Reflection session

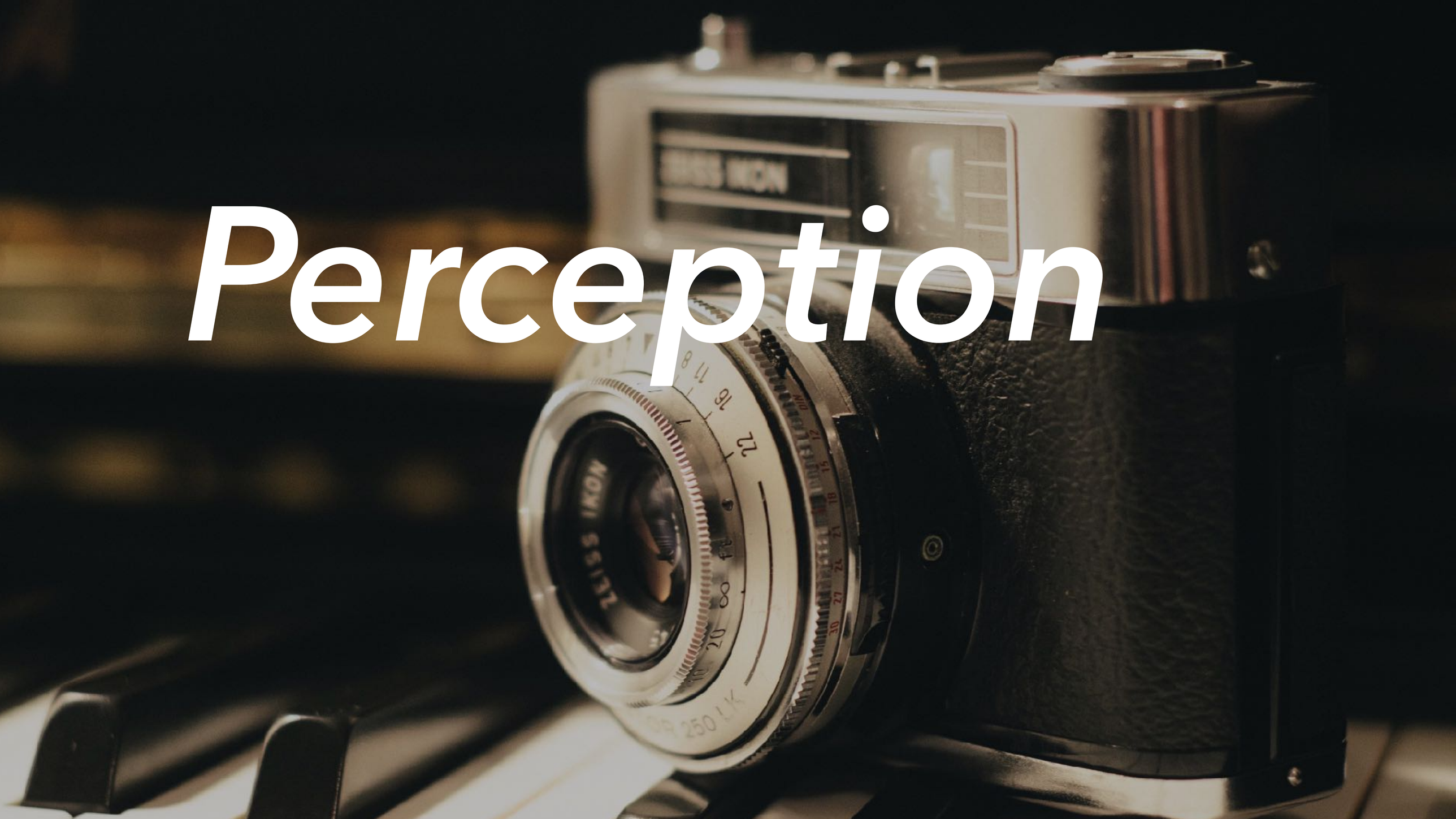
Step 1:

In pairs of rows, take turns discussing with your neighbors what you read and what you found interesting about it.

- 10 minutes

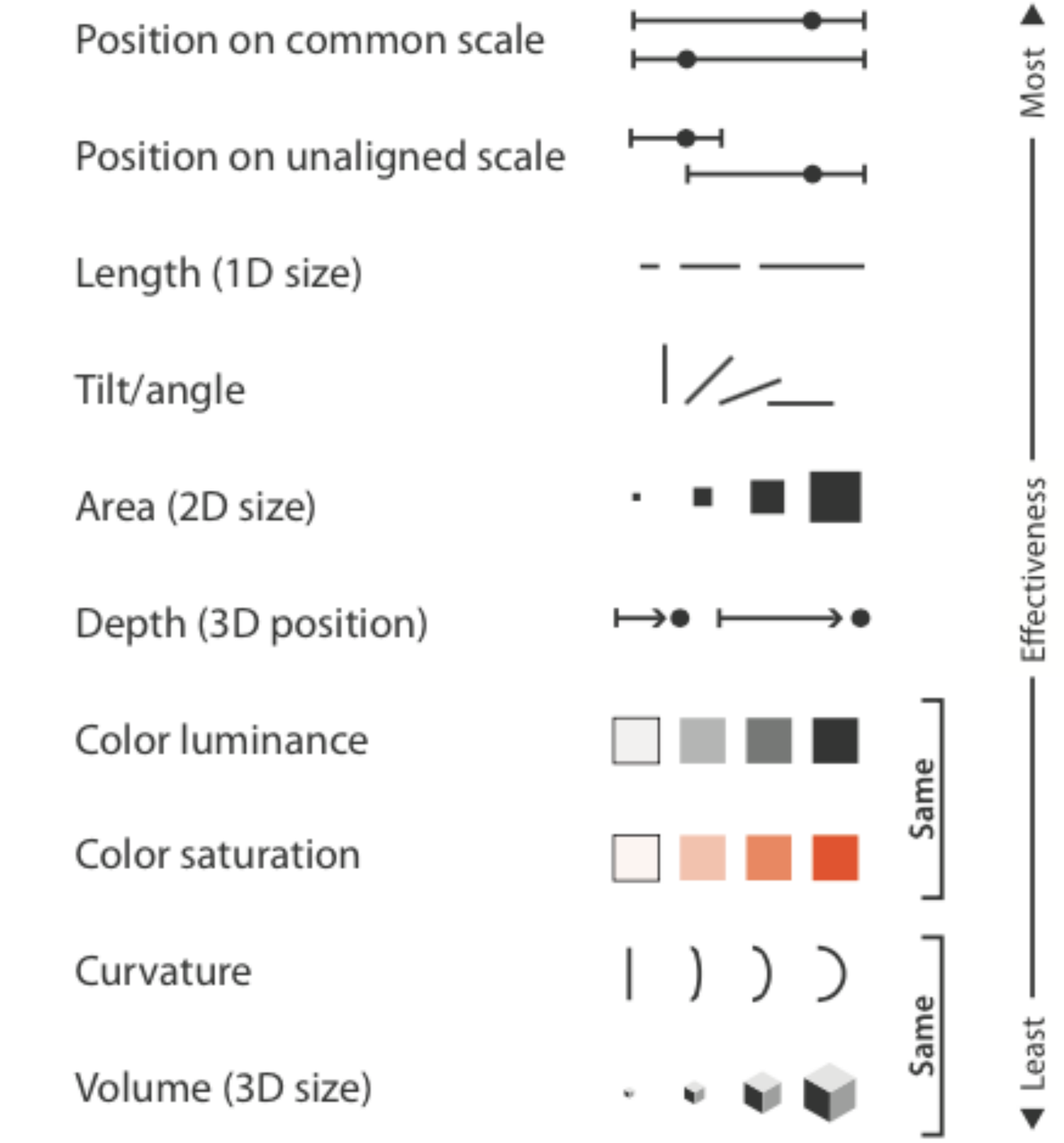
Visual Channels and Data Mapping

Perception and Cognition


Perception

Perception (Channels)

Magnitude Channels: Ordered Attributes



Position (Common Scale)

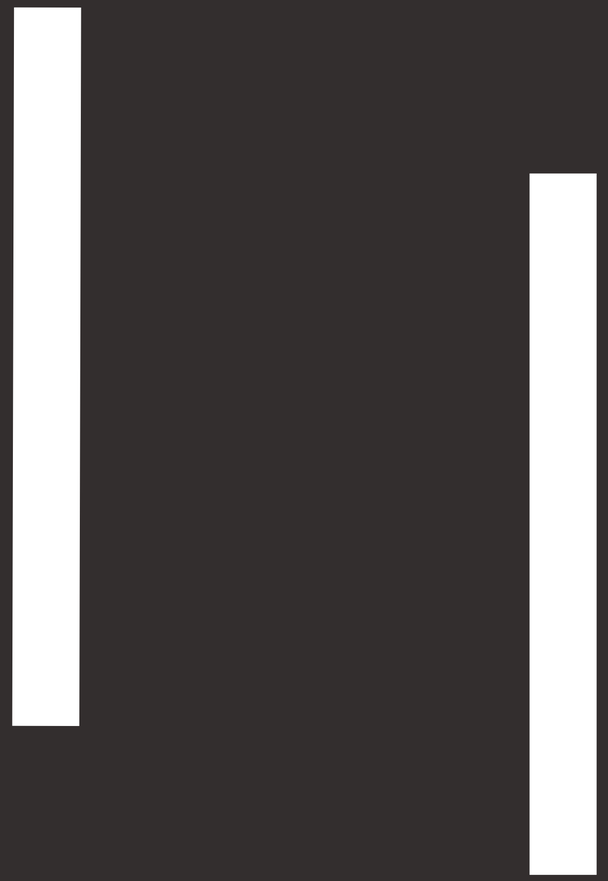
-scatterplots

-bar charts

-line charts

-???

Position (Un-aligned Scale)



-stacked bars

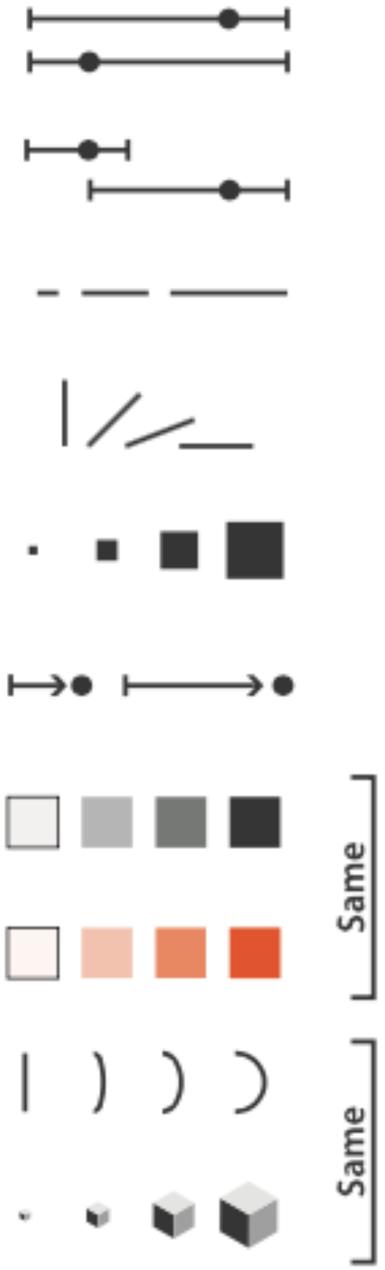
-stacked area

-???

Identity

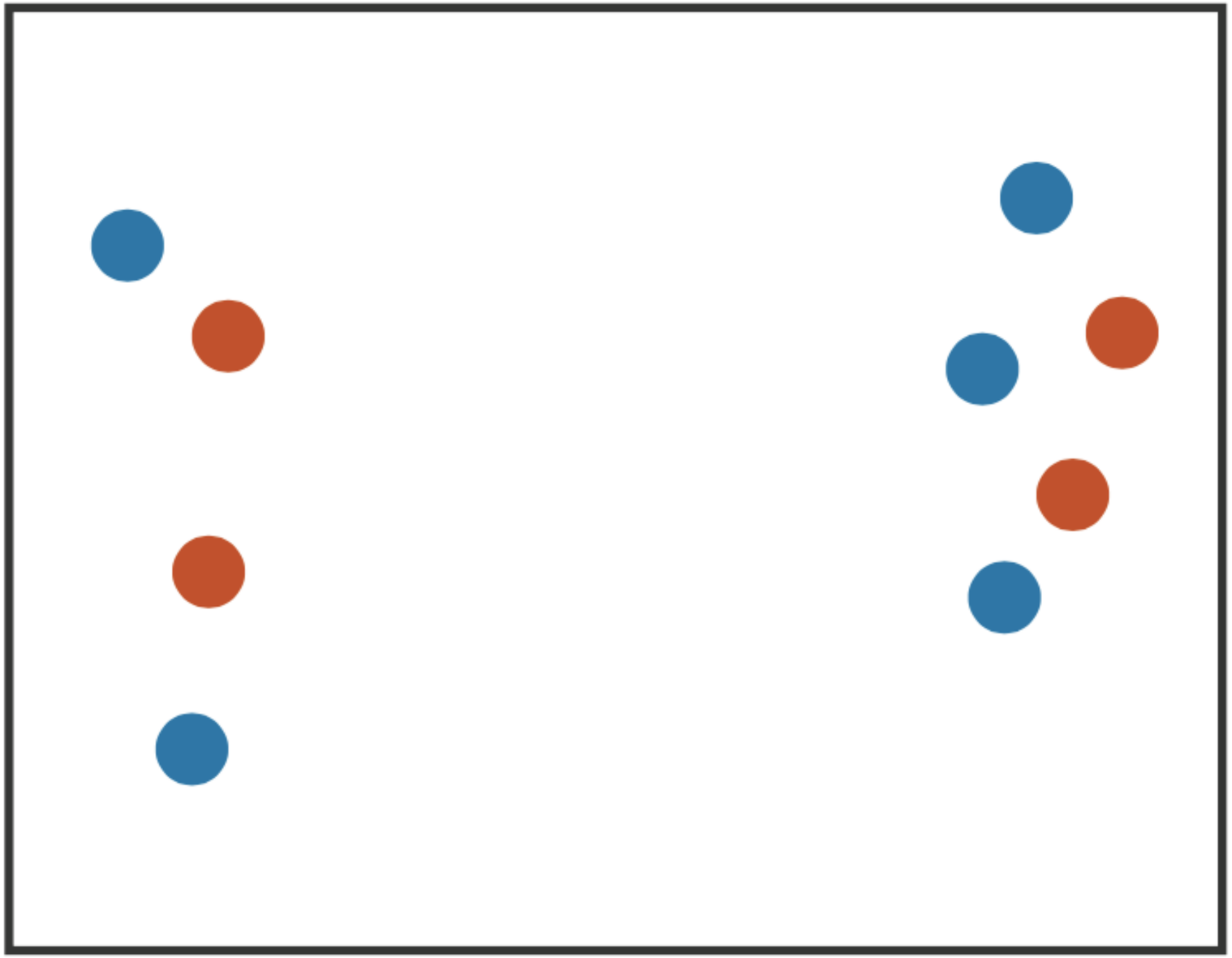
Magnitude Channels: Ordered Attributes

- 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)



Identity Channels: Categorical Attributes

- Spatial region
- Color hue
- Motion
- Shape

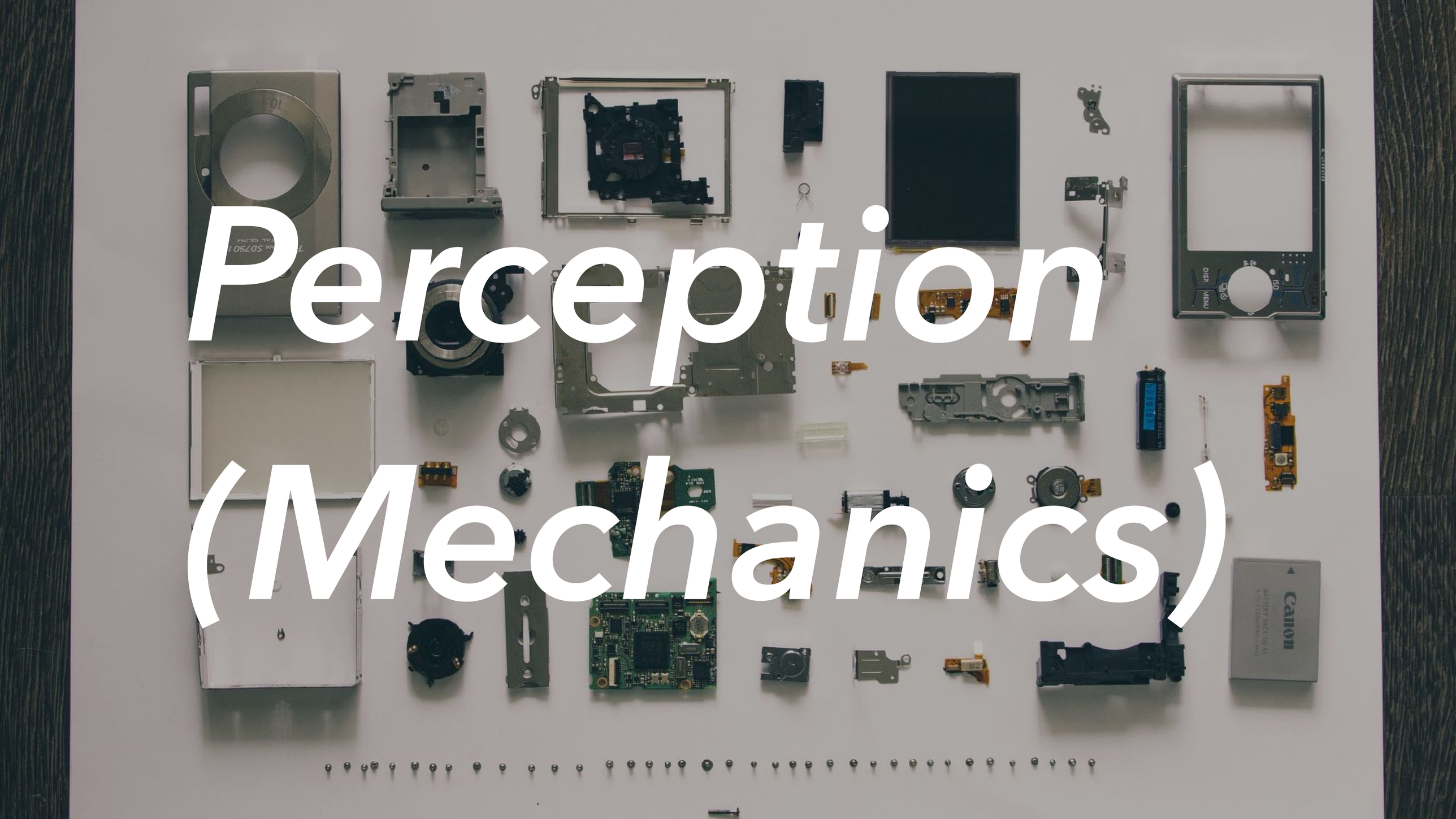


Spatial Region

Hue sucks for magnitude:

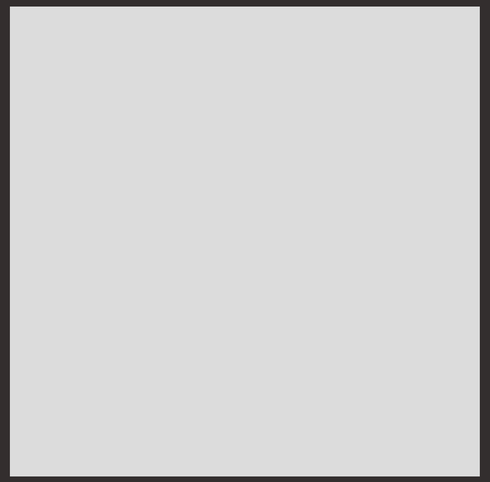
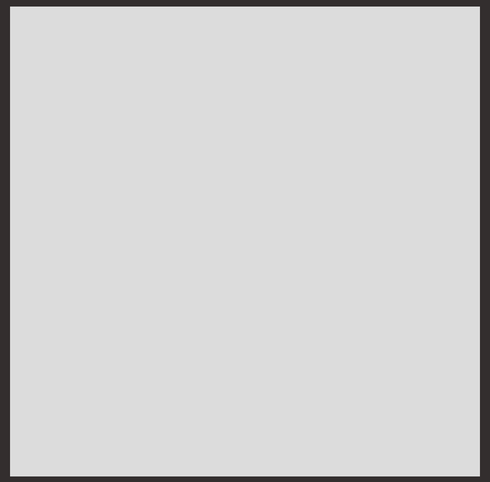
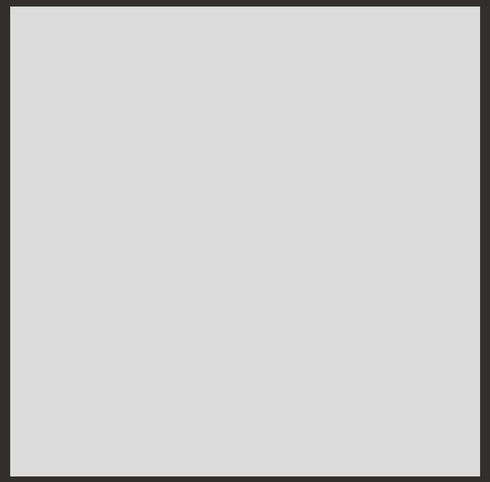
Hue sucks for magnitude:

