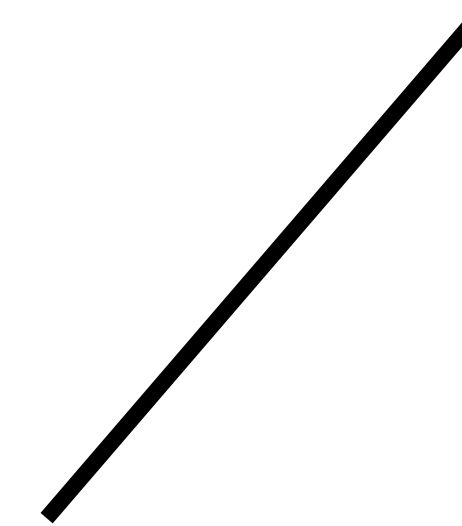
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## Visual Perception

**Which line is bigger?**



**Line A**



**Line B**

## Visual Perception

**Which line is bigger?**

Line A

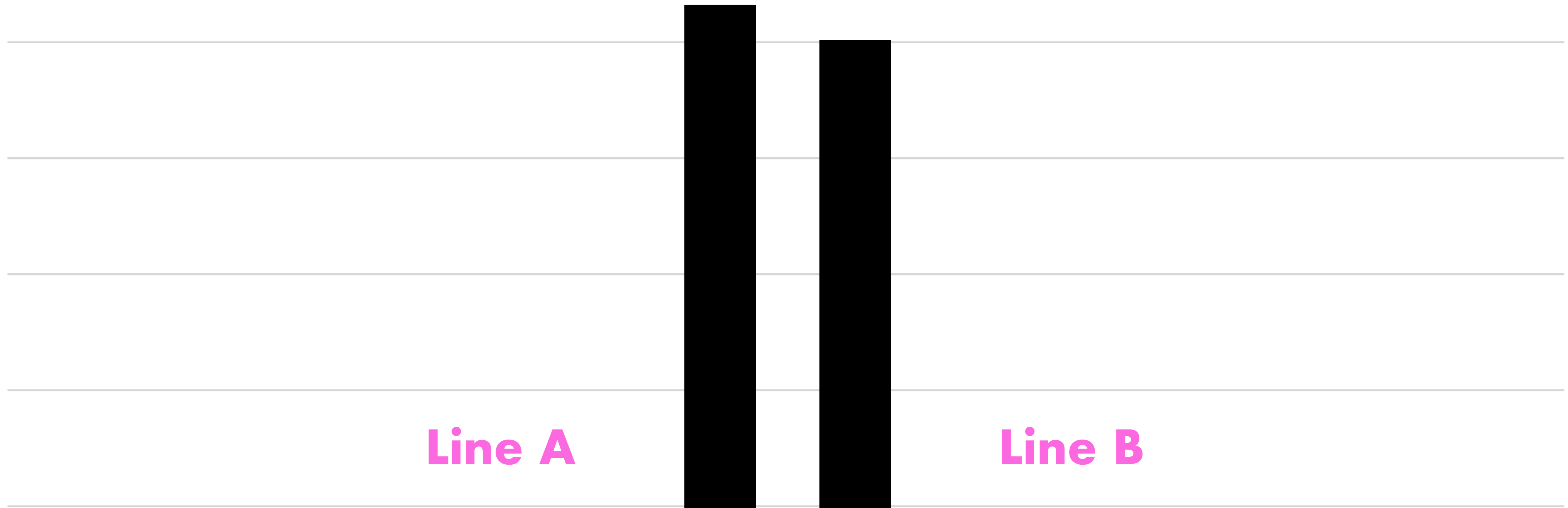


Line B



## Visual Perception

**Which line is bigger?**

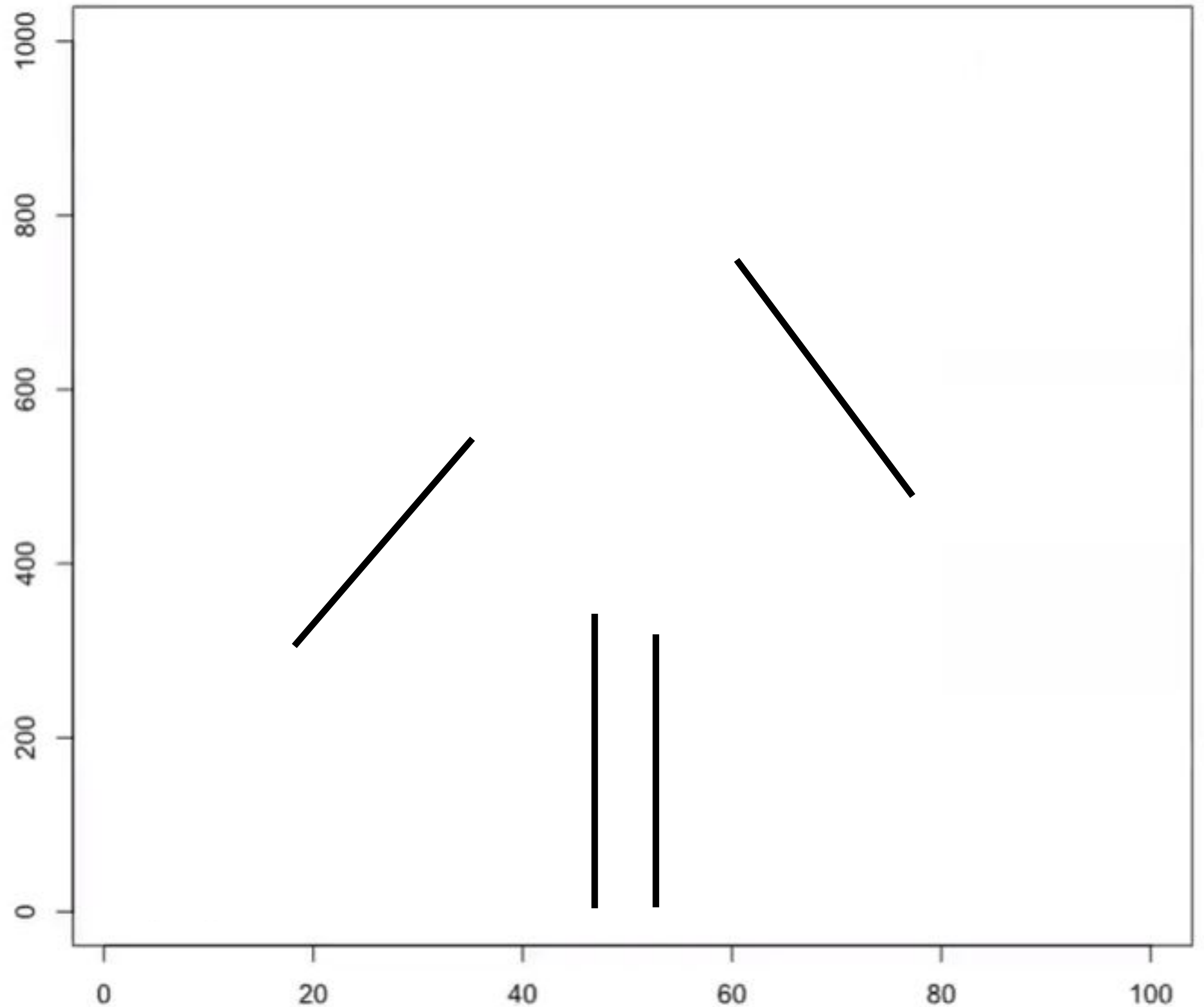




## Visual Perception

# Which line is bigger?

It is easier to compare widths when 2 lines are compared on the same axis.



## Visual Perception

Which area is bigger?

'JK Rowling'  
or 'Others'?

