

Lecture 4

**DD 324:
Data Visualisation**

Human Visual Perception

Exercise

Data Visualisation Tools

The screenshot shows a web browser window with the URL gyanl.com in the address bar. The page content is as follows:

Data Visualization About Syllabus Light Mode

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 in the address bar. The page content is as follows:

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.

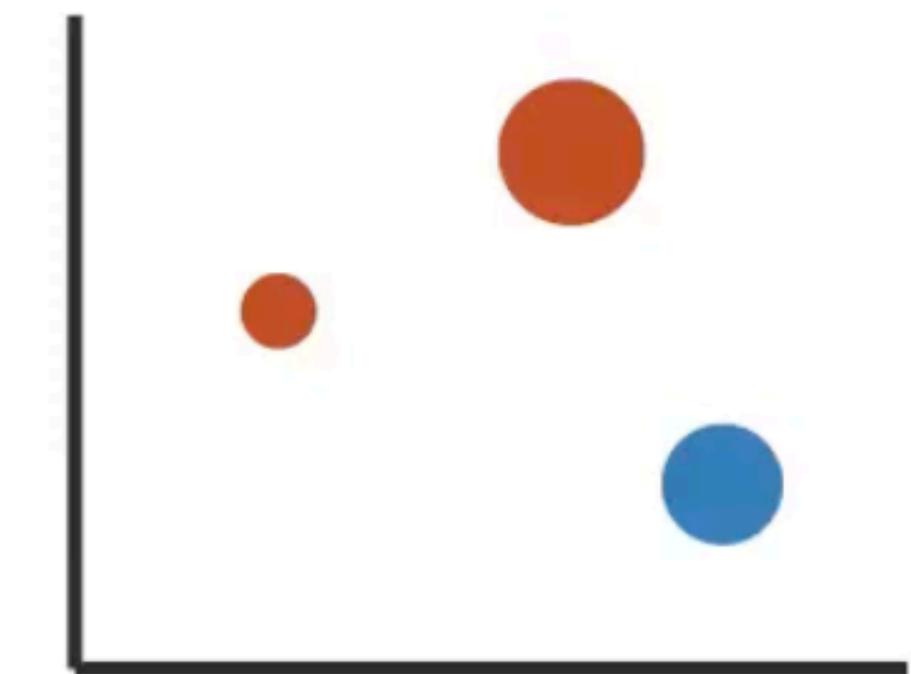
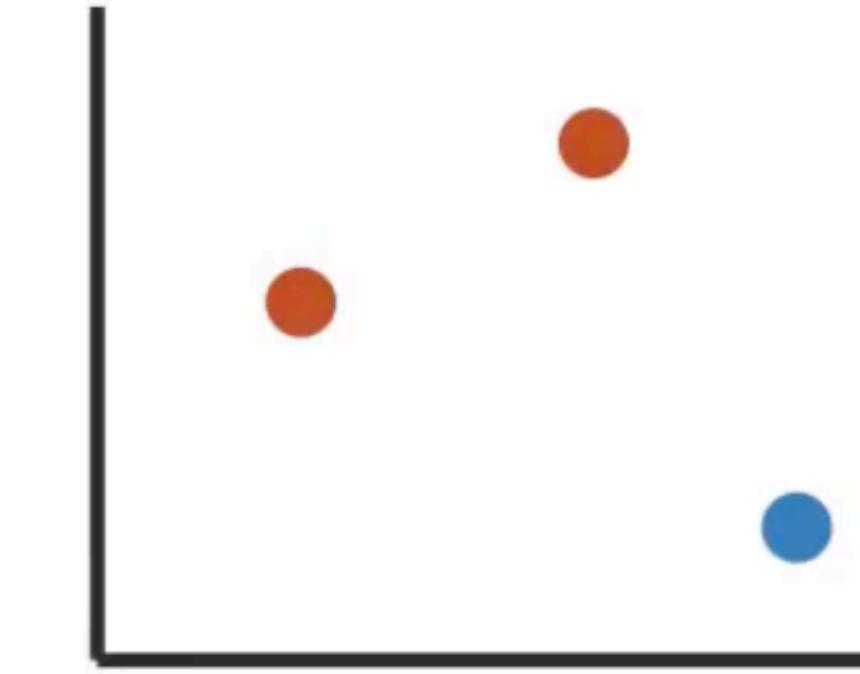
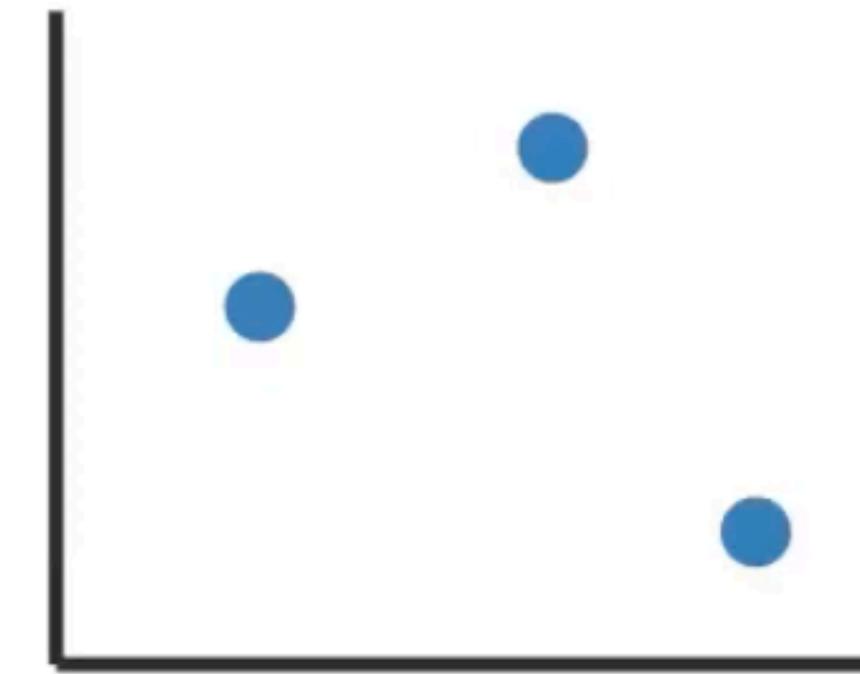
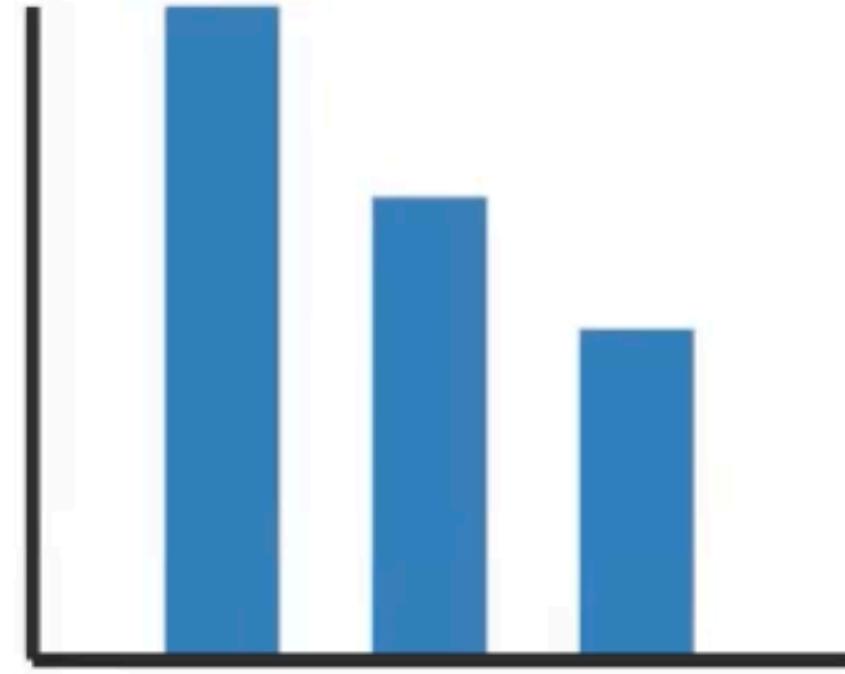
They also have a project called [1 dataset. 100 visualizations.](#) which visualises a small table in 100 different ways.

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

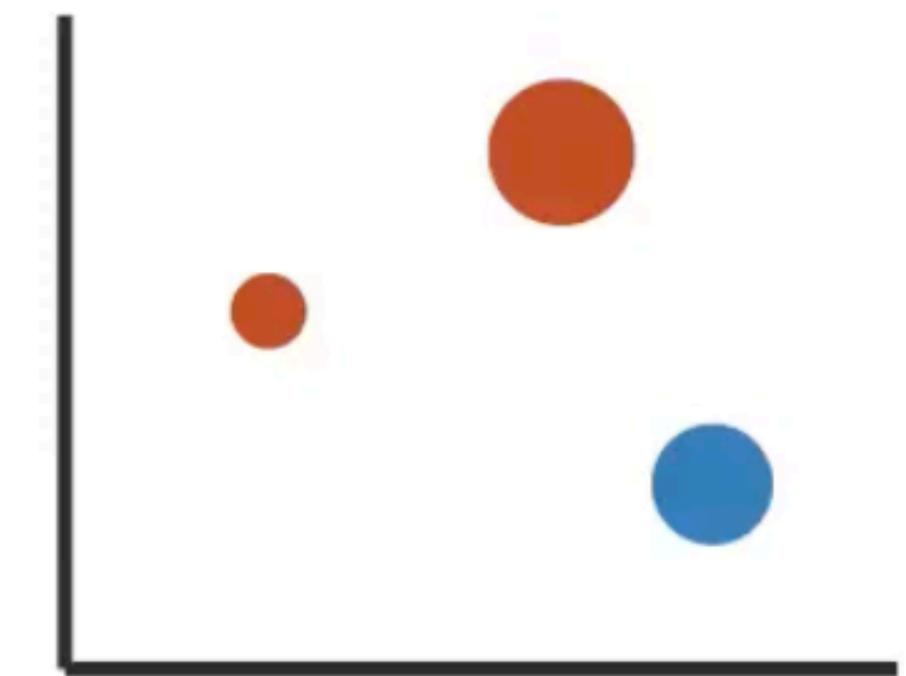
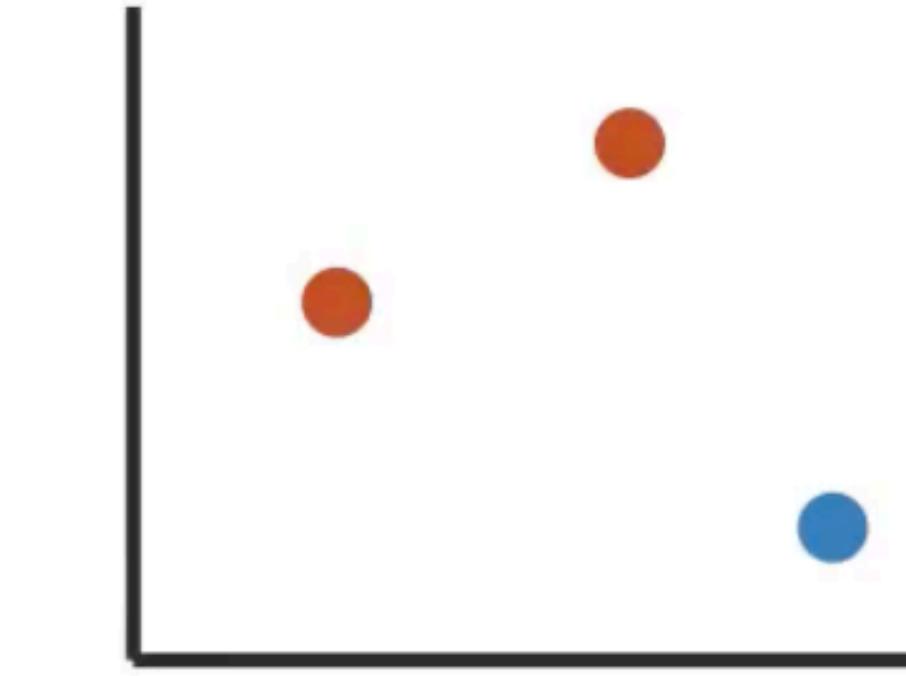
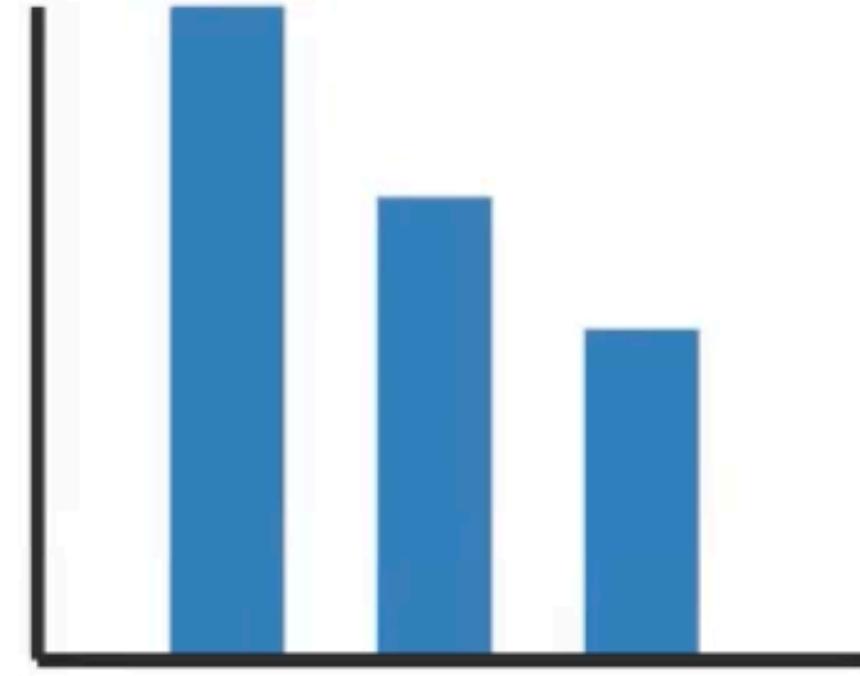
Instructions

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



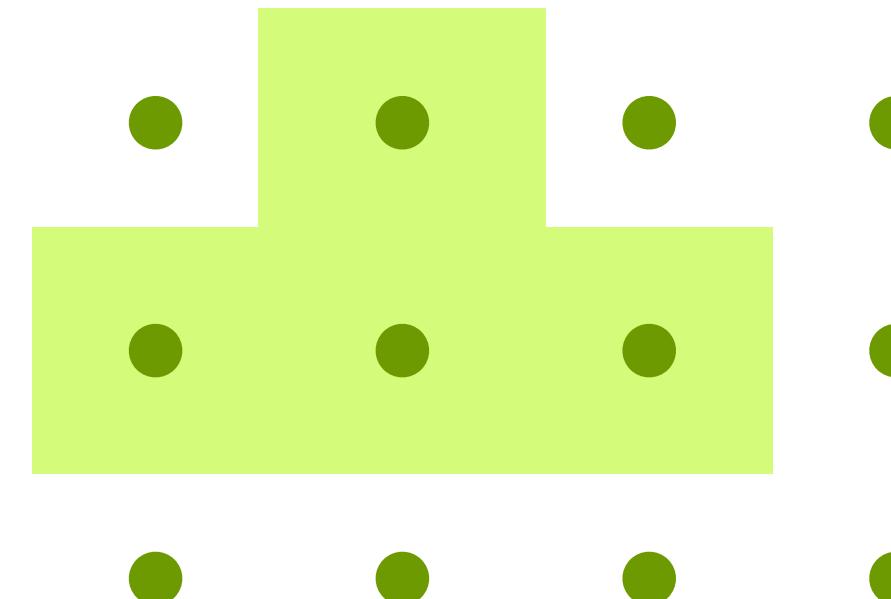
3D - Volume



Marks

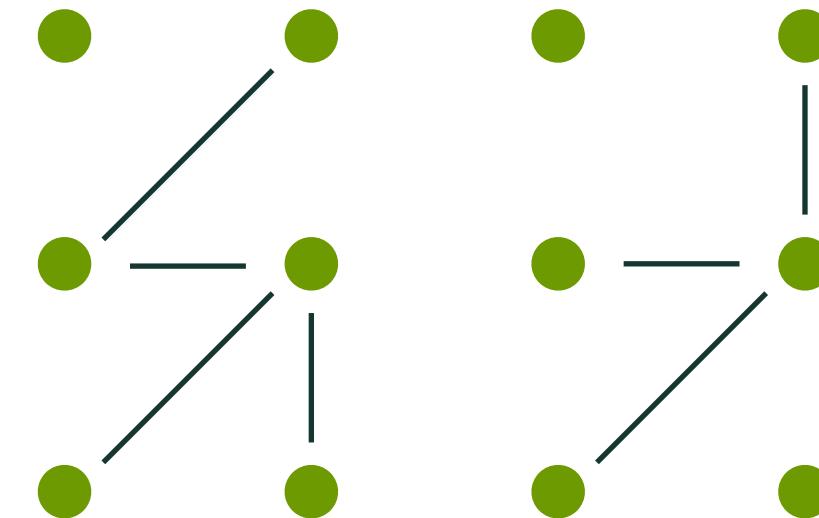
Represent items or links

Containment



Represent items or links

Connection



Channels

Change appearance of marks based on attributes

Nominal Ordinal Interval Ratio
Categorical

④ Identity Channels: Categorical Attributes

Spatial region



Color hue



Motion



Shape



Most ▲

Effectiveness

▼ Least

Channels

Change appearance of marks based on attributes

Nominal Ordinal Interval Ratio

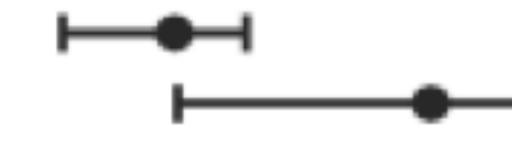
Magnitude

④ Magnitude Channels: Ordered Attributes

Position on common scale



Position on unaligned scale



Length (1D size)



Tilt/angle



Area (2D size)



Depth (3D position)



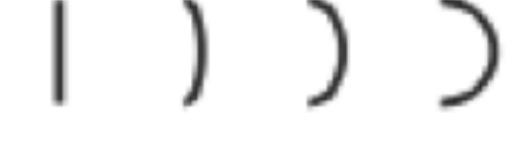
Color luminance



Color saturation



Curvature



Volume (3D size)



