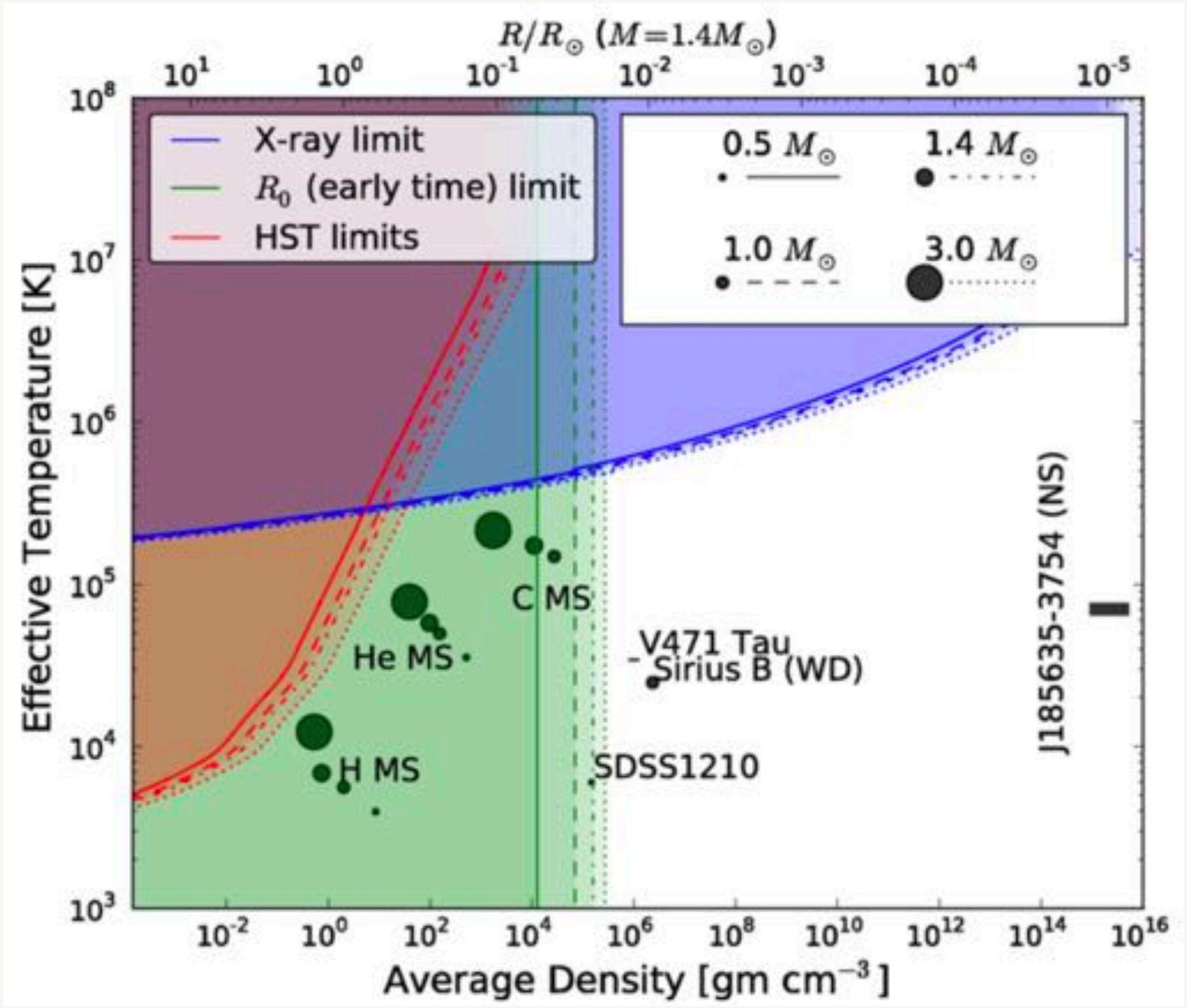


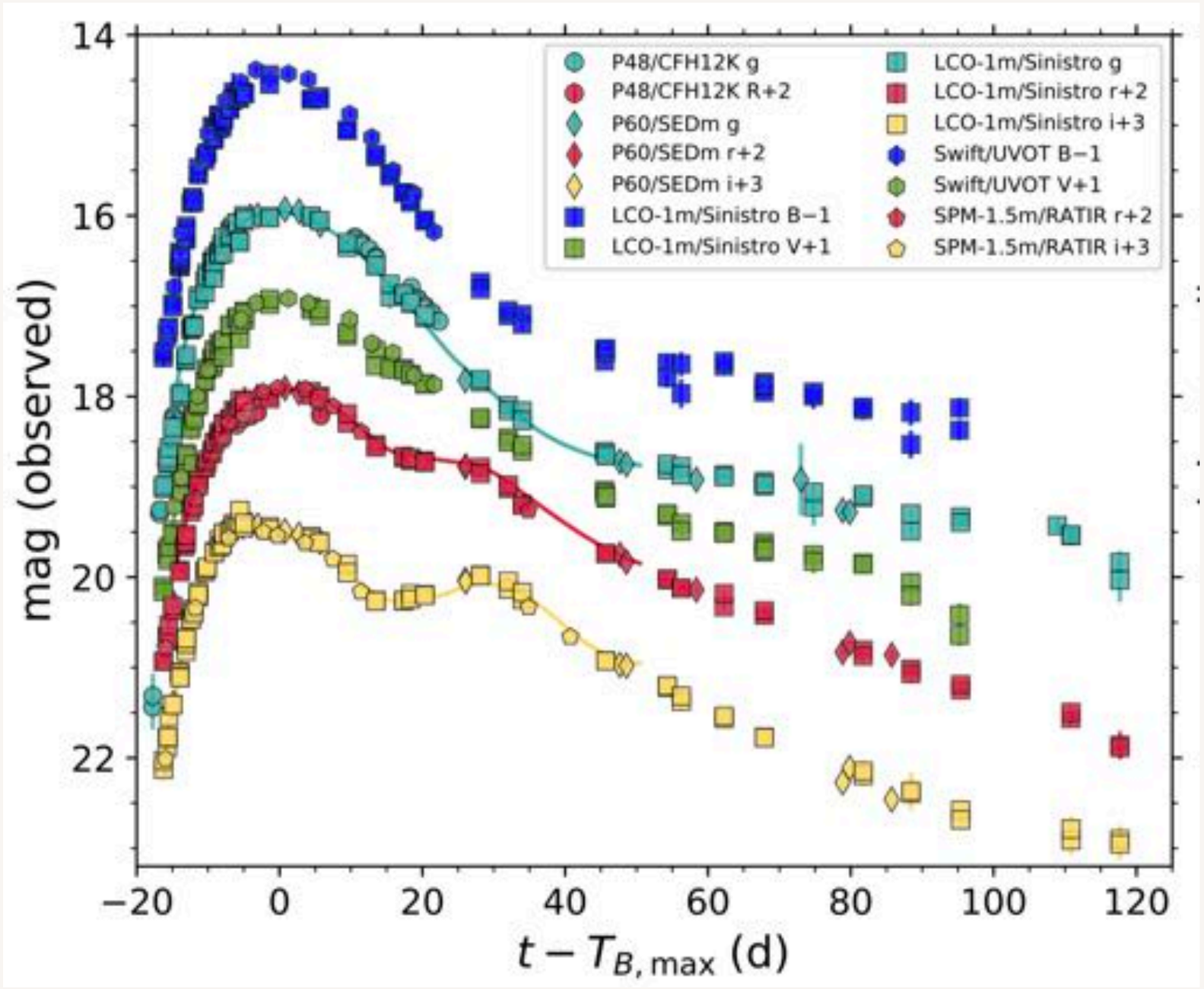
Upper limits obtained in the hours after explosion for SN 2011fe enable precise constraints on the radius of the progenitor star when compared to expectations from shock break-out models. Combined with pre-explosion limits on the temperature of the progenitor, it is possible to definitively conclude that a WD must have exploded for this type Ia SN.

Bloom+12

Human brain is not a multiprocessor

Information transmission needs to be efficient
Impossible to simultaneously read *and* listen

Context matters (an aside)

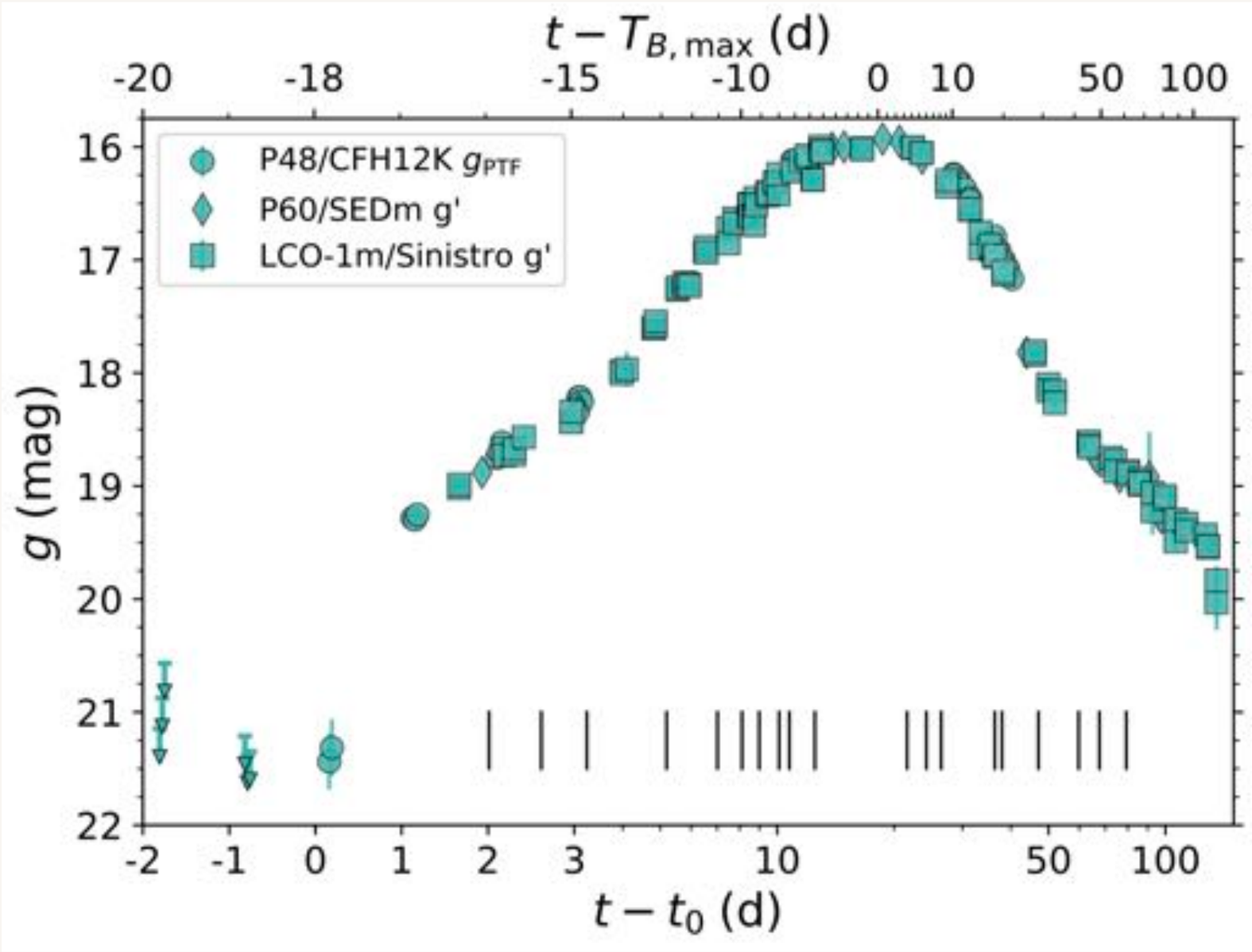


I absolutely loathe this

Info-ink ratio is tiny

Miller+18

Context matters (an aside)



Can summarize main features with less data

Miller+18

Effective Communication via Principles of Design

Building better plots and slides

© Apple

Adam A Miller
CIERA/Northwestern & Adler Planetarium
LSSTC DSFP Session 9
11 June 2019

Inspiration

Points of view — Nature Methods by Bang Wong & Collaborators


POINTS OF VIEW

Color coding

See also — **Daniela Huppenkothen**’s talk from LSSTC DSFP S2

Communication

(noun) a process by which info is exchanged between individuals through a common system of symbols, signs, behavior

Communication

(noun) a process by which info is exchanged between individuals through a common system of symbols, signs, behavior

Humans communicate via stories

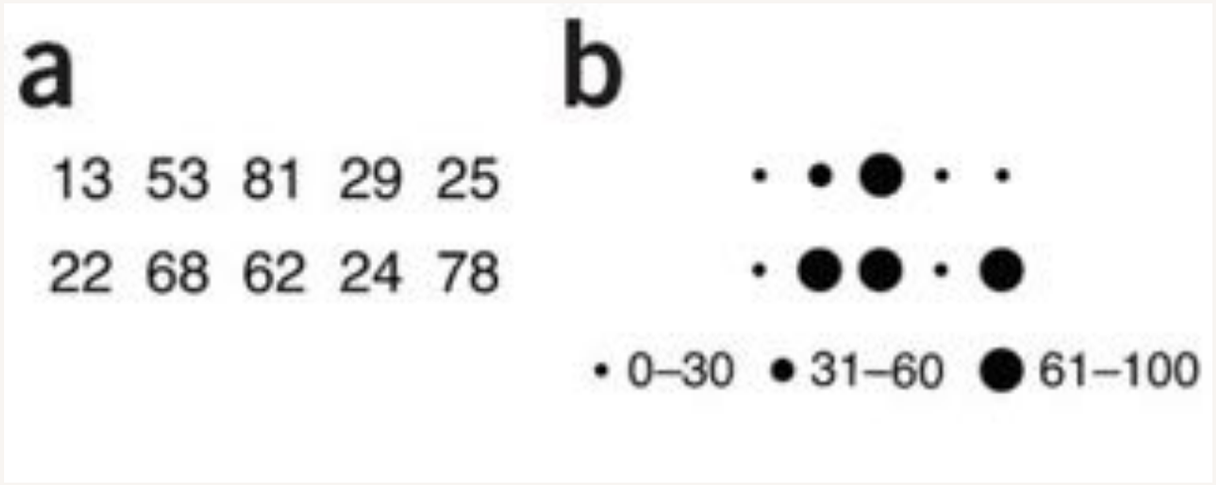
- stories have a beginning, middle, and end
- narrative requires introduction, question, conflict, buildup, and a resolution

Storytelling

Use aggregation to emphasize the message

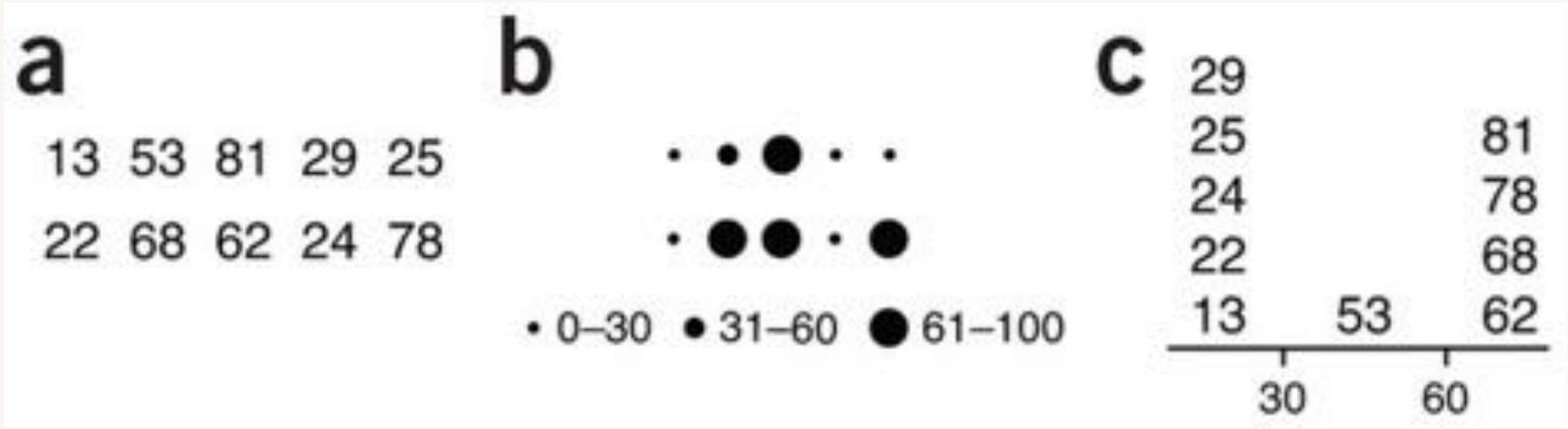
Storytelling

Use aggregation to emphasize the message



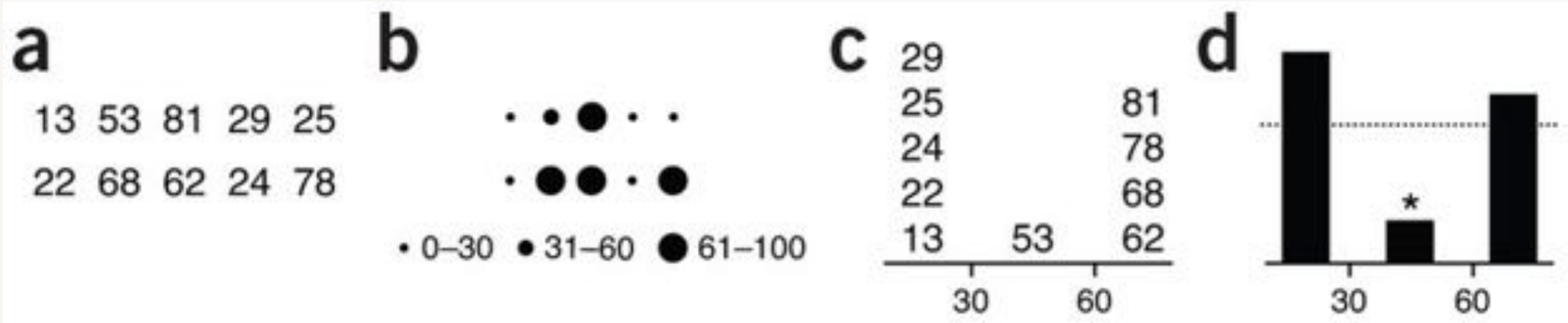
Storytelling

Use aggregation to emphasize the message



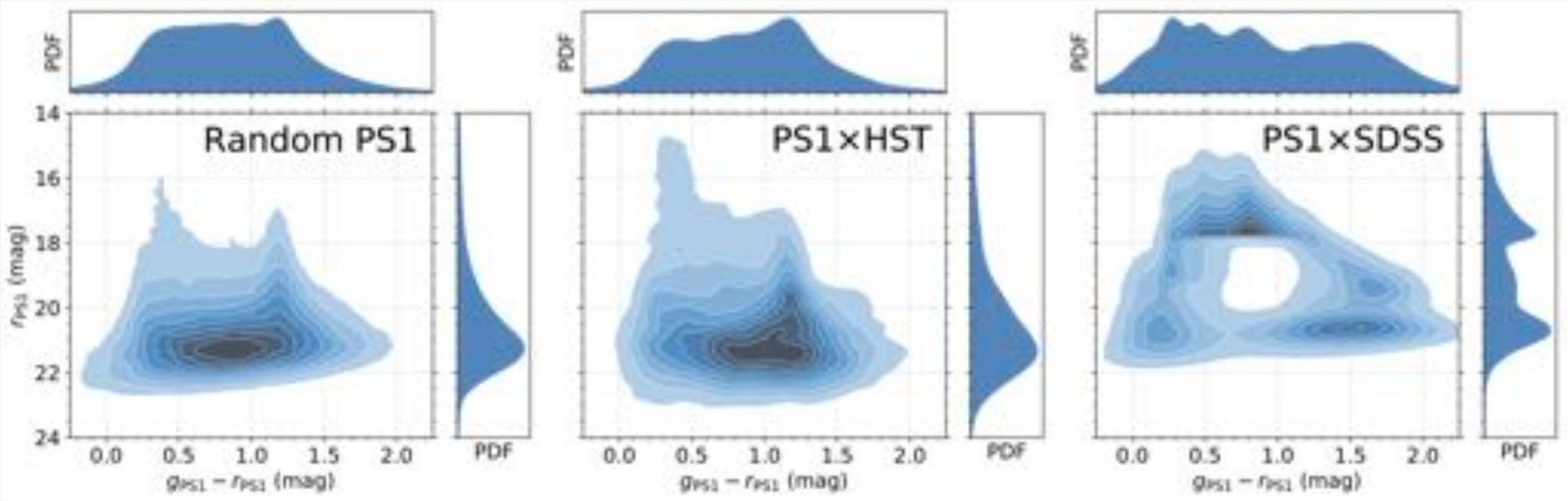
Storytelling

Use aggregation to emphasize the message



Storytelling

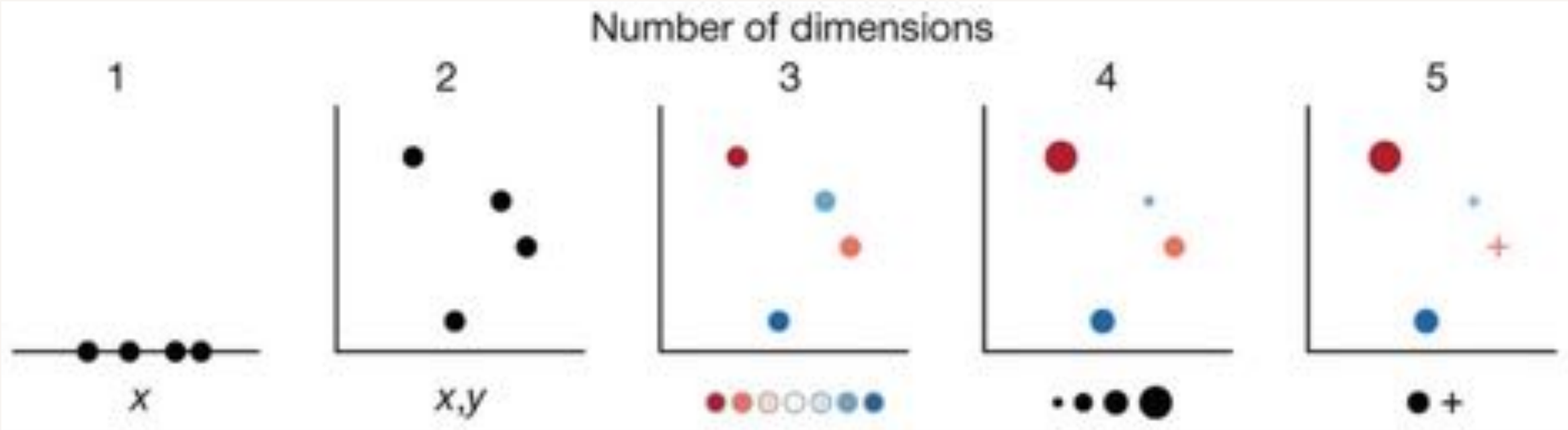
What is the story of this figure?



