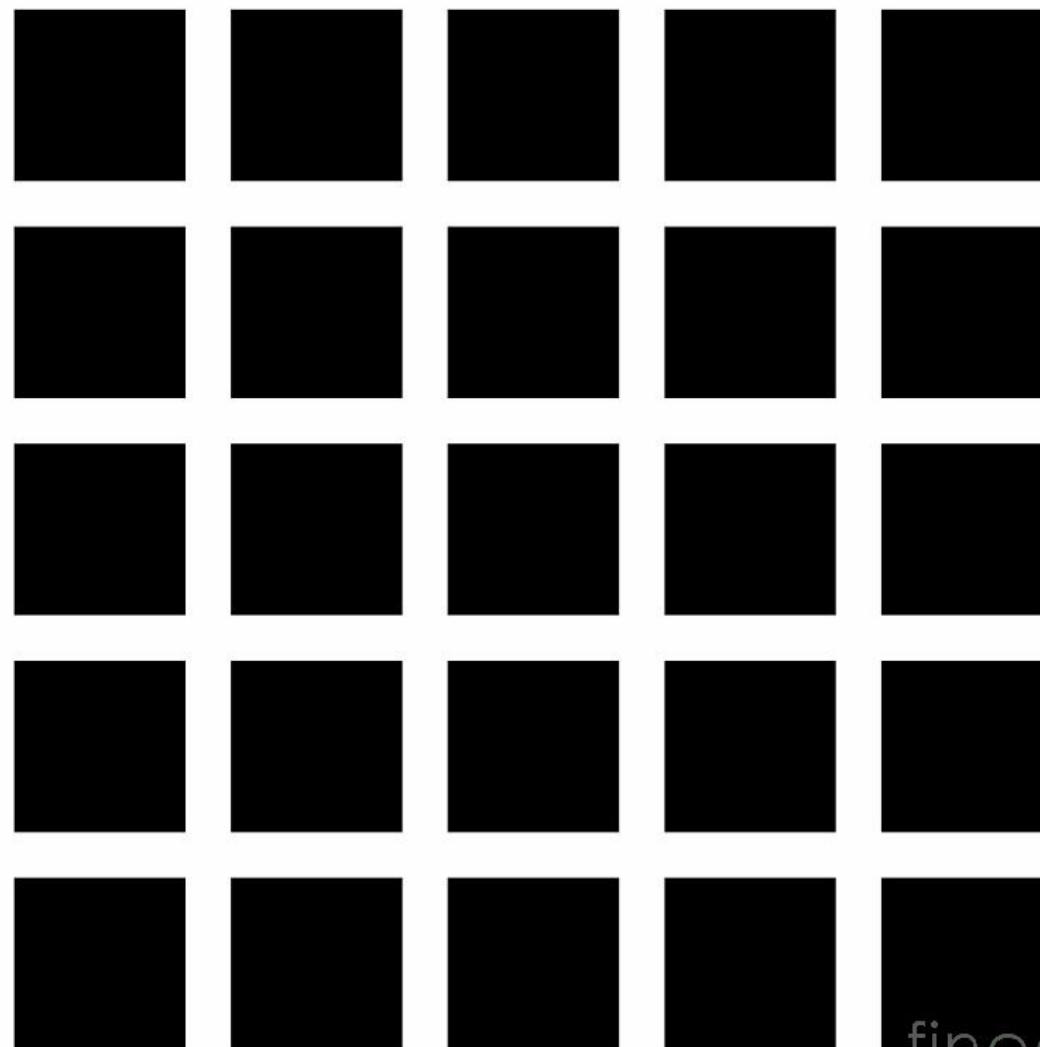
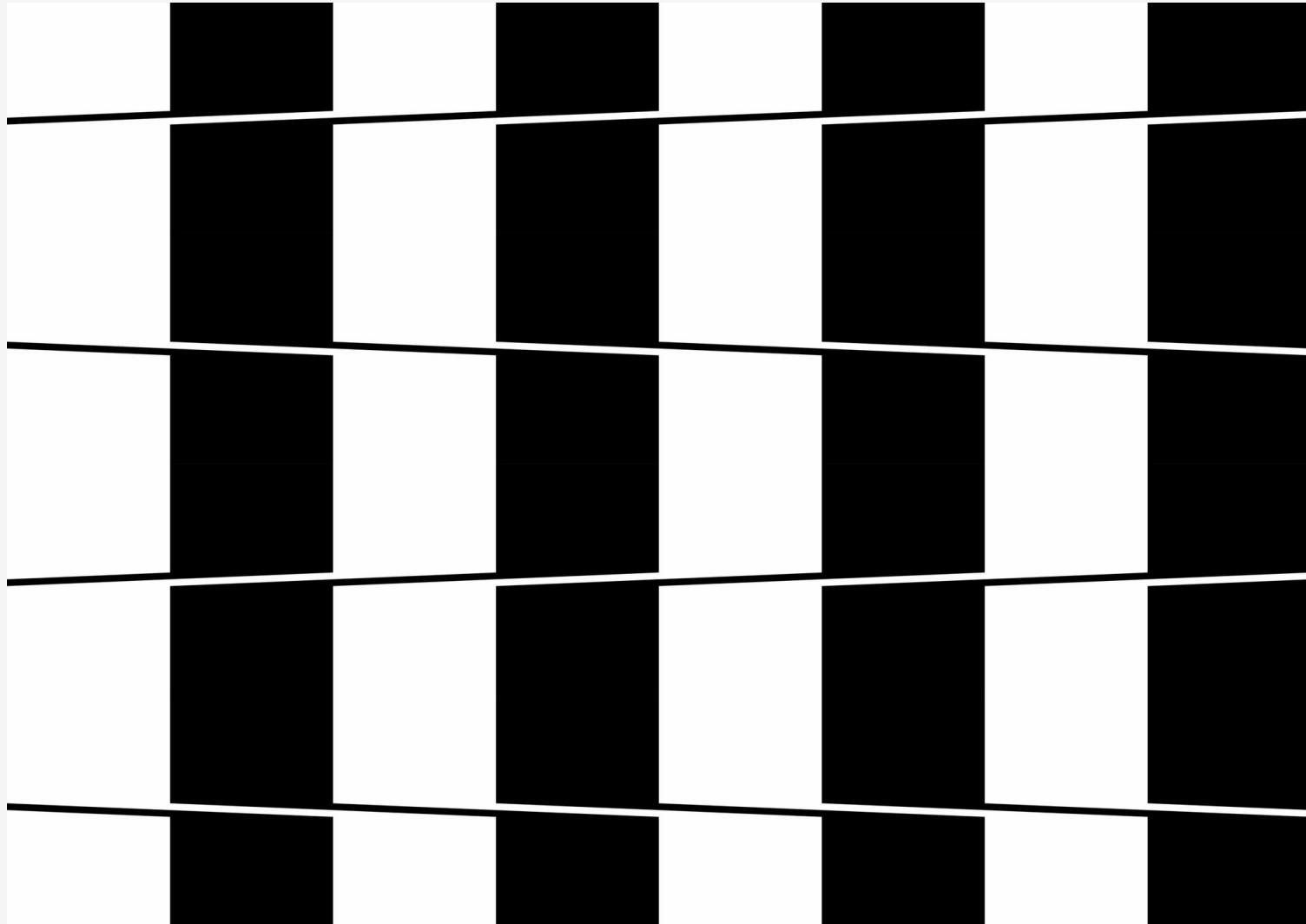


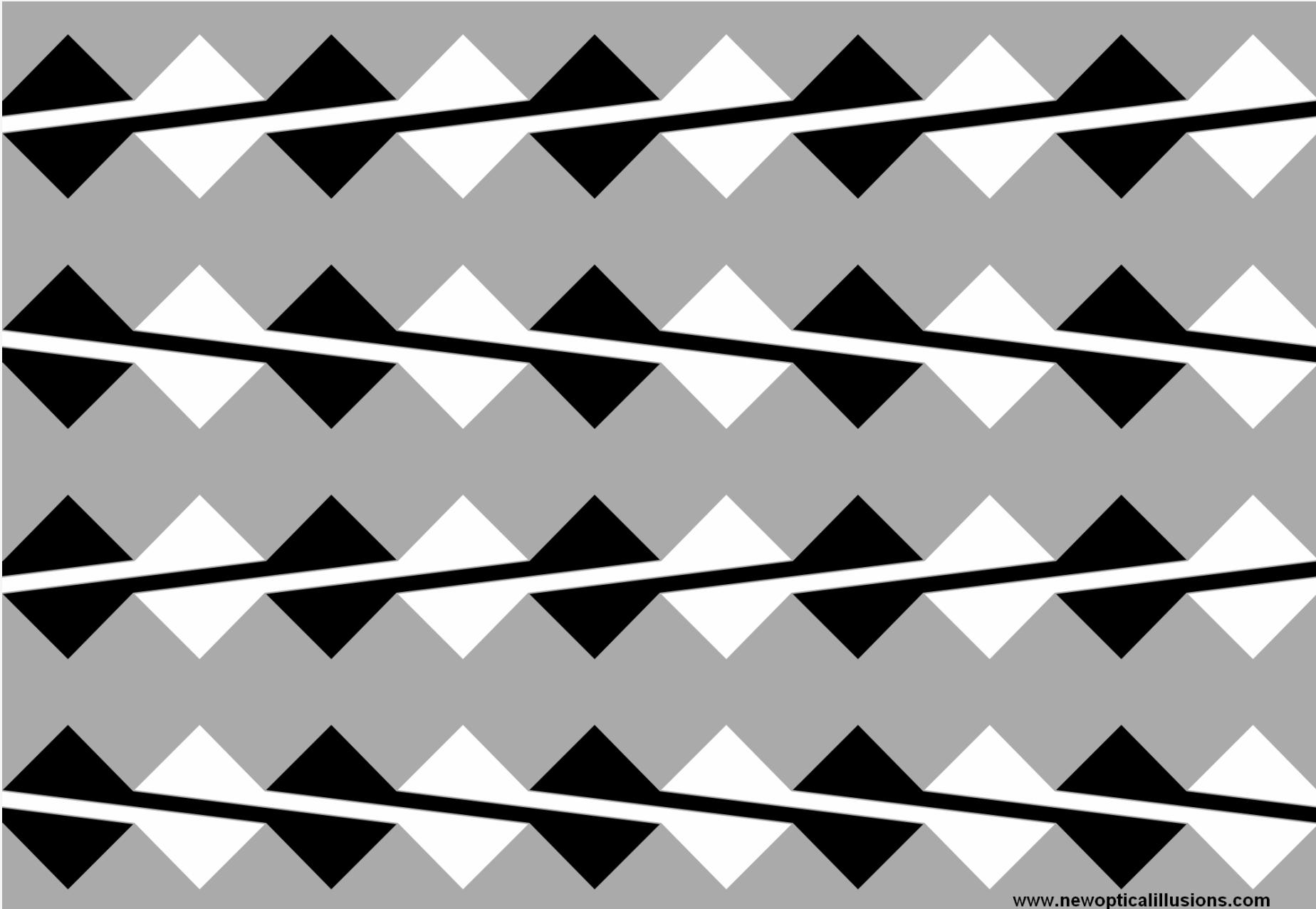
# **Perception: Seeing and Not Seeing**

# Edges & Contrasts



fine  
© 2010

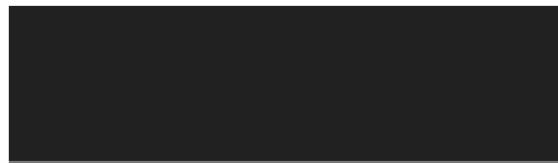




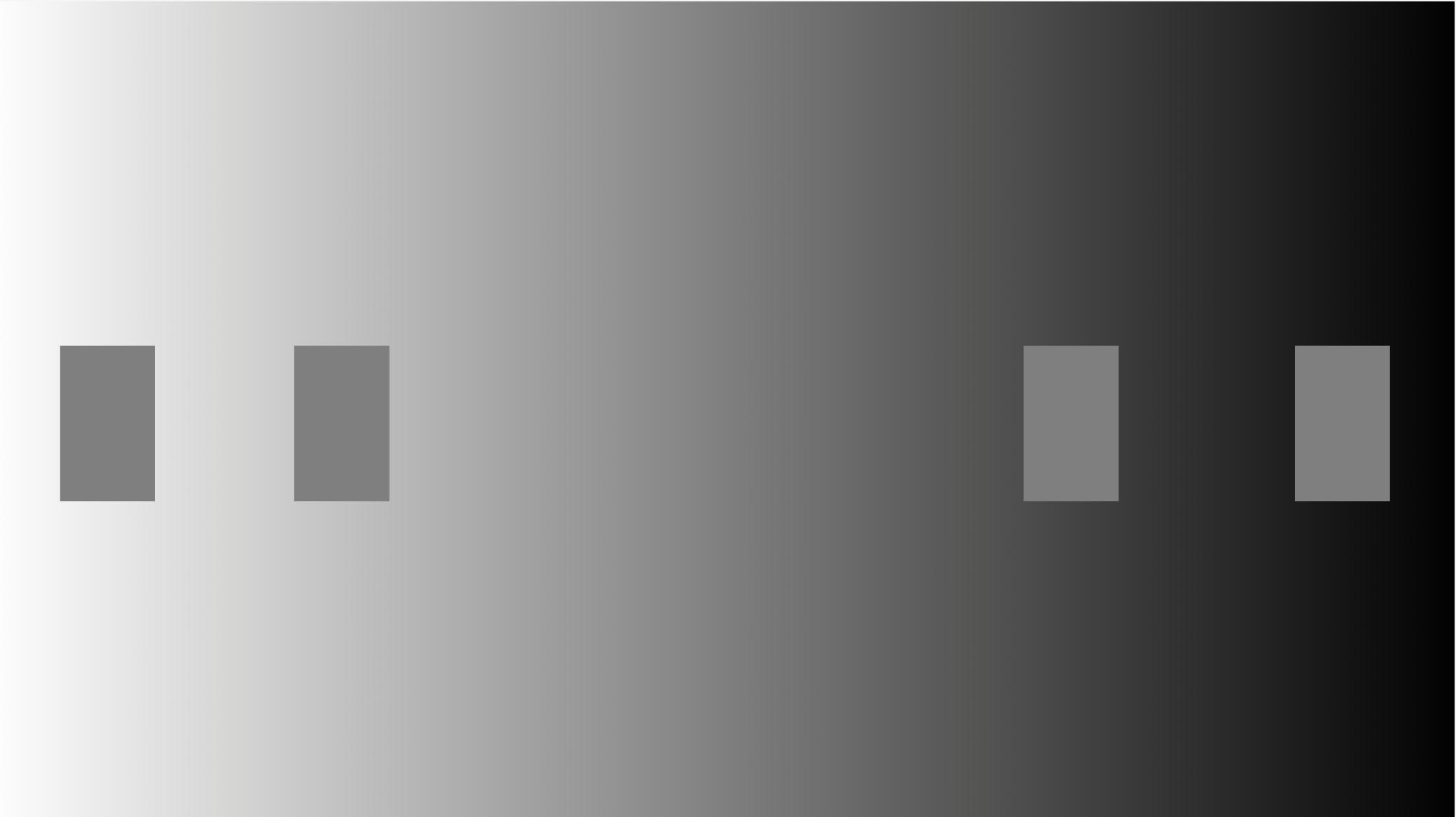


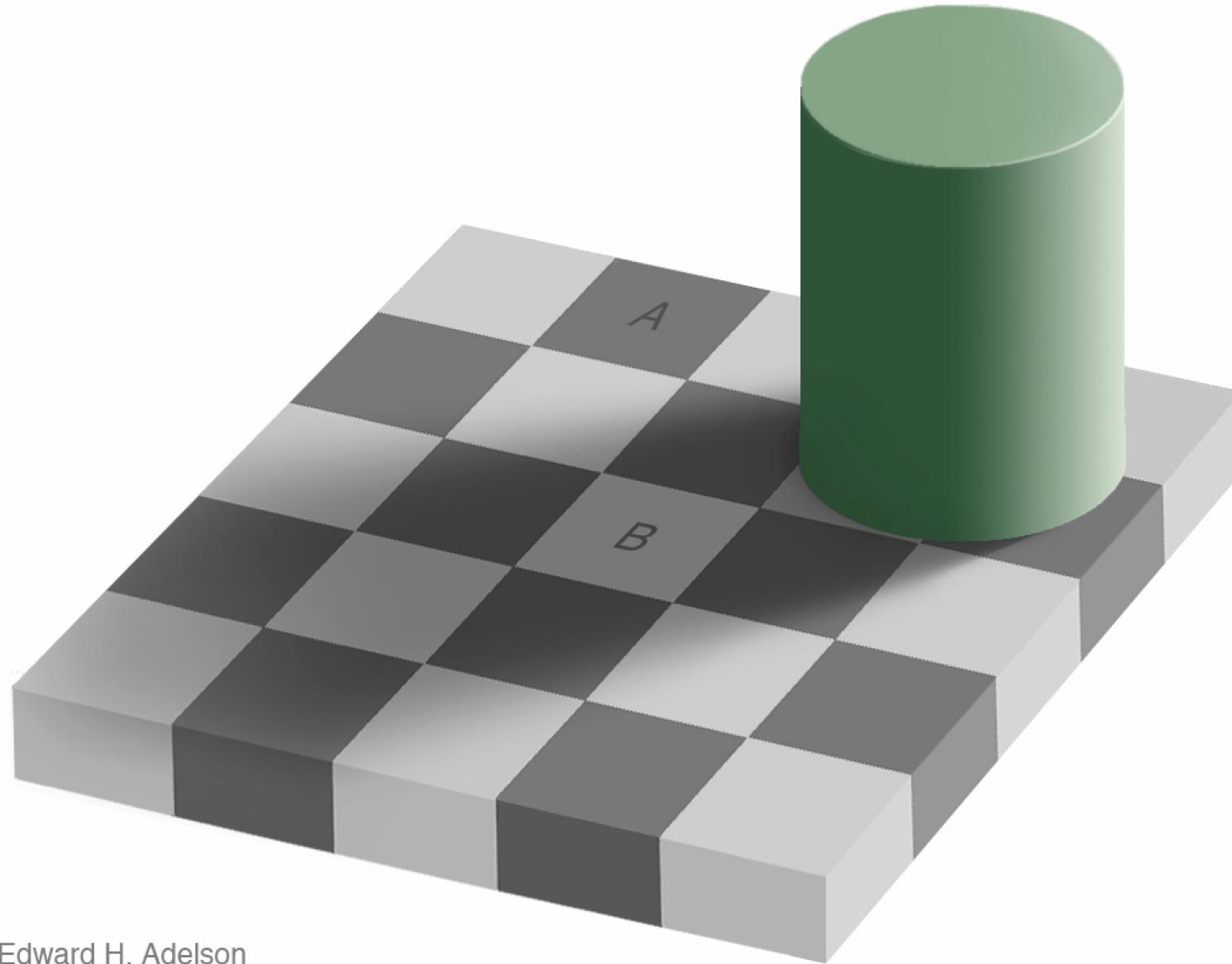
These are two perfectly  
geometrical circles