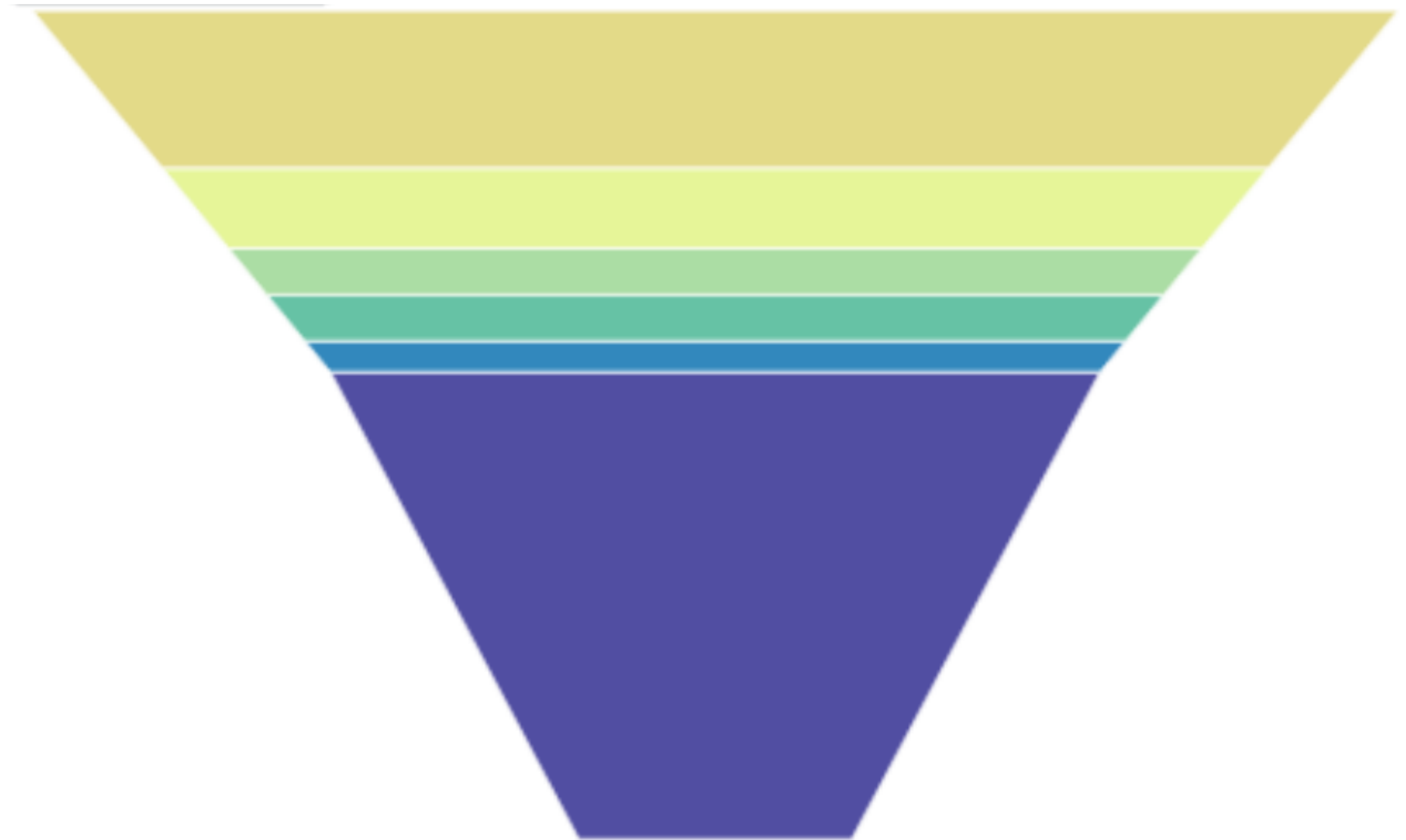


Chart by Isshita Bansal

JK Rowling Dan Brown E.L. James Stephenie Meyer Stieg Larsson Others

## Visual Perception

**Which area is bigger?**

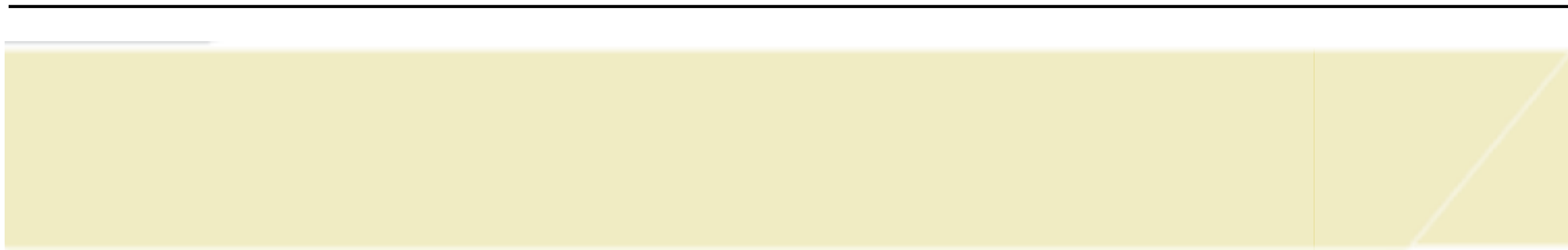


**'JK Rowling'  
or 'Others'?**





1020



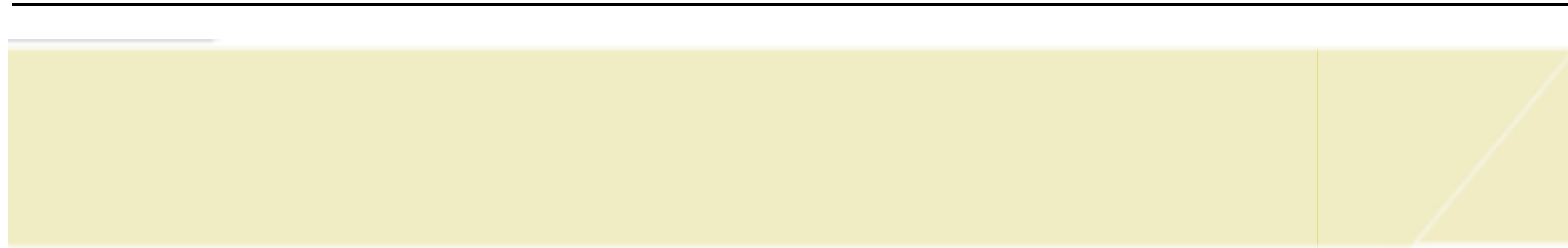
130

430



380

1020



130

**1,32,600**  
sq units

430

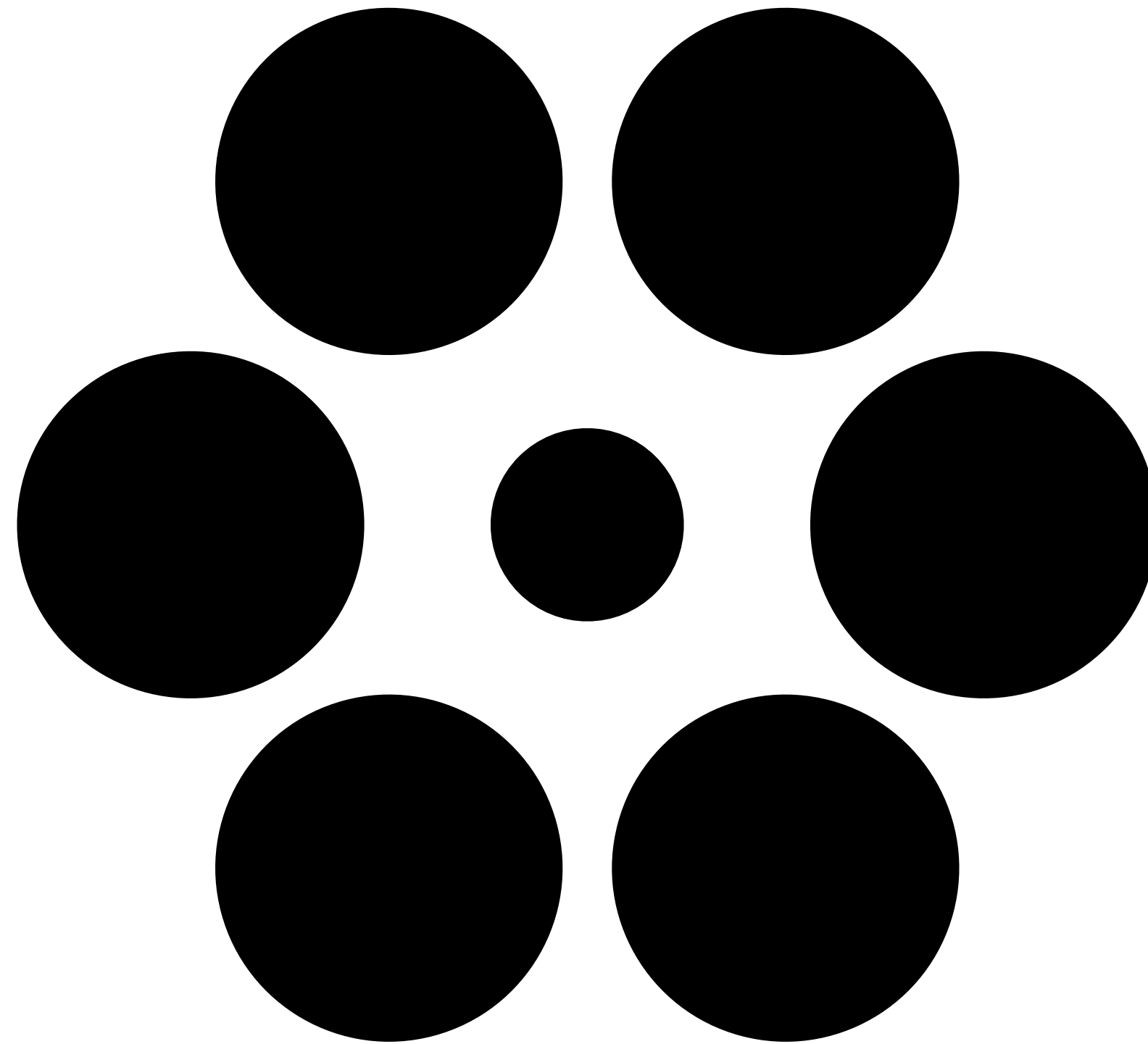


380

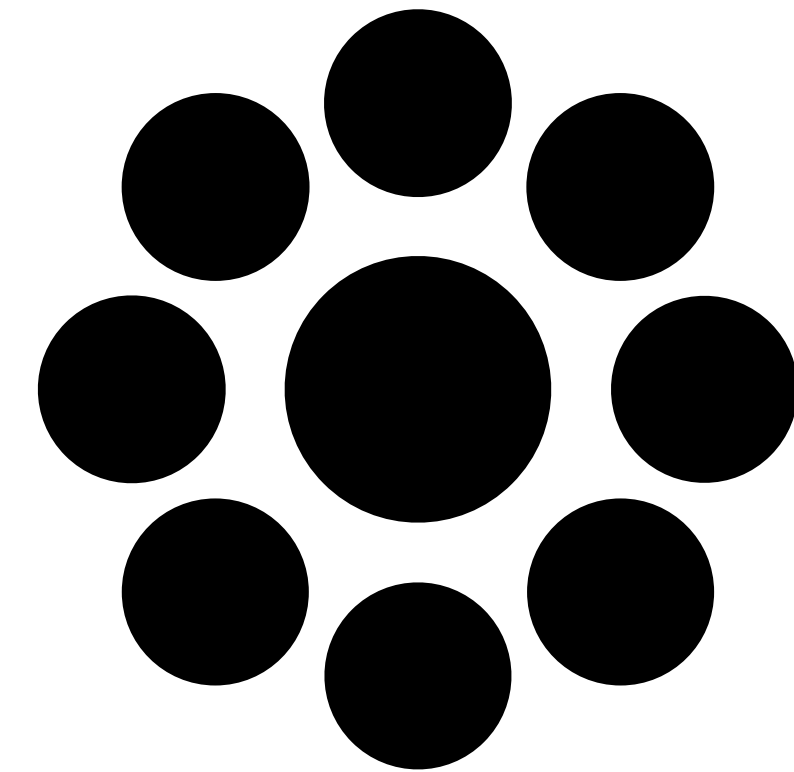
**1,63,400**  
sq units

## Visual Perception

**Which inner  
circle is  
bigger?**



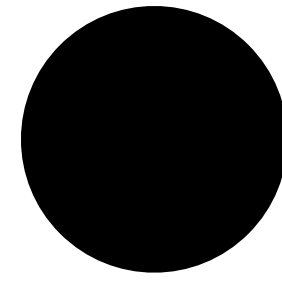
**Circle A**



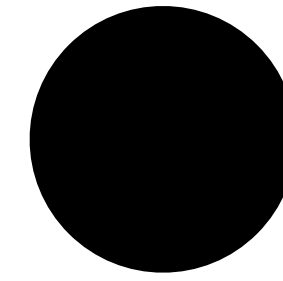
**Circle B**

## Visual Perception

**Which inner  
circle is  
bigger?**



**Circle A**



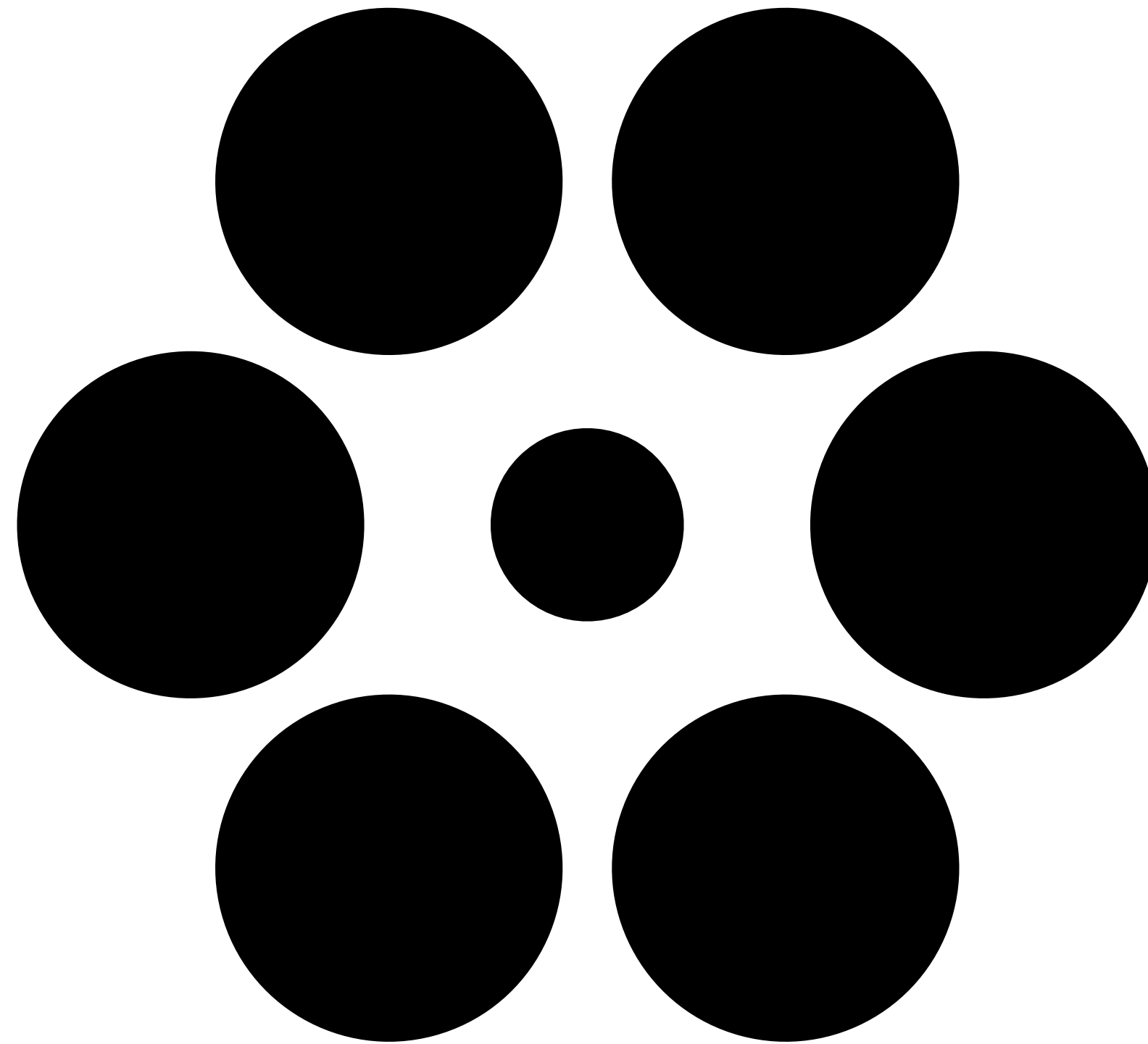
**Circle B**



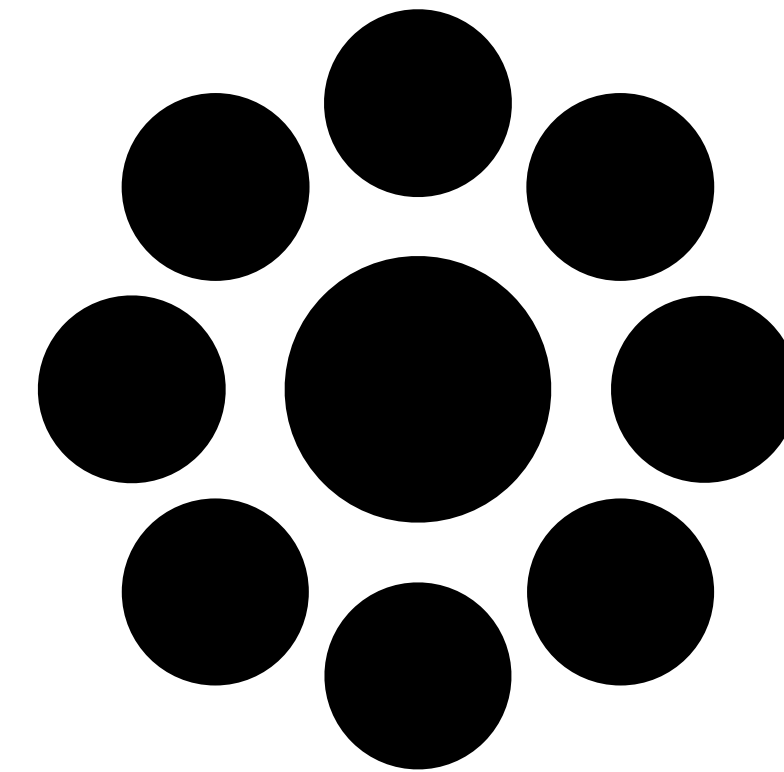
## Visual Perception

**Which inner circle is bigger?**

Neighbouring objects can make an object feel smaller or larger by comparison.