Effectiveness ▲ Least ▼ Same ▲ Most



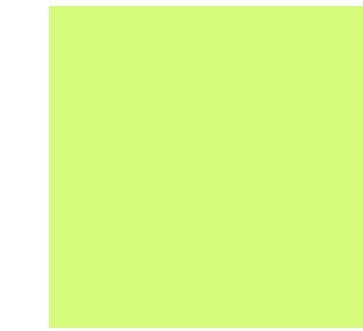
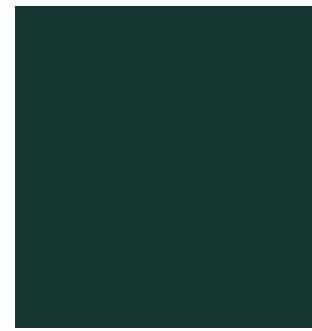
More than 1 channel
can be used at the same
time

Area (2D size)





Area



Color Saturation

More than 1 channel
can be used at the same
time

Area (2D size)



Color saturation





Area

More than 1 channel
can be used at the same
time

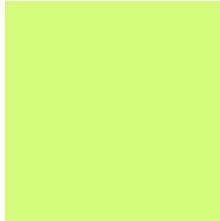


Area (2D size)



Color Saturation

Color saturation



Area and Color Saturation

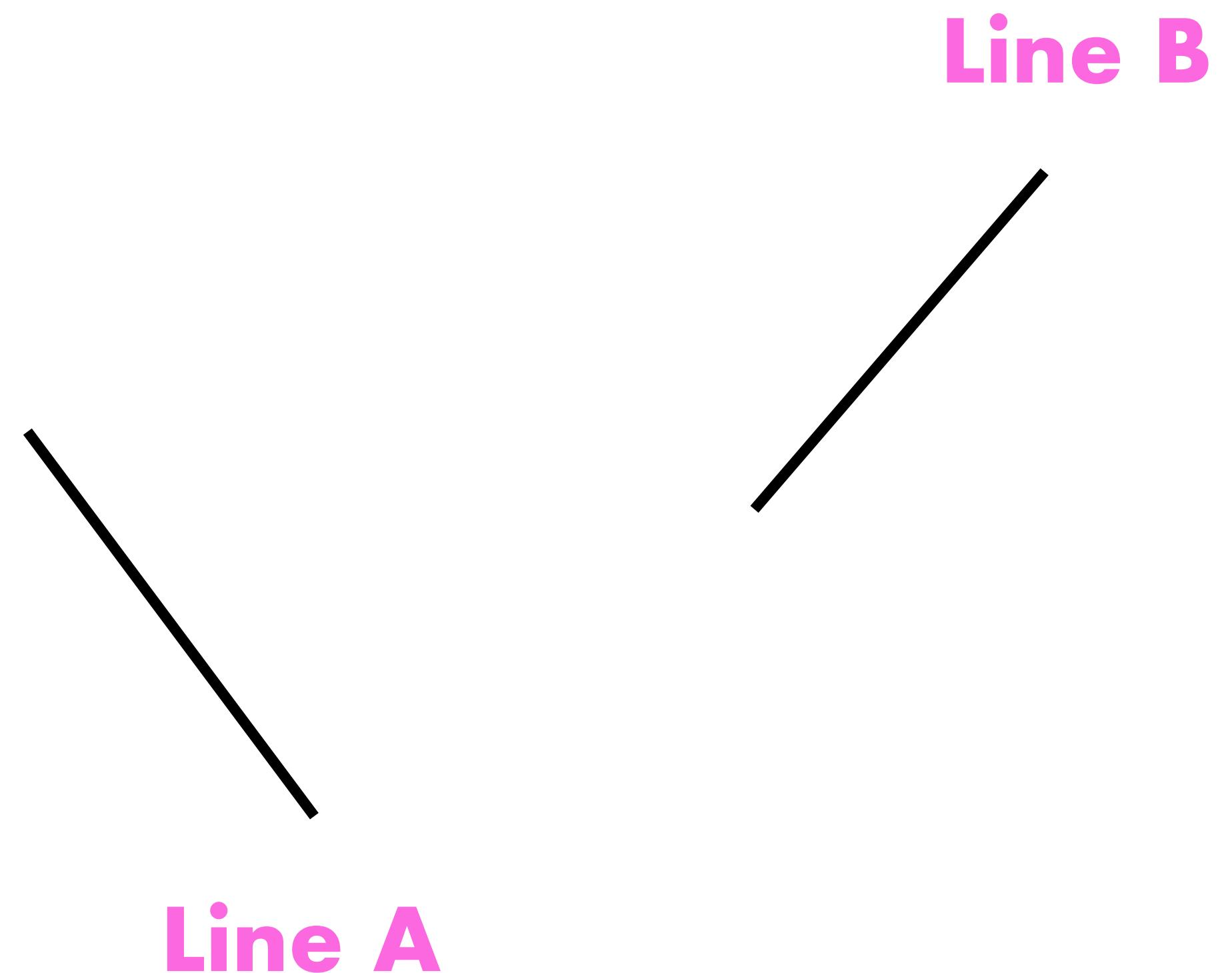
Lecture 4

DD 324:
Data Visualisation

Human Visual Perception

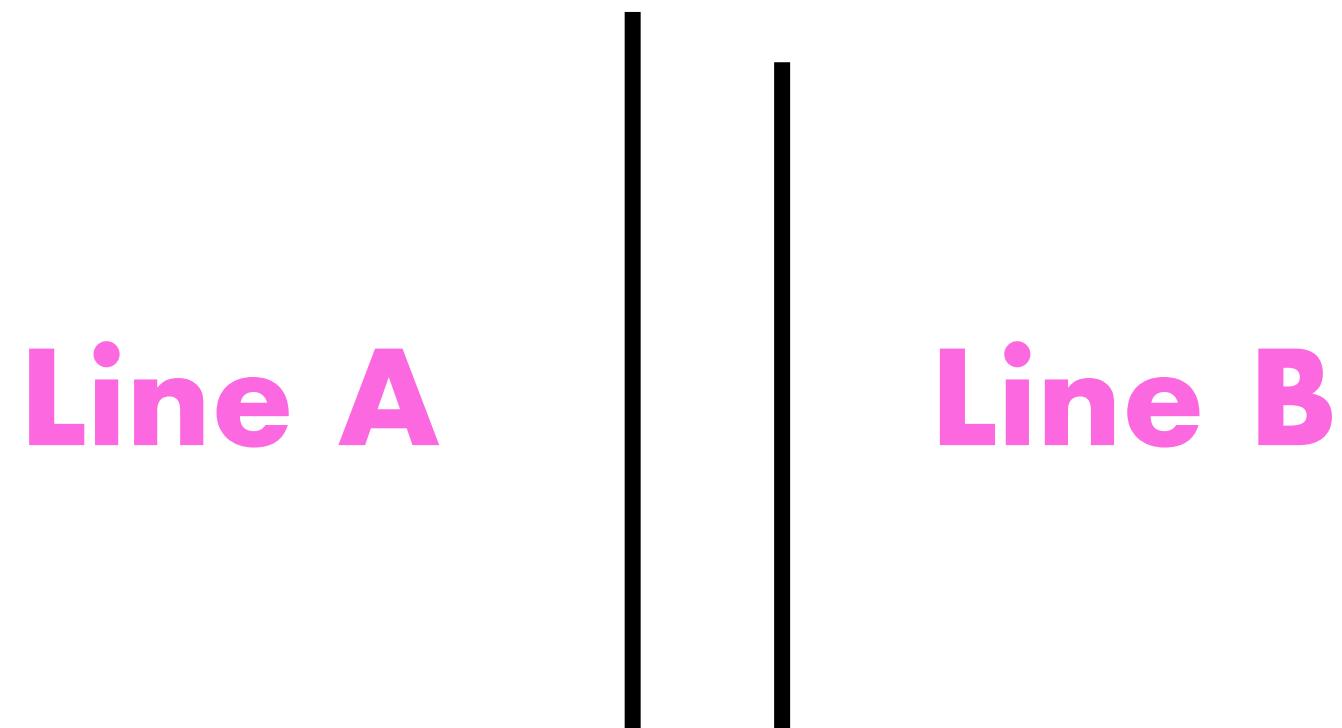
Visual Perception

Which line is
bigger?



Visual Perception

Which line is
bigger?



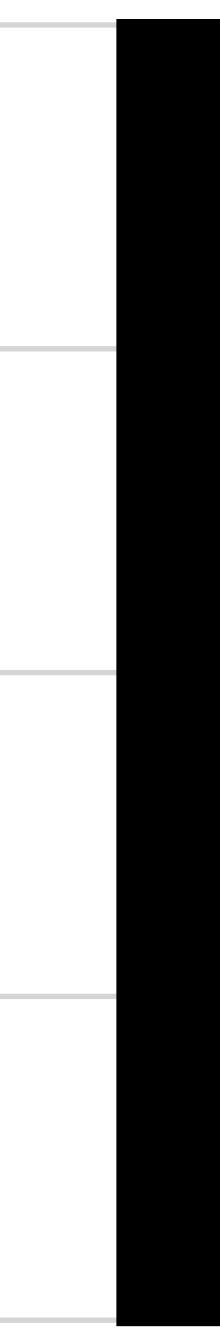
Visual Perception

Which line is
bigger?

Line A



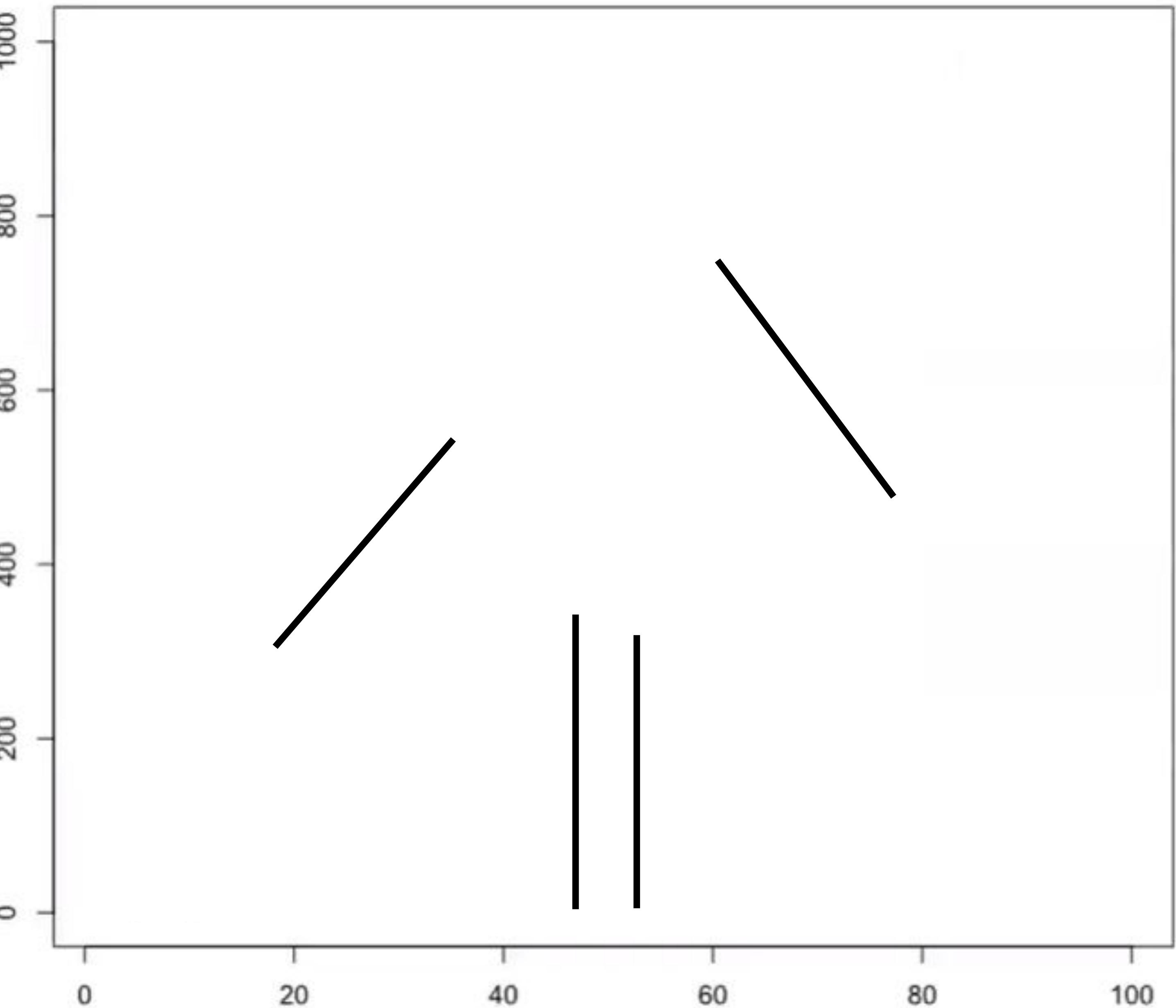
Line B



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'?