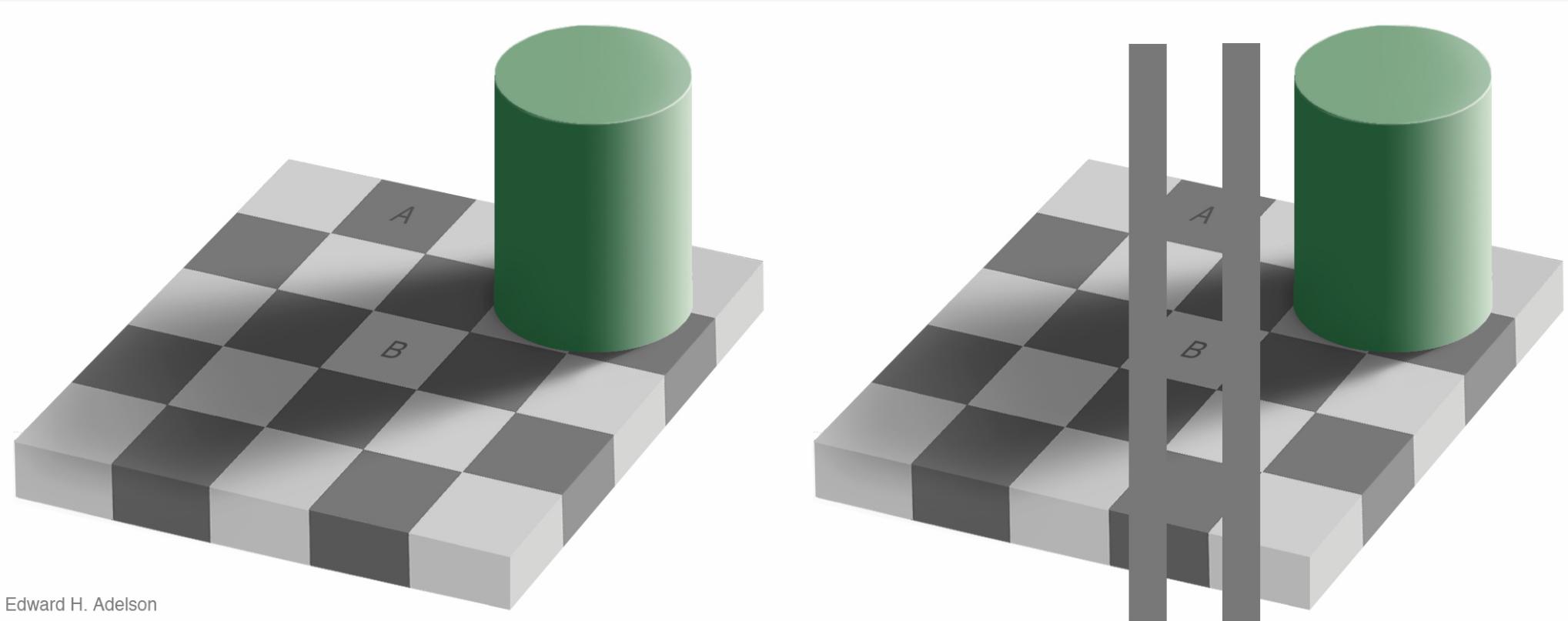








Edward H. Adelson

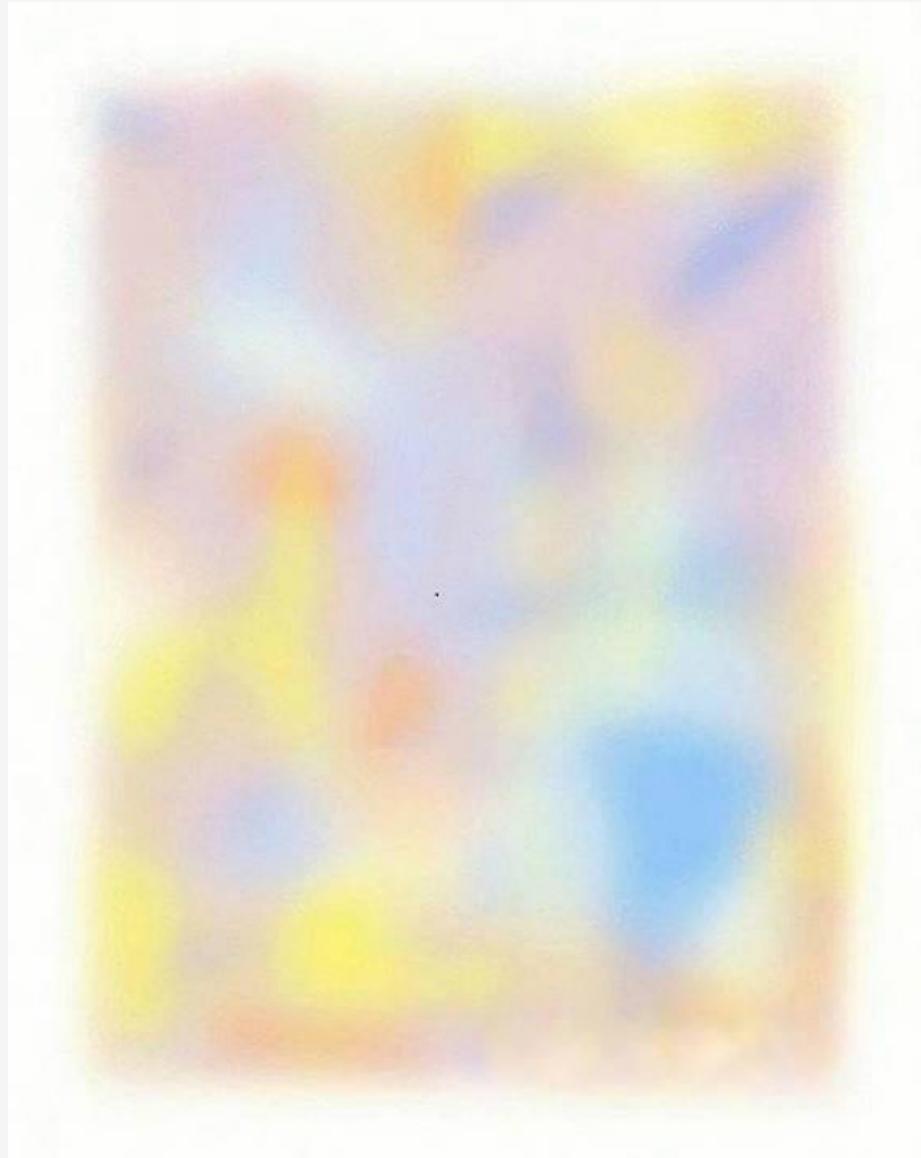


Edward Adelson

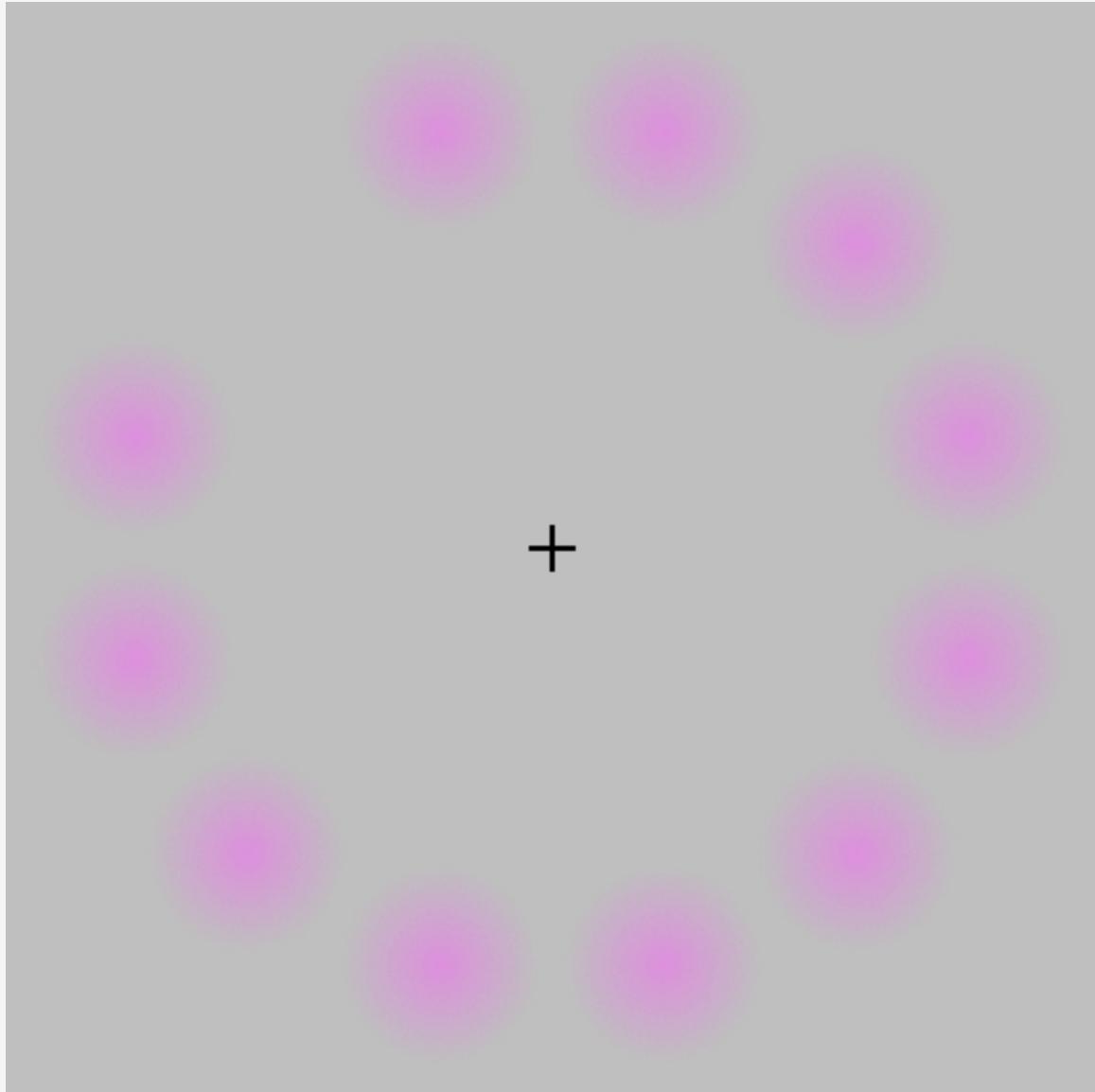


Edward Adelson

# Luminance and Color

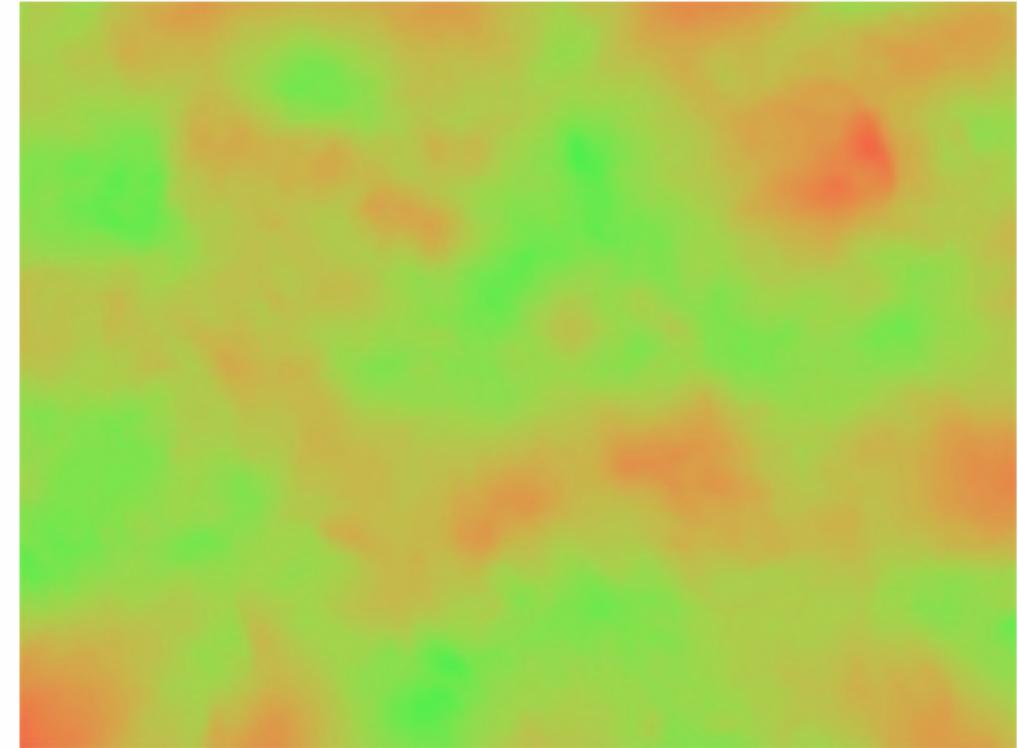


Troxler effect

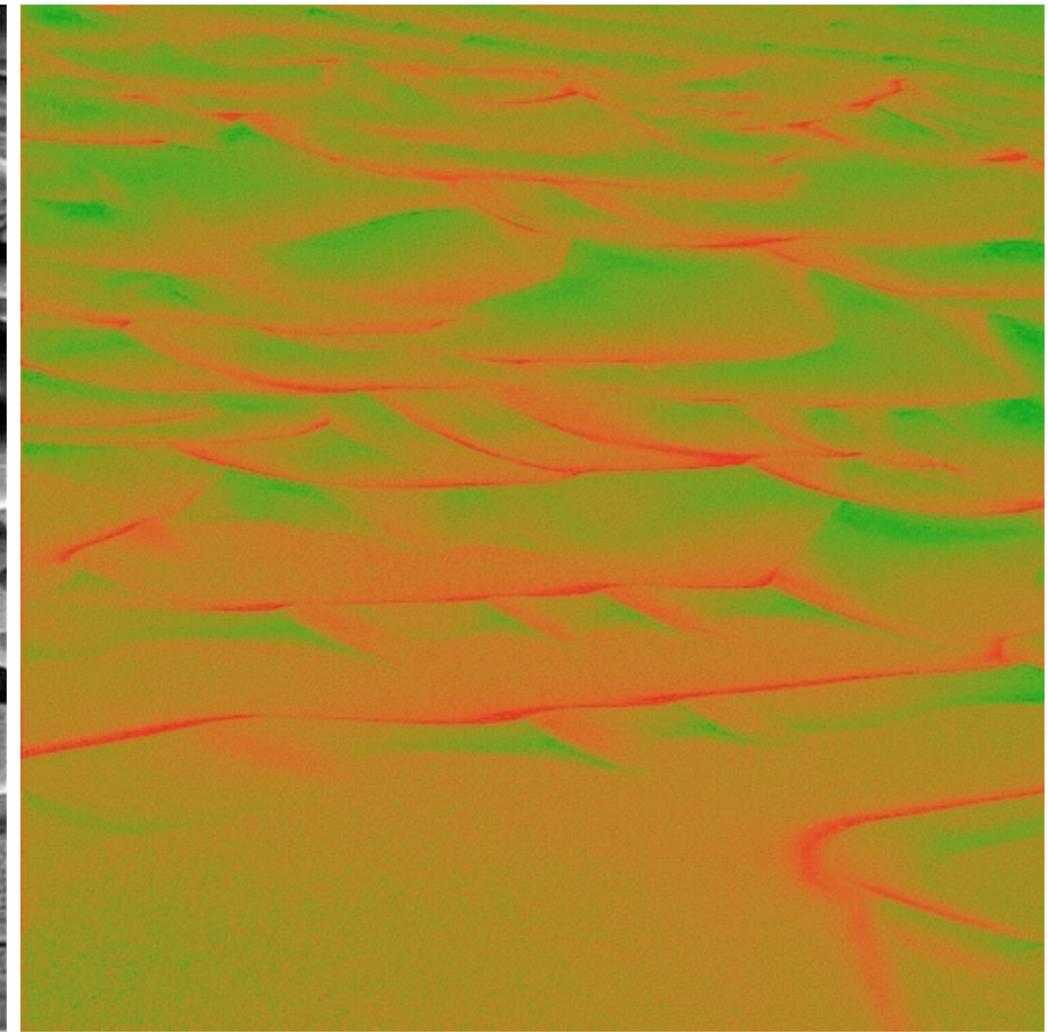
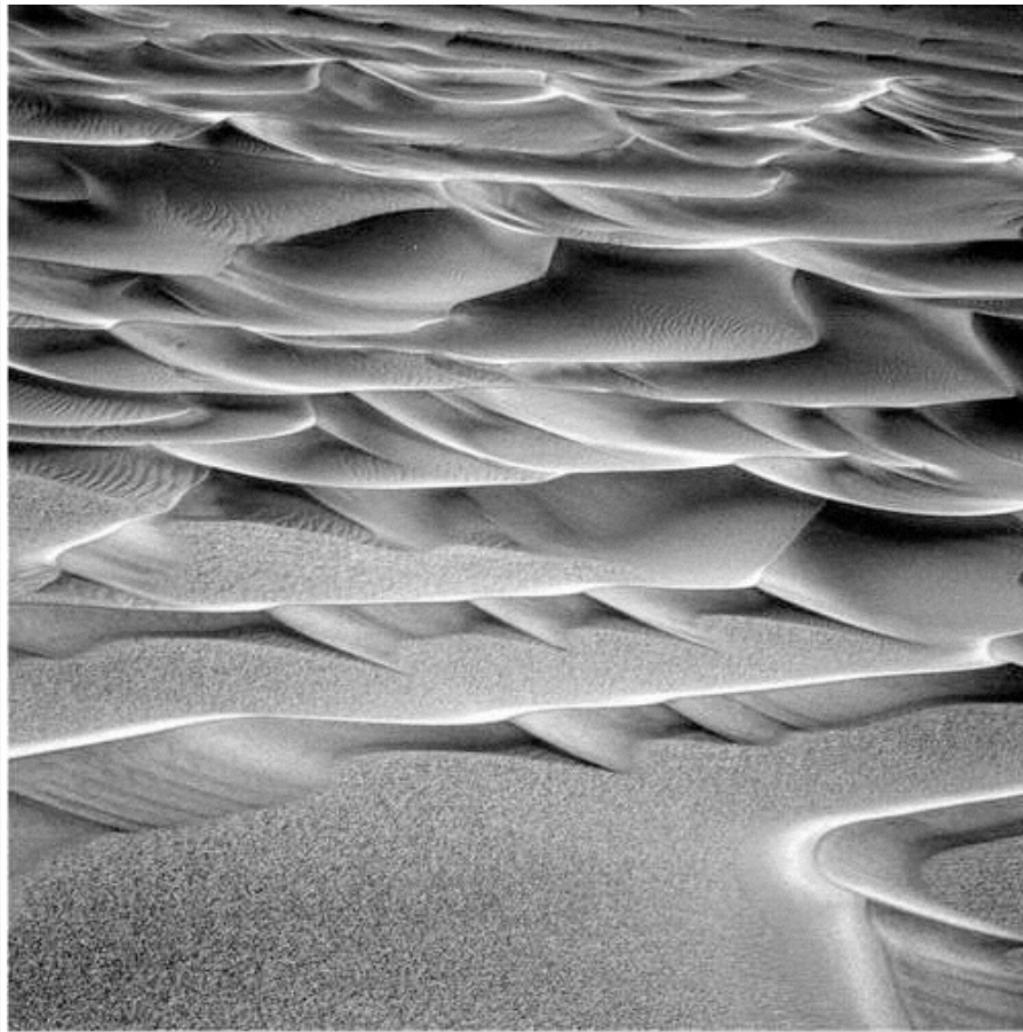


+

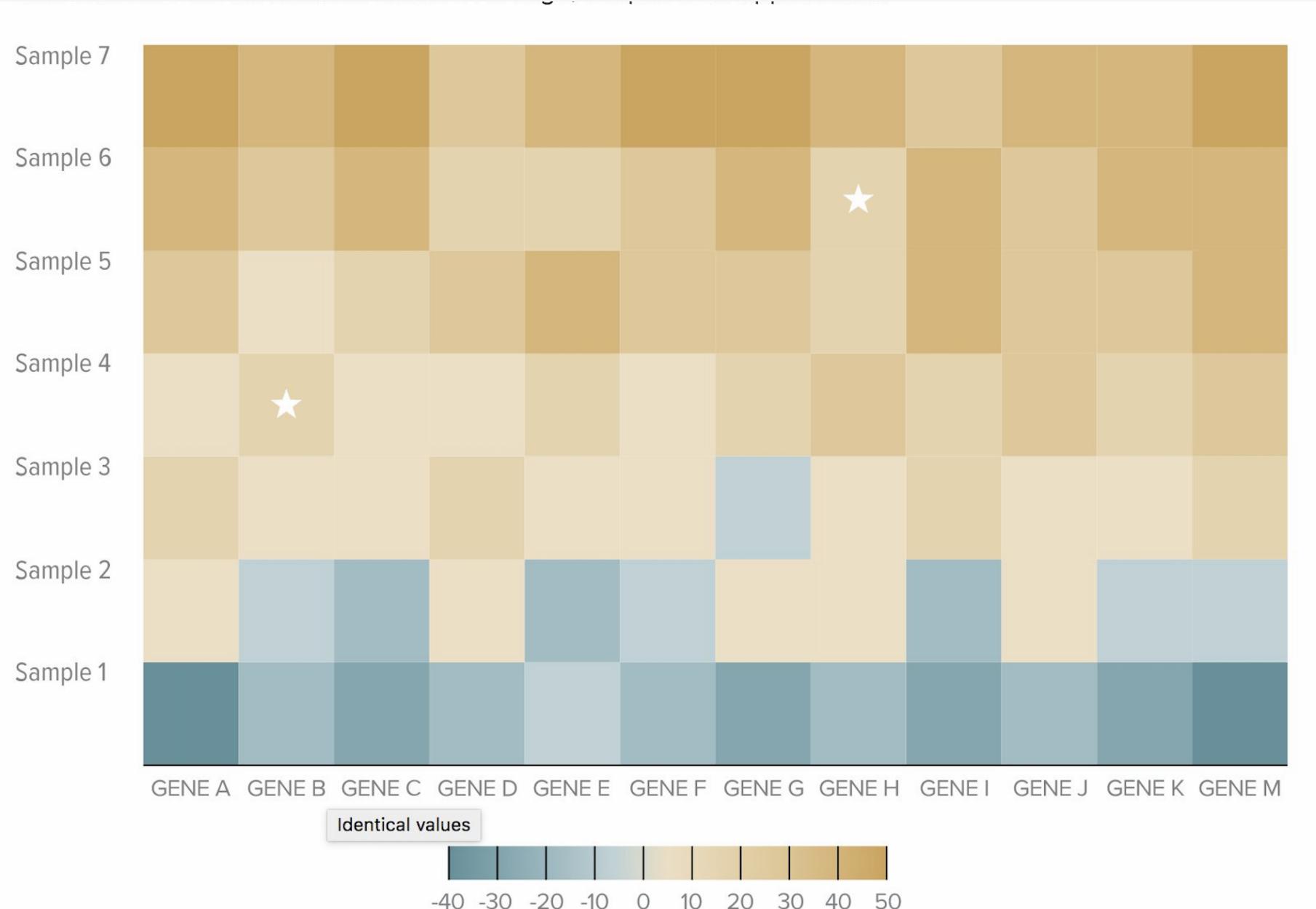
"Lilac Chaser"