Tachibana & Miller 18

Storytelling

Critical given dimensionality of data and figures



Outline

Perception

Plotting

Slides

Outline

Perception

Plotting

Slides

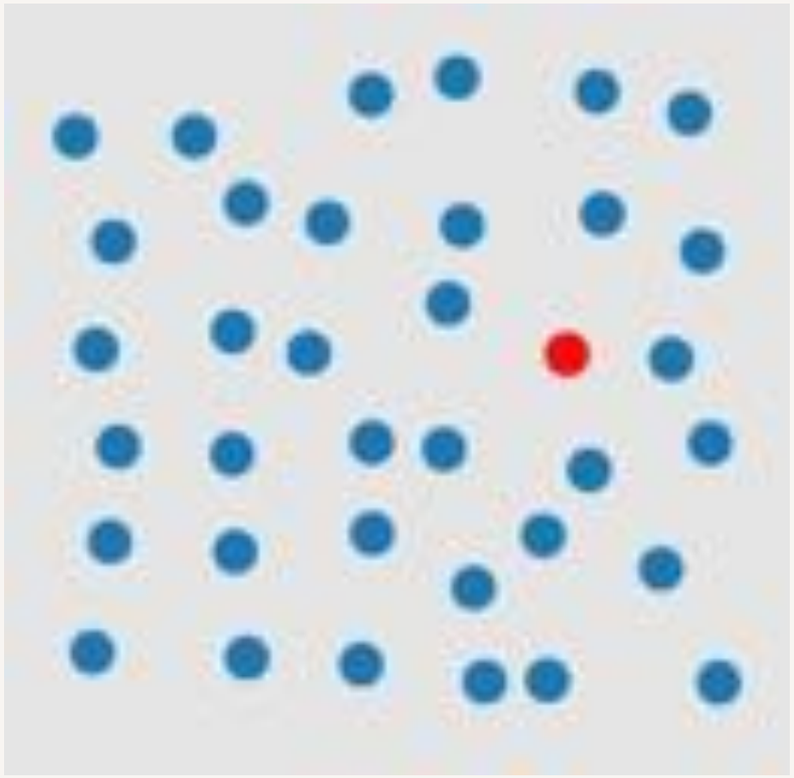
Perception

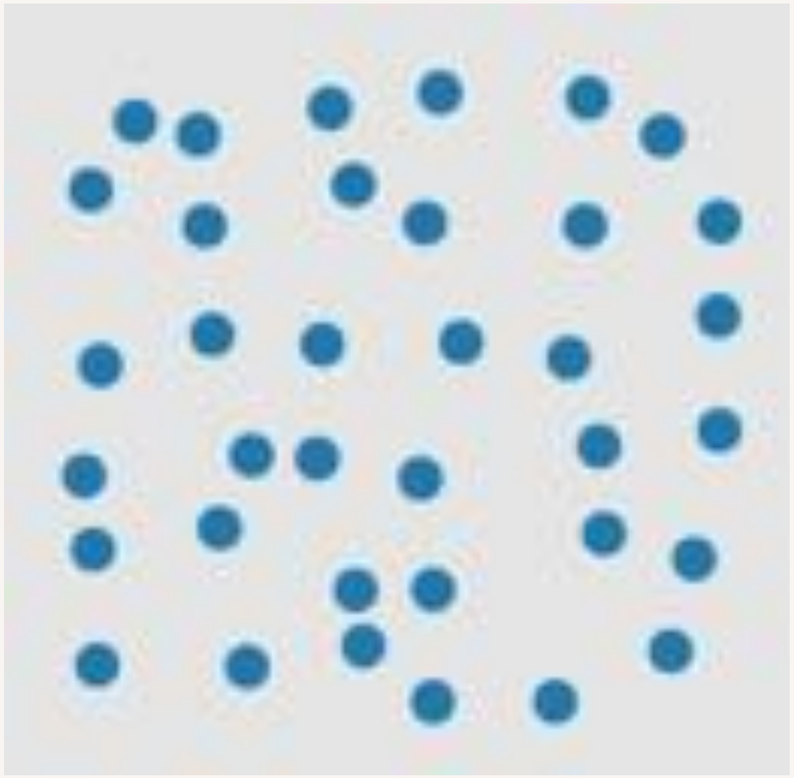
An exercise

https://www.csc2.ncsu.edu/faculty/healey/PP/#jscript_search

Perception

Pre-attentive processing





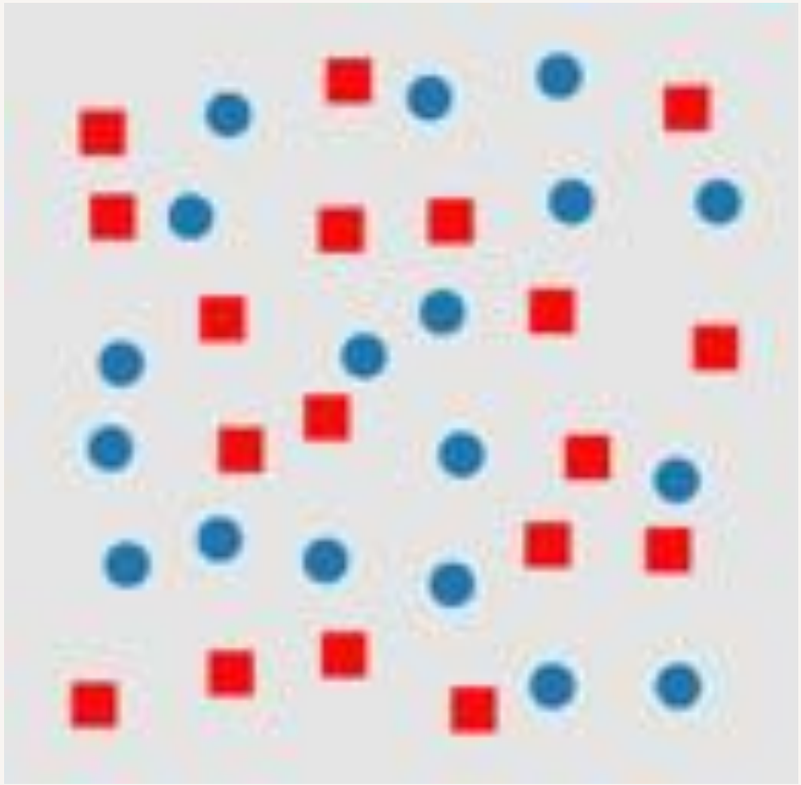
< 250 ms = pre-attentive

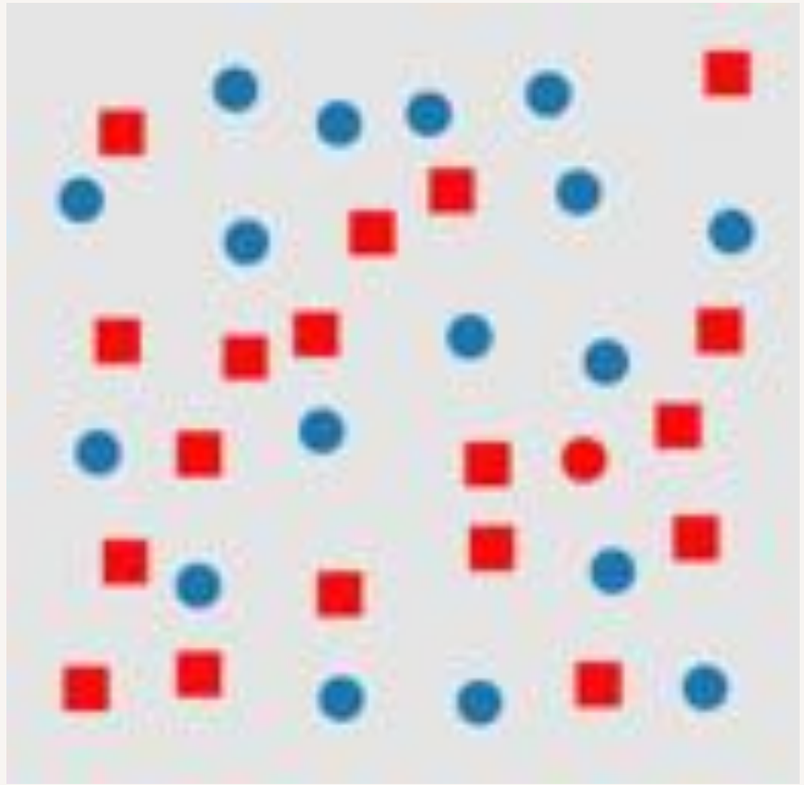
unique target allows:
“parallel” search
does not scale w/ N

Healey & Enns 2012

Perception

Pre-attentive processing





conjunction target:
"serial" search
much harder

Healey & Enns 2012

Gestalt Principles

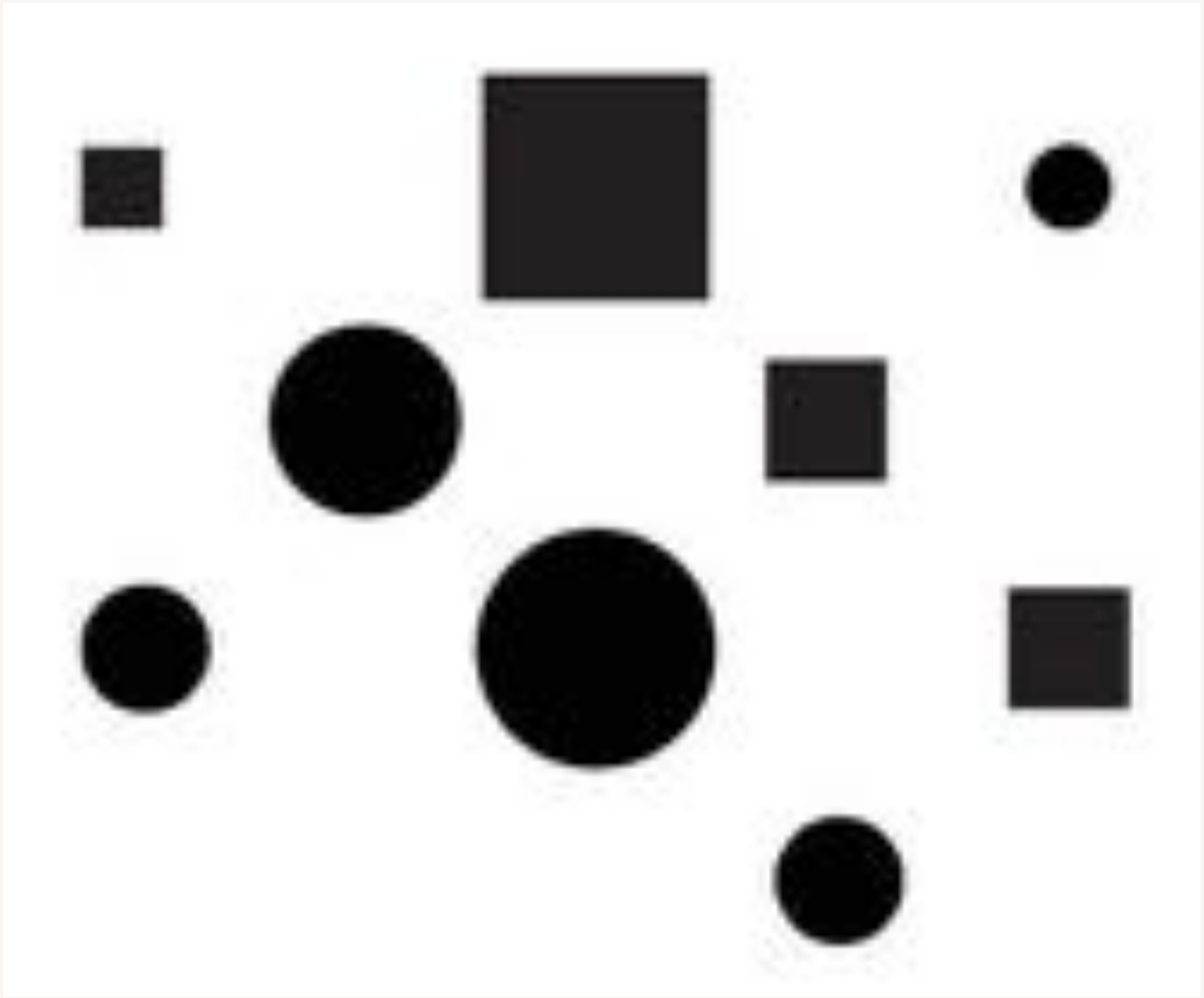
Naturally assemble individual objects into groups

How many triangles are drawn in this figure?