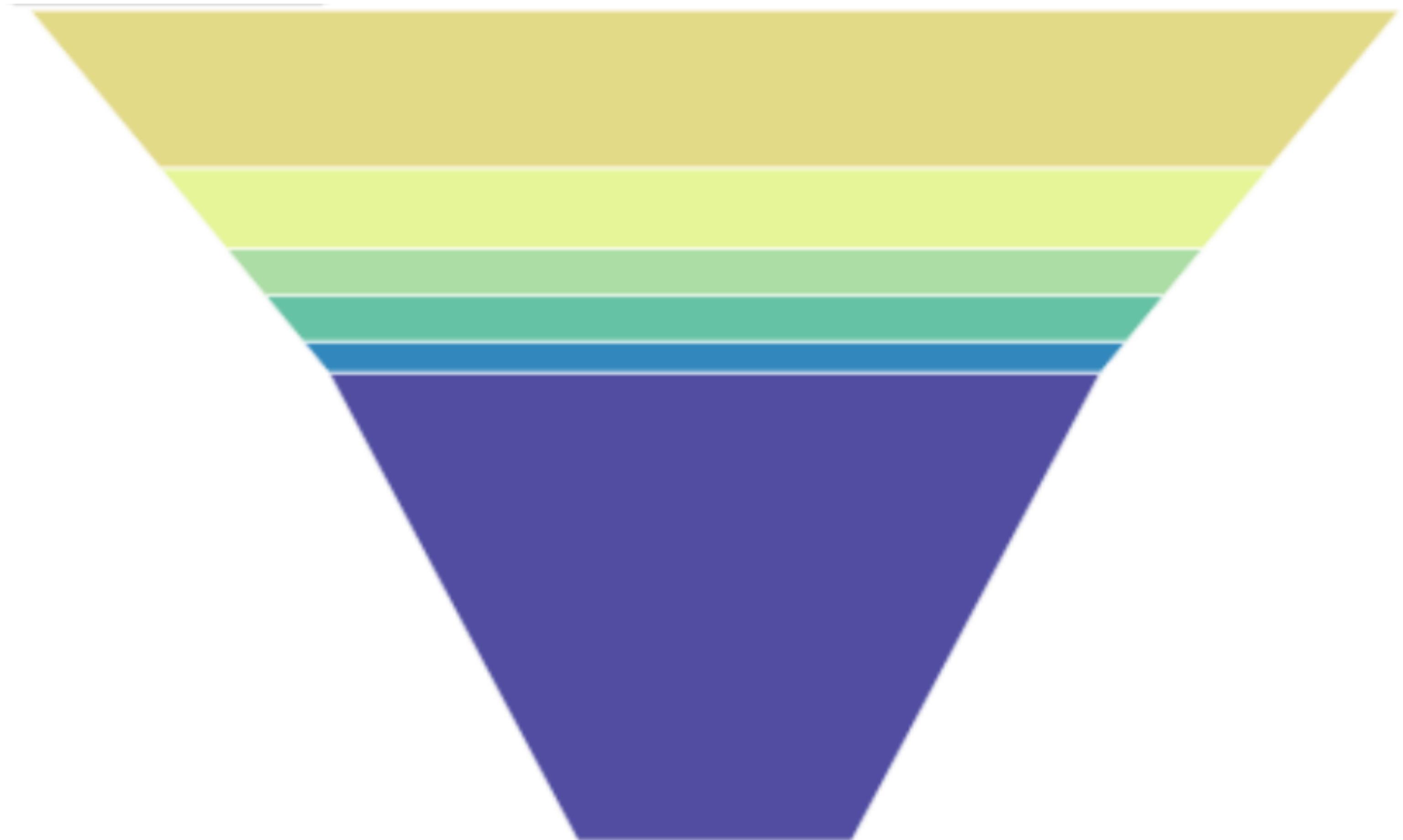


Chart by Isshita Bansal

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

Visual Perception

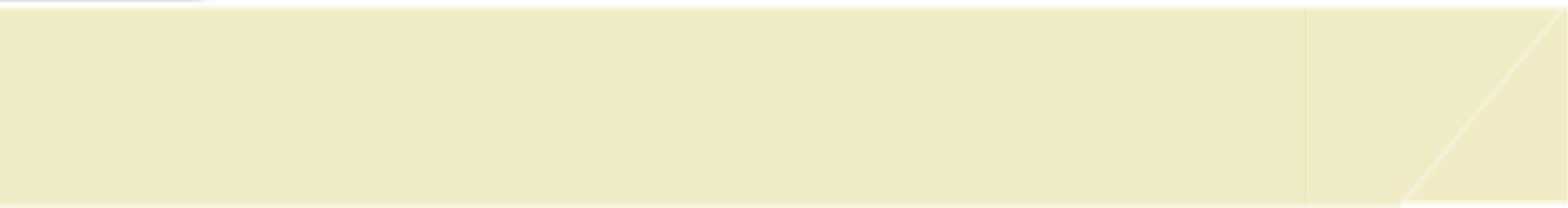
**Which area is
bigger?**

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





1020



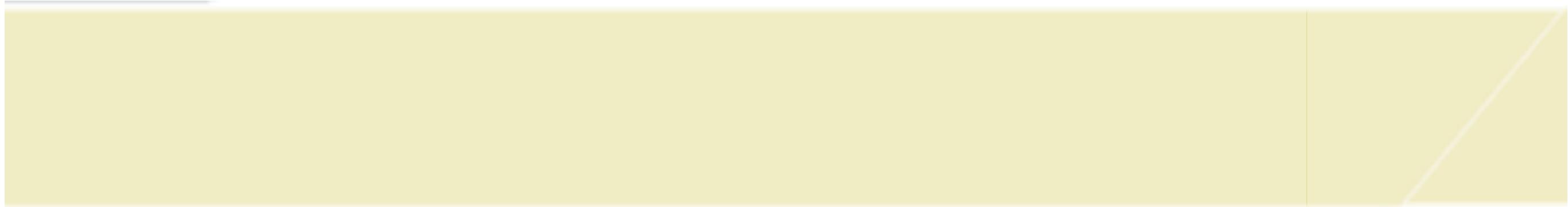
130

430



380

1020



130

1,32,600
sq units

430

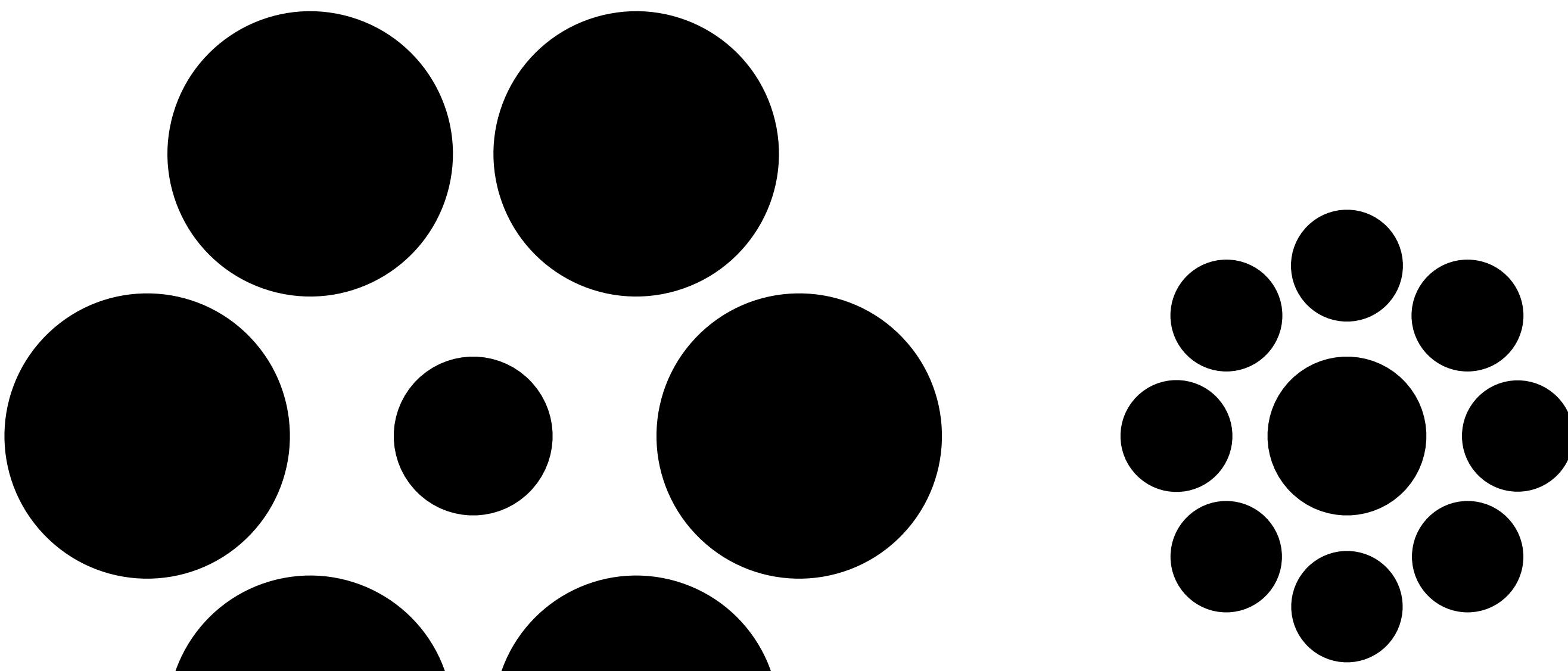


380

1,63,400
sq units

Visual Perception

Which inner
circle is
bigger?

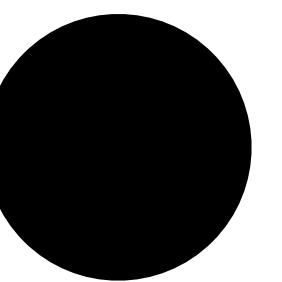


Circle A

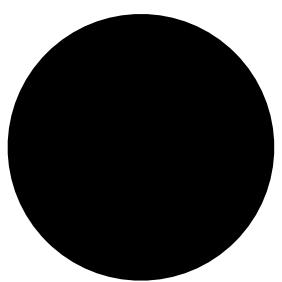
Circle B

Visual Perception

**Which inner
circle is
bigger?**



Circle A

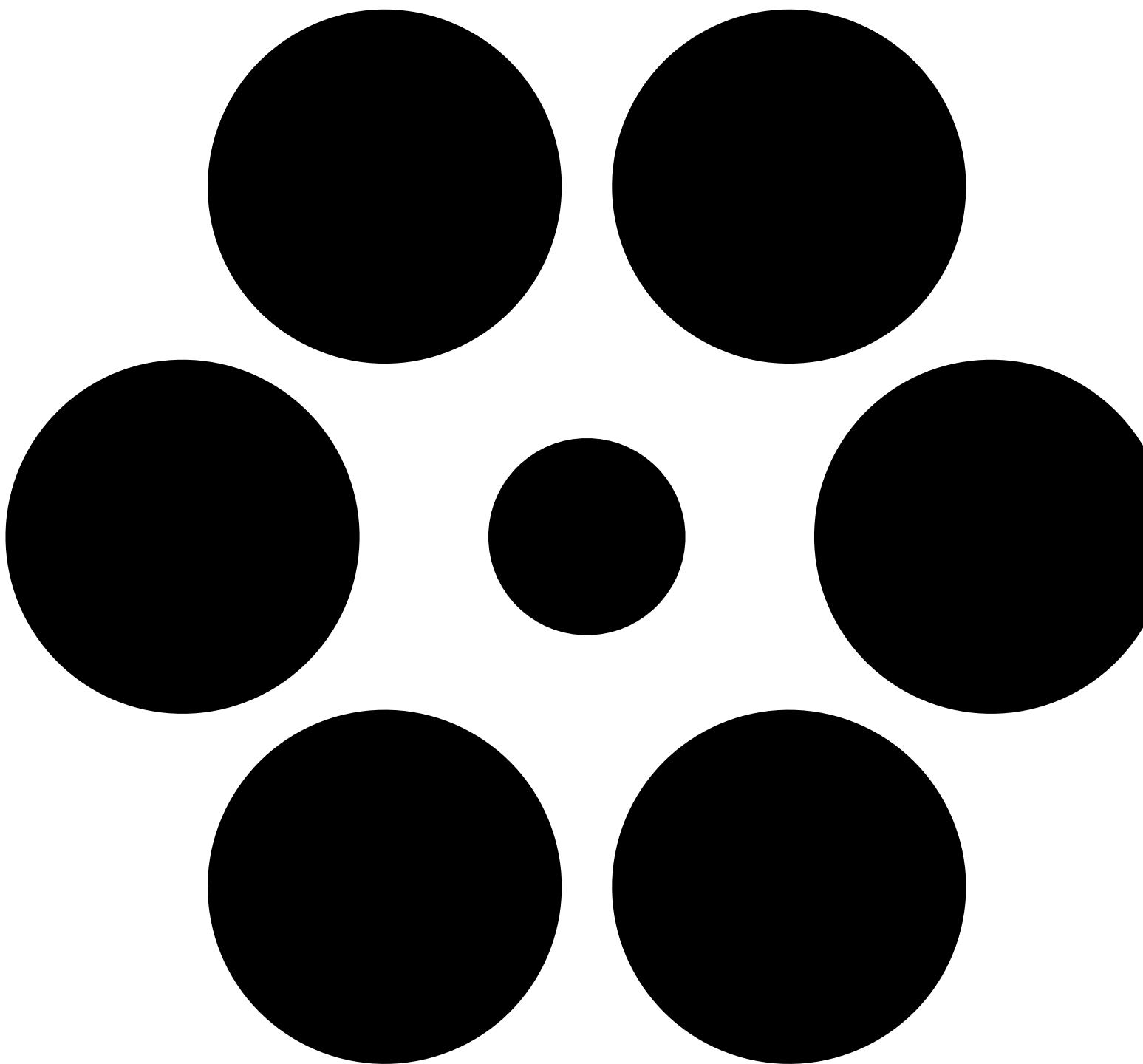


Circle B

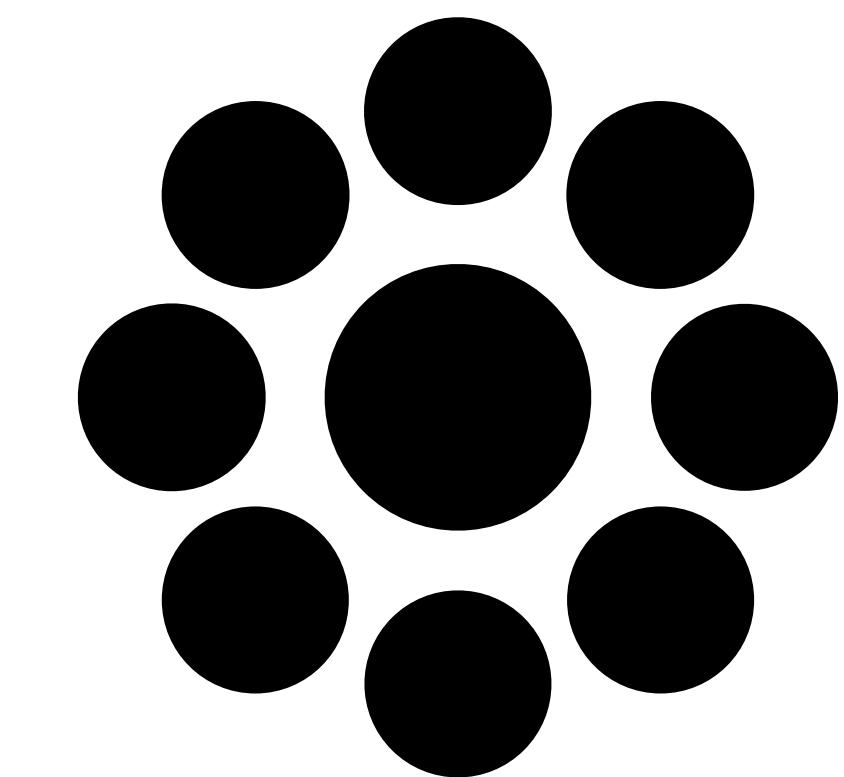
Visual Perception

Which inner circle is bigger?

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



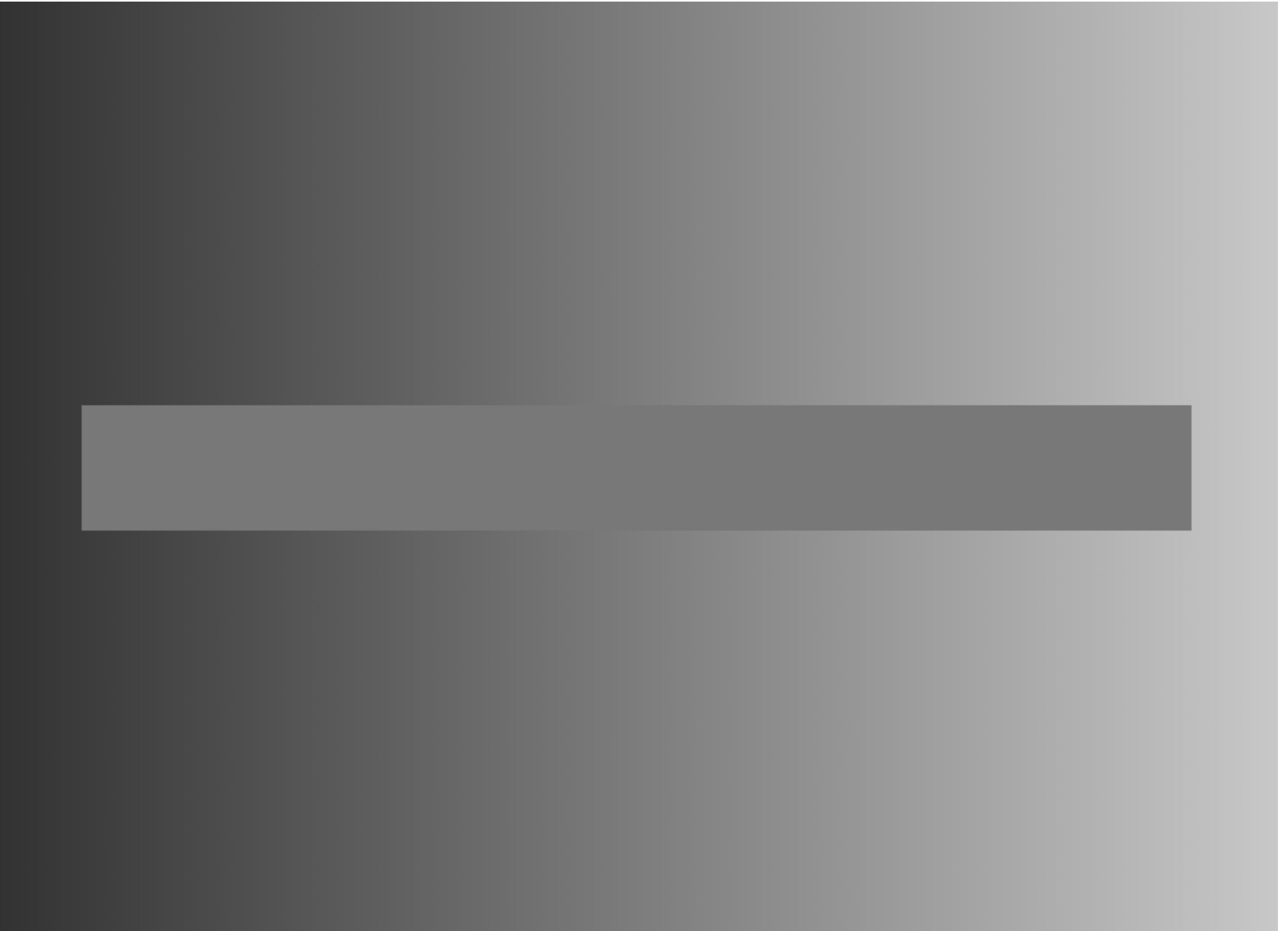
Circle A



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

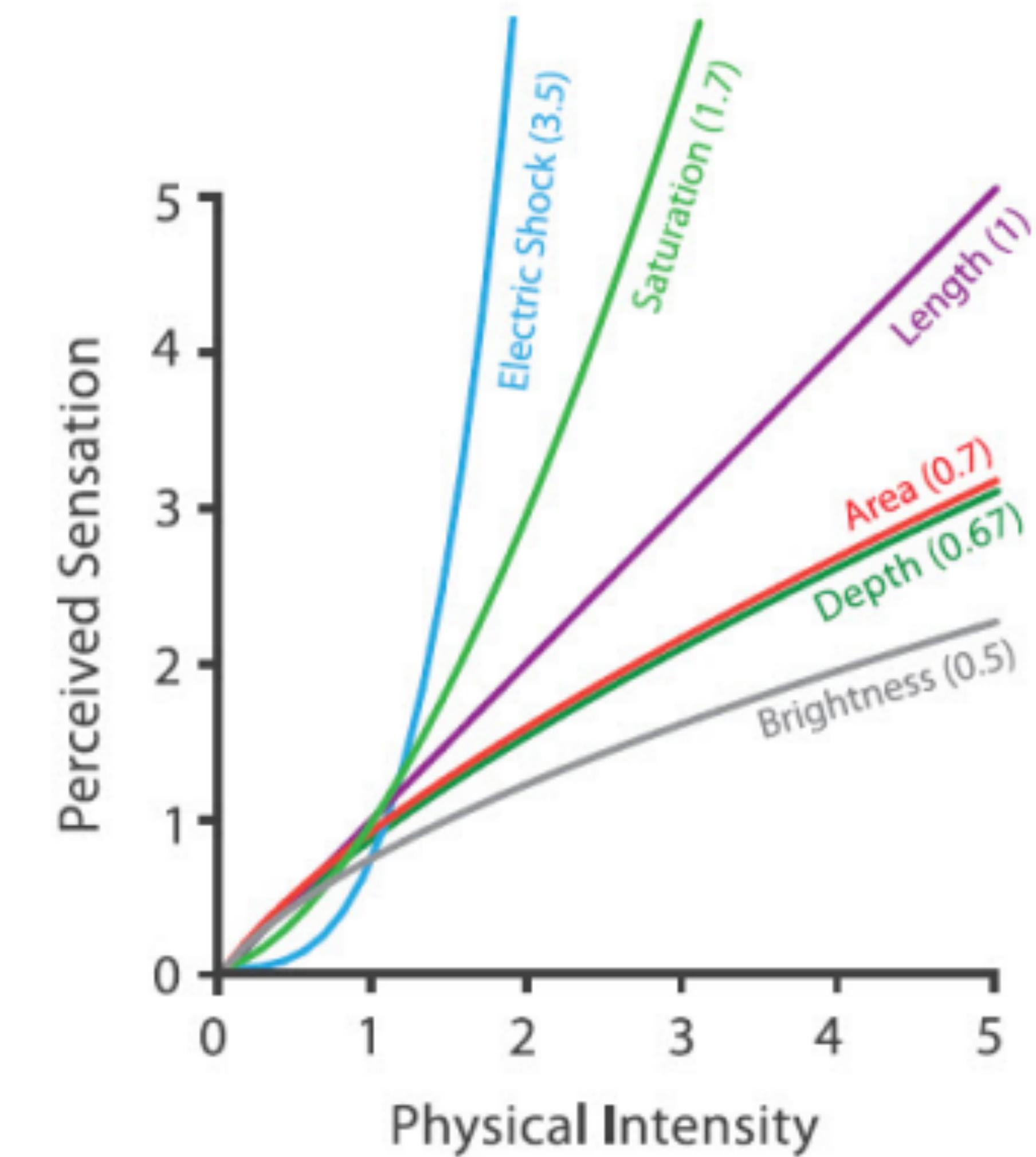
Is the centre
rectangle a
gradient?