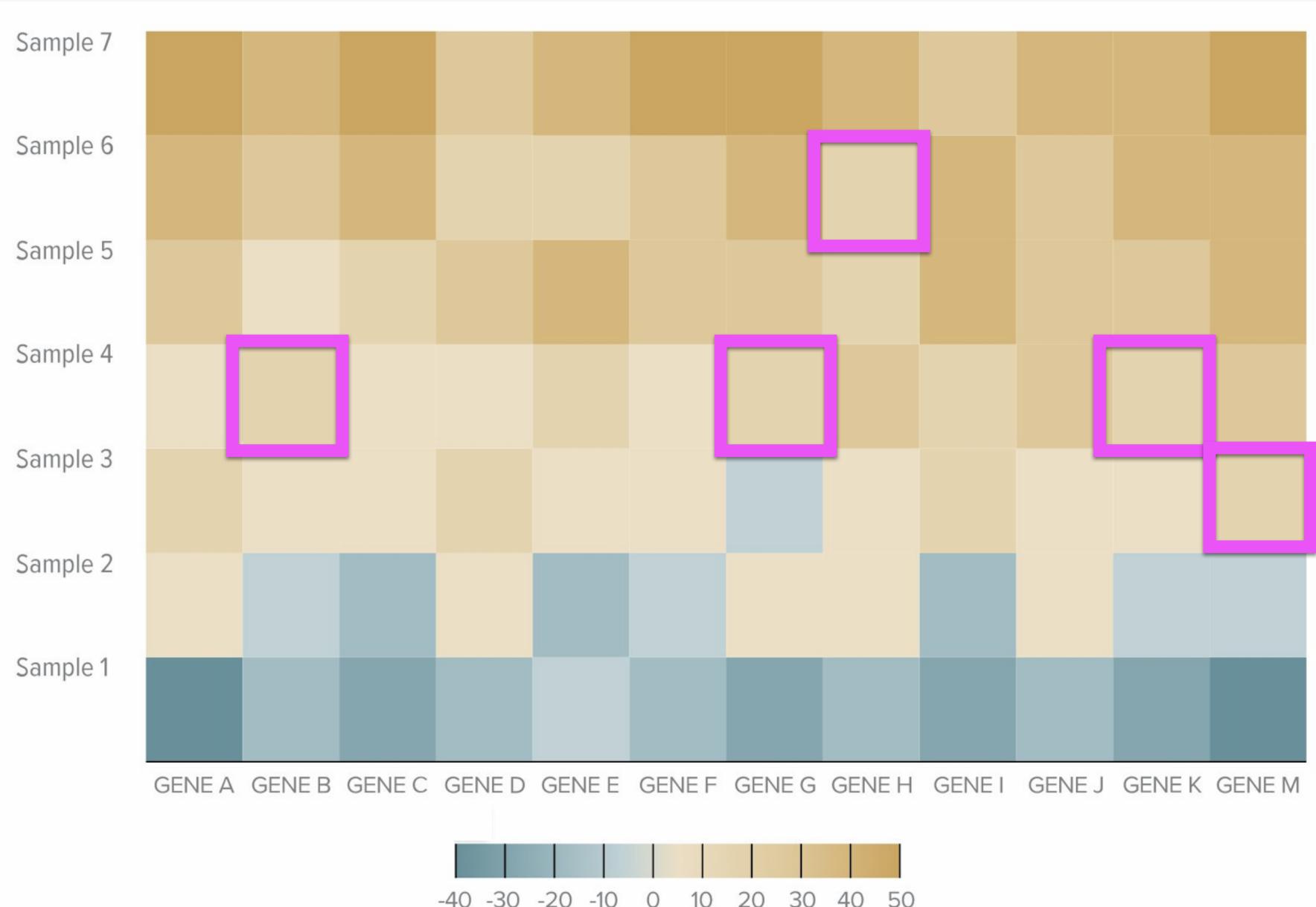
Colin Ware



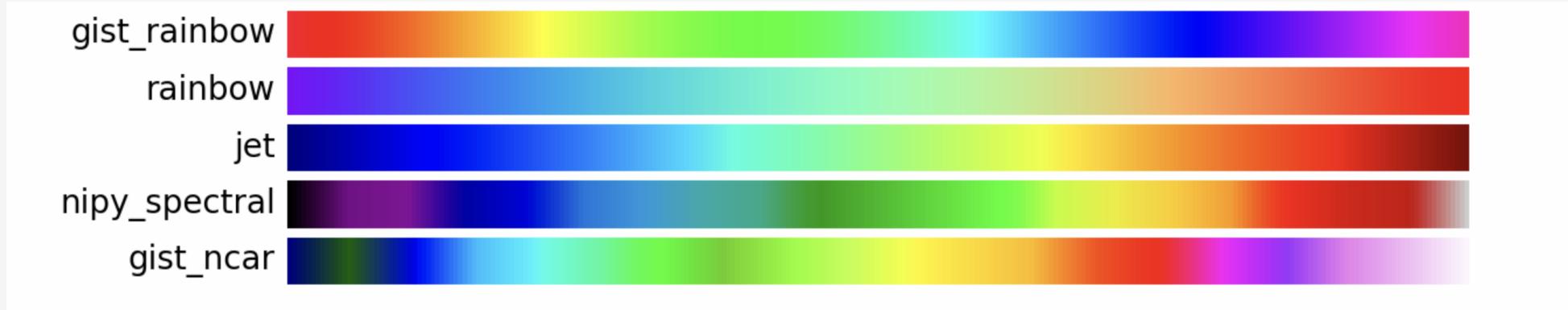
Colin Ware











## Perceptually Uniform Sequential colormaps

viridis



plasma



inferno

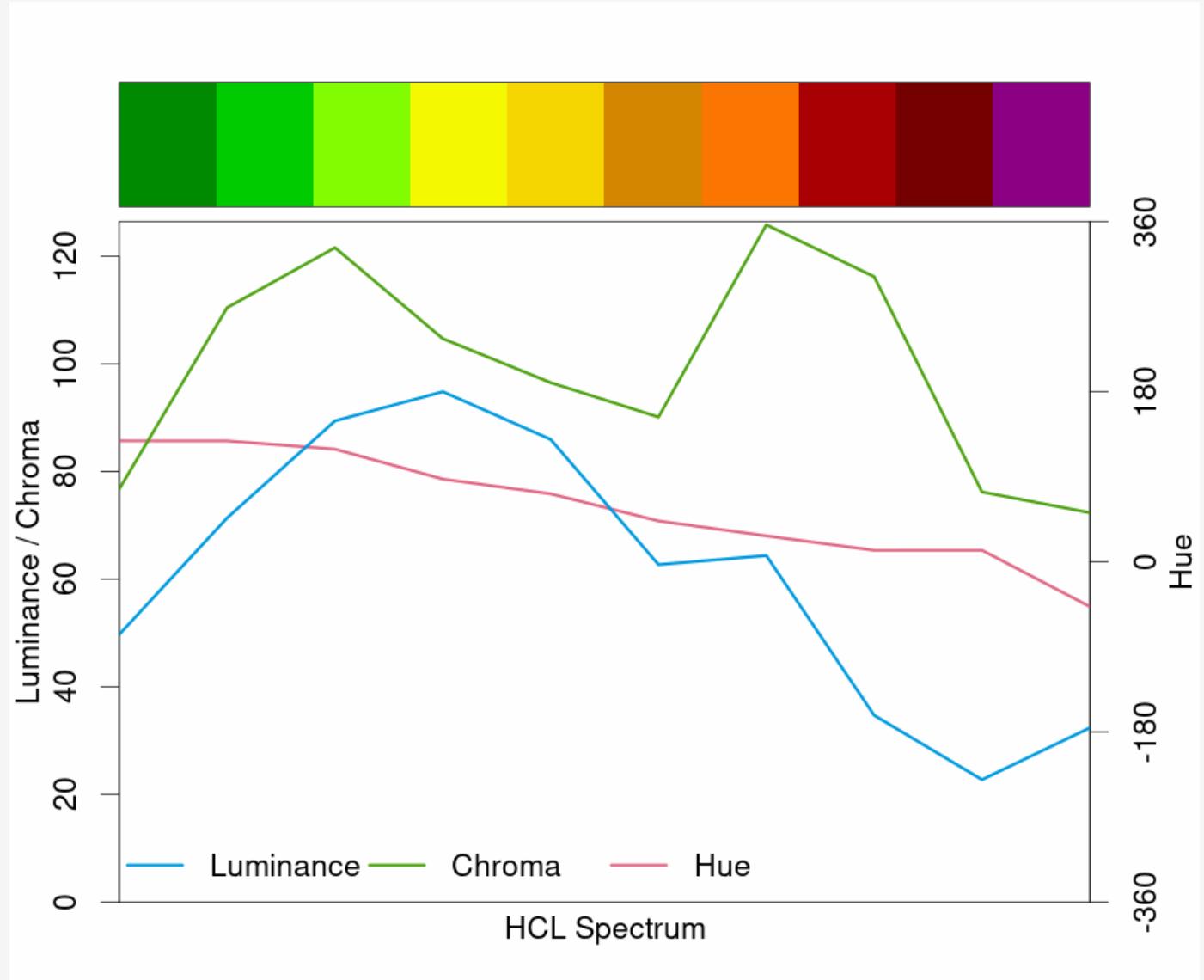


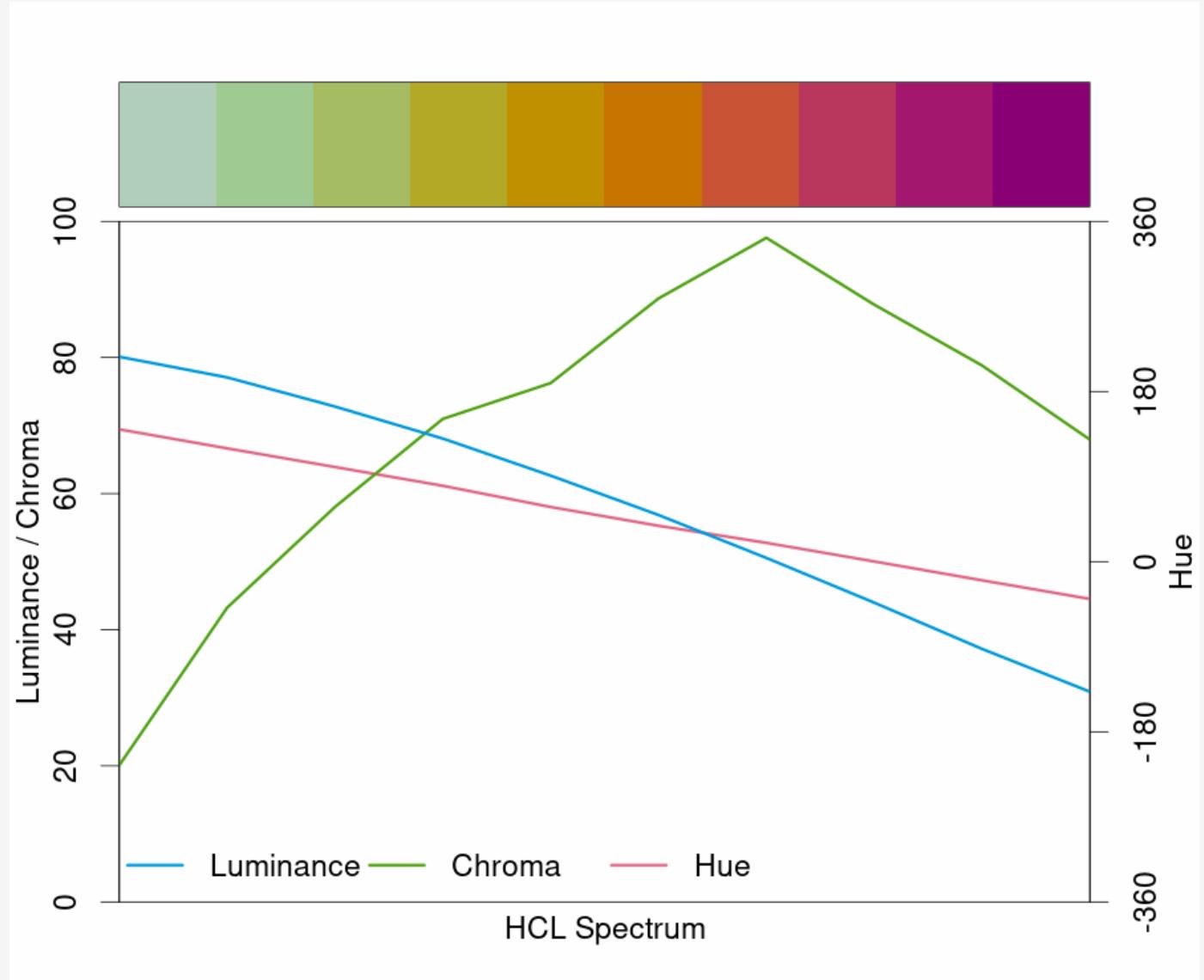
magma



cividis







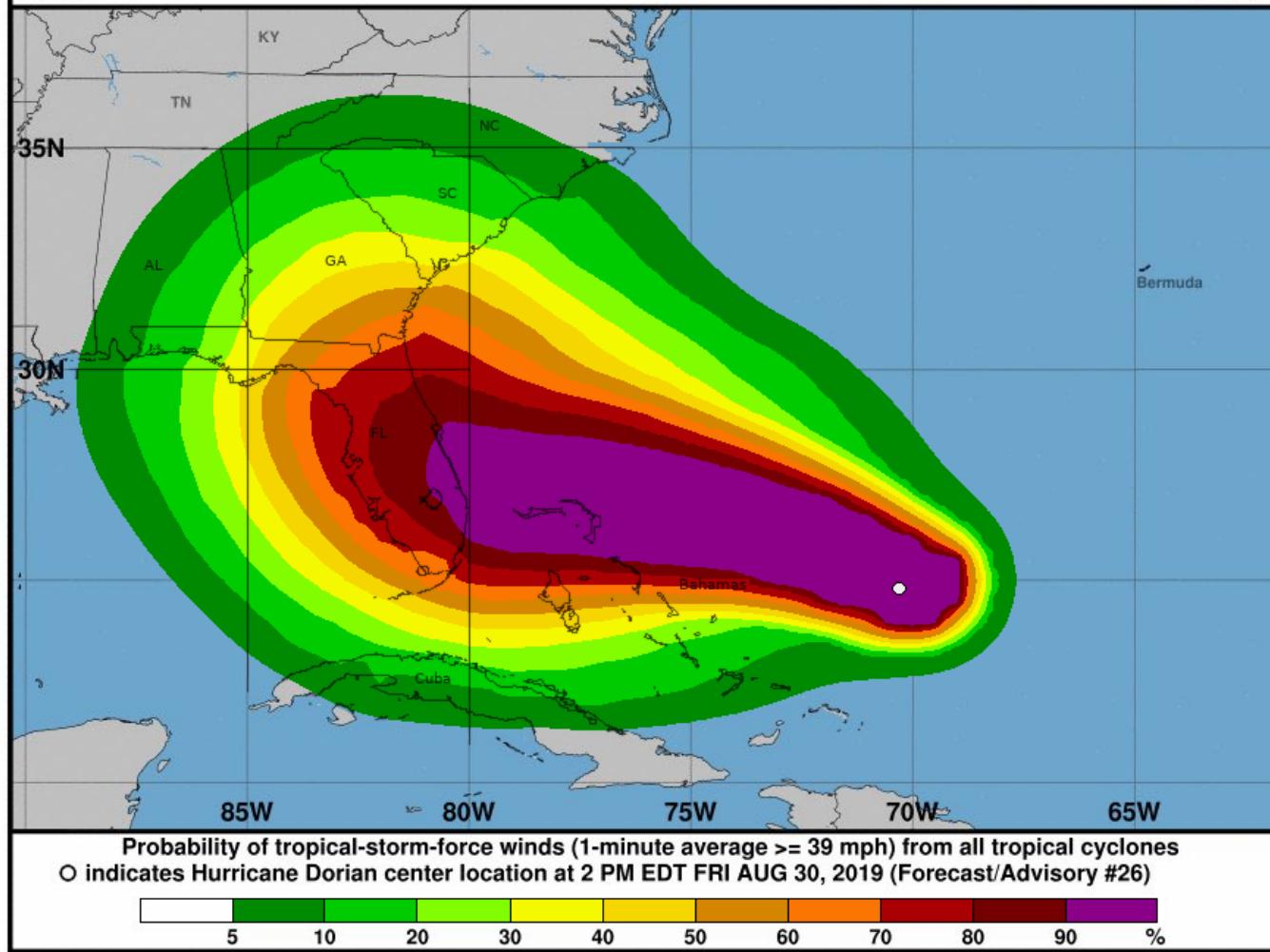


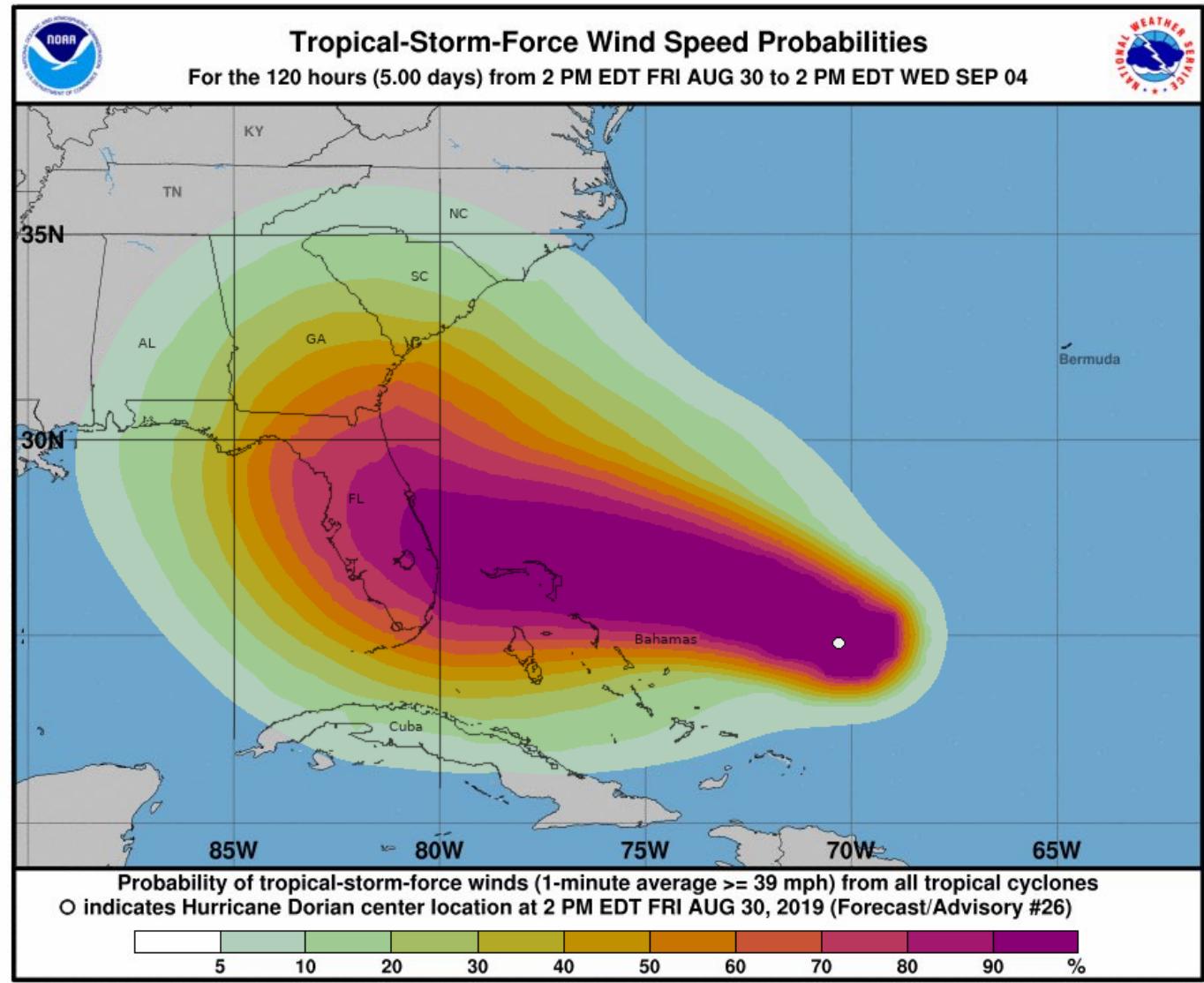


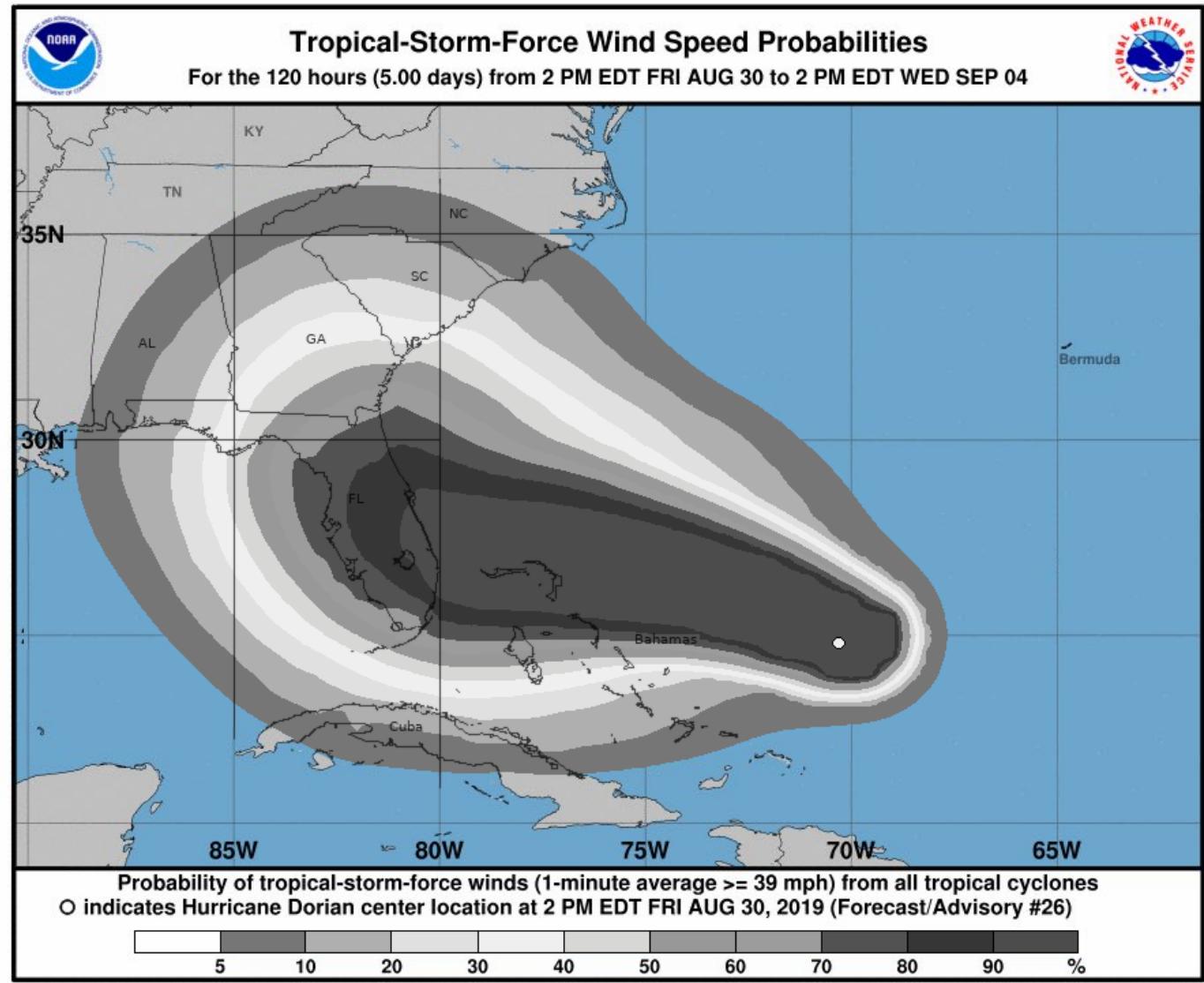


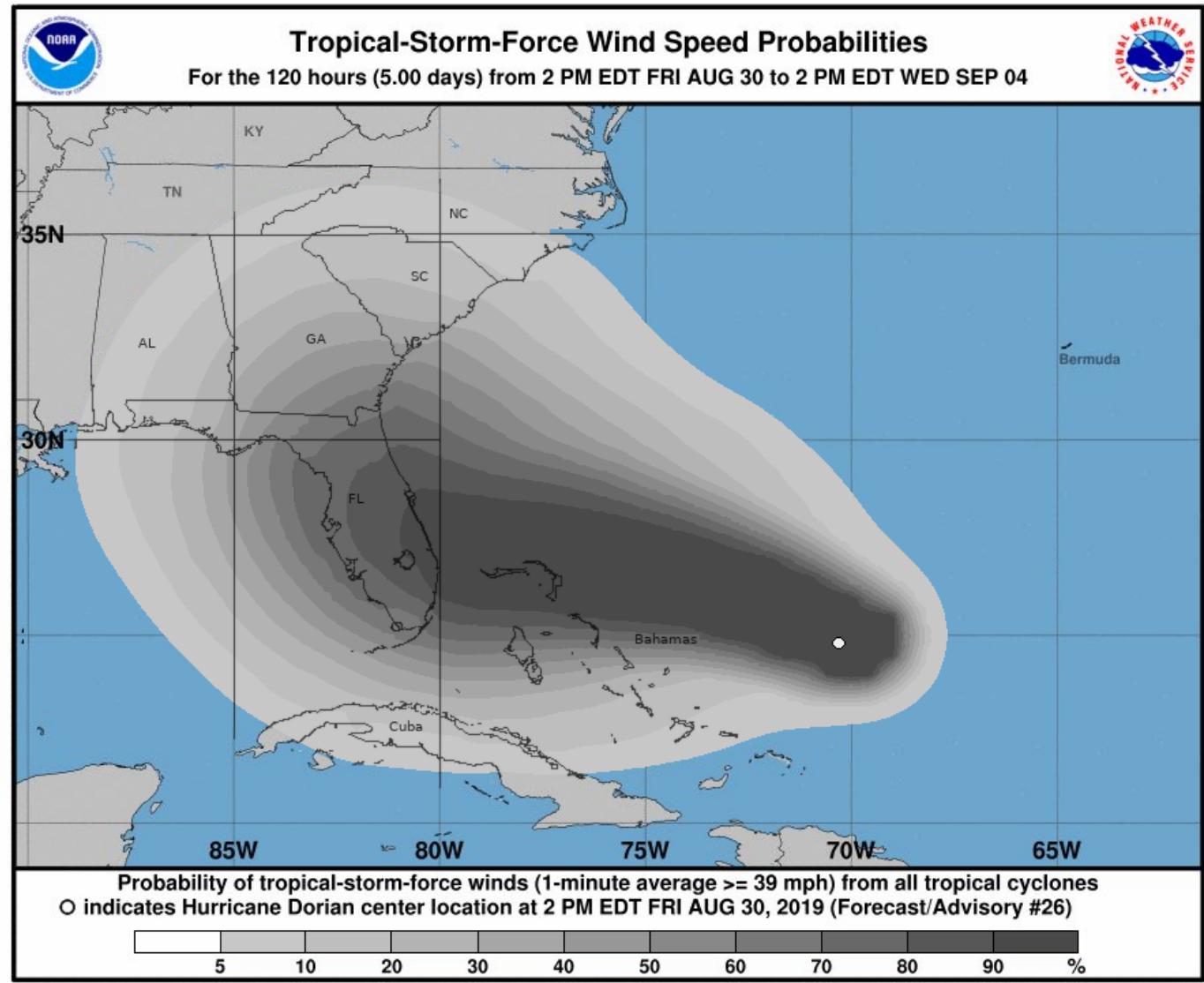
## Tropical-Storm-Force Wind Speed Probabilities