Wong, Nature Methods, 2010

Gestalt Principles

Similarity

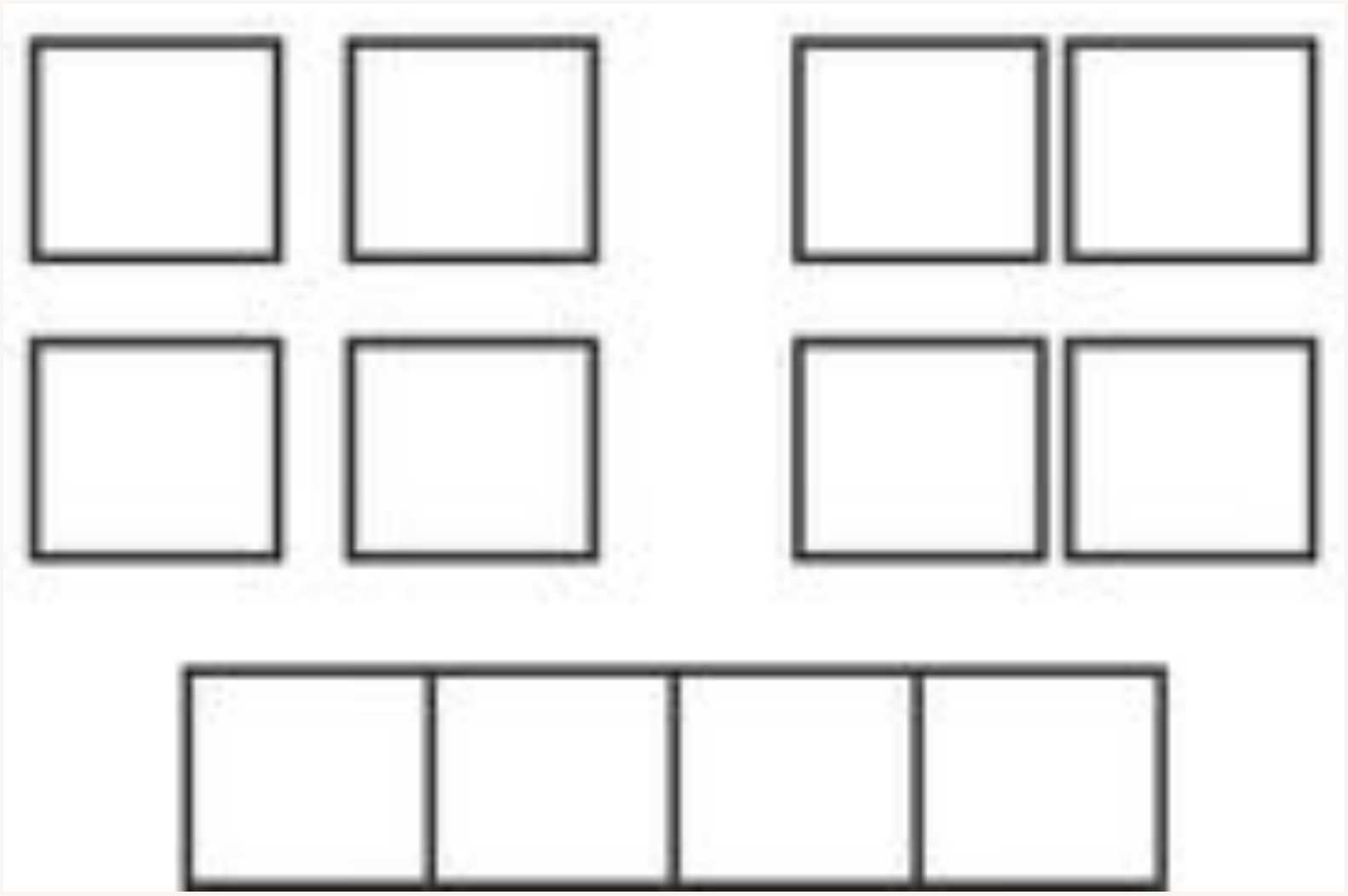


Naturally group similar
size & shape

Wong, Nature Methods, 2010

Gestalt Principles

Proximity

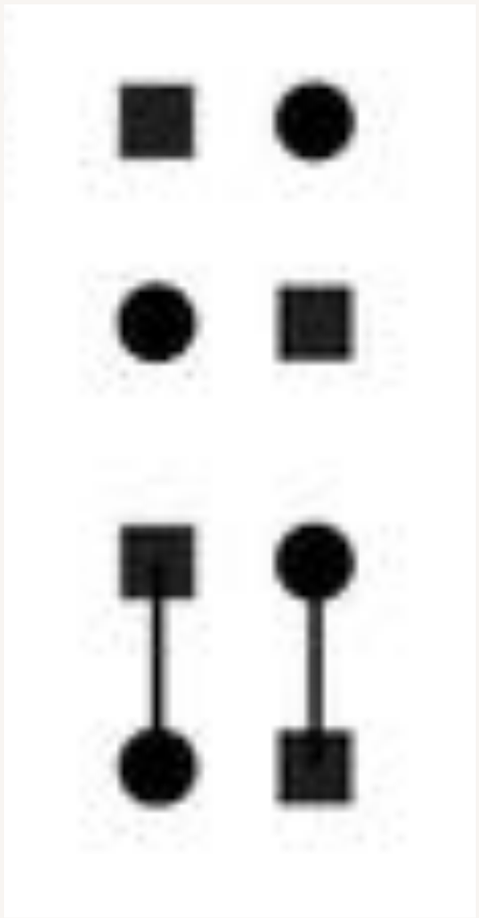


Naturally group objects
that are close together

Wong, Nature Methods, 2010

Gestalt Principles

Connection

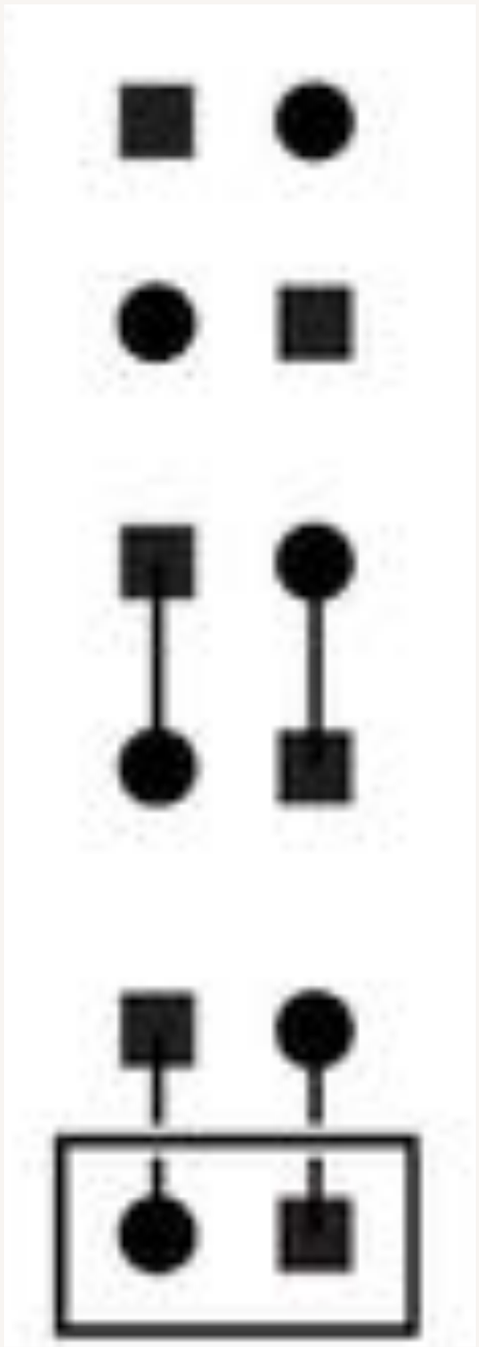


connection > similarity

Wong, Nature Methods, 2010

Gestalt Principles

Enclosure

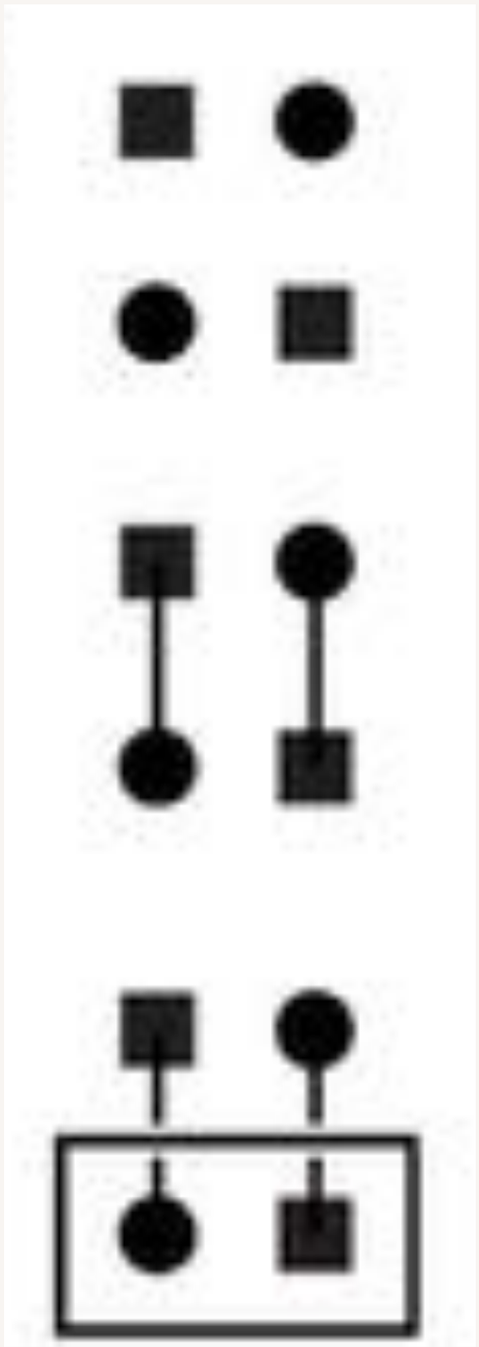


enclosure > connection

Wong, Nature Methods, 2010

Gestalt Principles

Enclosure

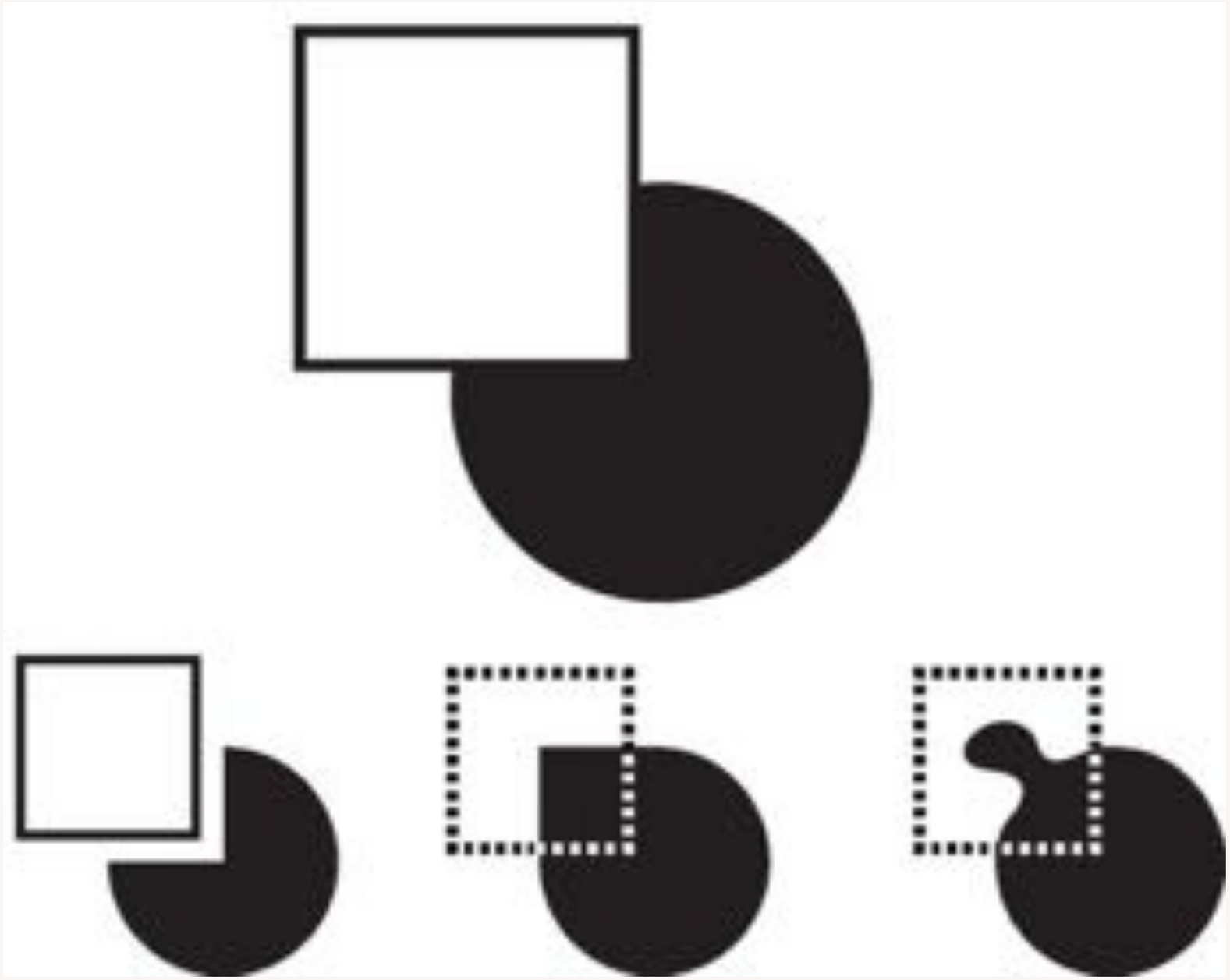


enclosure > connection

Wong, Nature Methods, 2010

Gestalt Principles

Visual completion



Naturally complete
circle behind the square

Wong, Nature Methods, 2010

Outline

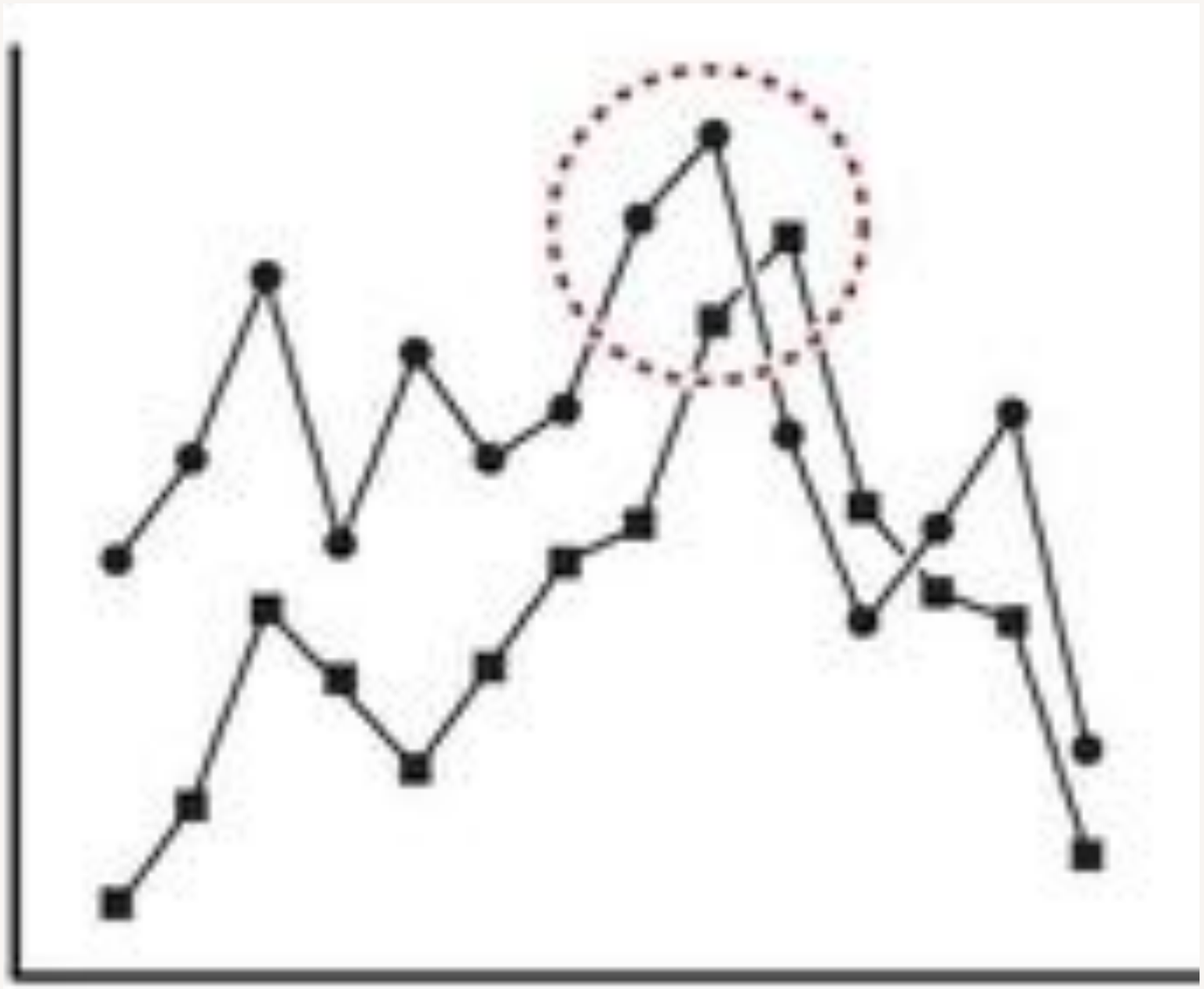
Perception

Plotting

Slides

Salience

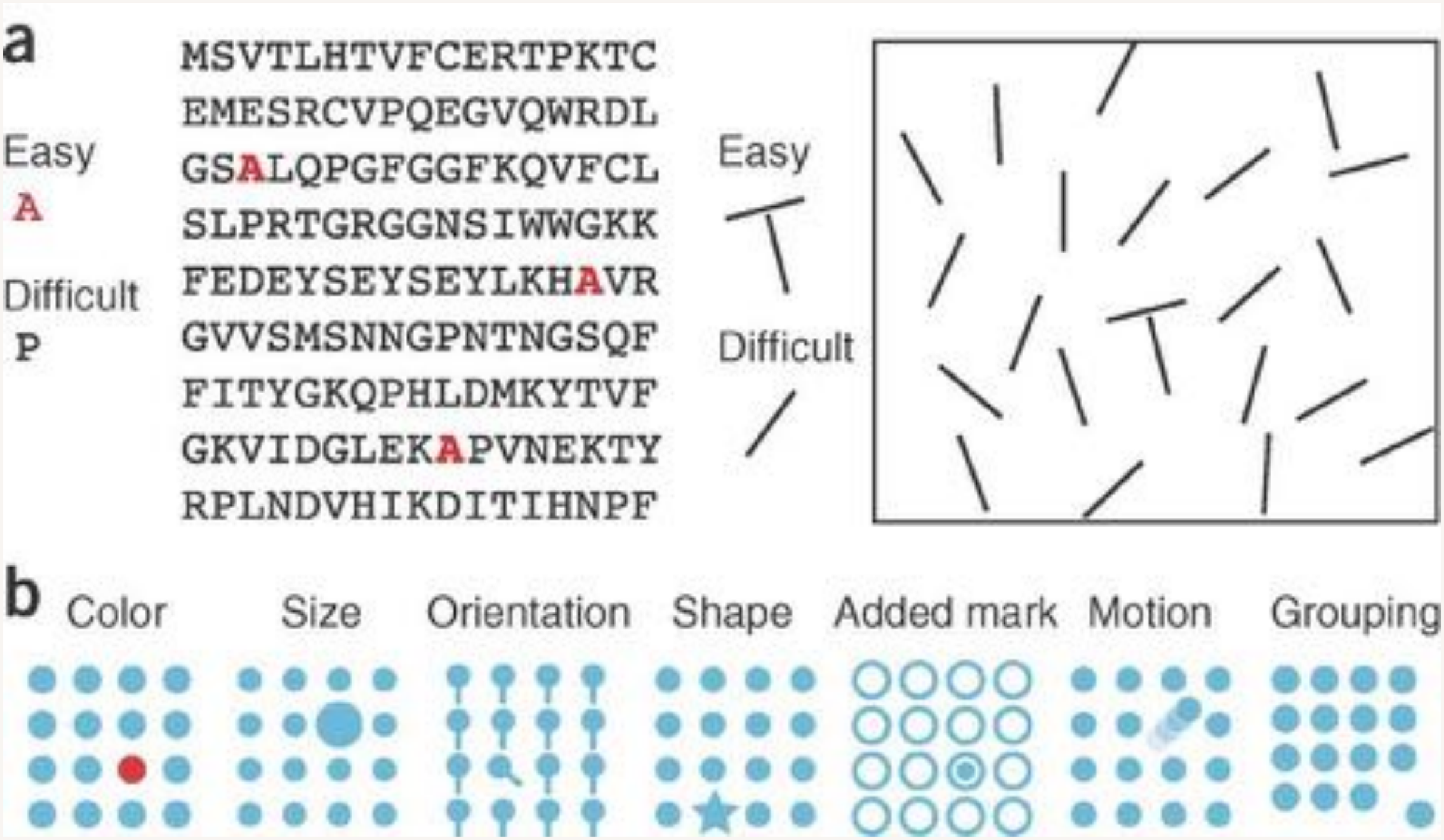
Gestalt principles >> identify most important features



