

Visualization & Visual Analytics 1

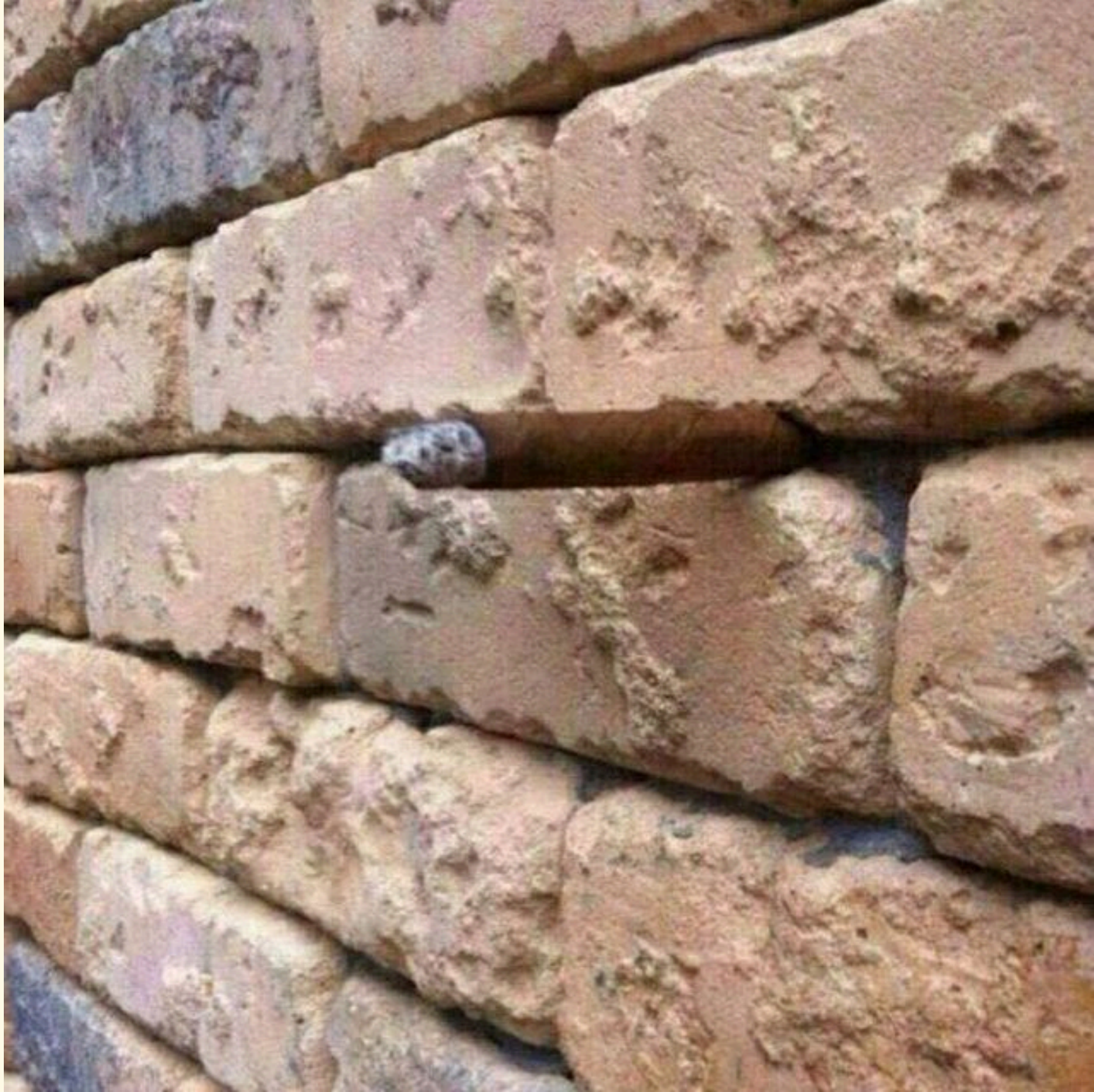
Angus Forbes

[http://creativecoding.evl.uic.edu/
courses/cs424](http://creativecoding.evl.uic.edu/courses/cs424)