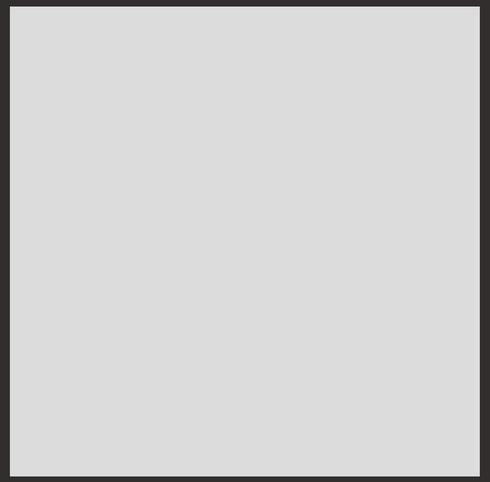
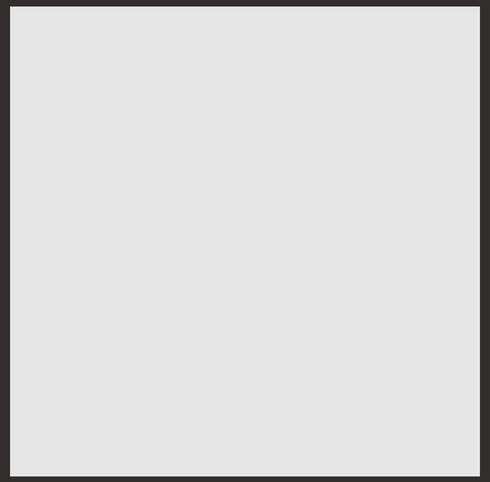
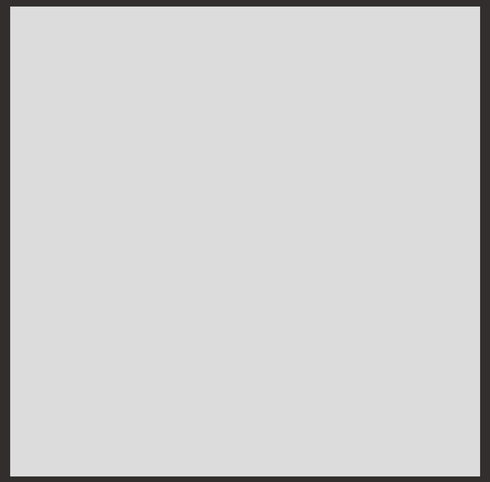
Hue doesn't suck for identity:

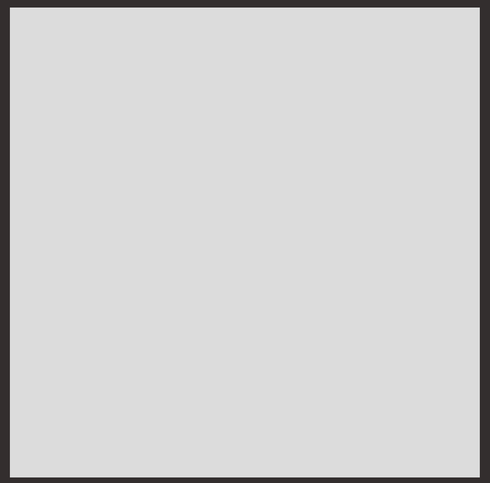

Perception
(Mechanics)

Discrimination

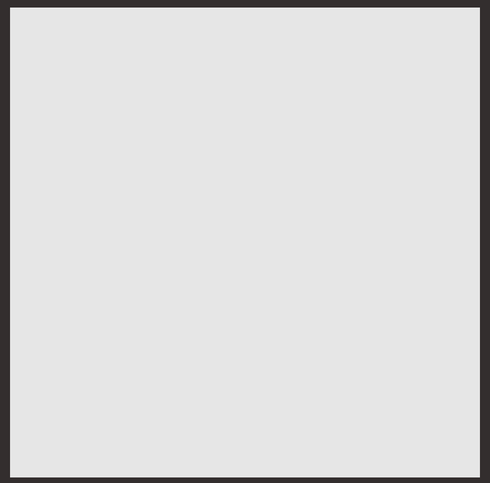
Which is brighter?



(220,220,220)



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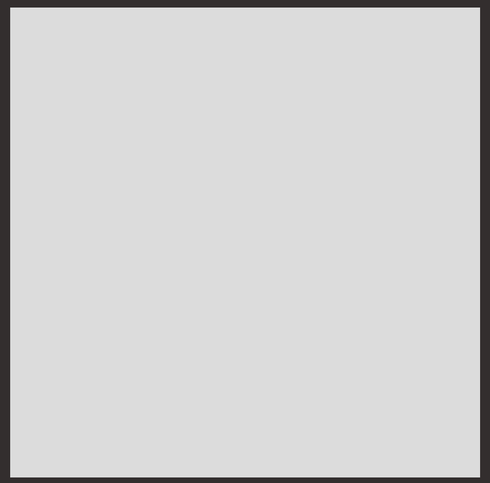
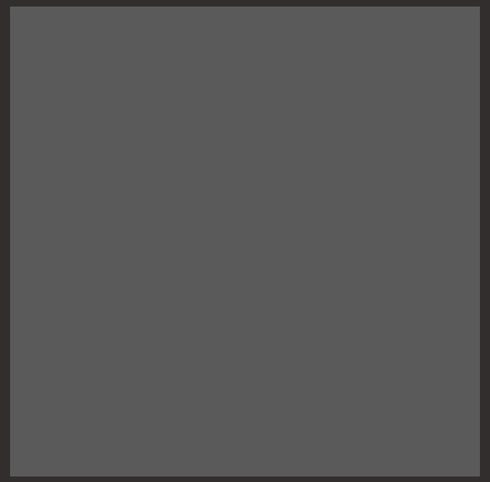


(220,220,220)

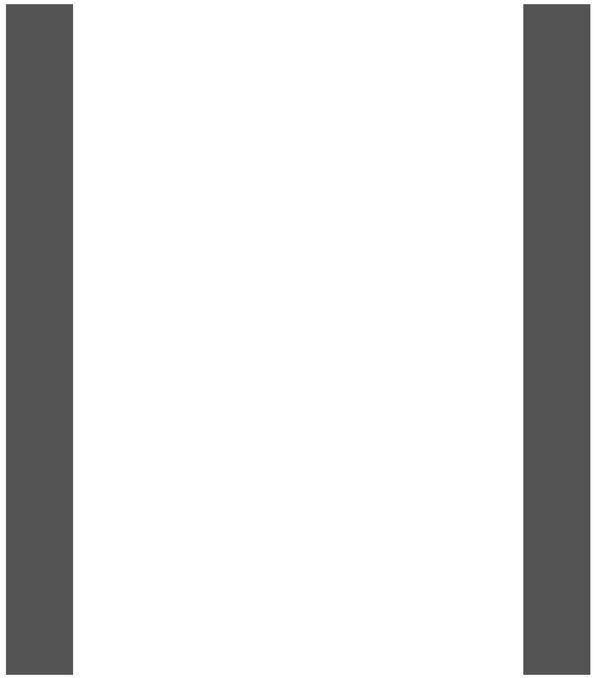

(80,80,80)

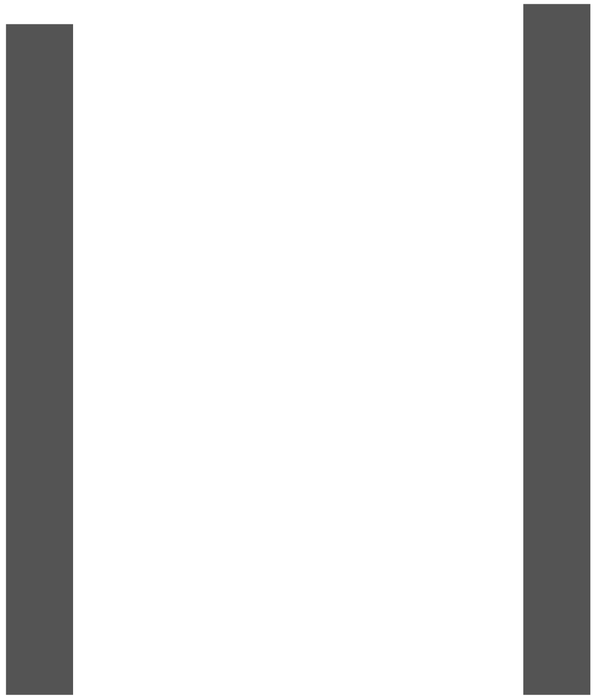
(90,90,90)

(80,80,80)

Same distance, but easier. Why?

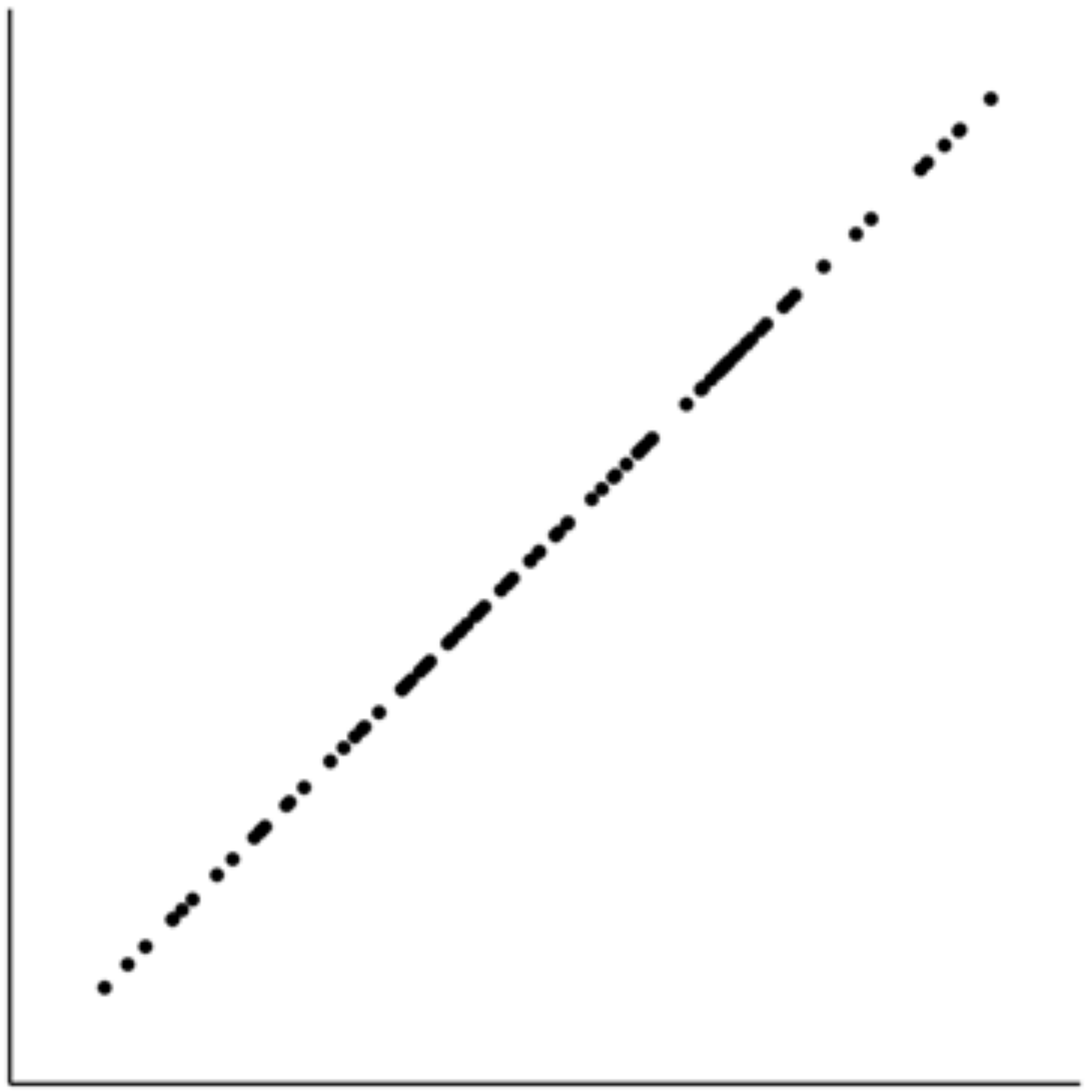
Which is longer?

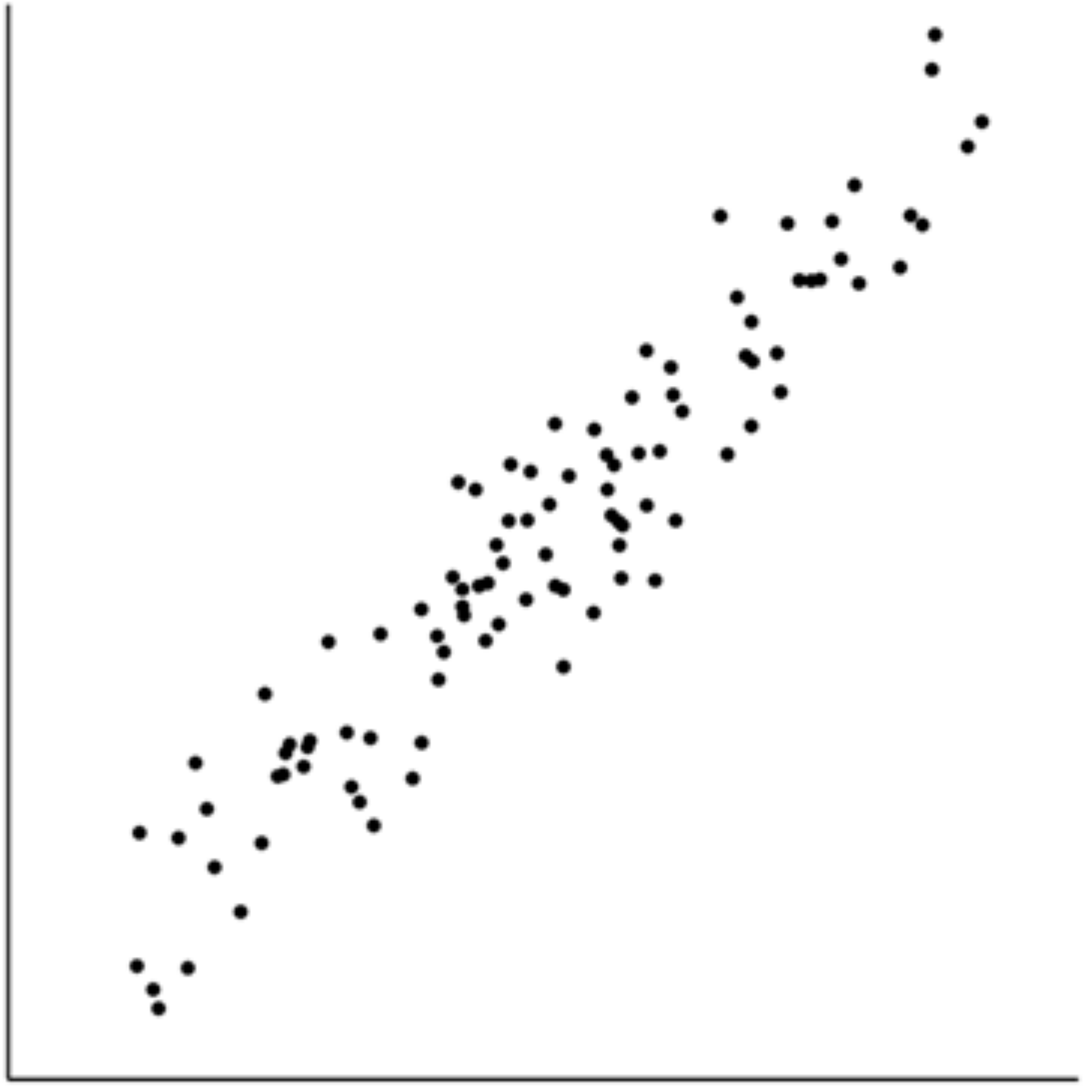




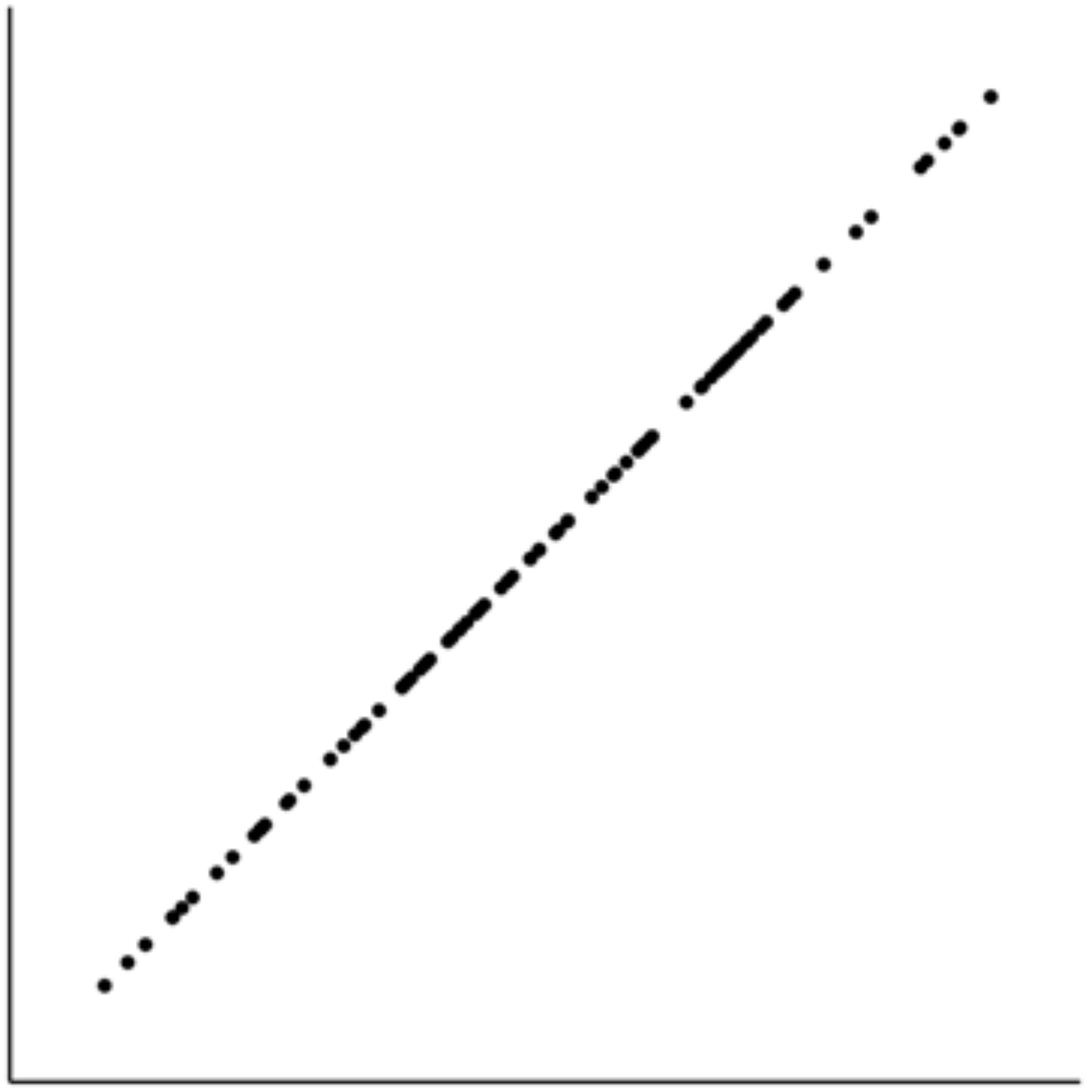
Same distance, but same. Why!?

Which is more correlated?