Wong, Nature Methods, 2010

Salience

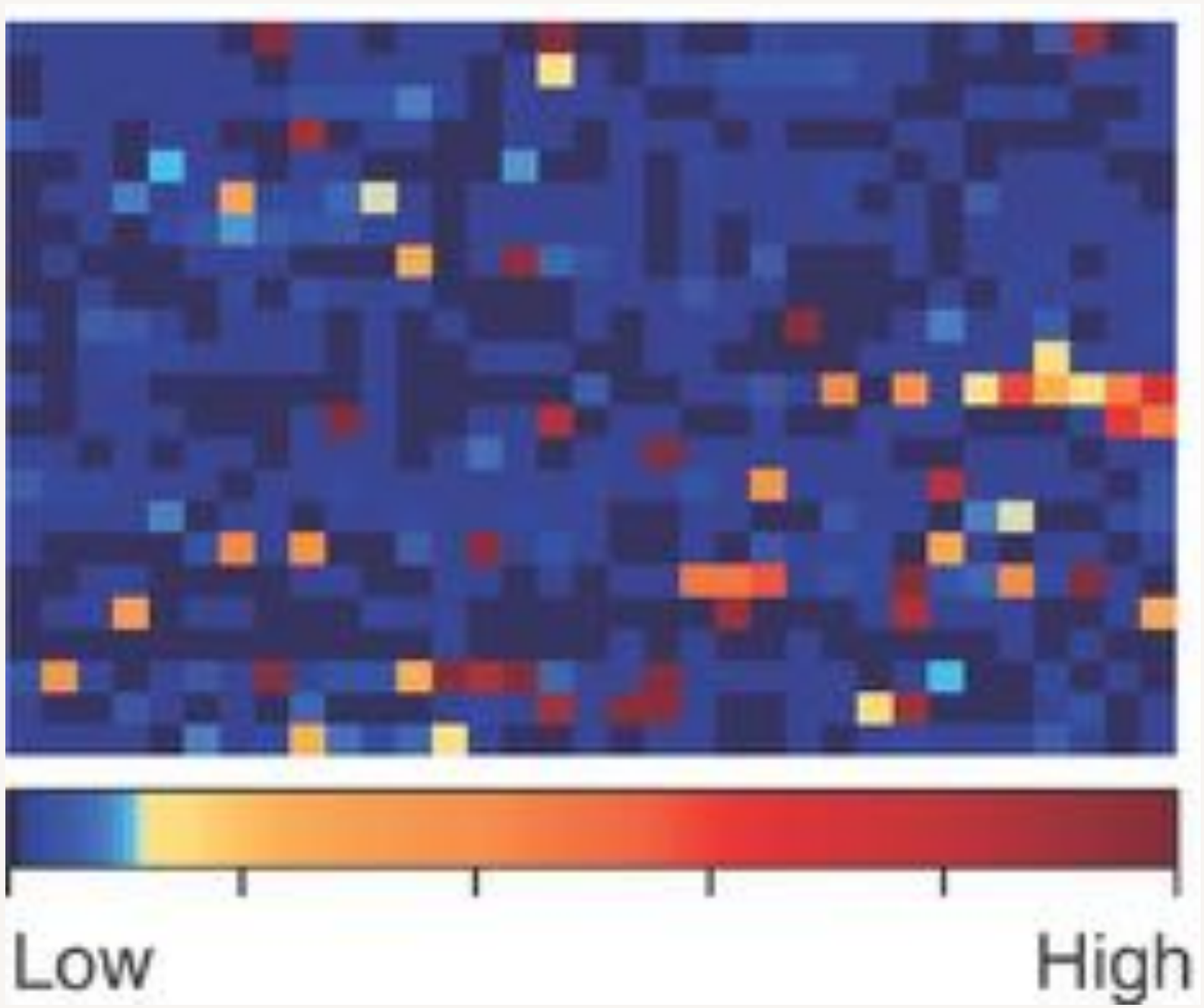
Things that stand out are easy to find



Wong, Nature Methods, 2010

Salience

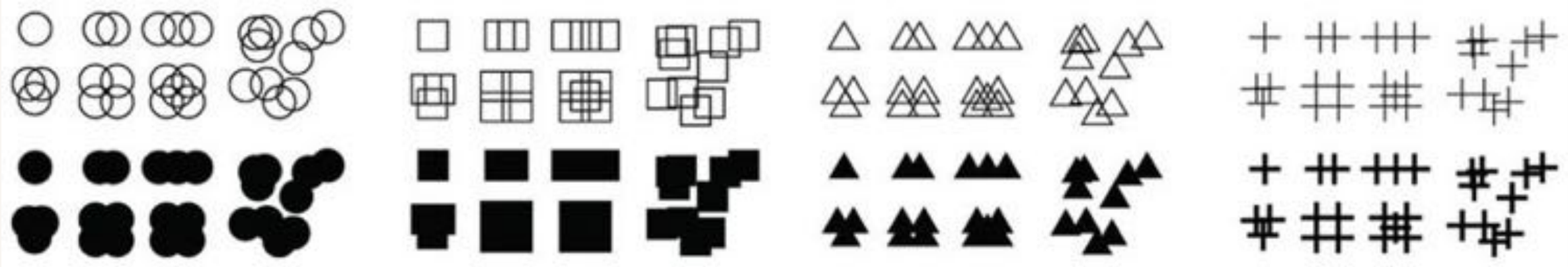
Salience must match relevance



Wong, Nature Methods, 2010

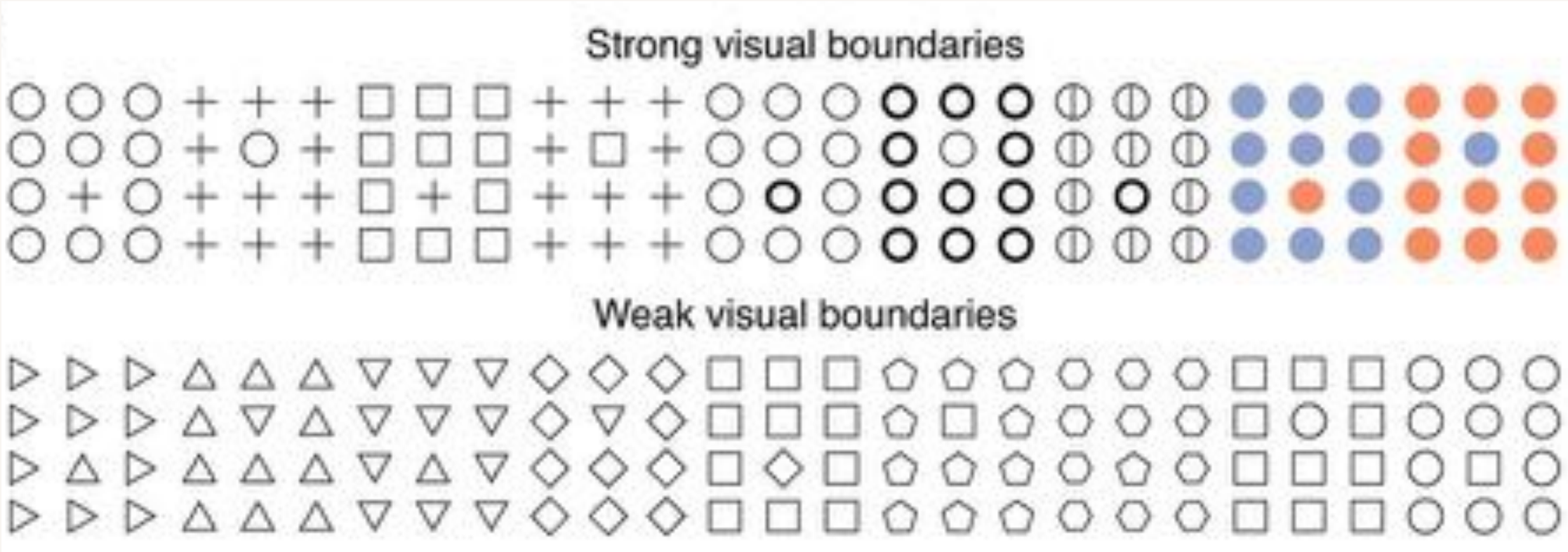
Symbols

Hollow circle is the most flexible and robust



Symbols

Form strong visual boundaries

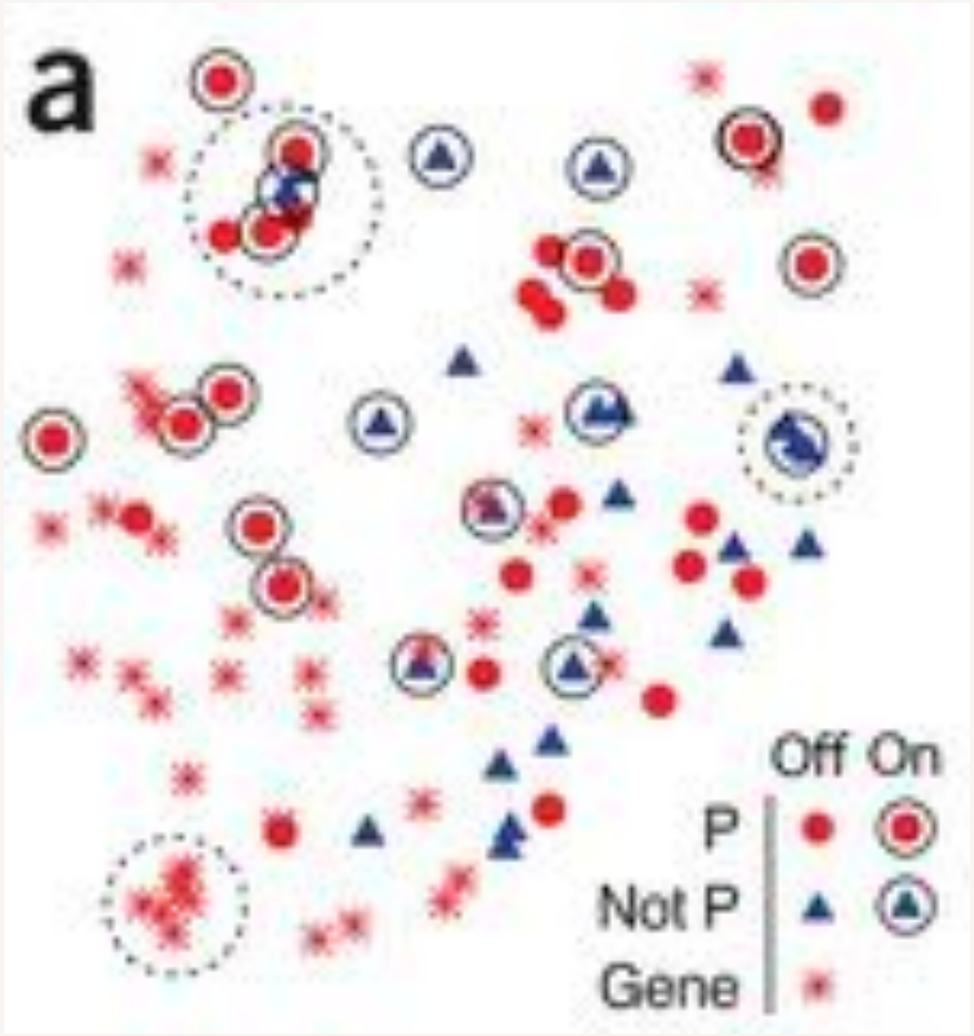


Symbols

Form strong visual boundaries

Symbols

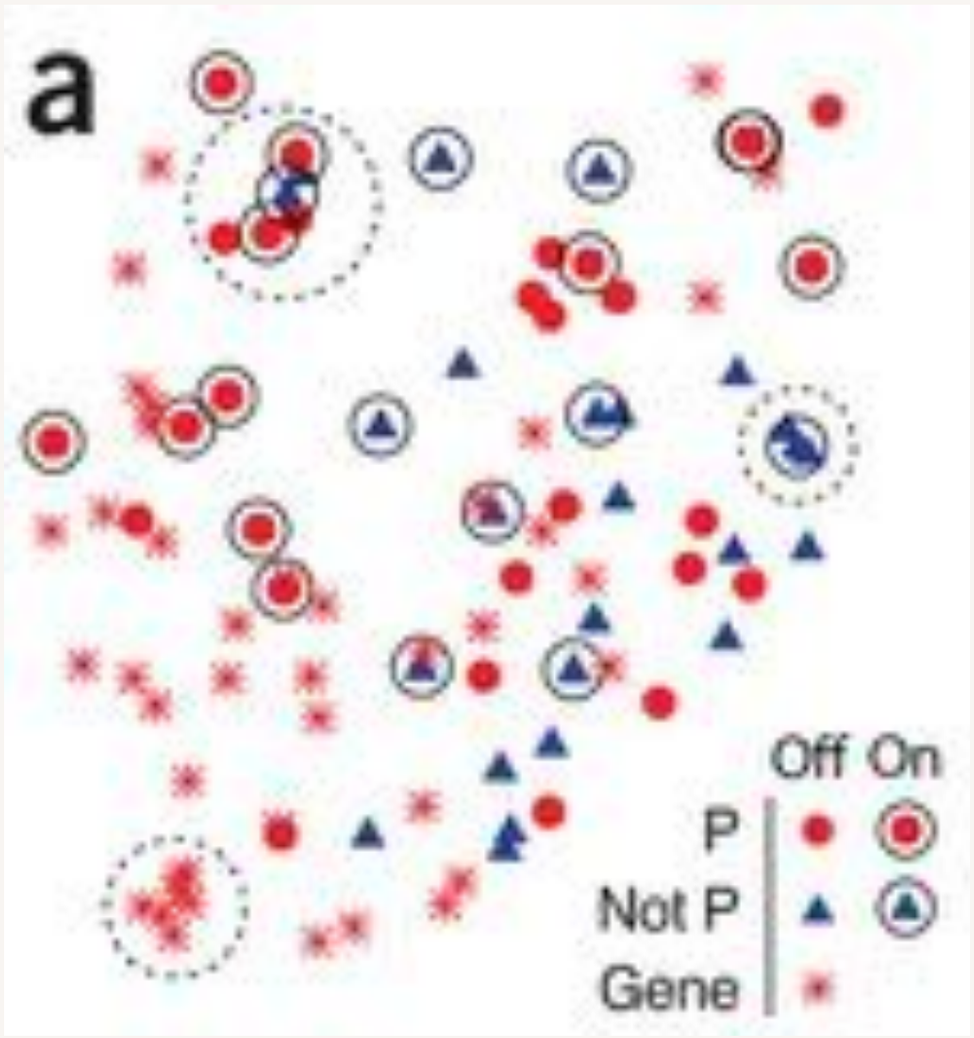
Build hierarchies into plotting choices

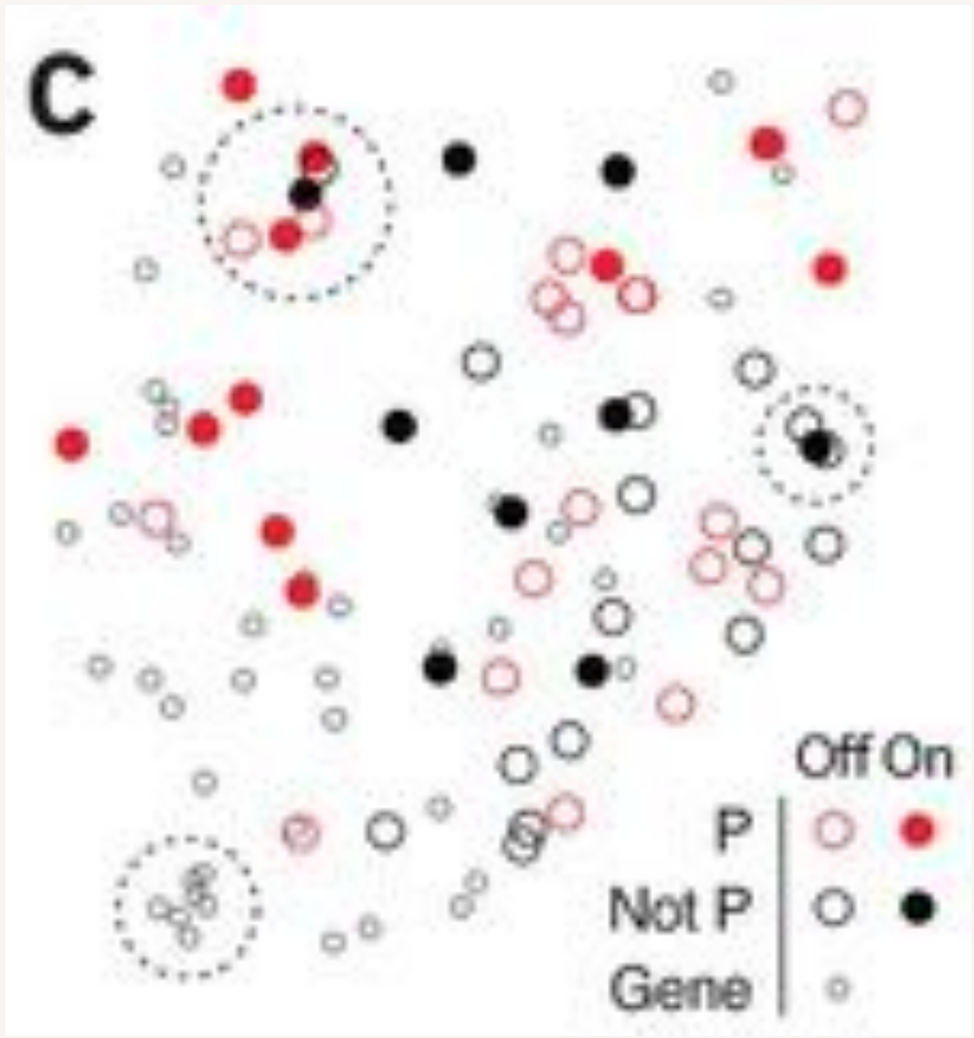


Krzywinski & Wong 13

Symbols

Build hierarchies into plotting choices

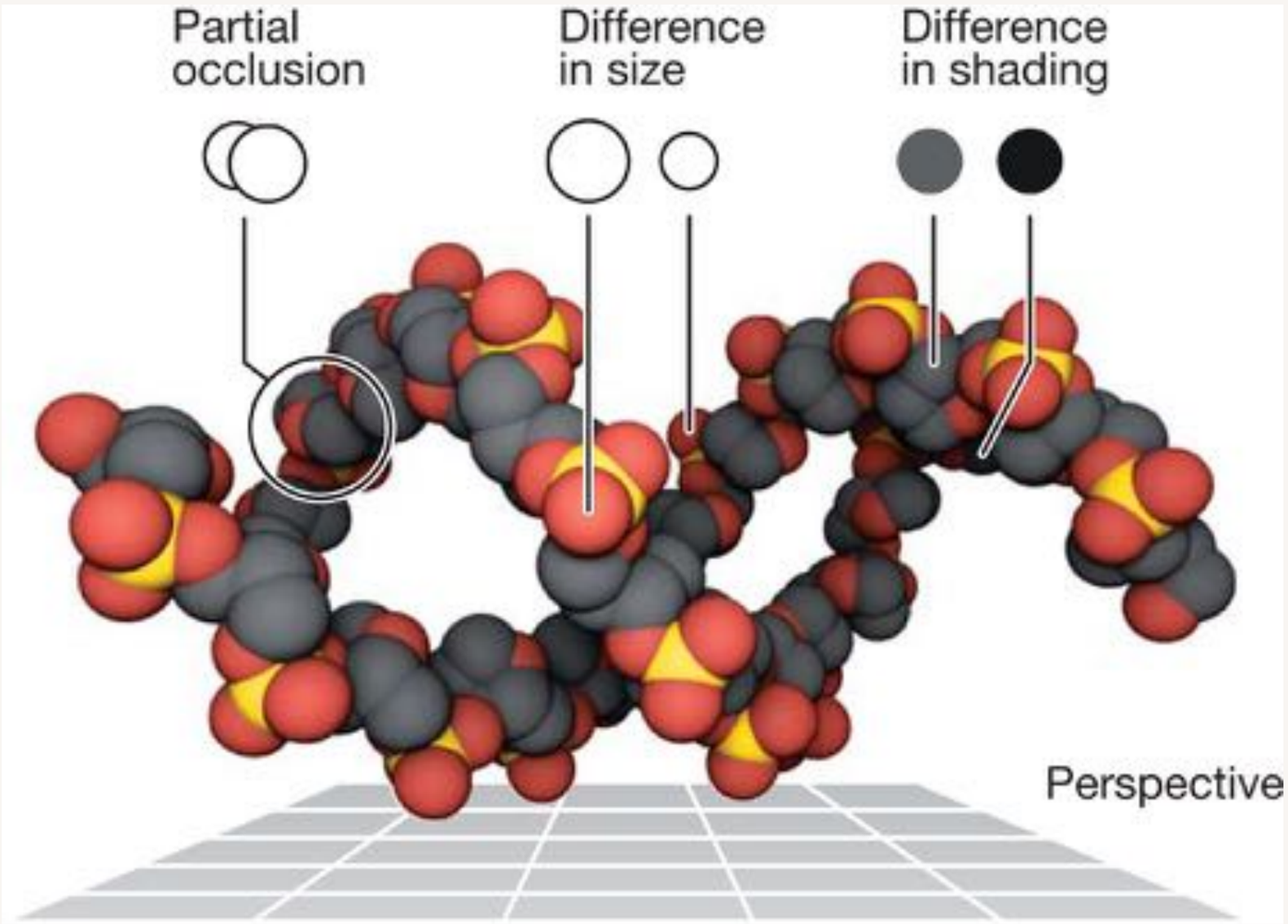




Krzywinski & Wong 13

Multiple Dimensions

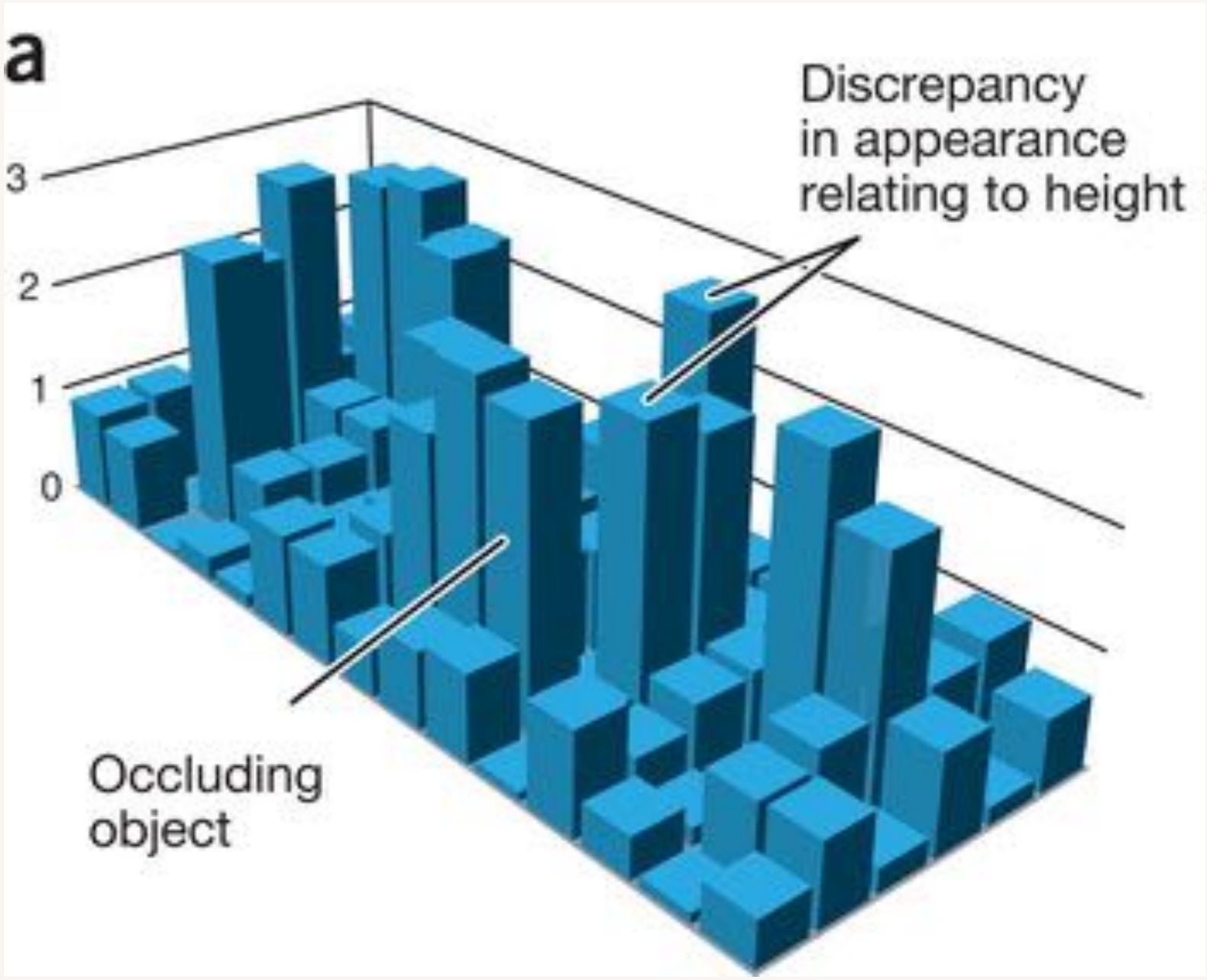
Restrict 3d plots to spatial representations



Gehlenborg & Wong, Nature Methods, 2012

Multiple Dimensions

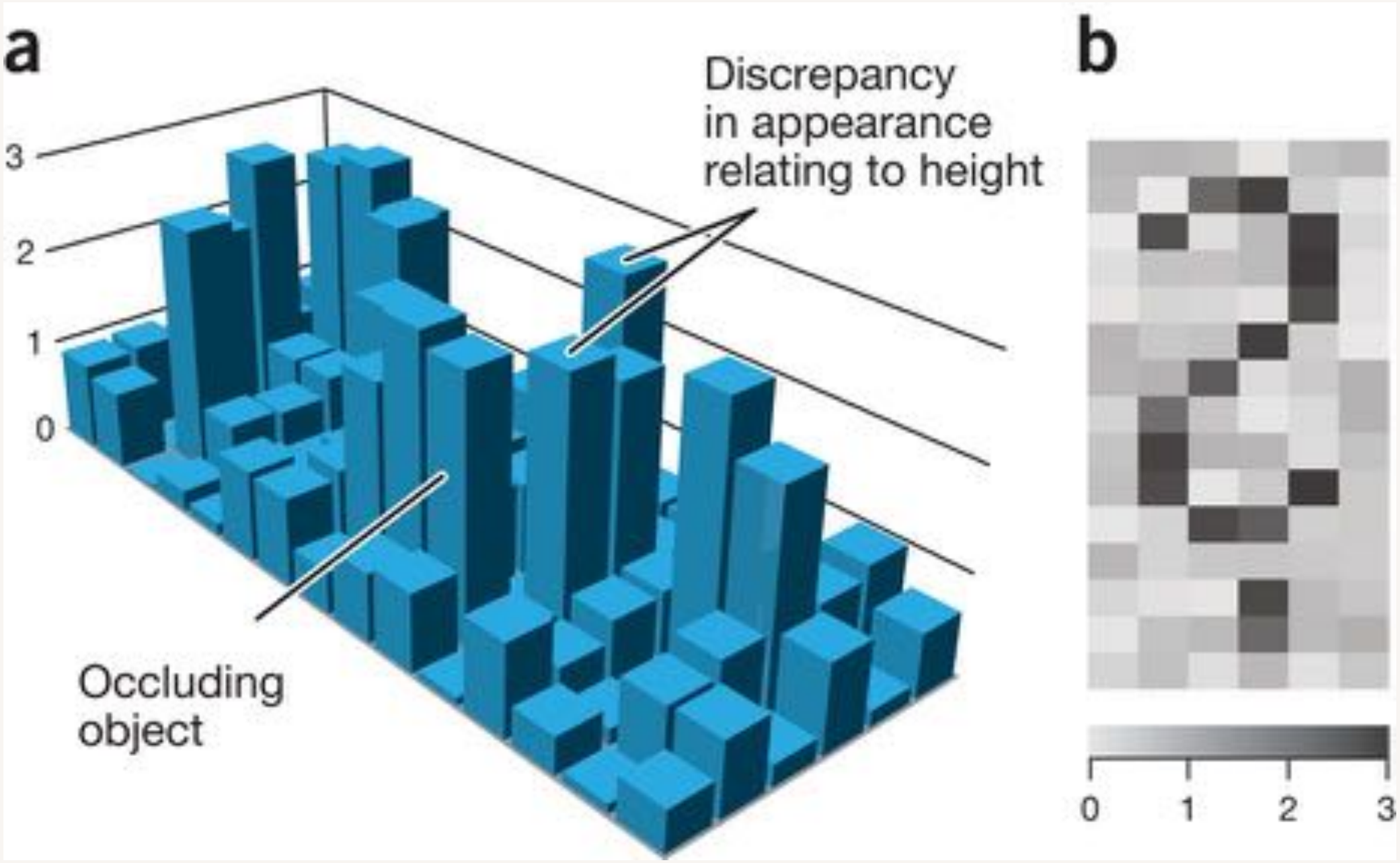
Restrict 3d plots to spatial representations



Gehlenborg & Wong, Nature Methods, 2012

Multiple Dimensions

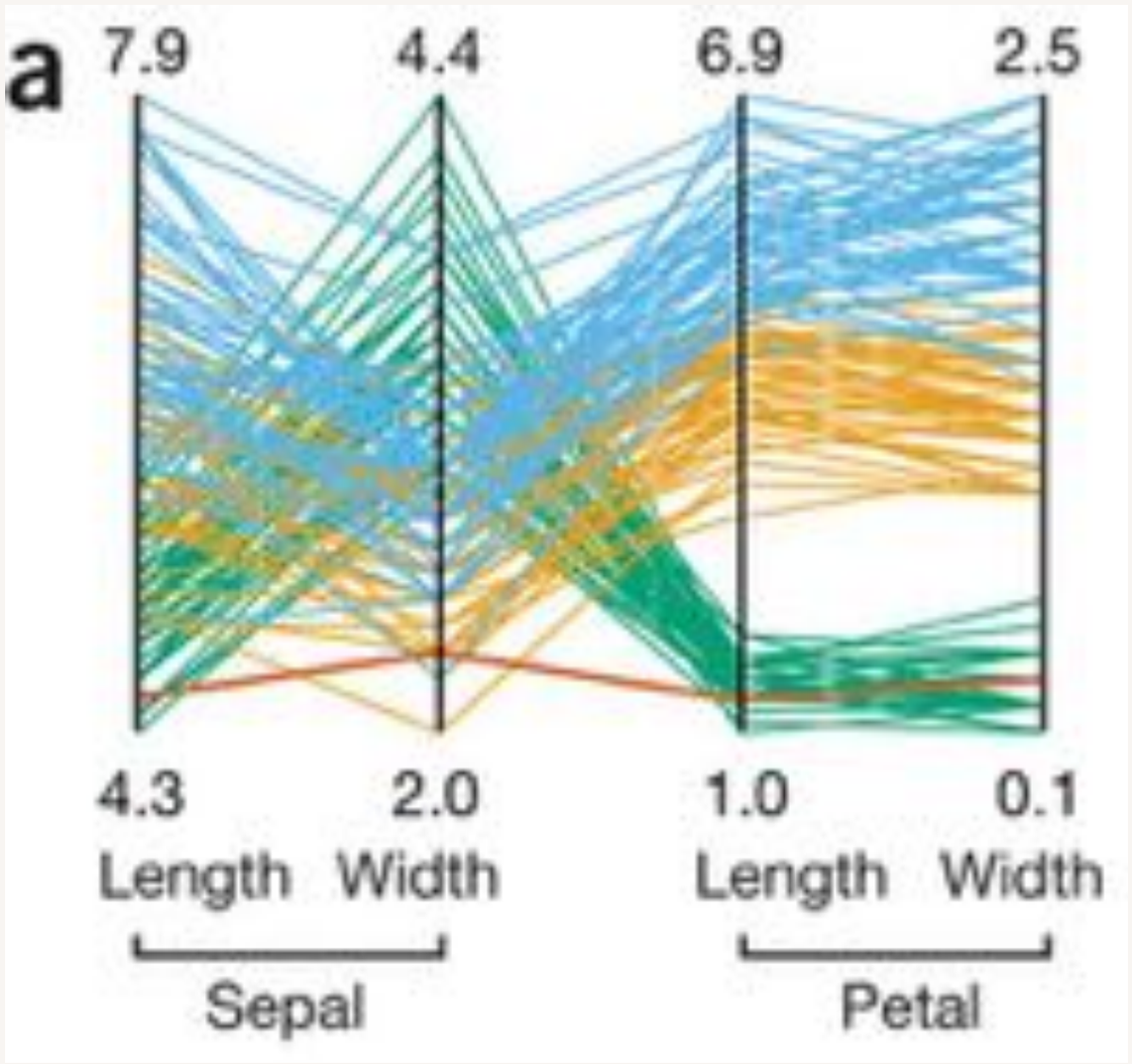
Restrict 3d plots to spatial representations