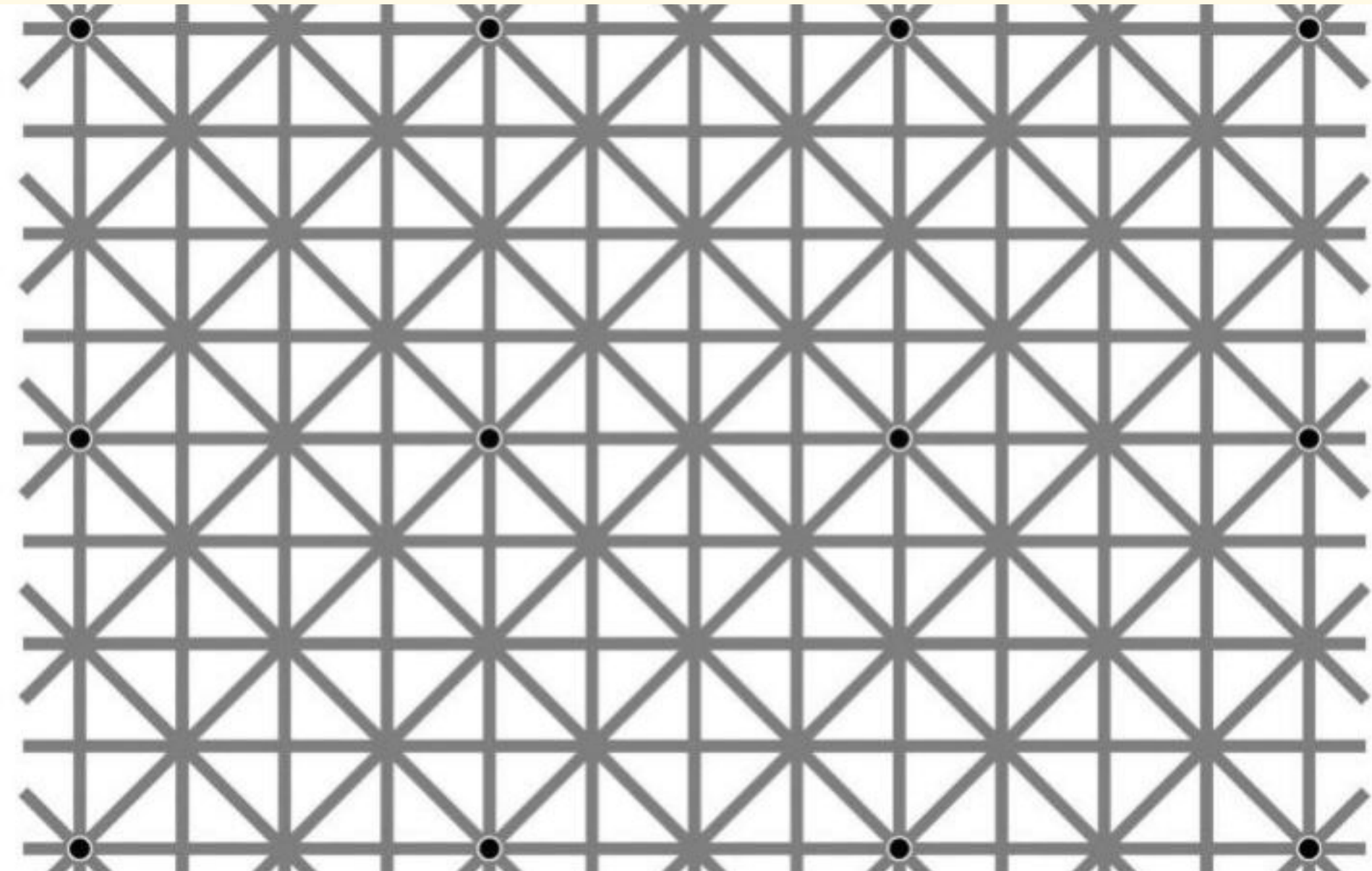
See anything unusual in this pile of wood?