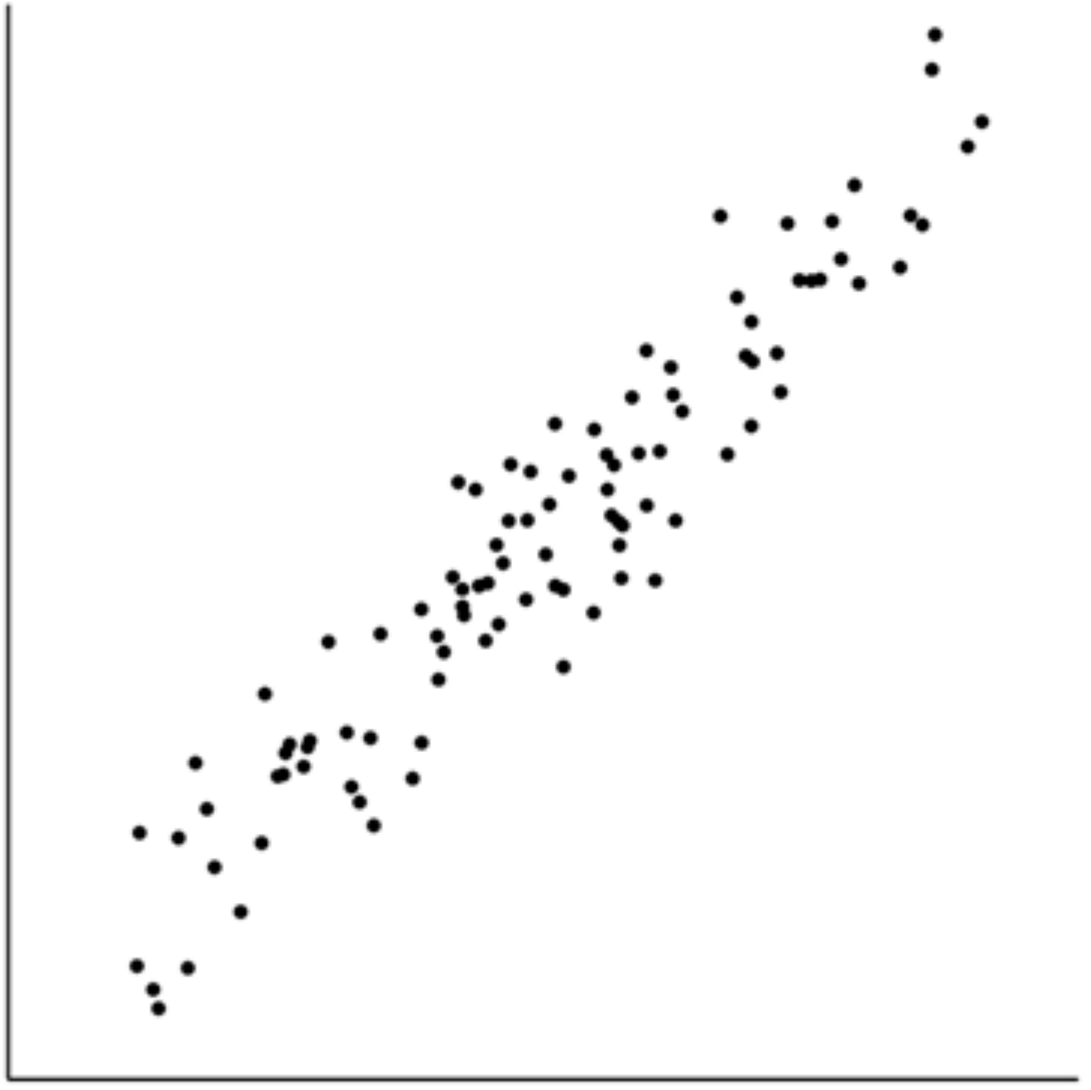


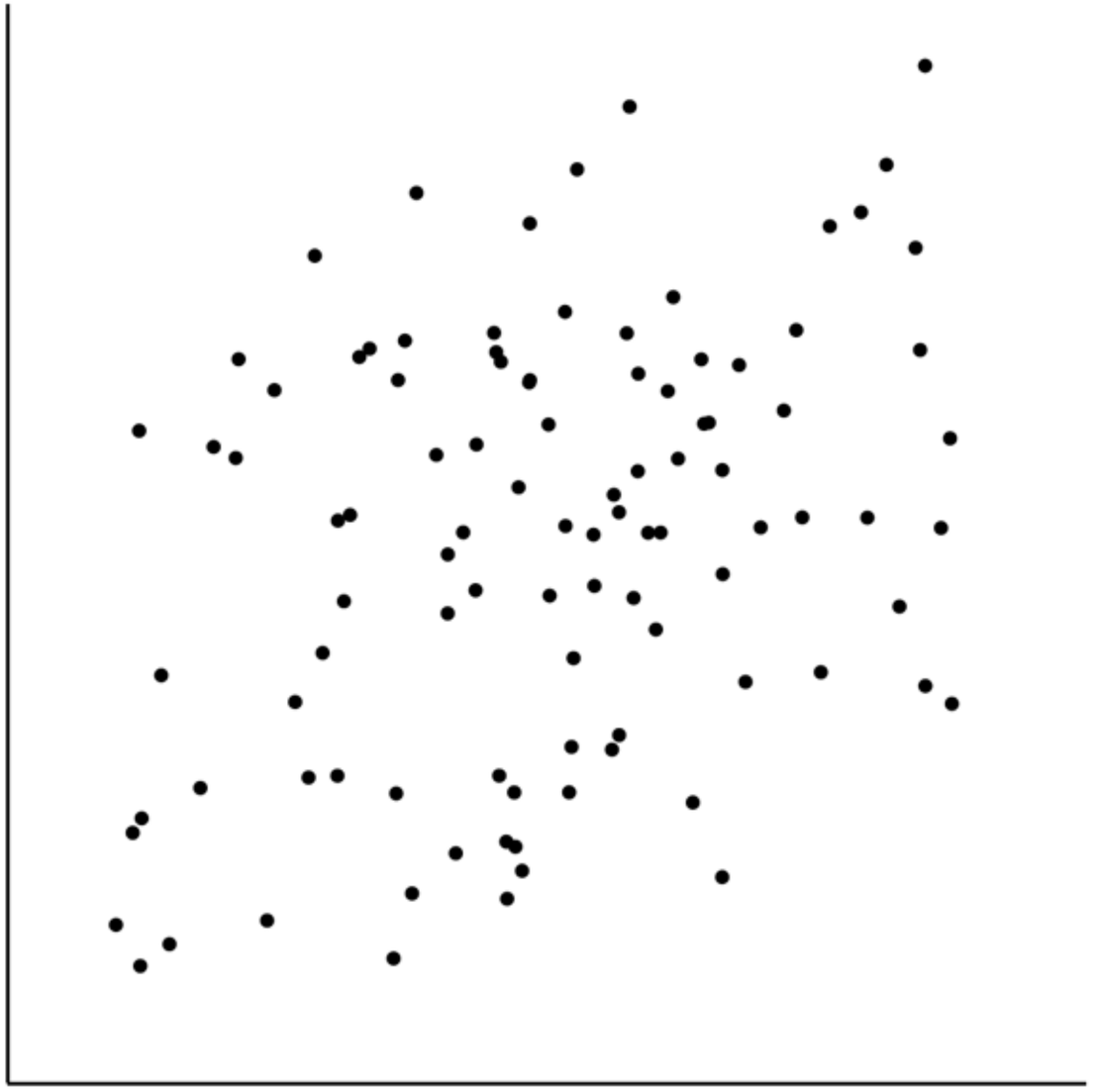


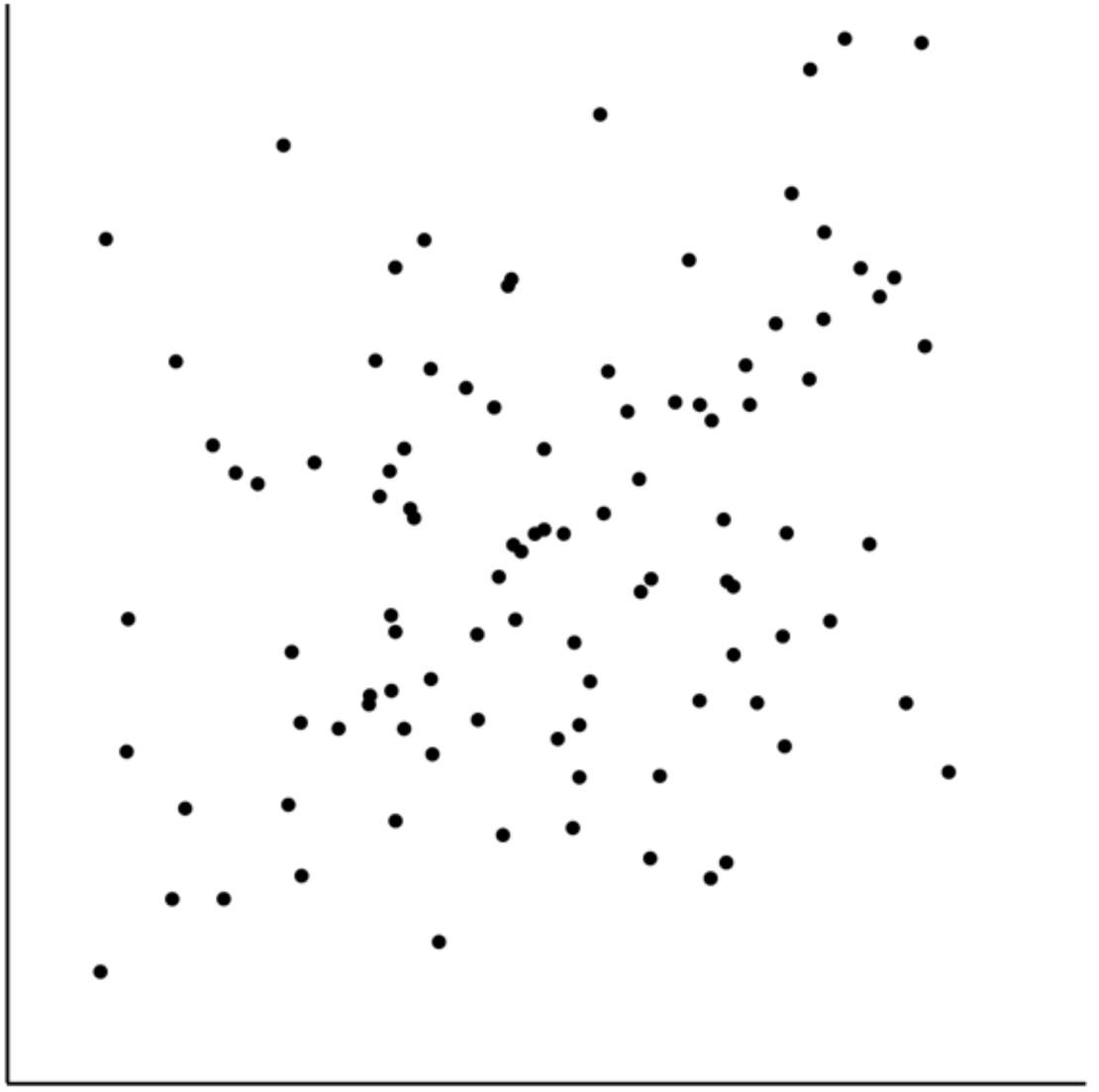
r = 1



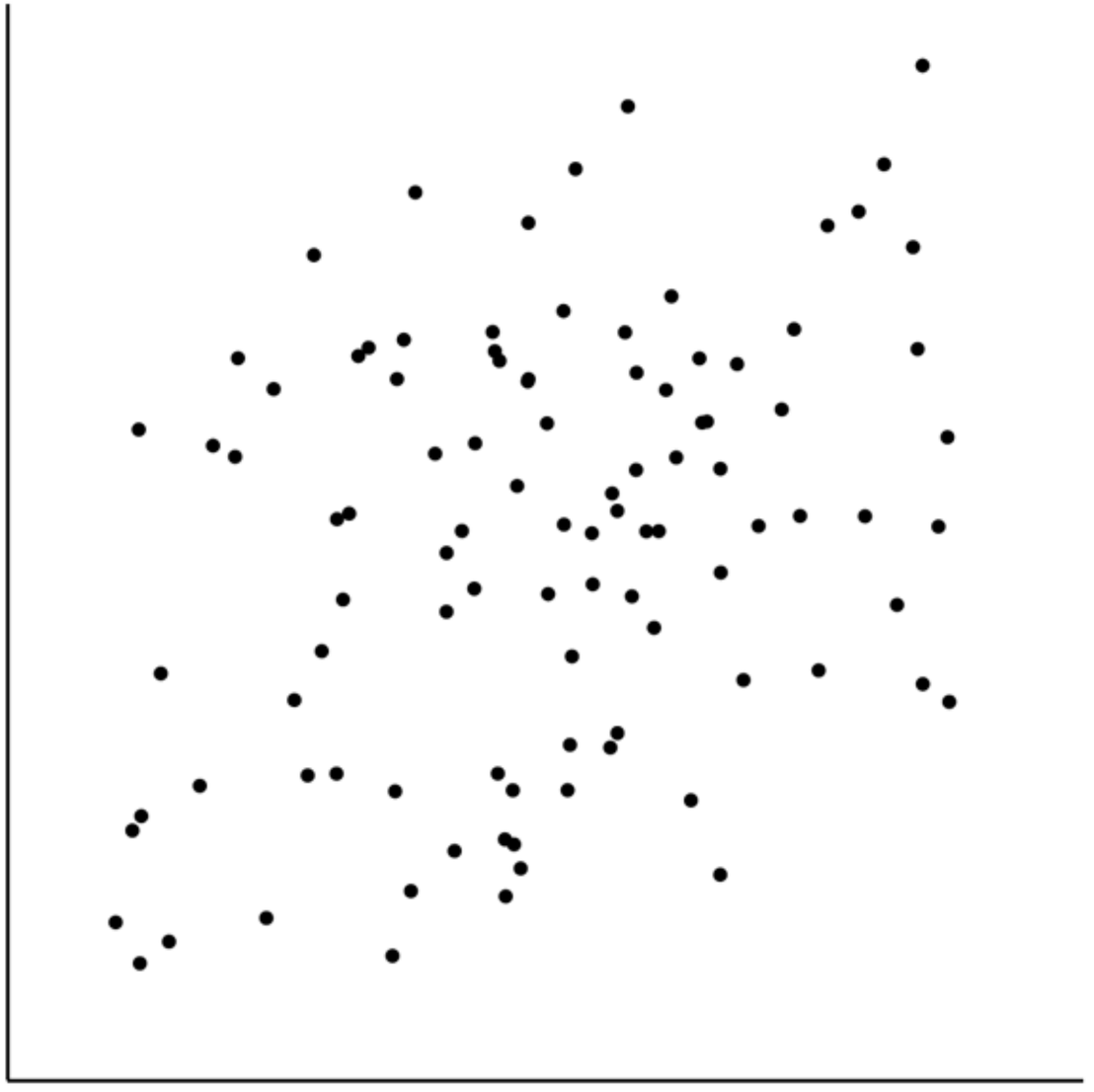
r = 0.95



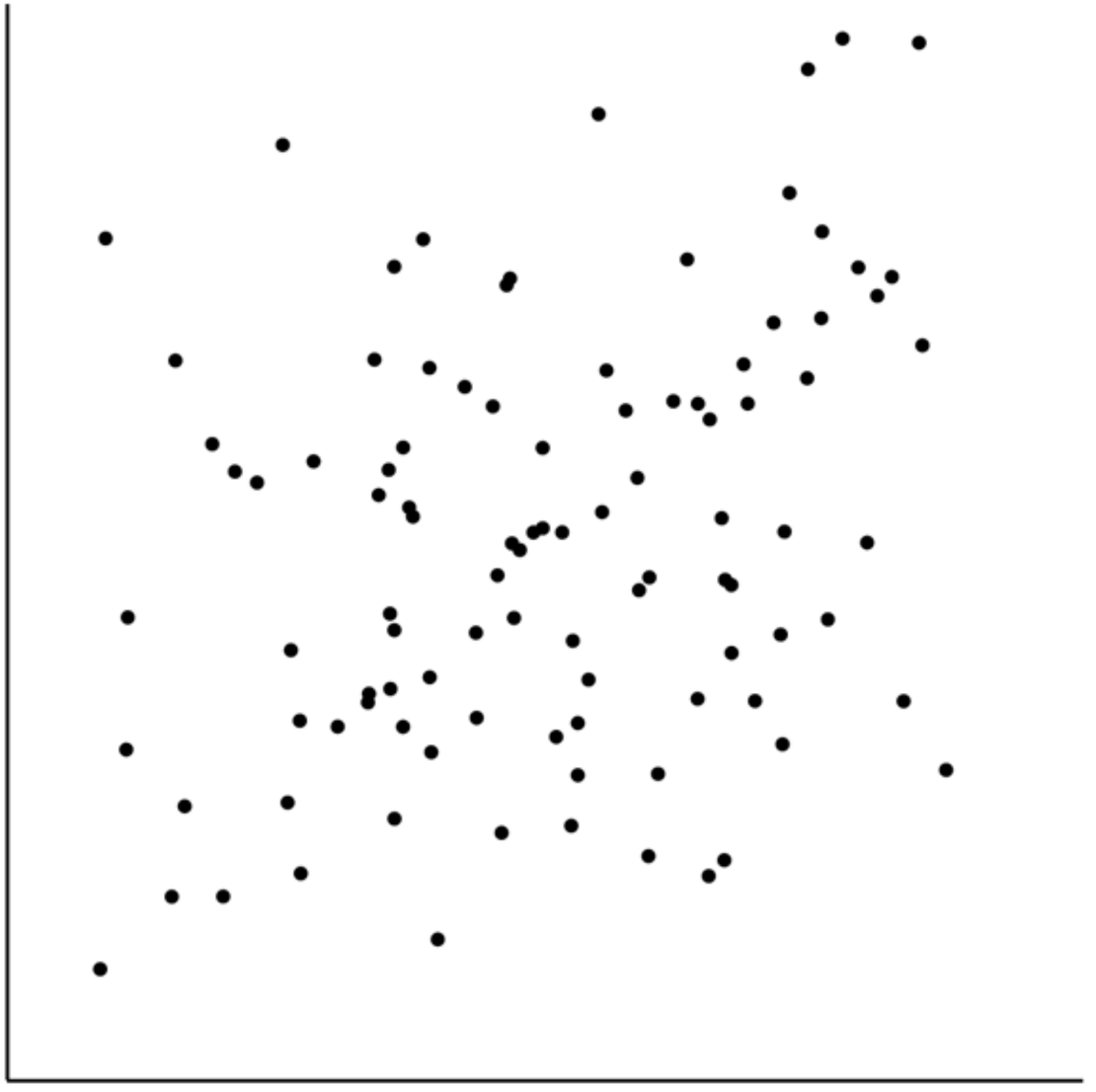




r = 0.35



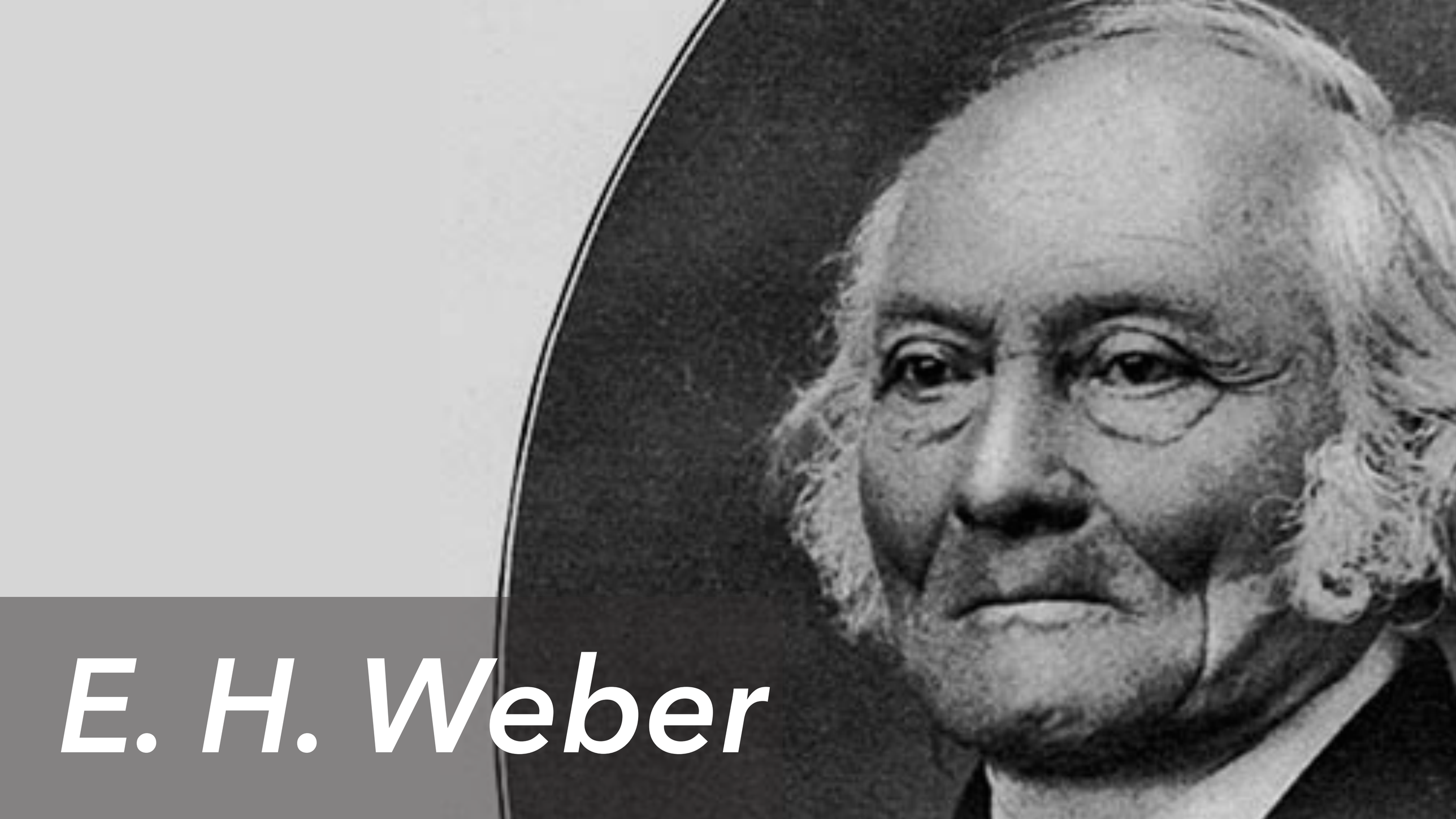
r = 0.3



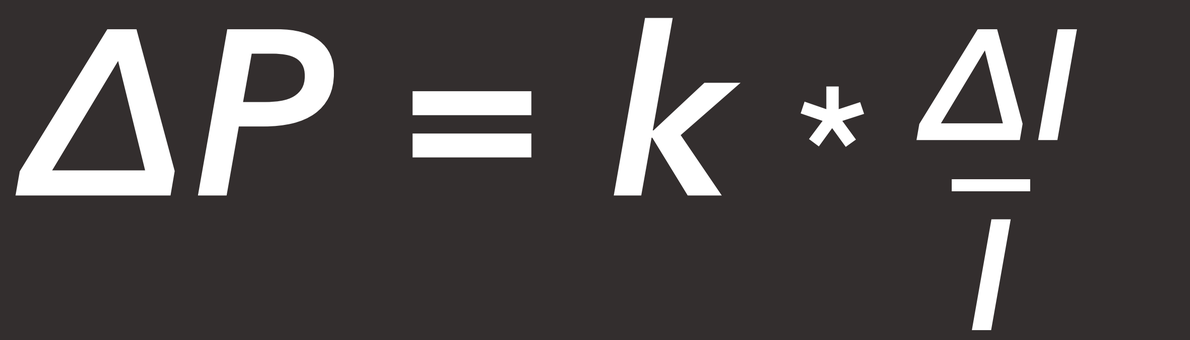
just-noticeable differences (jnd)

The smallest difference necessary to perceive two stimuli as being different.

Why were some distances different?



E. H. Weber



Weber's Law

Perceived diff

$$\Delta P = k * \frac{\Delta I}{I}$$

Perceived diff

$$\Delta P = k * \frac{\Delta I}{I}$$

