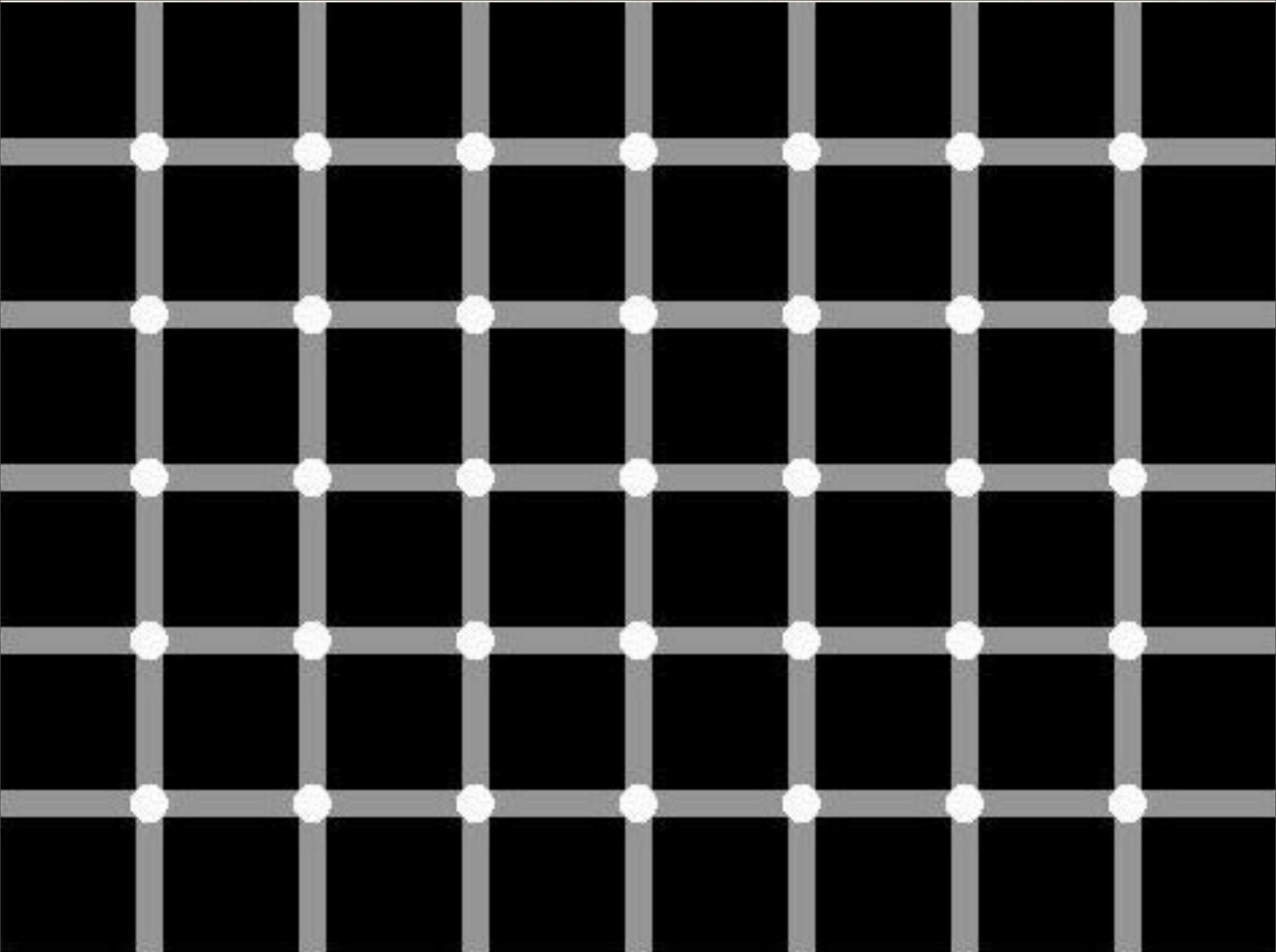
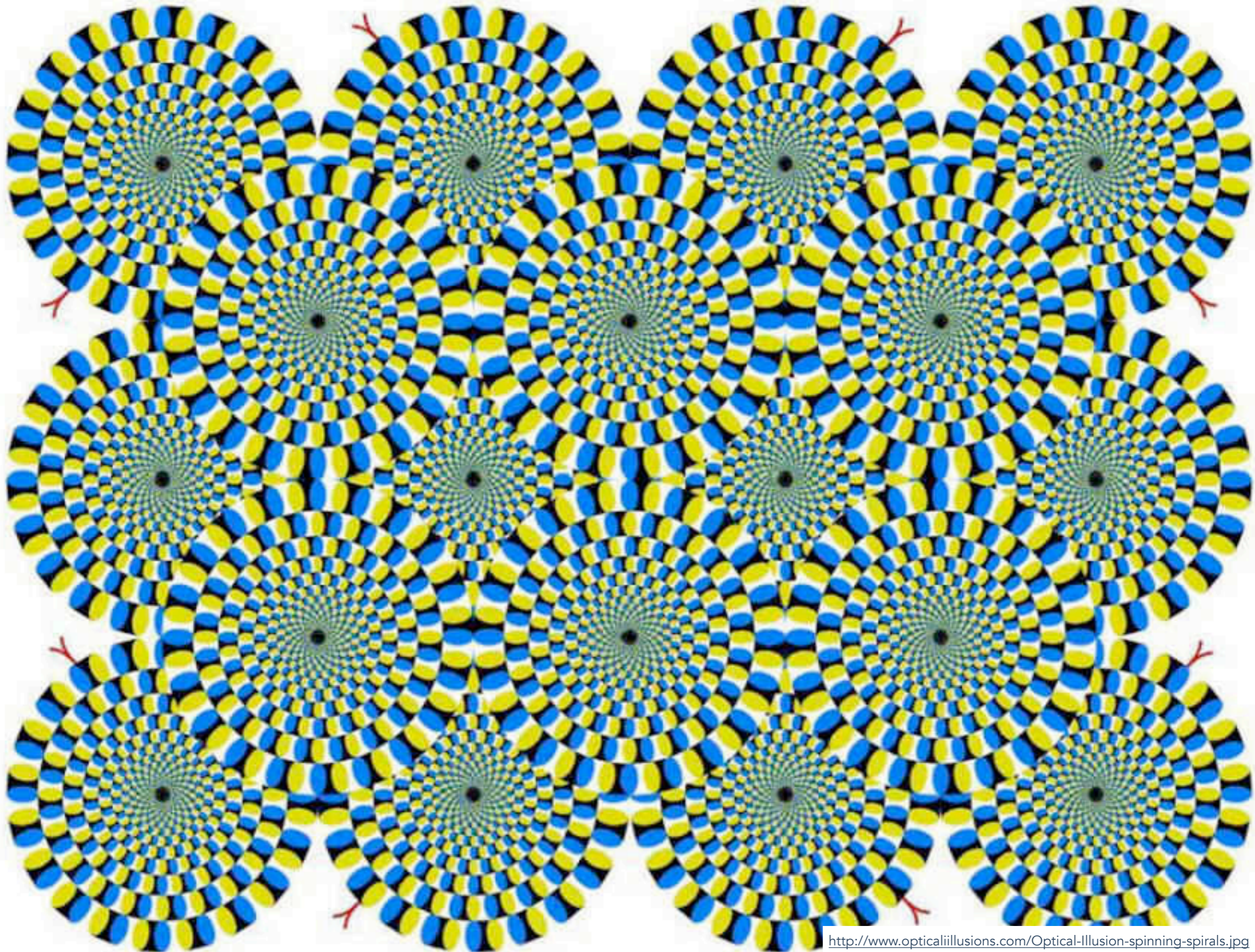