#787878

Visual Perception

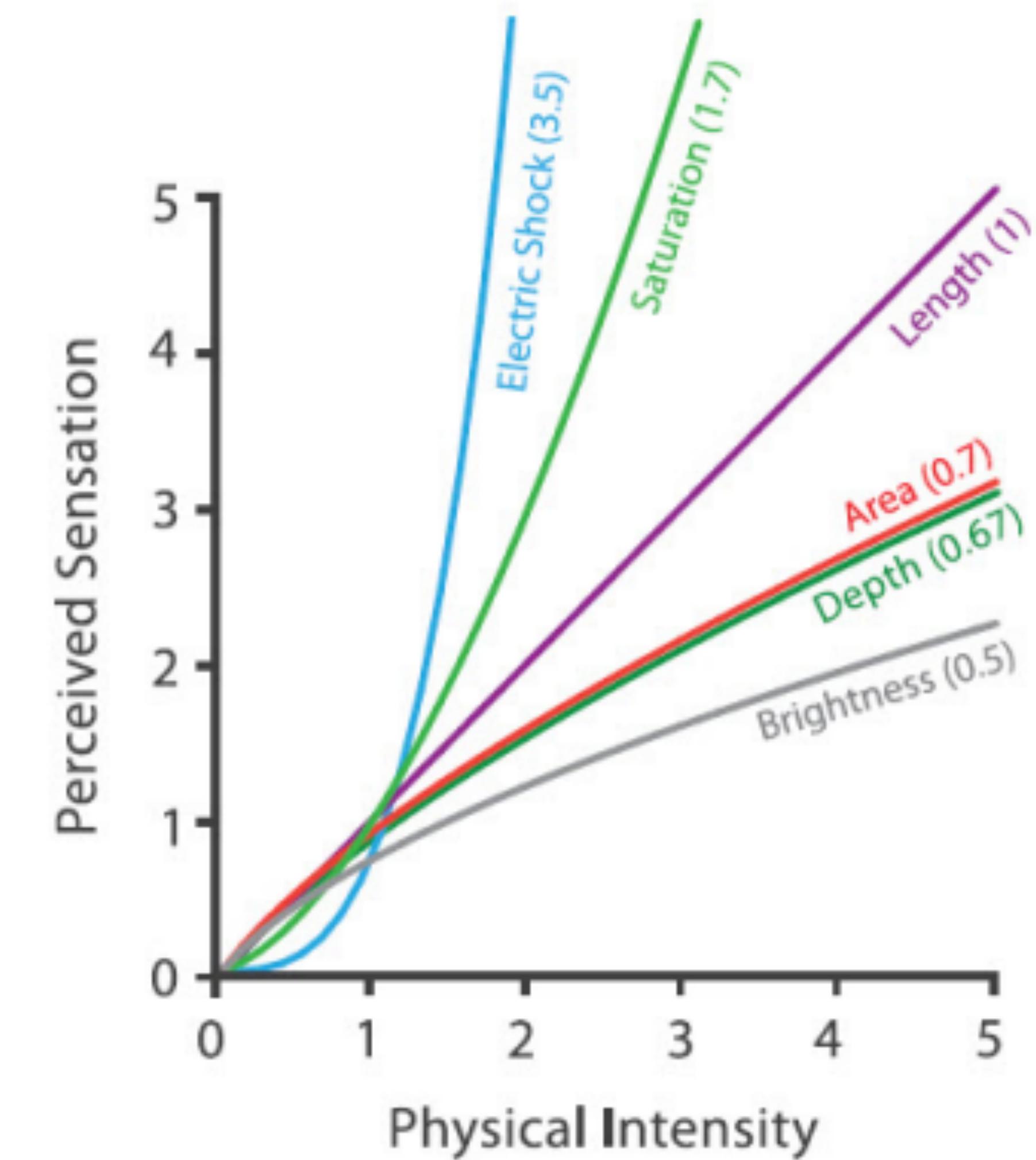
Steven's Psychophysical Power Law



Visual Perception

Steven's Psychophysical Power Law

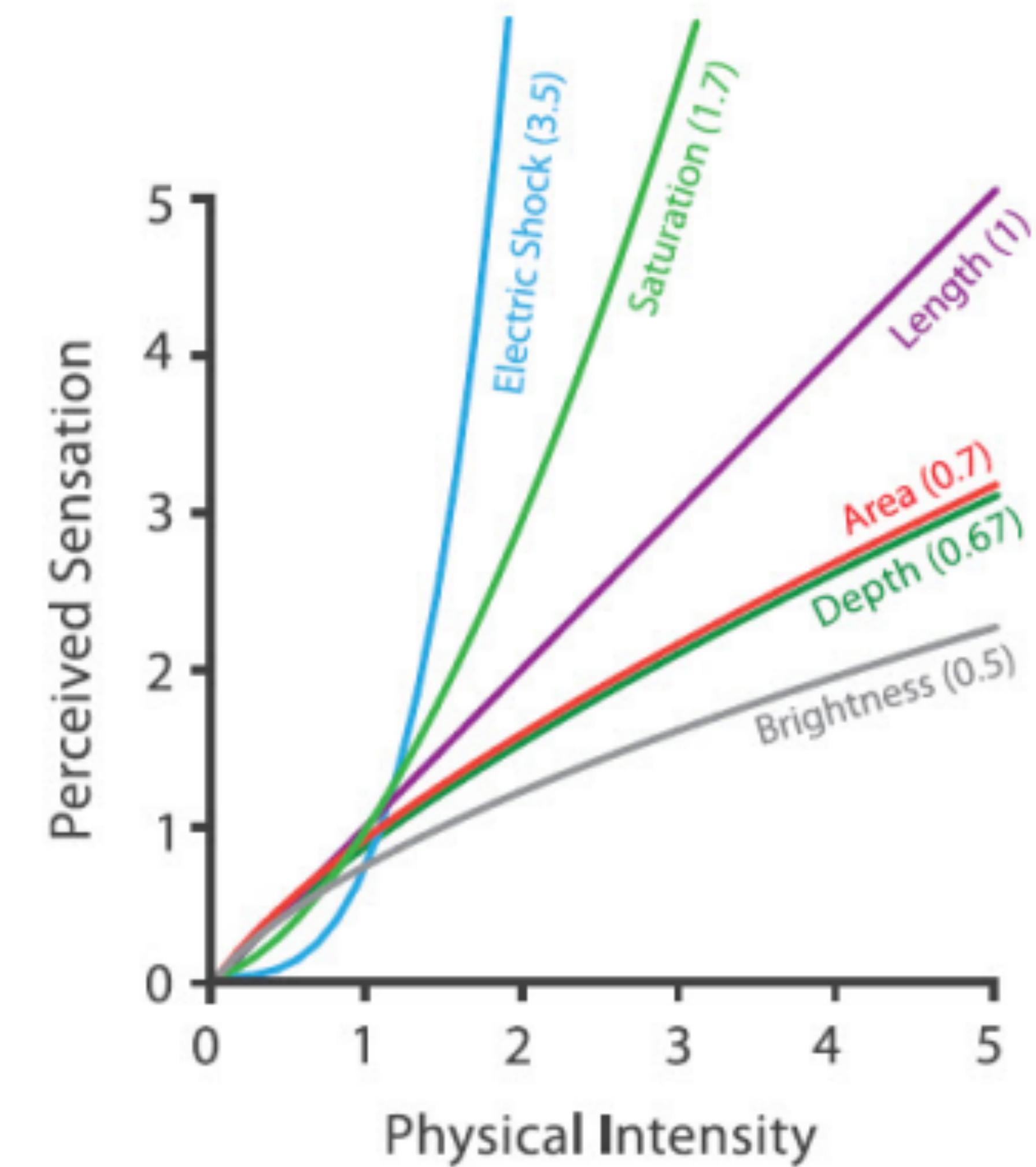
Humans perceive different stimulus differently.



Visual Perception

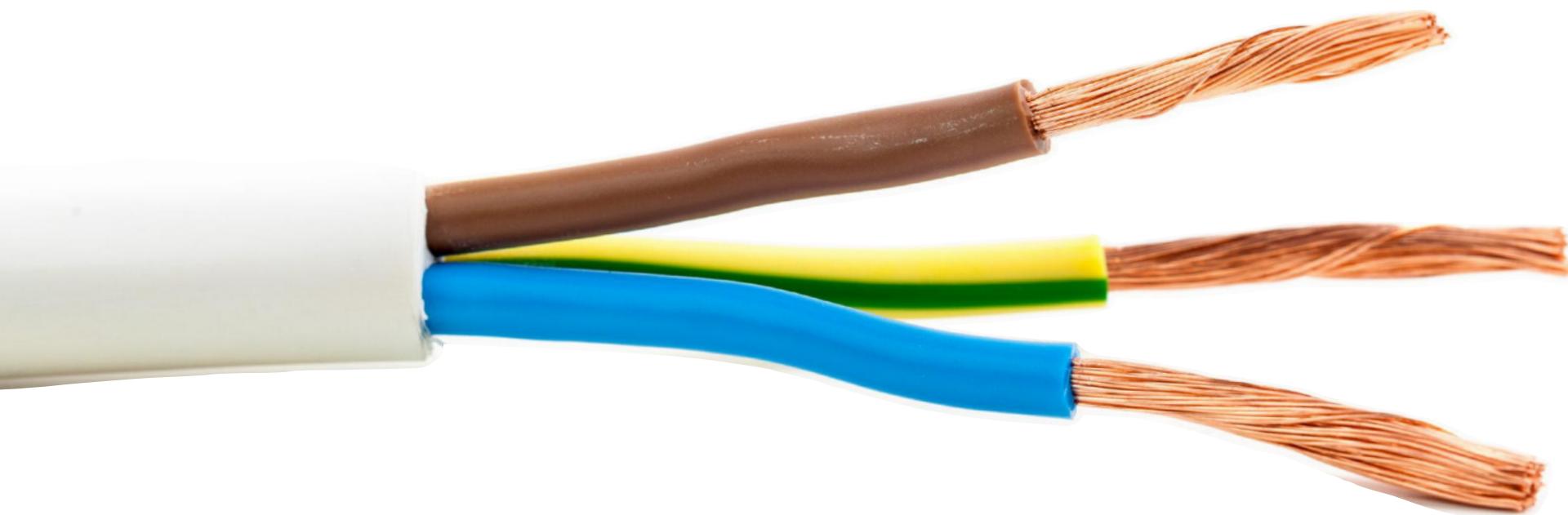
Steven's Psychophysical Power Law

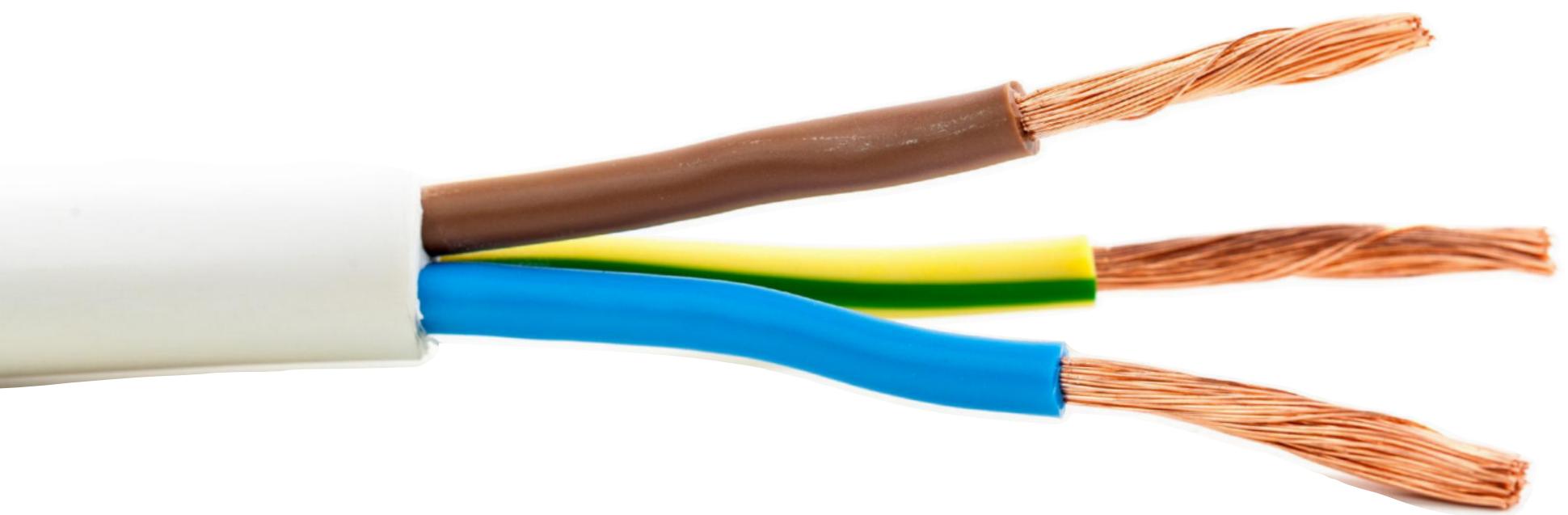
For eg, small increases in electric current are felt very sharply.



5 milli Amp

Ouch!



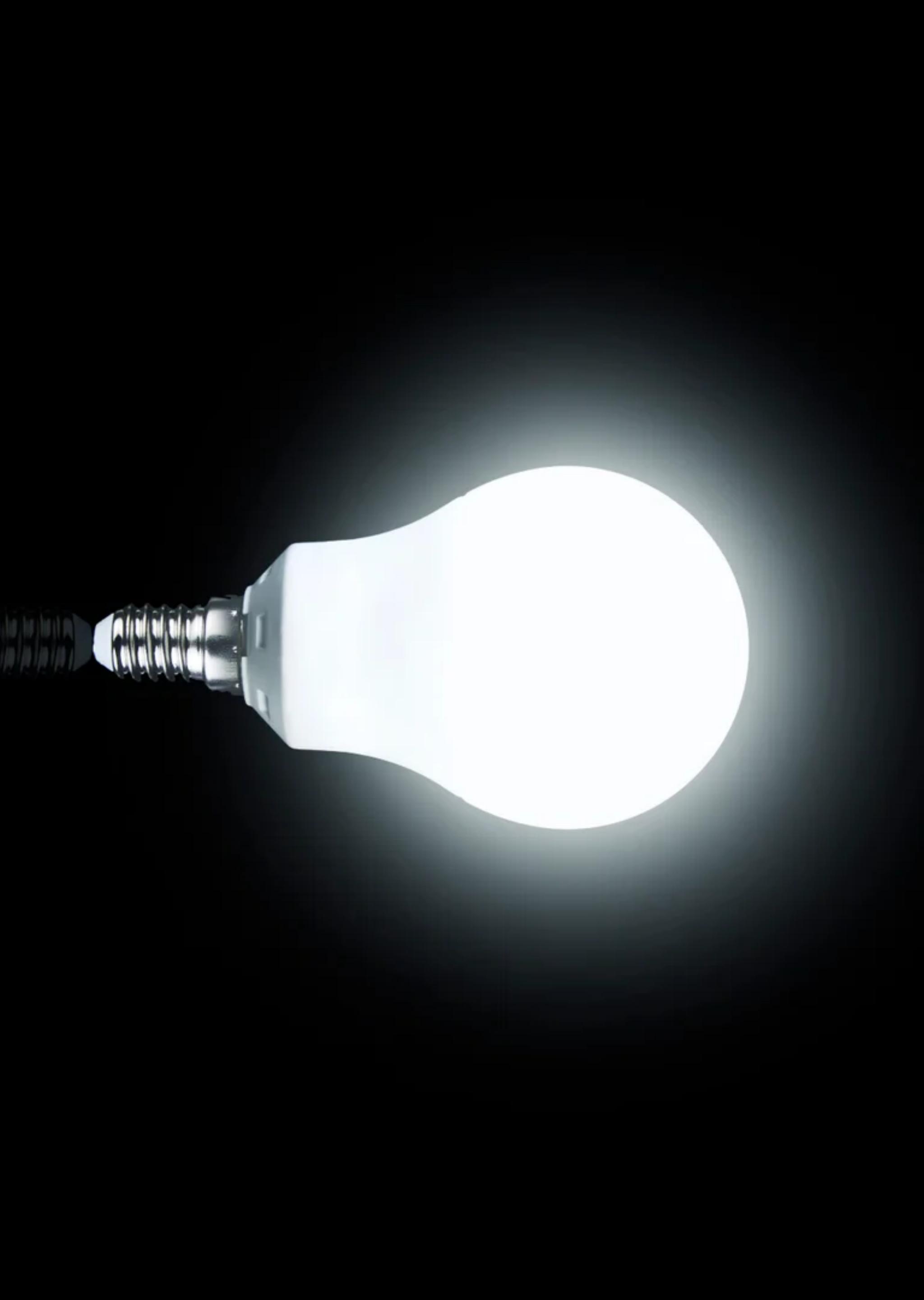


5 milli Amp

Ouch!

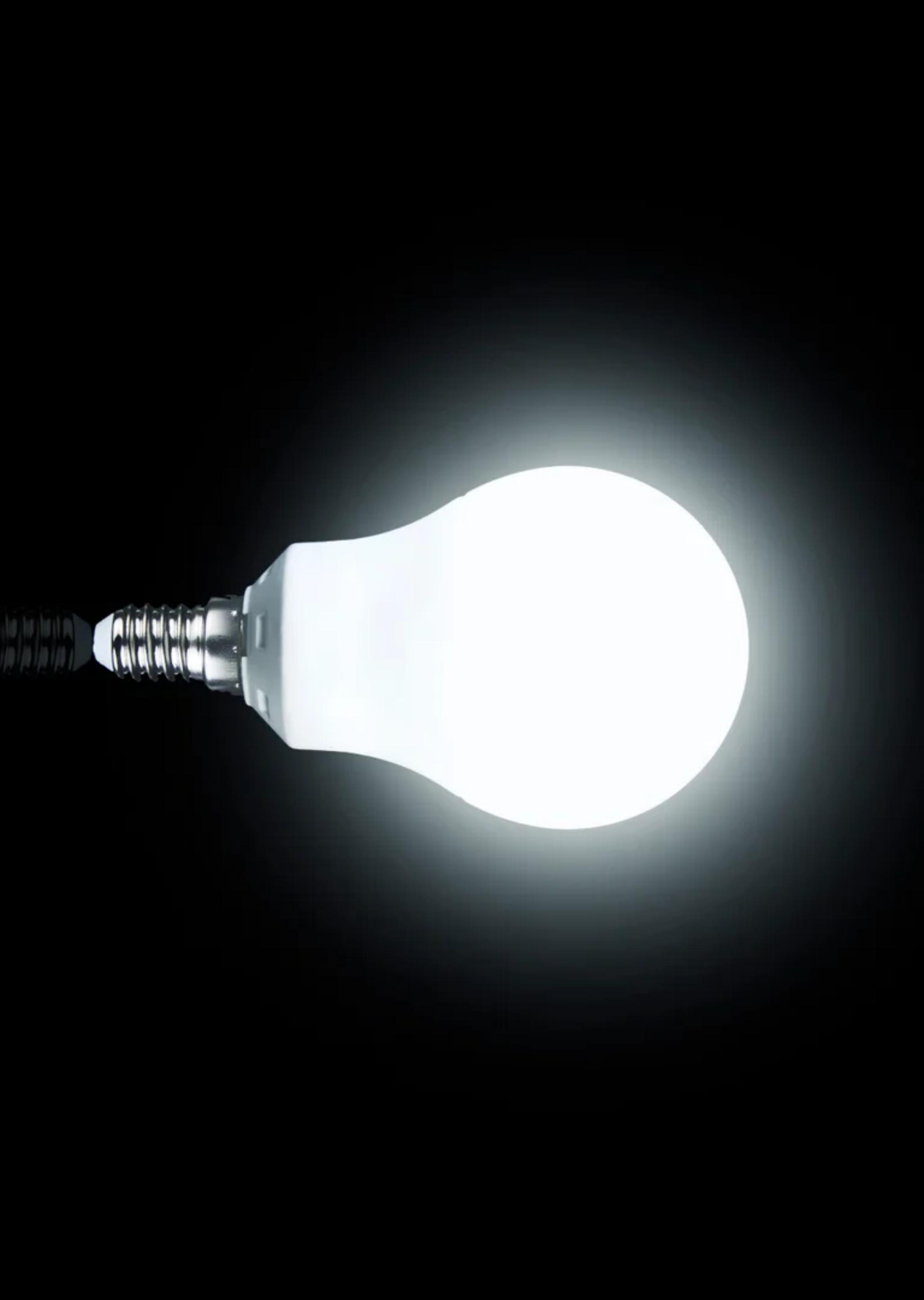
10 milli Amp

Can't let go!