Gehlenborg & Wong, Nature Methods, 2012

Multiple Dimensions

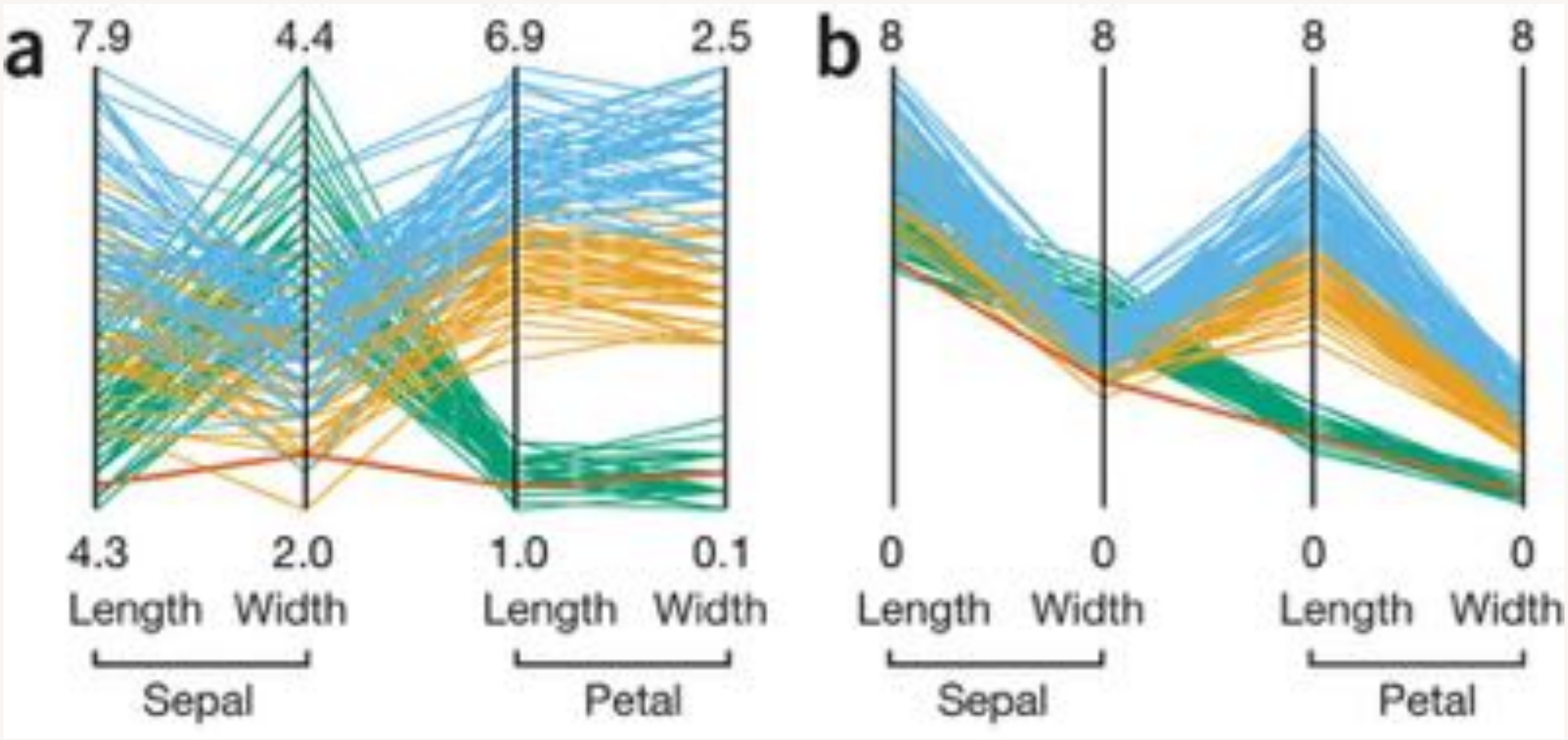
Combine multiple dimensions in 2D



Gehlenborg & Wong, Nature Methods, 2012

Multiple Dimensions

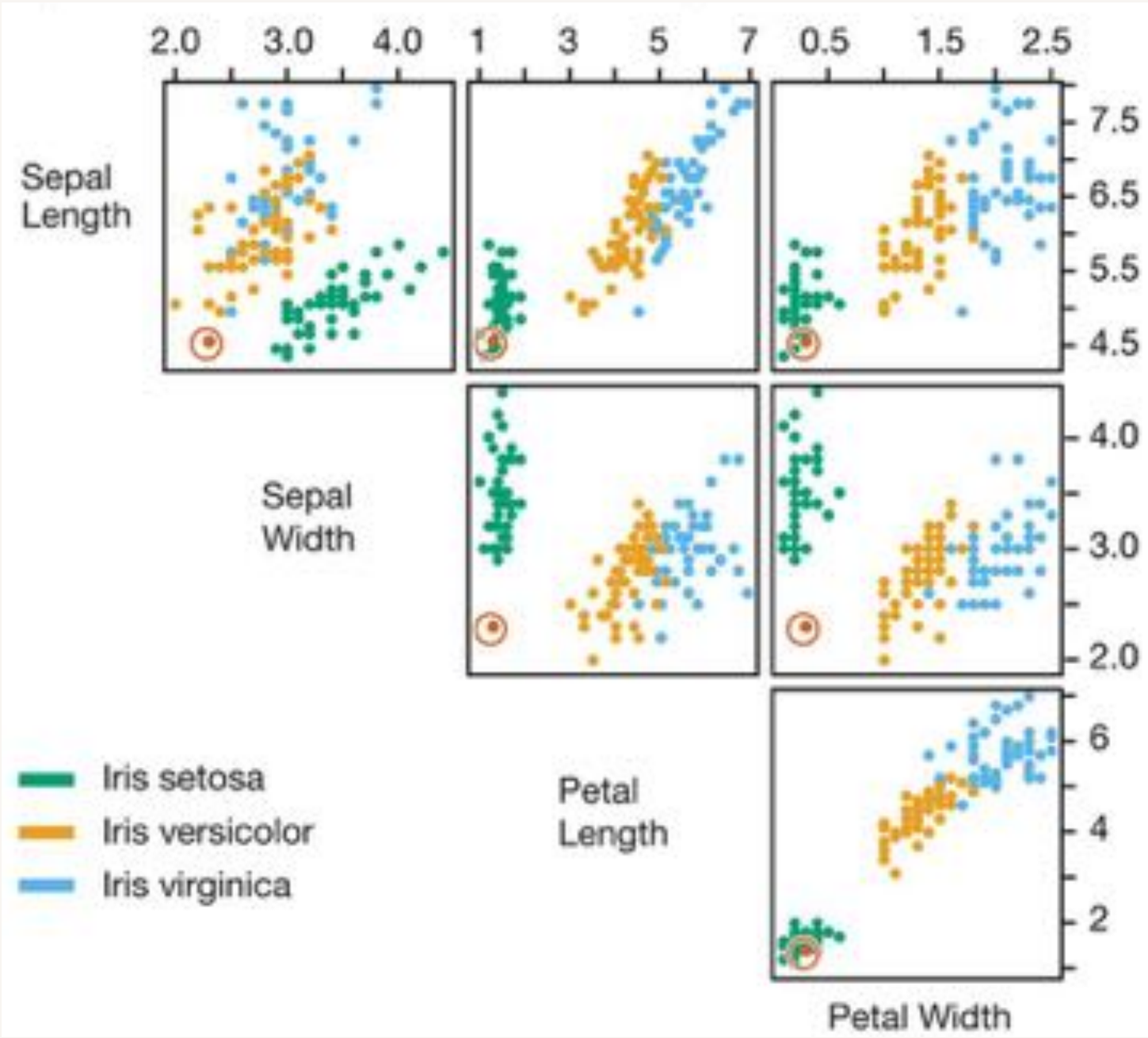
Combine multiple dimensions in 2D



Gehlenborg & Wong, Nature Methods, 2012

Multiple Dimensions

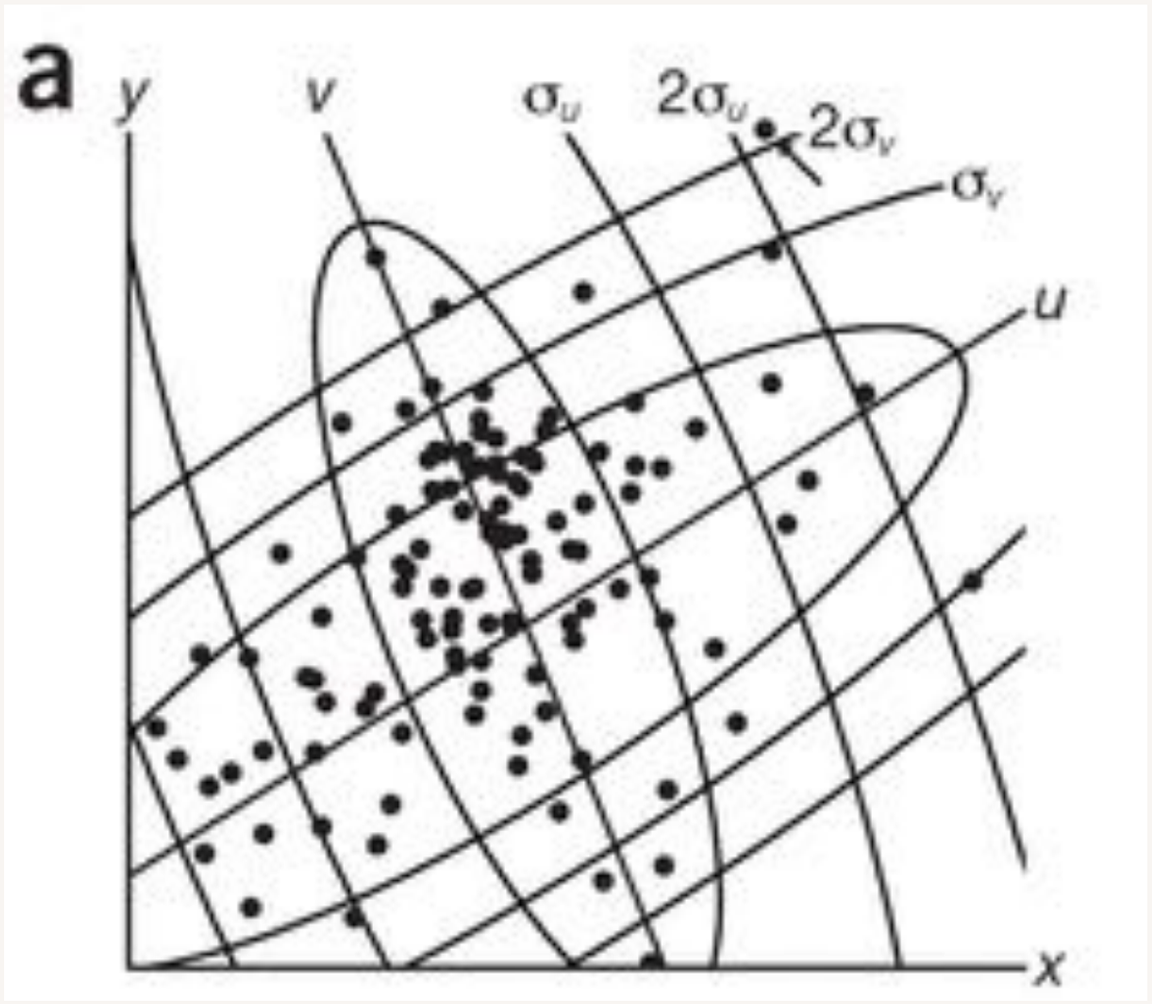
Combine multiple dimensions in 2D



Gehlenborg & Wong, Nature Methods, 2012

Axes & Grids

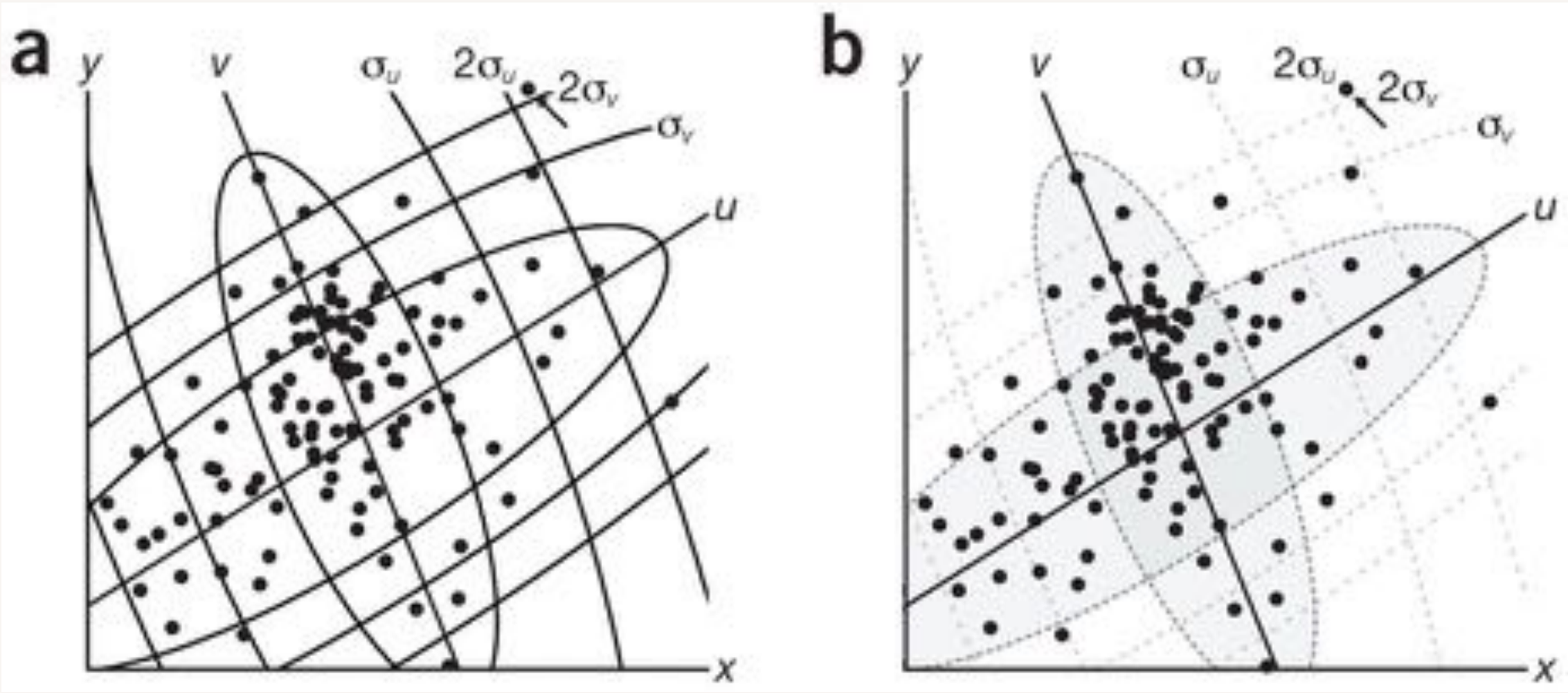
Make navigational elements visually distinct



Krzywinski, Nature Methods, 2013

Axes & Grids

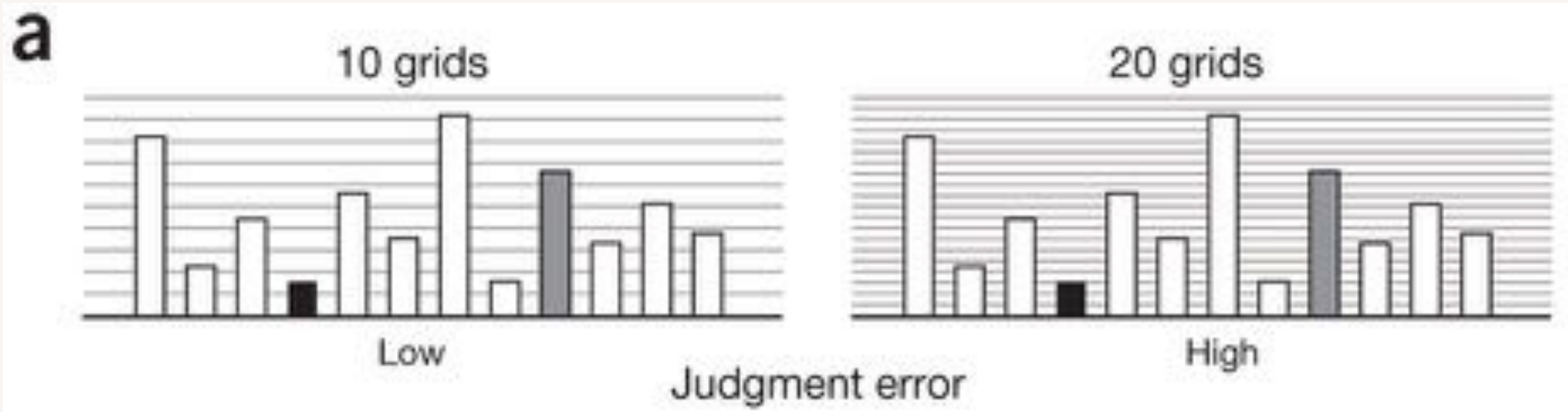
Make navigational elements visually distinct