Perception

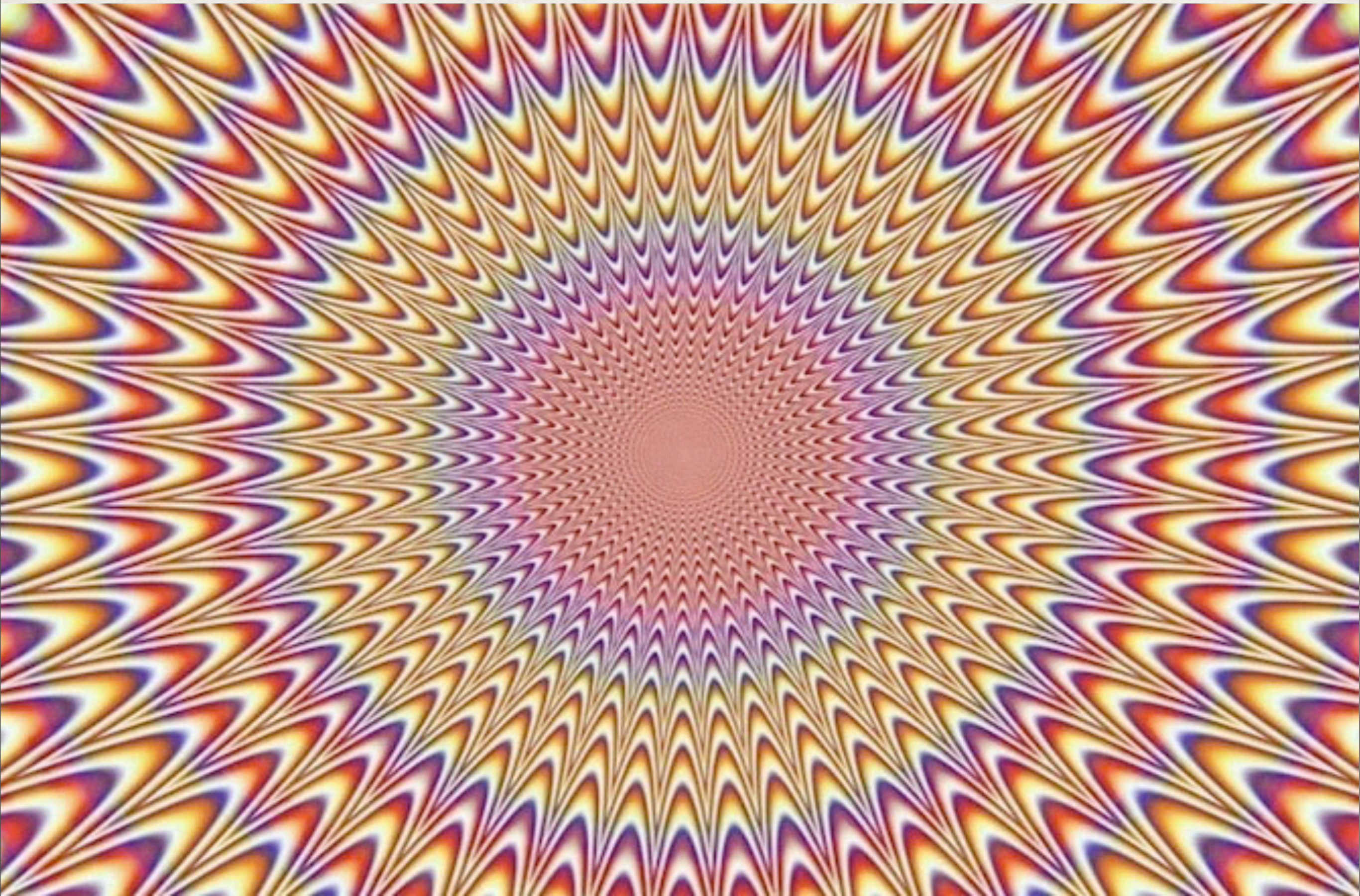
C. Andrews

2014-02-18

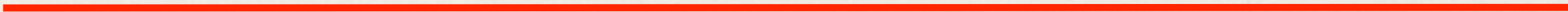
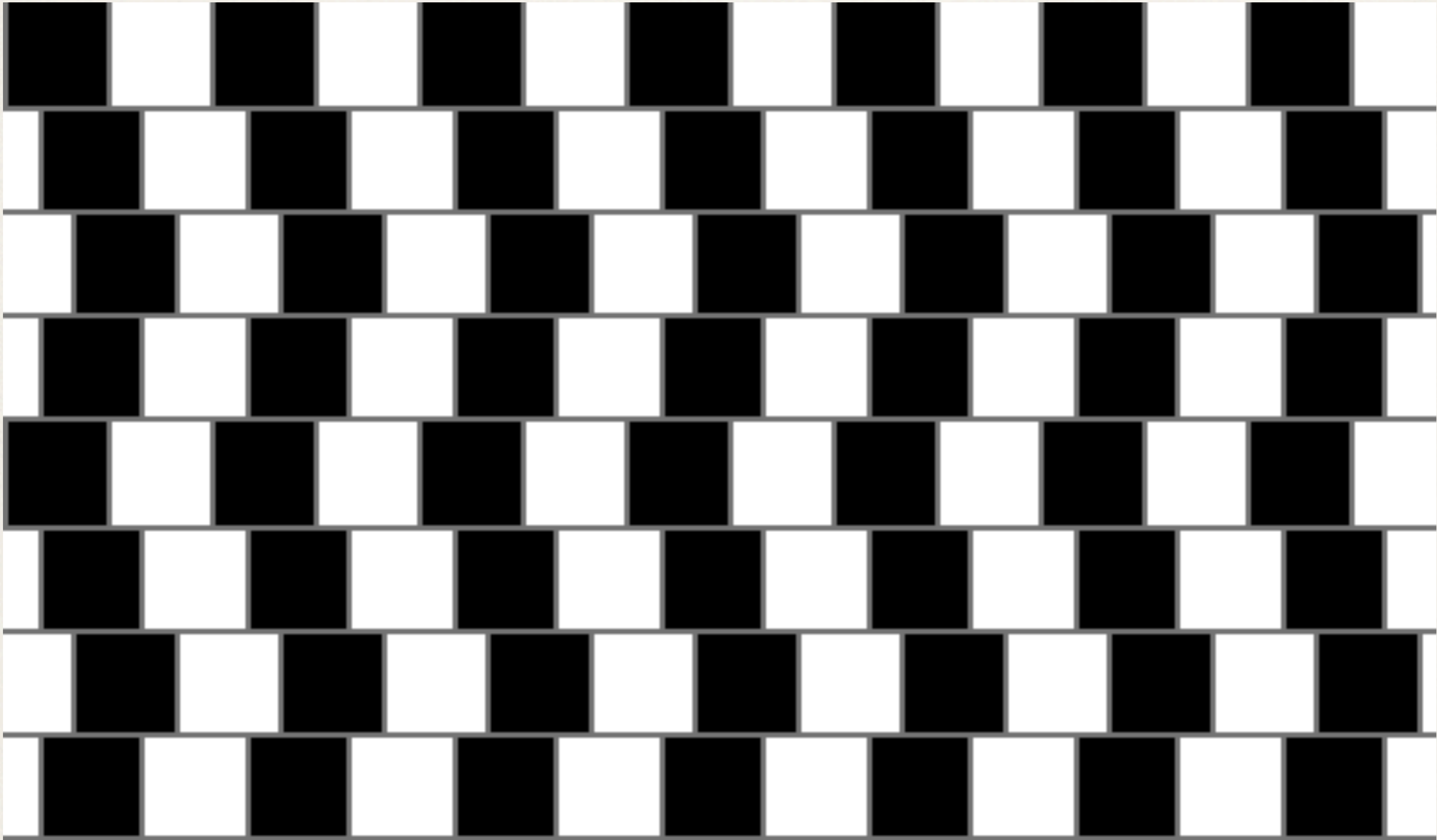