A single incandescent lightbulb is shown from a side-on perspective, angled towards the left. The bulb is brightly lit, casting a soft glow and a distinct shadow on the dark, textured surface it rests on. The background is a solid, dark gray.

100 Lumens

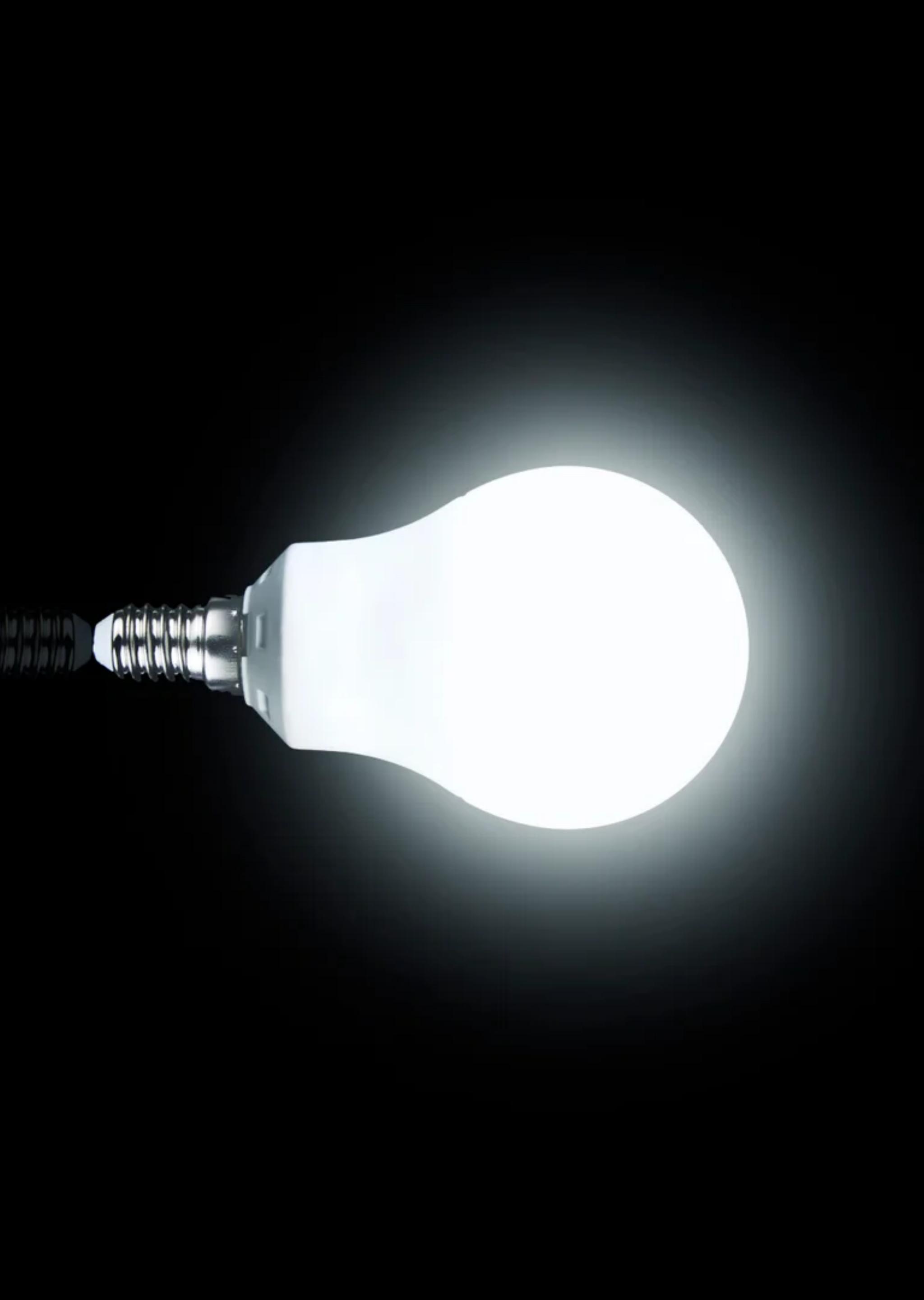
Bright



100 Lumens

Bright

200 Lumens



100 Lumens

Bright

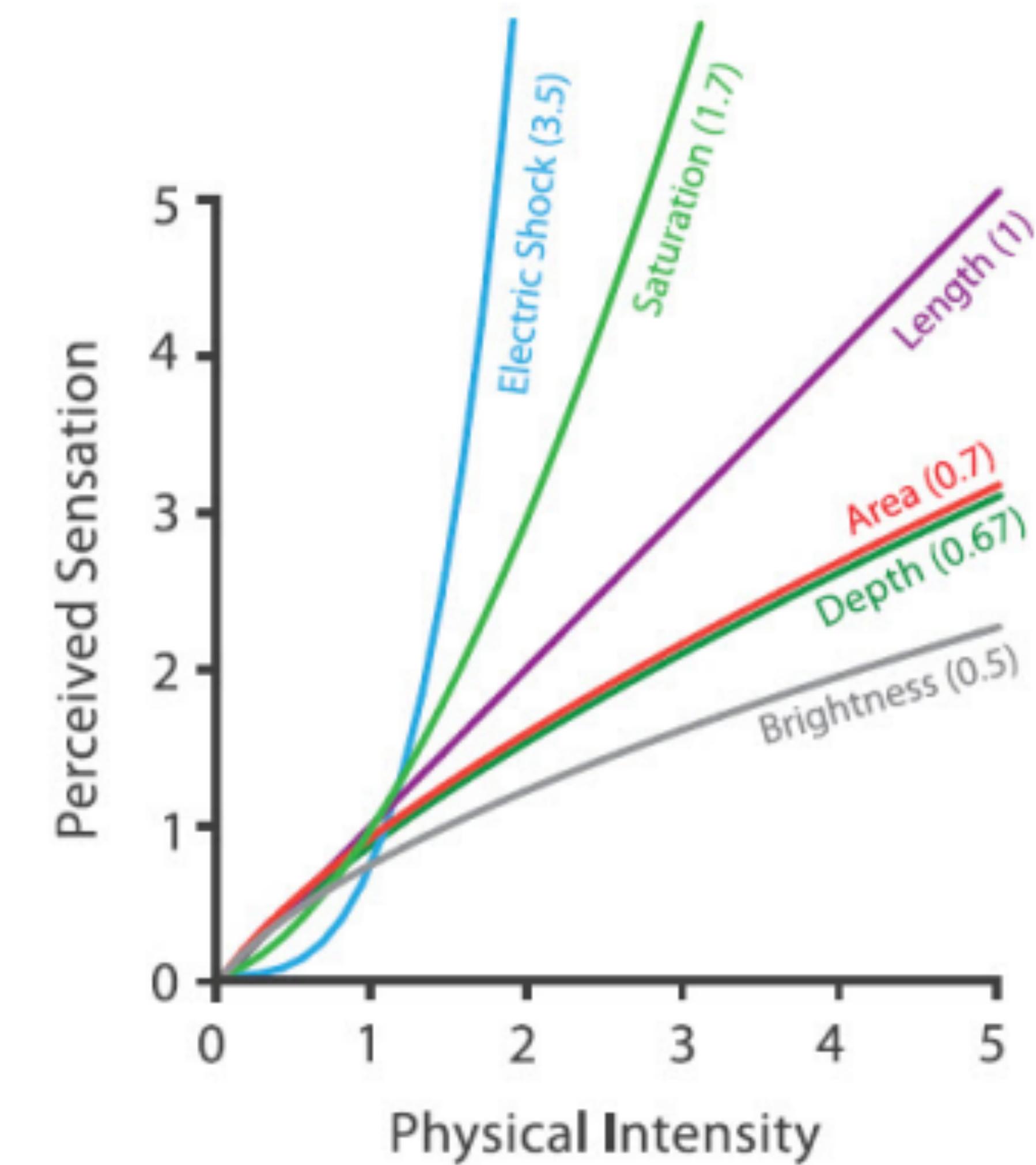
200 Lumens

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.



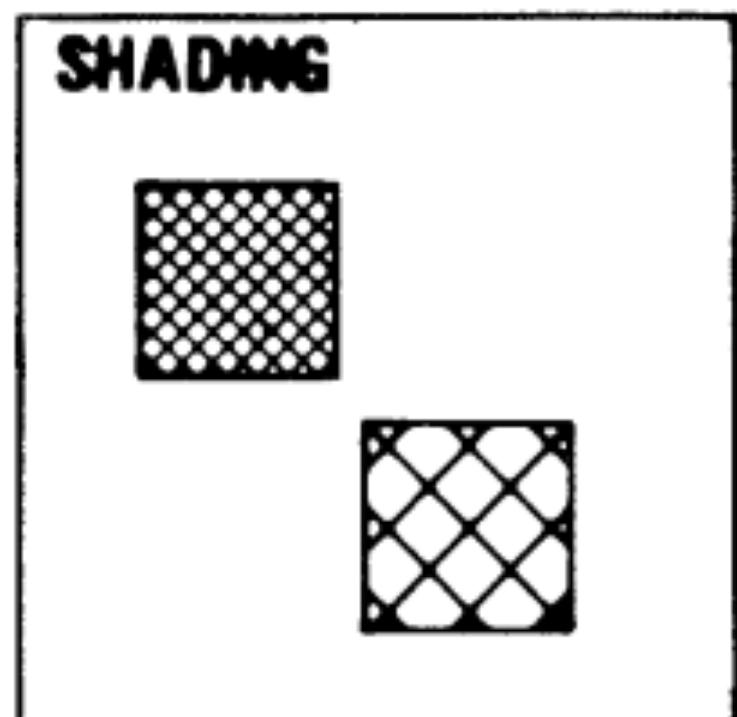
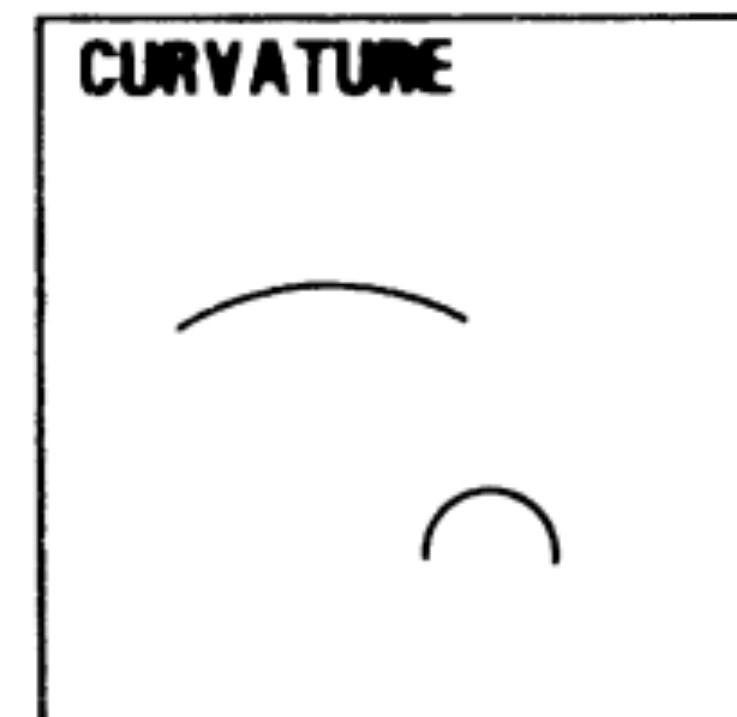
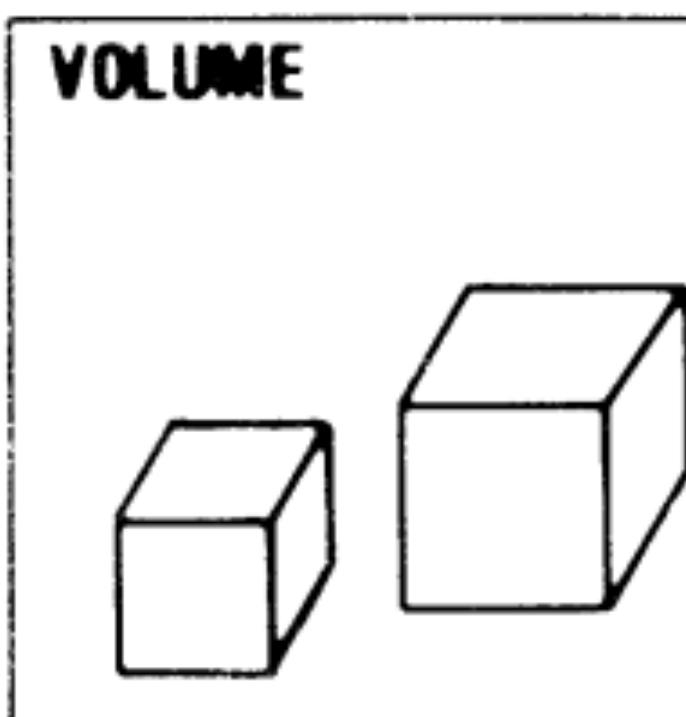
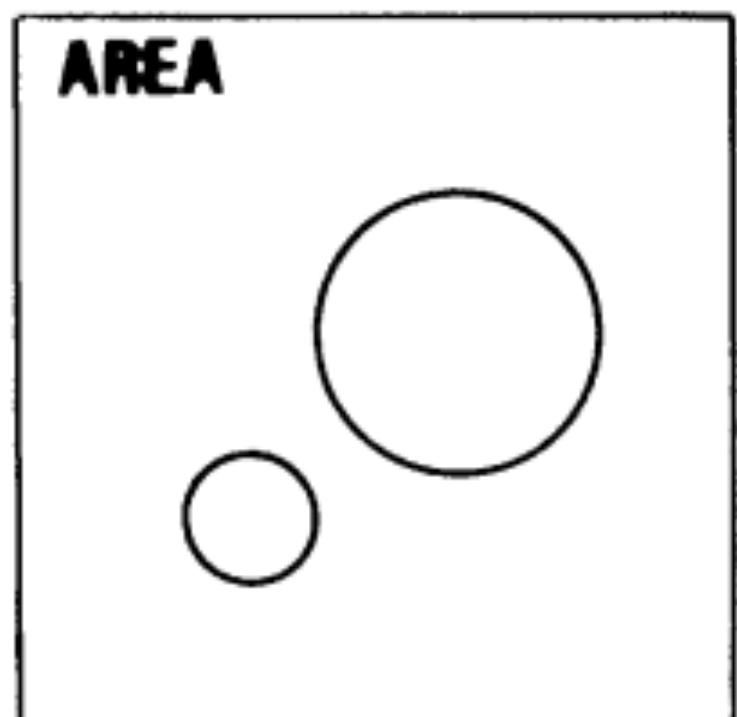
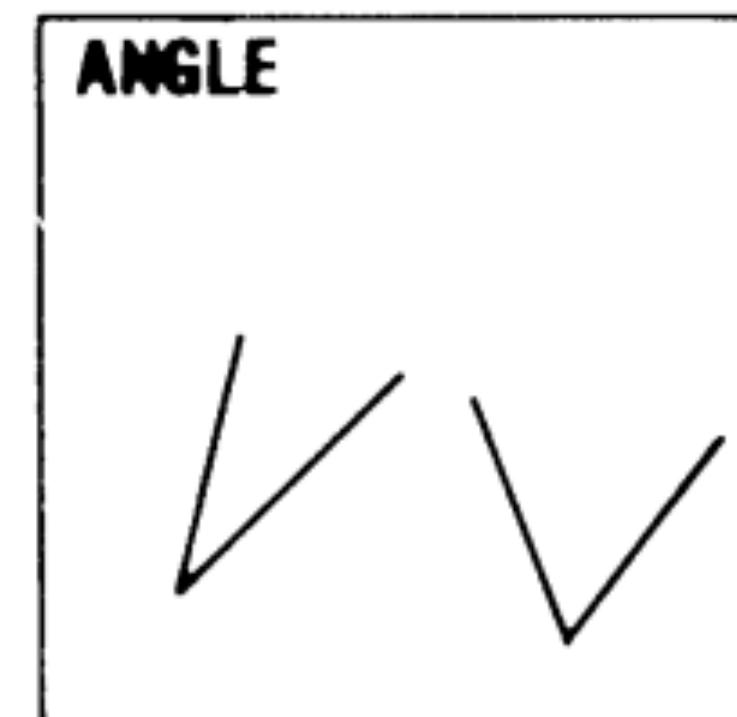
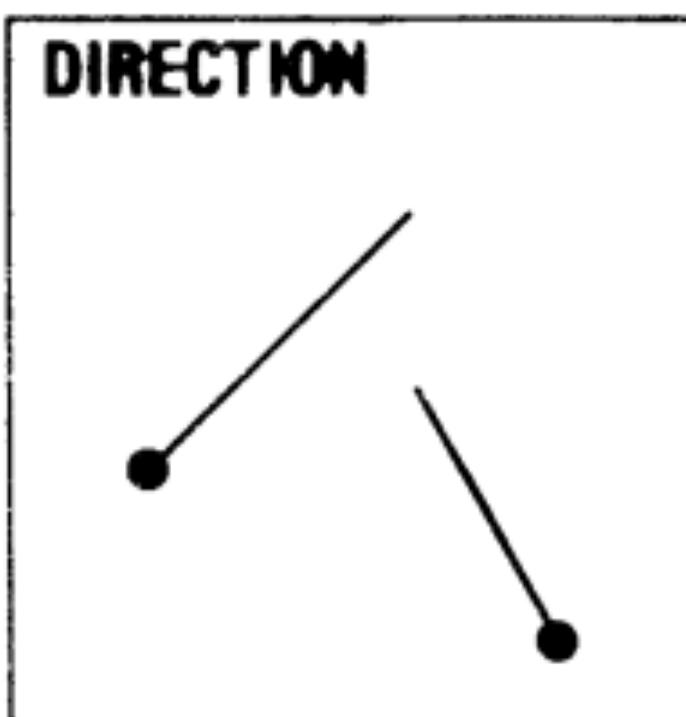
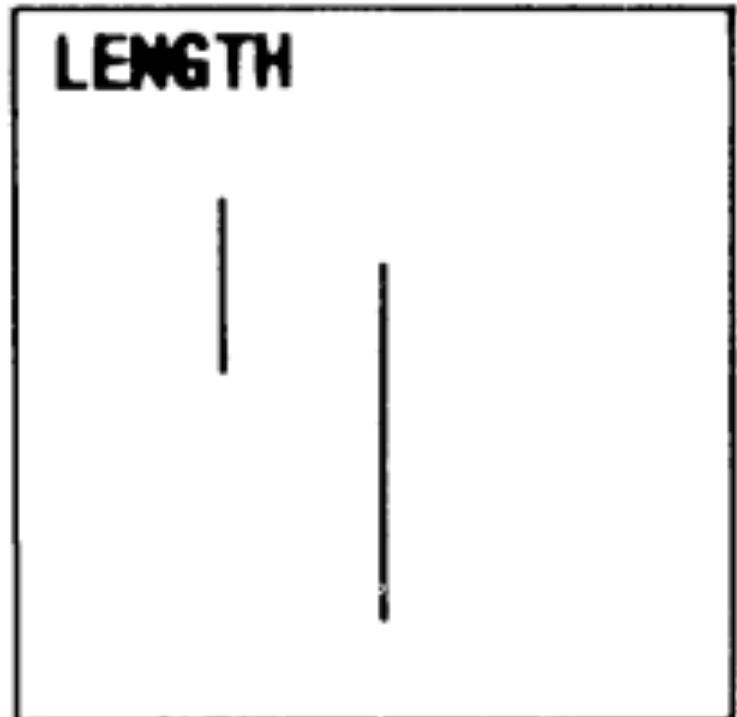
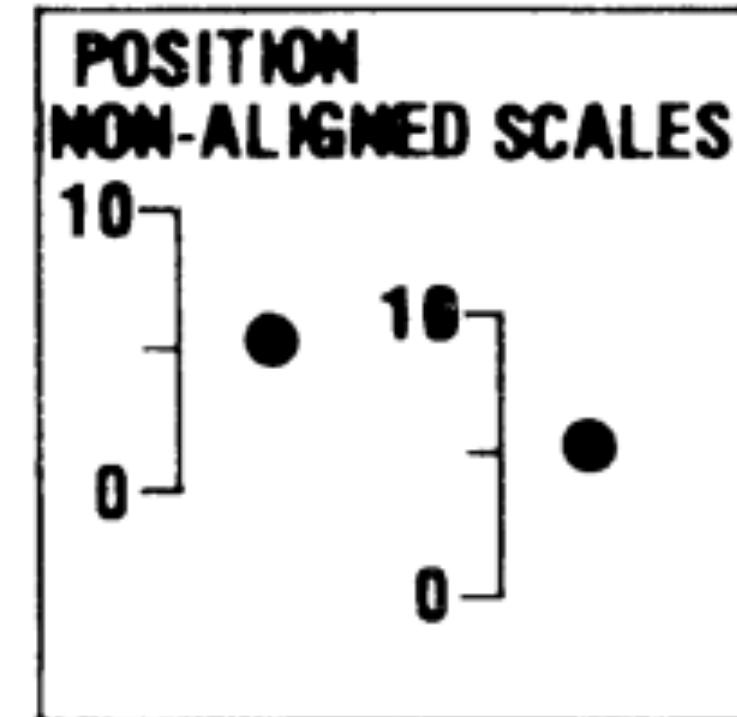
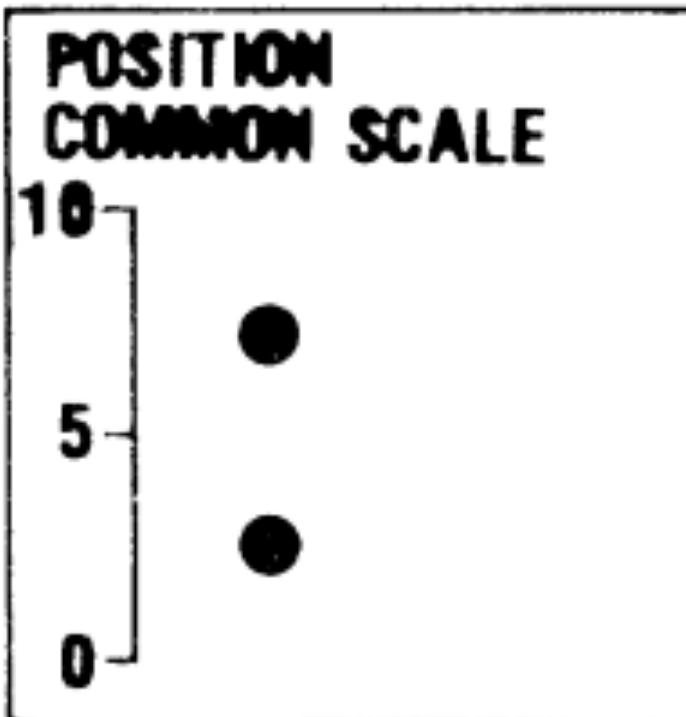
Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods

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

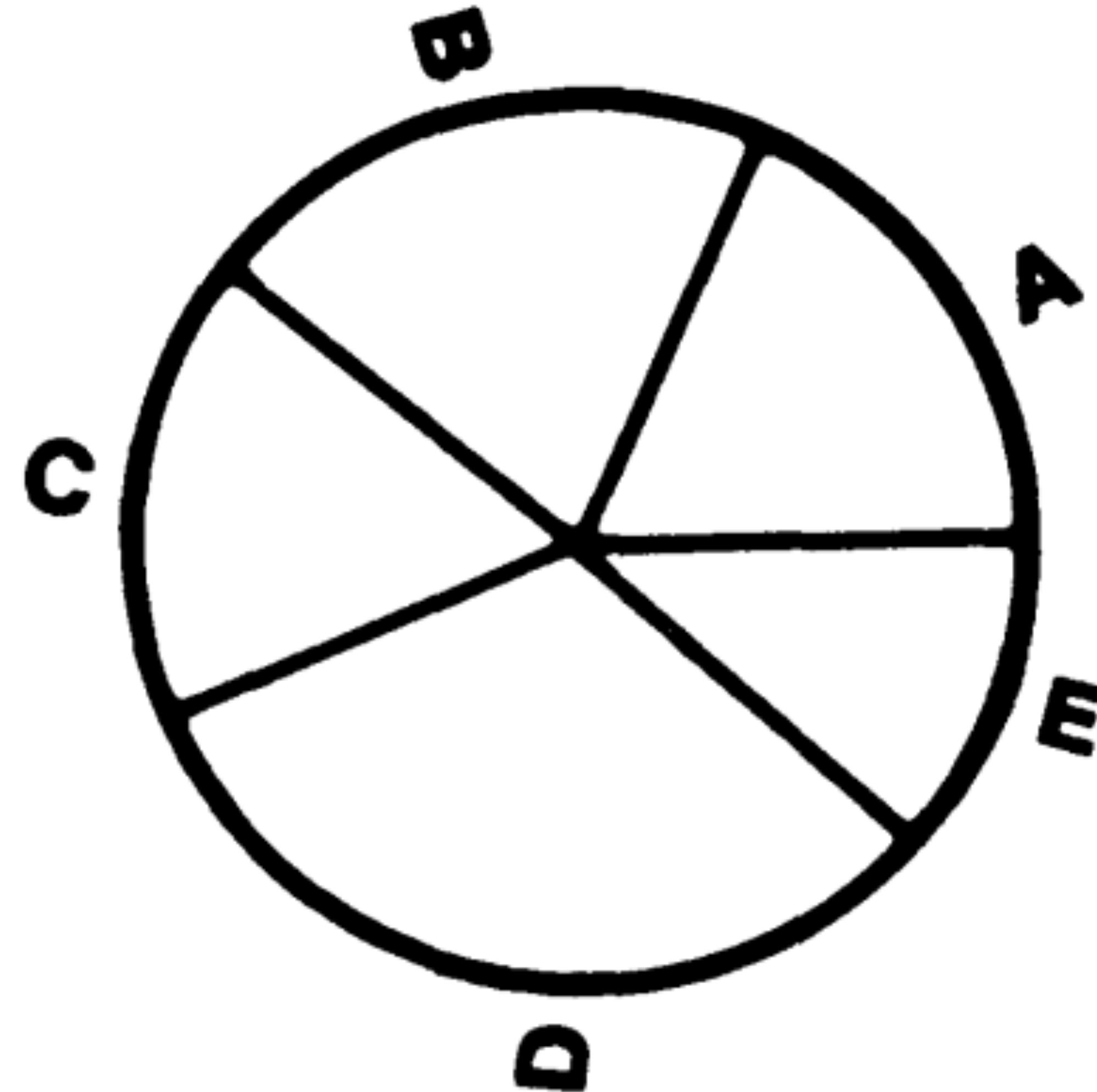
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Is A bigger or C?

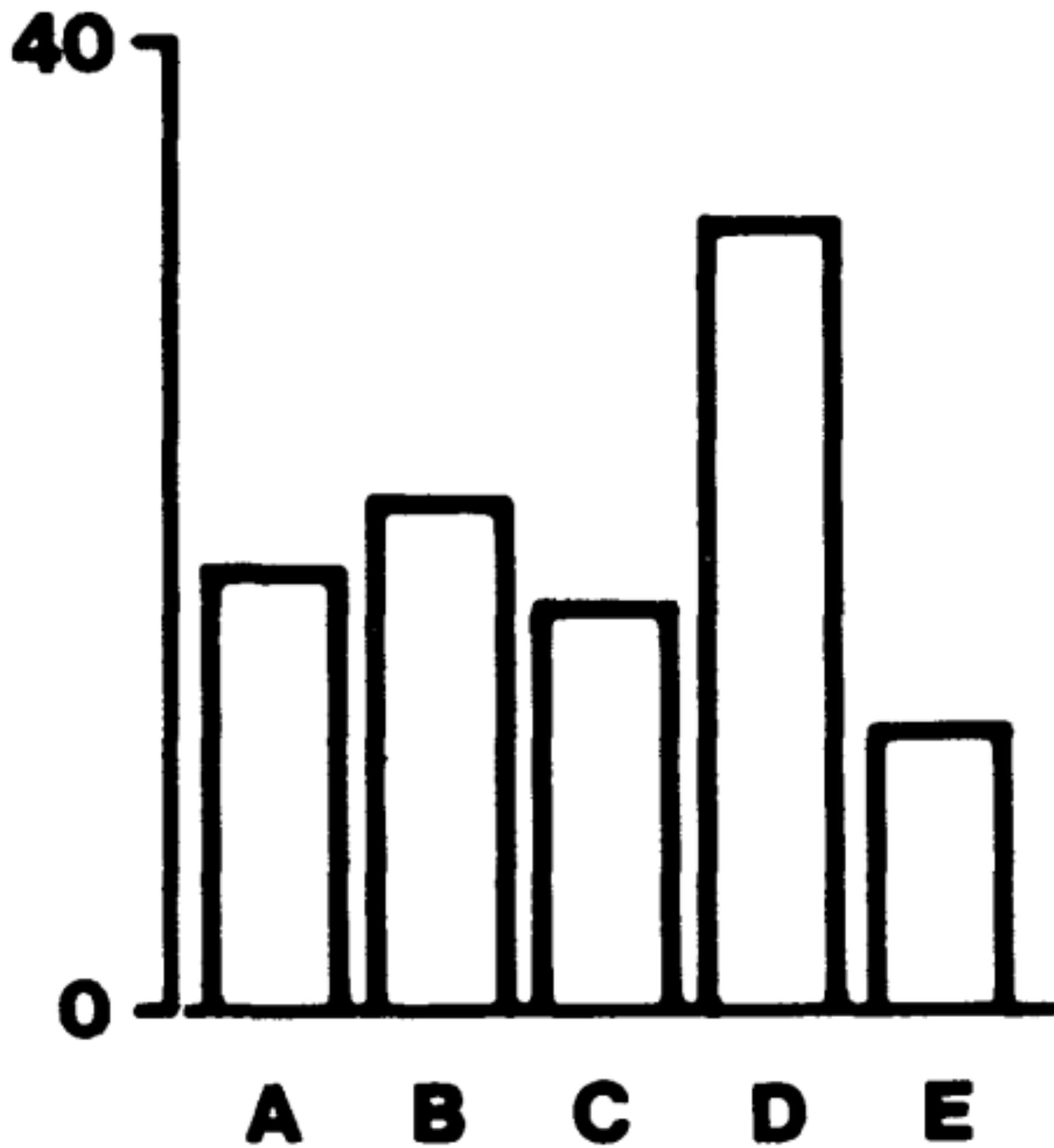
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Is A bigger or C?