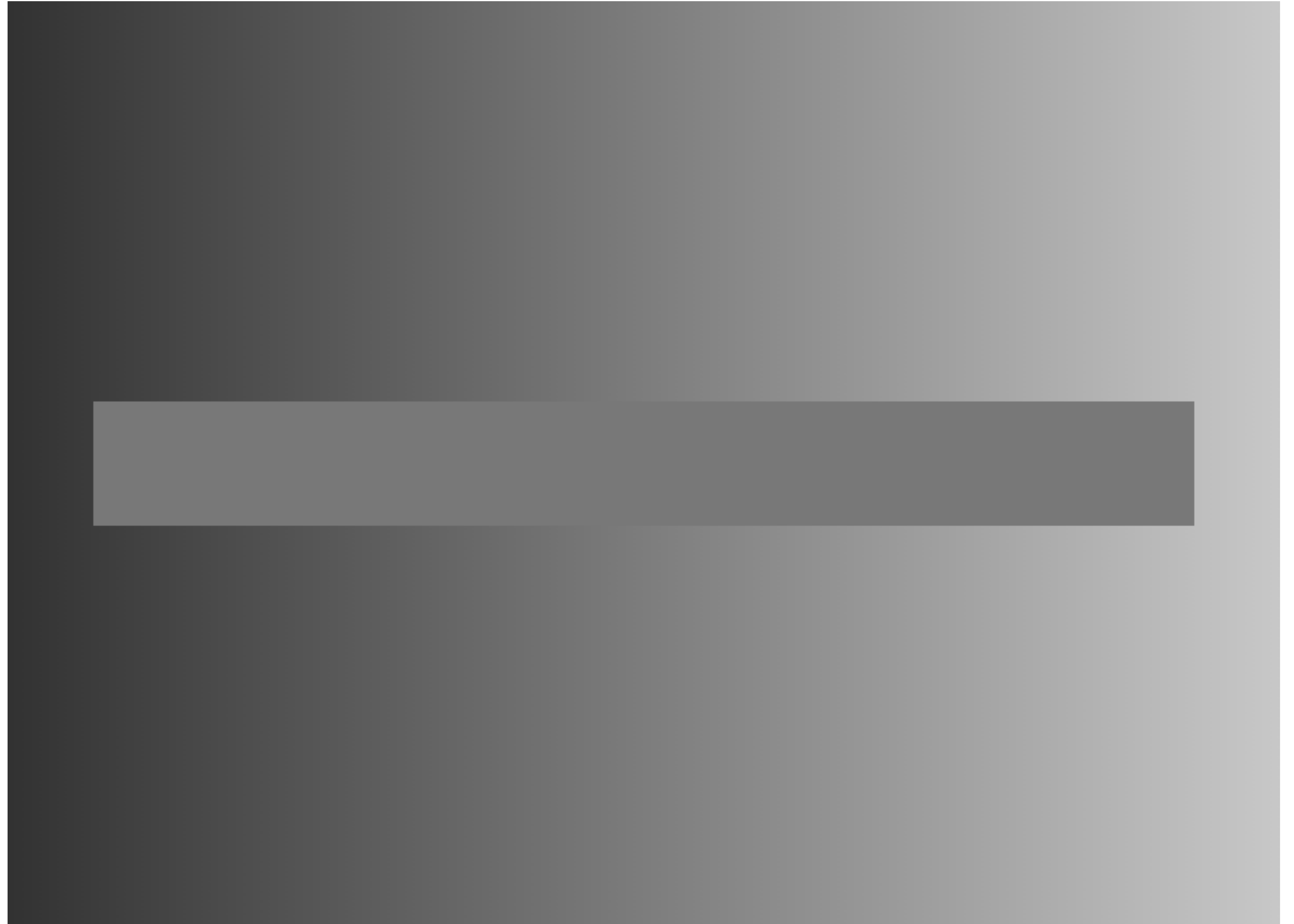
**Circle A**



**Circle B**

**Visual Perception**

**Is the centre  
rectangle a  
gradient?**



## Visual Perception

**Is the centre  
rectangle a  
gradient?**



## Visual Perception

**Is the centre  
rectangle a  
gradient?**



## Visual Perception

**Is the centre  
rectangle a  
gradient?**



## Visual Perception

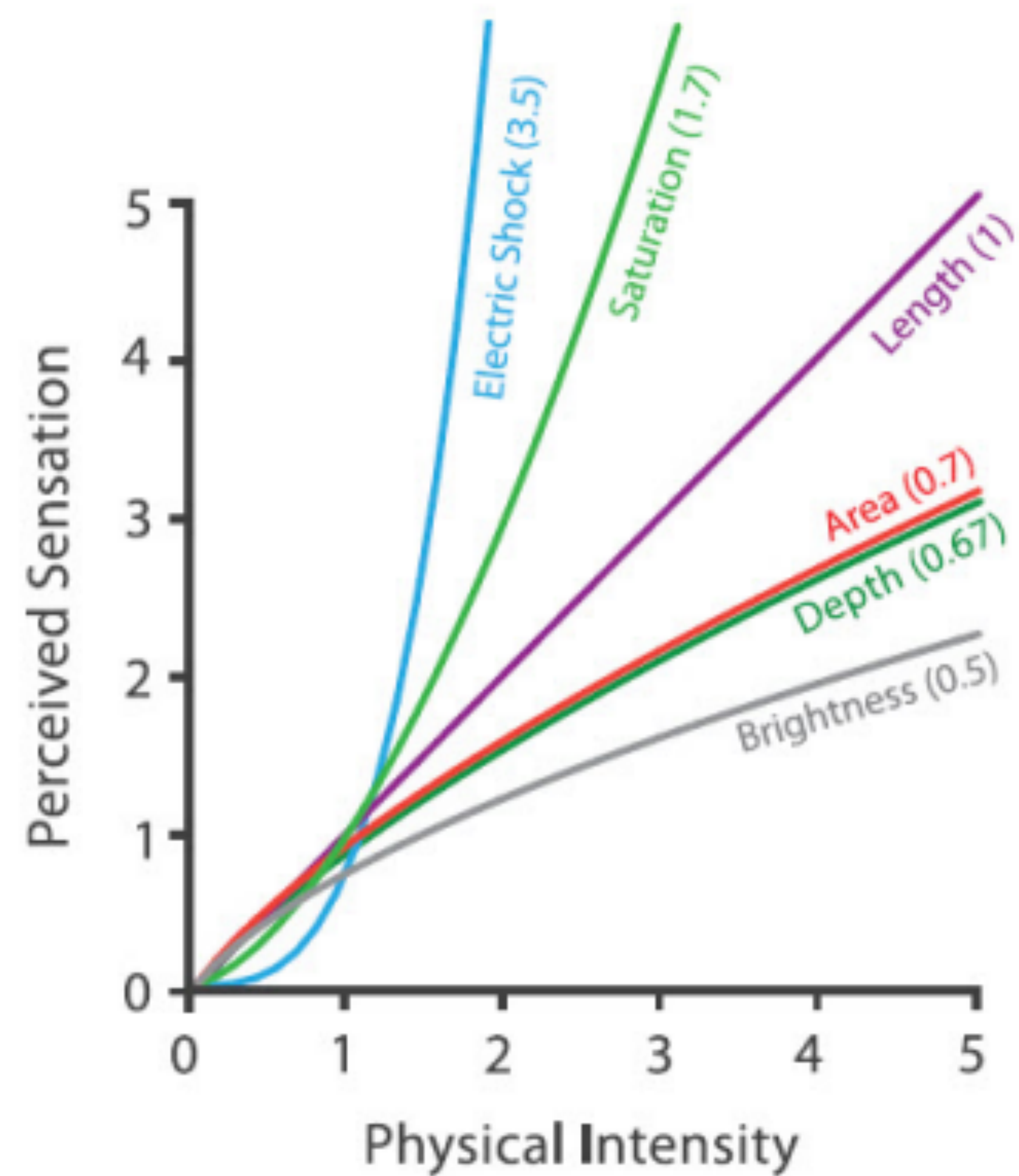
**Is the centre  
rectangle a  
gradient?**



**#787878**

## Visual Perception

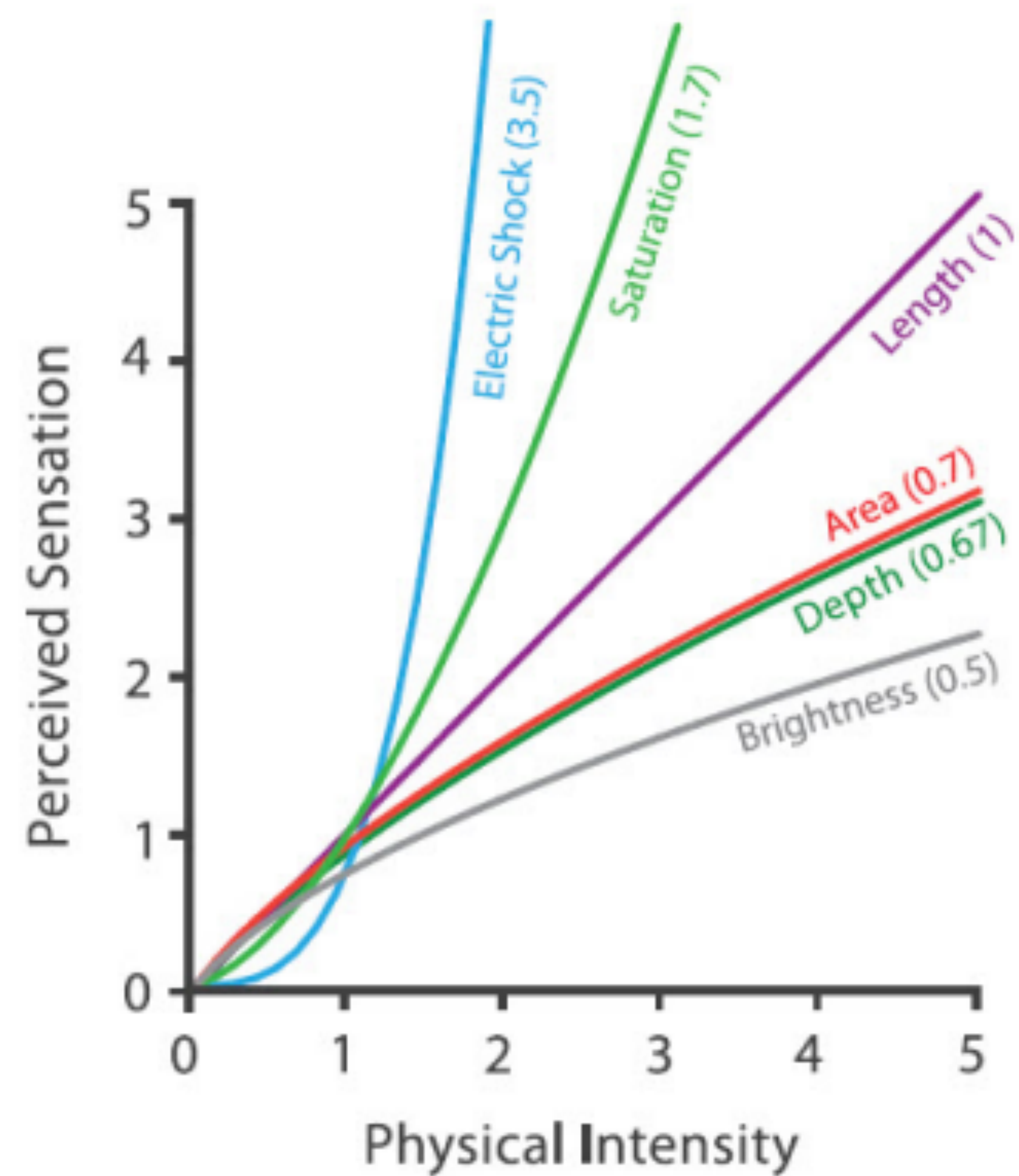
# Steven's Psychophysical Power Law



## Visual Perception

# Steven's Psychophysical Power Law

Humans perceive  
different stimulus  
differently.

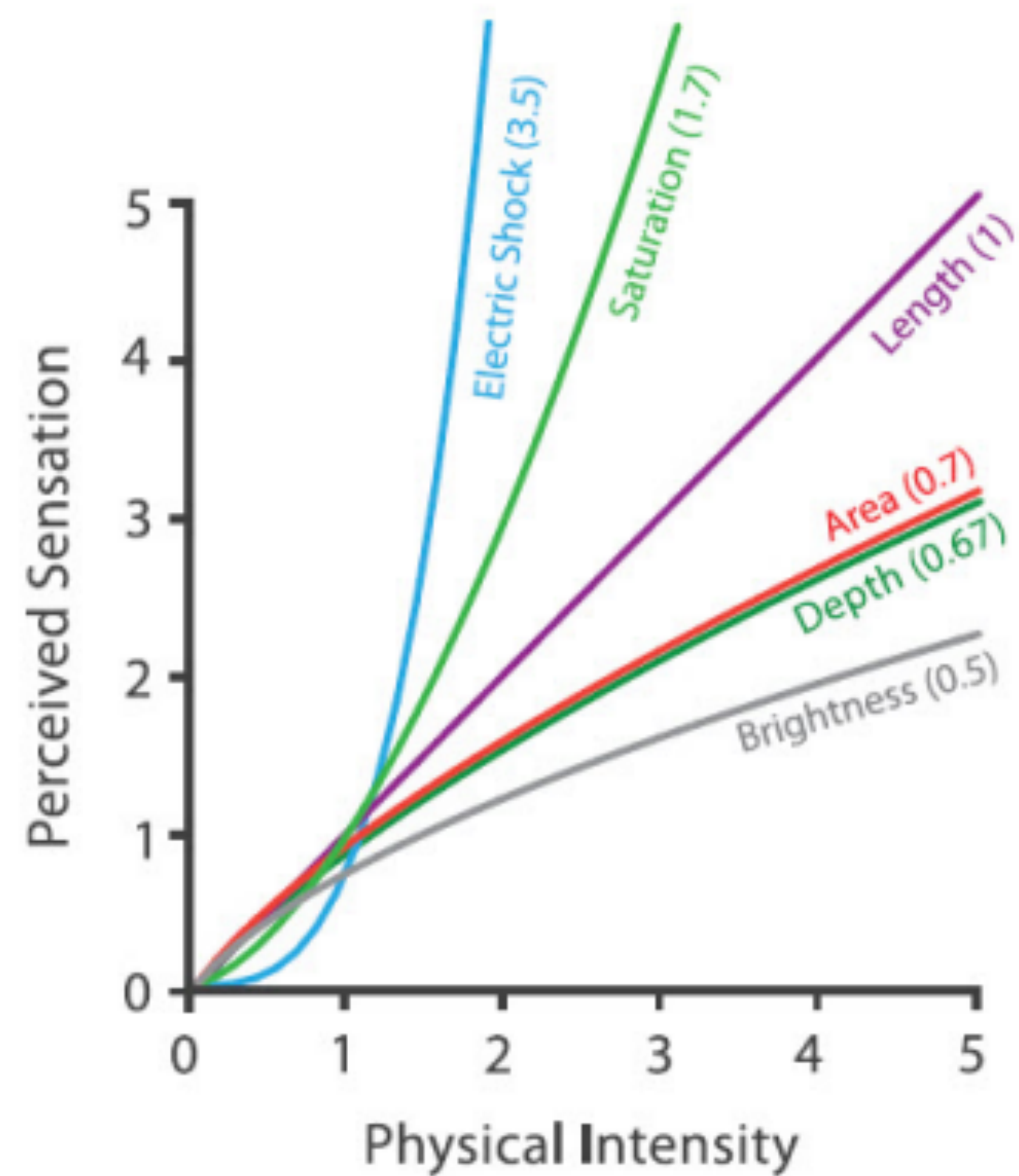




## Visual Perception

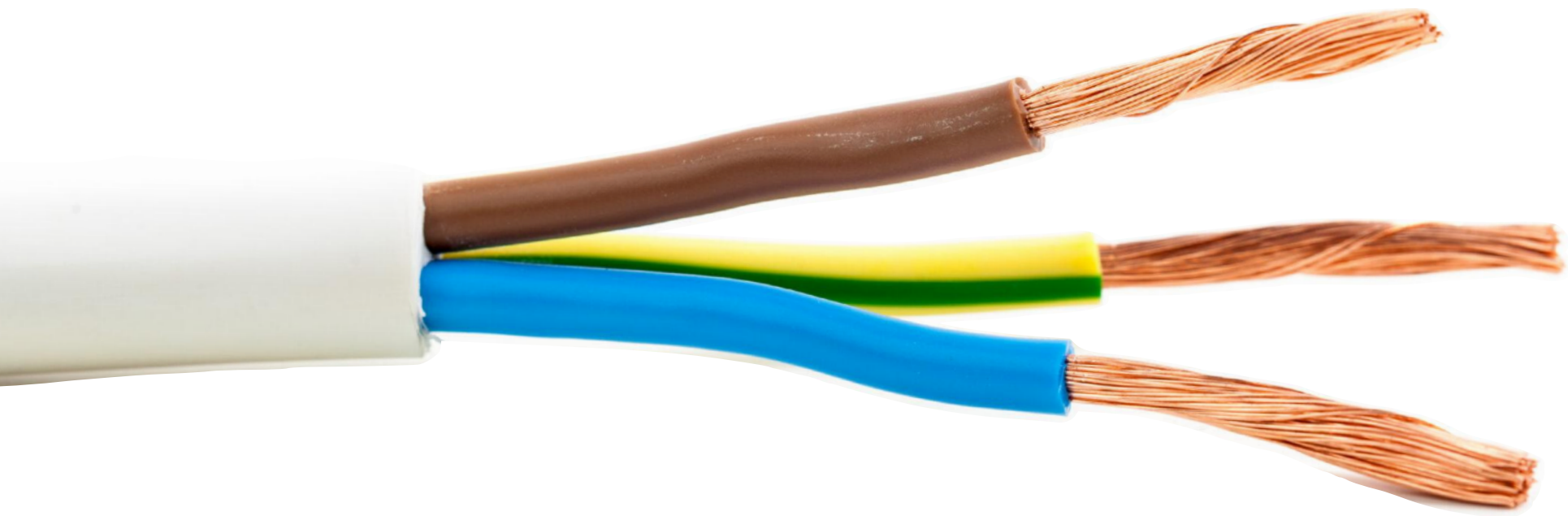
# Steven's Psychophysical Power Law

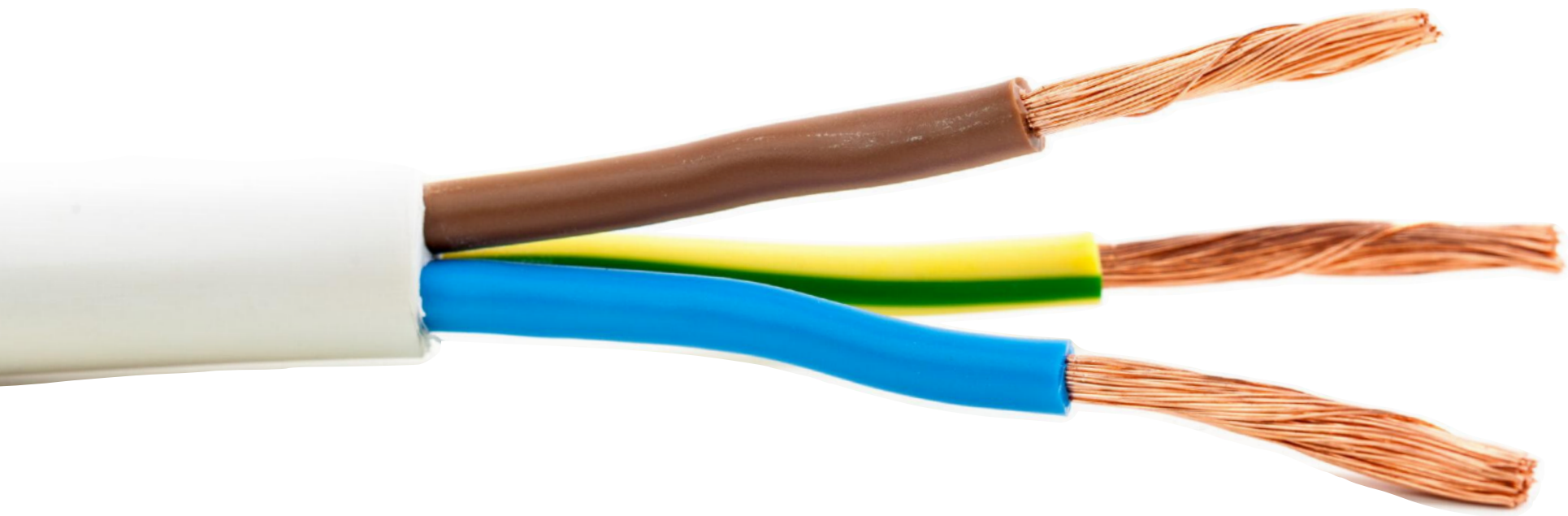
For eg, small increases in electric current are felt very sharply.



**5 milli Amp**

**Ouch!**





**5 milli Amp**

Ouch!

**10 milli Amp**

Can't let go!