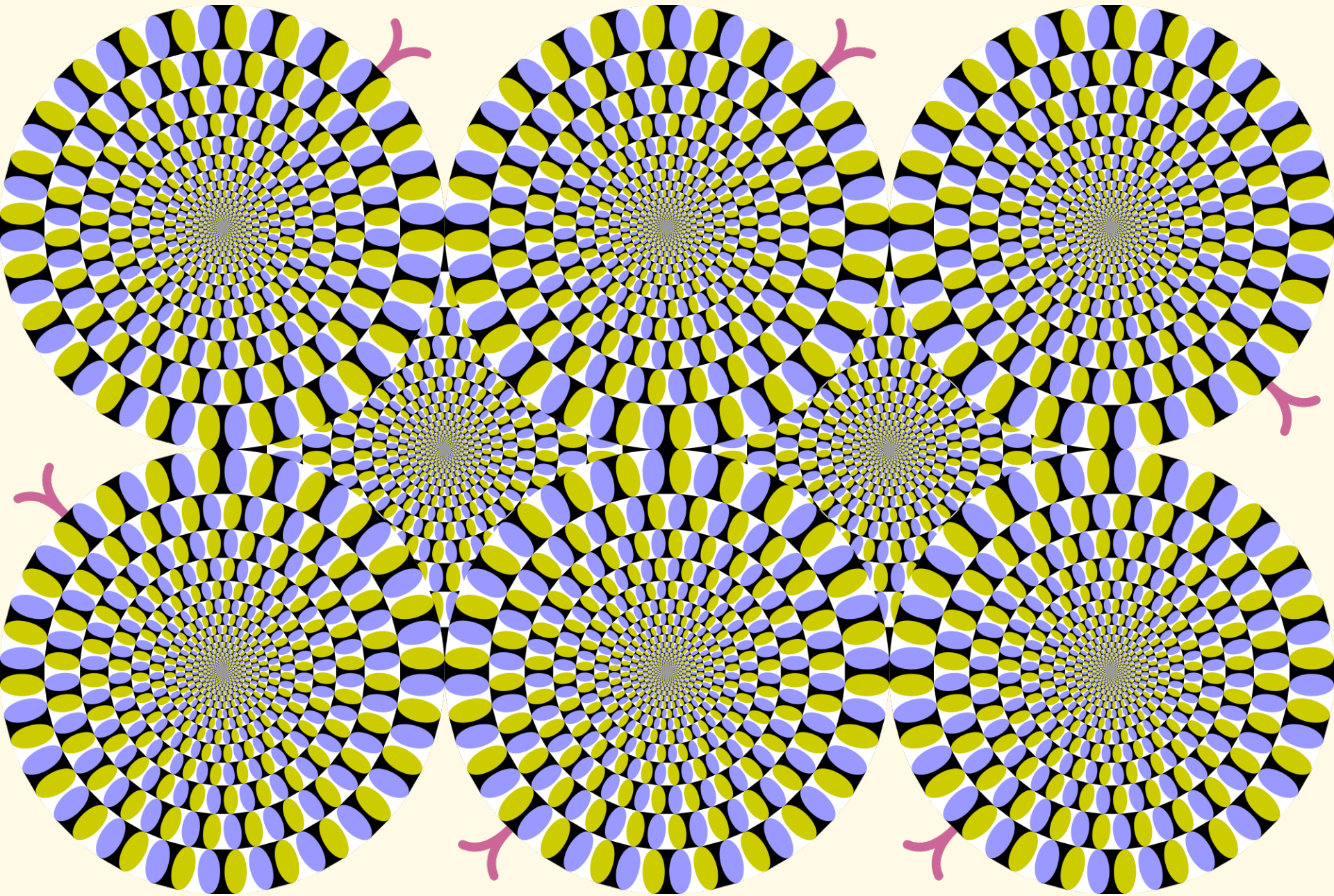