For the 120 hours (5.00 days) from 2 PM EDT FRI AUG 30 to 2 PM EDT WED SEP 04



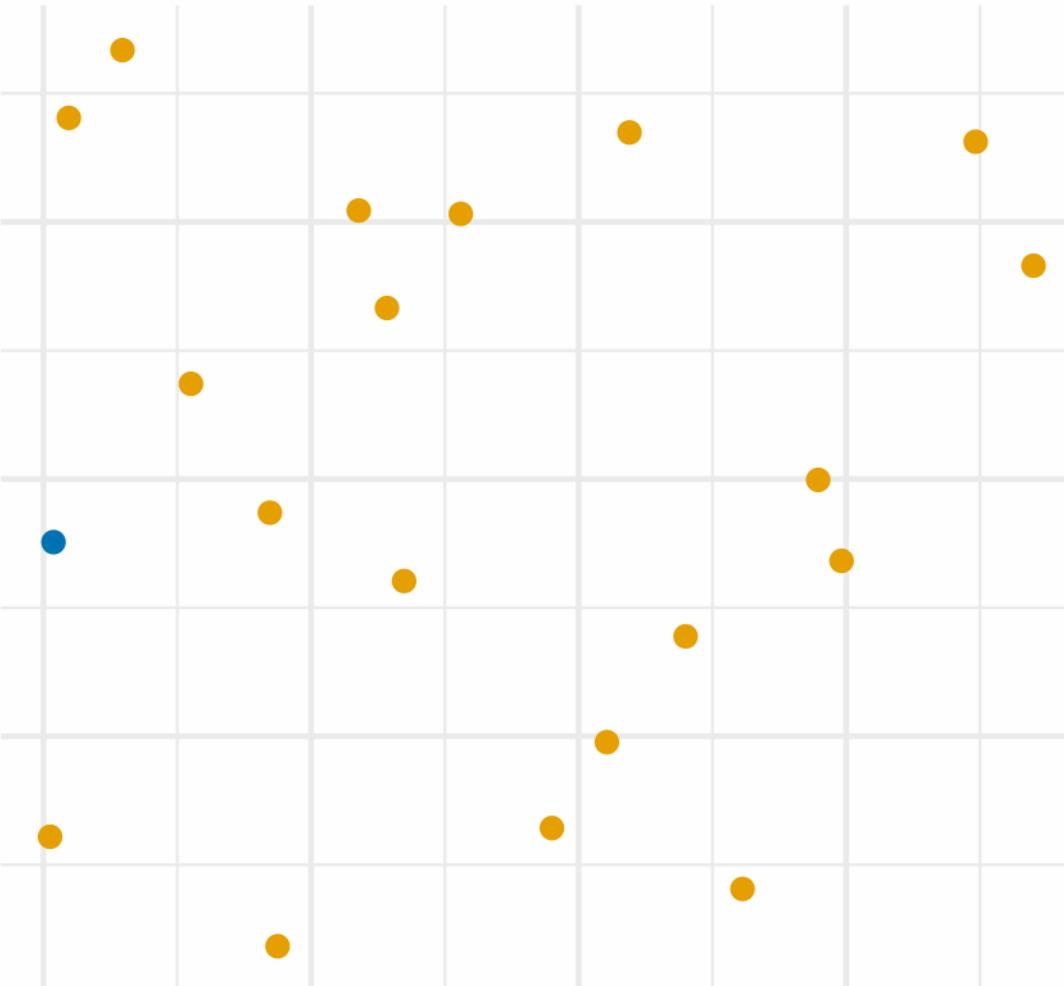




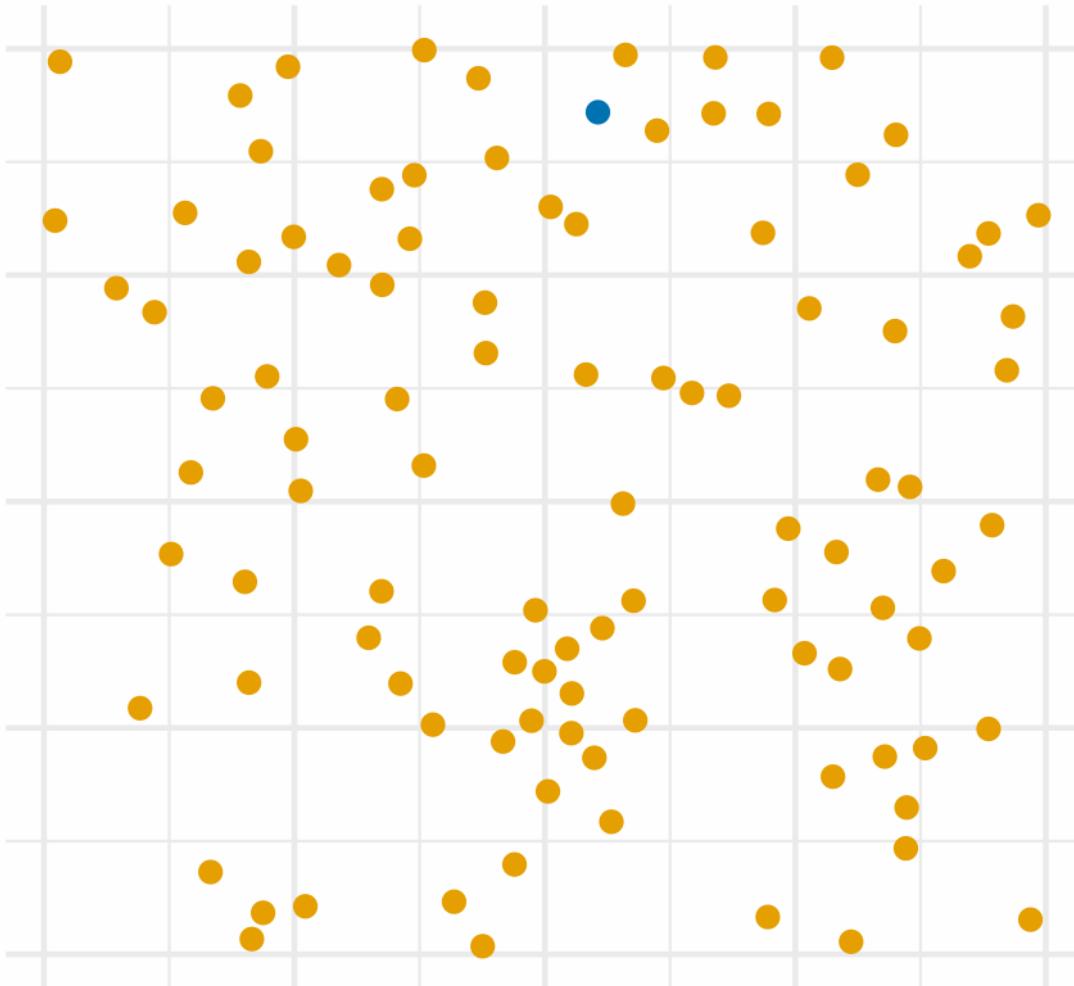


# Pre-Attentive Processing

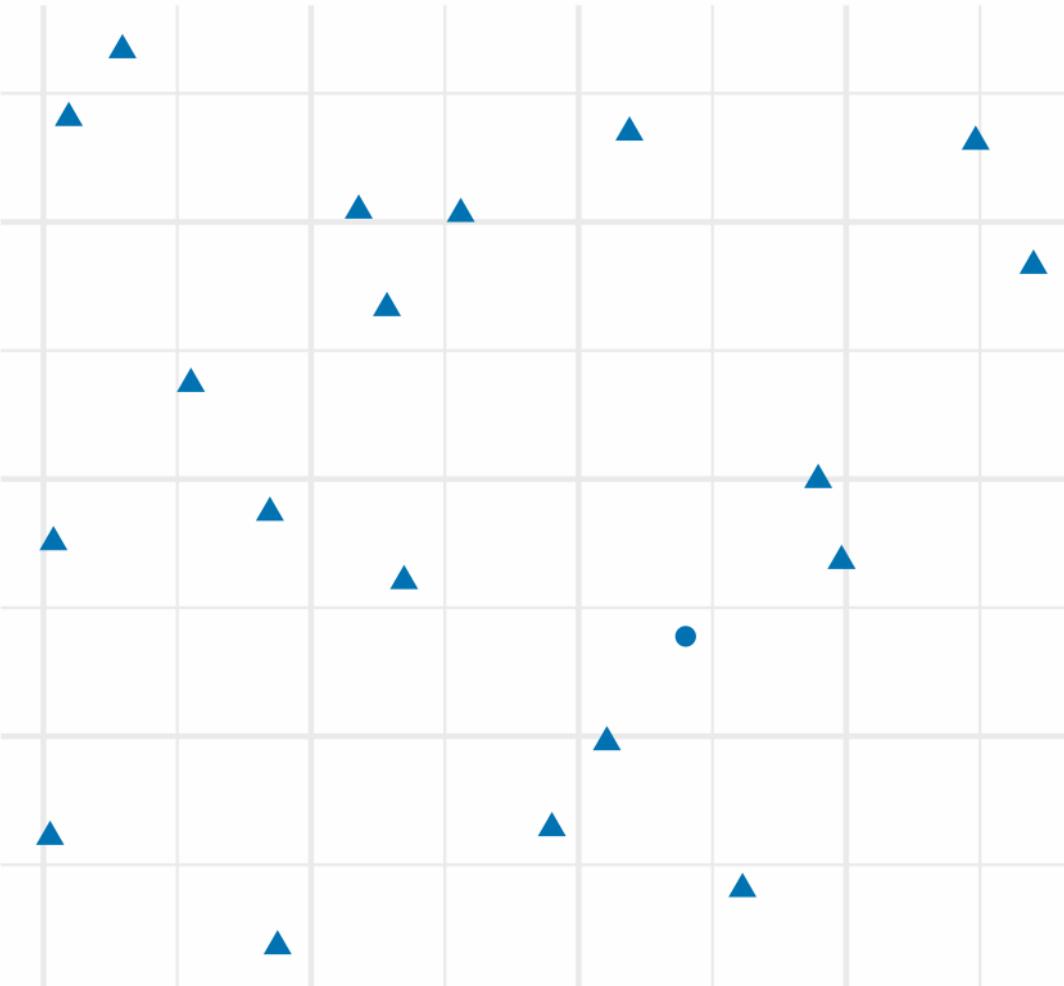
## Color only, N = 20



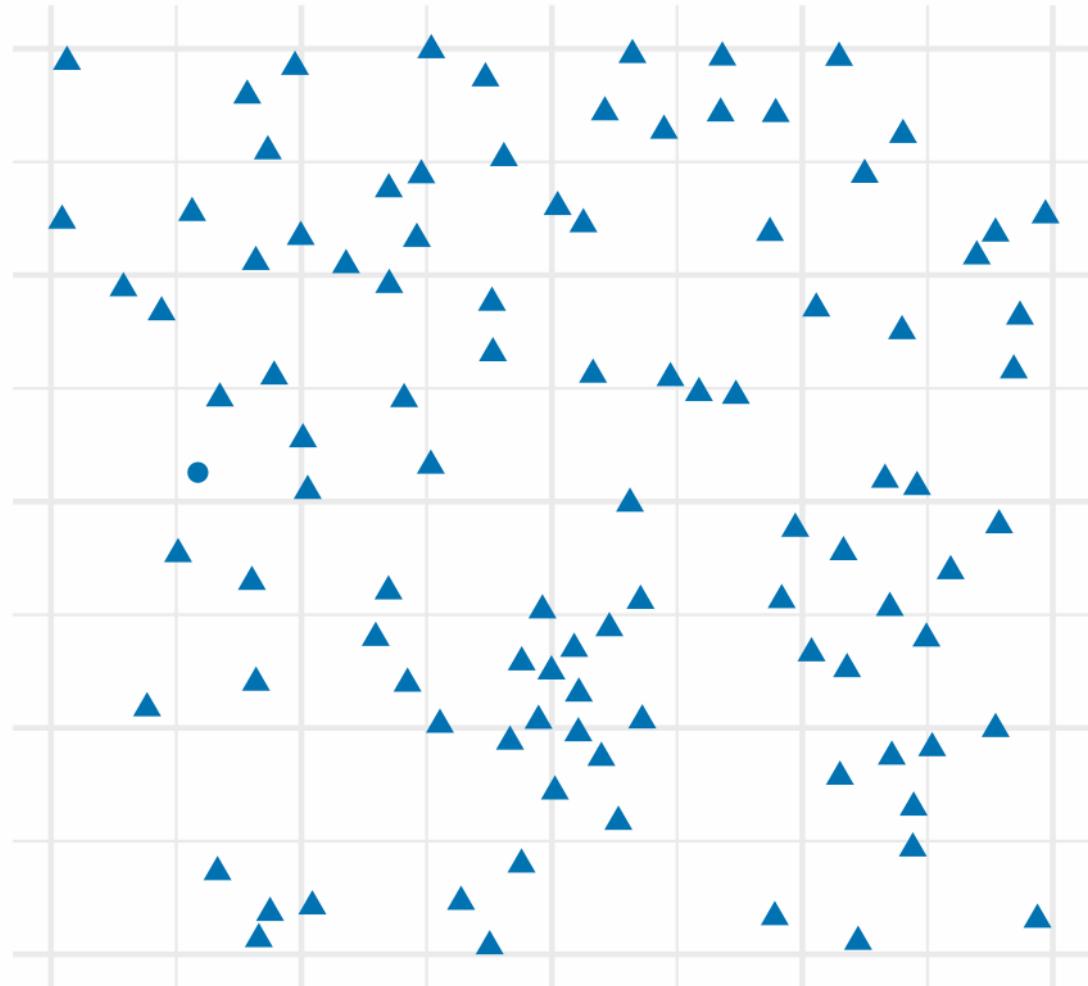
# Color only, N = 100



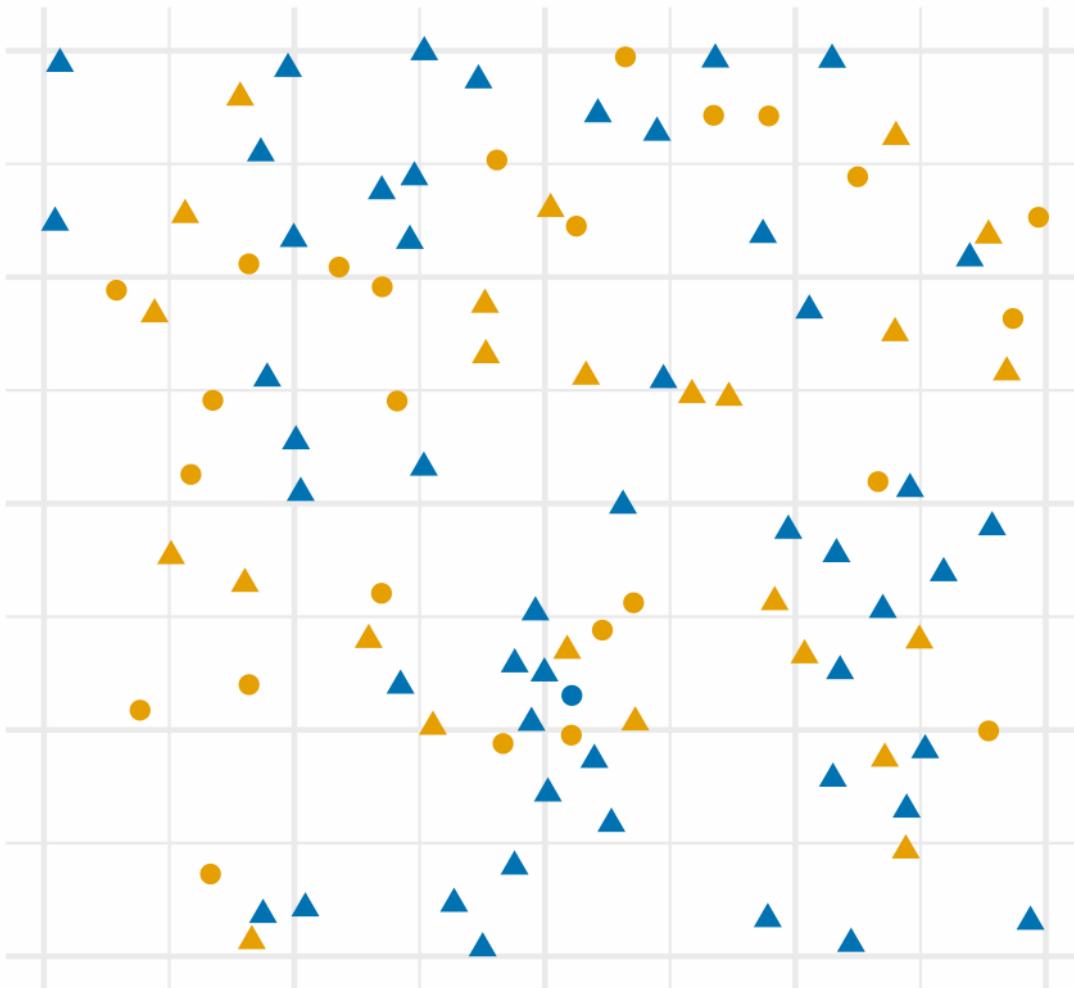
## Shape only, N = 20

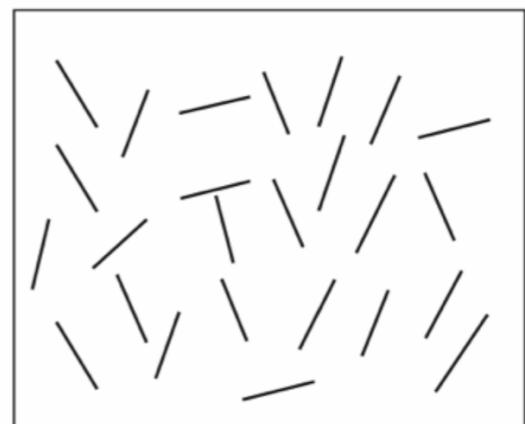
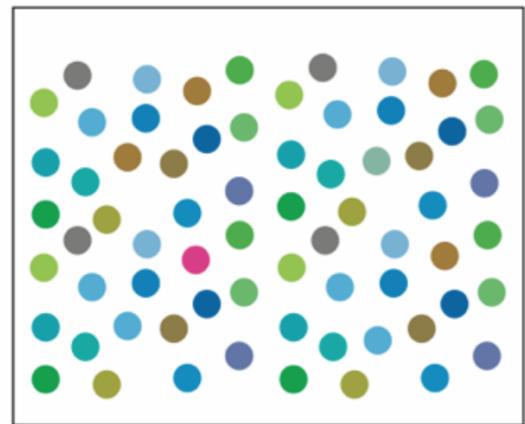
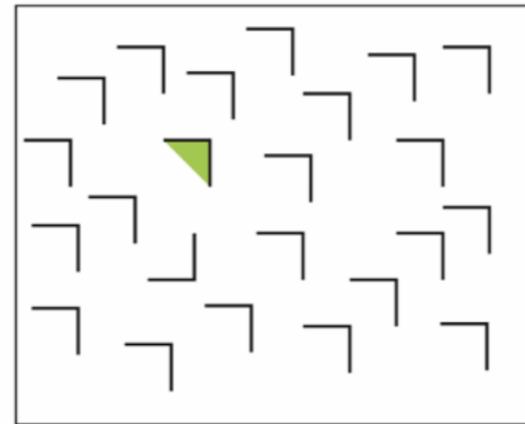
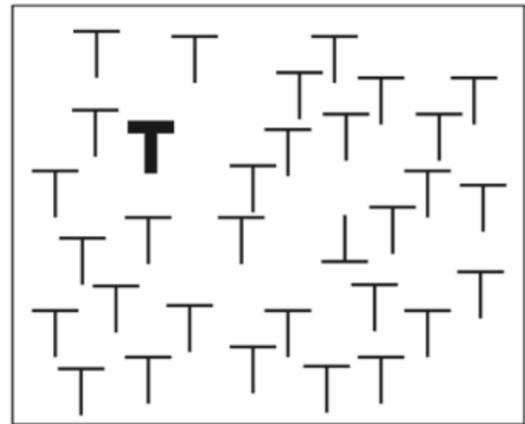


# Shape only, N = 100

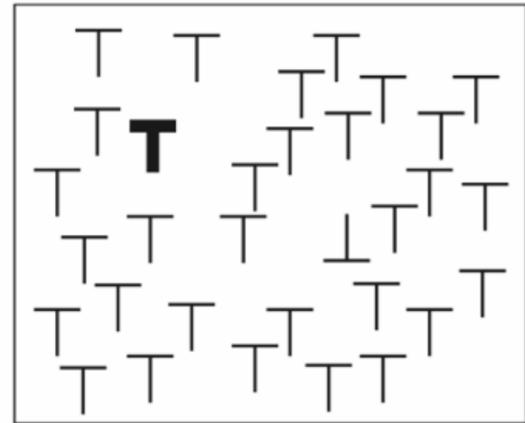


# Color and Shape, N = 100

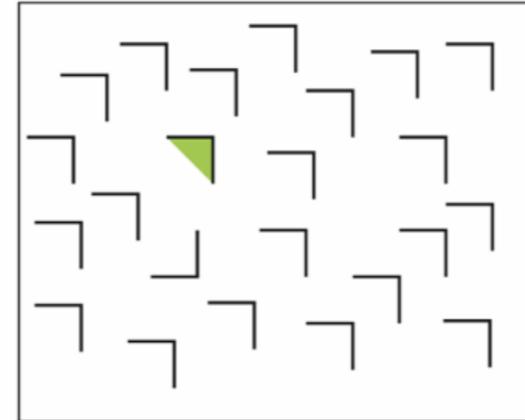




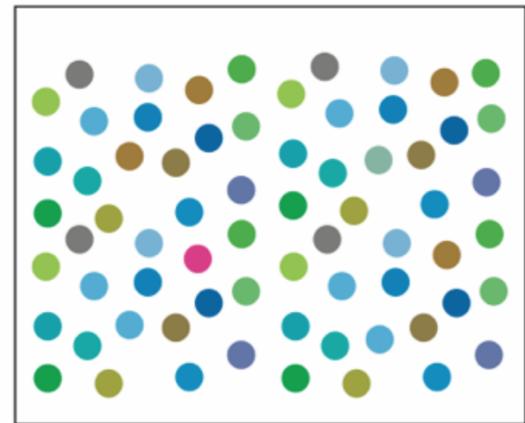
$\perp$   
difficult  
**T**  
easy



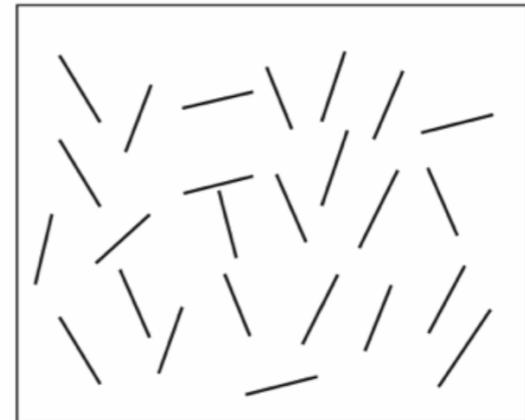
$\sqcup$   
difficult  
  
easy



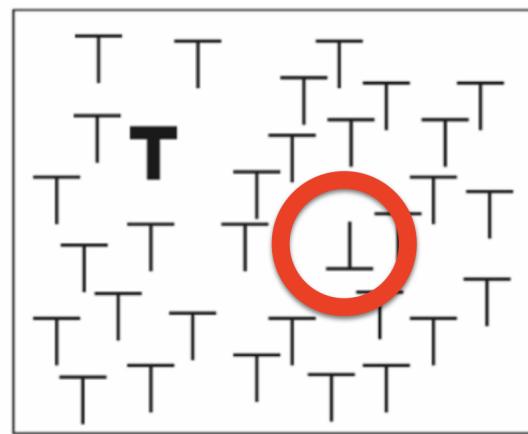
  
difficult  
  
easy



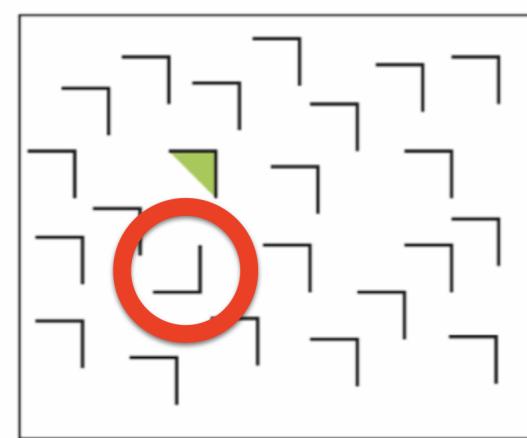
$\diagup$   
difficult  
 $\diagdown$   
easy