100 Lumens

Bright



100 Lumens

Bright

200 Lumens



100 Lumens

Bright

200 Lumens

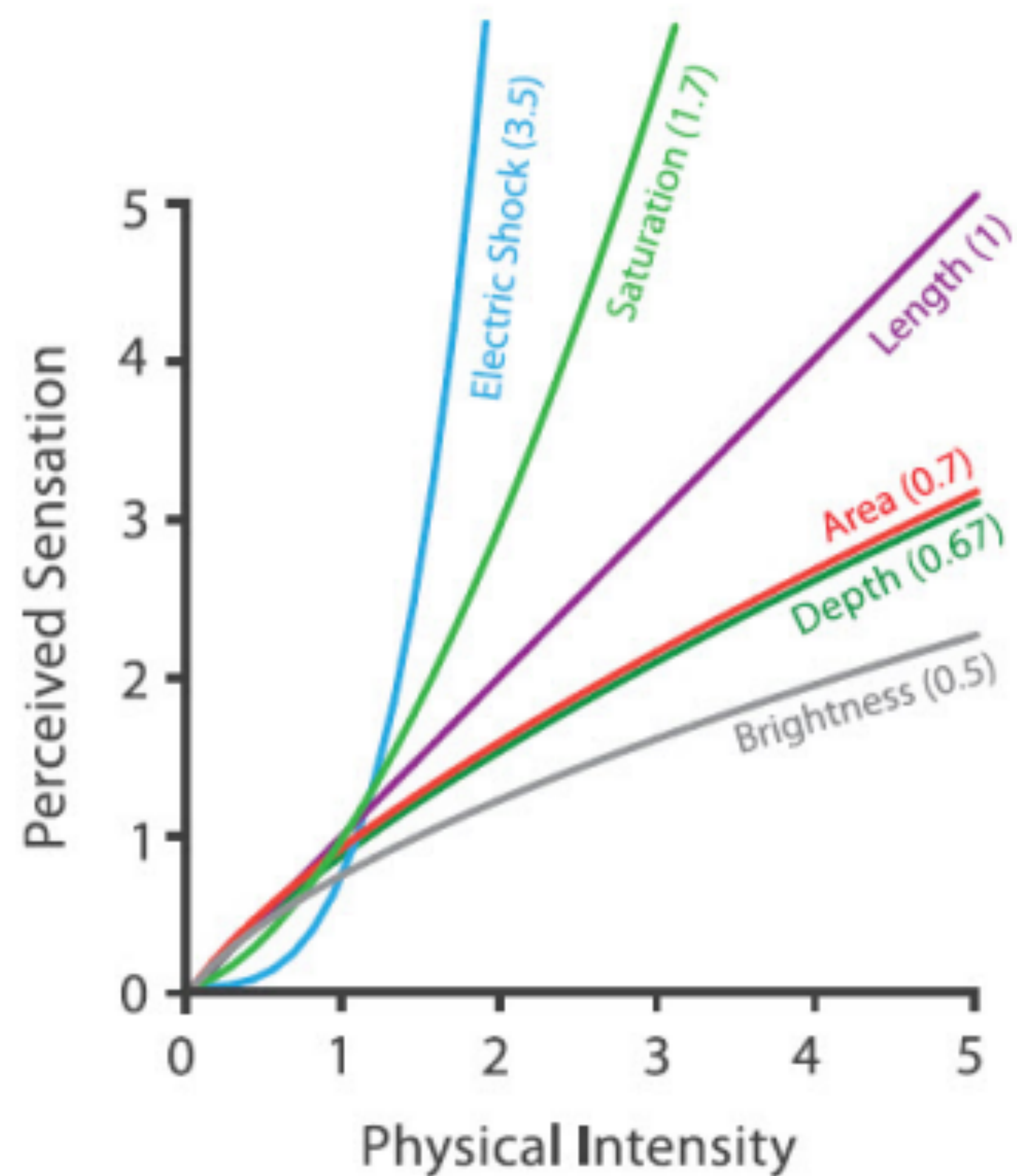
Only a little brighter



## Visual Perception

# Steven's Psychophysical Power Law

Difference in brightness is harder to tell apart for humans, and the least amount of brightness difference required for two sources to be identifiably different is also higher.



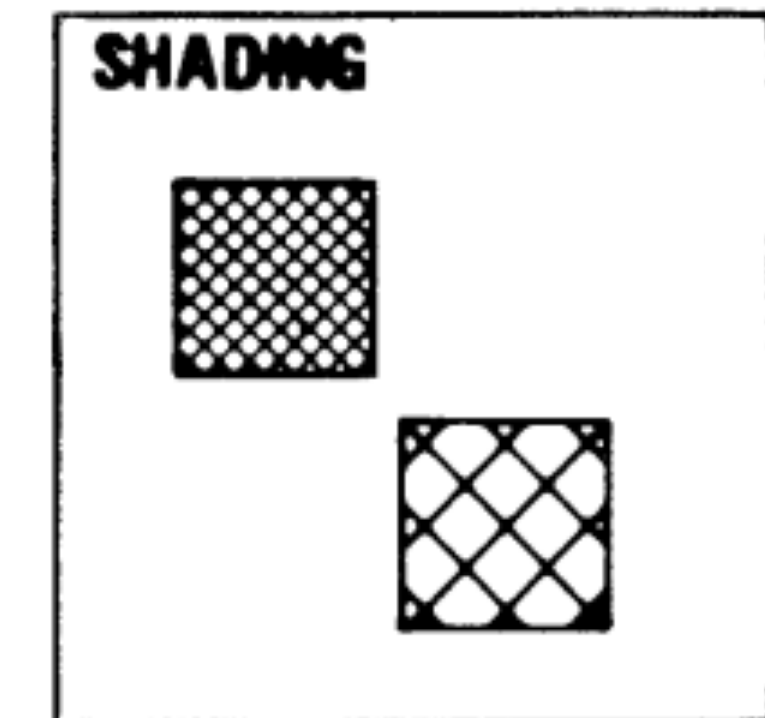
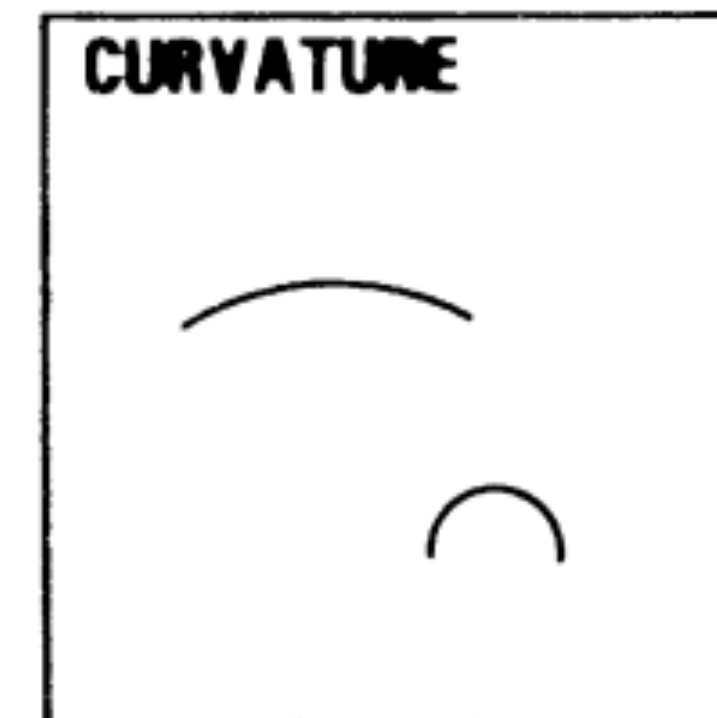
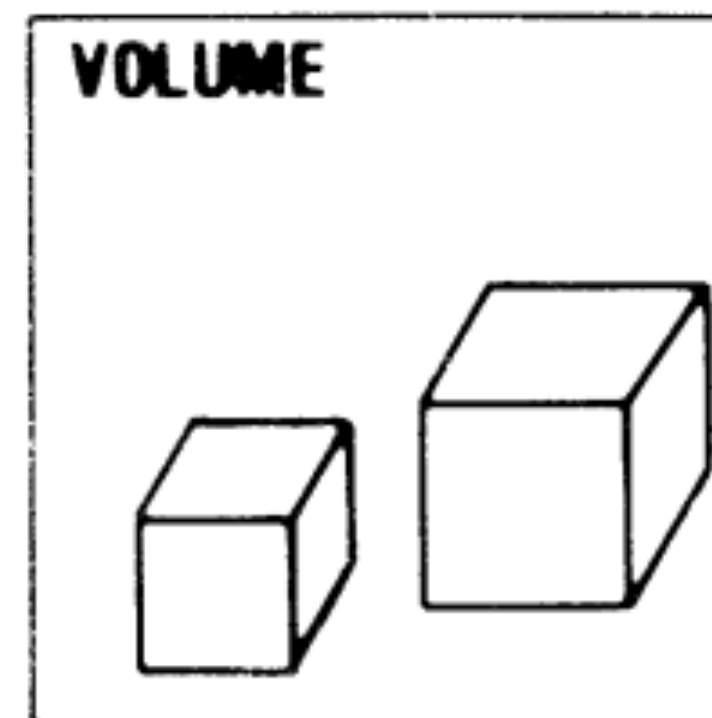
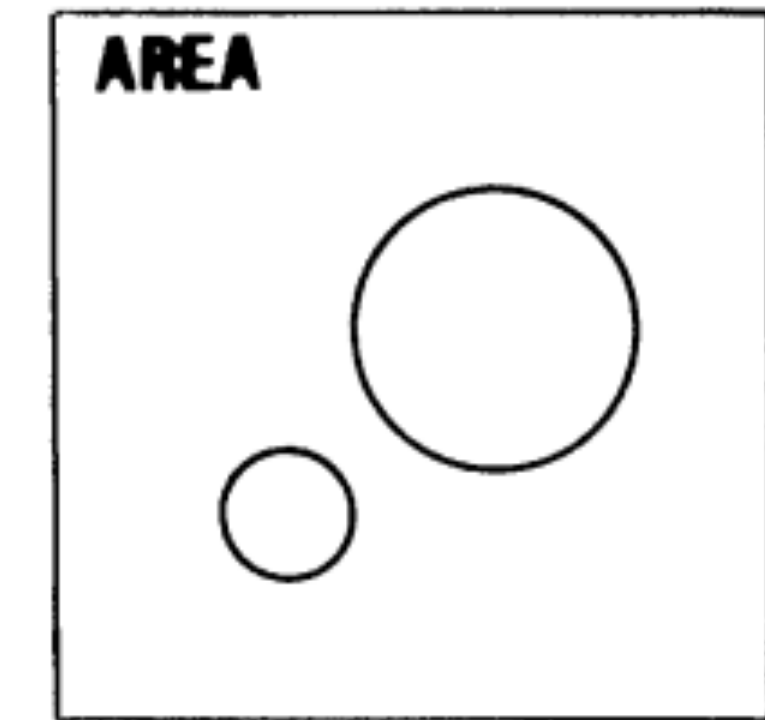
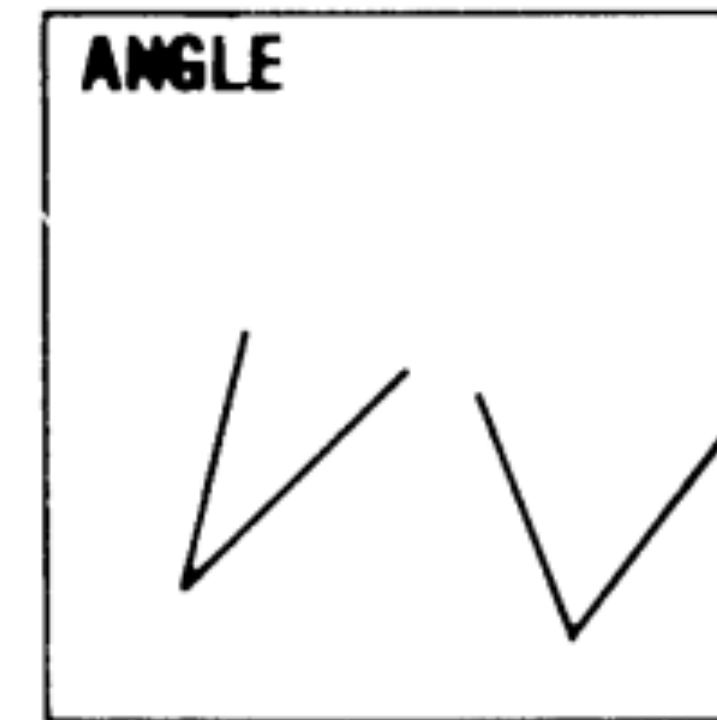
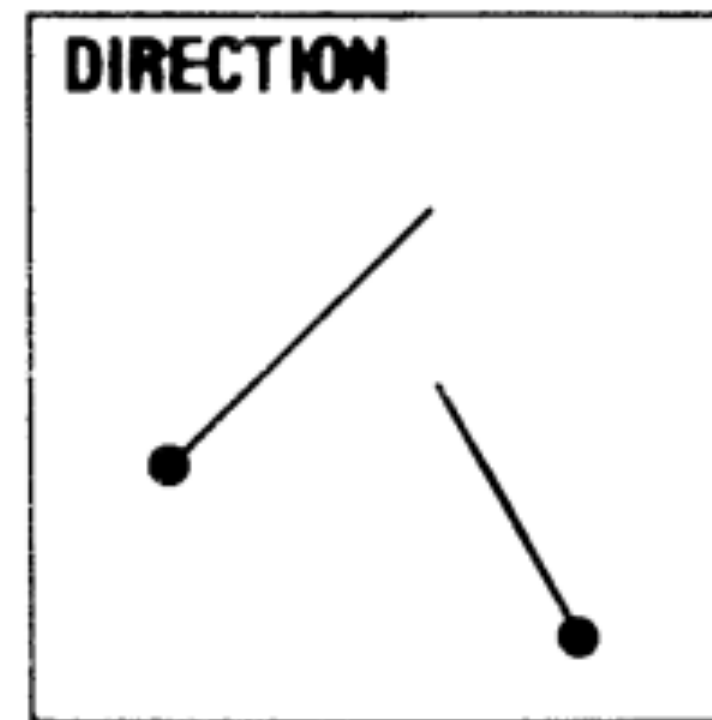
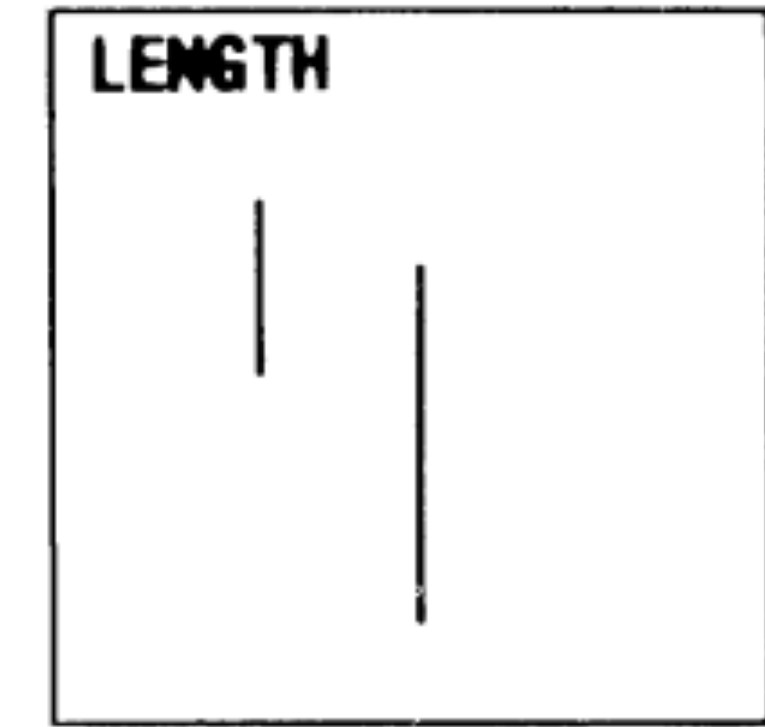
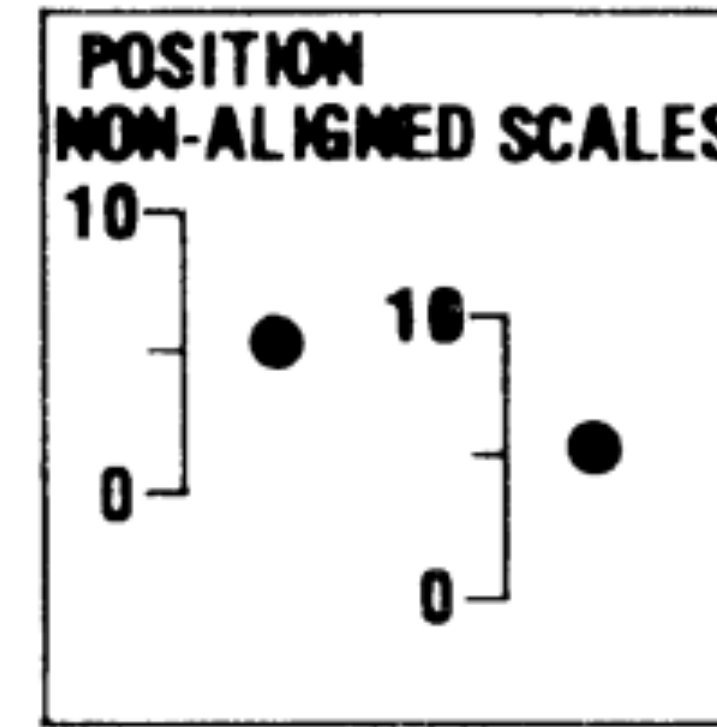
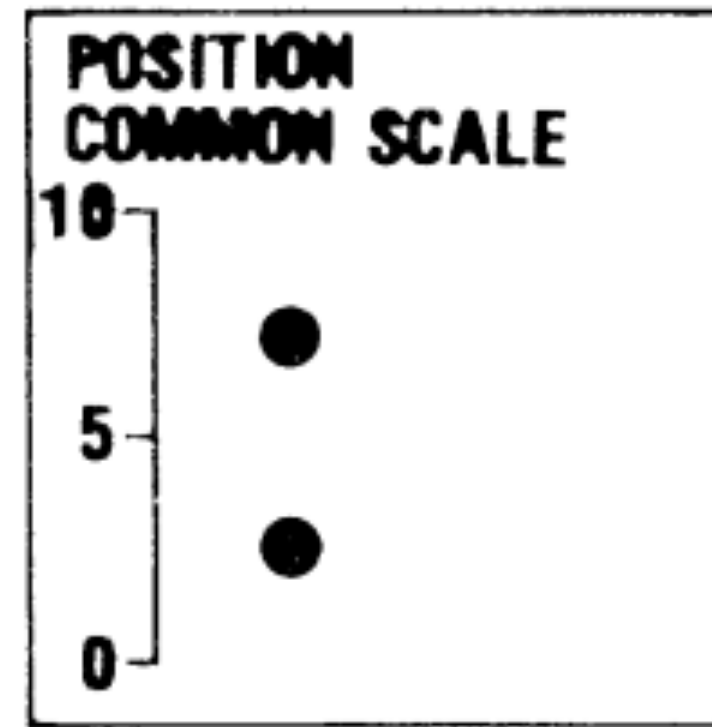
# Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods

## Author(s):

William S. Cleveland and Robert McGill

## Source:

Journal of the American Statistical Association, Sep., 1984, Vol. 79, No. 387 (Sep., 1984), pp. 531-554



**COLOR SATURATION**



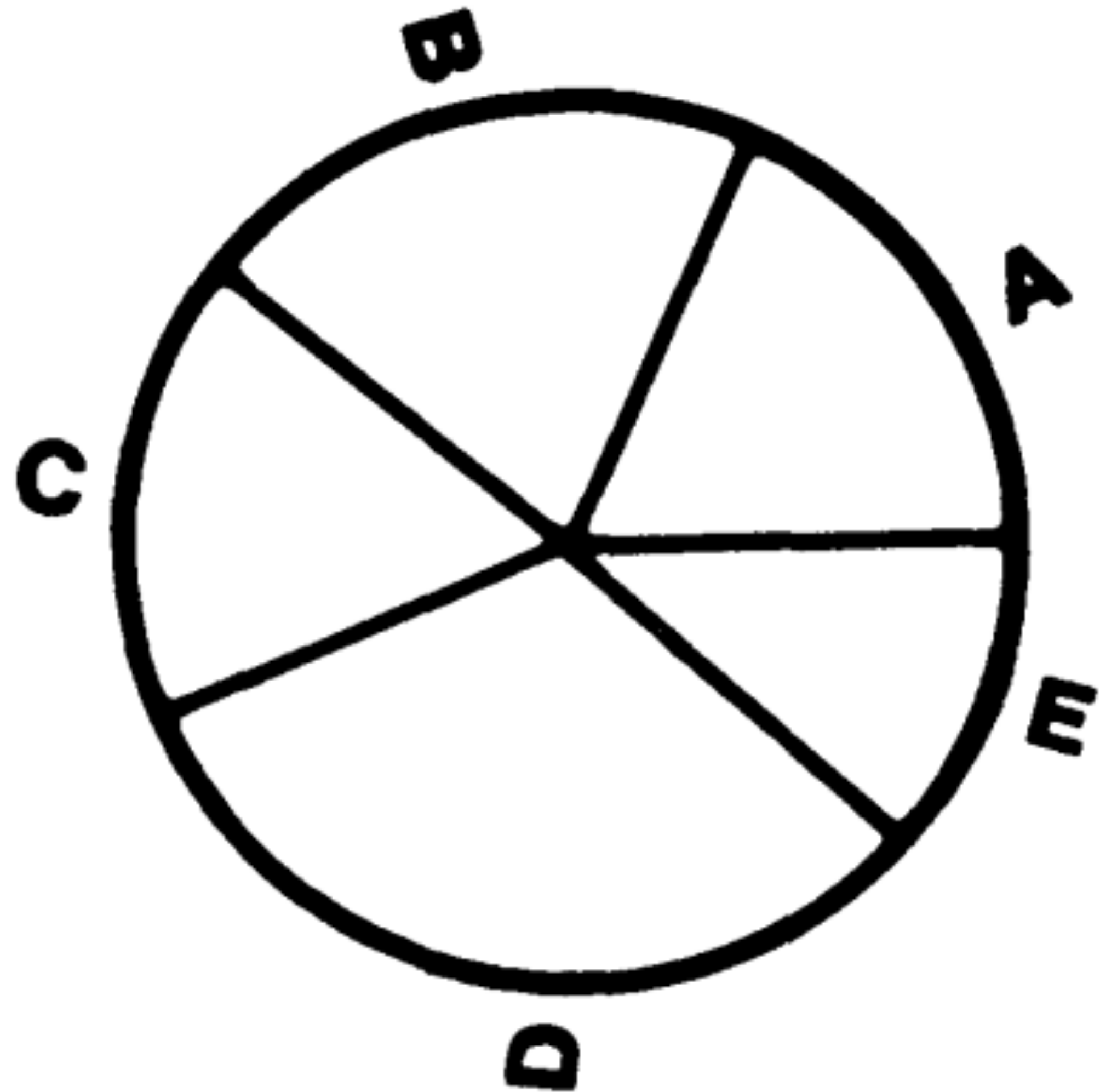
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McGill

**Source:**

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Association , Sep., 1984, Vol. 79,  
No. 387 (Sep., 1984), pp.  
531-554



Is A bigger or C?

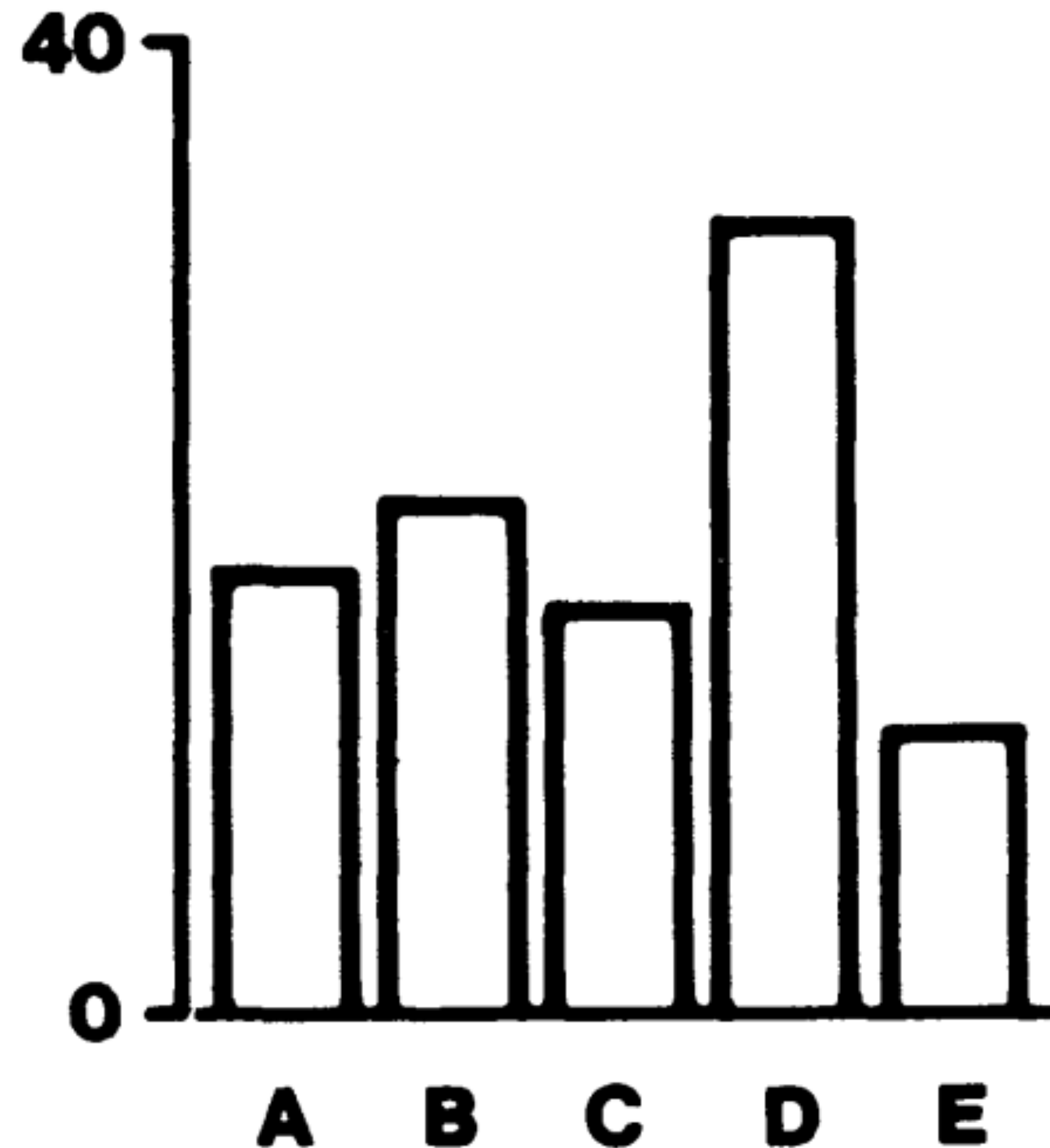
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Is A bigger or C?