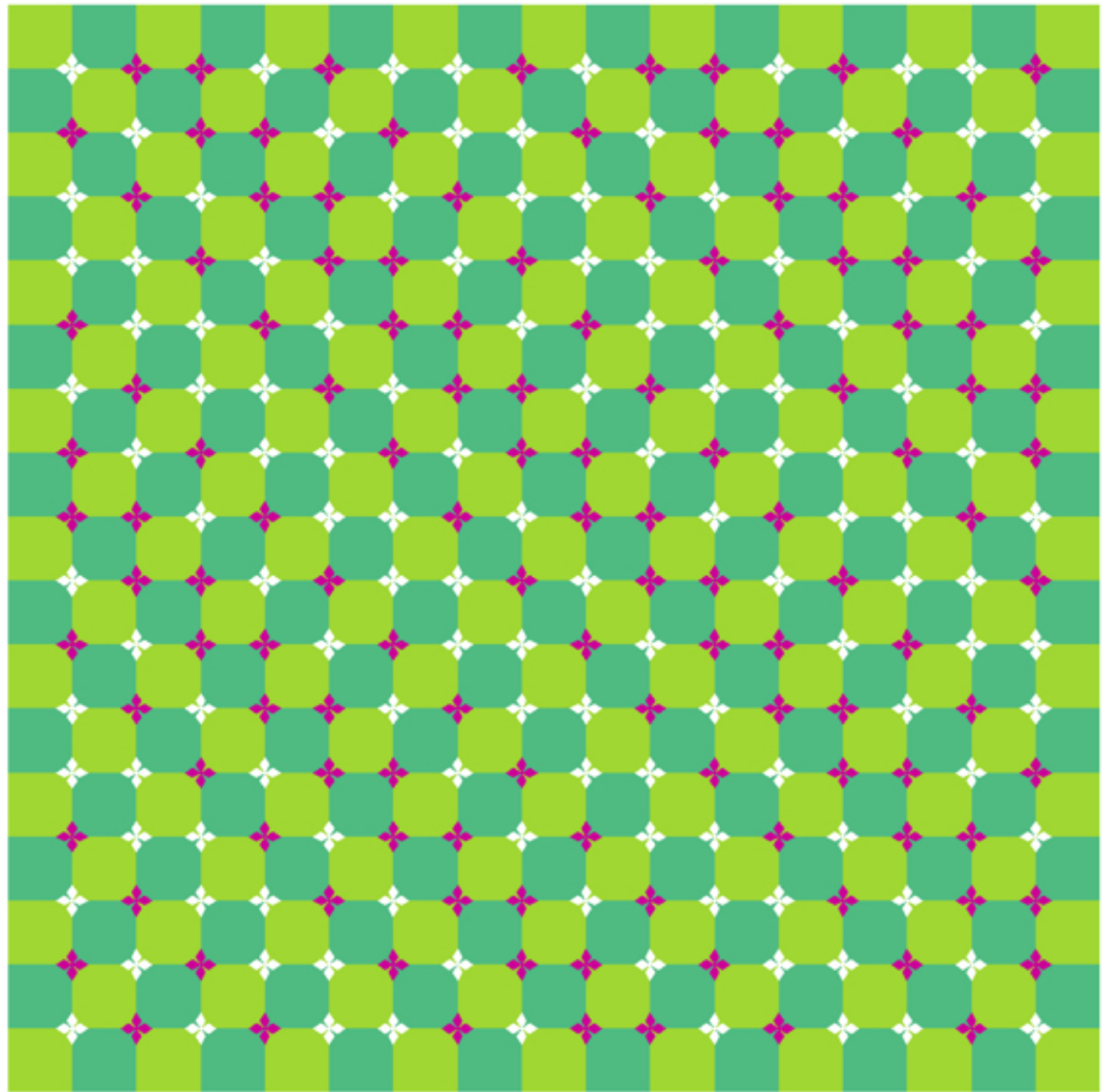
See
anything
unusual
in this
brick
wall?