Actual intensity of Stimulus

Perceived diff

Change in Intensity

$$\Delta P = k * \frac{\Delta I}{I}$$

Actual intensity of Stimulus

imagine yourself in a dark room...

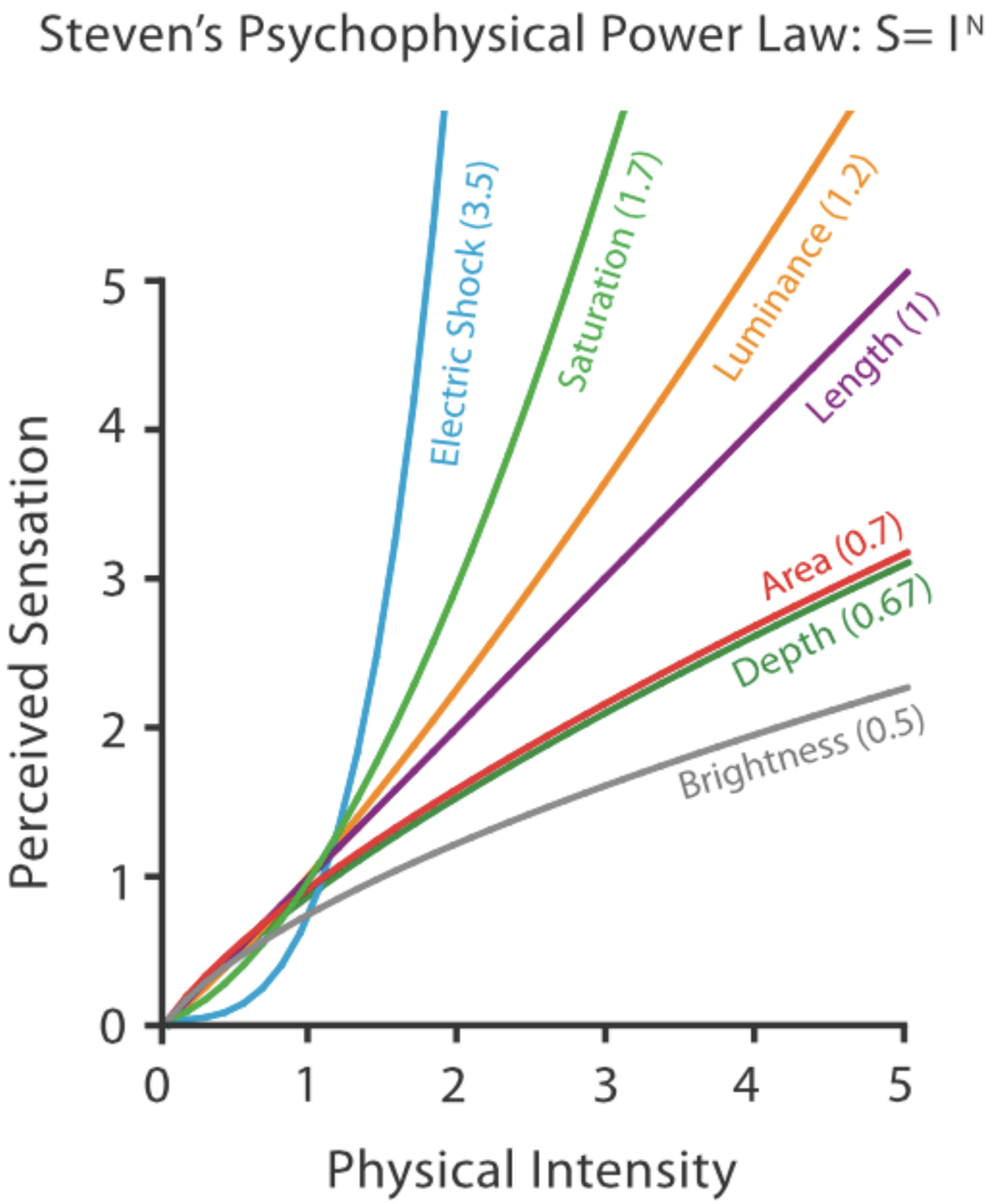
bright room, high intensity

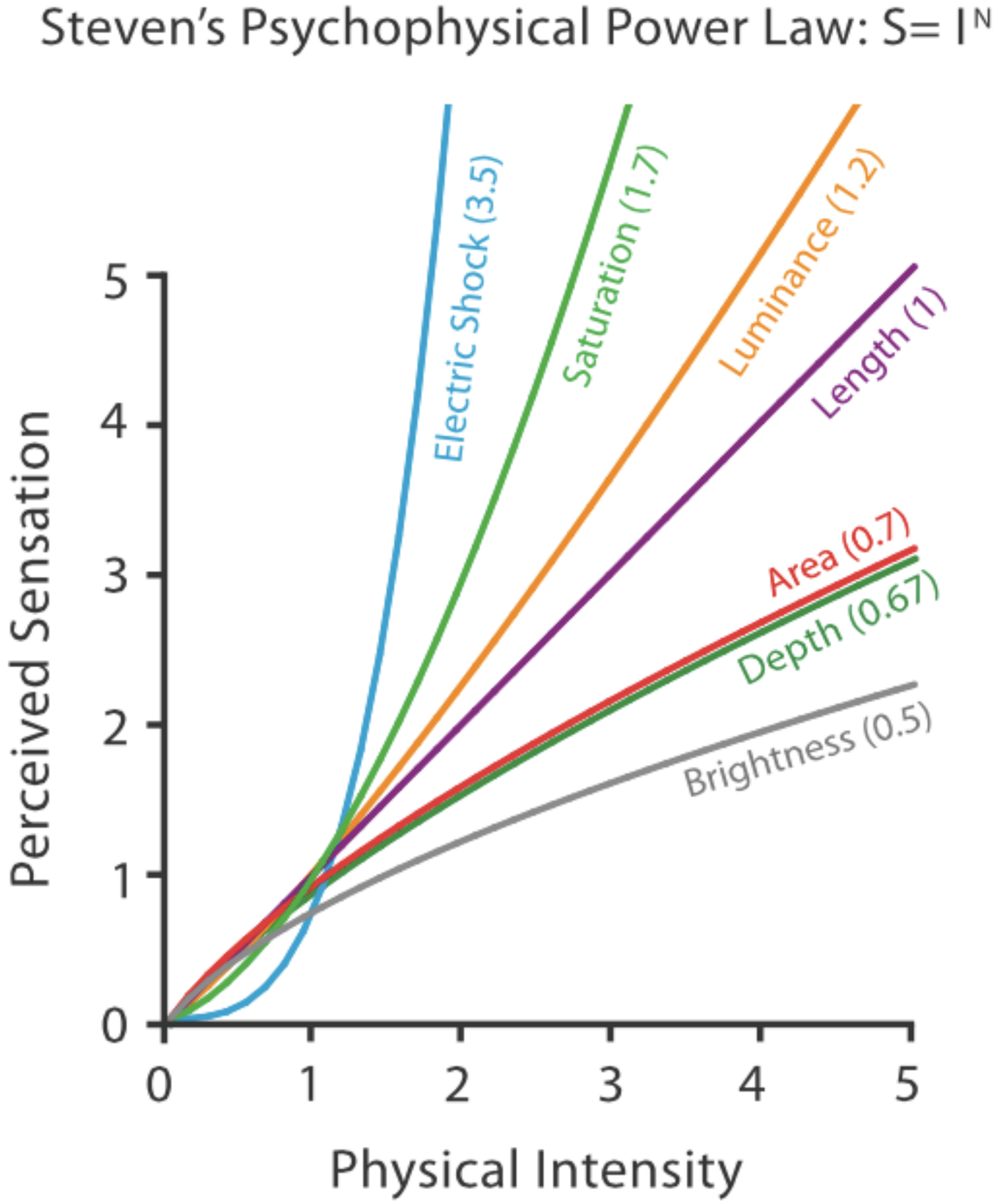
$$\Delta P = k * \frac{\Delta I}{I}$$

super bright light needed

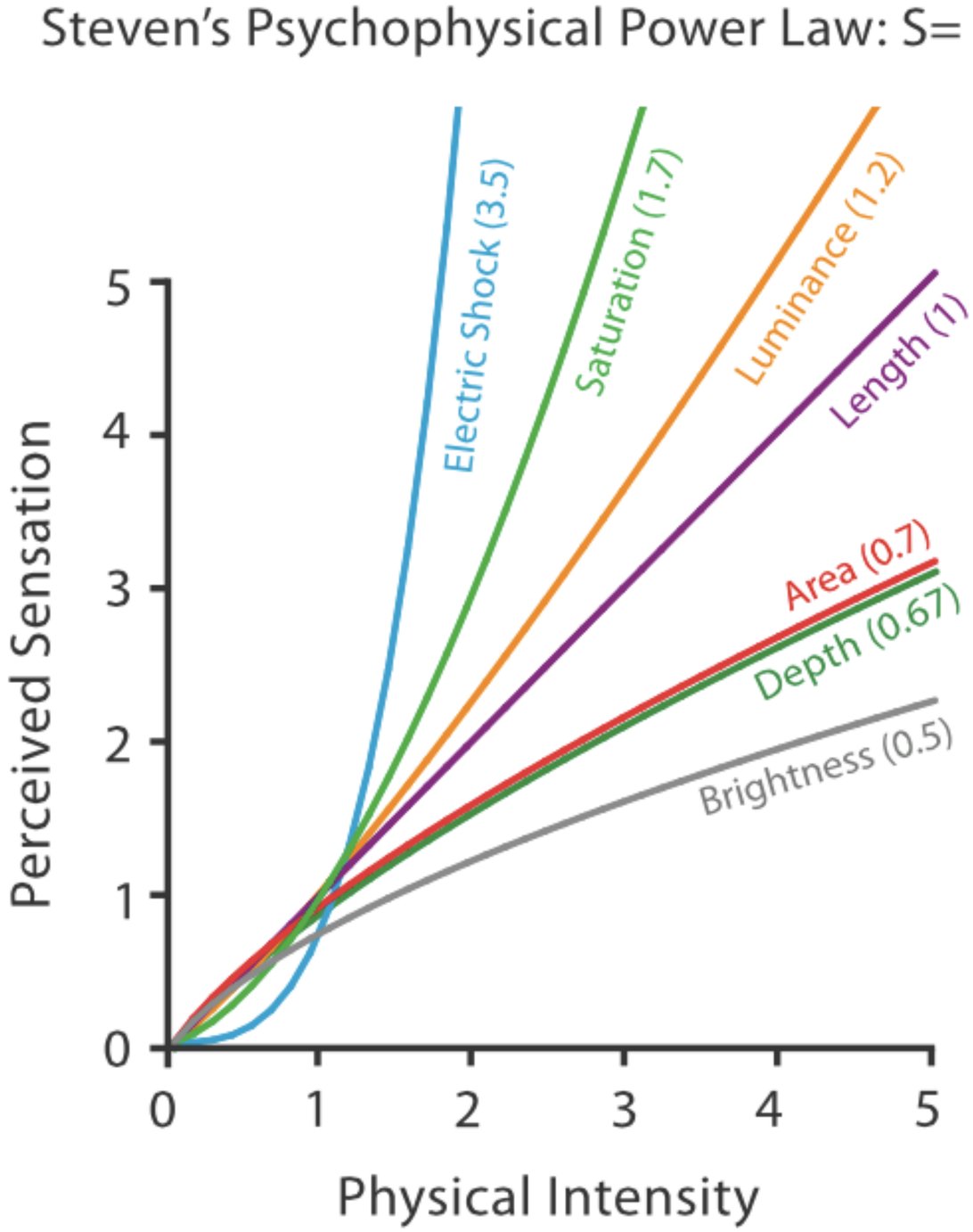
$$\Delta P = k * \frac{\Delta I}{I}$$

Estimation


Steven's Psychophysical Power Law: S= I^N
Perceived Sensation
Physical Intensity
0
1
2
3
4
5
Electric Shock (3.5)
Saturation (1.7)
Luminance (1.2)
Length (1)
Area (0.7)
Depth (0.67)
Brightness (0.5)