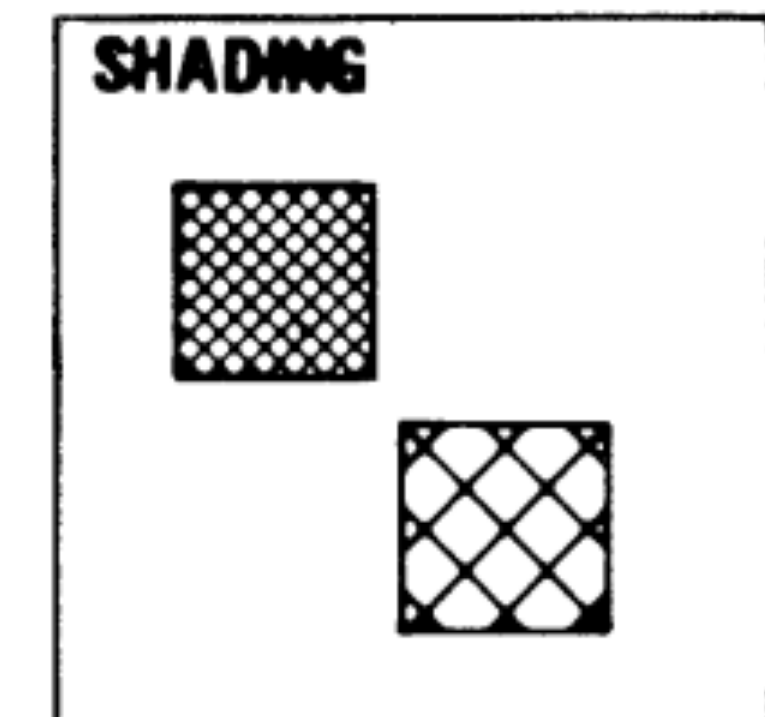
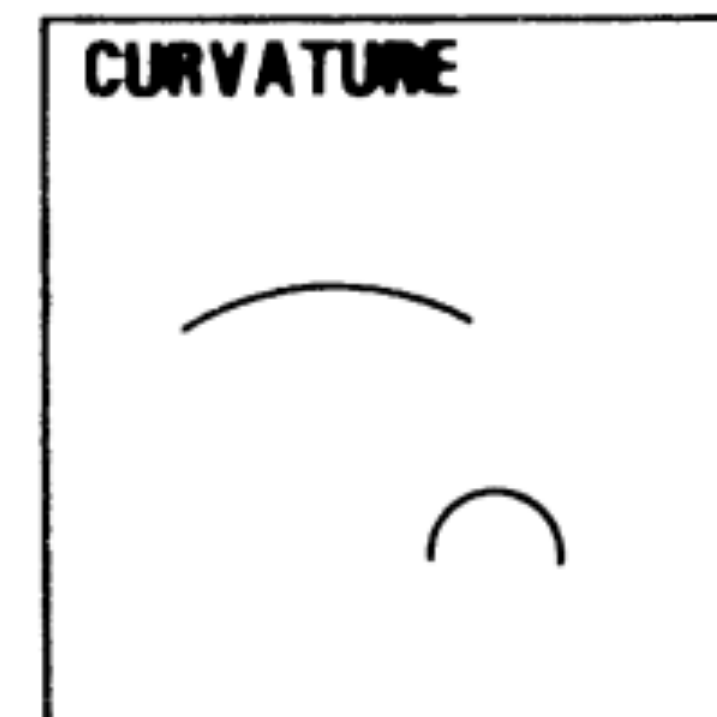
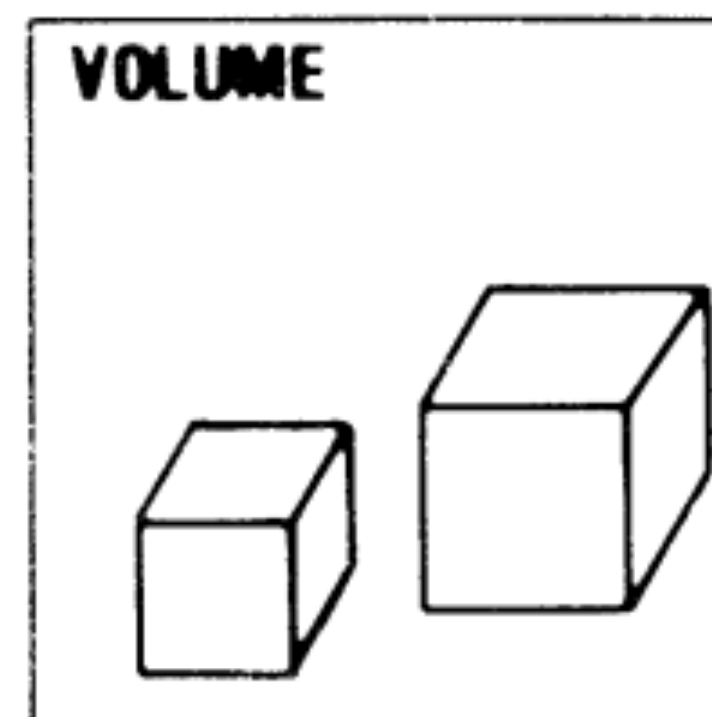
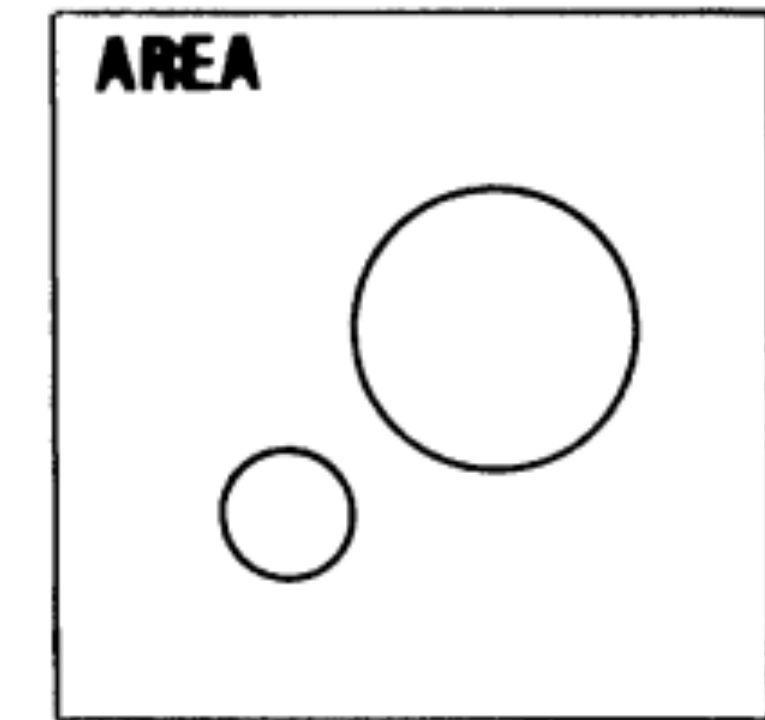
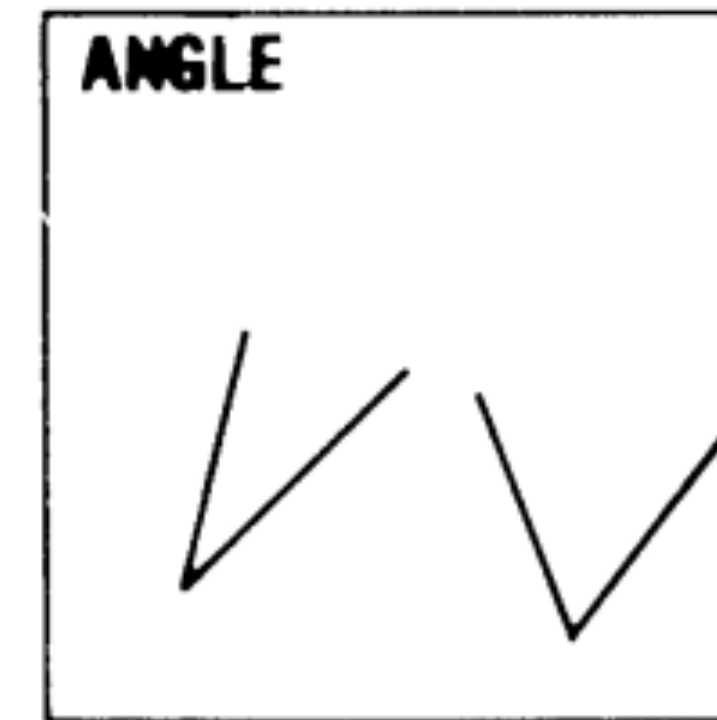
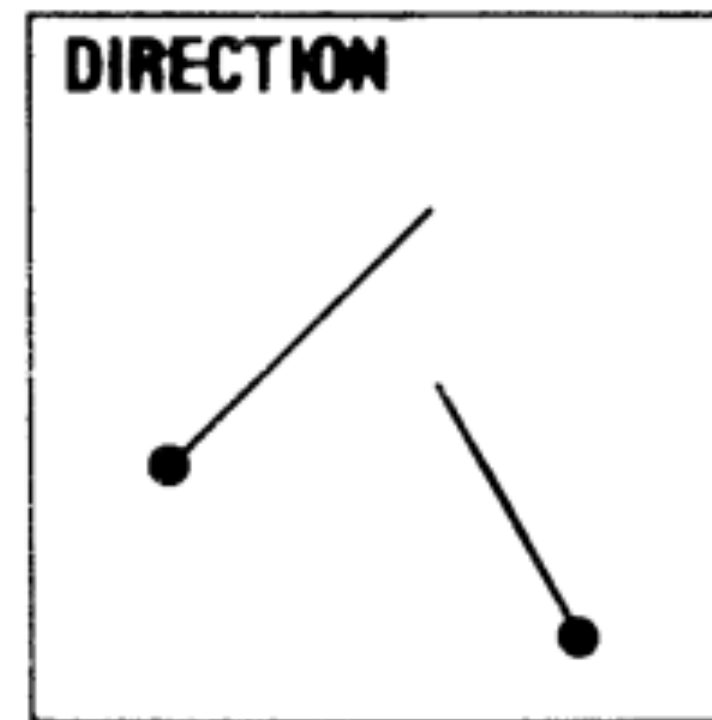
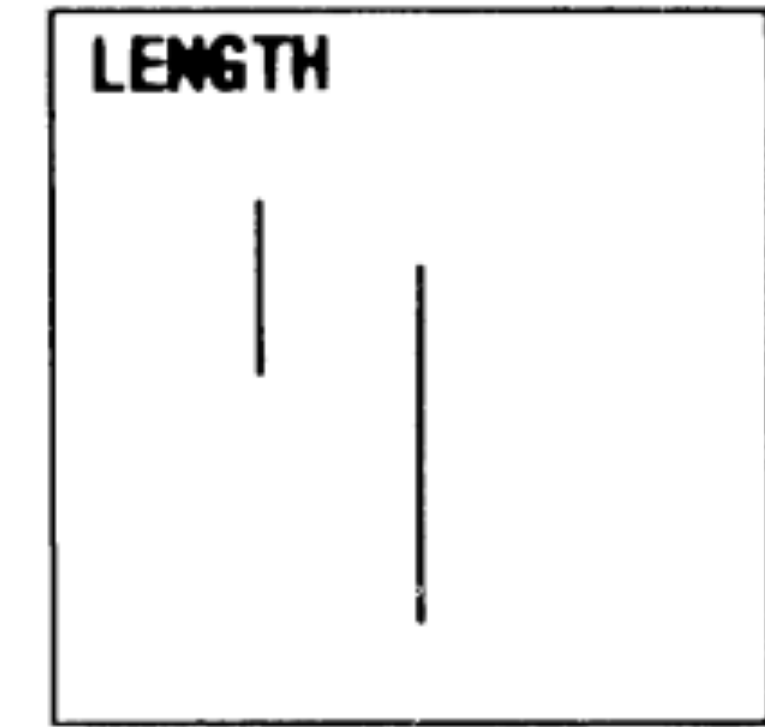
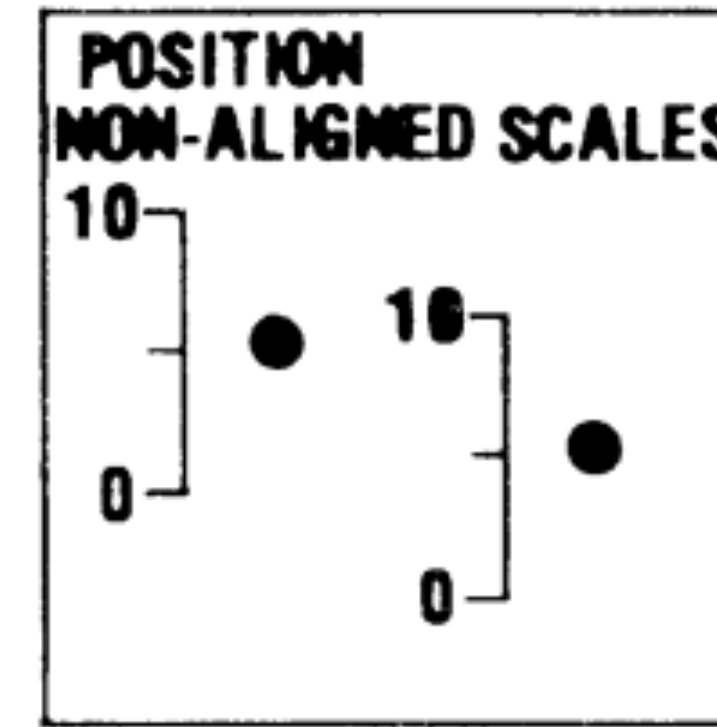
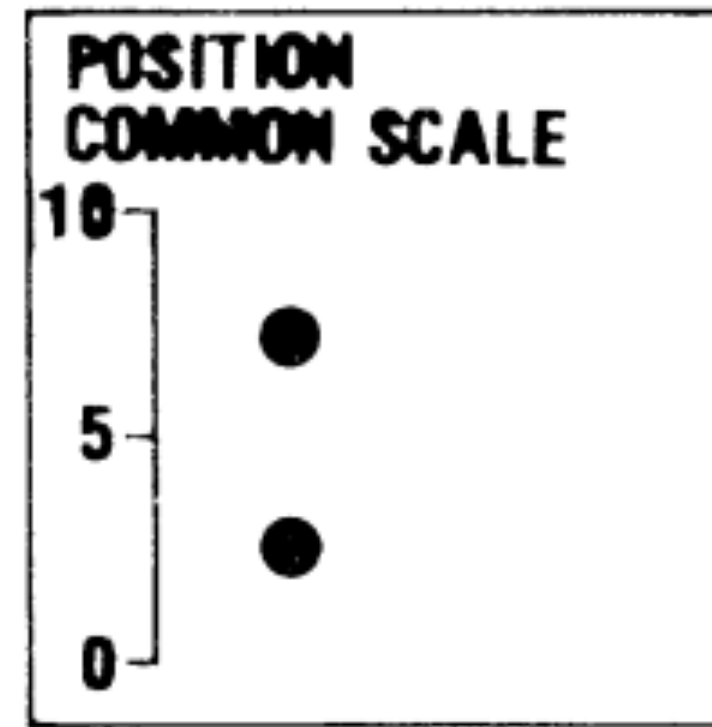
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**COLOR SATURATION**

# Takeaways

- Different encodings have a different “least noticeable difference”.
- You can pick encodings for functional or aesthetic reasons.
- There is usually a tradeoff and that is for you to decide. You can choose a technically worse encoding channel if it makes it easier to get the point across.





**Visual Perception**

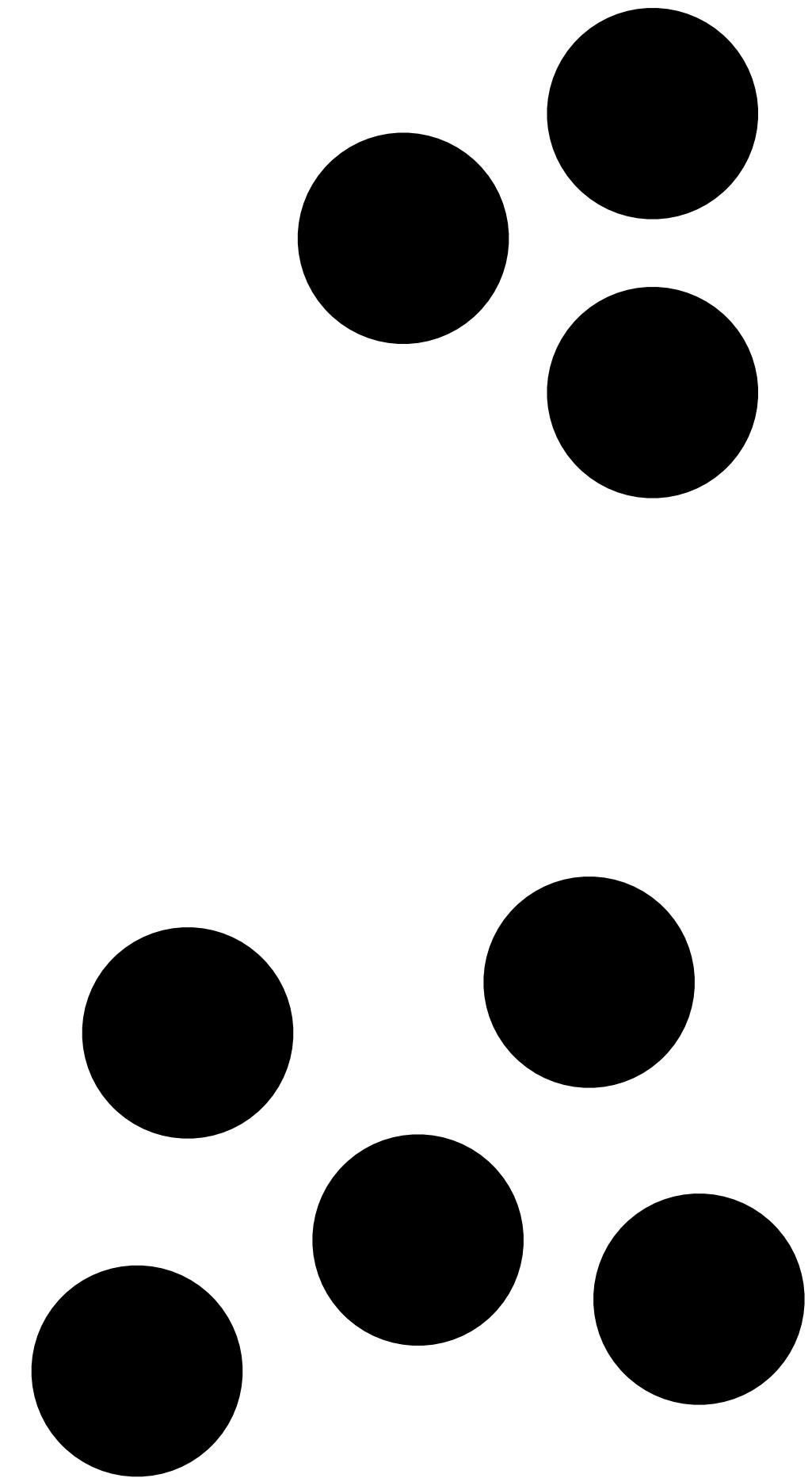
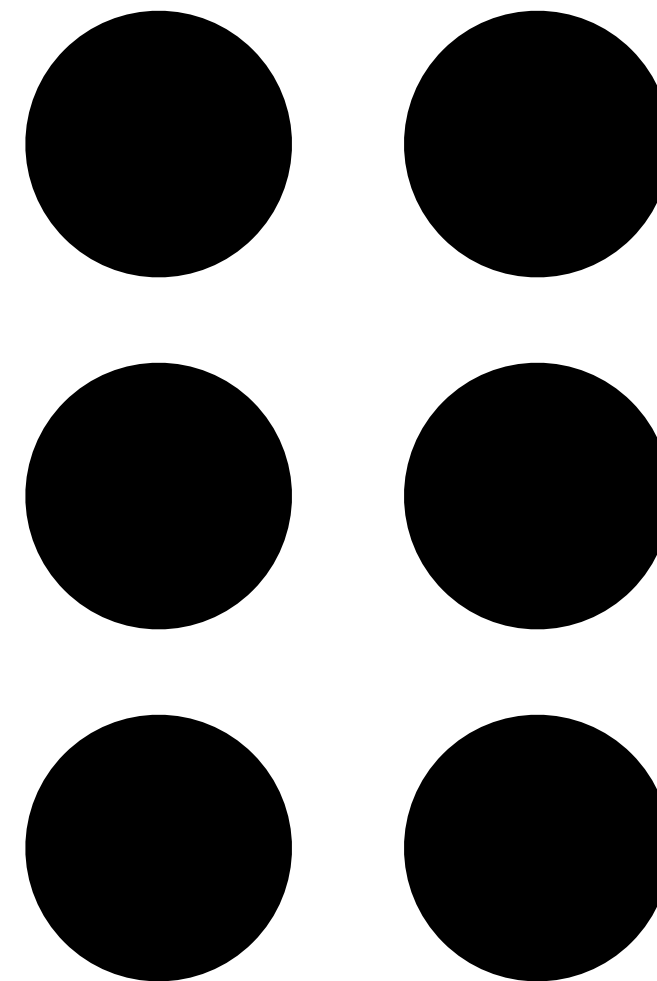
# **Gestalt Principles**