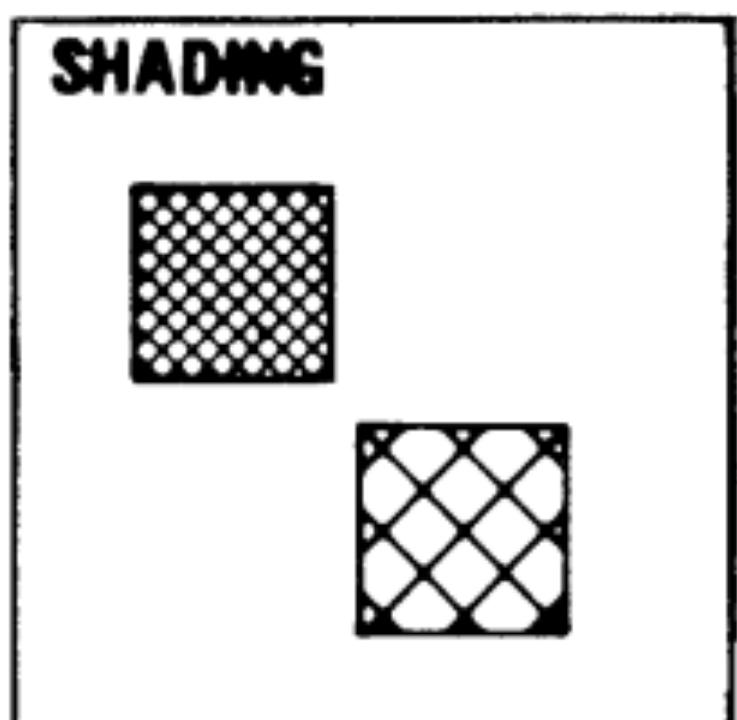
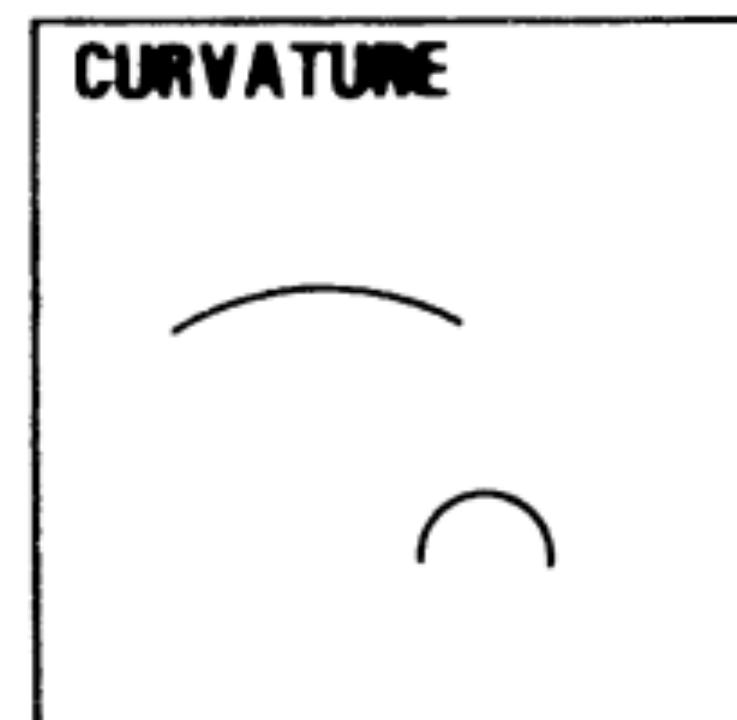
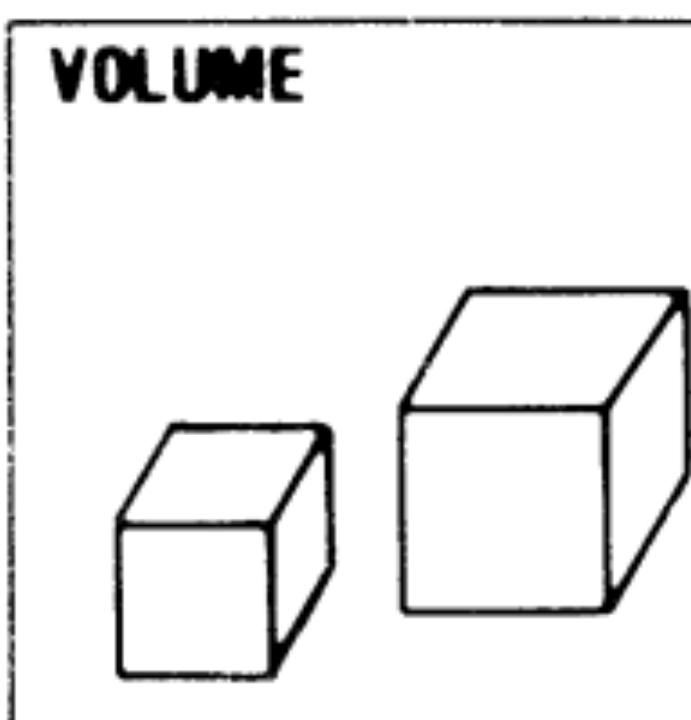
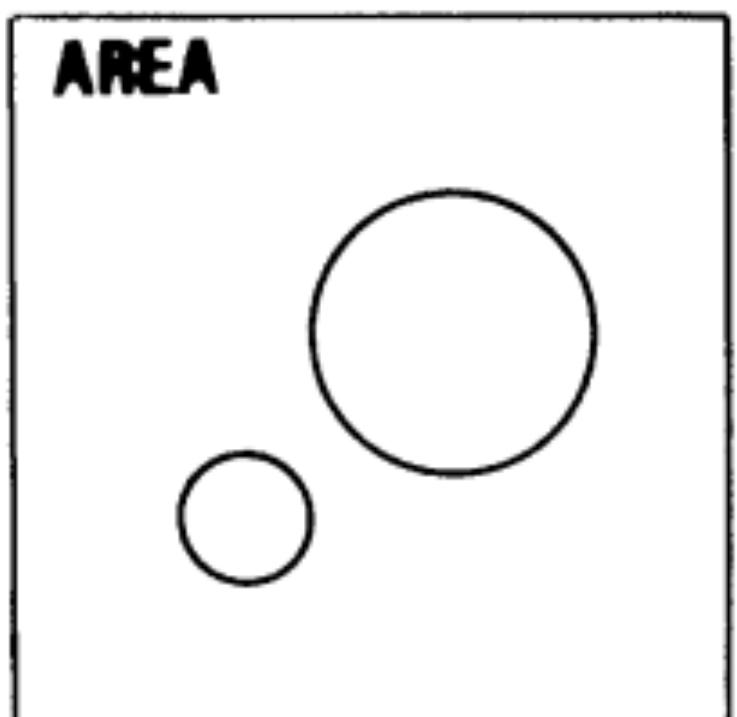
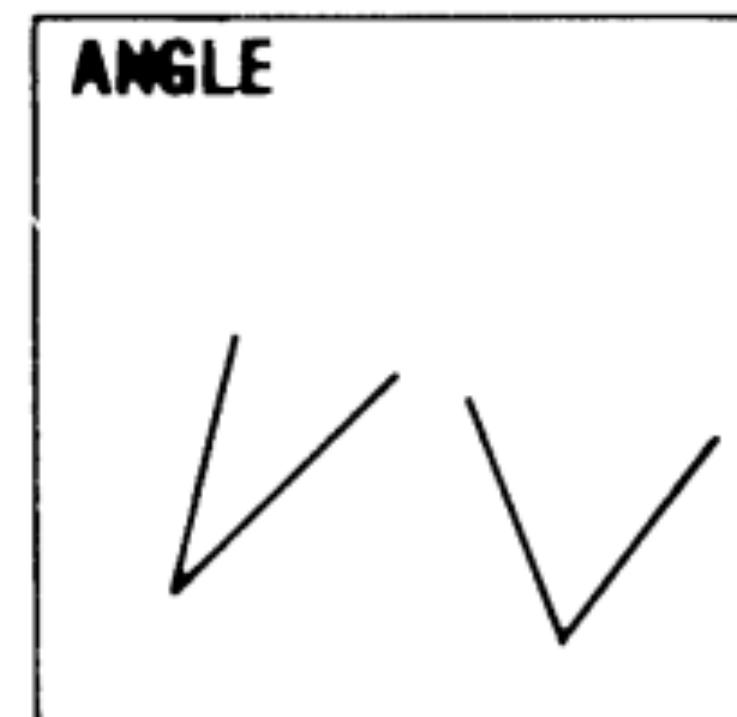
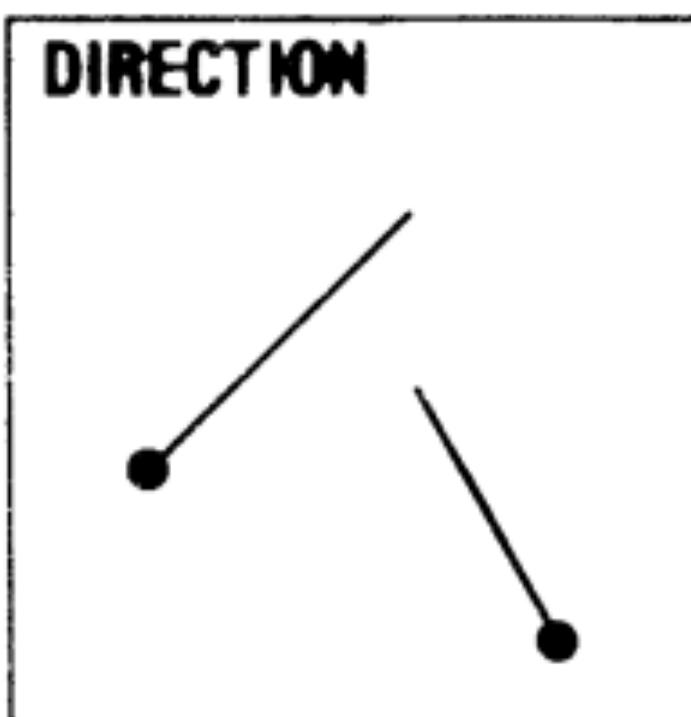
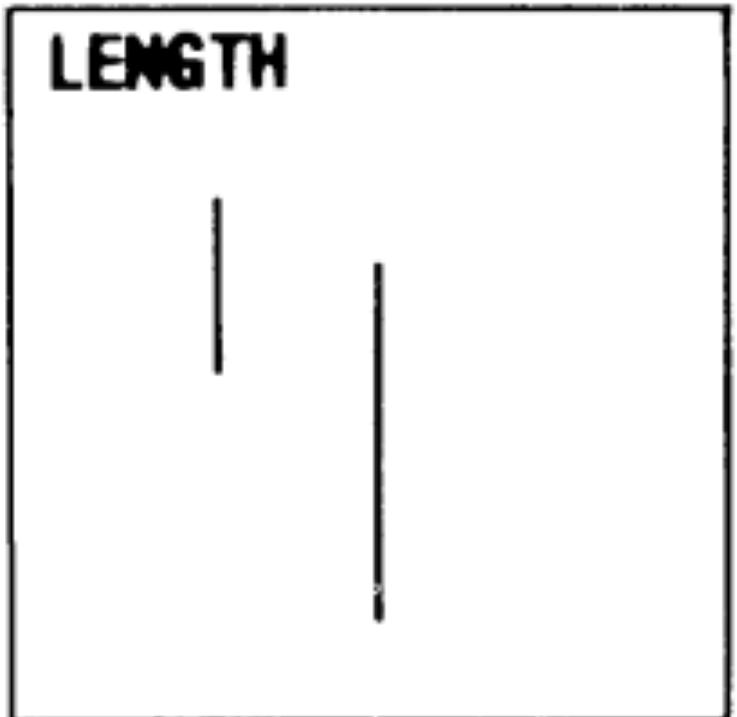
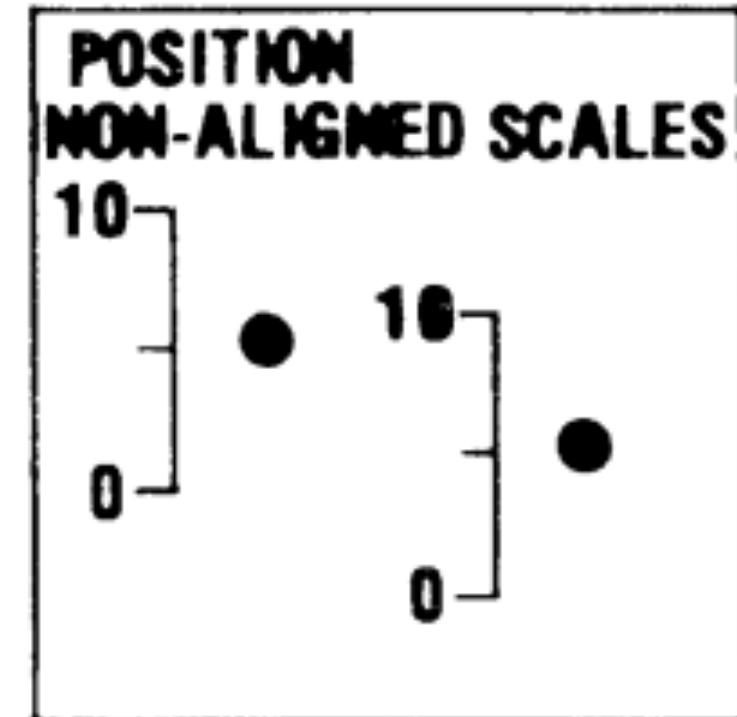
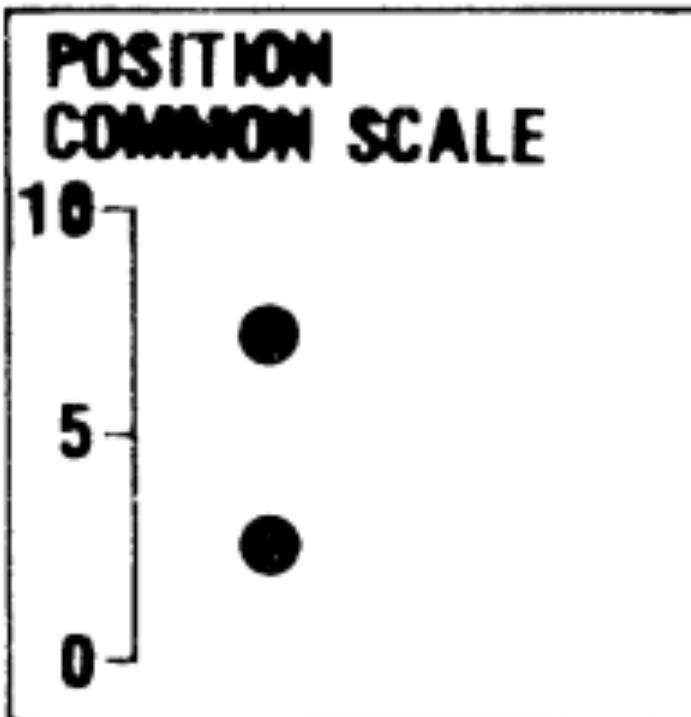
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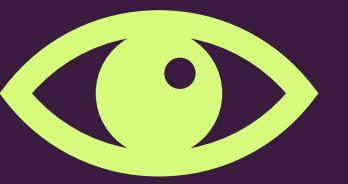
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No. 387 (Sep., 1984), pp.
531-554



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

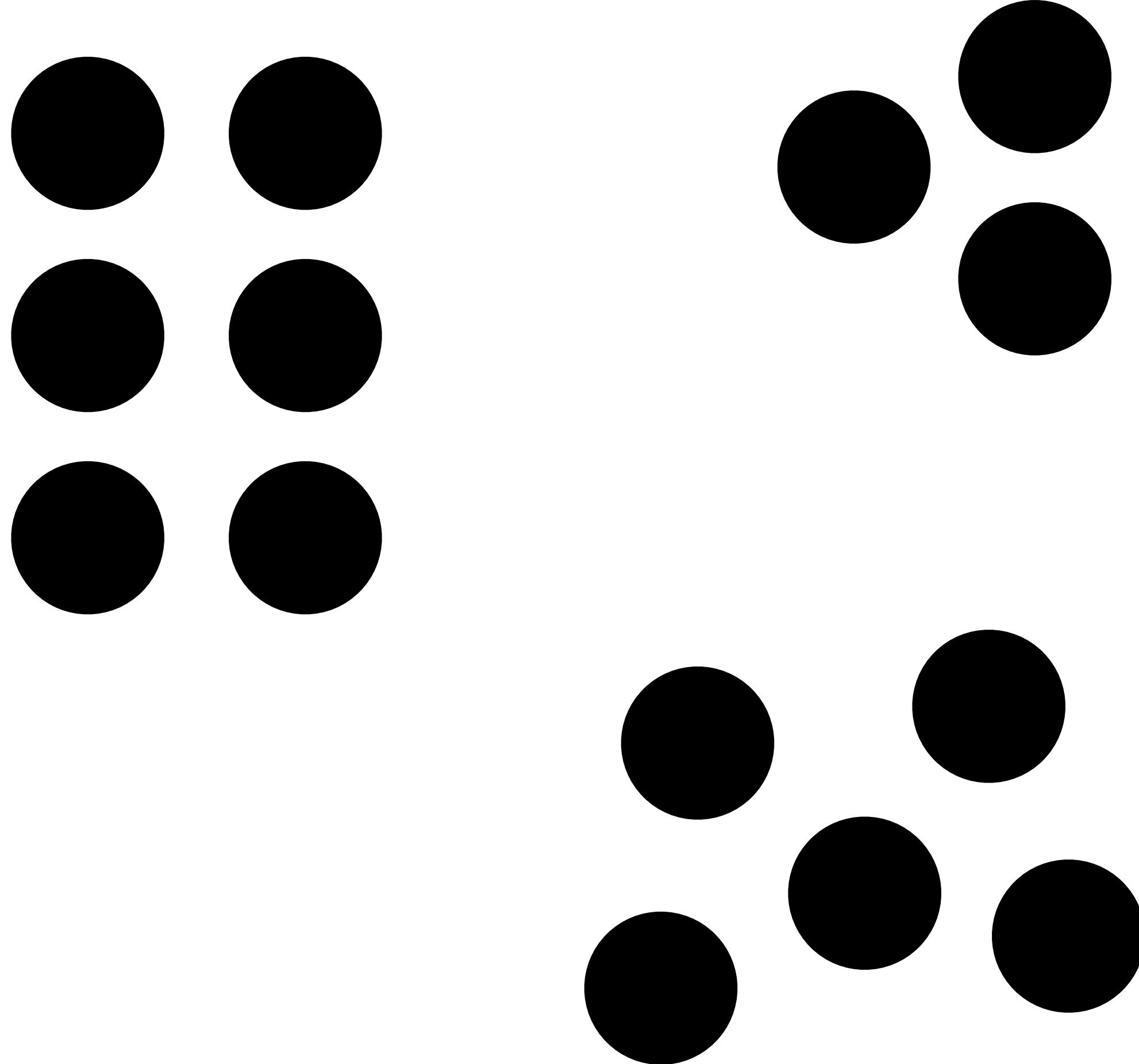
Gestalt Principles

Proximity

Gestalt Principles

Proximity

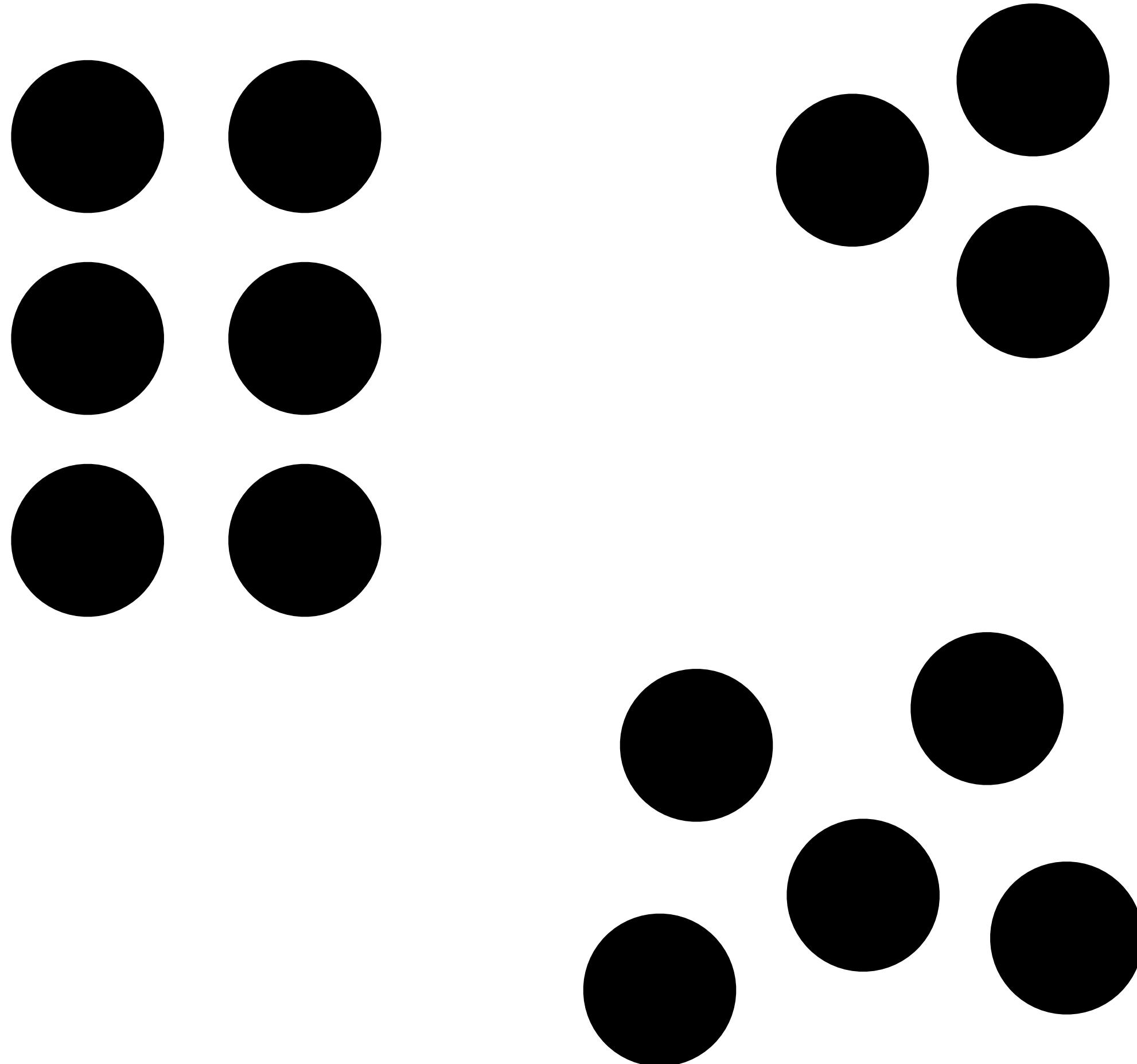
Objects that are close together are perceived as a group