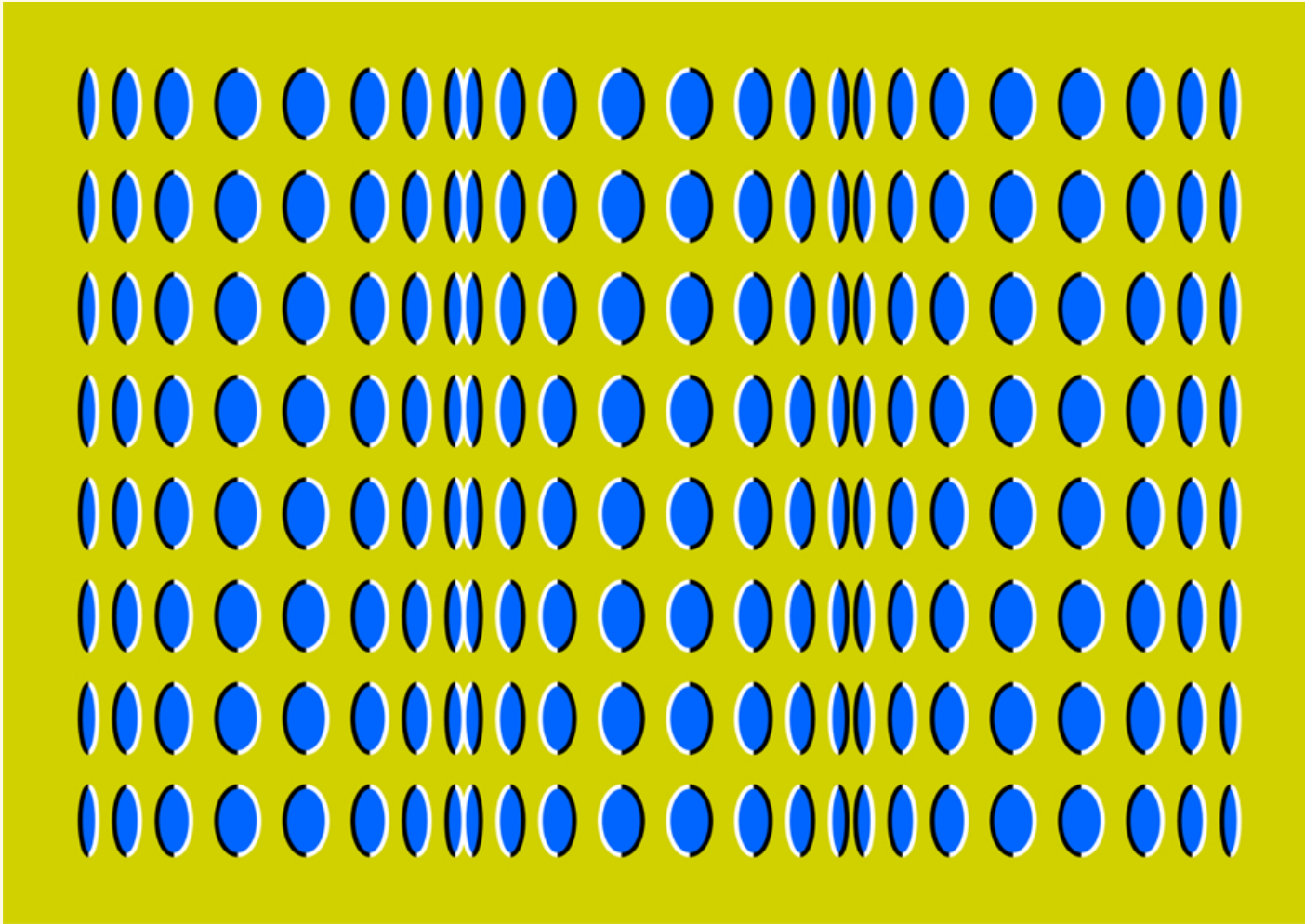


Perceptual Illusions









Visual Encoding

Marks and Channels define how salient aspects of your data is “encoded” (i.e., represented) visually

Marks: Basic geometric elements, or “primitives,” that depict items or links between items.

Channels: Controls the appearance of the primitives in order to encode its type (identity) or value (magnitude).

Marks

Marks as Items/Nodes

➔ Points



➔ Lines



➔ Areas

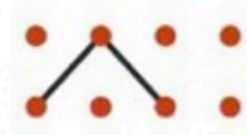


Marks as Links

➔ Containment



➔ Connection



Channels

→ Position

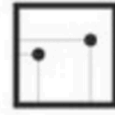
→ Horizontal



→ Vertical



→ Both



→ Color



→ Shape



→ Tilt

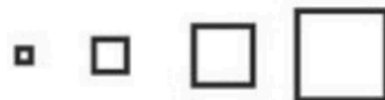


→ Size

→ Length



→ Area



→ Volume



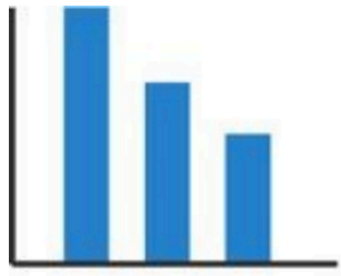
Visual Encoding

Particular combinations of marks and channels are more effective more particular tasks.

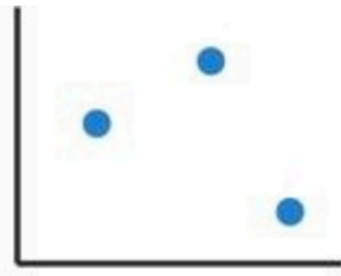
Psychophysics – or the study of human perception – helps to inform design choices regarding which marks and channels to use.

Despite this body of knowledge, choosing visualization elements is very much an art as well as a science.

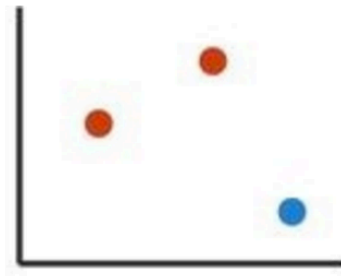
Channels



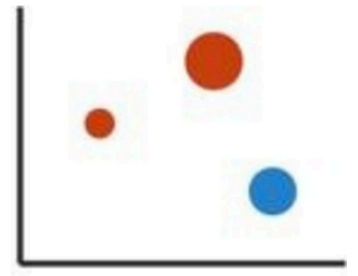
(a)



(b)



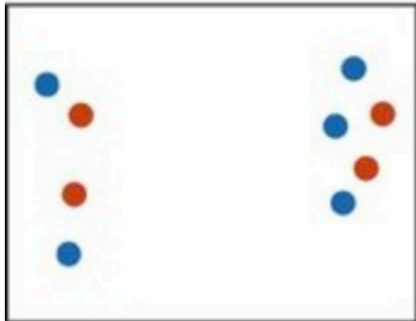
(c)



(d)

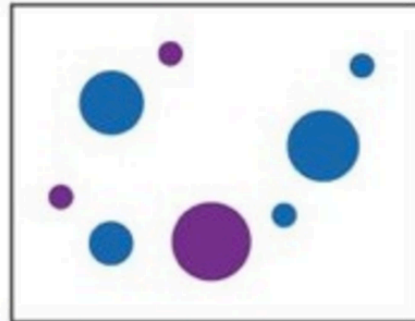
Channels

Position
+ Hue (Color)