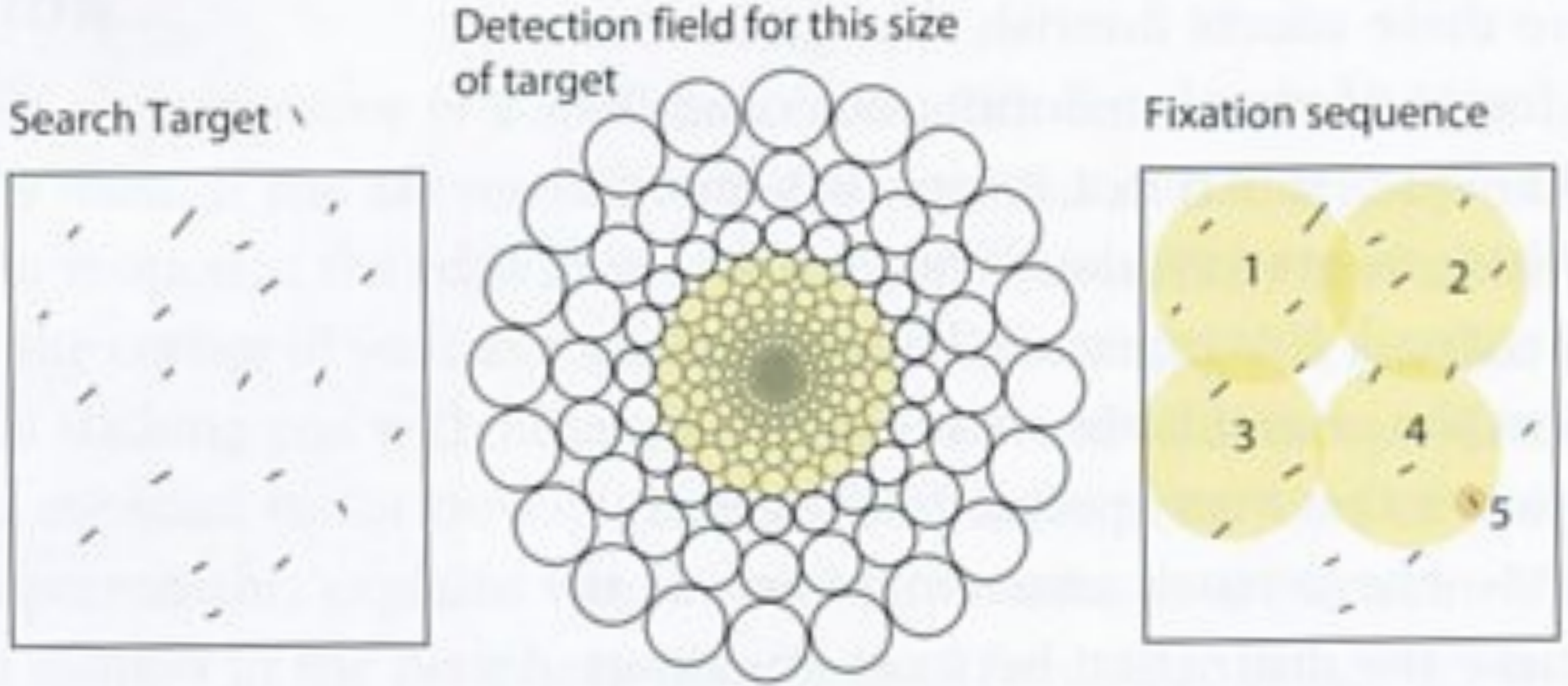


we under-estimate brightness



we are great at length

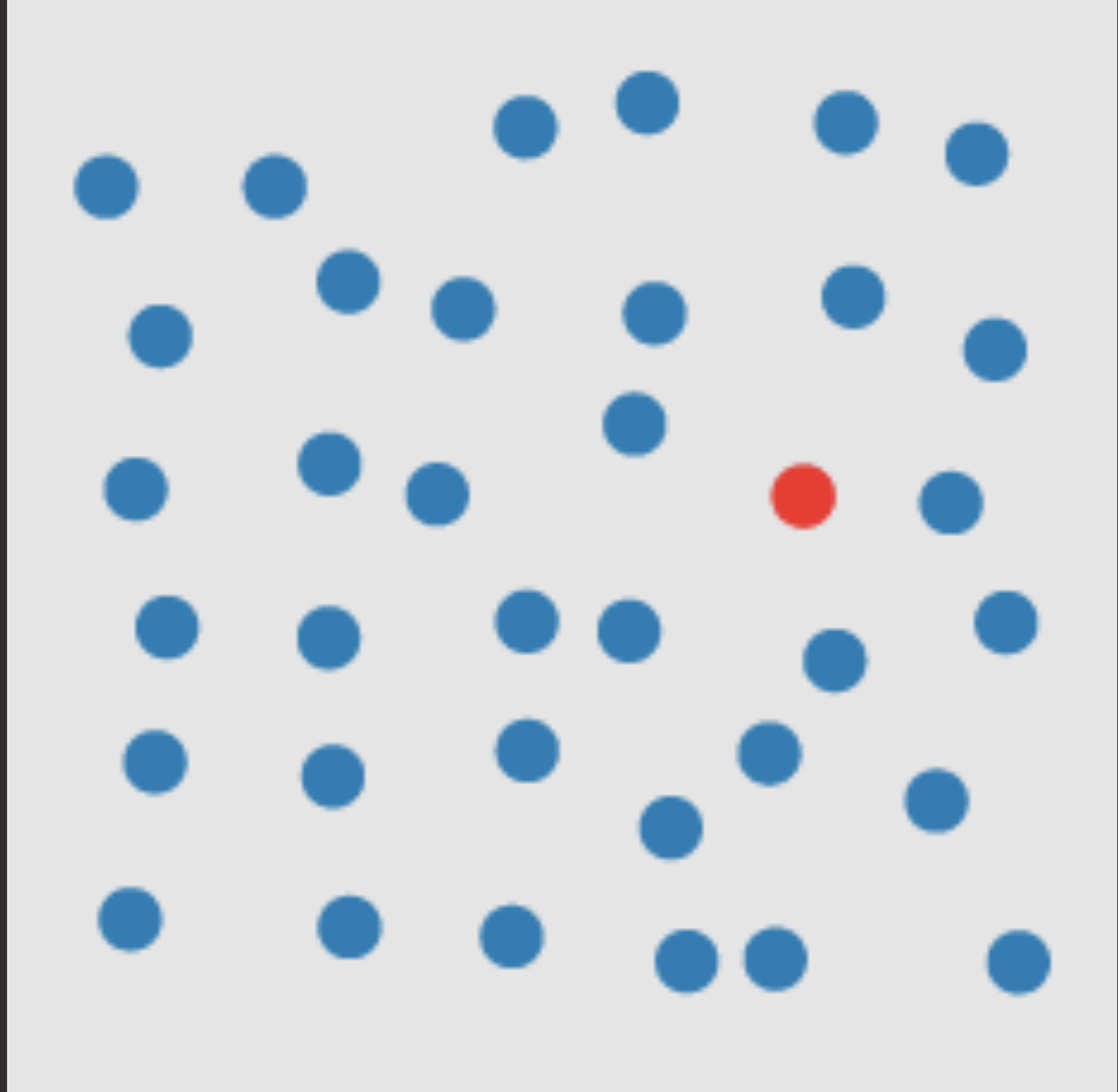
Eye-Movement



Visual-Search

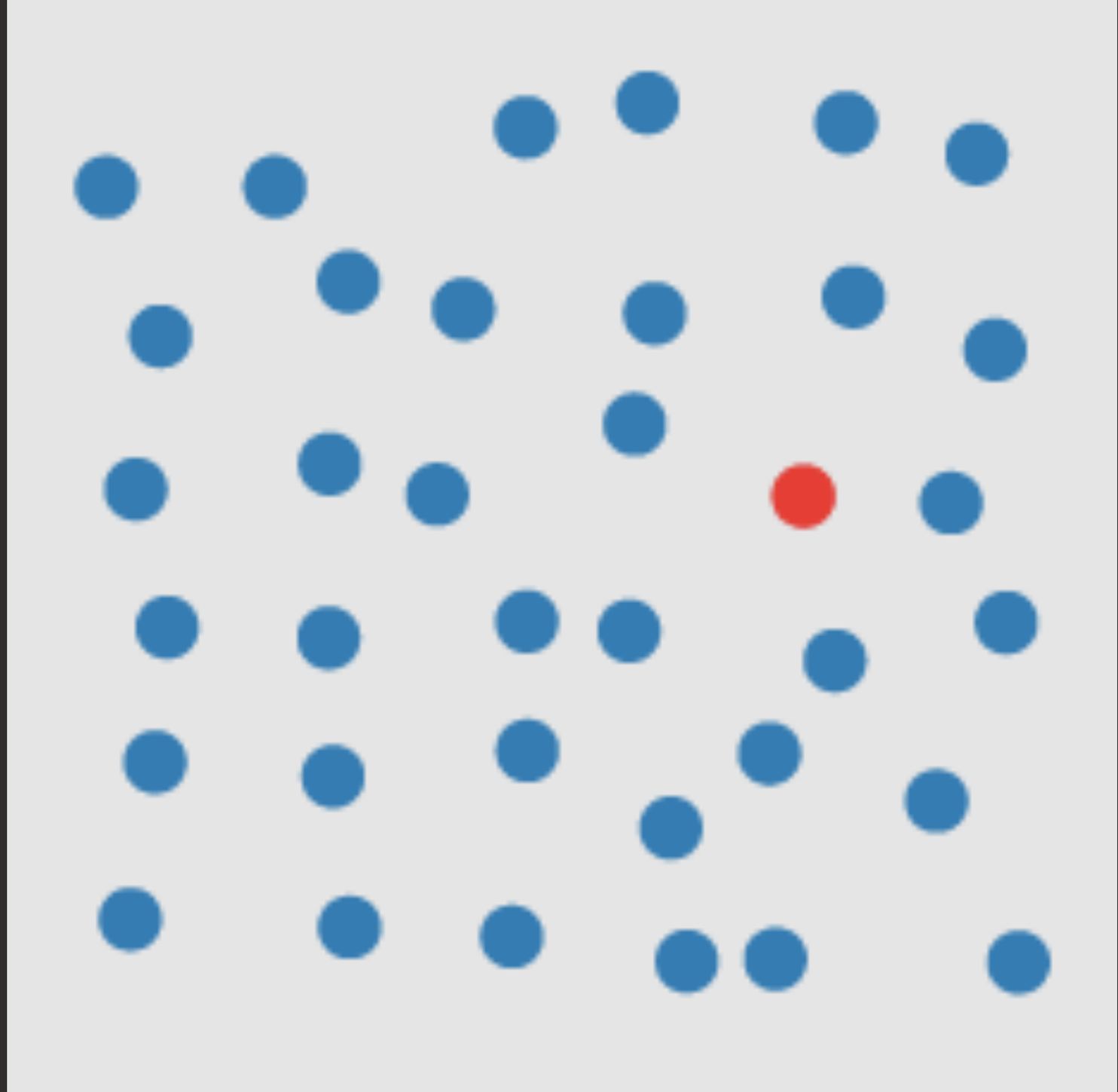
“Find the Tomato”

“Find the Tomato”



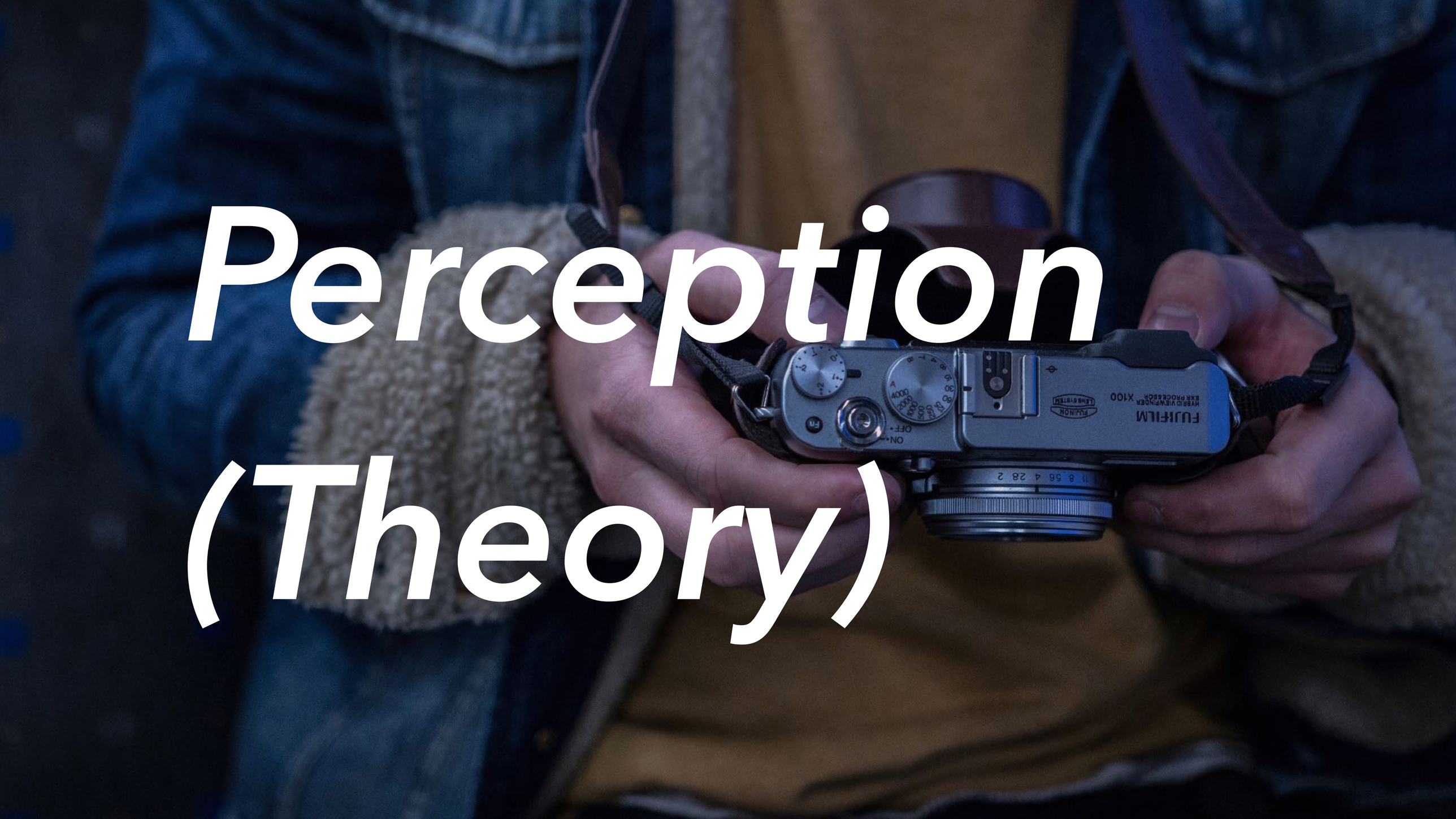
“Find the Tomato”

one O(1) eye-move!

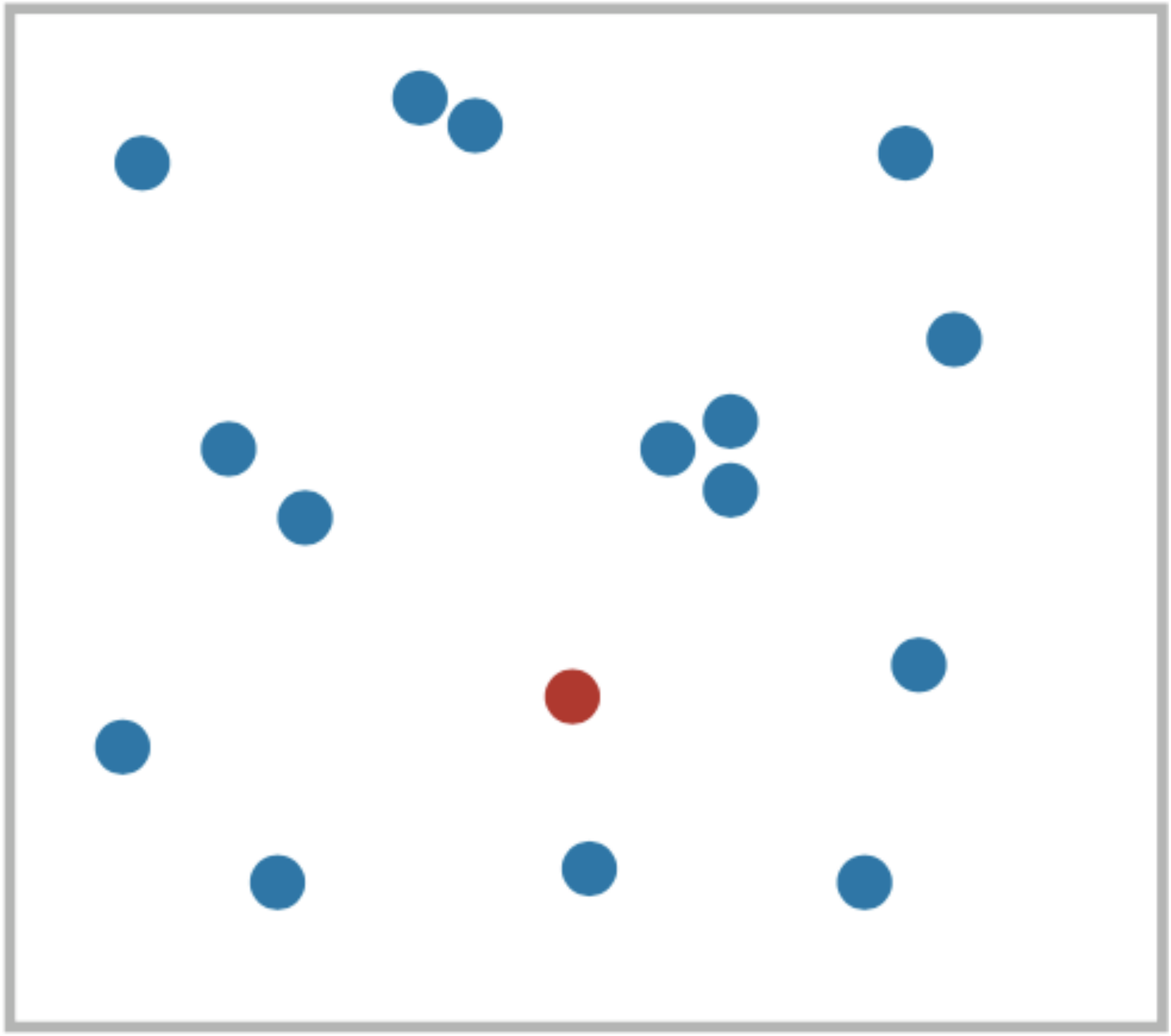


recap

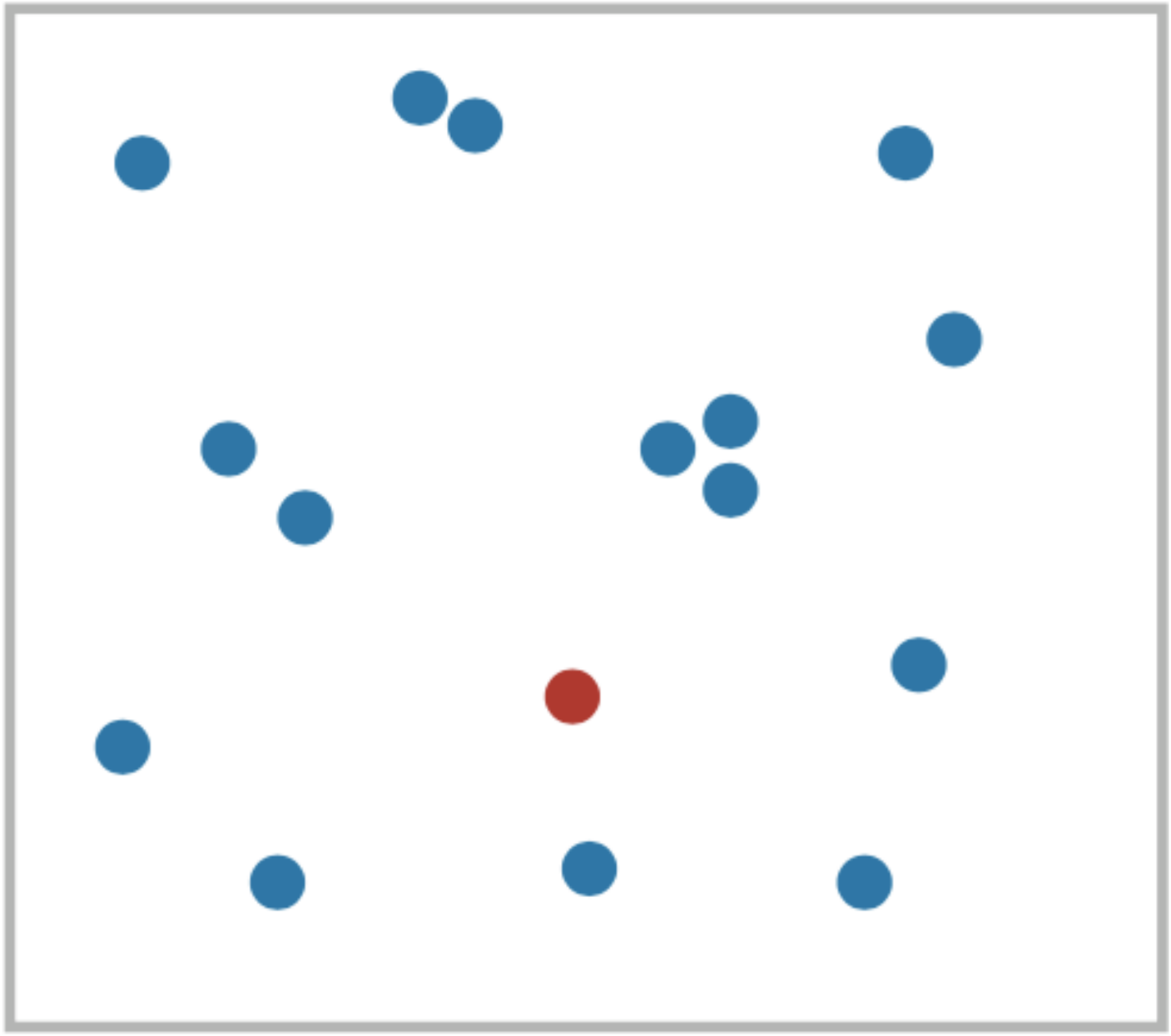
Discrimination	*Weber's Law (jnd)*
Estimation	*Stephen's Power Law*
Targeting	*Eye-Movement*



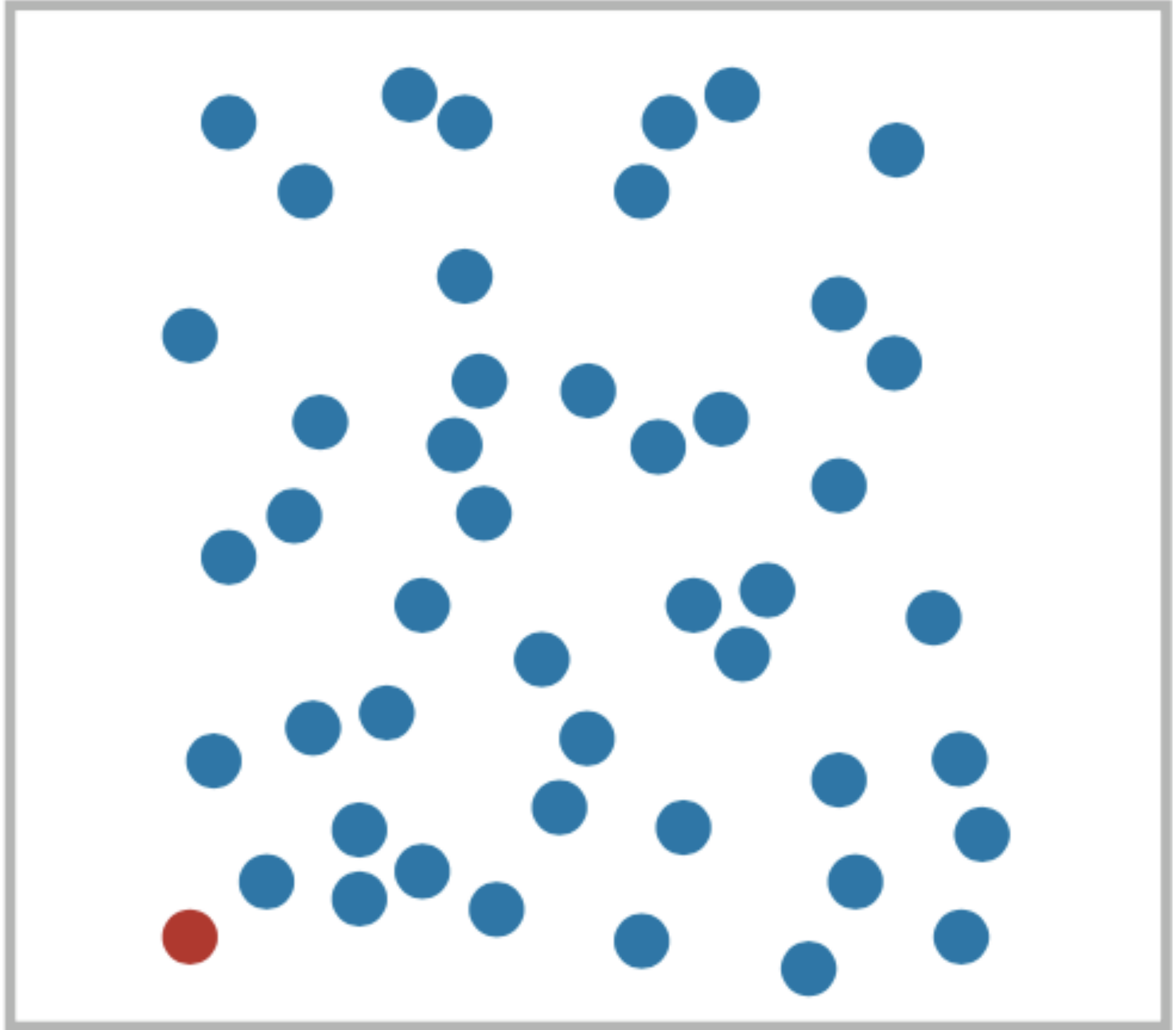
Perception (Theory)