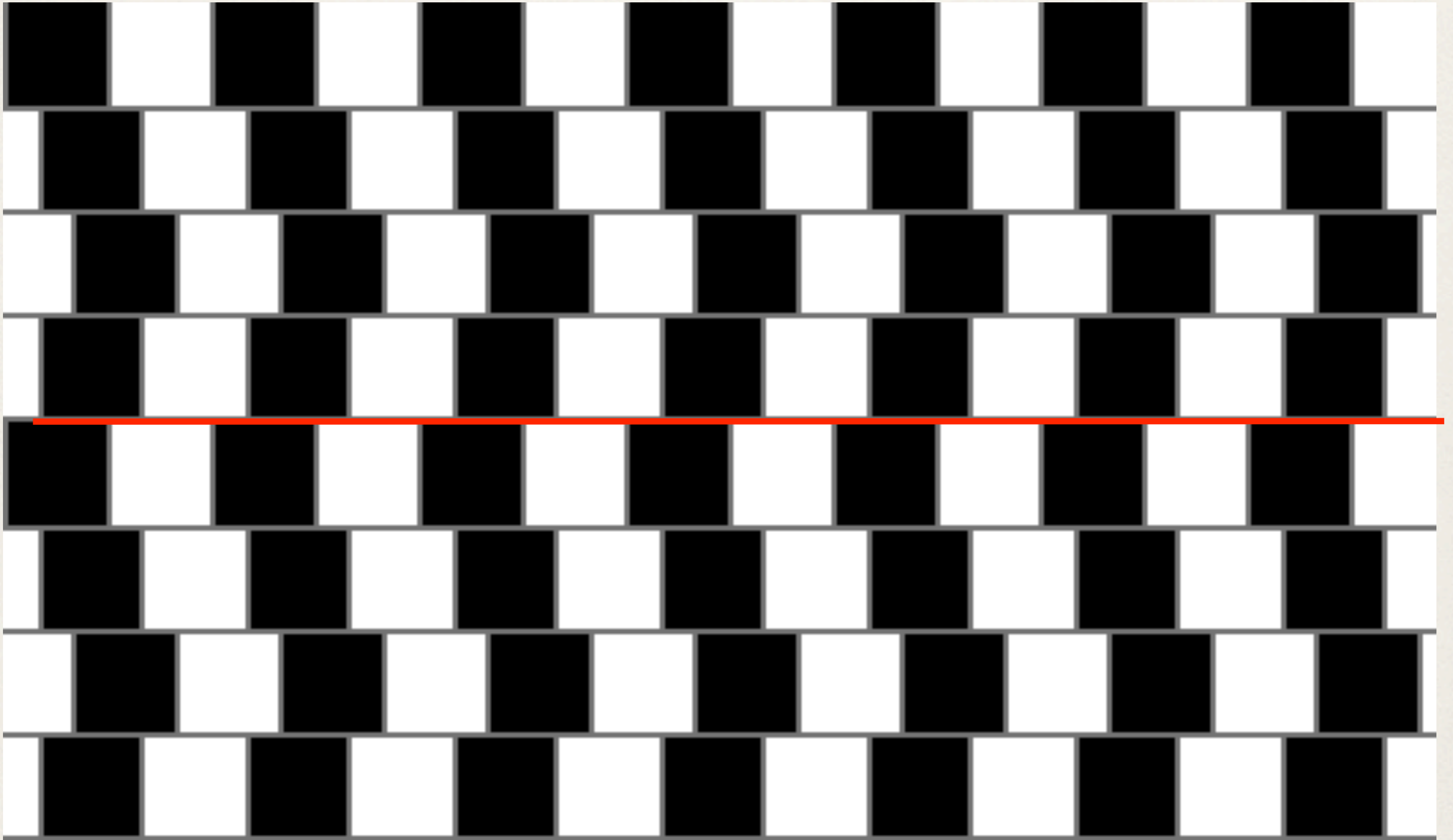


<http://www.opticalillusions.com/Optical-Illusion-spinning-spirals.jpg>



<http://static.ddmcdn.com/gif/0-optical-illusions-pulsing-burst-670.jpg>







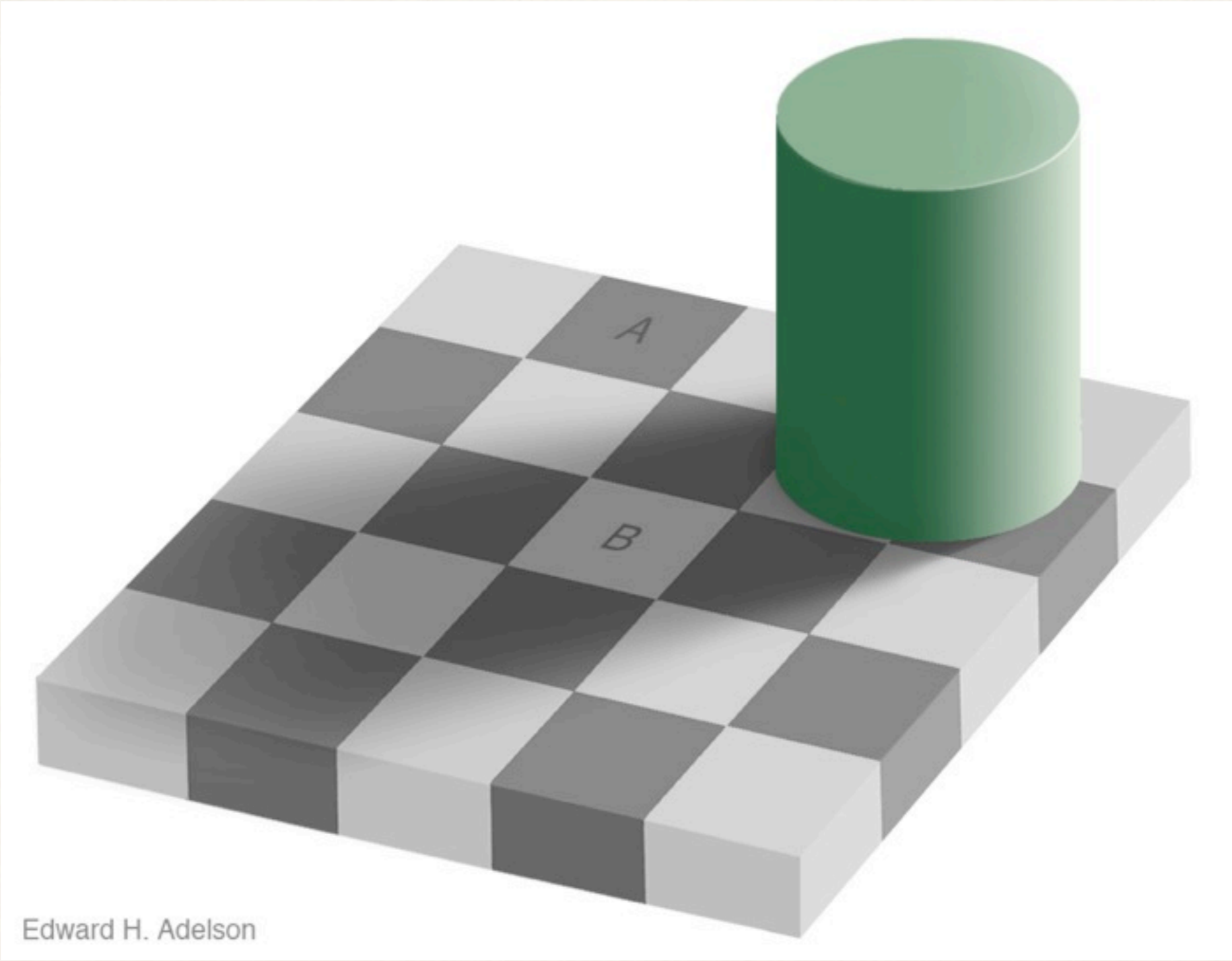
"My wife and mother in law", W.E. Hill