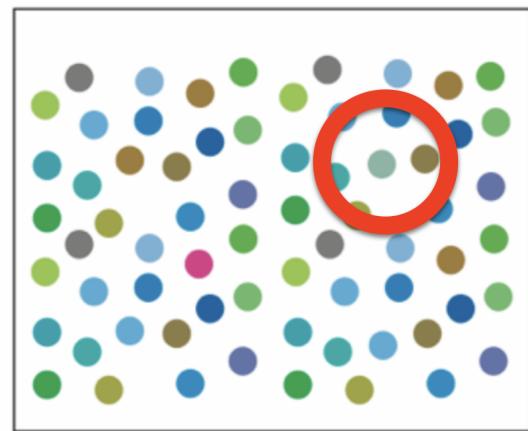
$\perp$   
difficult  
**T**  
easy



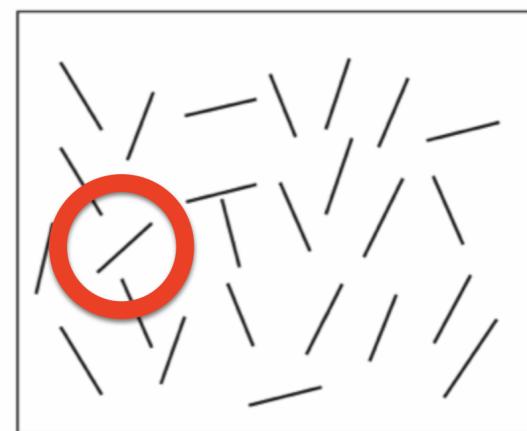
$\perp$   
difficult  
▼  
easy



●  
difficult  
●  
easy



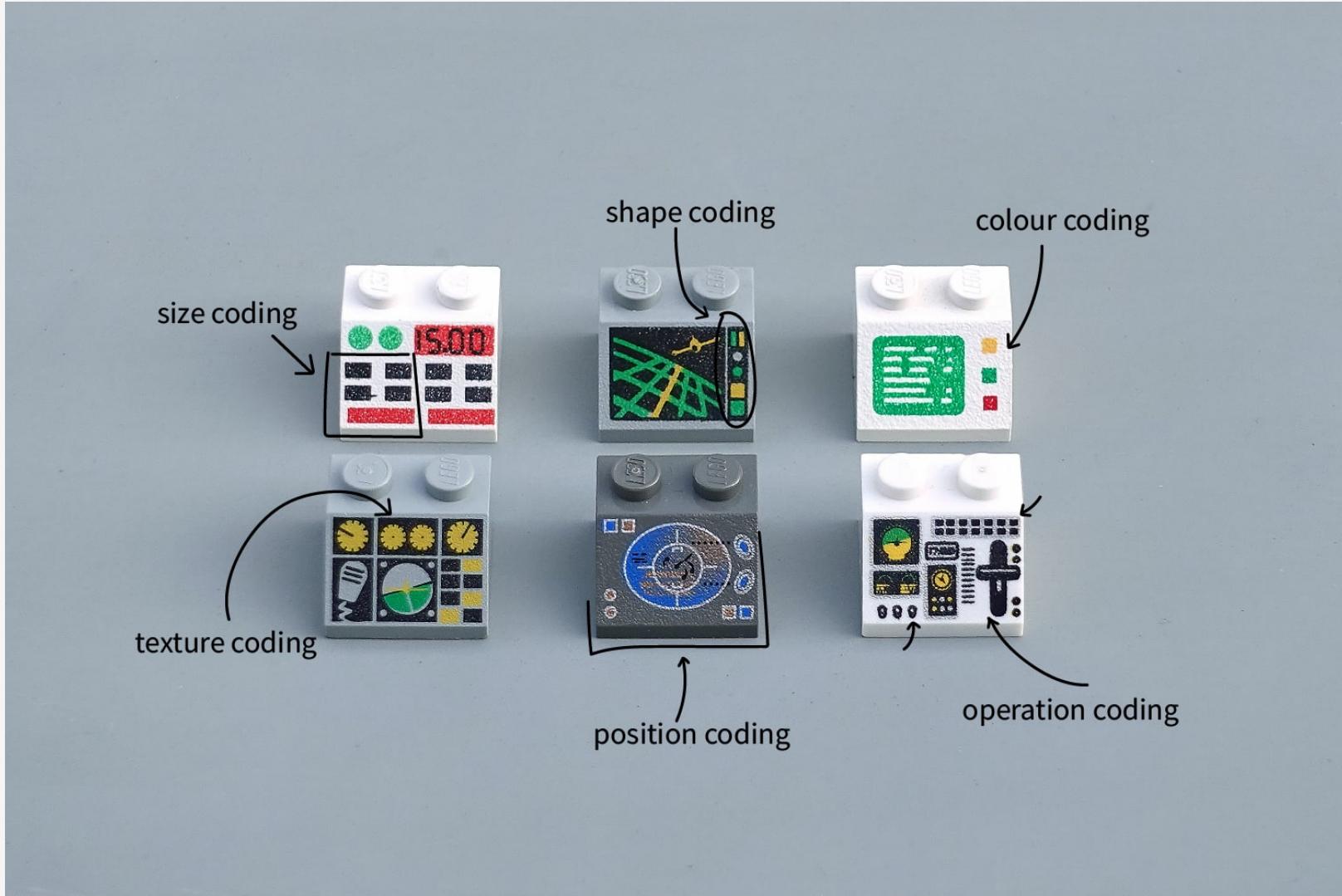
/  
difficult  
—  
easy



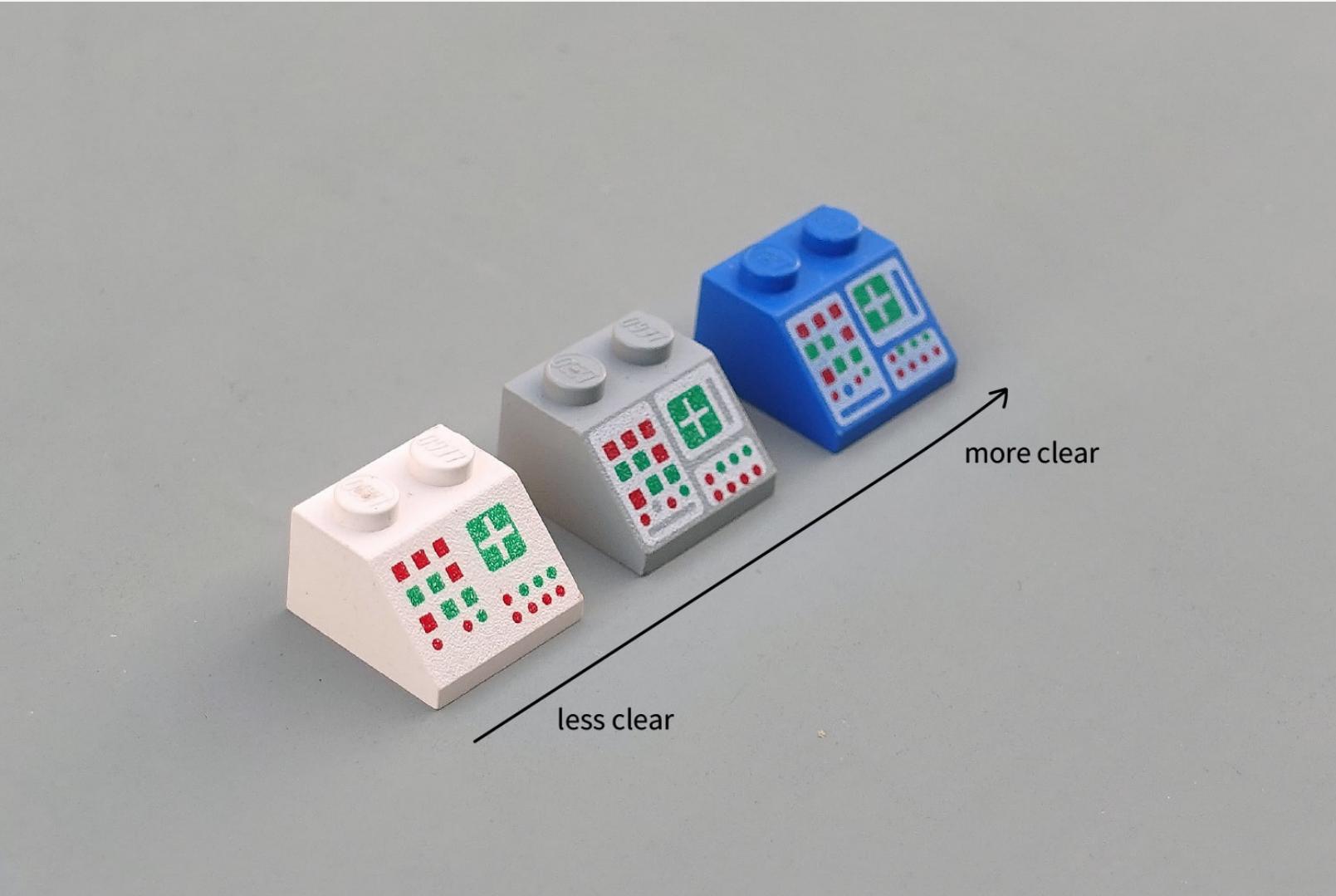
# Gestalt Inferences and Design



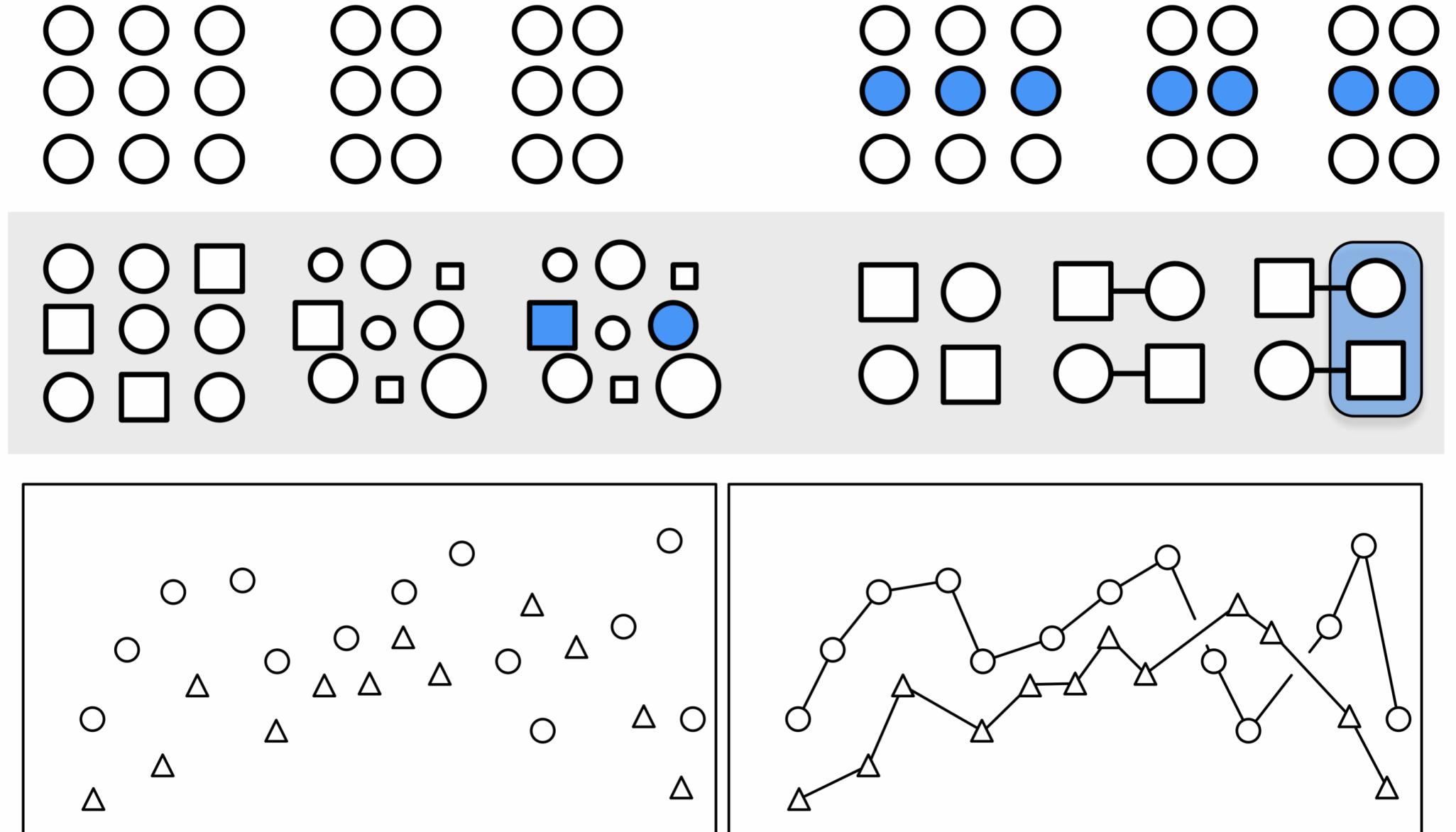
George Cave



George Cave



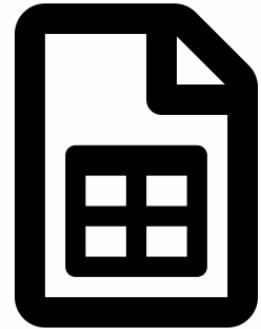
George Cave



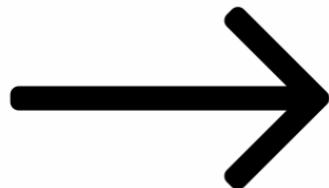
**Encodings  
or mappings  
for data**

**What's a  
graph,  
anyway?**

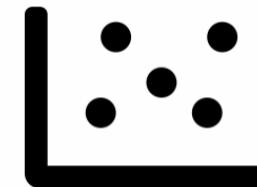
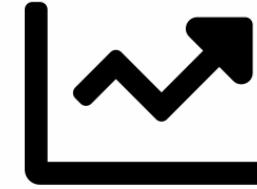
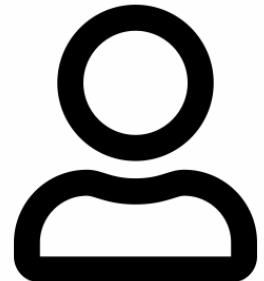
# Data



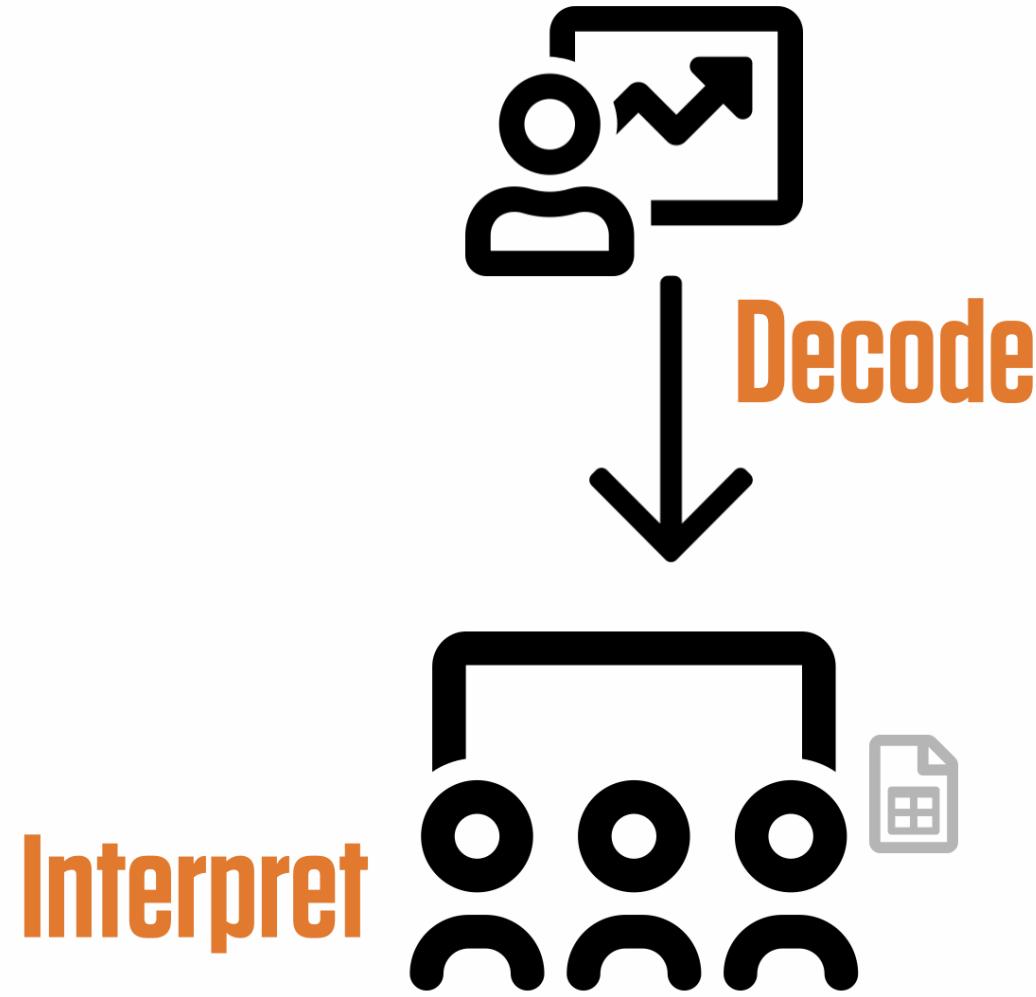
Encoded



or mapped

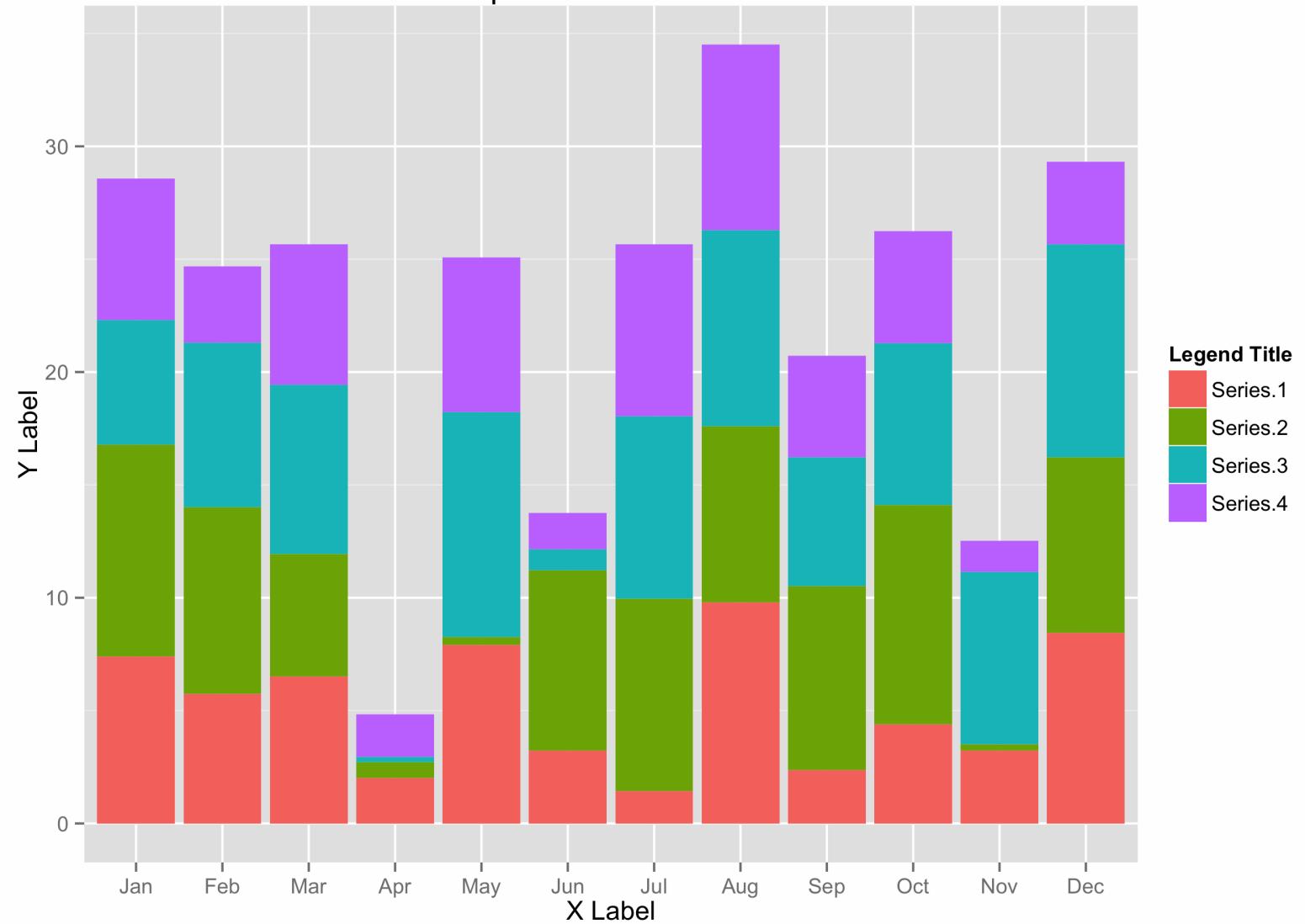


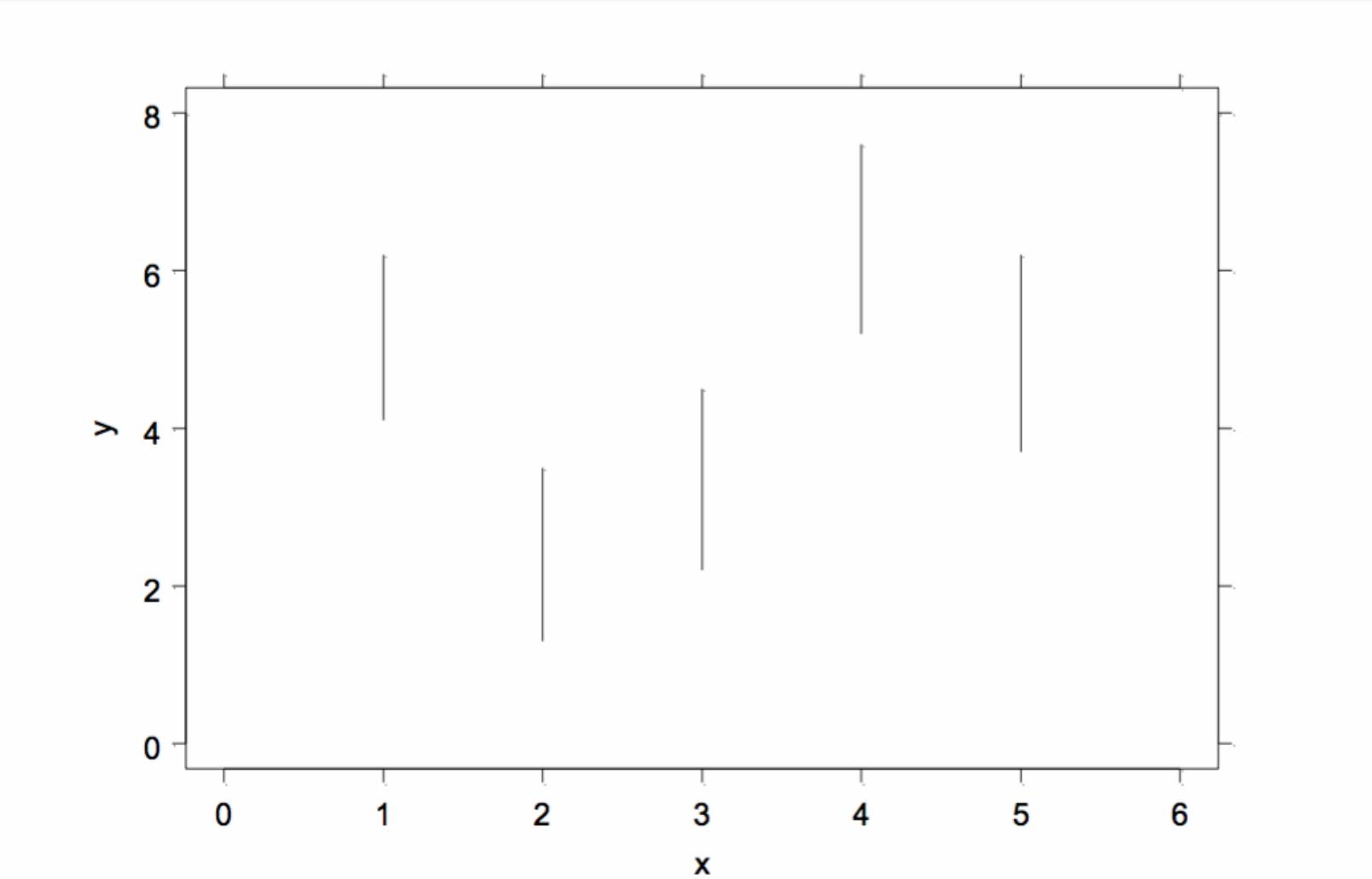
Some sort of  
faithful visual  
representation