Krzywinski, Nature Methods, 2013

Axes & Grids

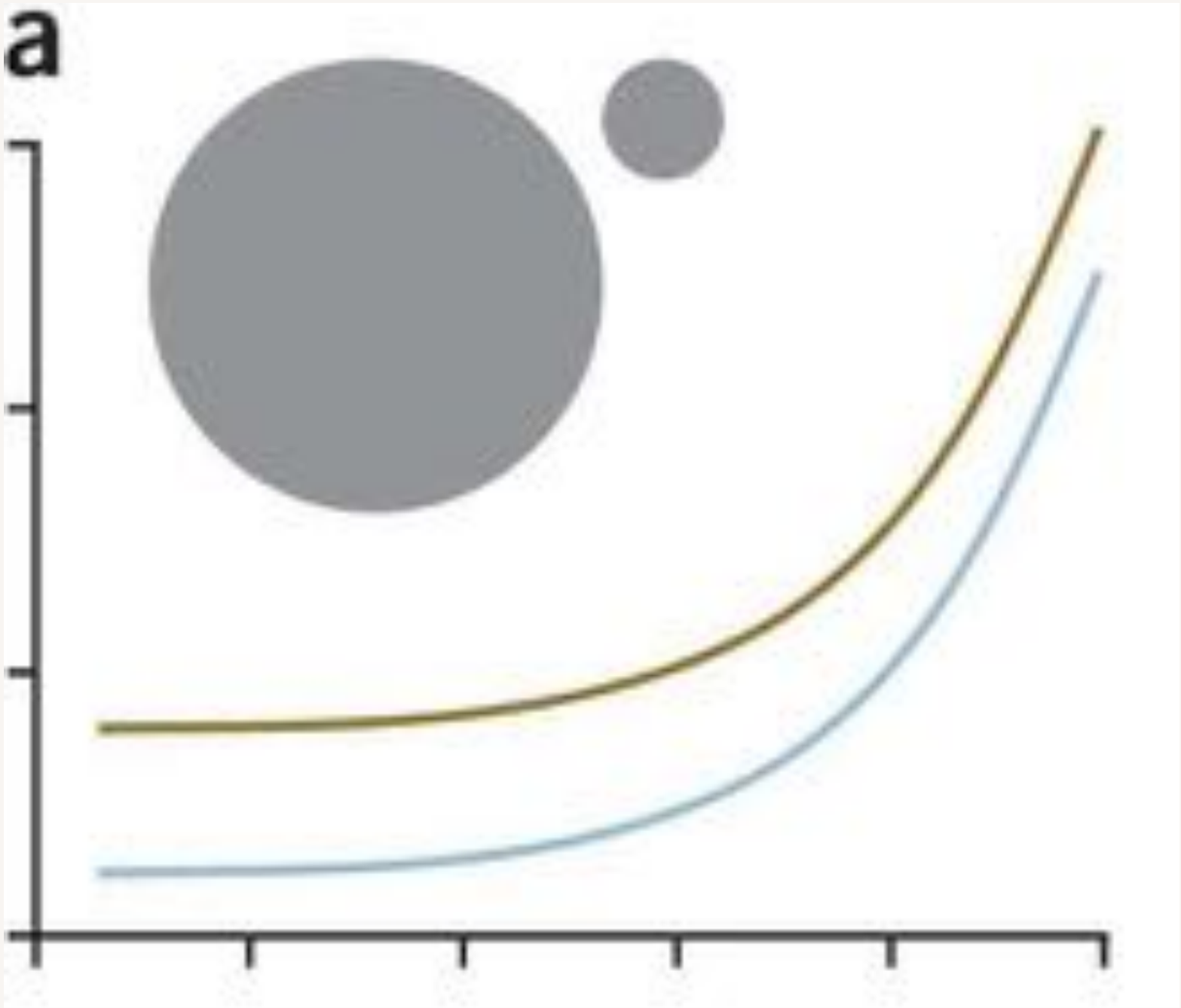
Use grid lines judiciously



Krzywinski, Nature Methods, 2013

Figure Design

Use easy-to-estimate visual representations

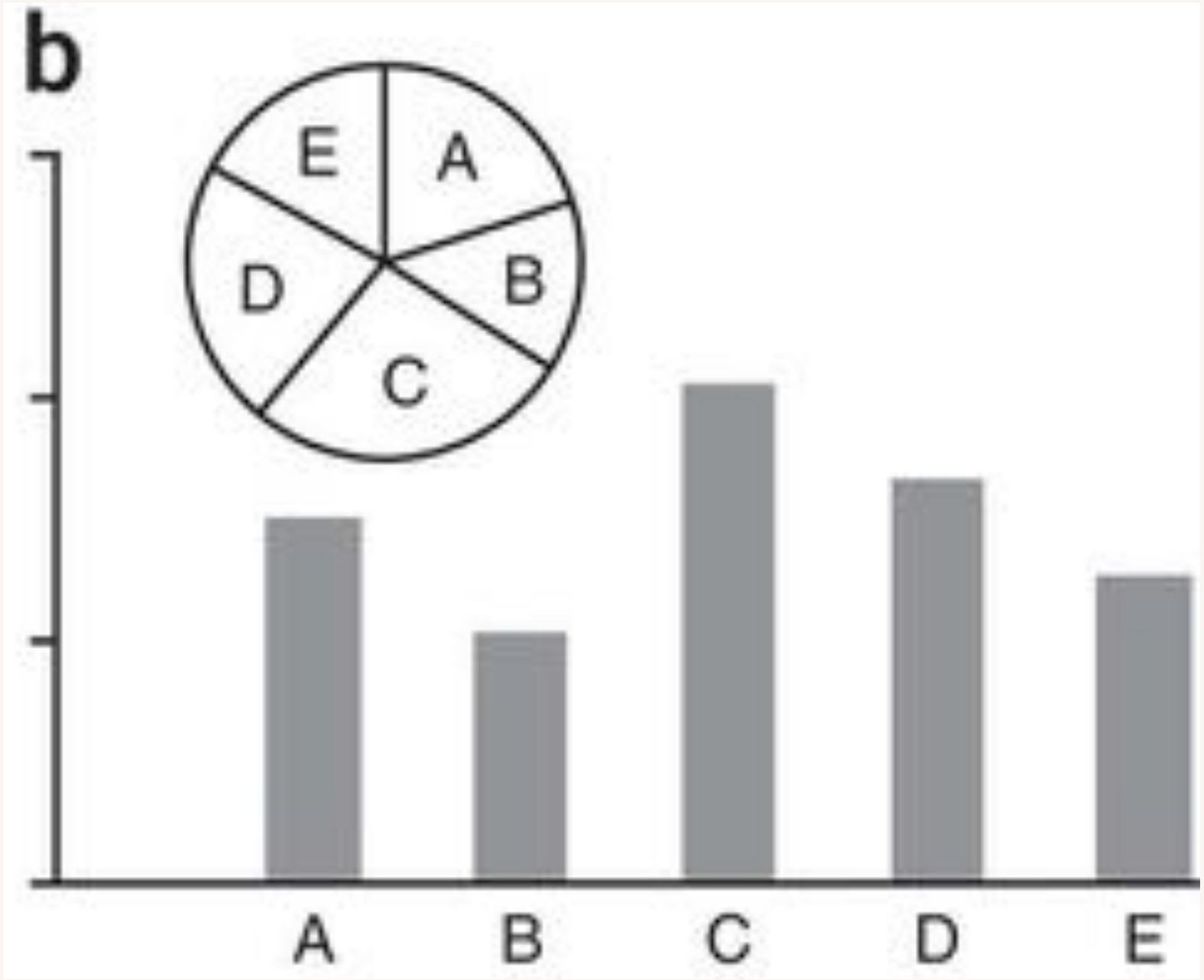


relative area = easier
curve separation = hard

Wong, Nature Methods, 2010

Figure Design

Use easy-to-estimate visual representations



bar graphs = easy
pie charts = stupid hard

Wong, Nature Methods, 2010

Figure Design

Use easy-to-estimate visual representations

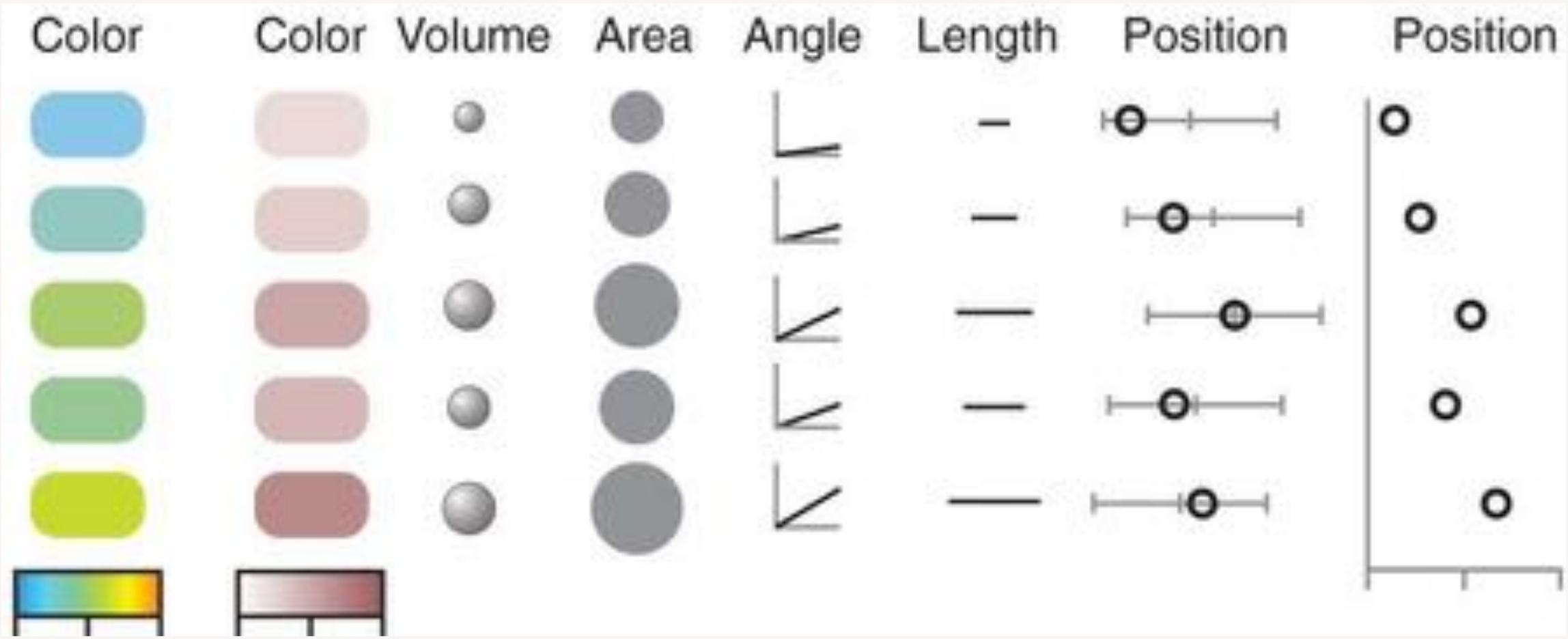
Rank	Aspect to Compare
1	Positions on a common scale
2	Positions on the same but nonaligned scales
3	Lengths
4	Angles, slopes
5	Area
6	Volume, color saturation
7	Hue

Cleveland & McGill 1985

Figure Design

Use easy-to-estimate visual representations

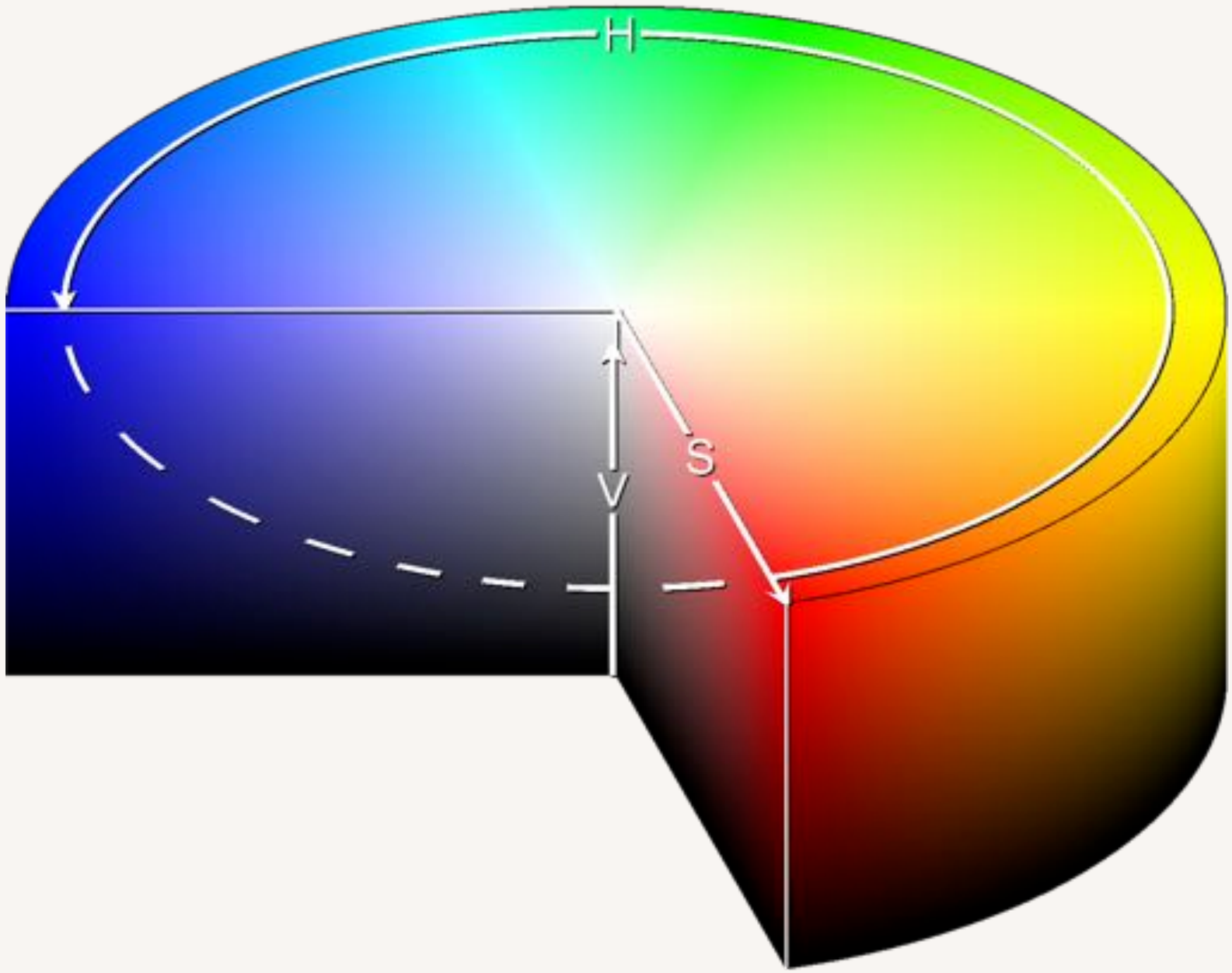
positions = easy
colors = hard



Wong, Nature Methods, 2010

Color

Color defined by hue, saturation, lightness

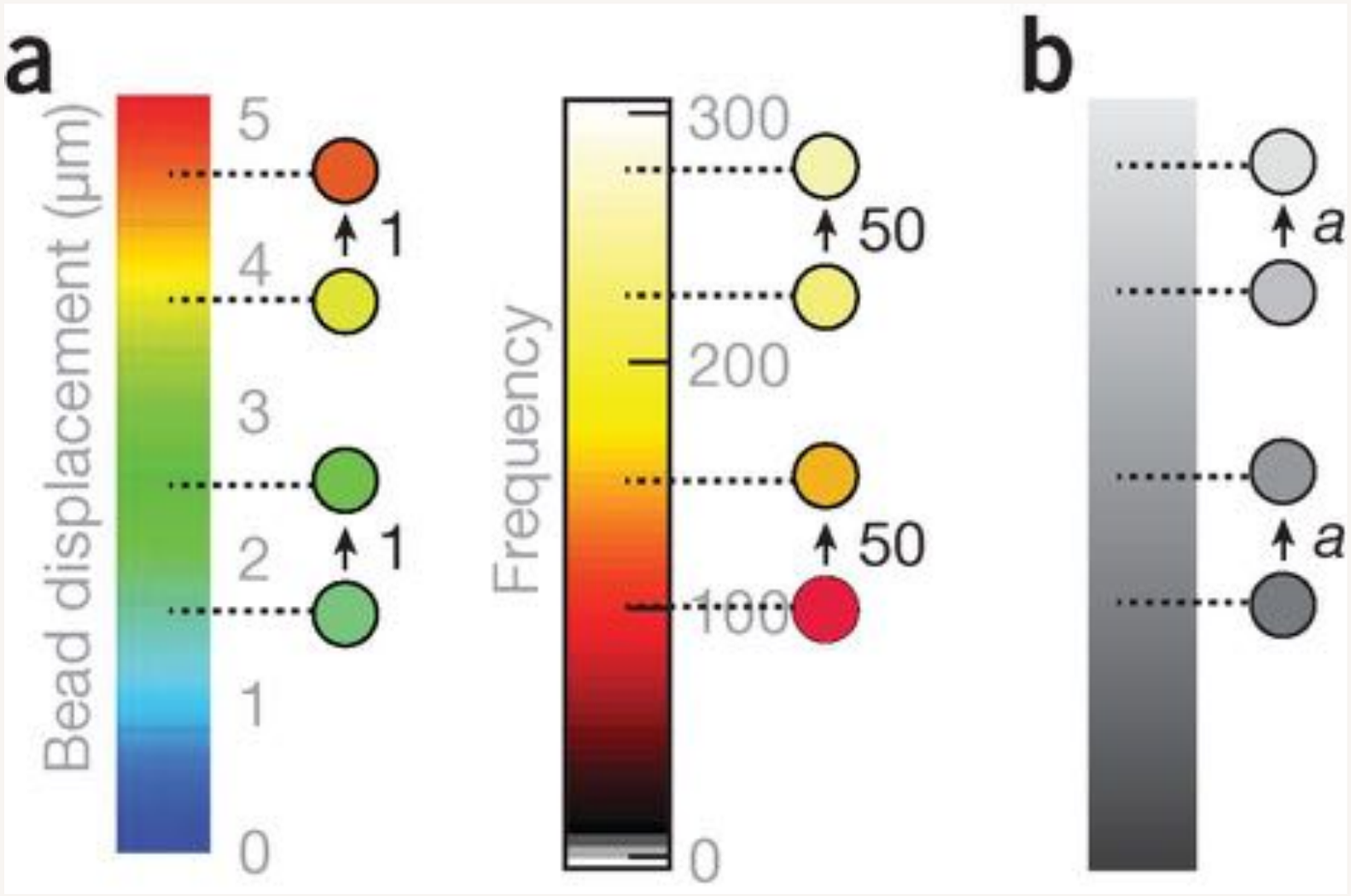


best for categorical data
>6 = hard to interpret

wiki commons

Color

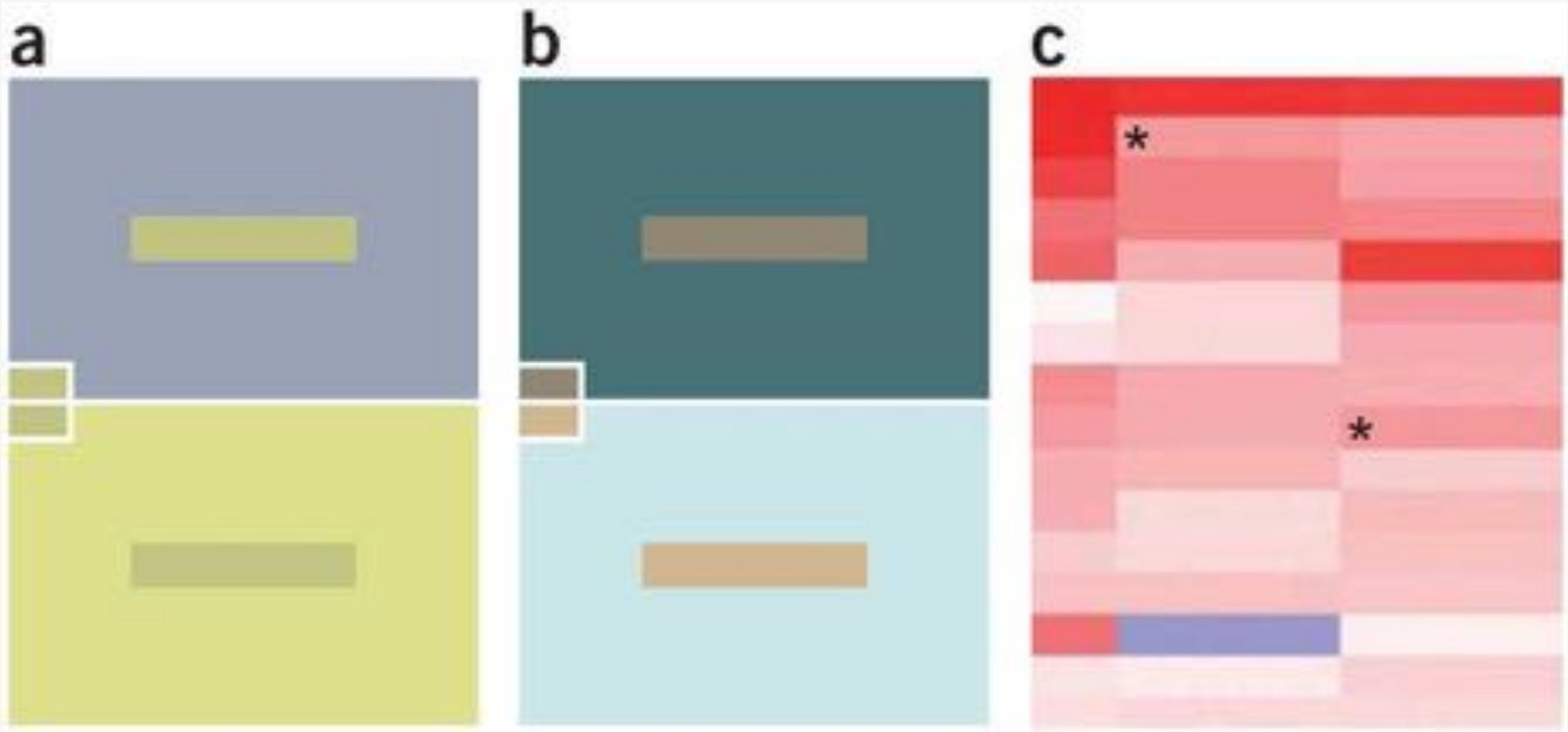
Hue does a poor job encoding relative numerical values



Wong, Nature Methods, 2010

Color

Color perception depends on context



Wong, Nature Methods, 2010

Color

Select semantically resonant colors

banana

anger

money

sky

Lin+13

Color

Select semantically resonant colors

banana

anger

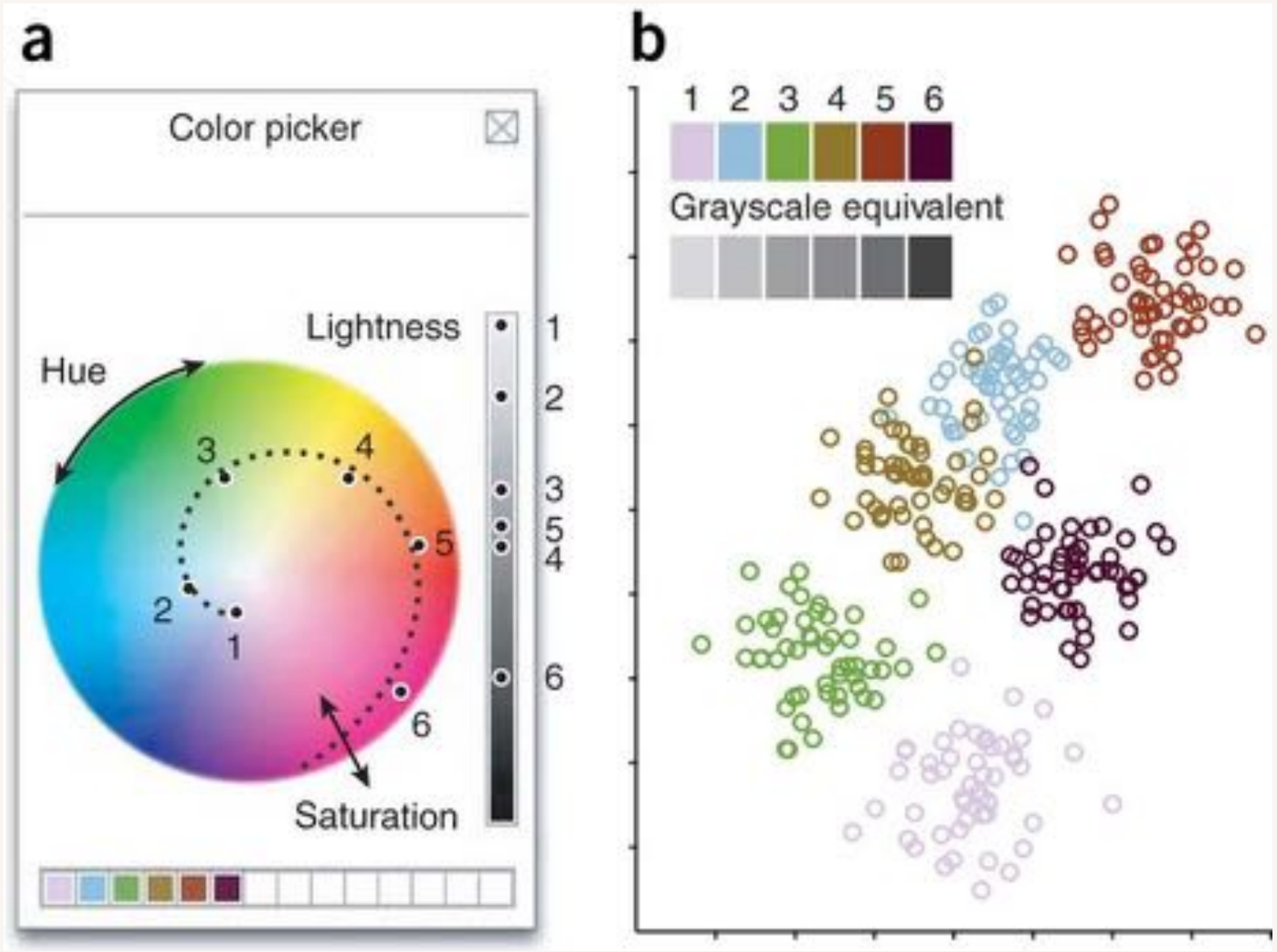
money

sky

Lin+13

Color

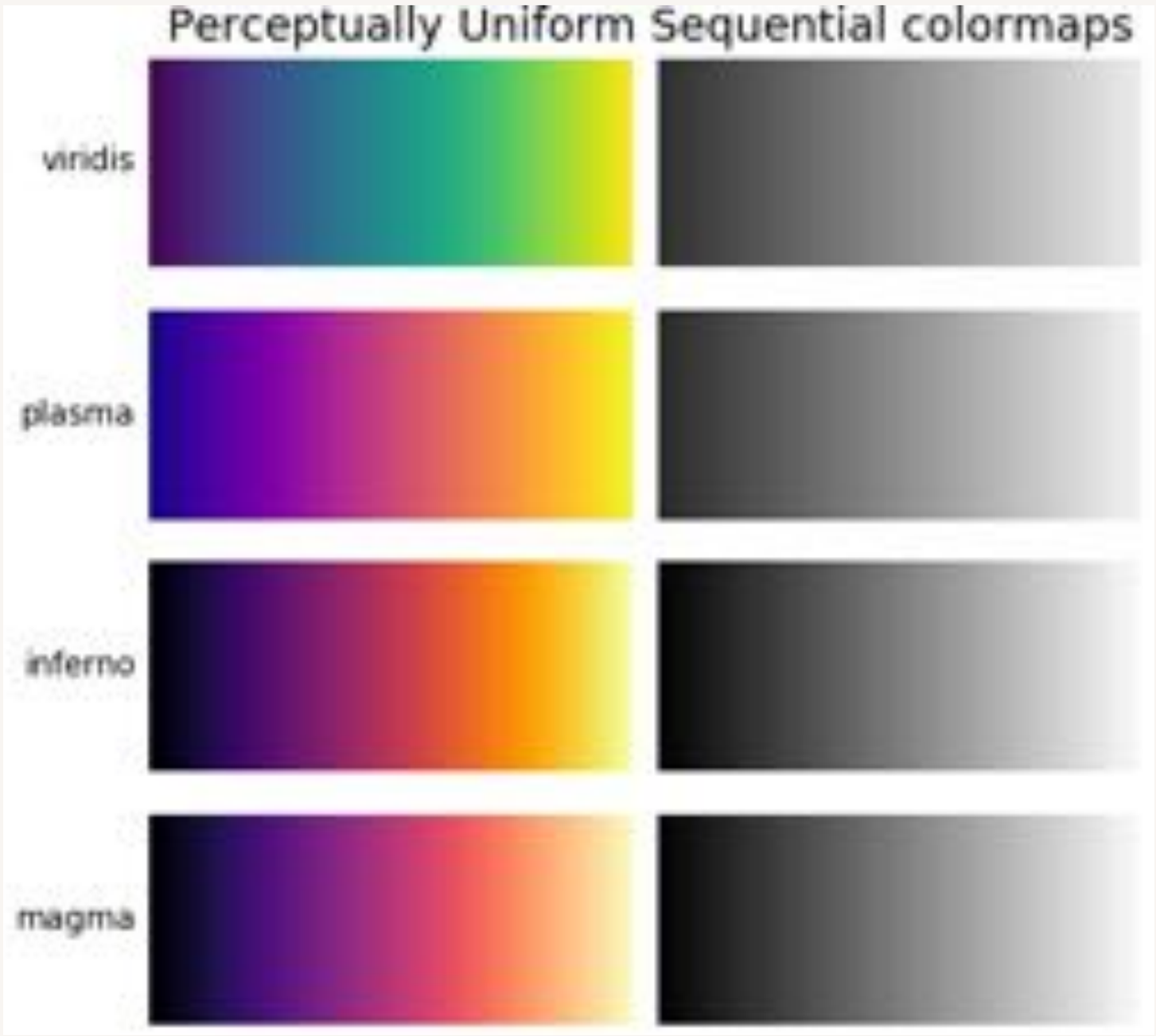
Rotate through color wheel for categorical selection