FUNELIXIR.COM

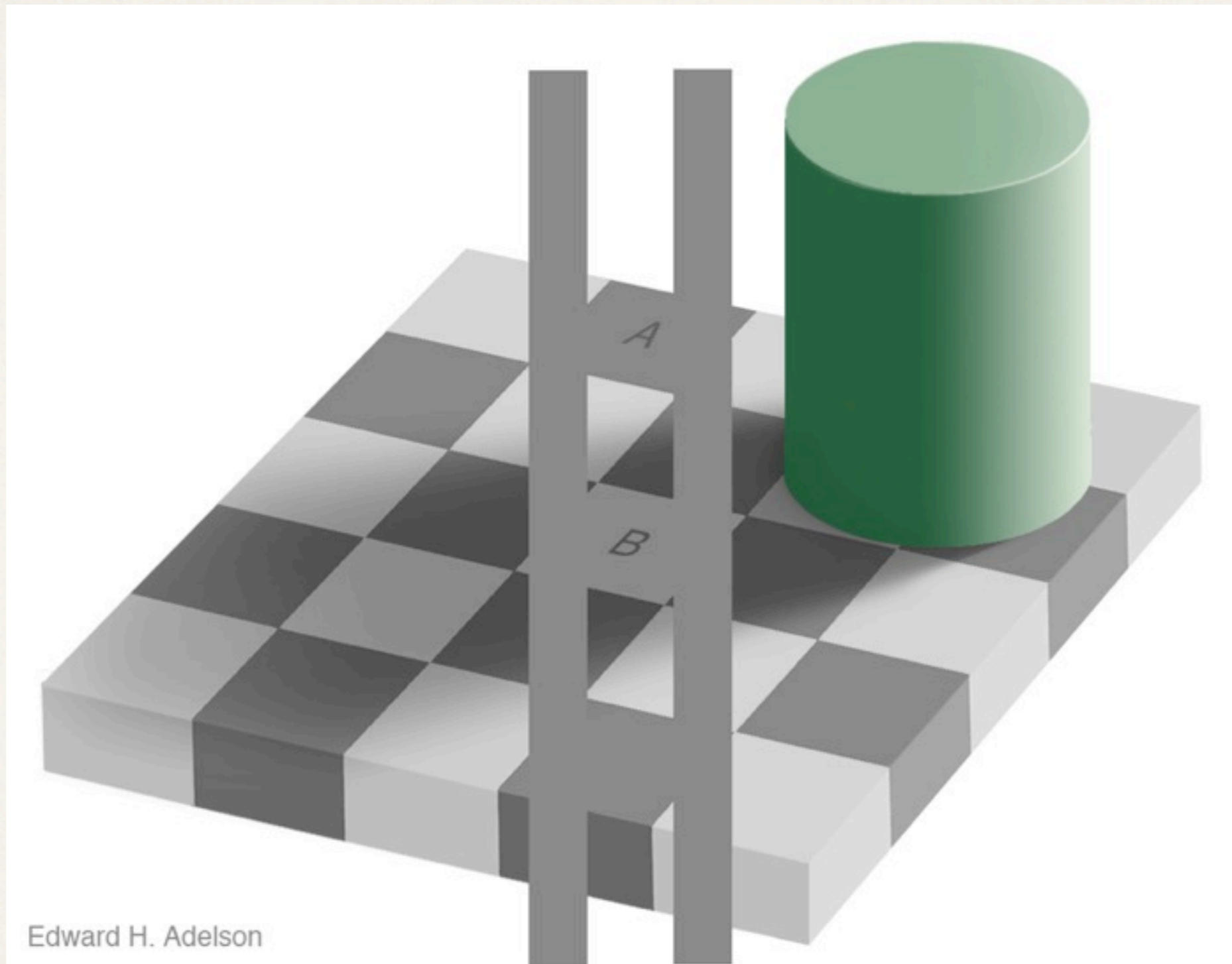


Did you see the dolphin?



Edward H. Adelson

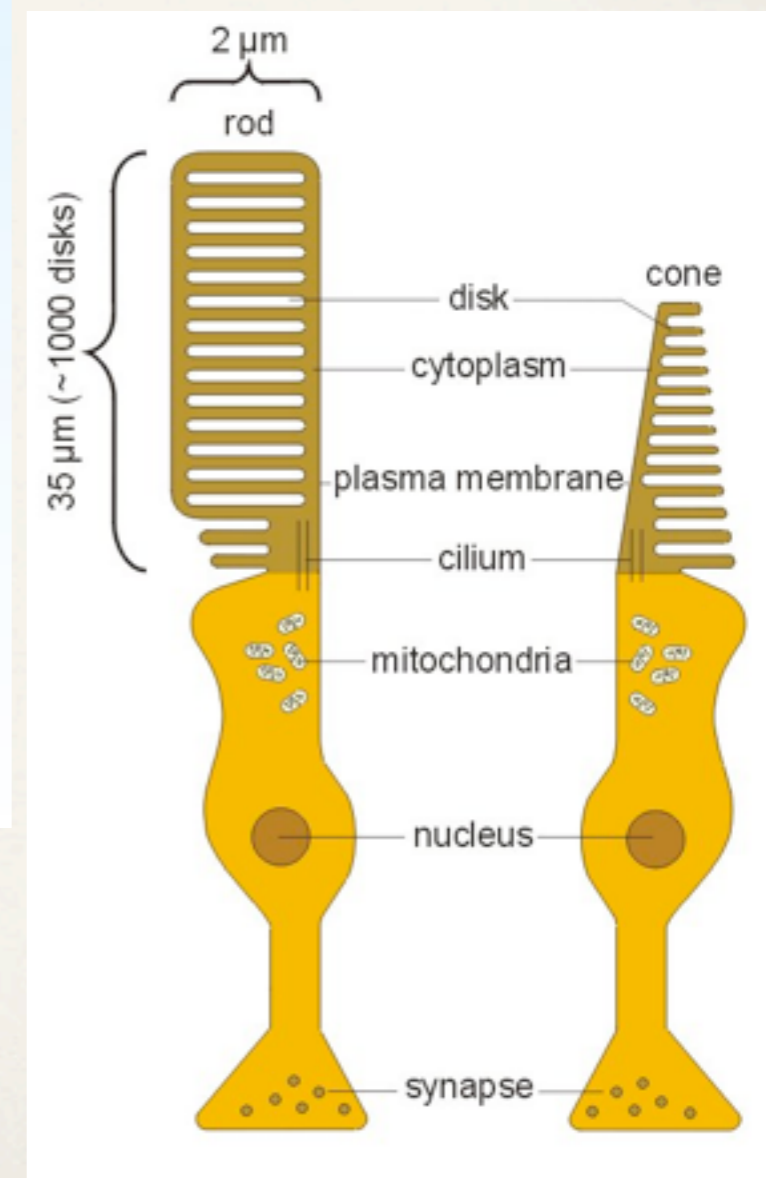
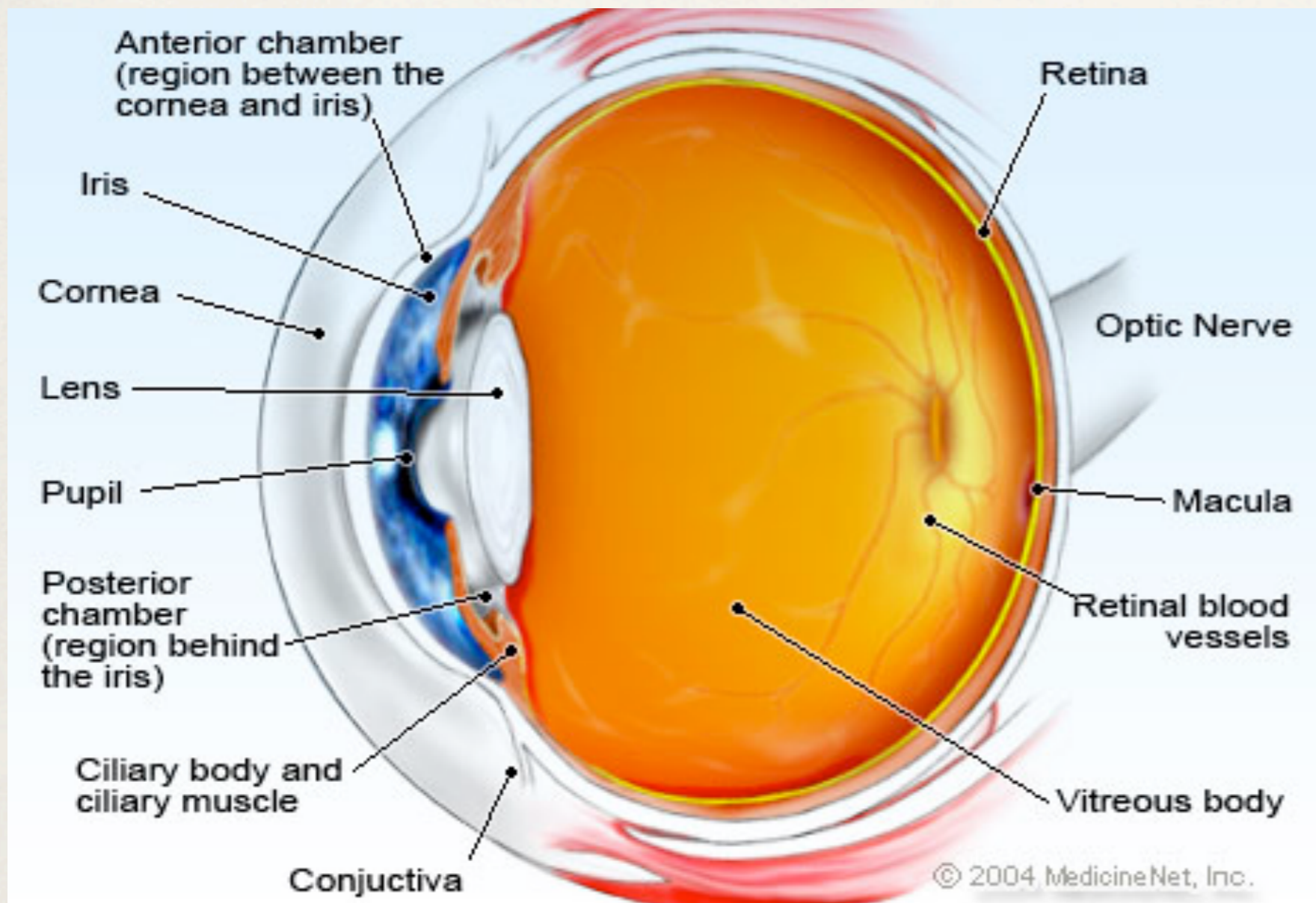
from: http://web.mit.edu/persci/people/adelson/checkershadow_illusion.html