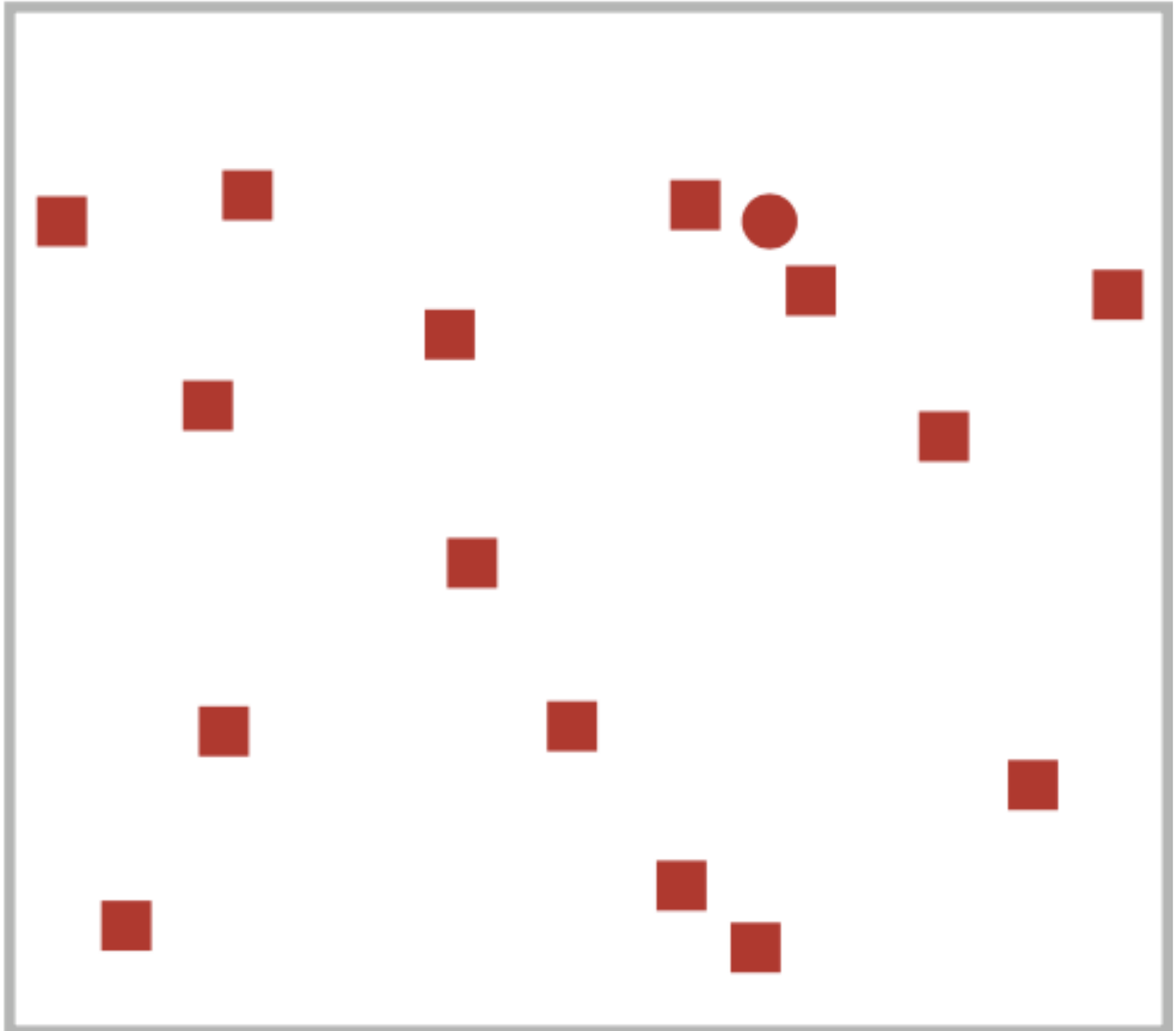


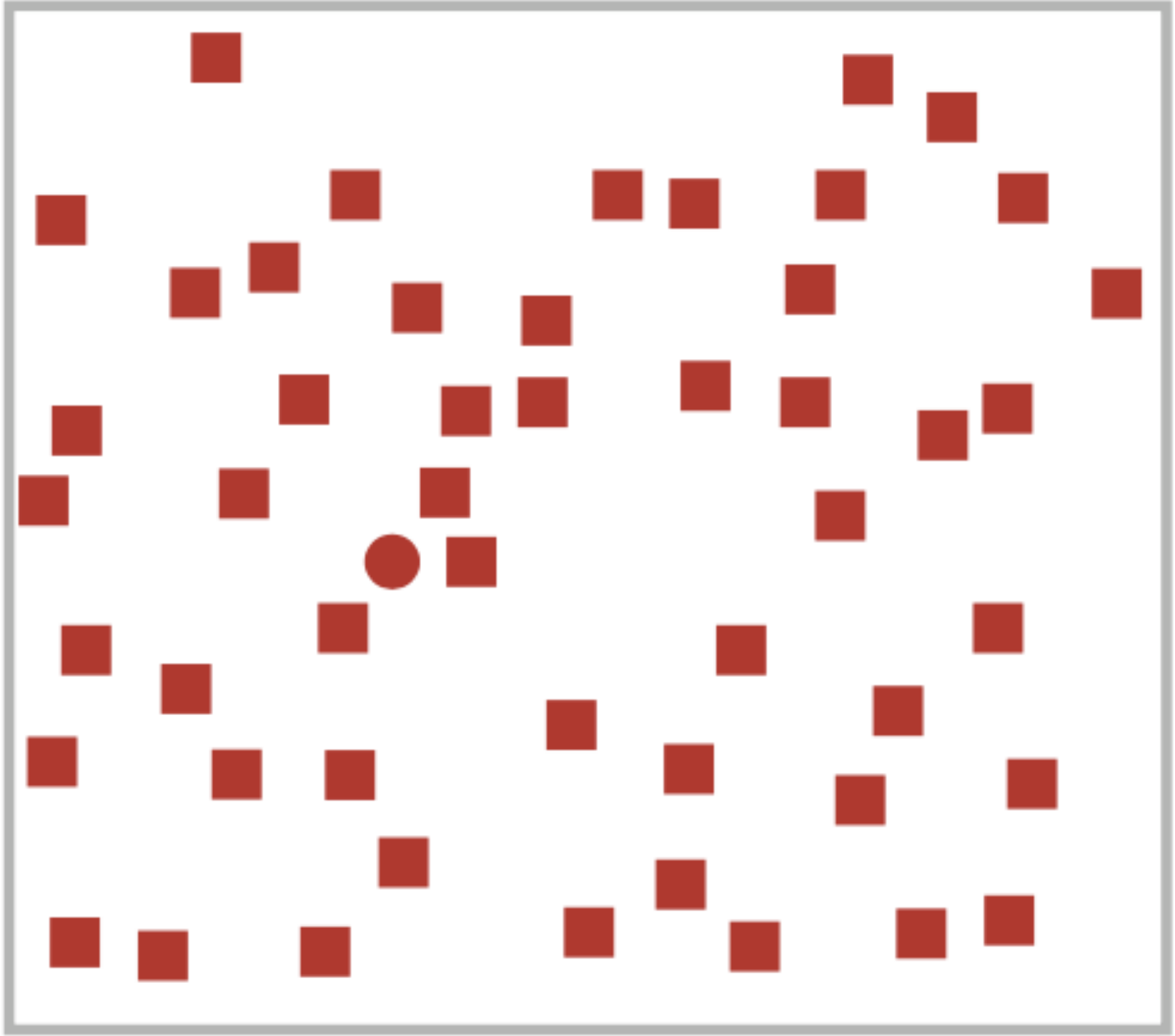
Find the Tomato, part 2



Let's add more distractors…



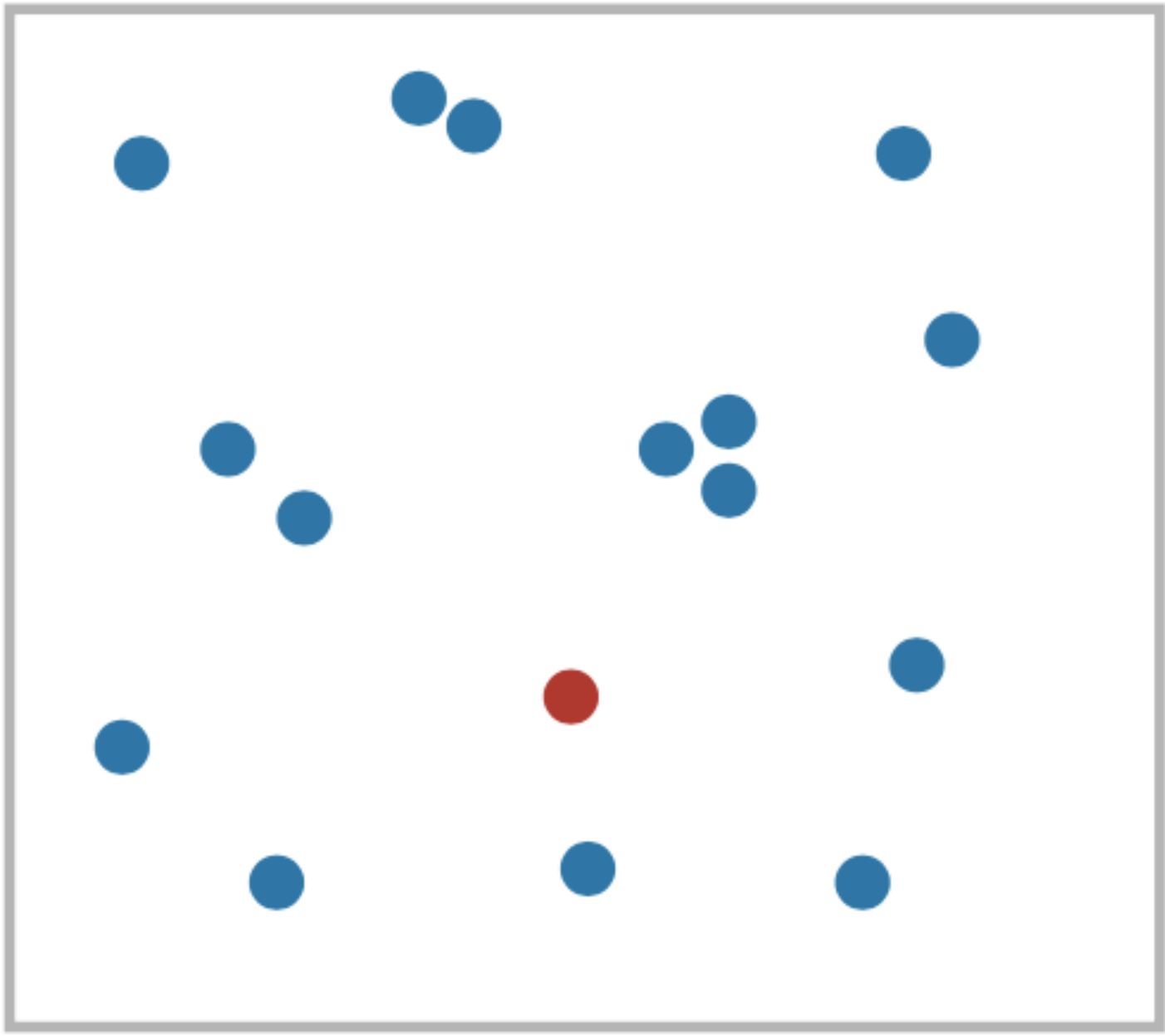


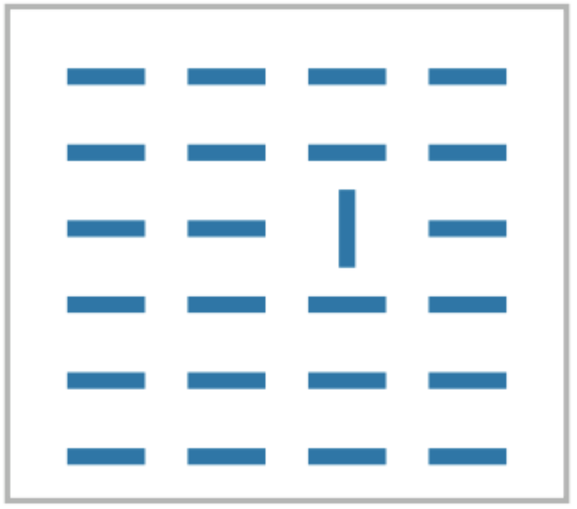


How would a computer search?

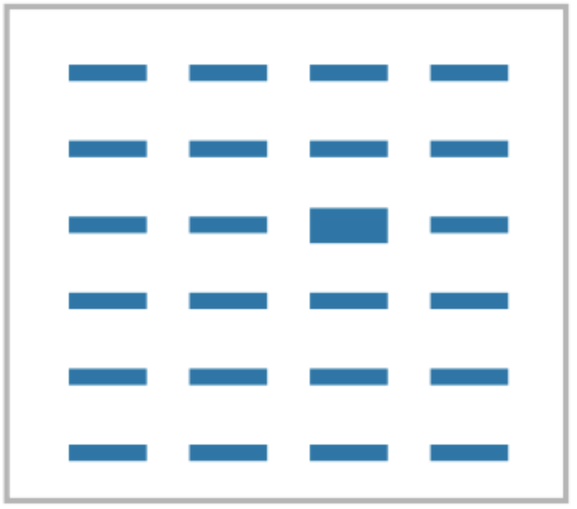
Pre-attentive processing

hard-wired many-channels

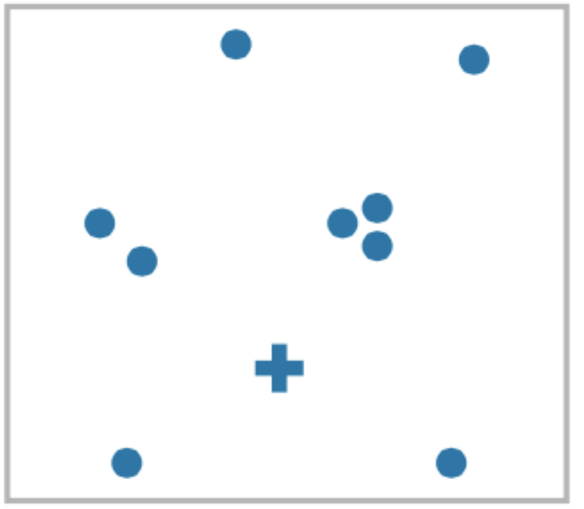




(a)

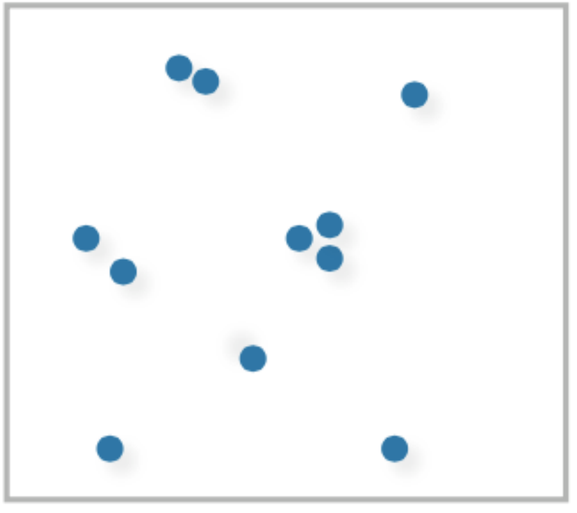


(b)

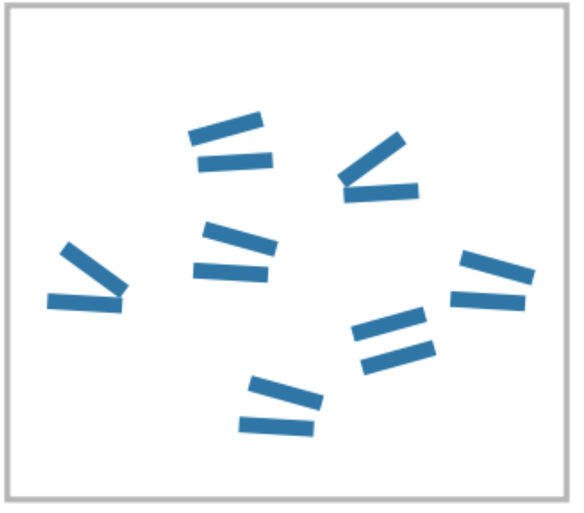


(c)

(d)



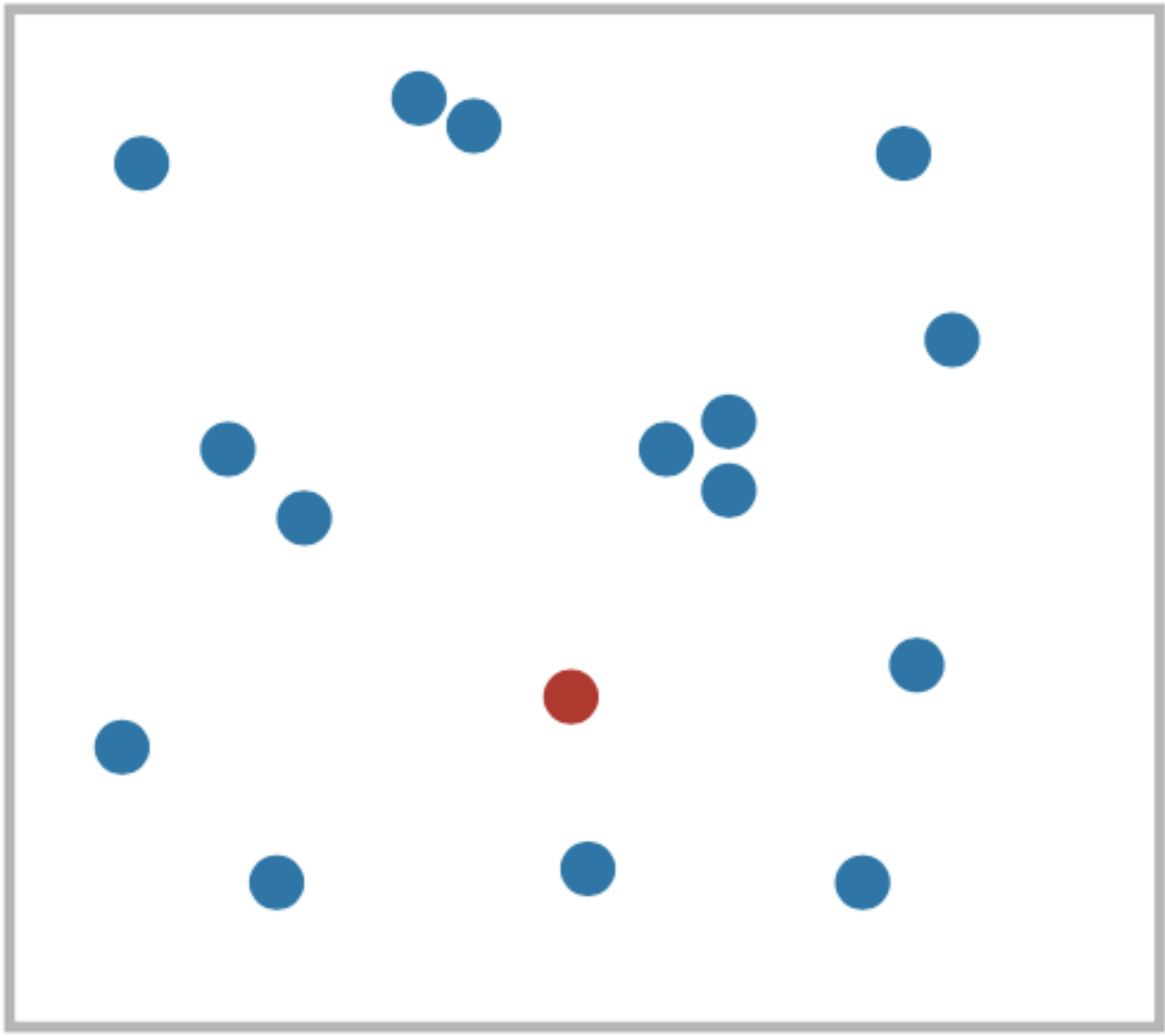
(e)