**Proximity**

## Gestalt Principles

# Proximity

Objects that are close together are perceived as a group

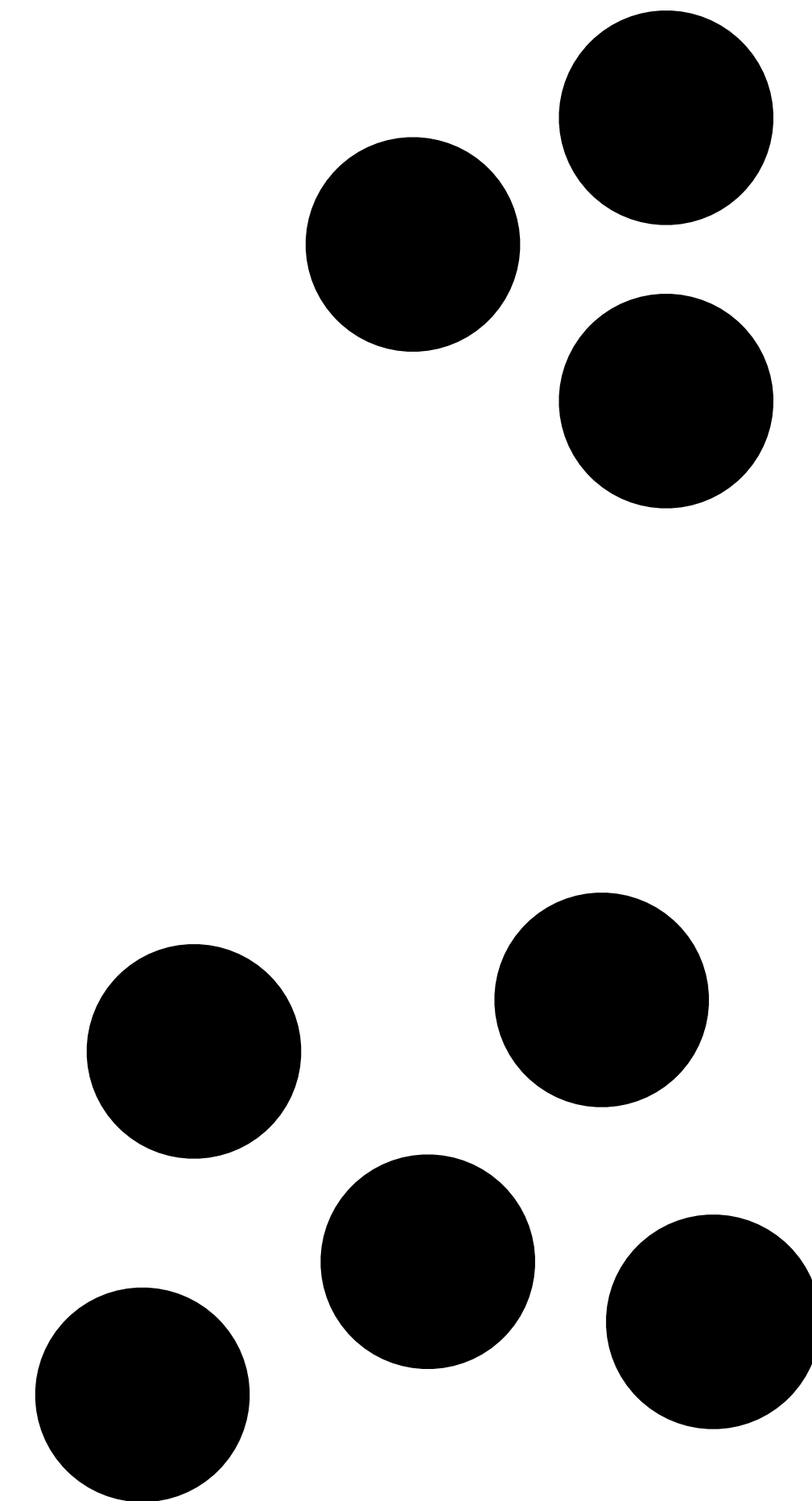
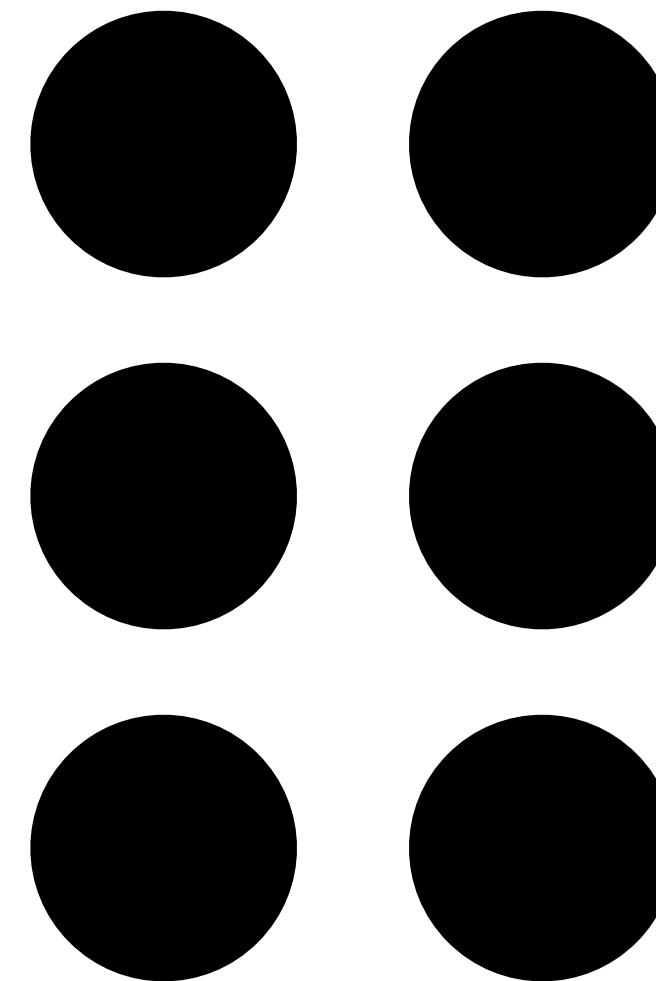




# Gestalt Principles

## Proximity

- Titles
  - Legends
  - Related Charts
  - Properties
- grouped together

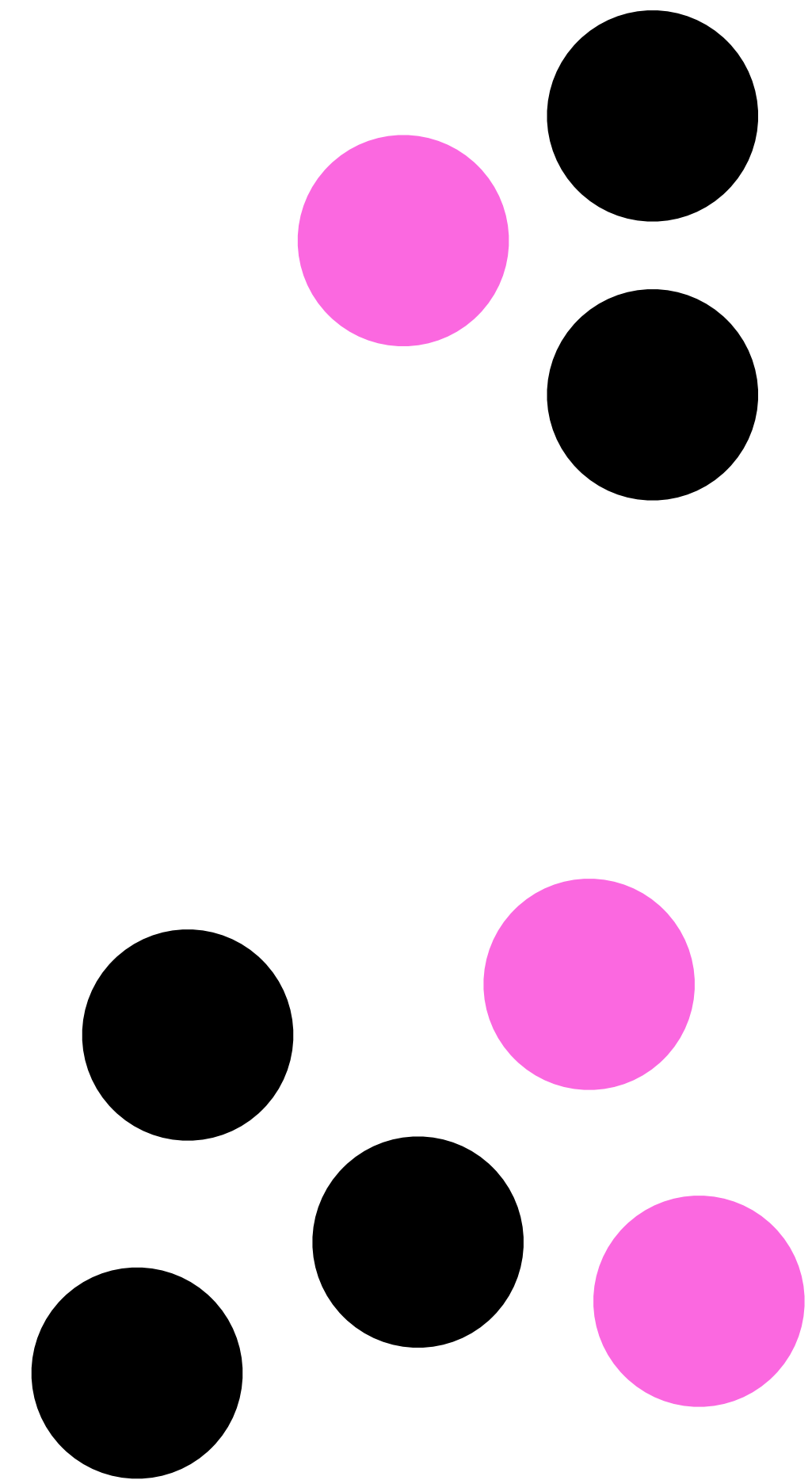
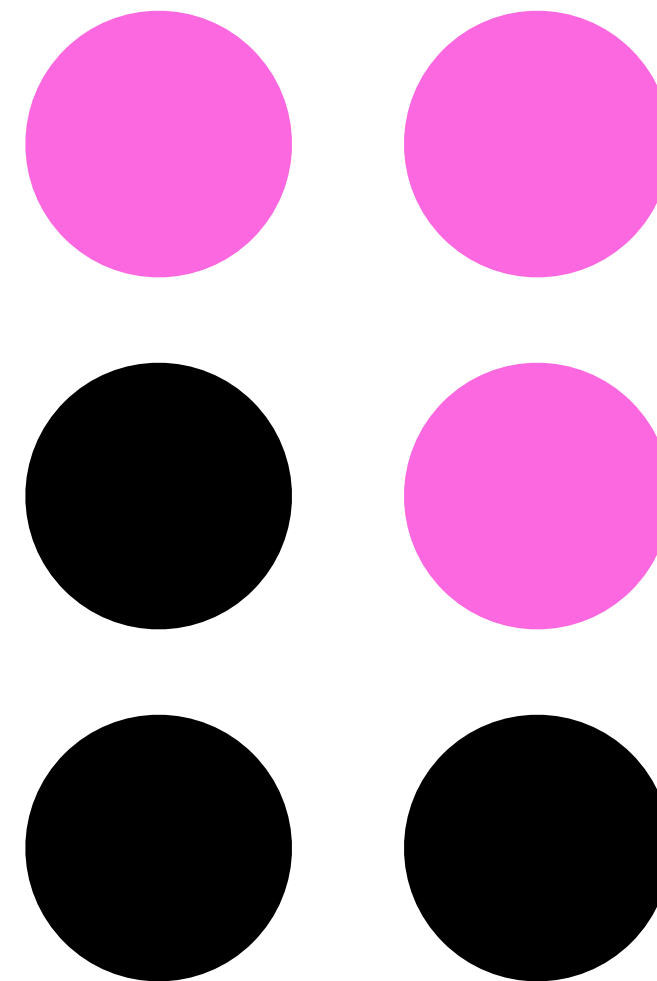


**Similiarity**

## Gestalt Principles

# Similarity

Objects with the same visual properties are assumed to be similar and are grouped together.

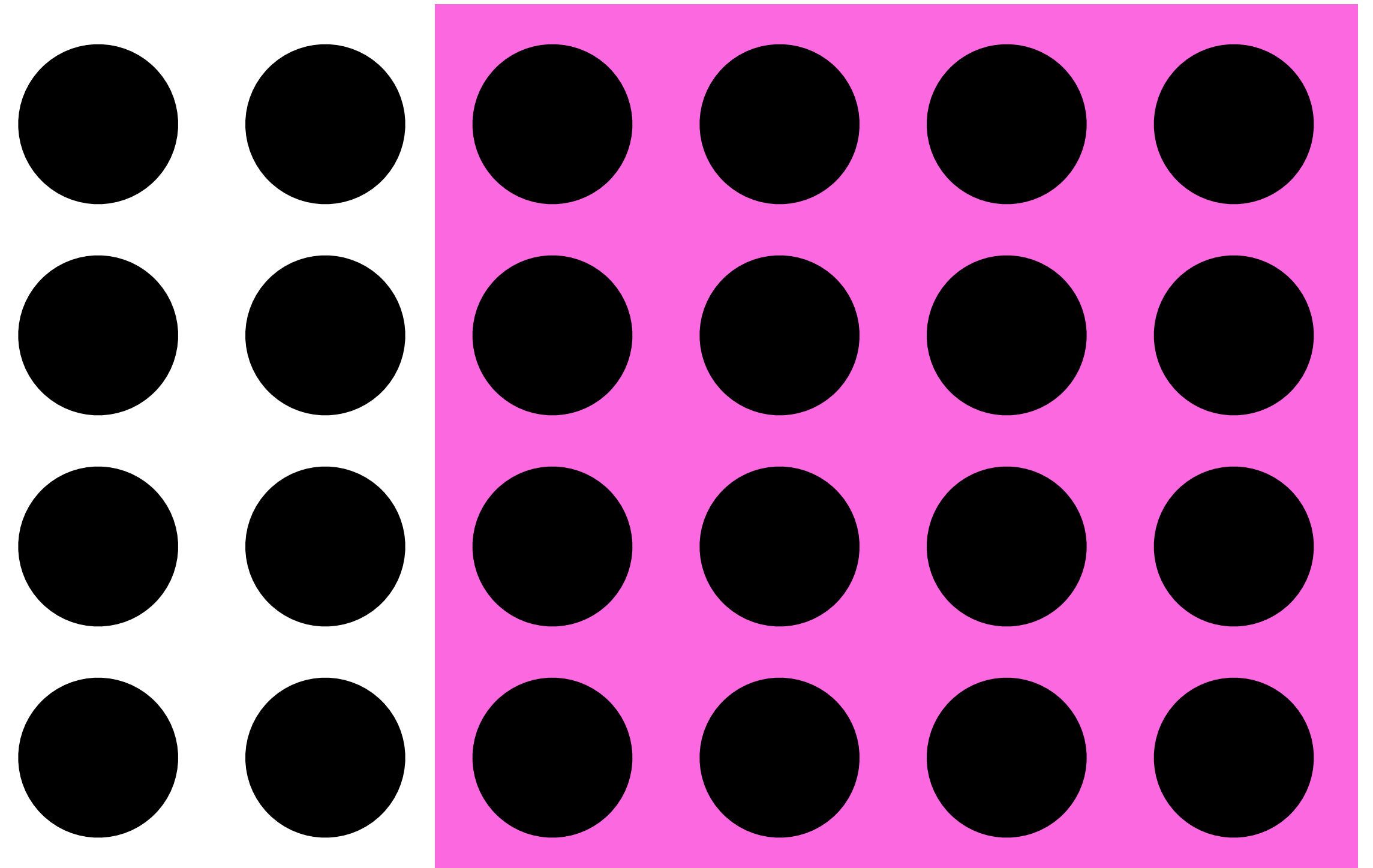


**Enclosure**

## Gestalt Principles

# Enclosure

Objects that appear to have a boundary around them (i.e., are found within the same common or enclosed region) are perceived as being related.