Edward H. Adelson

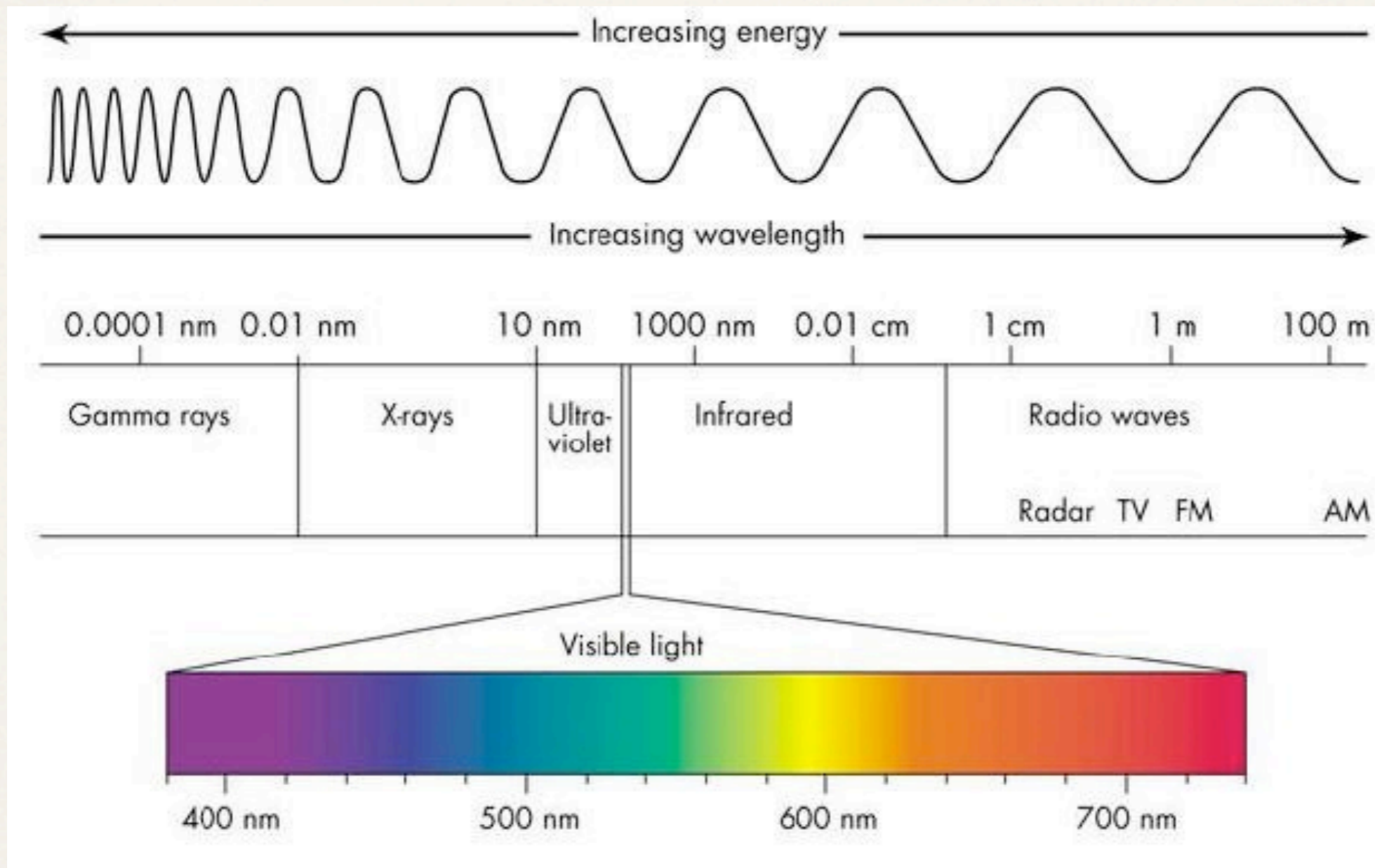
from: http://web.mit.edu/persci/people/adelson/checkershadow_illusion.html