Wong, Nature Methods, 2010

Color

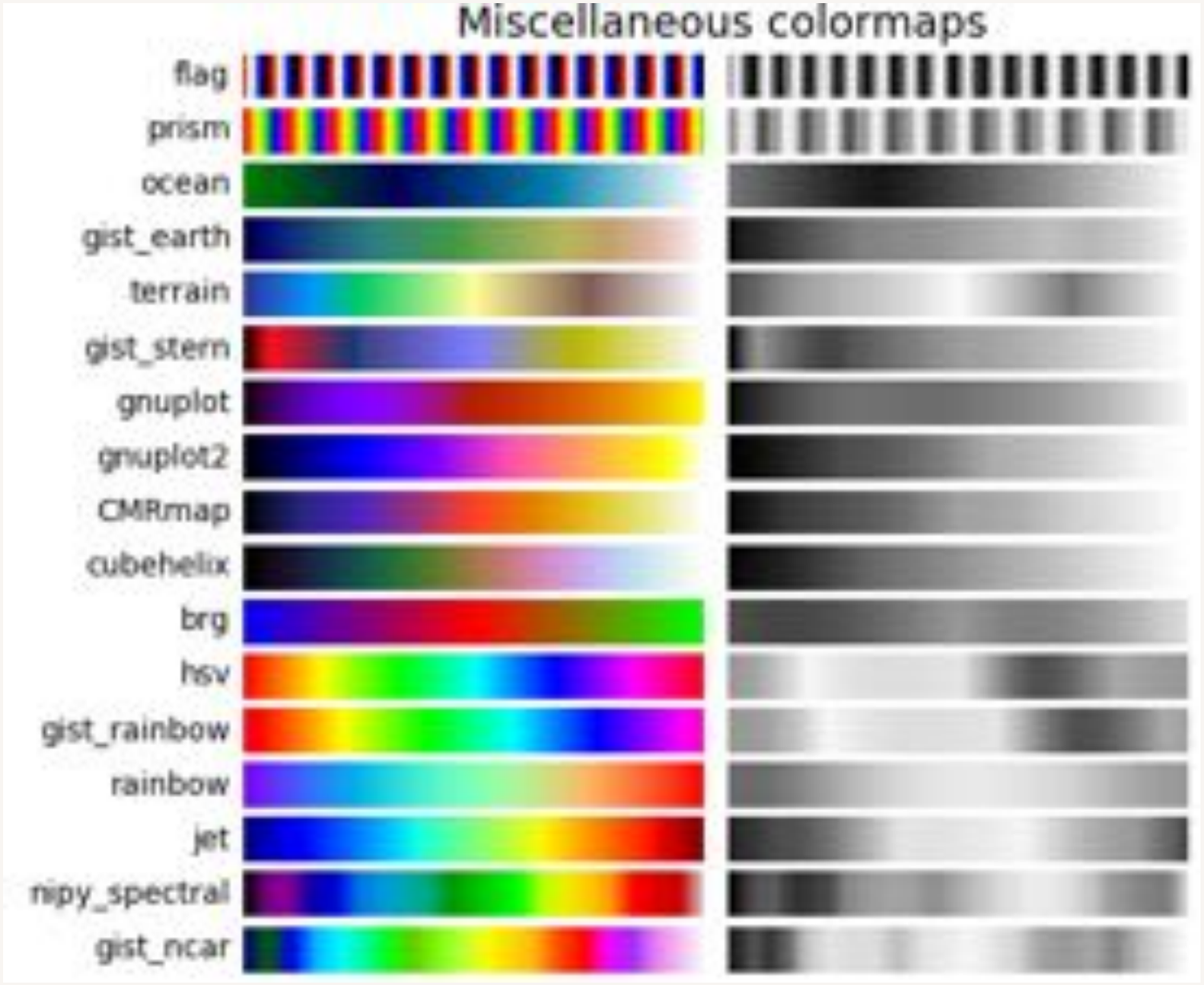
What does it look like in greyscale?



matplotlib

Color

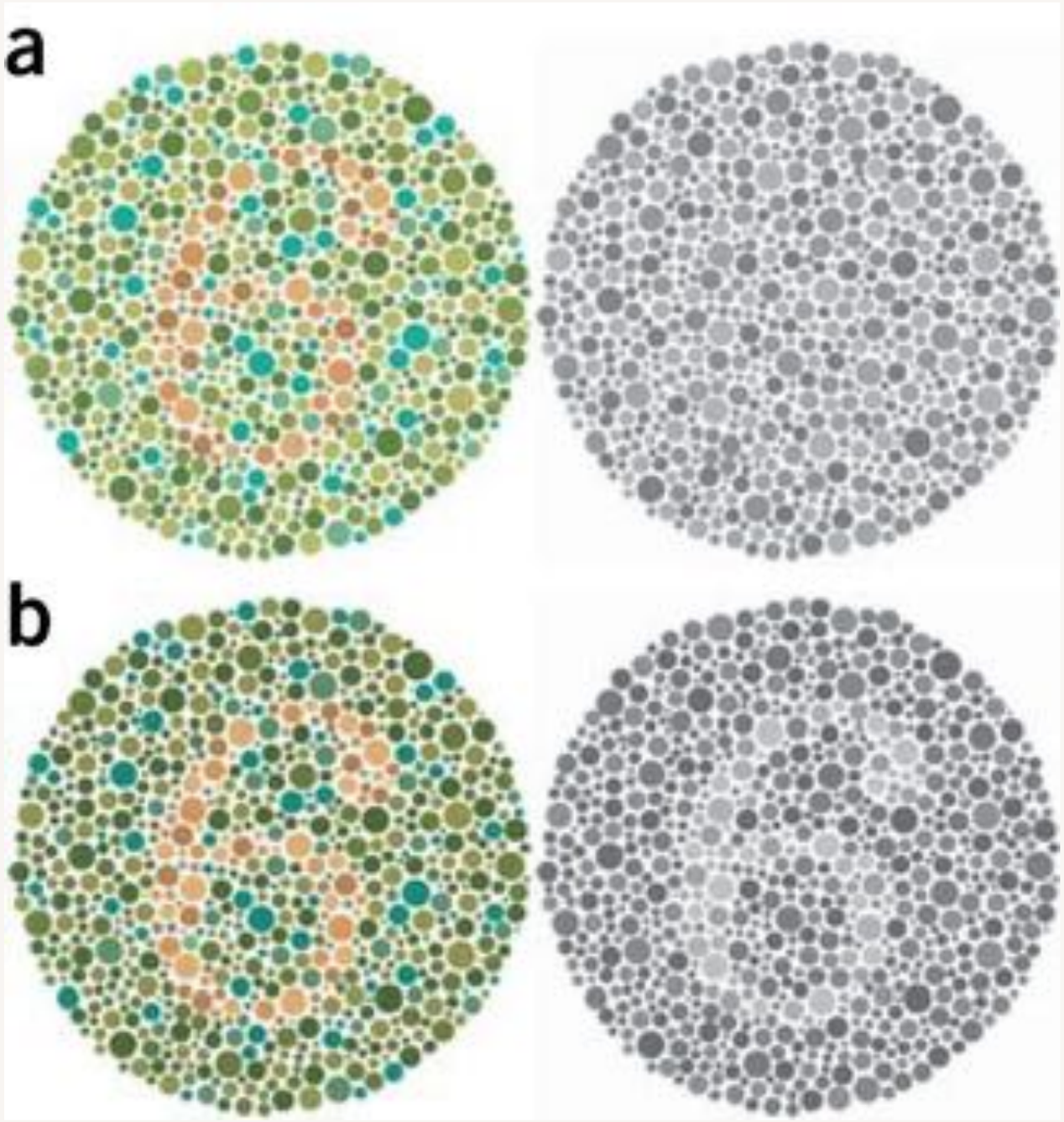
What does it look like in greyscale?



matplotlib

Color

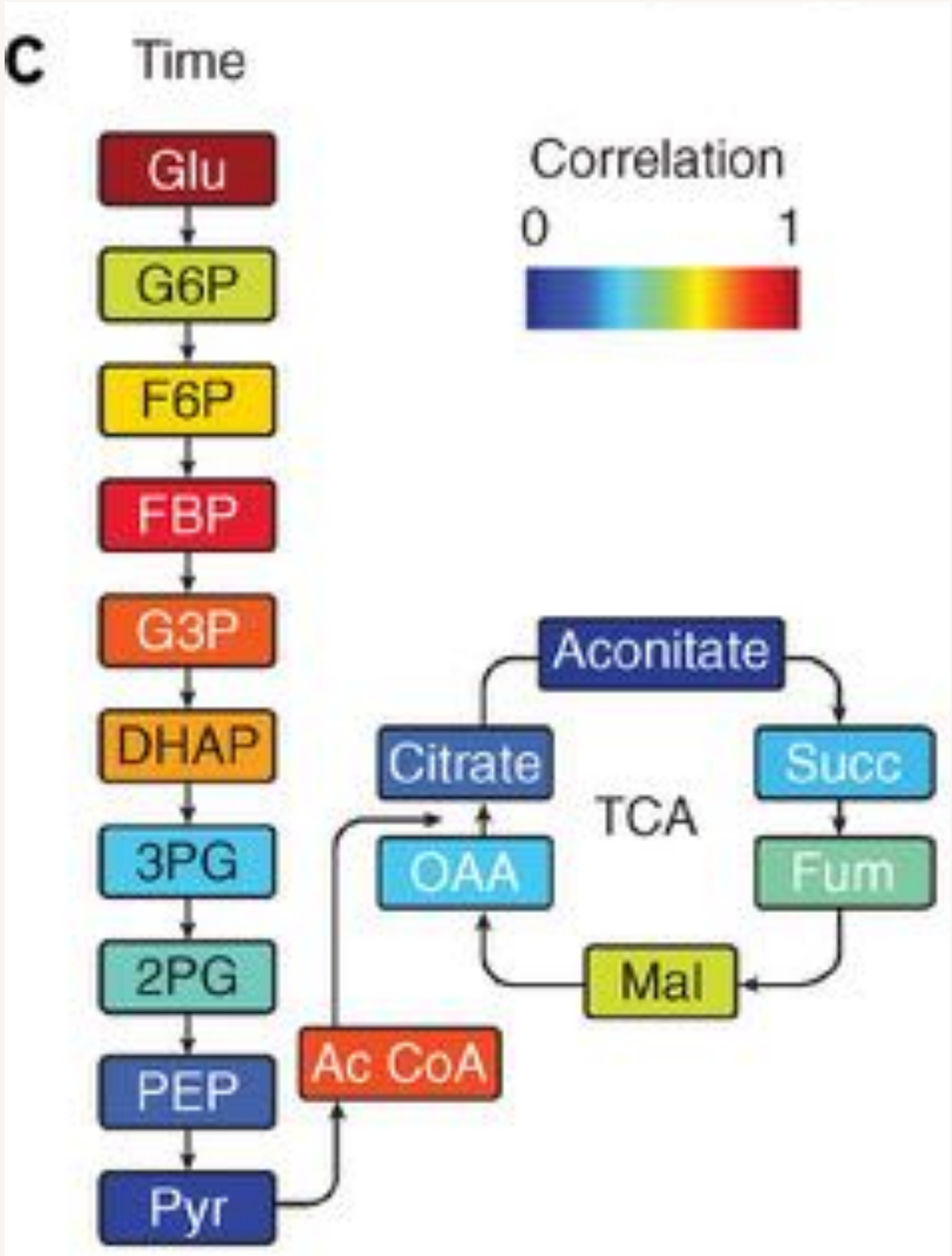
How does it look to the color blind?



Wong, Nature Methods, 2010

Color

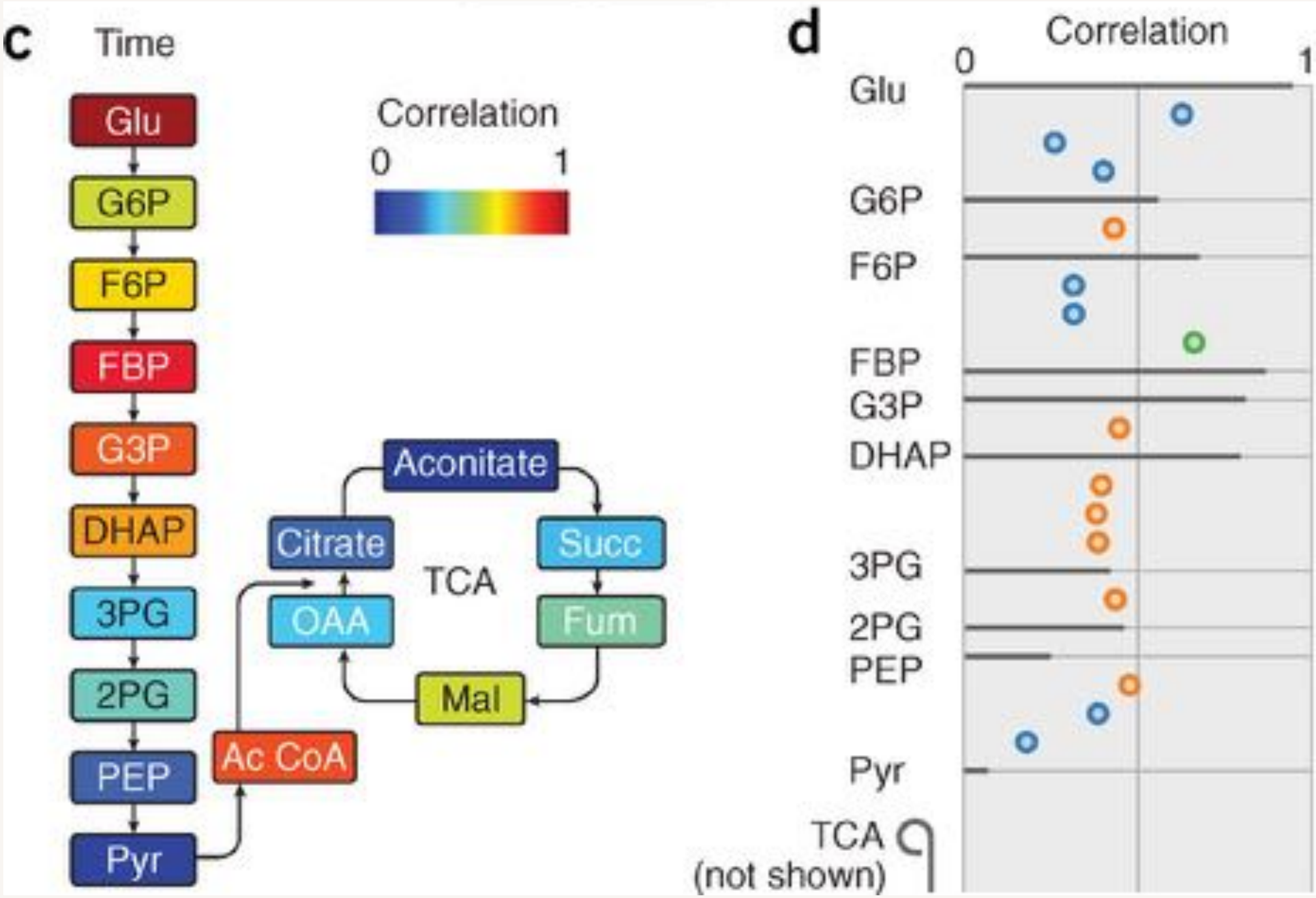
Best avoided if possible



Wong, Nature Methods, 2010

Color

Best avoided if possible



Wong, Nature Methods, 2010

Color

If you must…

use colorbrewer2.org to select colorblind friendly palettes

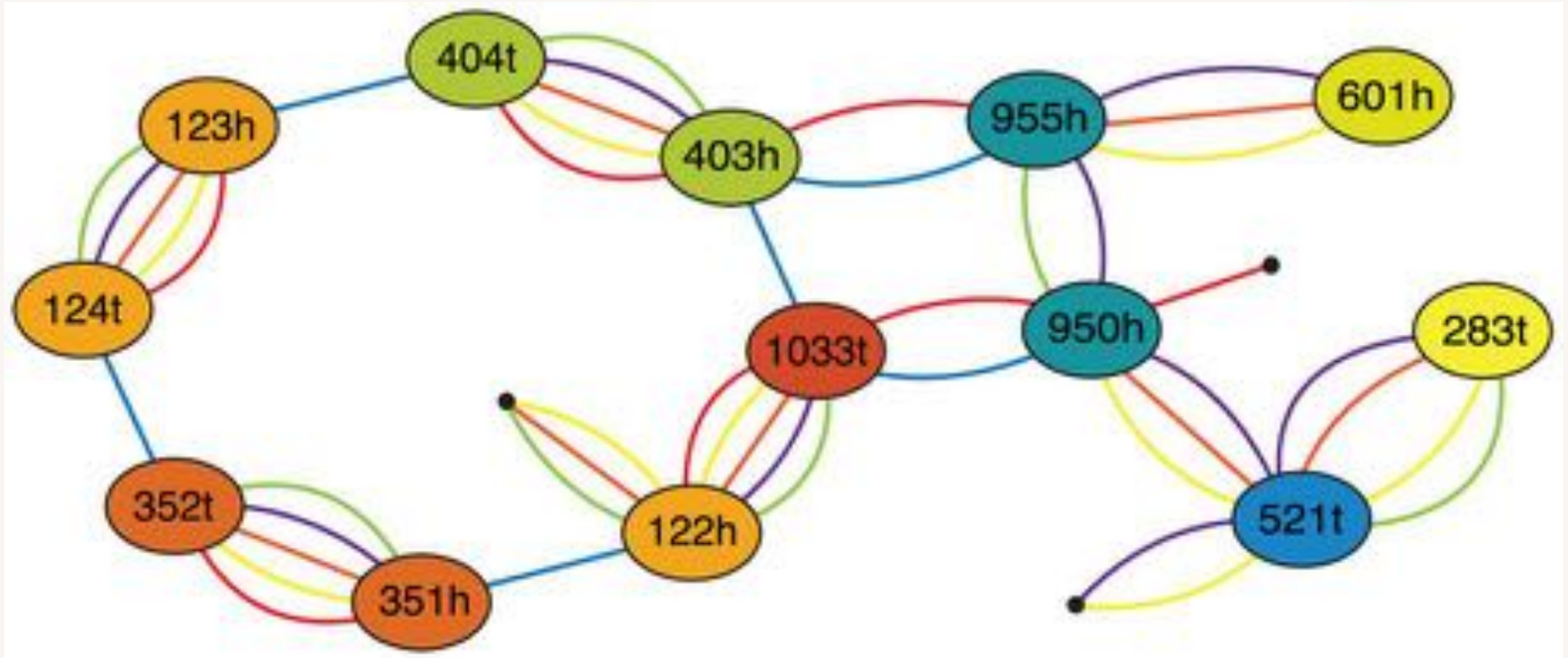
use shapes to better highlight salience

select semantically resonant colors

consider background colors and how this affects final appearance

Figure Design

Avoid overstimulation

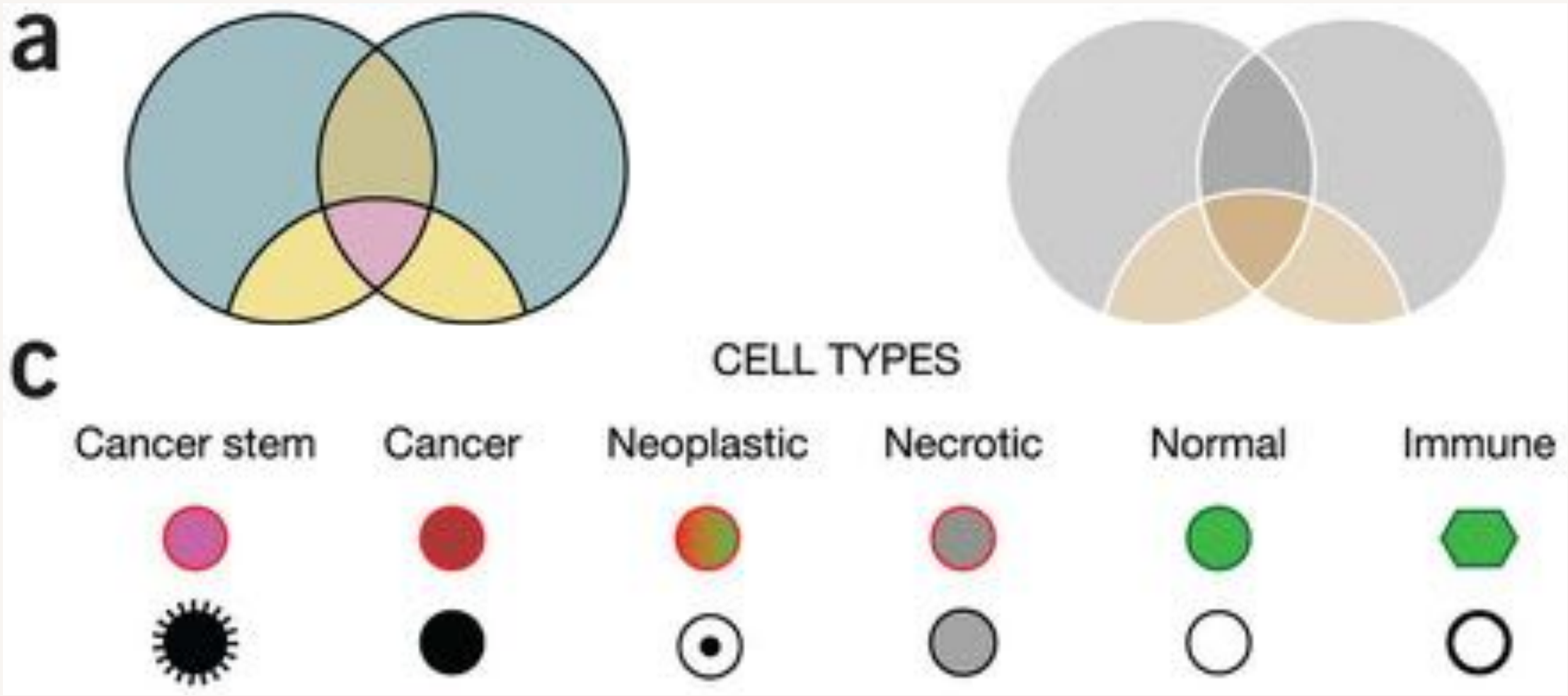


info reduction = greater emphasis on what is shown

"less is more"