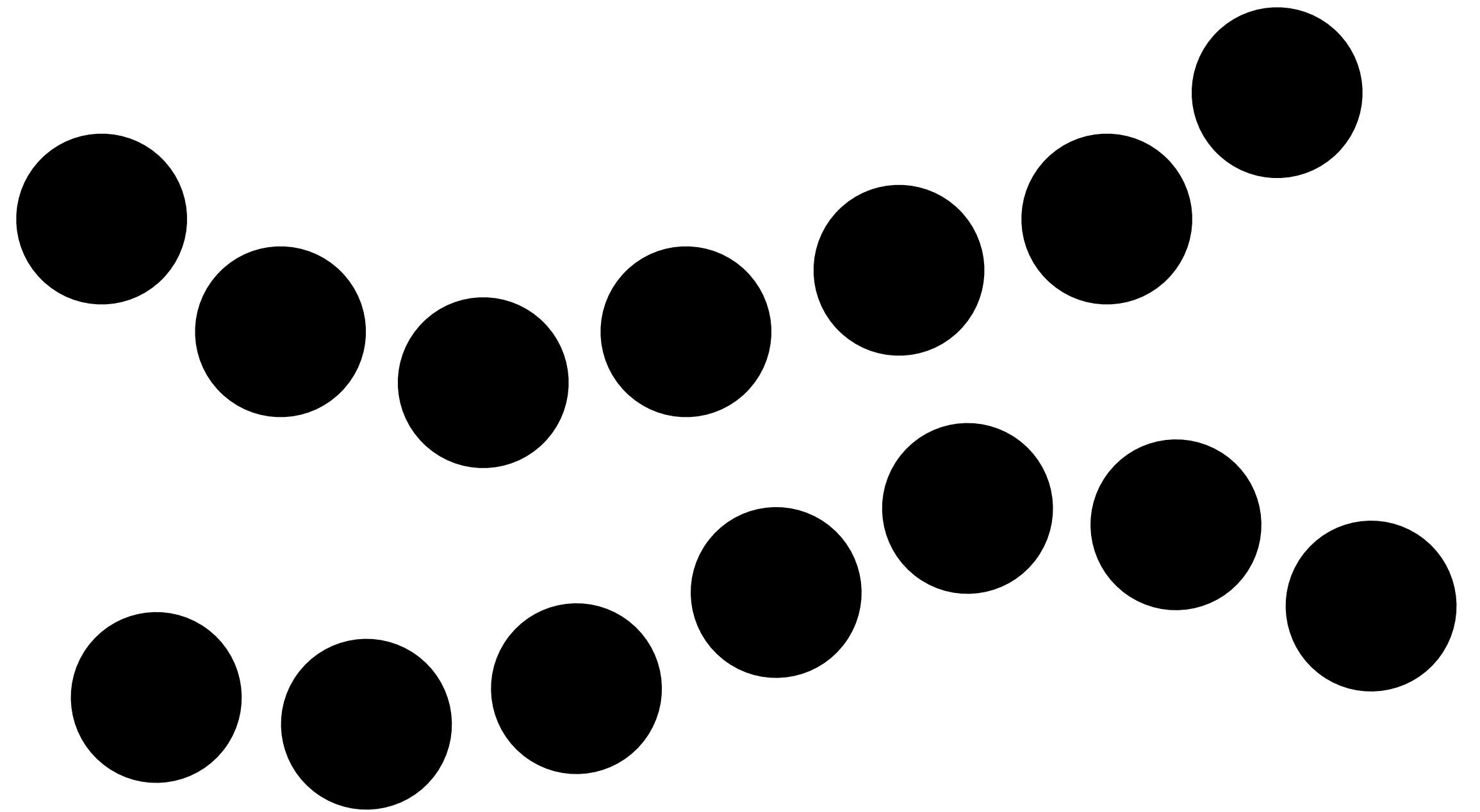


**Continuity**

## Gestalt Principles

# Continuity

Elements that are aligned (on the same line, curve, or plane) are perceived to be more closely related to each other than to other elements.



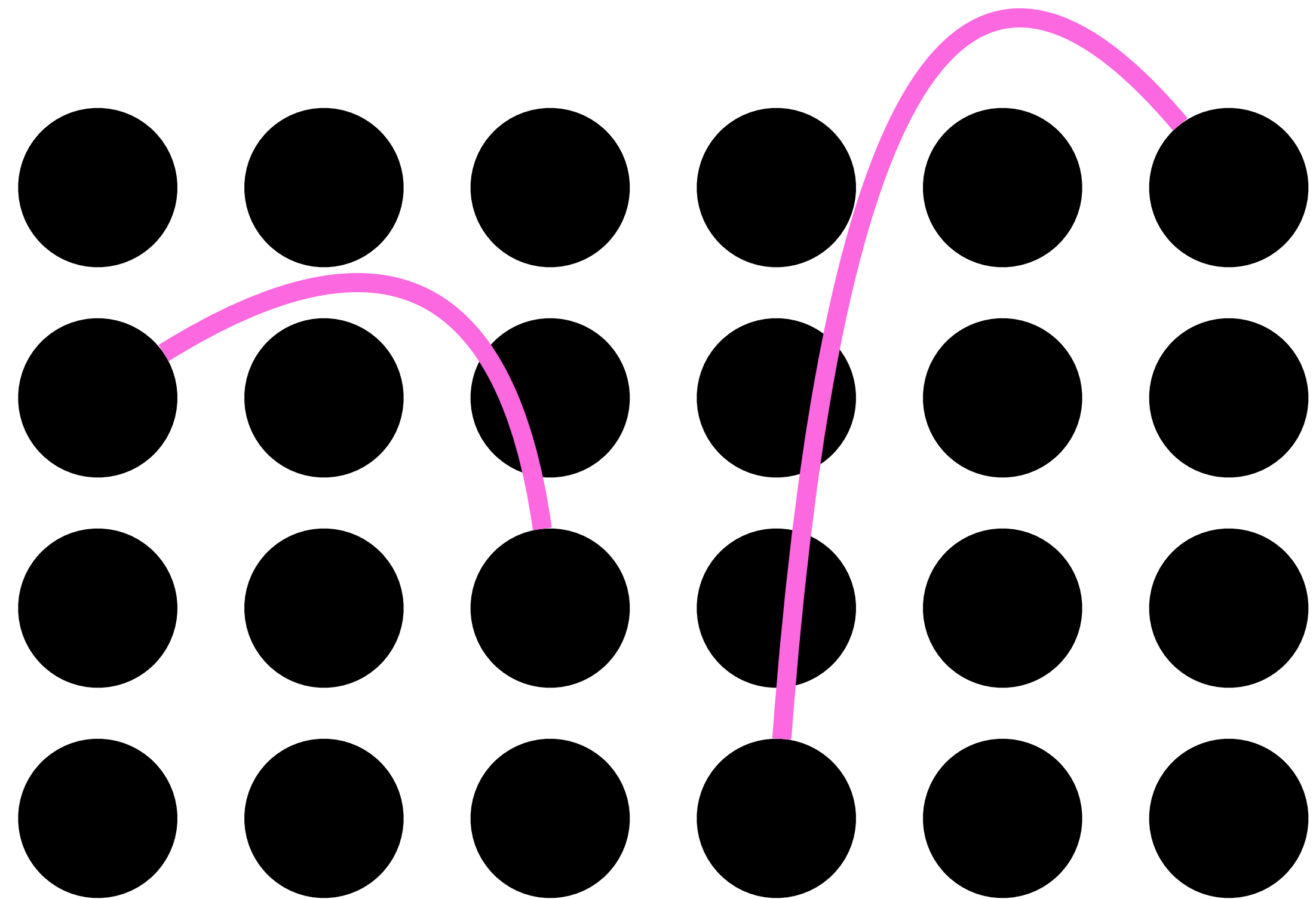
**Connection**



## Gestalt Principles

# Connection

Objects that are connected, such as by a line, are perceived as a group

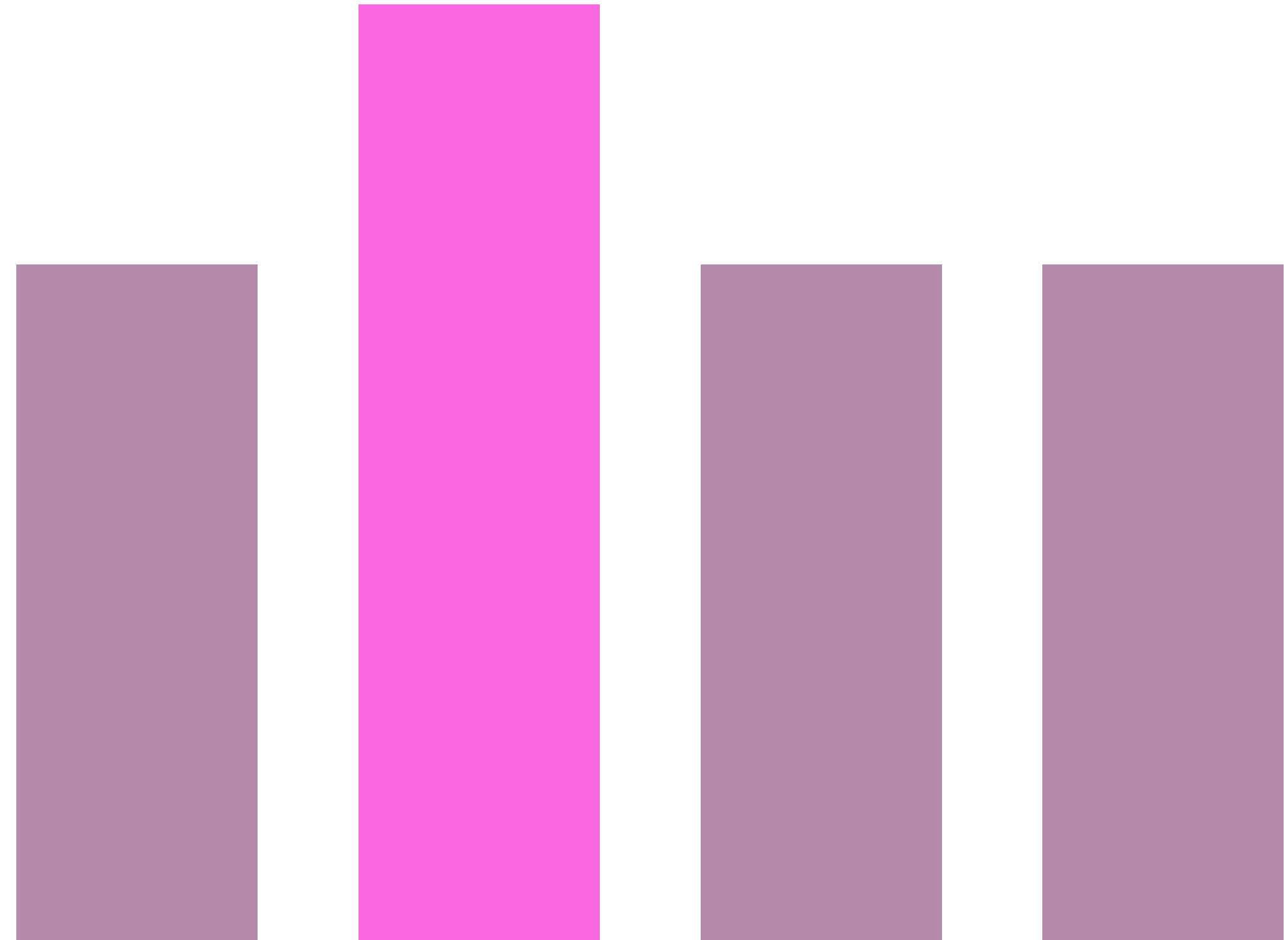


# Focal Point

## Gestalt Principles

# Focal Point

Whatever stands out visually is perceived as the most important. It will grab our attention first, and hold it for the longest.



# Figure and Ground

# Closure

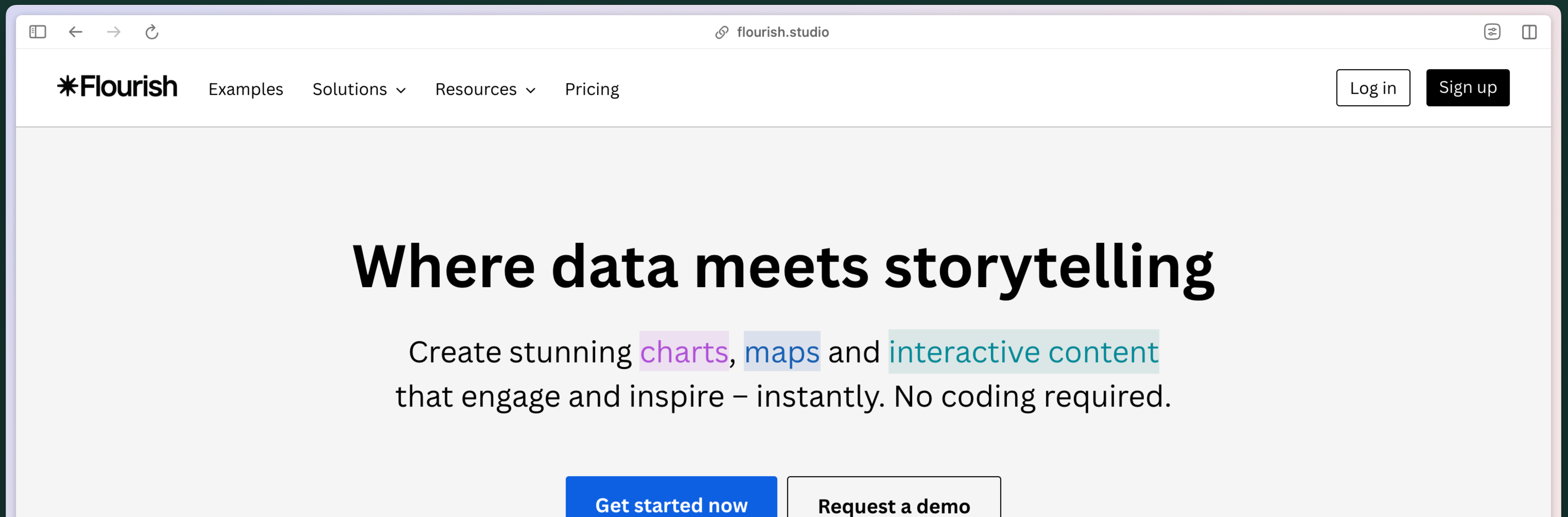
## Gestalt Principles

# How do we see?

- We don't view in a fixed order
- We see first what stands out
- We see only a few things at once
- We seek meaning and make connections
- We rely on conventions and metaphors

Flourish

www.flourish.studio



\*Flourish

Examples

Solutions ▾

Resources ▾

Pricing

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Sign up

# Where data meets storytelling

Create stunning **charts**, **maps** and **interactive content** that engage and inspire – instantly. No coding required.

Get started now

Request a demo

# Visual Perception and Encoding

- Using special properties of the visual system to help us think.
- Your visual system is good at specific tasks.
- All visualizations are made from a series of compromises.