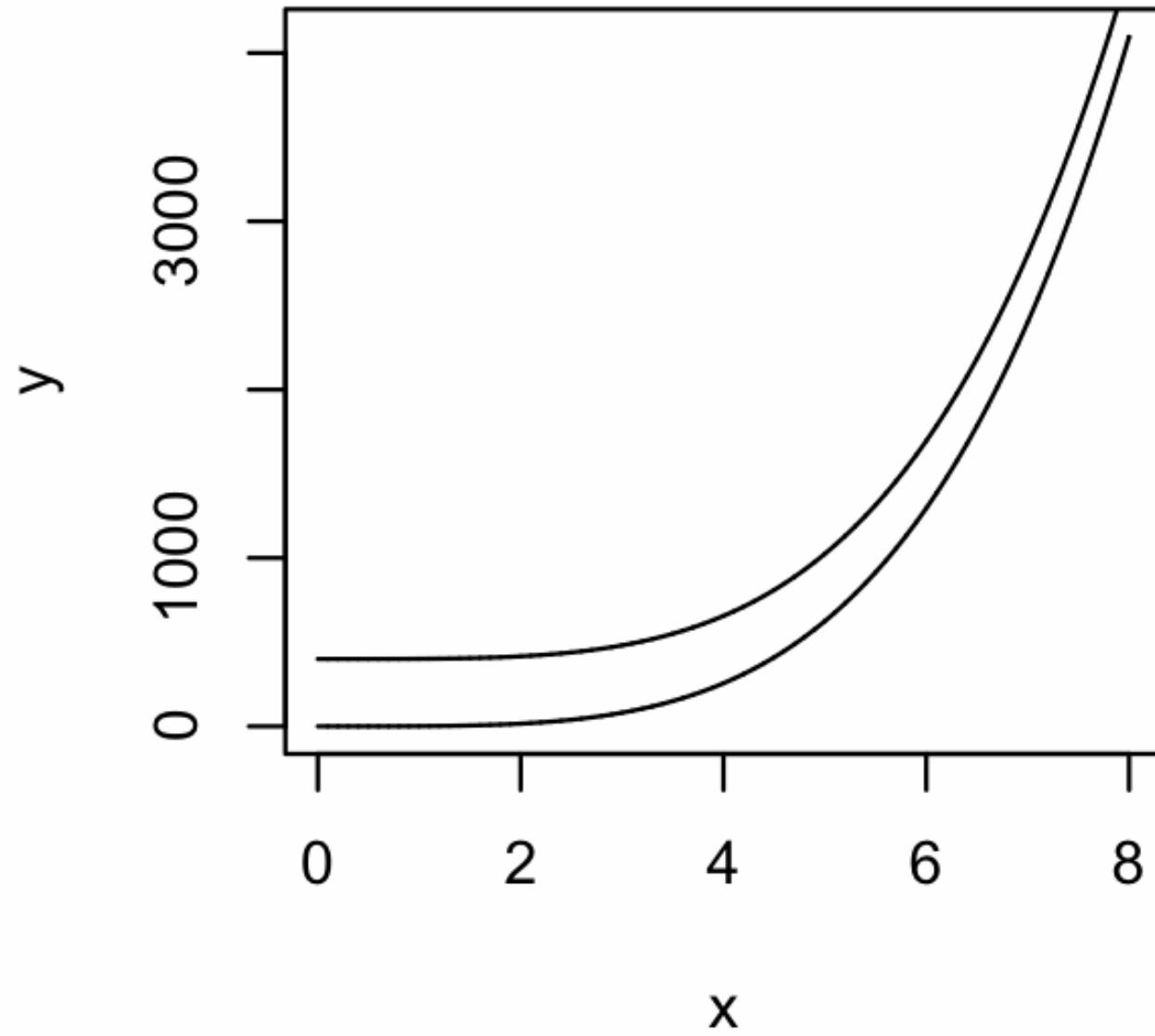
# Visual tasks in decoding graphs

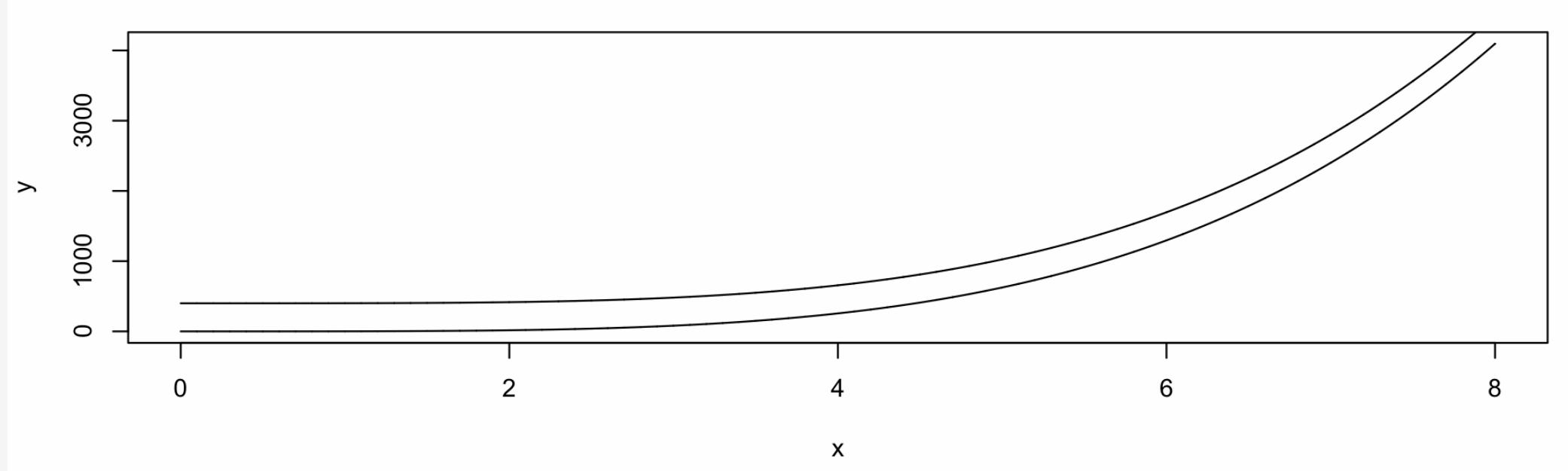
### An Example Stacked Column Chart



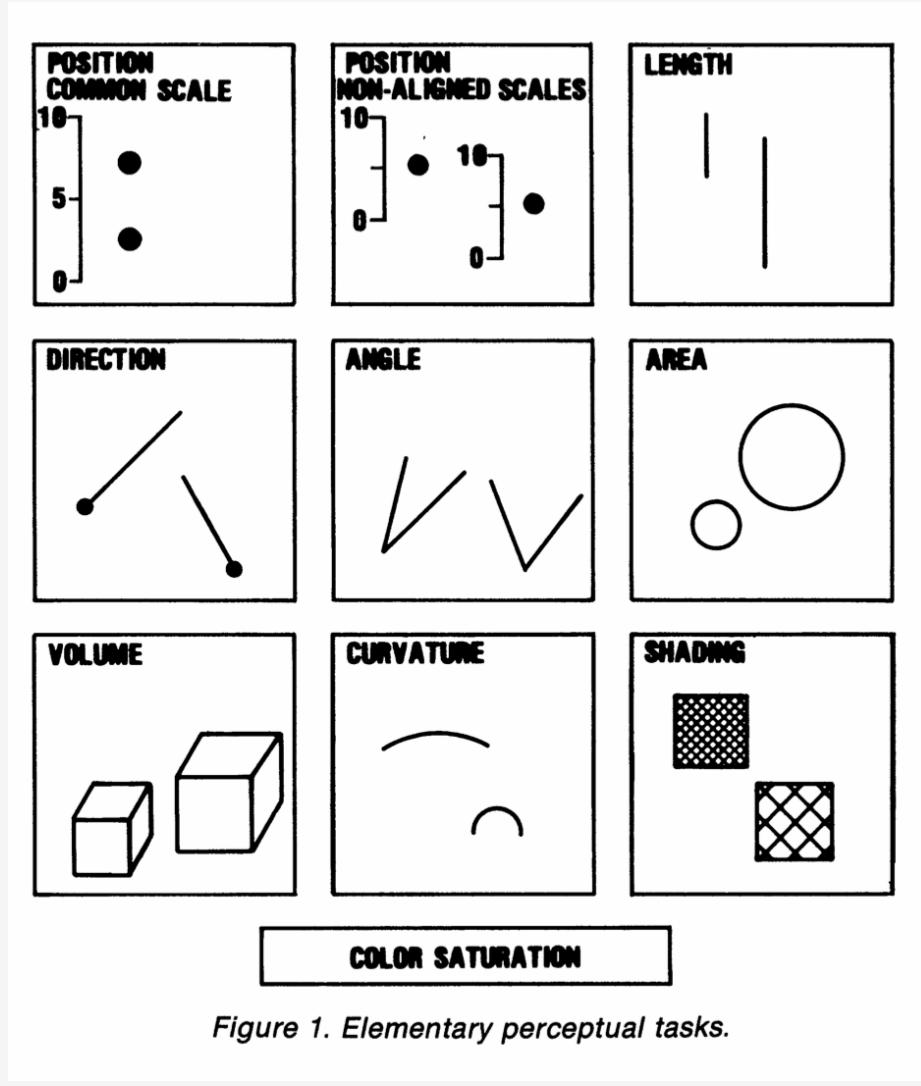


William Cleveland



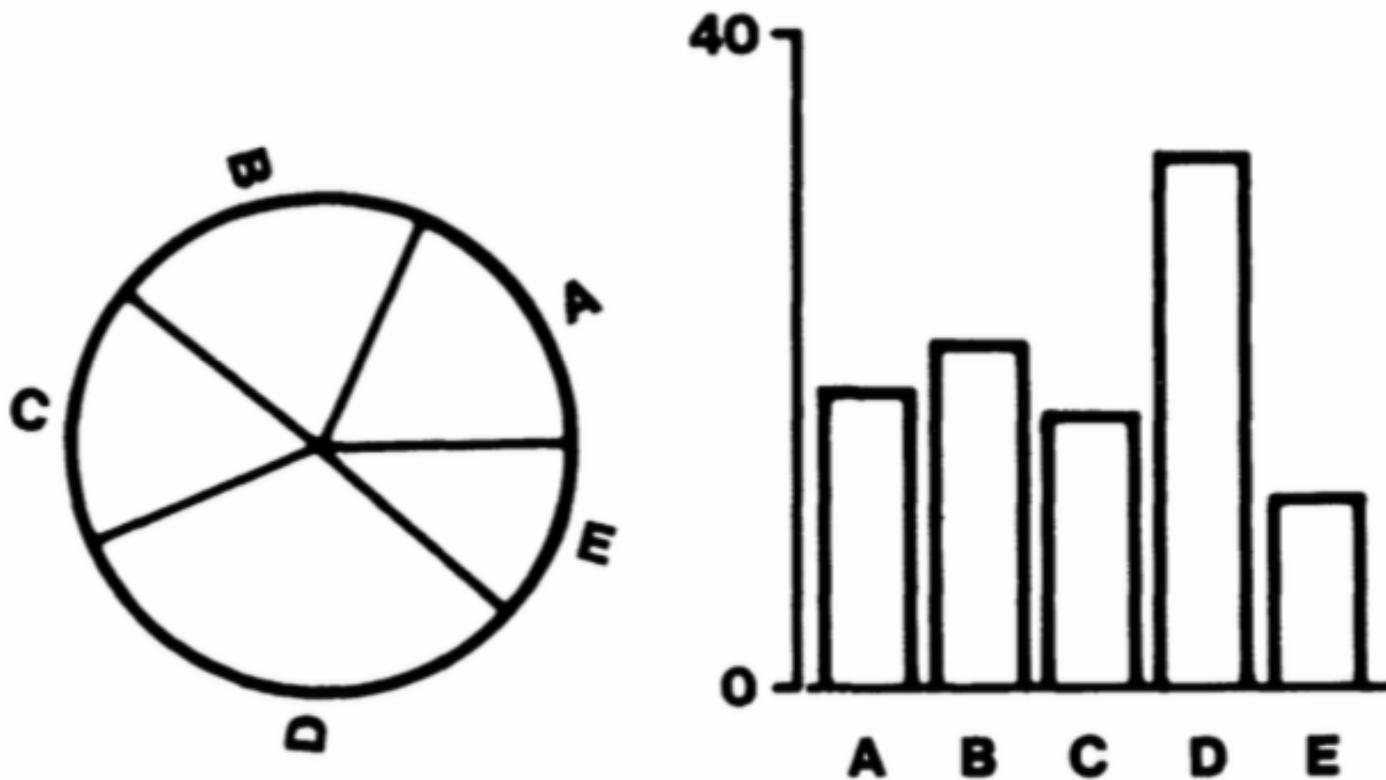


William Cleveland



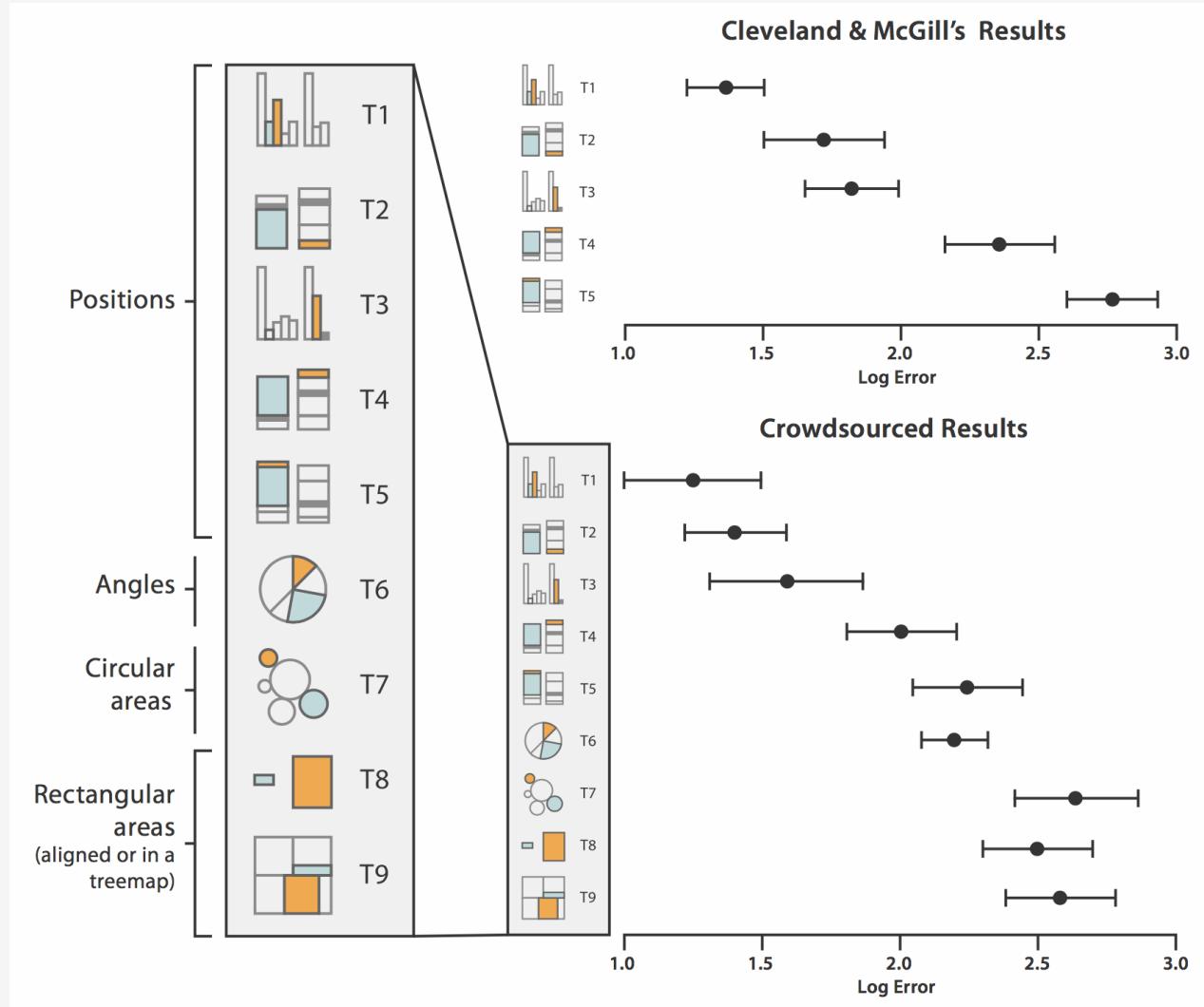
*Figure 1. Elementary perceptual tasks.*

William Cleveland



*Figure 3. Graphs from position-angle experiment.*

William Cleveland

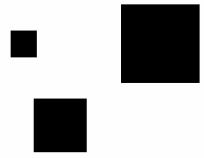


William Cleveland and Michael Bostock

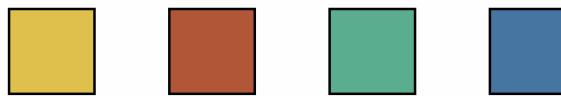
**A rough hierarchy  
of mappings for data**

Position on a common scale	
Position on unaligned scale	
Length (1D as size)	
Tilt or Angle	
Area (2D as size)	
Depth (3D as Position)	
Color luminance [brightness]	
Color saturation [intensity]	
Curvature	
Volume (3D as size)	

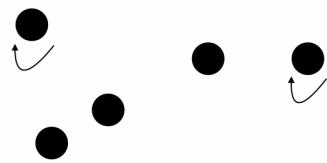
Spatial Region



Color [hue]