Figure Design

Appeal to intuition



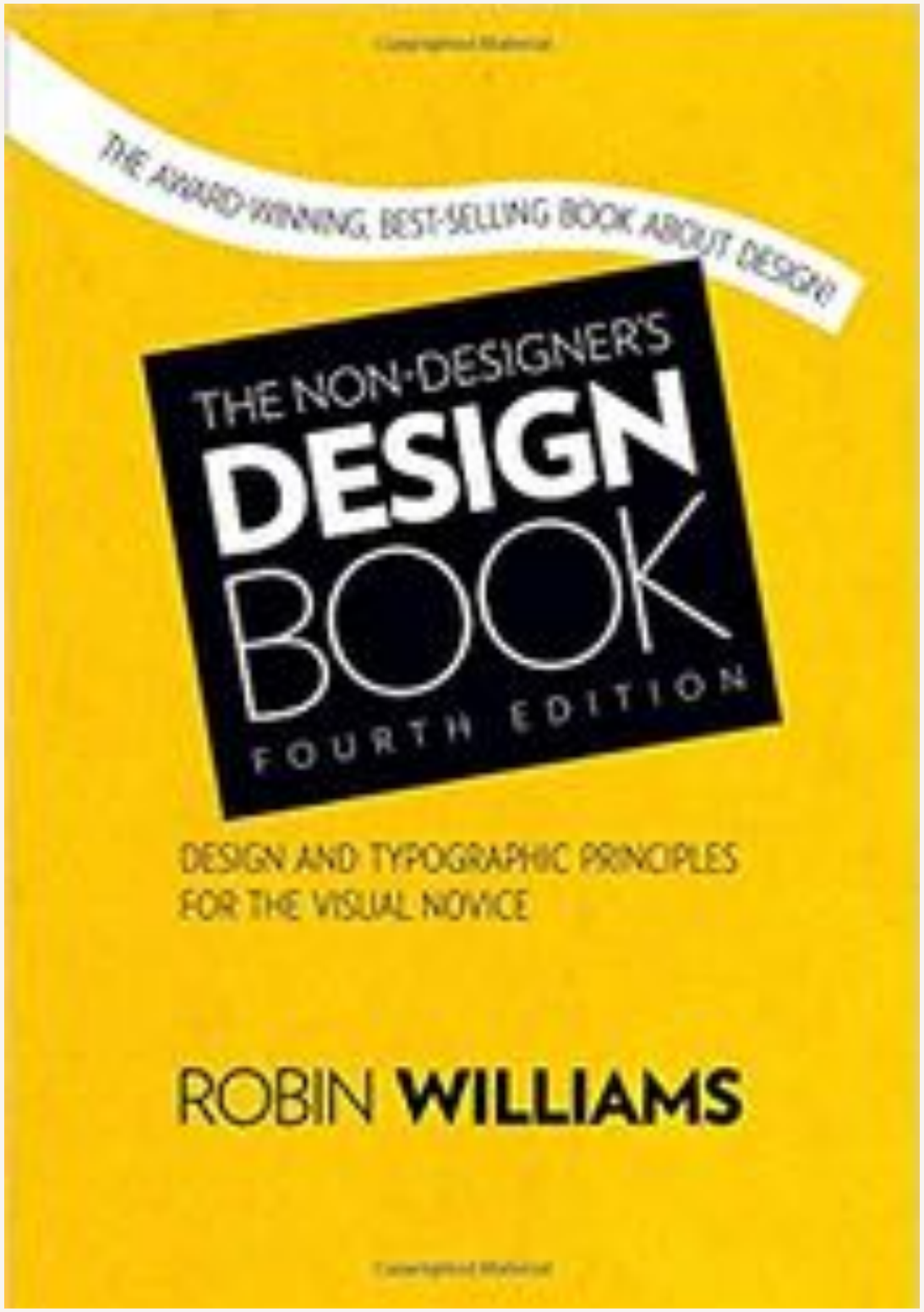
Outline

Perception

Plotting

Slides

Four Principals of Design



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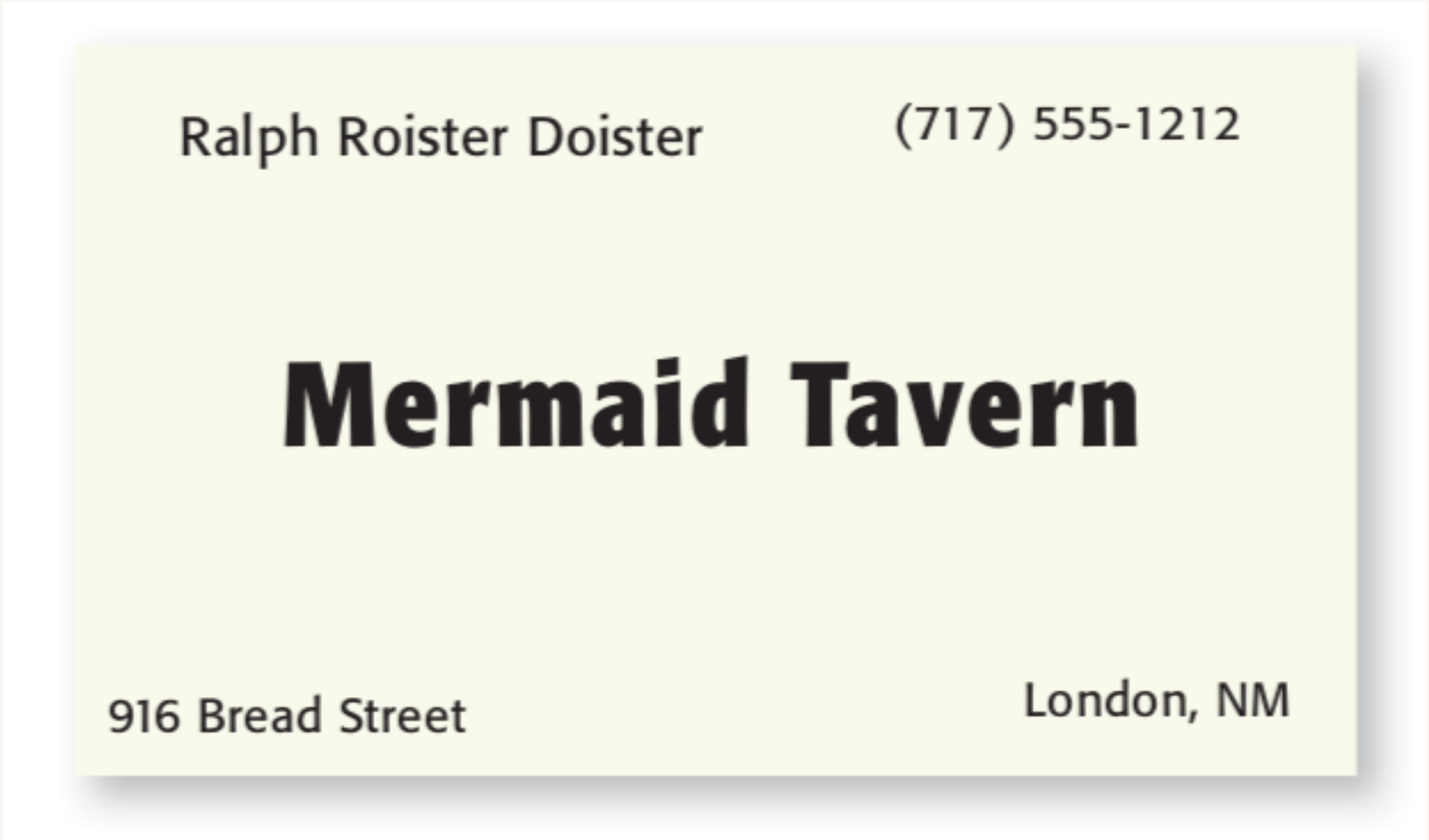
Proximity



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Proximity

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Alignment

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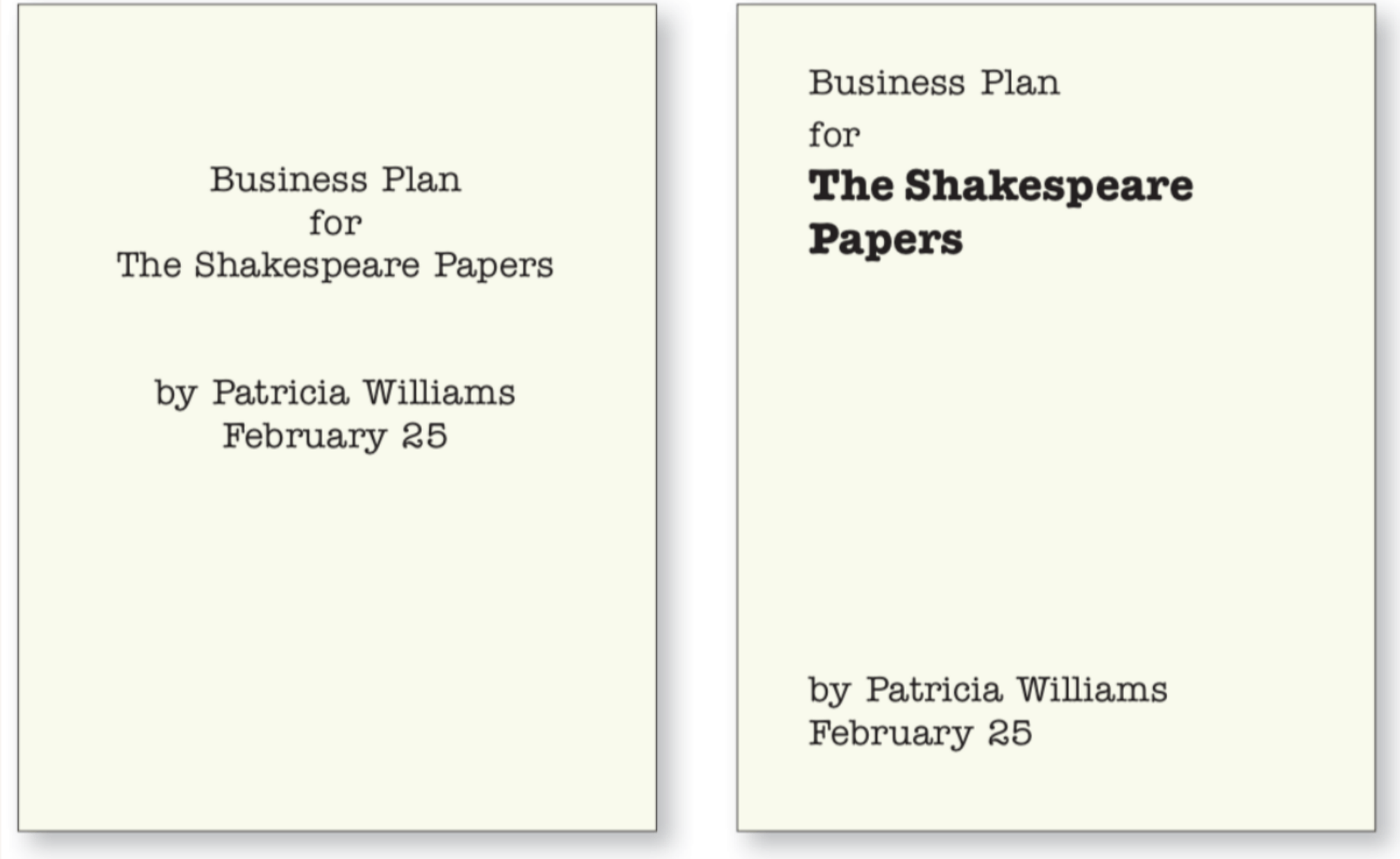
Alignment



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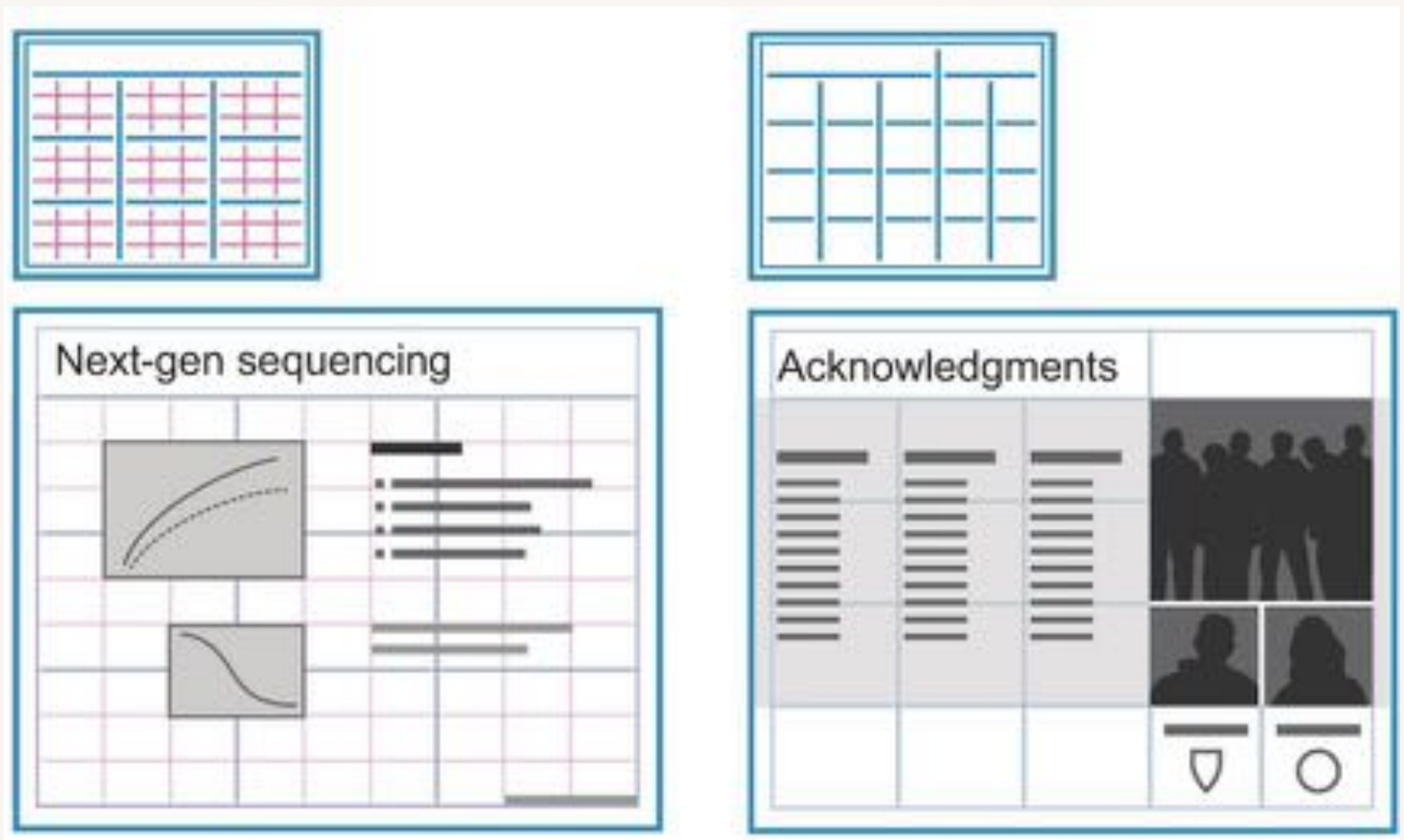
Alignment



Wong, Nature Methods, 2010

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Repetition

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Contrast

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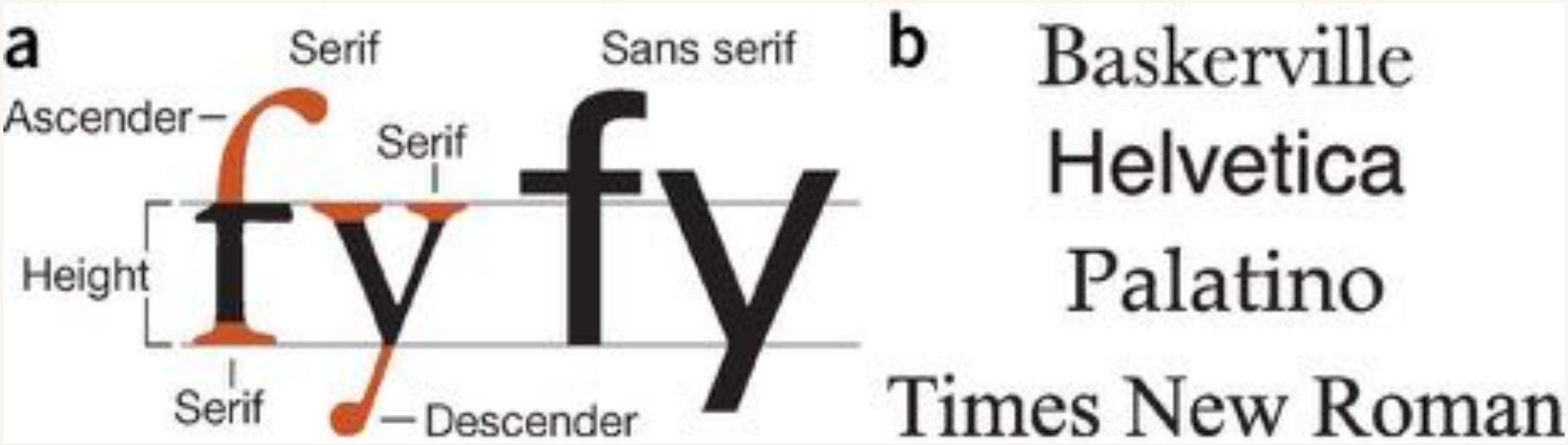
Contrast



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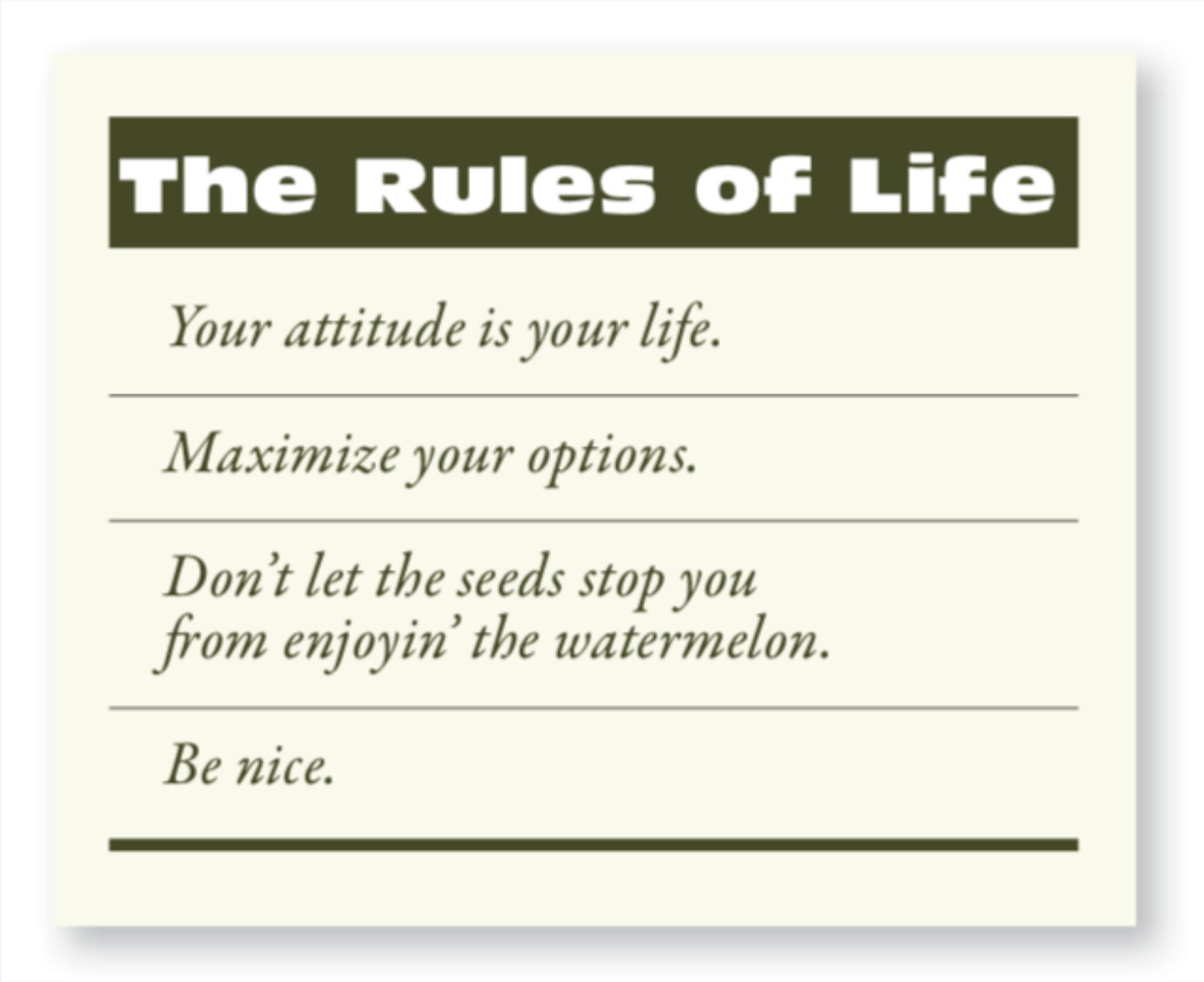
Contrast



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Adam A Miller
CIERA/Northwestern & Adler Planetarium
LSSTC DSFP Session 9
11 June 2019