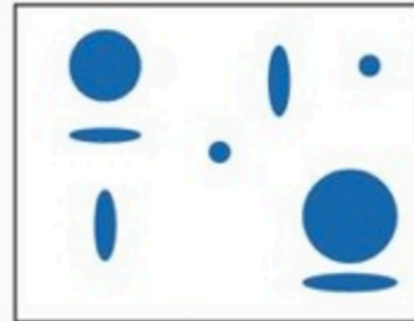
Fully separable

Size
+ Hue (Color)



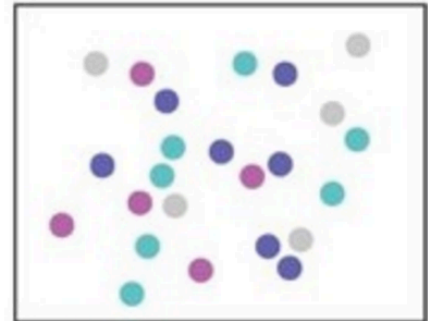
Some interference

Width
+ Height



Some/significant
interference

Red
+ Green



Major interference

Principle of Expressiveness

Your visualization should express *all of the information* available in the dataset attributes.

Your visualization should express *only the information* available in the dataset attributes.

- If your data is orderable, then you should use an encoding that makes the order obvious.
- If your data is not orderable, then your encoding should not give the impression that it is.

Principle of Effectiveness

The most **important** attributes are the **most noticeable** and the most **prevalent**.

Channels

➔ 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) 

Same Same

➔ Identity Channels: Categorical Attributes

Spatial region 

Color hue 

Motion 

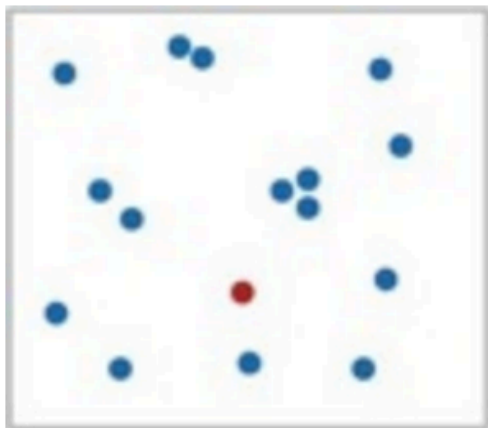
Shape 

Most Effectiveness Least

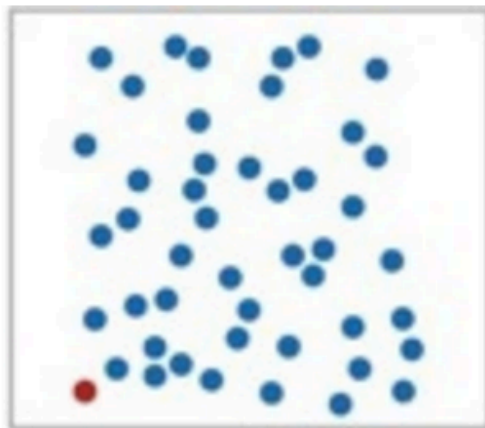
Effectiveness =

- **Accuracy** – how well can we interpret the channel?
- **Discriminability** – how many levels or types can you easily distinguish via your channel?
- **Separability** – how much interference is there with other channels?
- **Popout** – Can you see distinctions preattentively?
- **Grouping** – Does the channel promote the ability to infer relationships and clusters easily

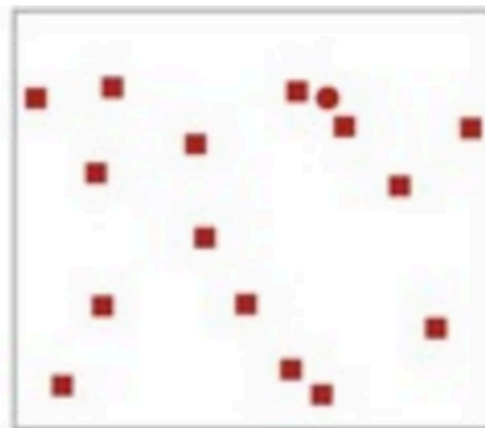
Pop-out



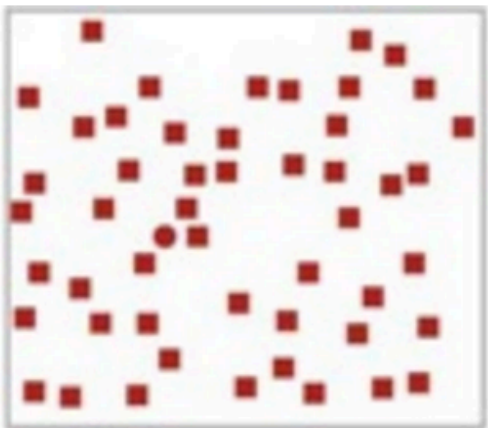
(a)