Motion

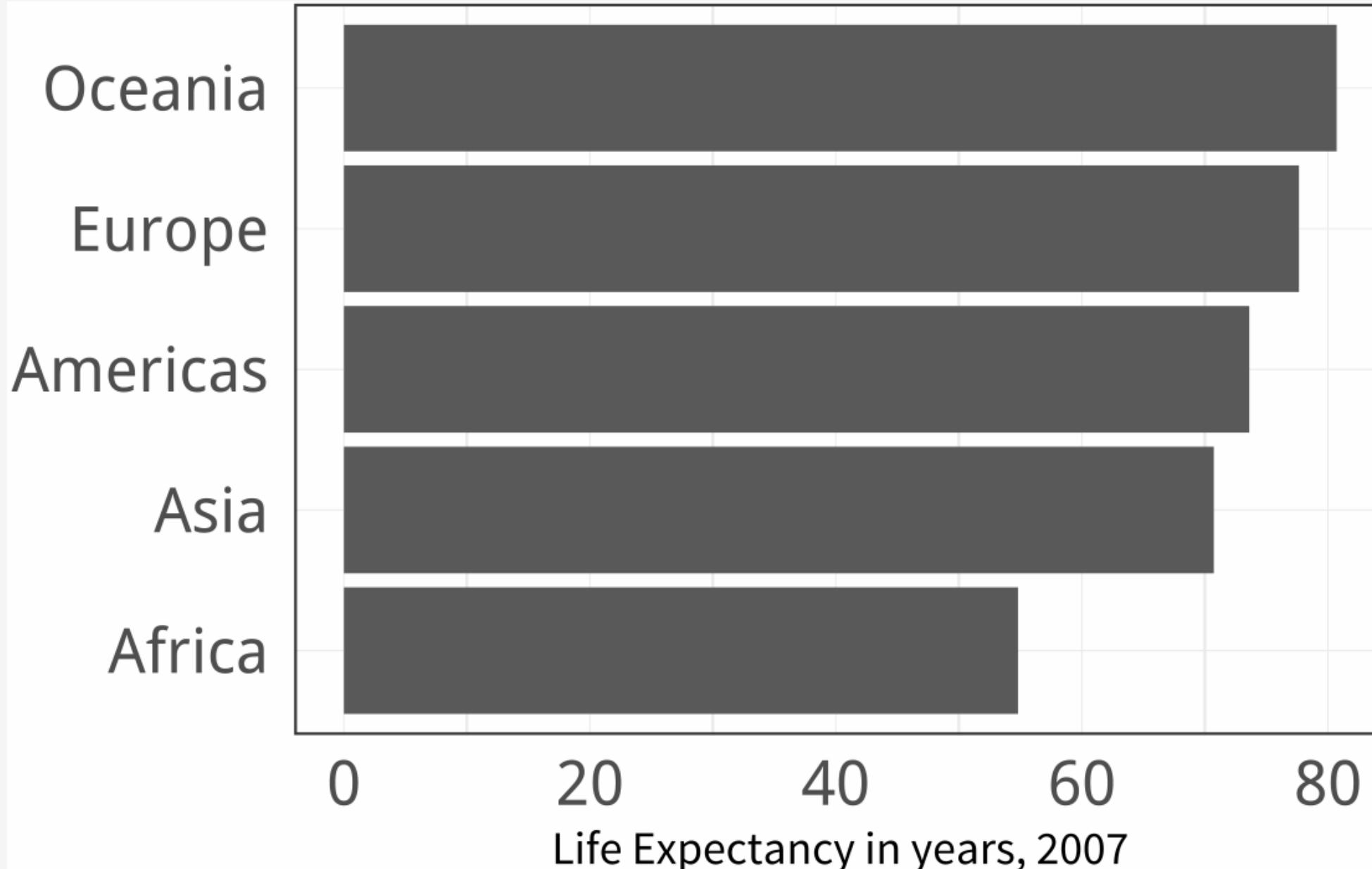


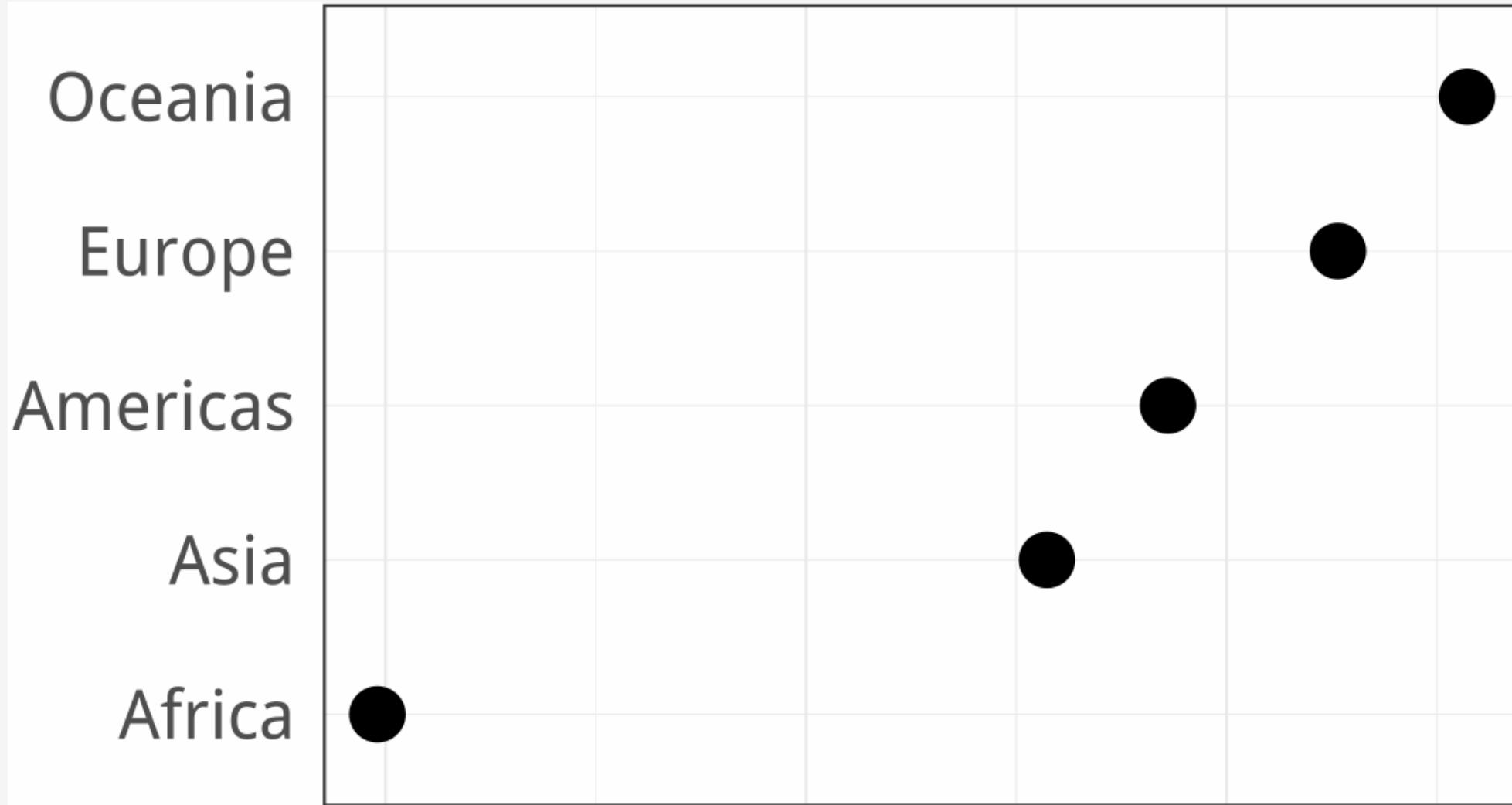
Shape



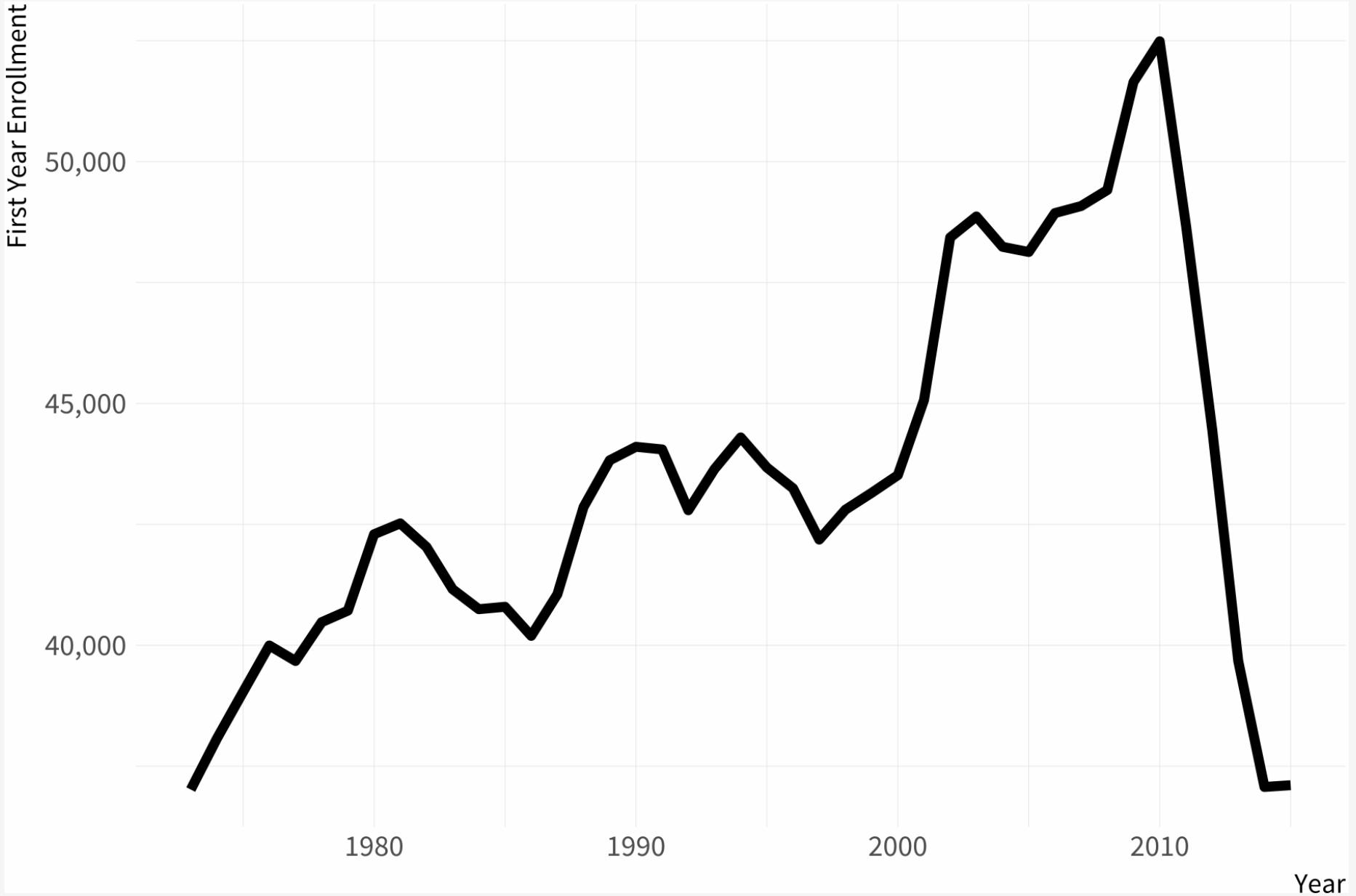
Tamara Munzer

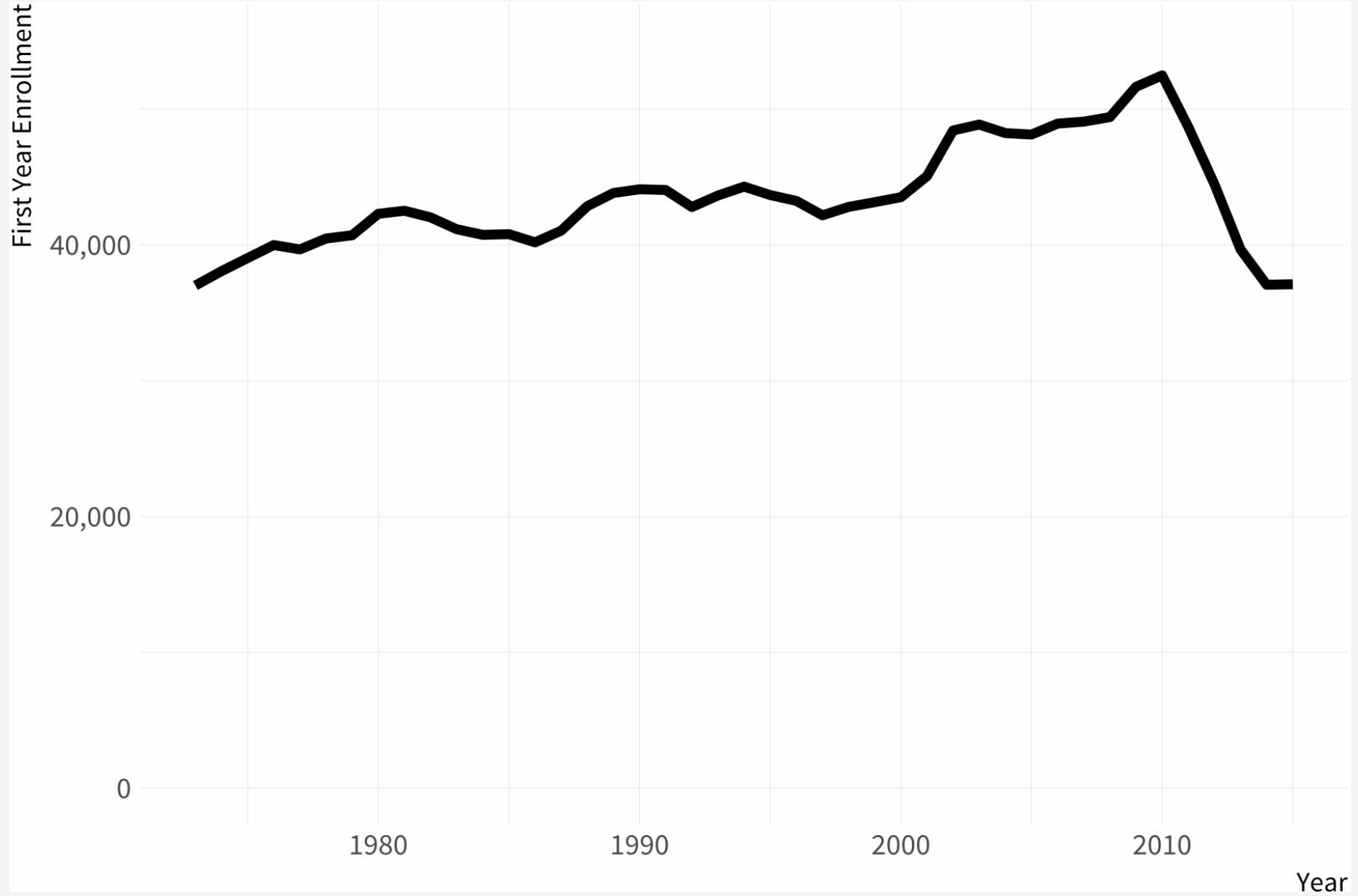
# Honesty & judgment





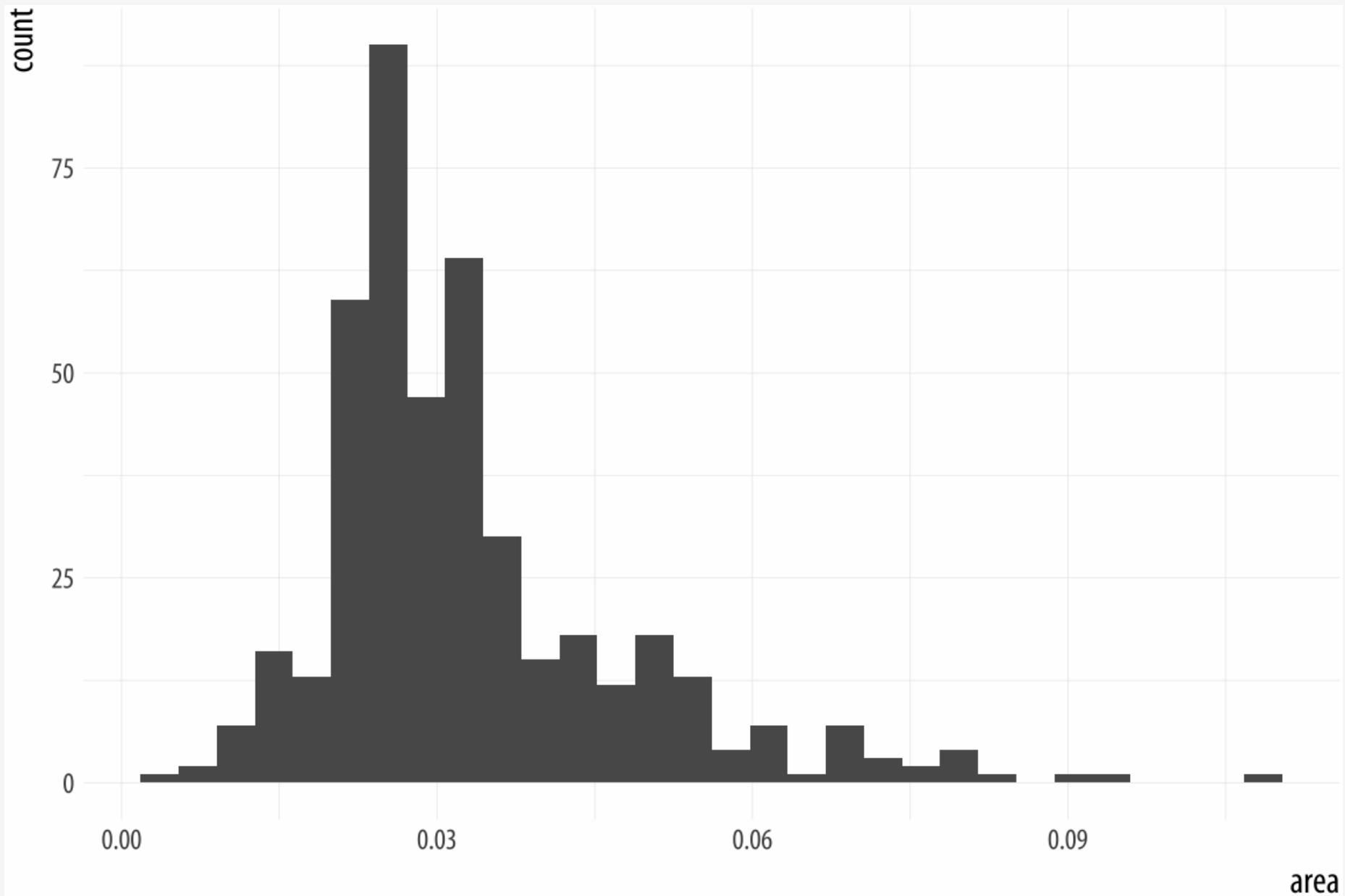
Life Expectancy in years, 2007

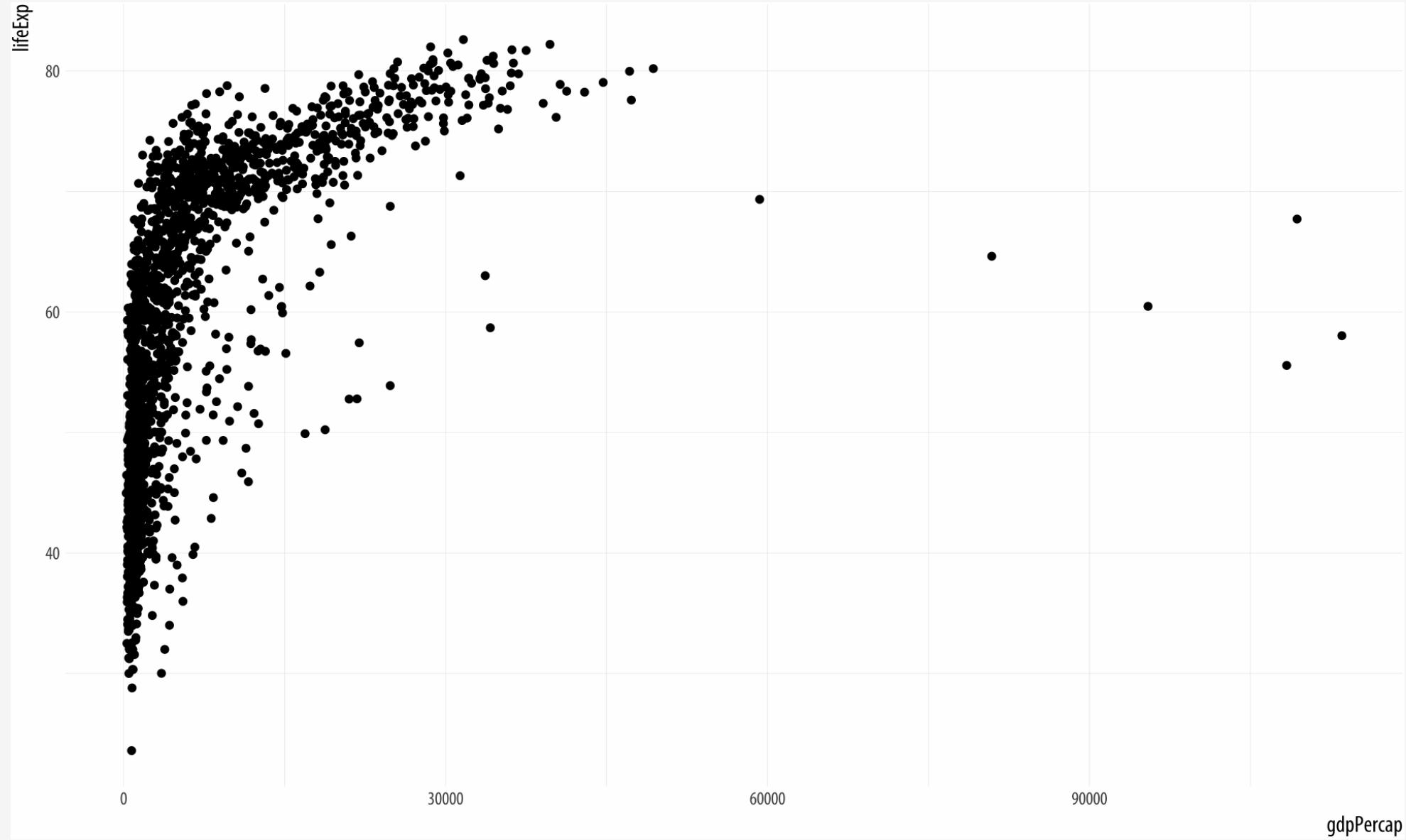


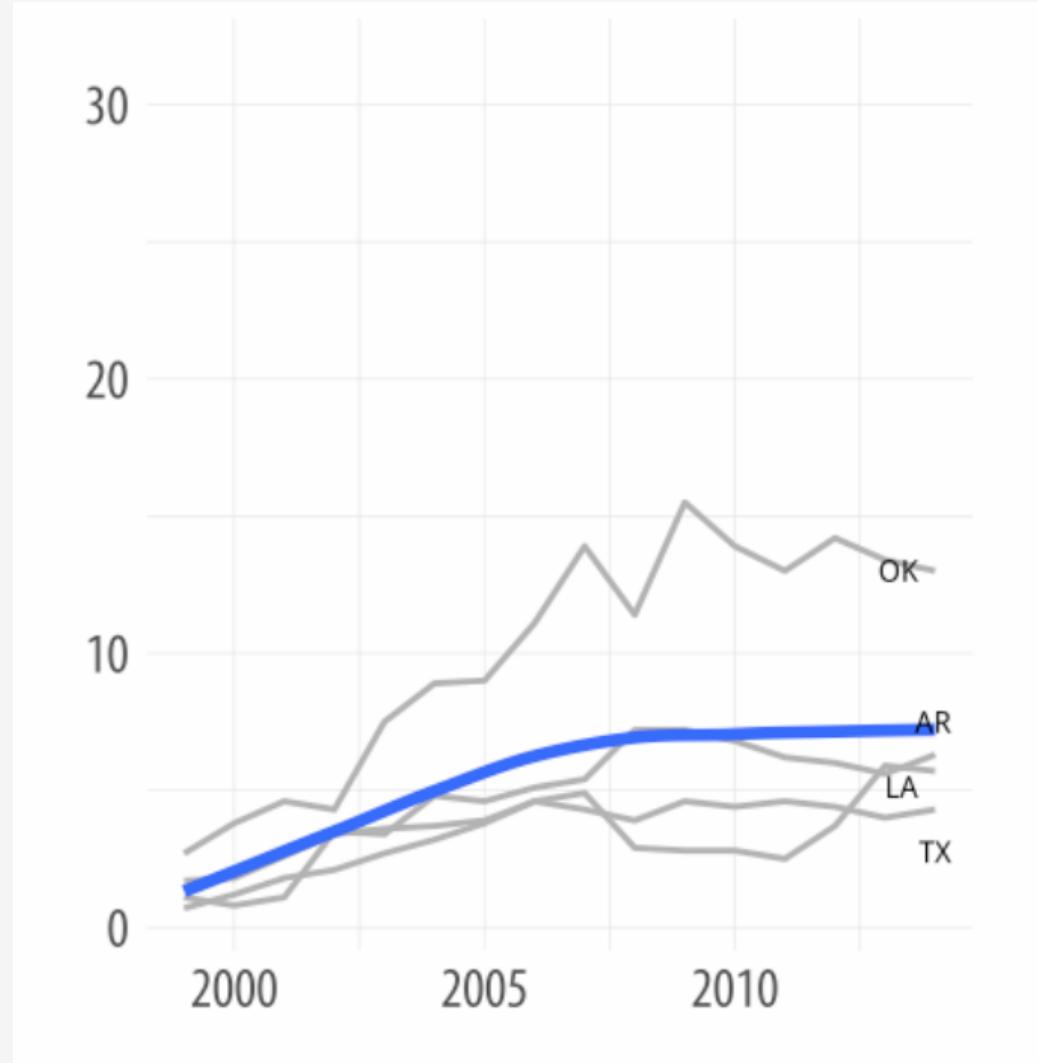


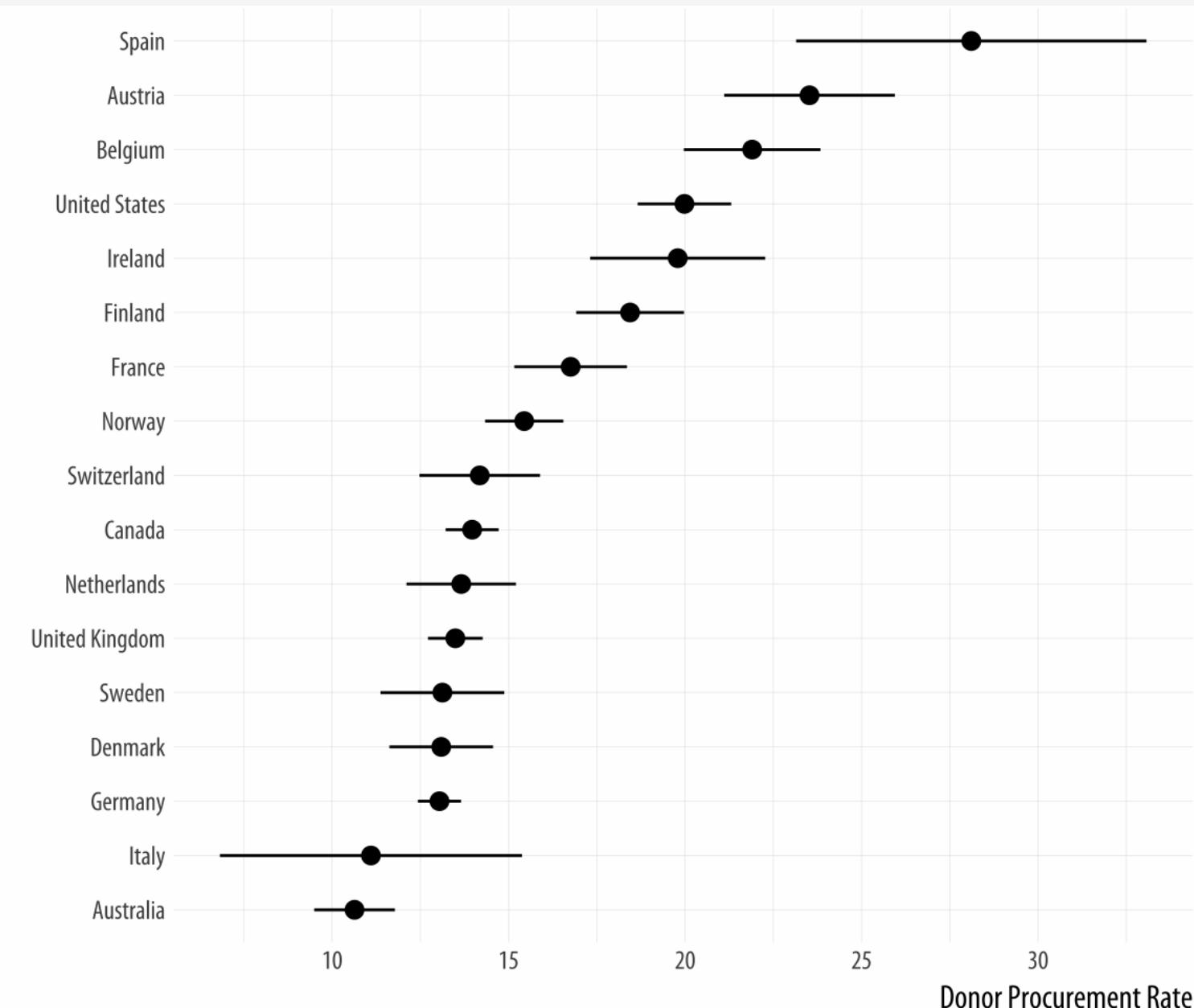
# Graphing in practice

# Workhorses



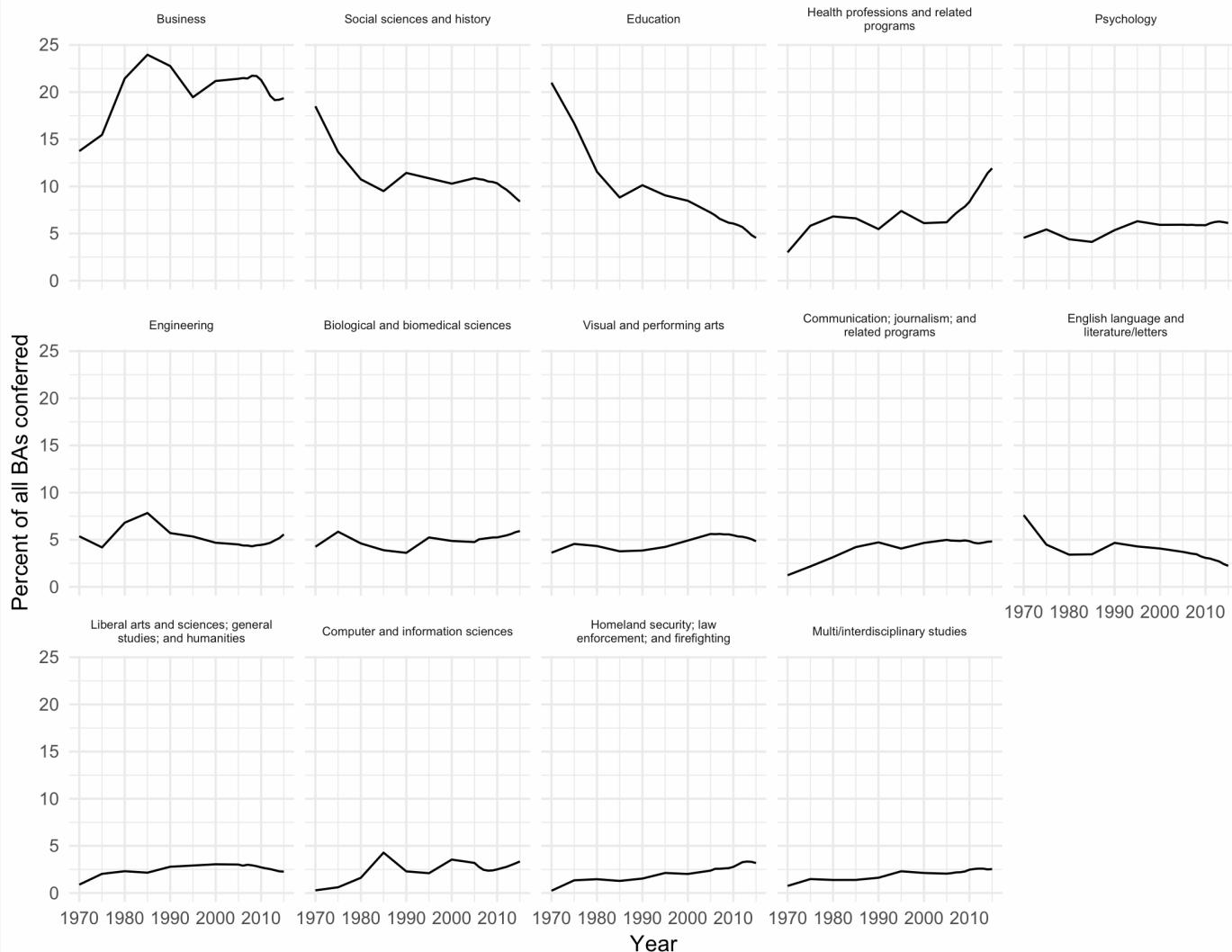






## US Trends in Bachelor's Degrees Conferred, 1970-2015, for Areas averaging more than 2% of all degrees

Observations are every 5 years from 1970-1995, and annually thereafter



Data from NCES Digest 2017, Table 322.10.

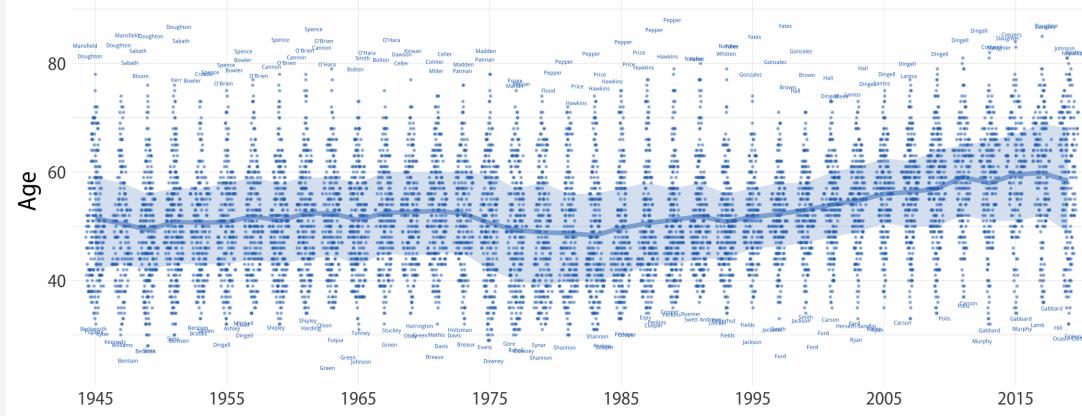
# Show Ponies

## Age Distribution of Congressional Representatives, 1945-2019

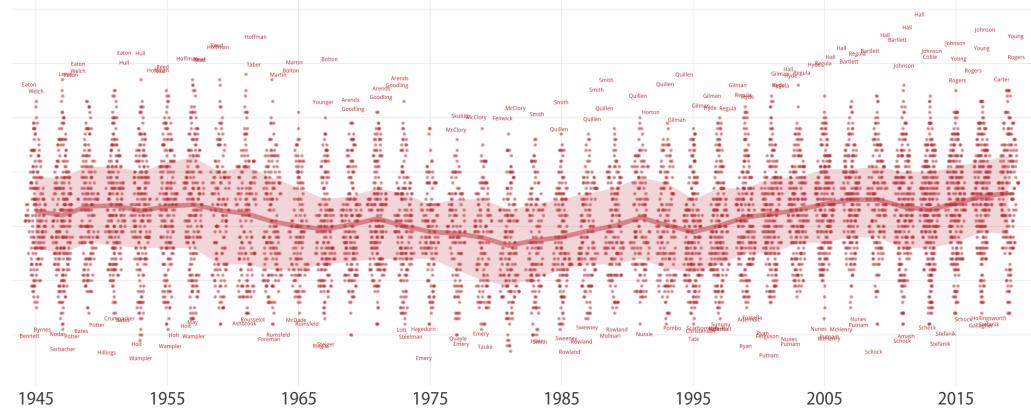
Trend line is mean age; bands are 25th and 75th percentiles of the range.

Youngest and oldest percentiles are named instead of being shown by points.