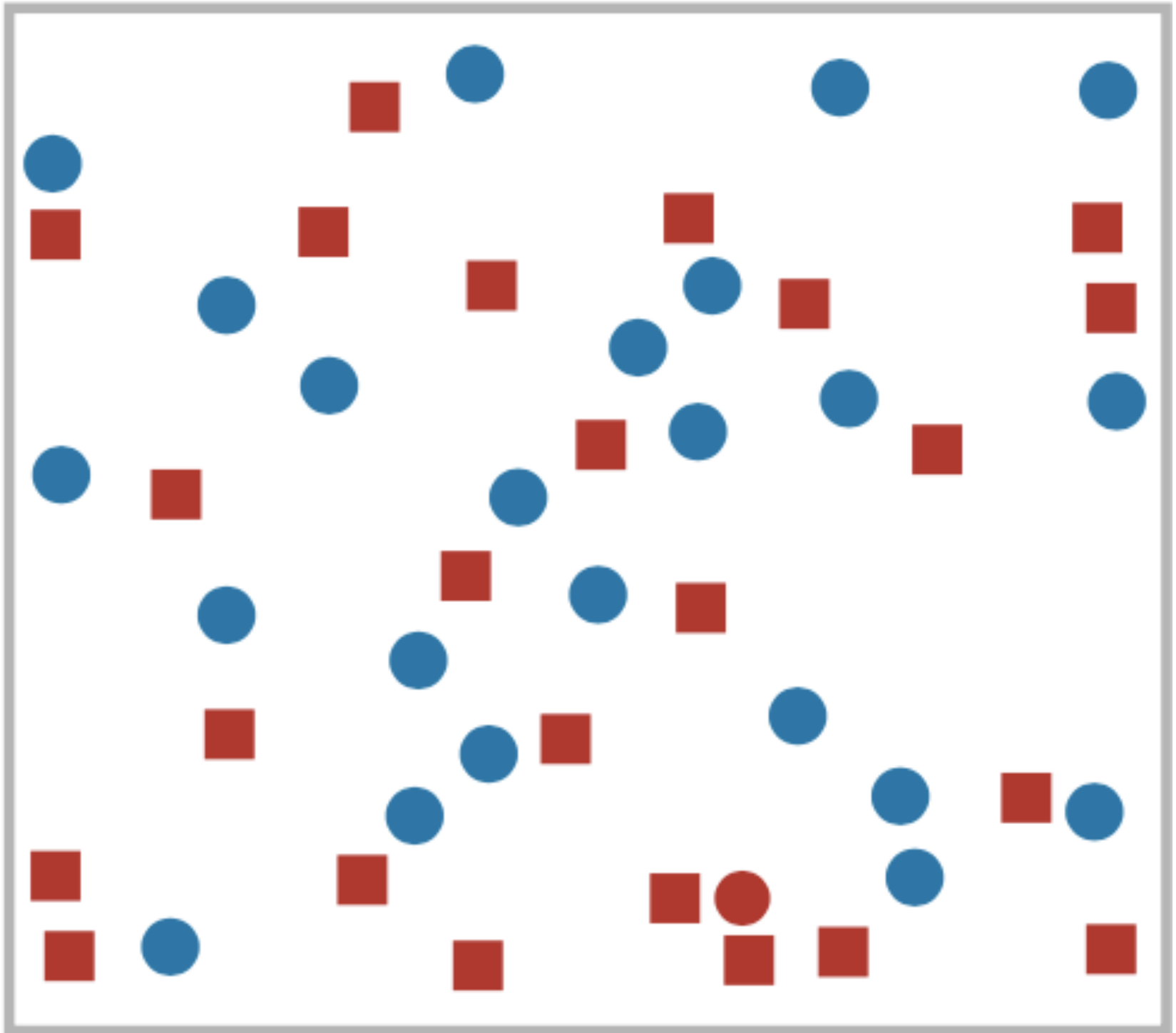


(f)

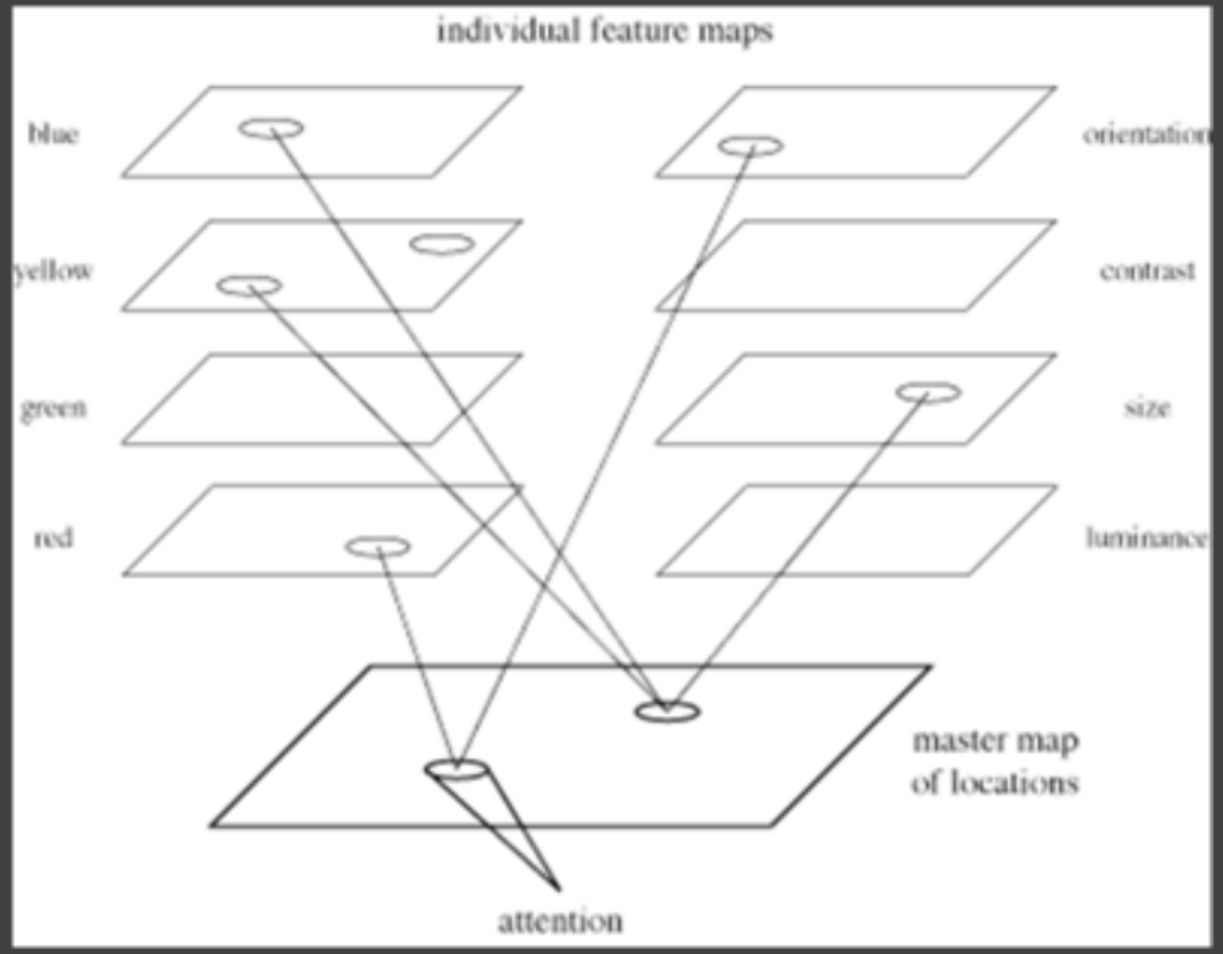
Pre-attentive processing

hard-wired
many-channels
easy to mess up

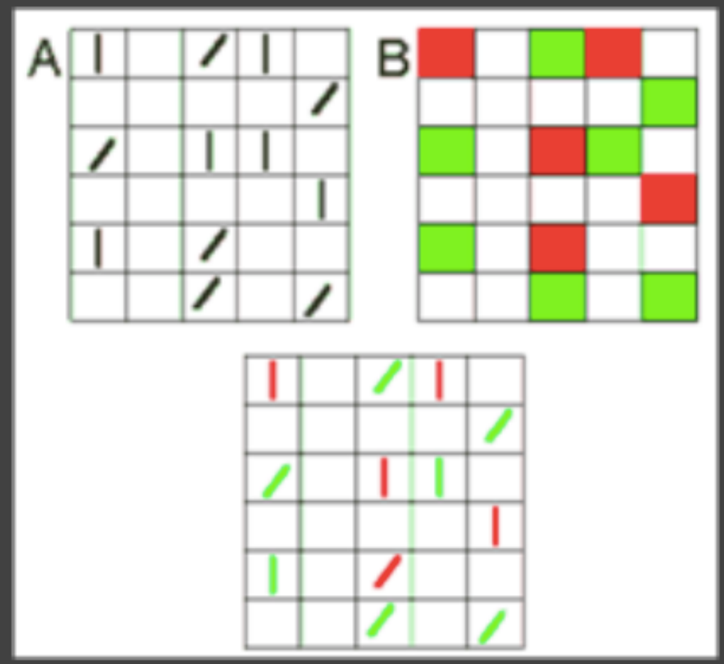




Feature Integration Theory

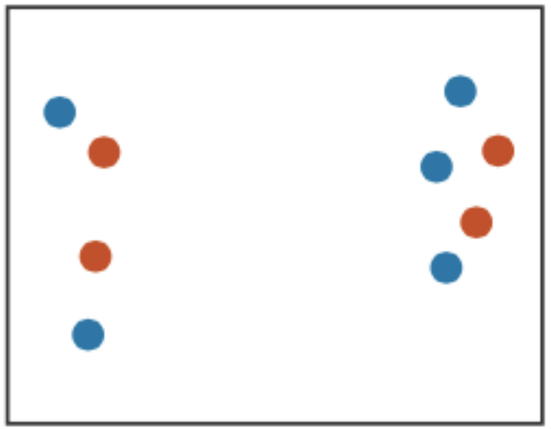


Treisman's feature integration model [Healey 04]



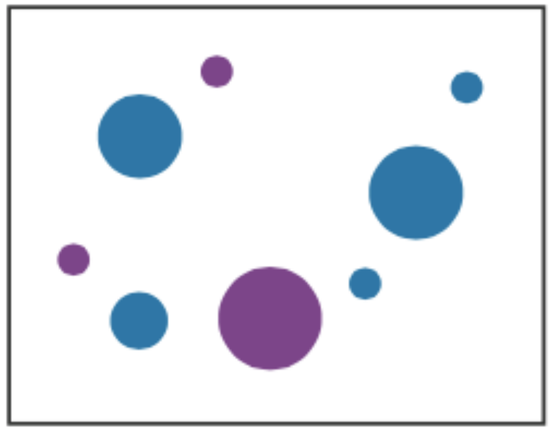
Feature maps for
orientation & color [Green]

Position
+ Hue (Color)



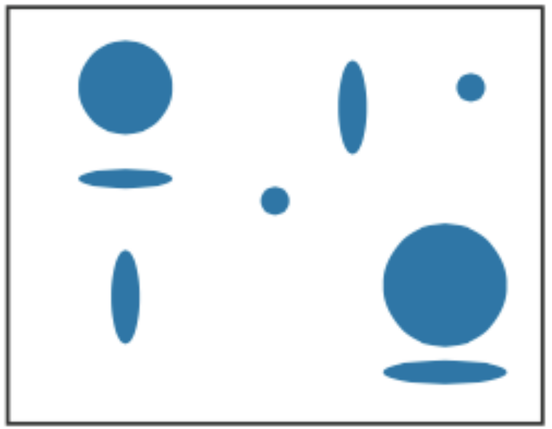
Fully separable

Size
+ Hue (Color)



Some interference

Width
+ Height



Some/significant interference

Red
+ Green

Major interference

Separable vs. Integral


Cognition

Change Blindness

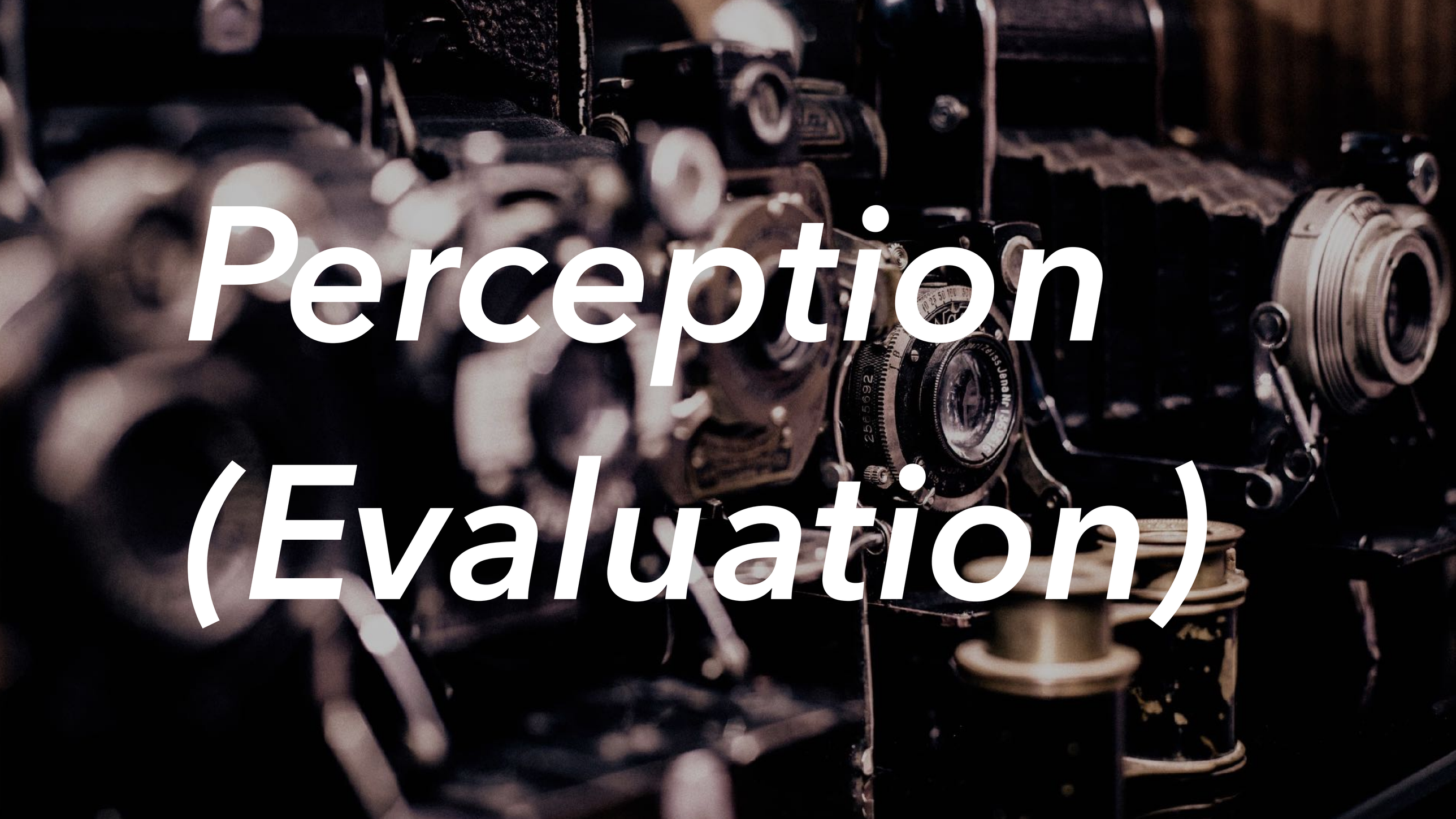
Attention

Working Memory

Latency

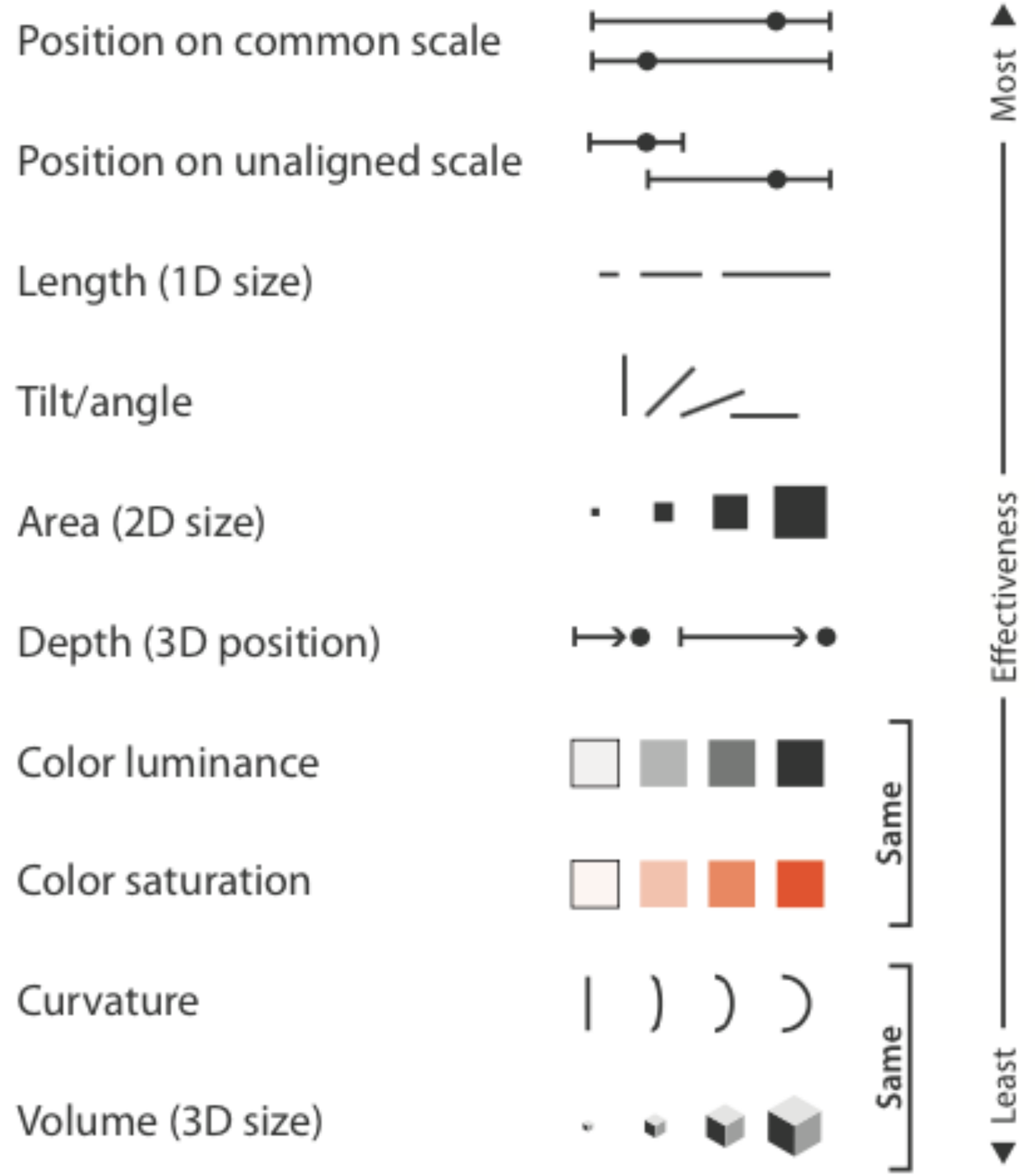
Time Constant	Value (in seconds)
perceptual processing	0.1
immediate response	1
brief tasks	10

Table 6.1. Human response to interaction latency changes dramatically at these time thresholds. After [Card et al. 91, Table 3].