Gestalt Principles

Proximity

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

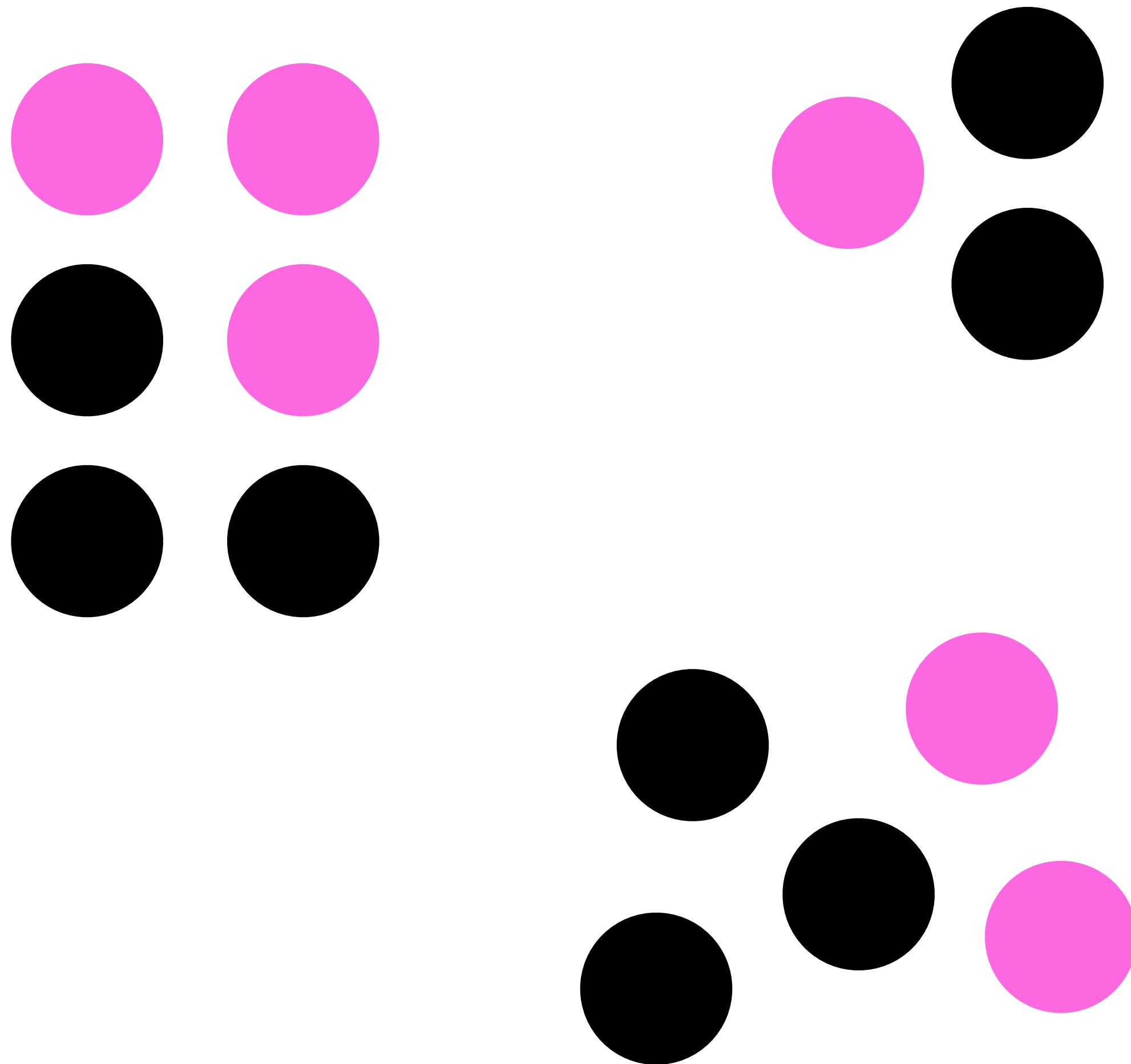


Similiarity

Gestalt Principles

Similarity

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

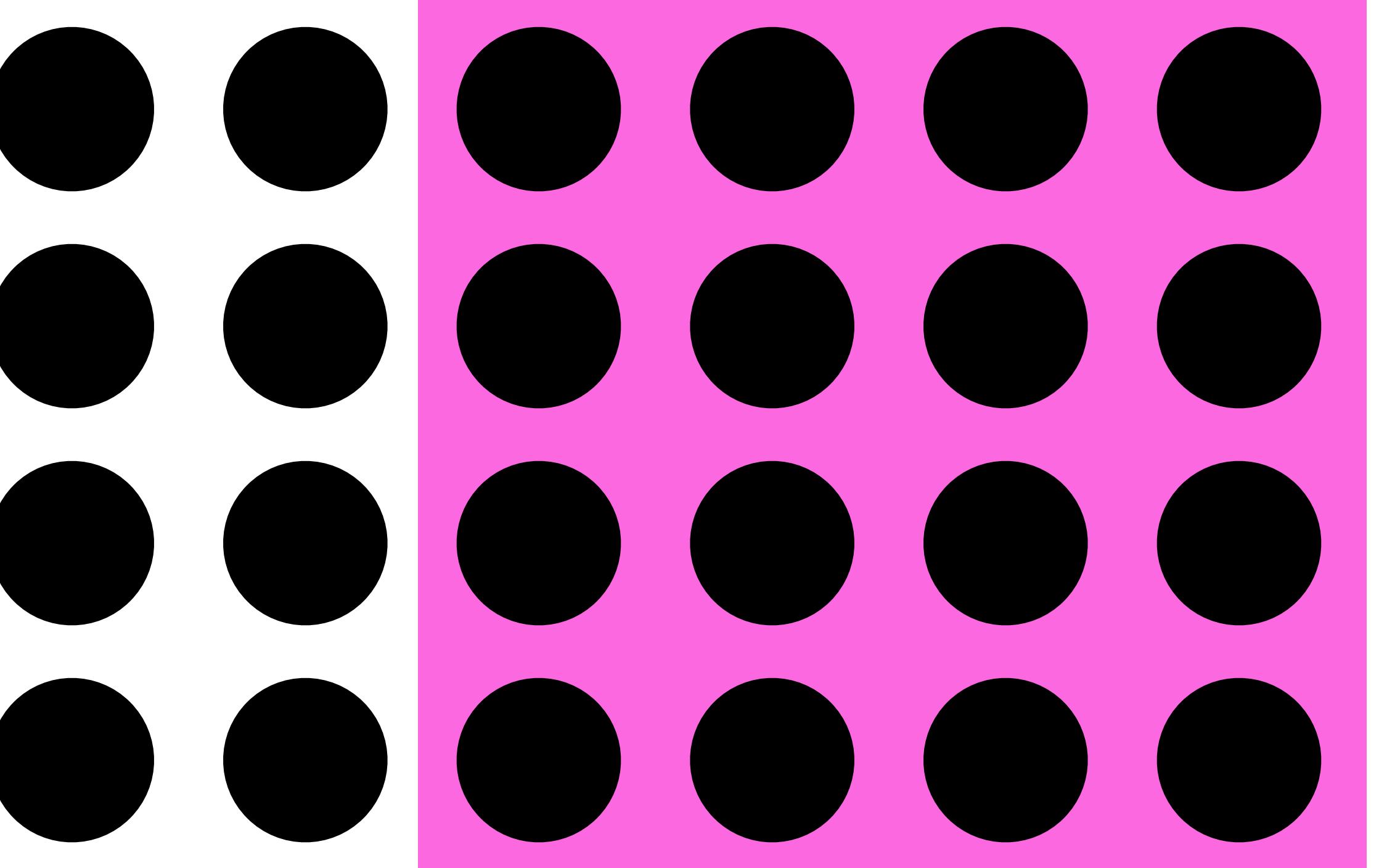


Enclosure

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.

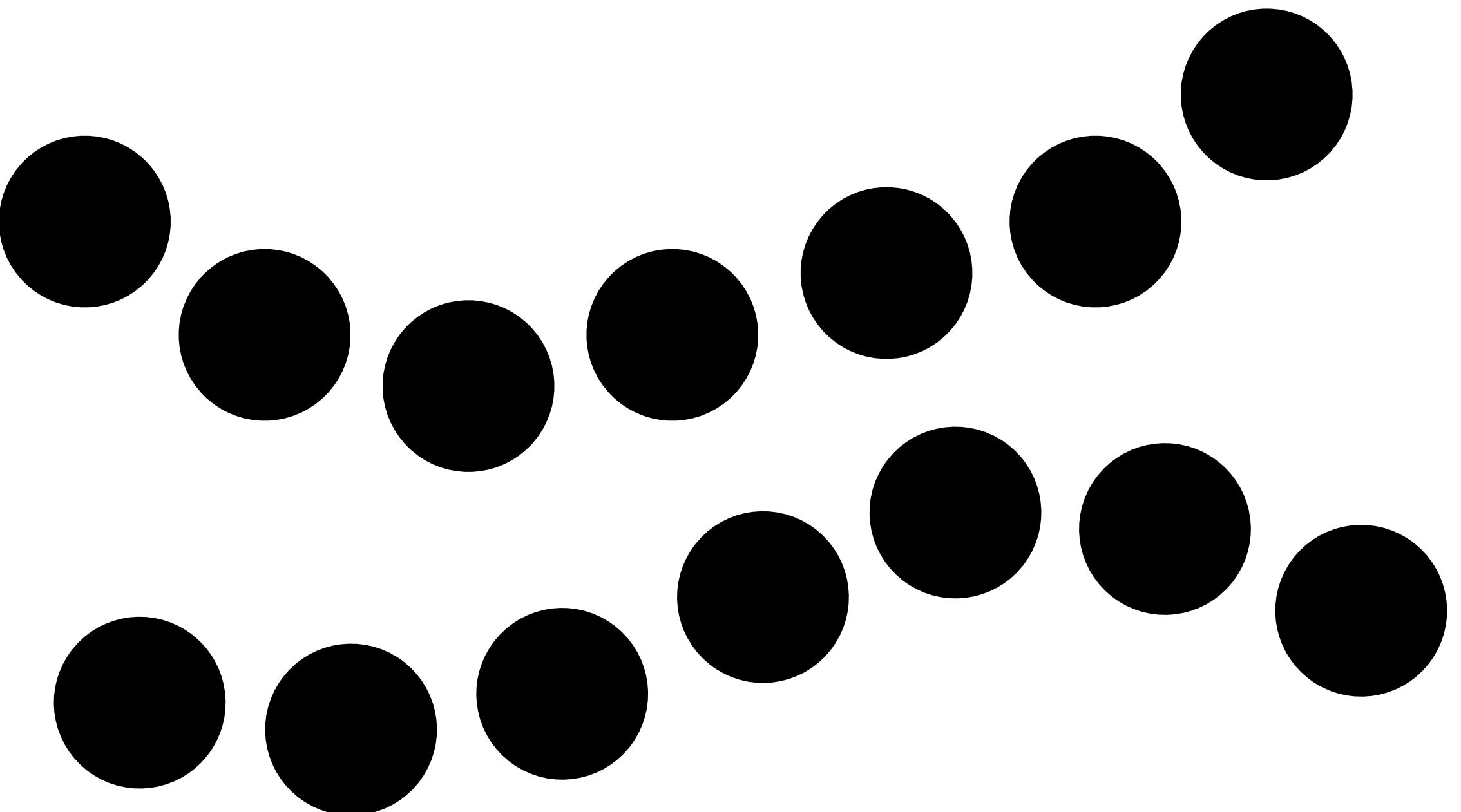


Continuity

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.

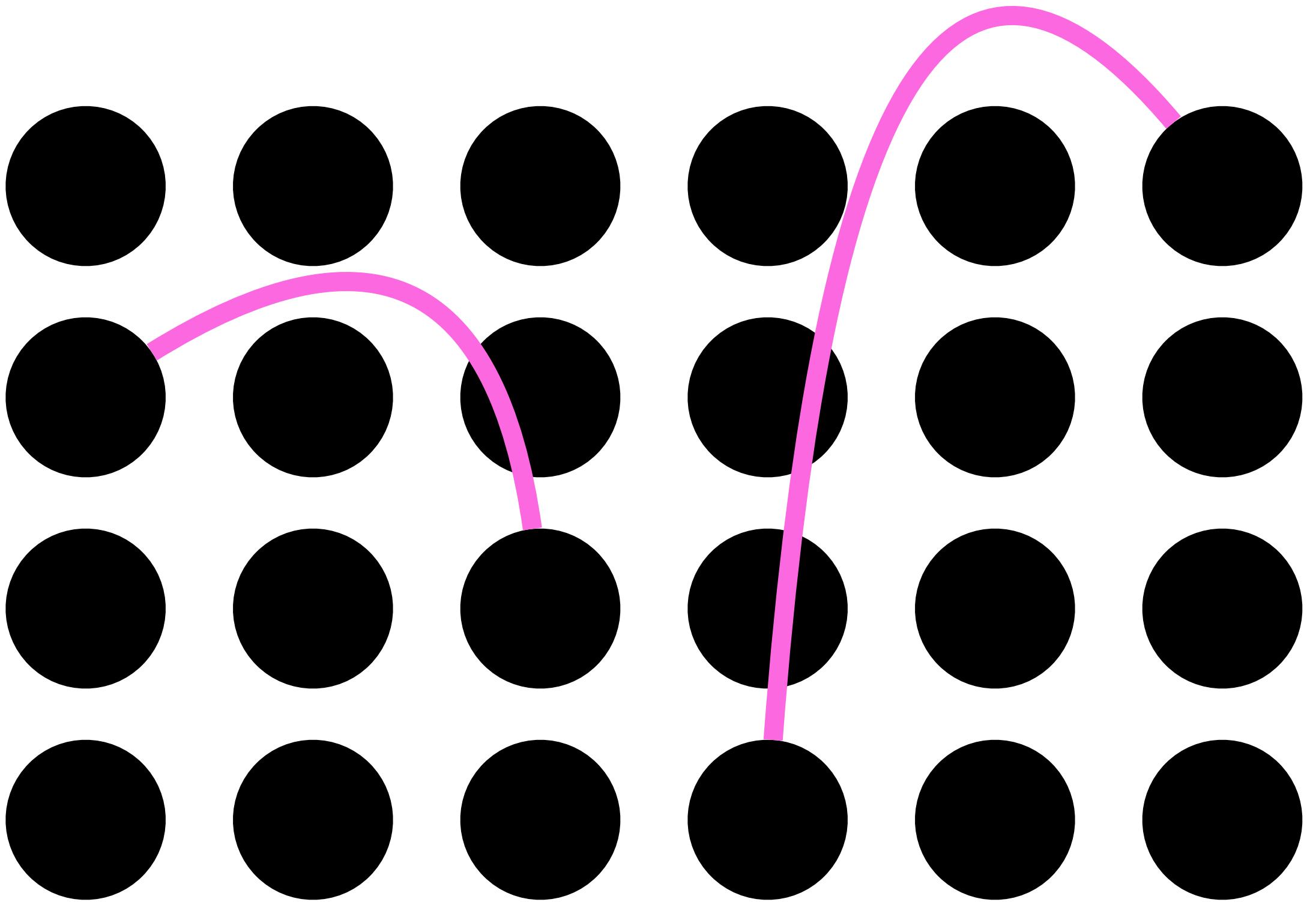


Connection

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 holds it for the longest.

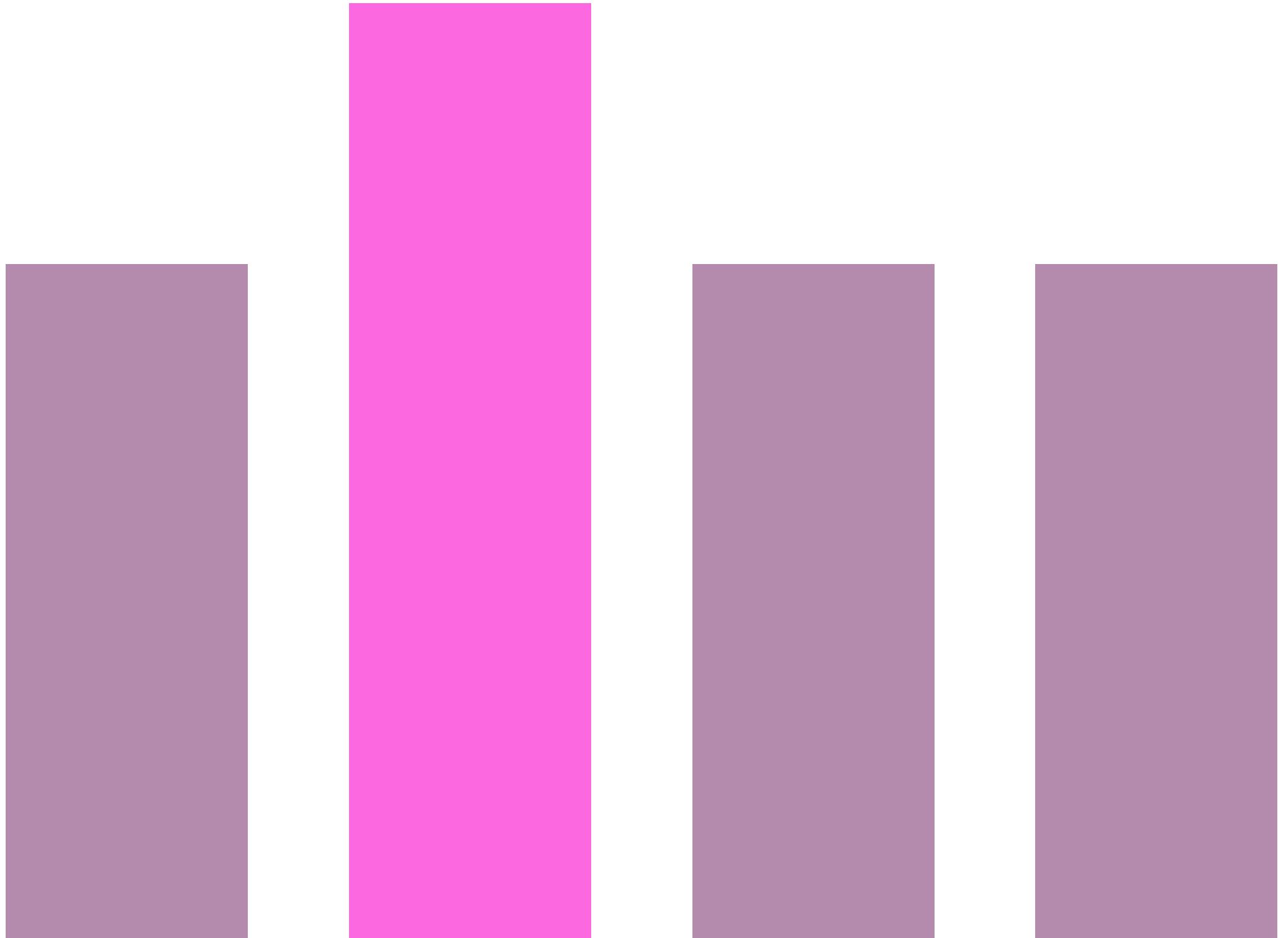


Figure and Ground

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

The screenshot shows the homepage of the Flourish studio website. At the top, there is a navigation bar with links for Examples, Solutions, Resources, Pricing, Log in, and Sign up. The main headline reads "Where data meets storytelling". Below the headline, there is a descriptive text: "Create stunning charts, maps and interactive content that engage and inspire – instantly. No coding required." At the bottom, there are two calls-to-action: "Get started now" and "Request a demo".

*Flourish Examples Solutions Resources Pricing Log in 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.