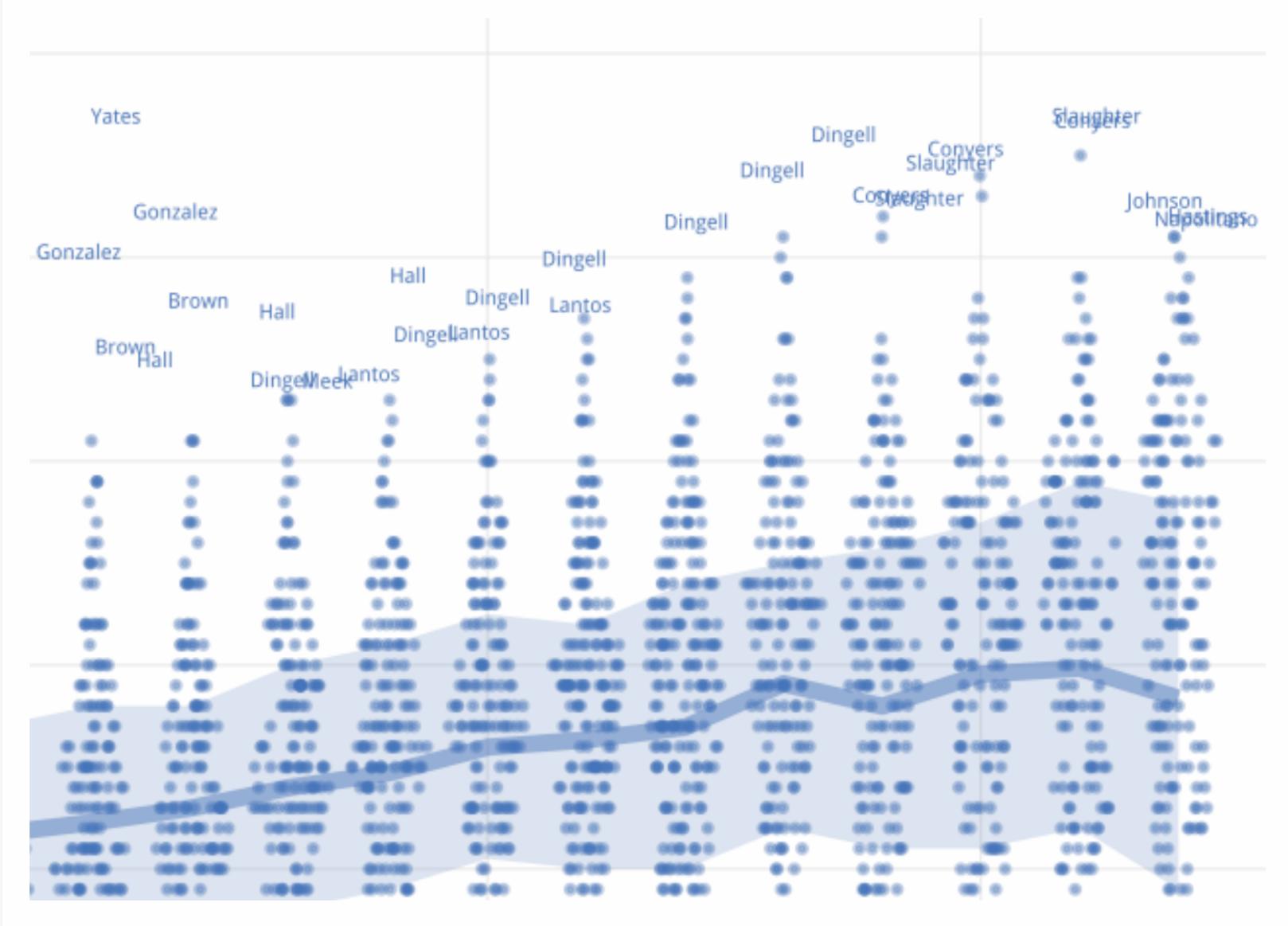
Democrats



Republicans

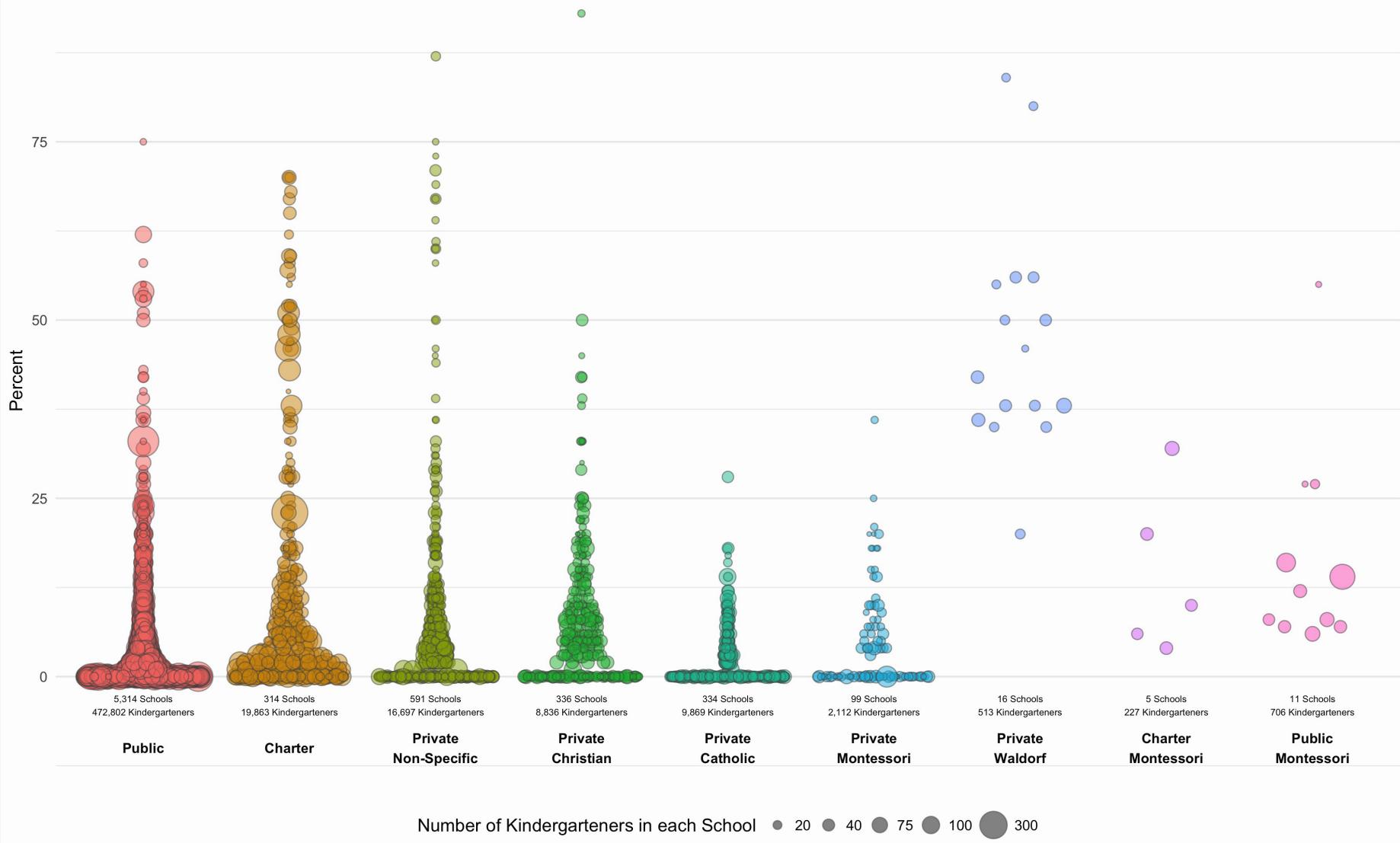


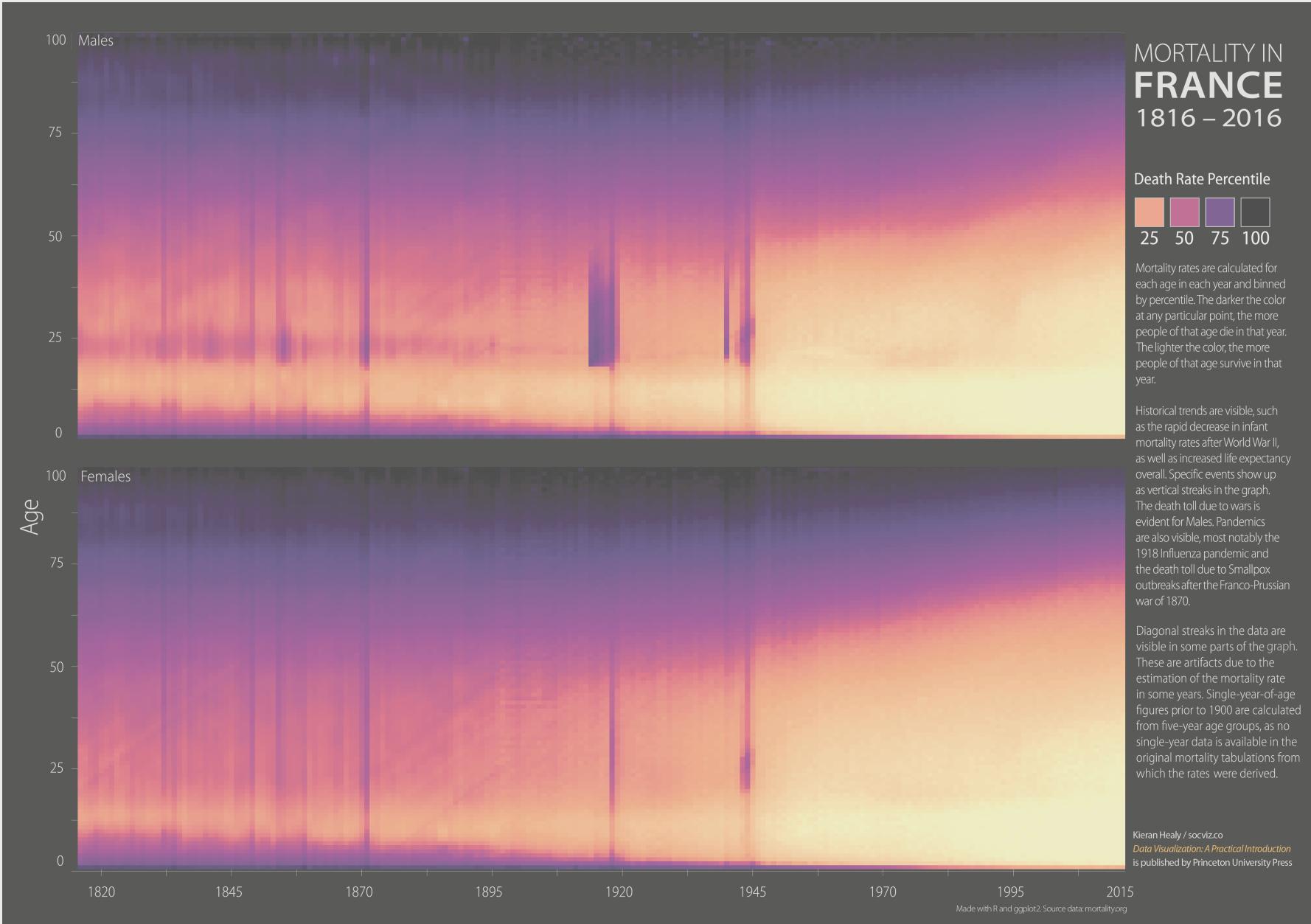
@kjhealy http://socviz.co Data: Congressional Quarterly



## Vaccination Exemption Rates in California Kindergartens

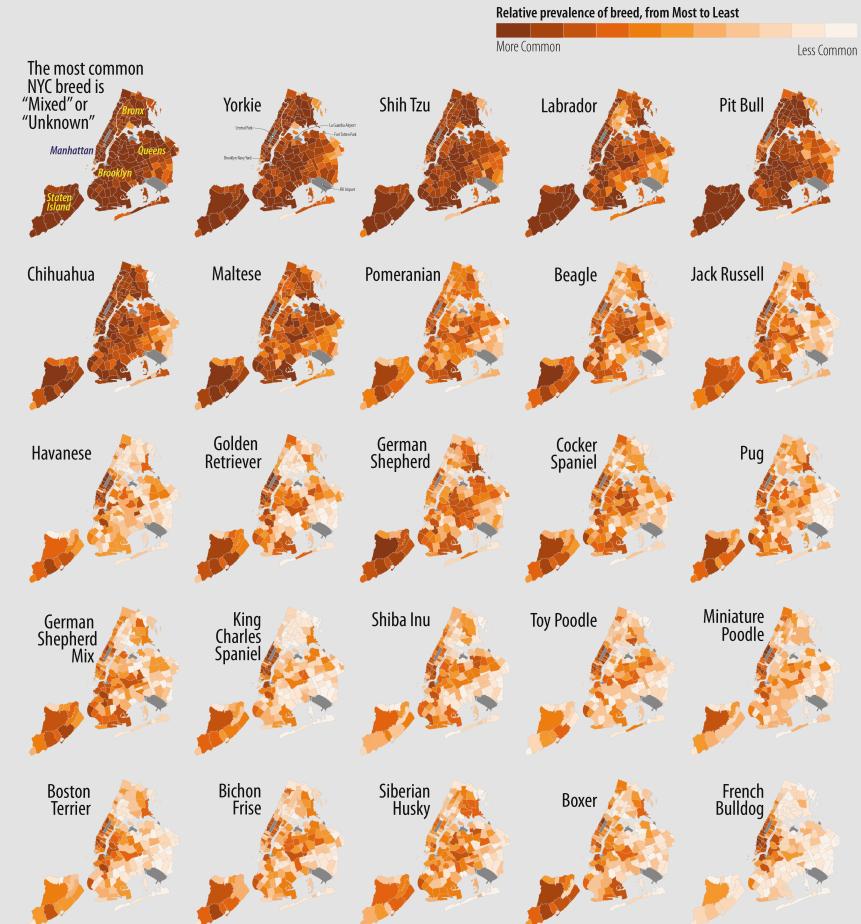
Percent of Kindergarteners with a Personal Belief Exemption, by Type and Size of School.





# Dogs of New York

Based on data from New York City's Dog Licensing System, these maps show the relative prevalence of the twenty five most common breeds of dog, by zip code.



# Unicorns ...

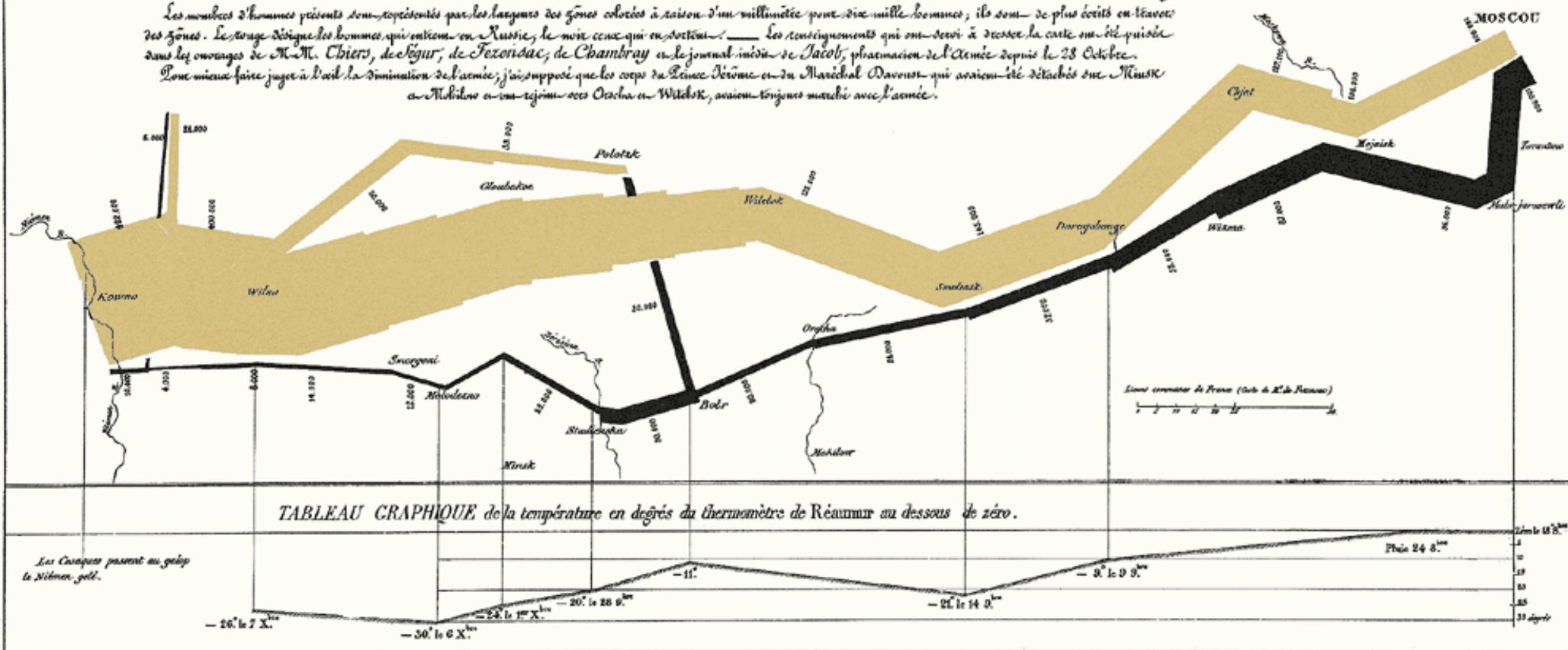
# Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.

Conçue par M. Minard, Inspecteur Général des Ponts et Chaussées en activité.

Paris, le 20 Novembre 1869

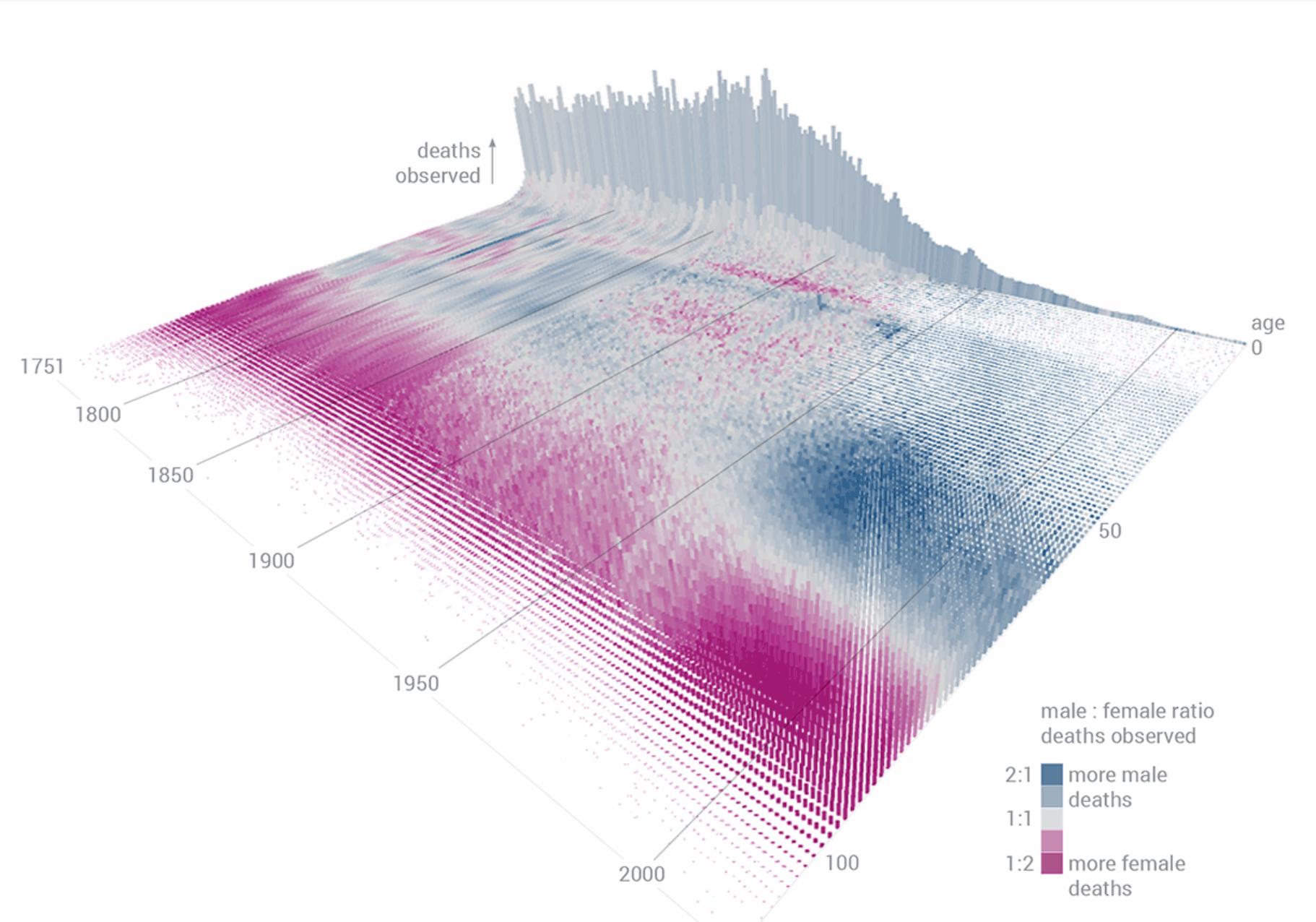
Les nombres d'hommes perdus sont représentés par les largeurs des bandes colorées à raison d'un millimètre pour dix-mille hommes ; ils sont de plus écrits en lettres des zones. Le rouge désigne les hommes qui ont été en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été pris dans les ouvrages de M. M. Chiers, de Léger, de Férouzat, de Chambray et le journal intitulé de Jacob, publication de l'Armée depuis le 28 Octobre.

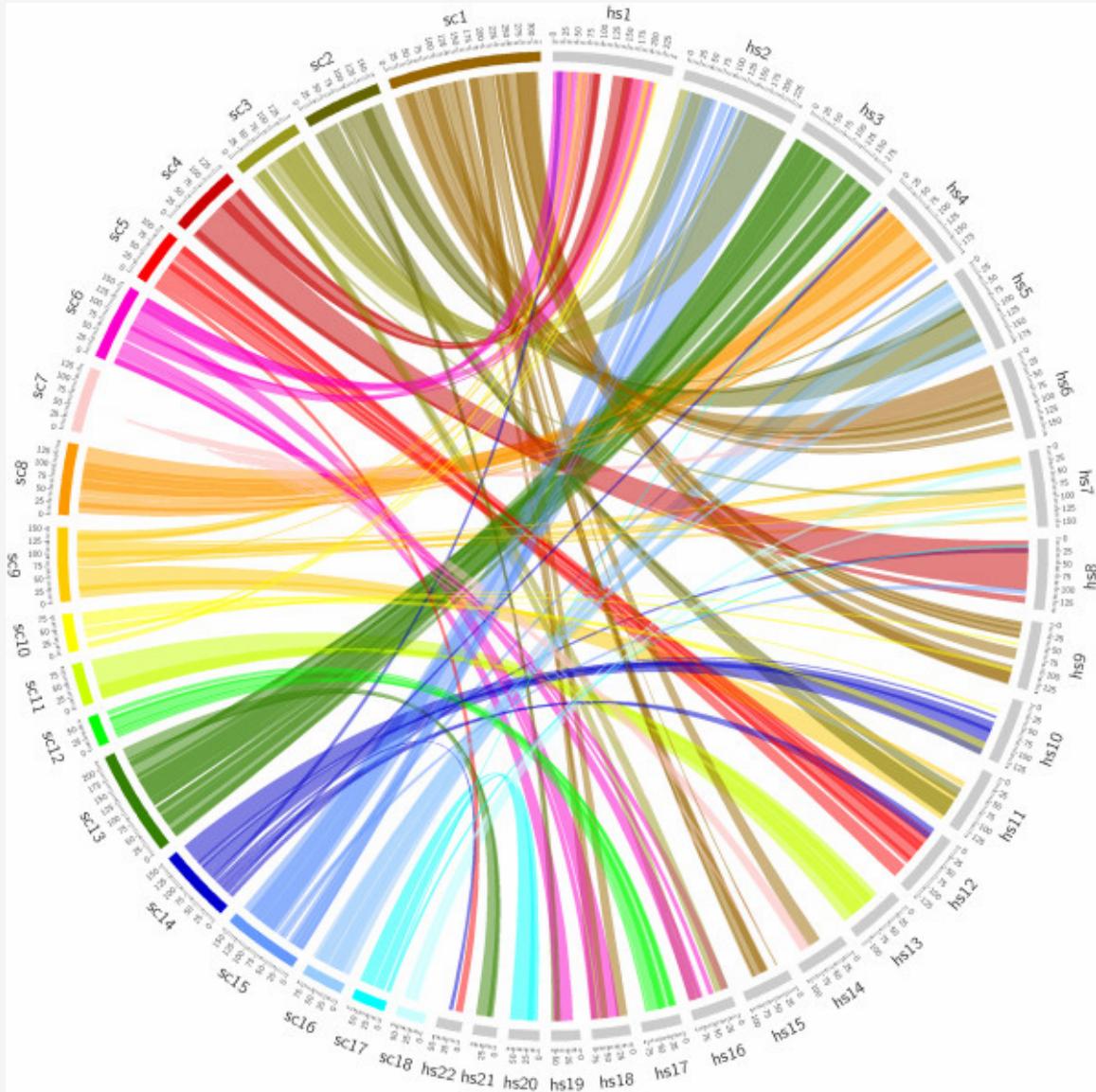
Pour mieux faire juger à l'œil la diminution de l'armée, j'ai superposé que les corps de l'Armée et du Maréchal Davout qui avaient été détachés une Moscou à Malakof et qui regagnaient Paris au Witebsk, n'aient toujours marché avec l'armée.



Imprimé par Bony, 1. Rue J. Marais. 3<sup>e</sup> étage à Paris.

Dep. Int. Republ. à l'Assemblée.





... or monsters