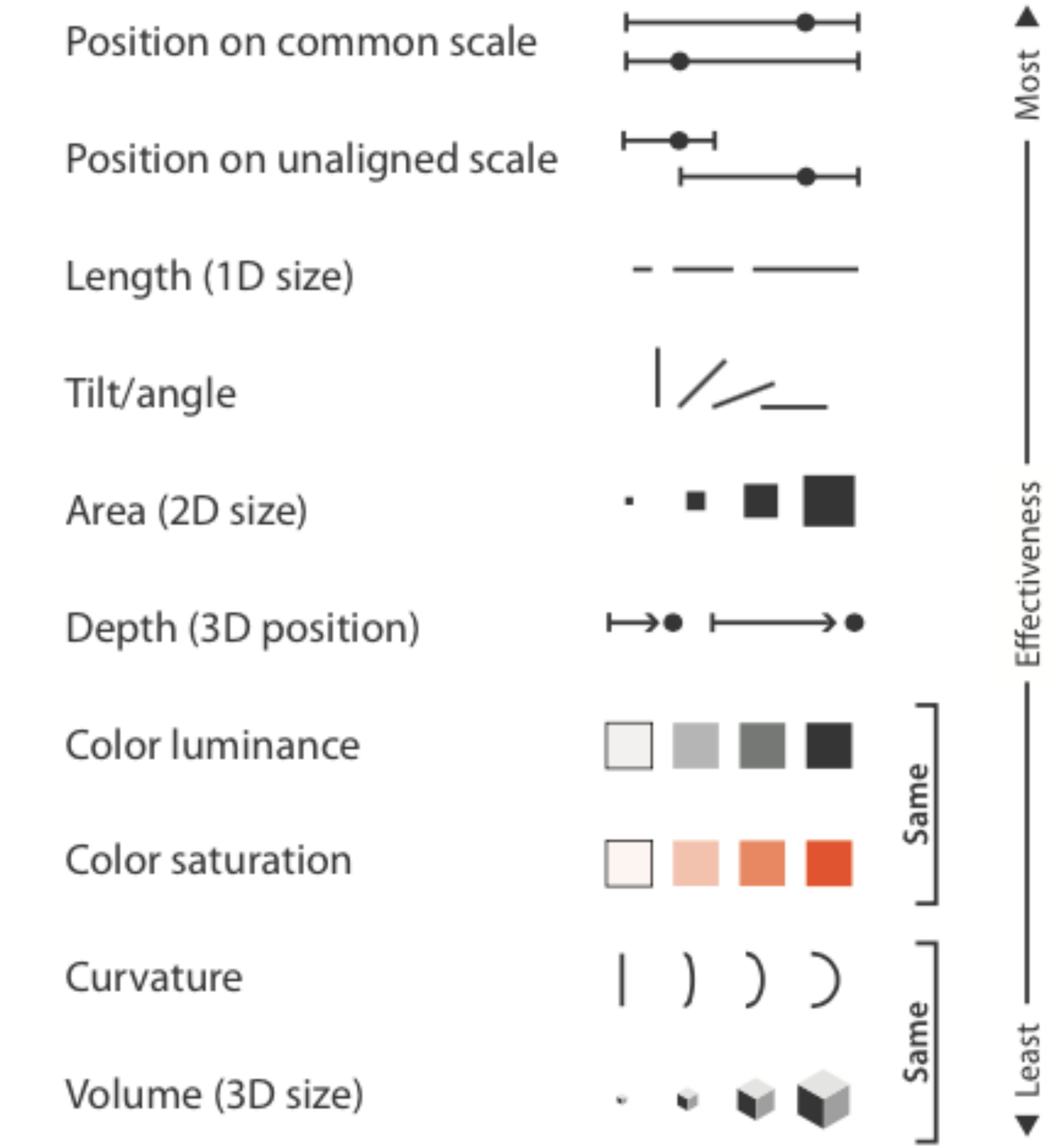
Perception (Evaluation)

Magnitude Channels: Ordered Attributes

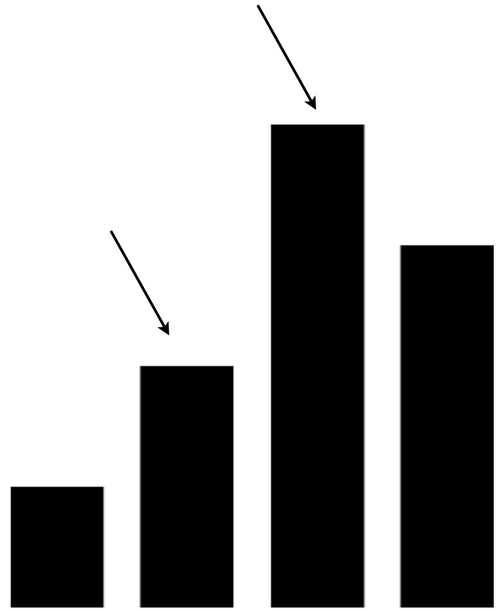


How do we get this?

Magnitude Channels: Ordered Attributes

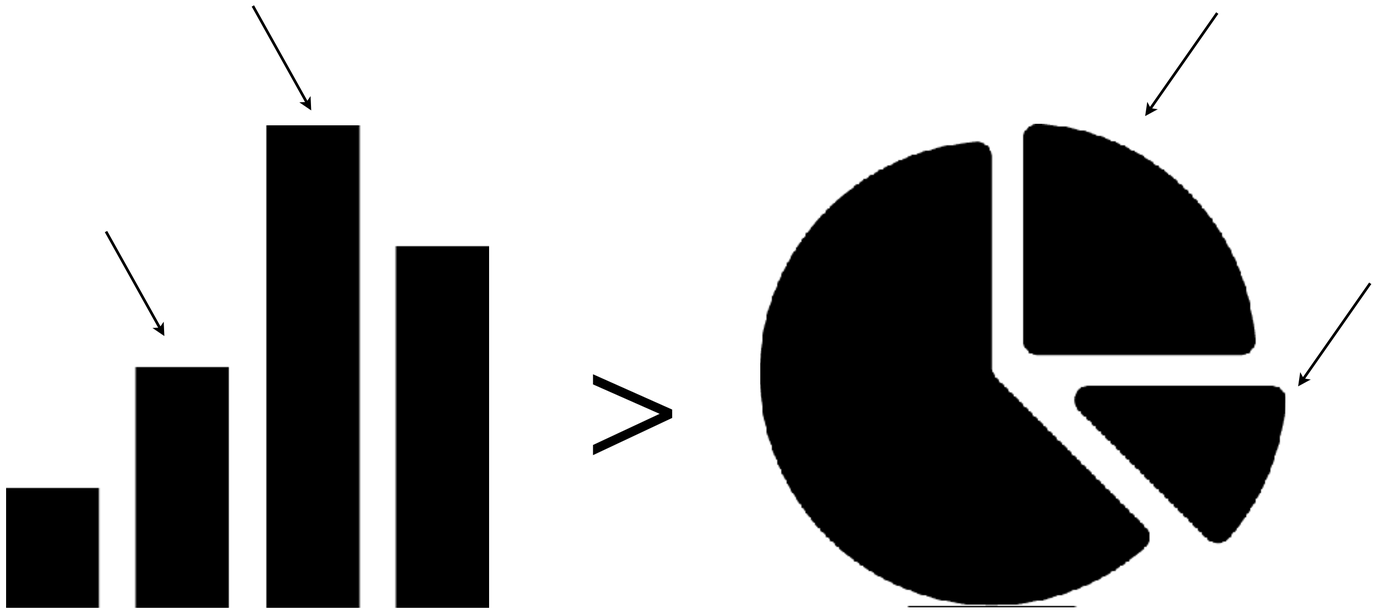


How do we get this?



a. Which of the two is larger?

b. What percentage is the smaller of the larger?



Position

Angle

(Cleveland & McGill,1984)

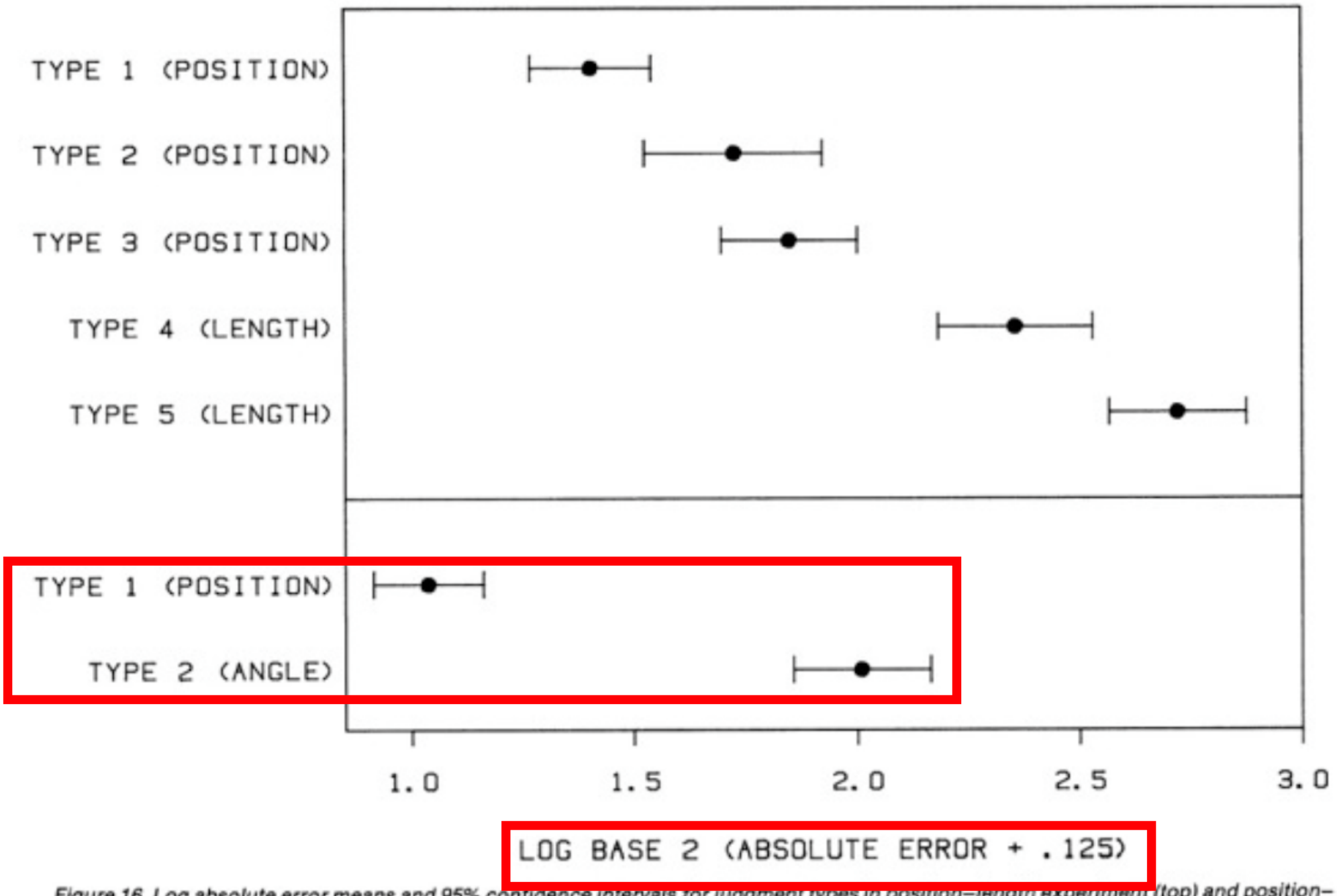
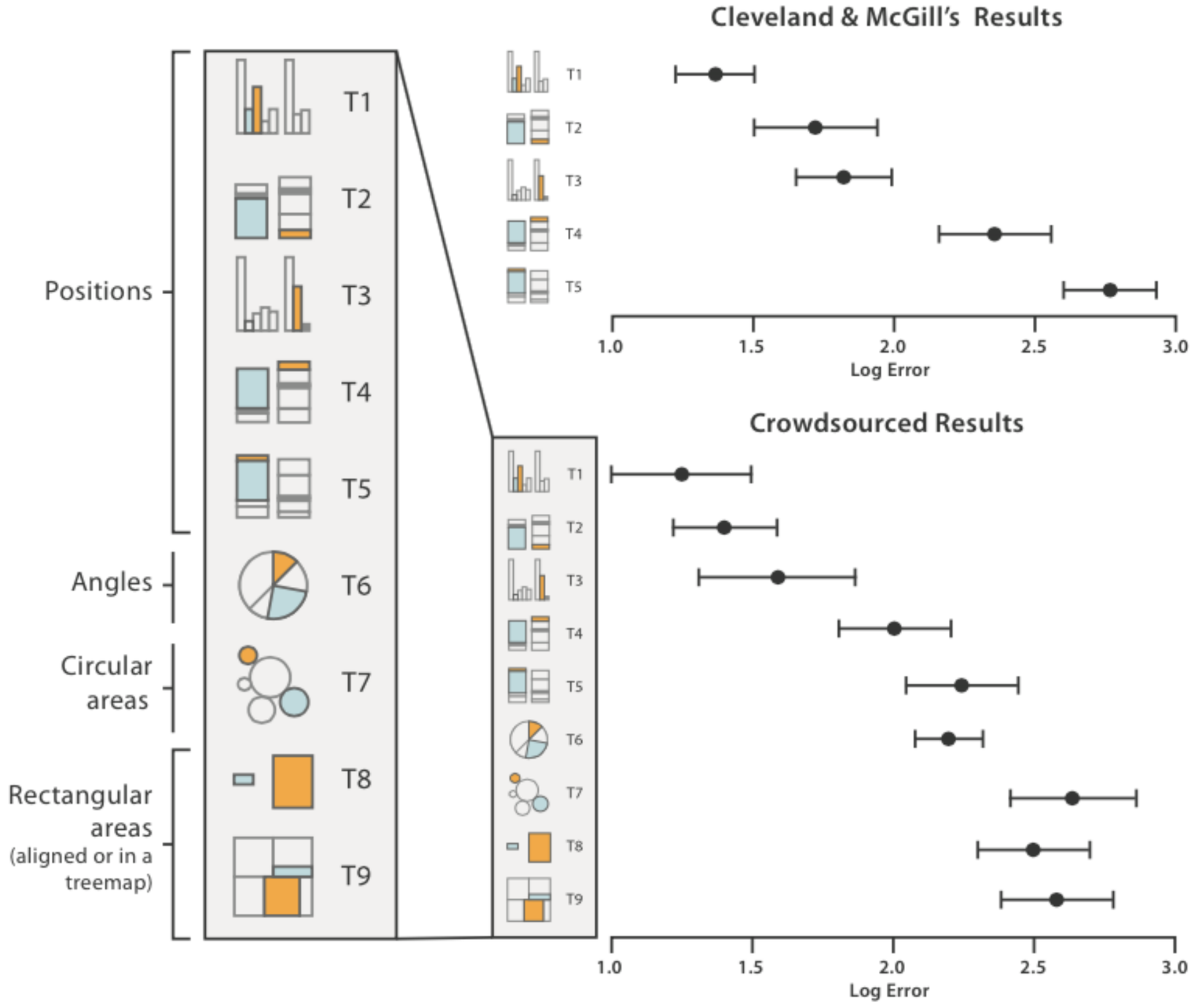
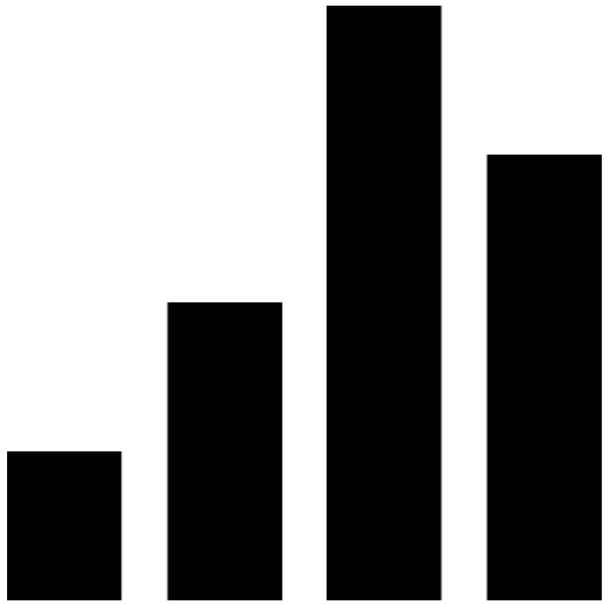


Figure 16. Log absolute error means and 95% confidence intervals for judgment types in position–length experiment (top) and position–angle experiment (bottom).


Cleveland & McGill's Results
Crowdsourced Results
Positions
Angles
Circular areas
Rectangular areas (aligned or in a treemap)
T1
T2
T3
T4
T5
T6
T7
T8
T9
1.0
1.5
2.0
2.5
3.0
Log Error

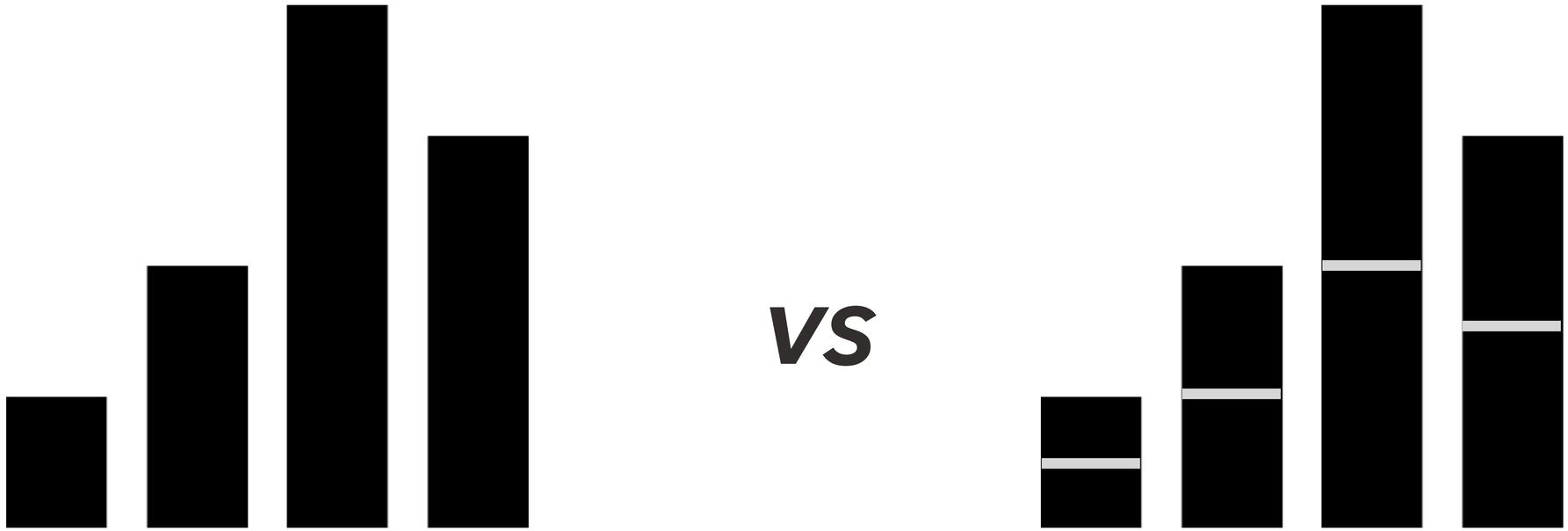
What changes can help perception?



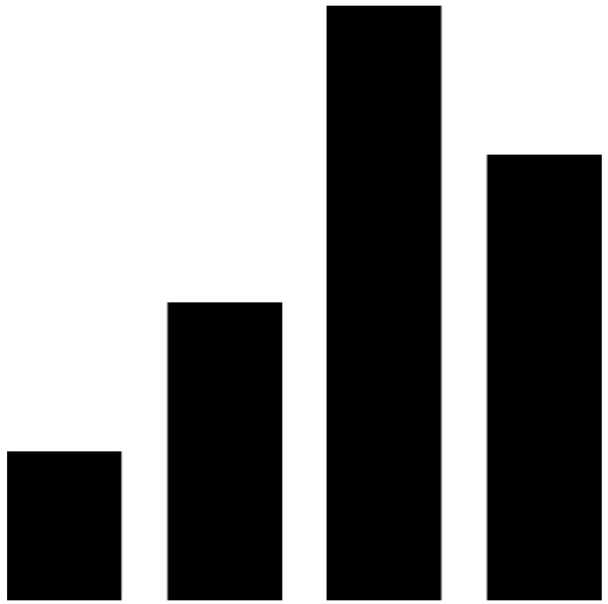
vs

???

What changes can help perception?



What changes can help perception?



vs