Human eye



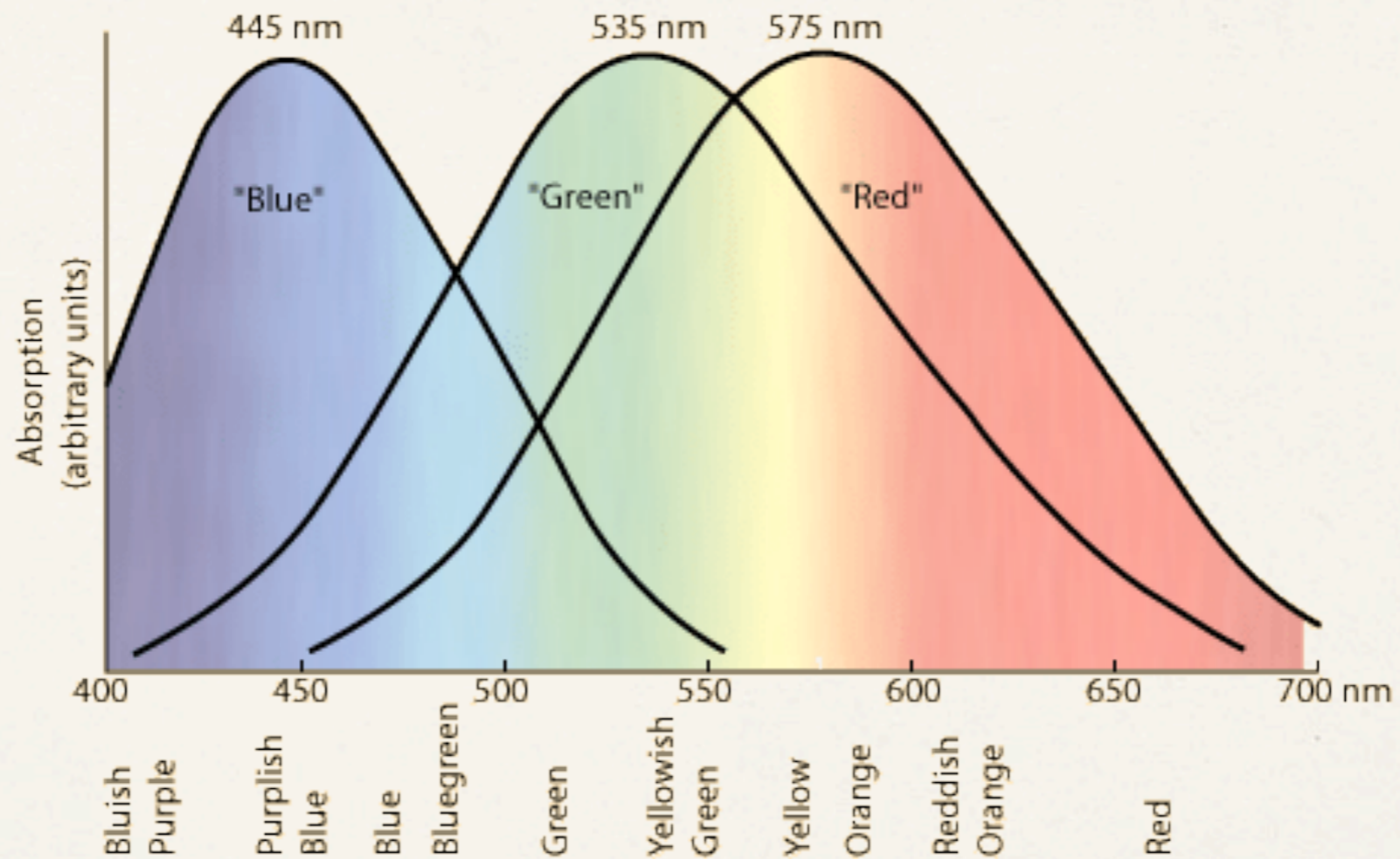
<http://www.cea1.com>

Visible light spectrum



from: <http://lumenistics.com/what-is-full-spectrum-lighting/>

Human sensitivity to color



from: <http://hyperphysics.phy-astr.gsu.edu/hbase/vision/colcon.html>

Eye movement

Conjugate eye movements

also called *pursuit* movements

eyes maintain the same angle from a normal to the face

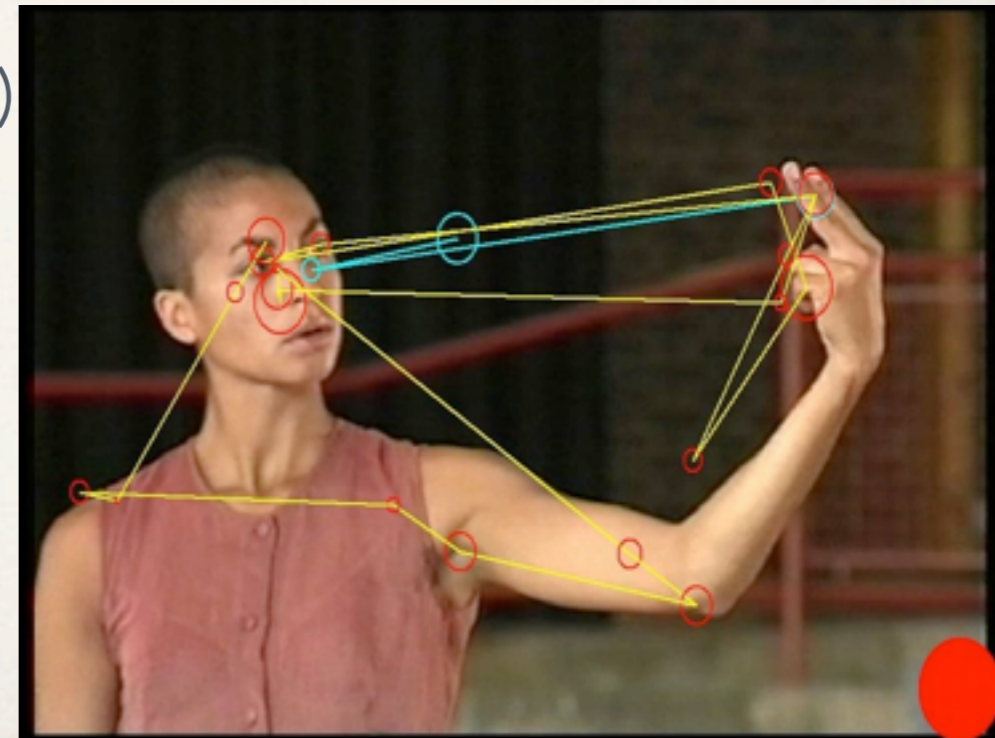
Vergence eye movements

eyes move at different angles (going cross-eyed)

Saccadic eye movements

fast movement to switch targets (25 ms to move)

suppression occurs between targets



<http://bodyinmovement.se/?pid=60&sub=41&sub2=37>

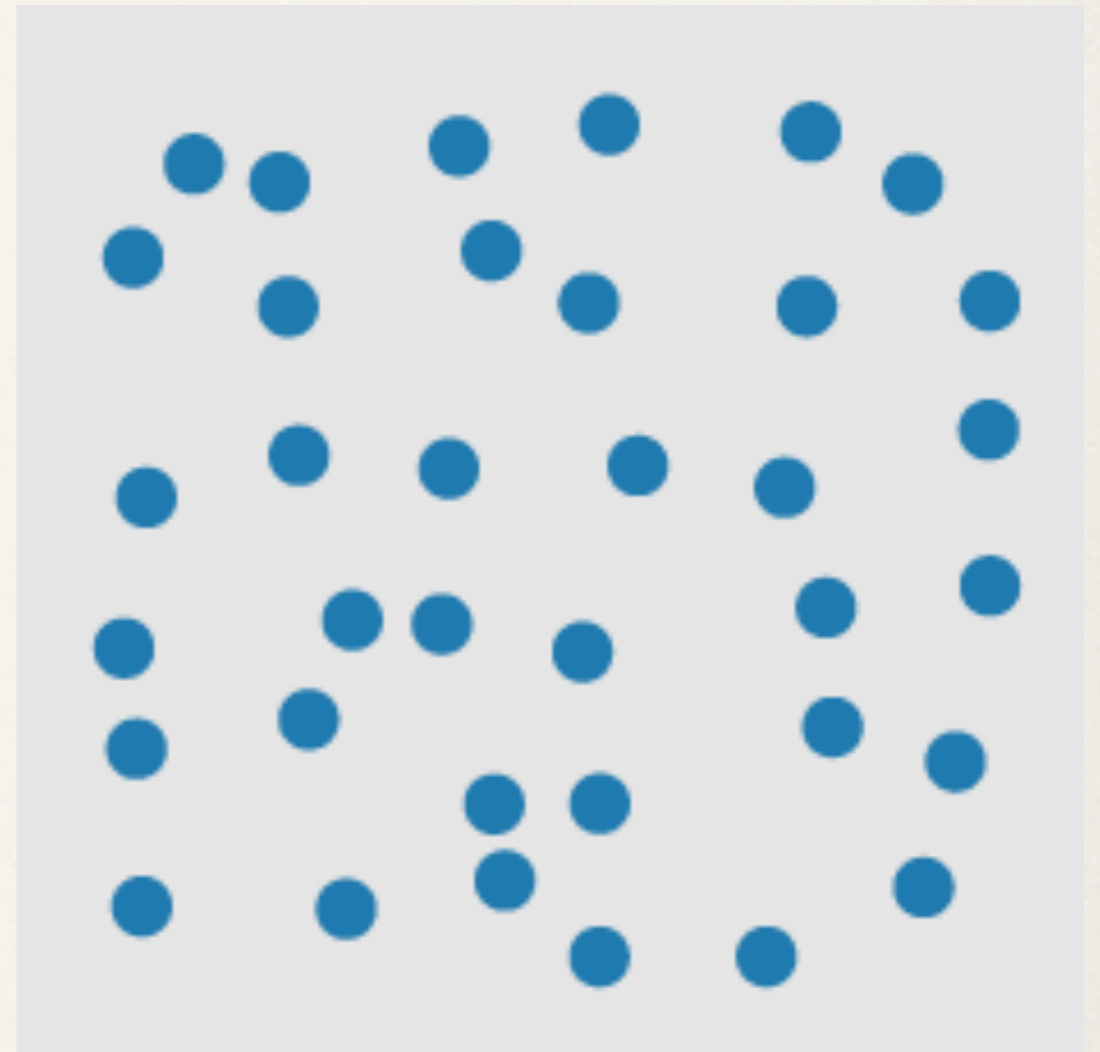
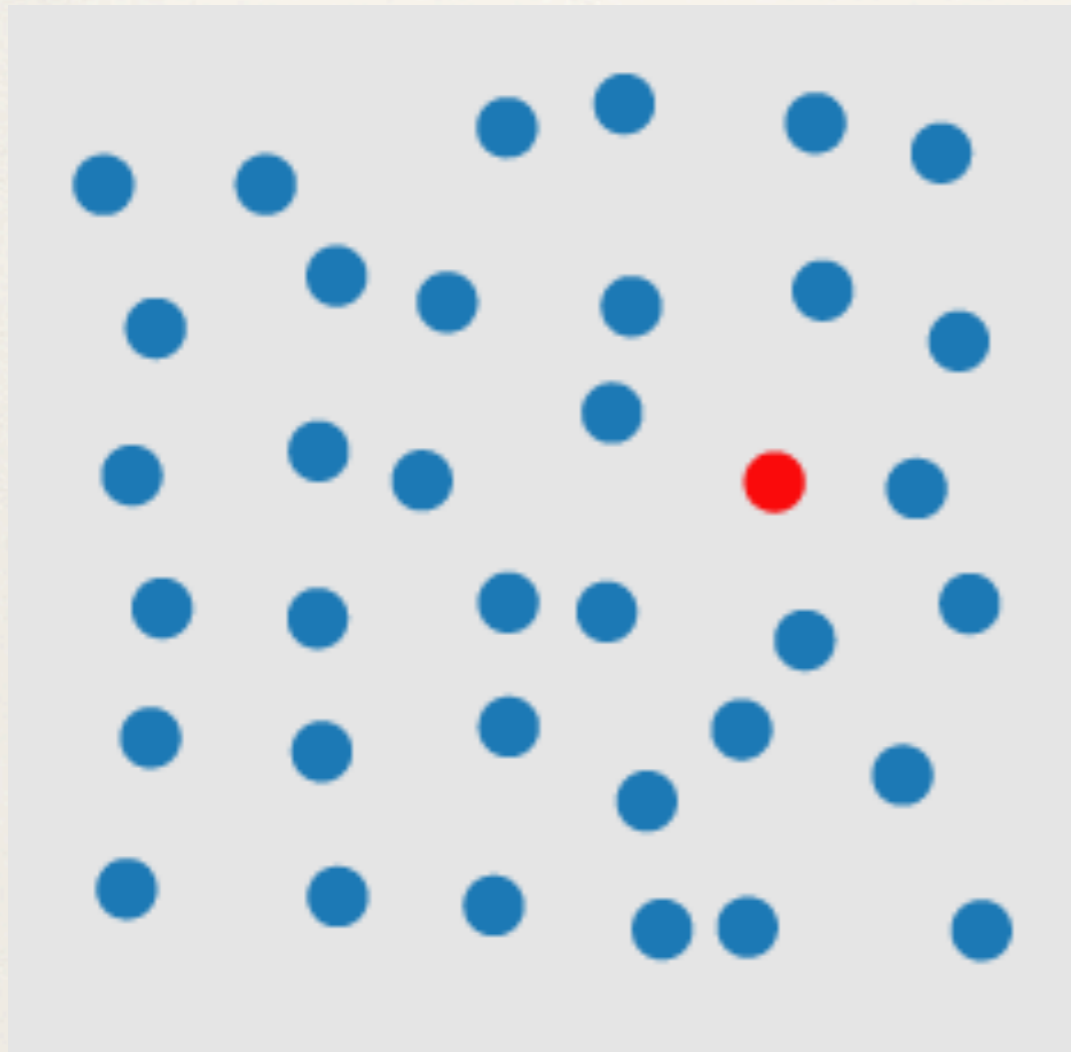
How many threes?