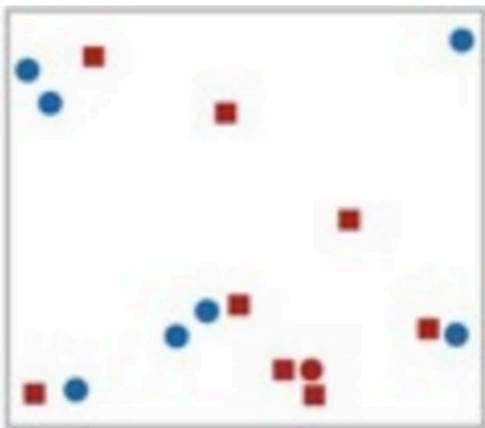
(b)



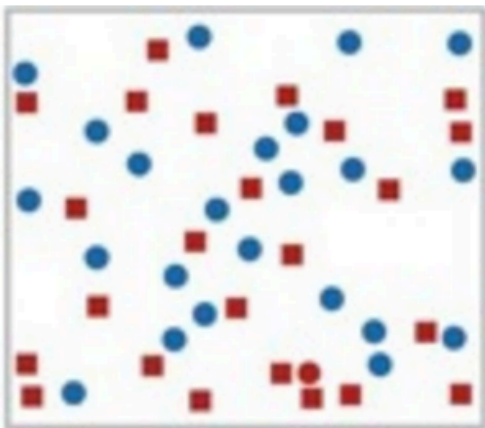
(c)



(d)

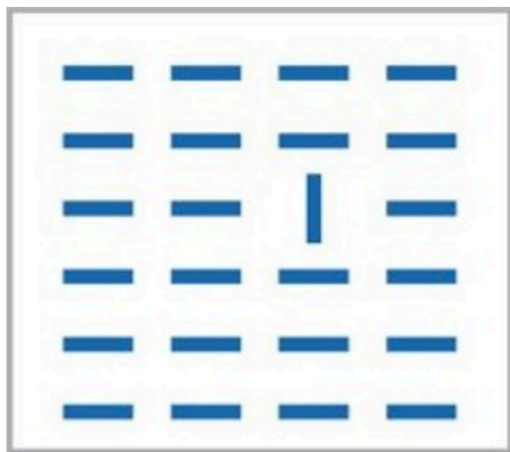


(e)

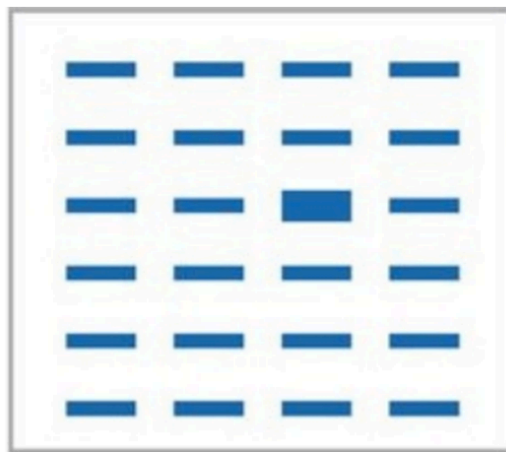


(f)

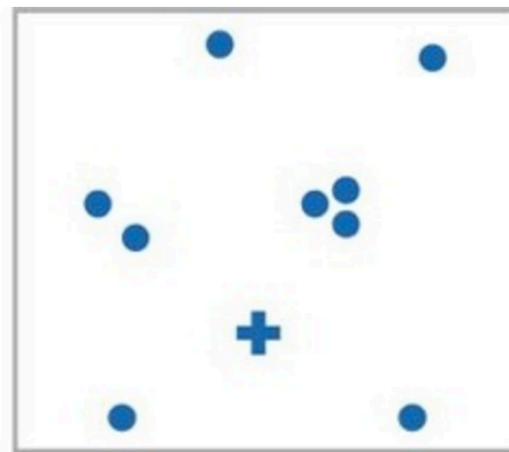
Pop-out



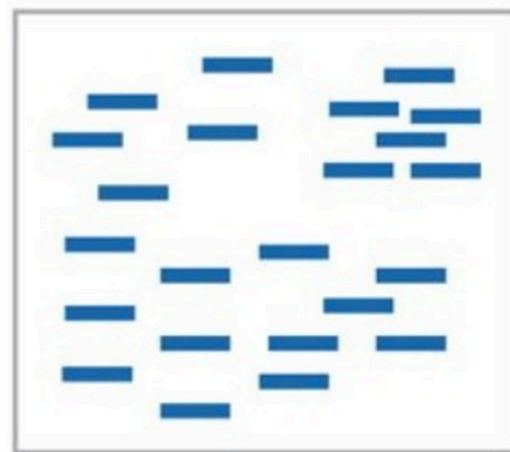
(a)