45929078059772098775972655665110049836645
27107462144654207079014738109743897010971
43907097349266847858715819048630901889074
25747072354745666142018774072849875310665

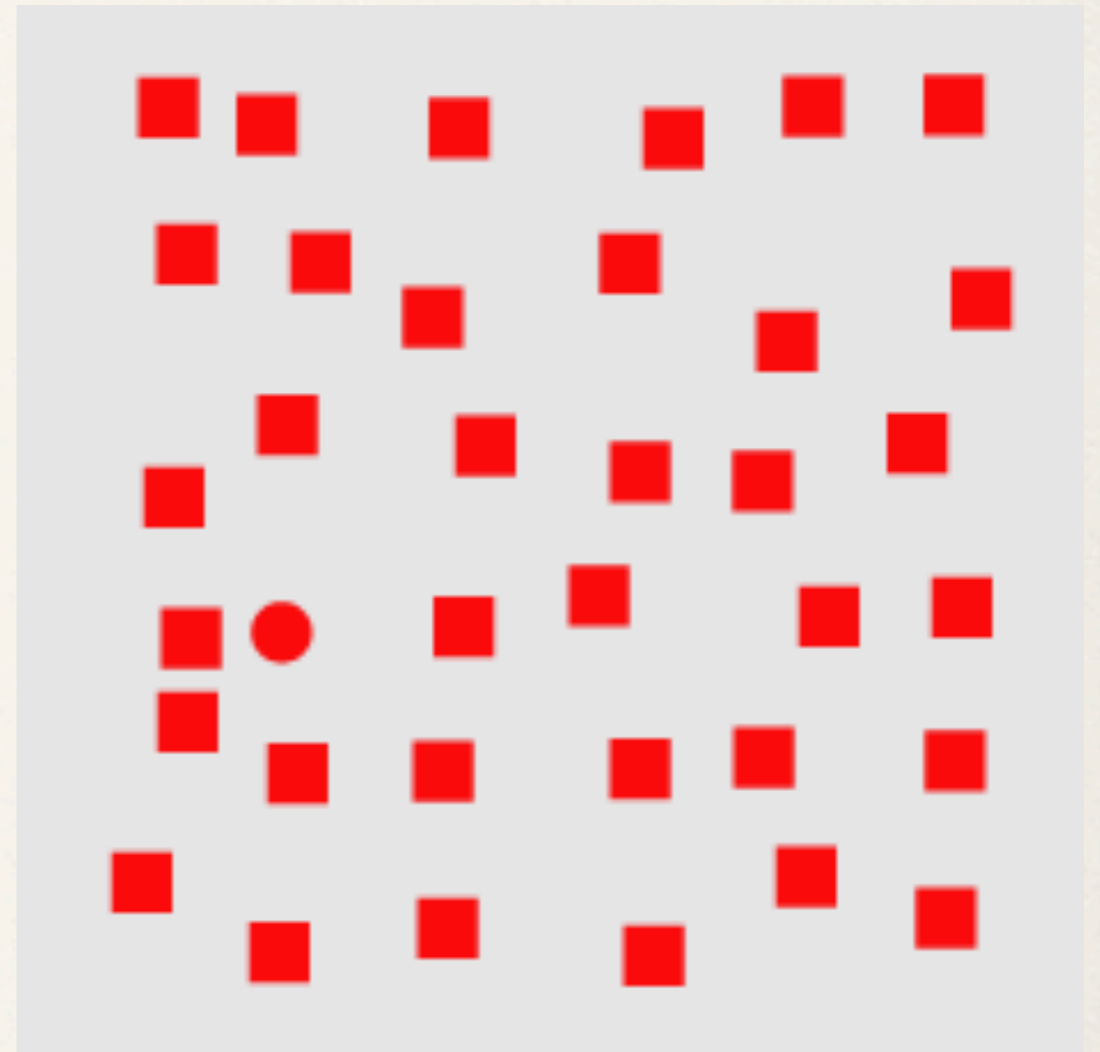
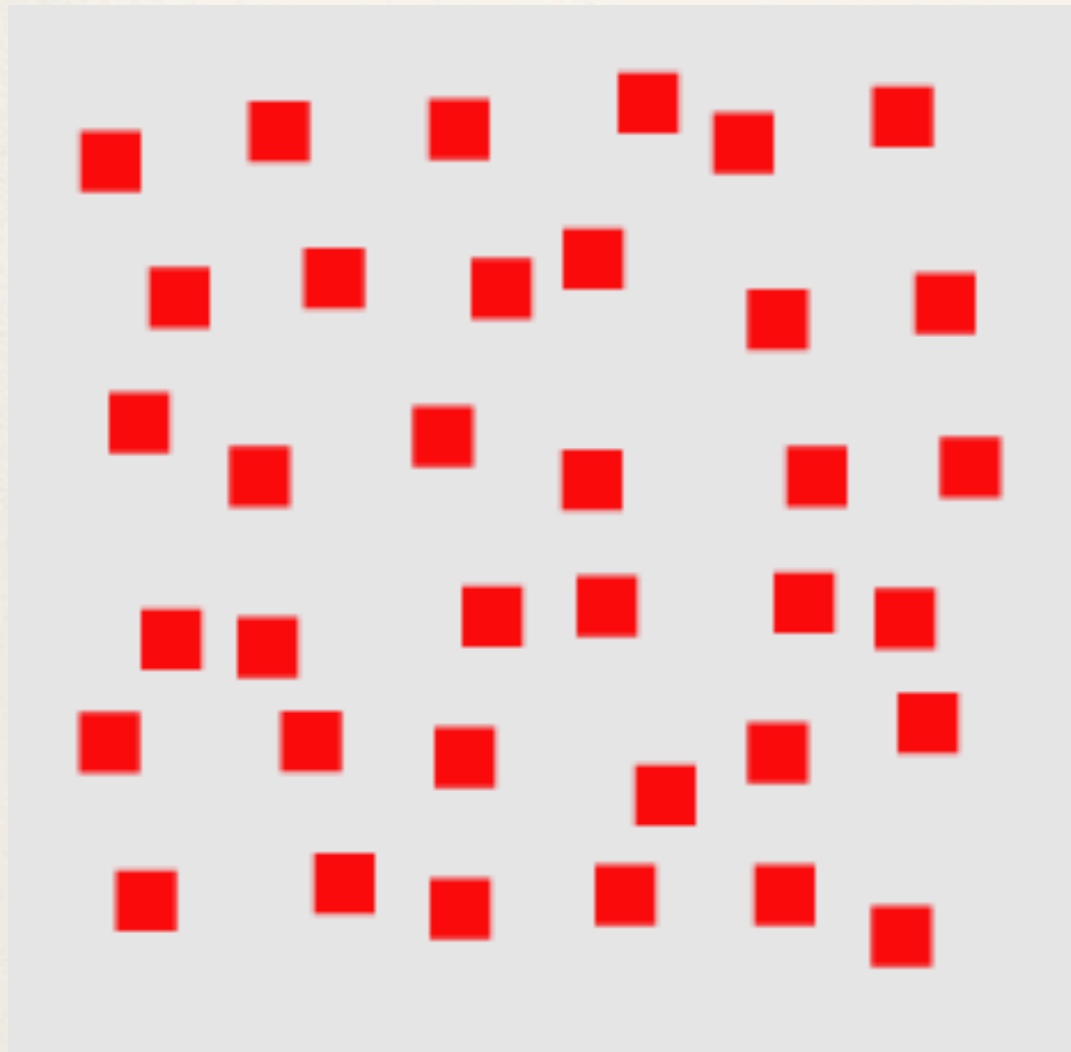
How many threes?