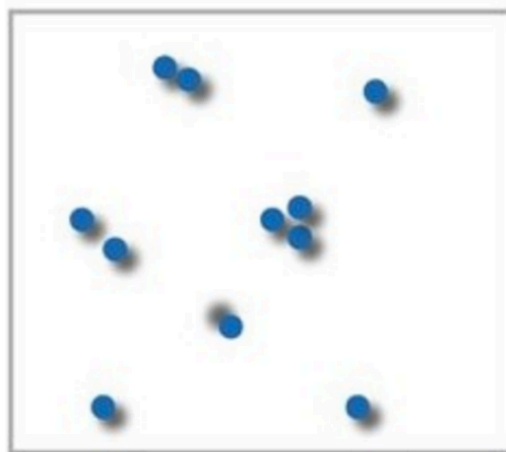
(b)



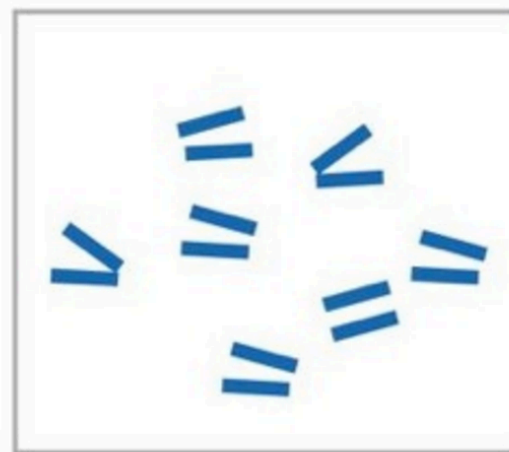
(c)



(d)



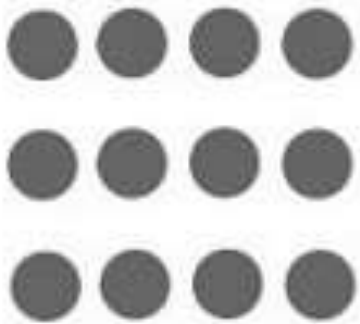
(e)



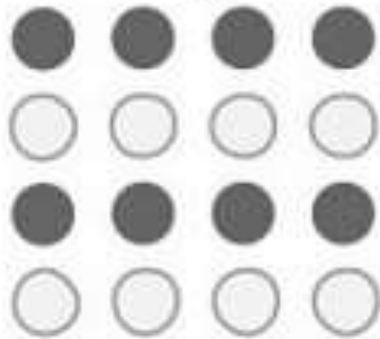
(f)

Grouping

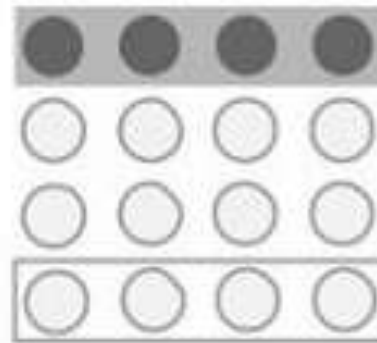
Proximity



Similarity



Enclosure



Symmetry



Closure



Continuity



Connection

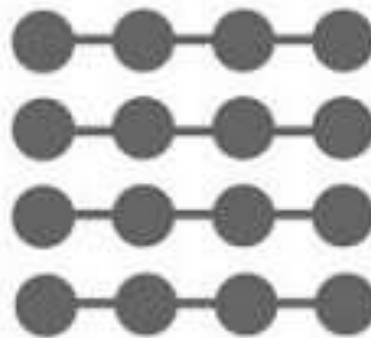


Figure & ground



Exercise

Download a visualization from the 2014 Best Infographics, posted on Piazza.

- What data is being visualized?
- What marks and channels are used?
- How expressive is the visualization (both in terms of the technical and everyday meaning)?
- How effective are the channels, in terms of: accuracy, discriminability, separability, etc)
- What elements are used in the visualization that aren't described by Munzner's marks and channels, but still seem to serve as an element of visual communication?

For next week

For Tuesday:

Read the Munzner text, Chapters 4 and 6

Tuesday and/or Thursday:

I will go over your projects and introduce
Project 2