459290780597720987759726556651100498**3**6645
271074621446542070790147**3**810974**3**897010971
4**3**907097**3**492668478587158190486**3**0901889074
25747072**3**54745666142018774072849875**3**10665

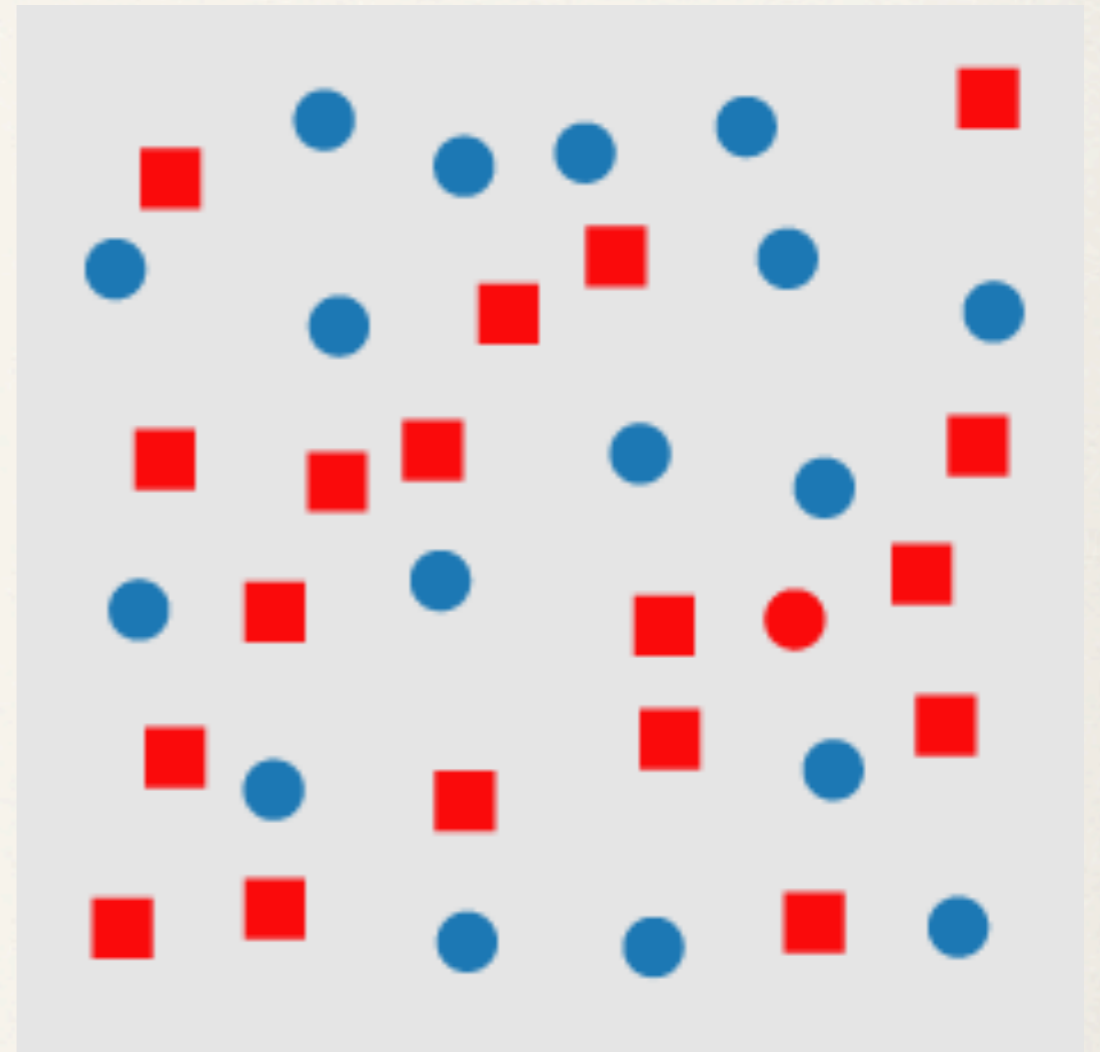
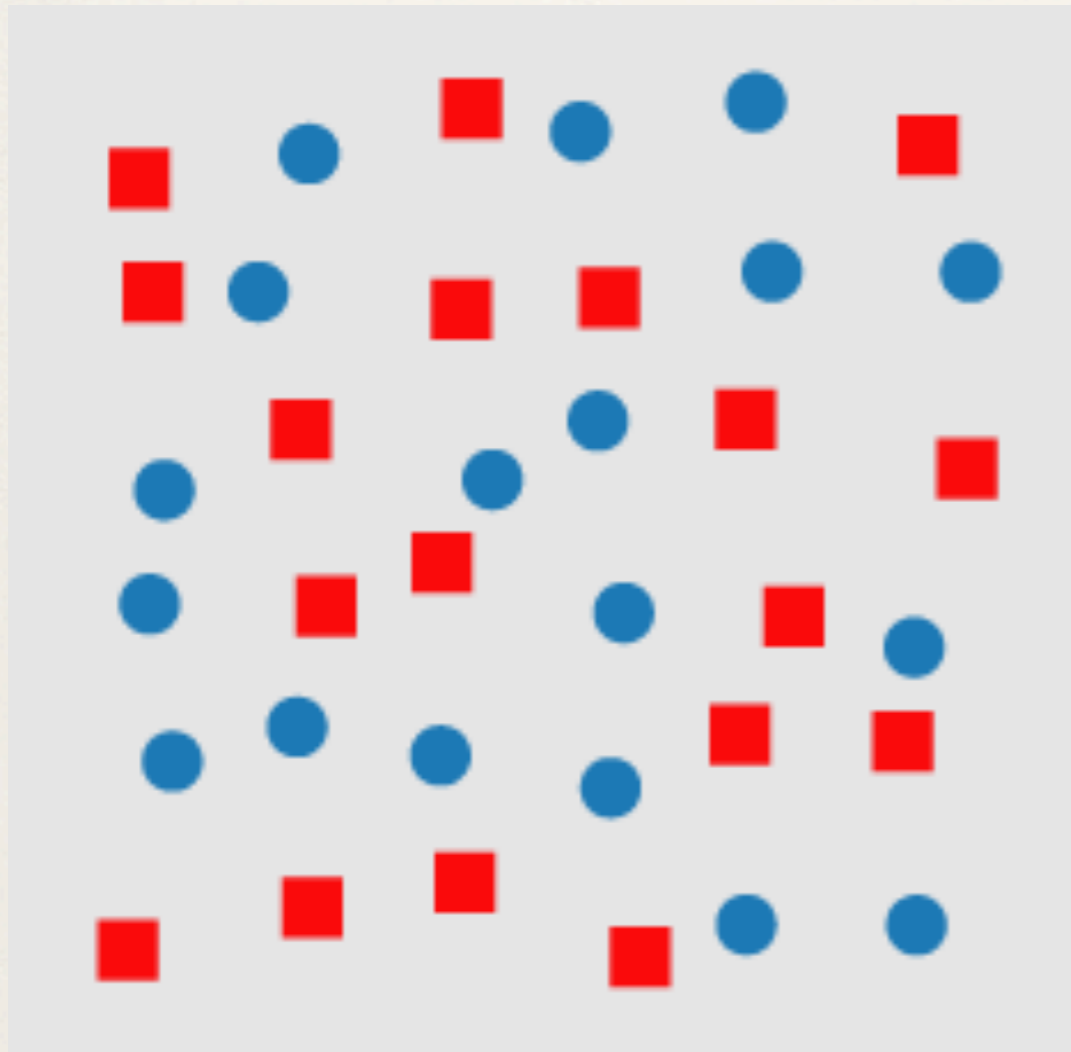
Is there a red circle?



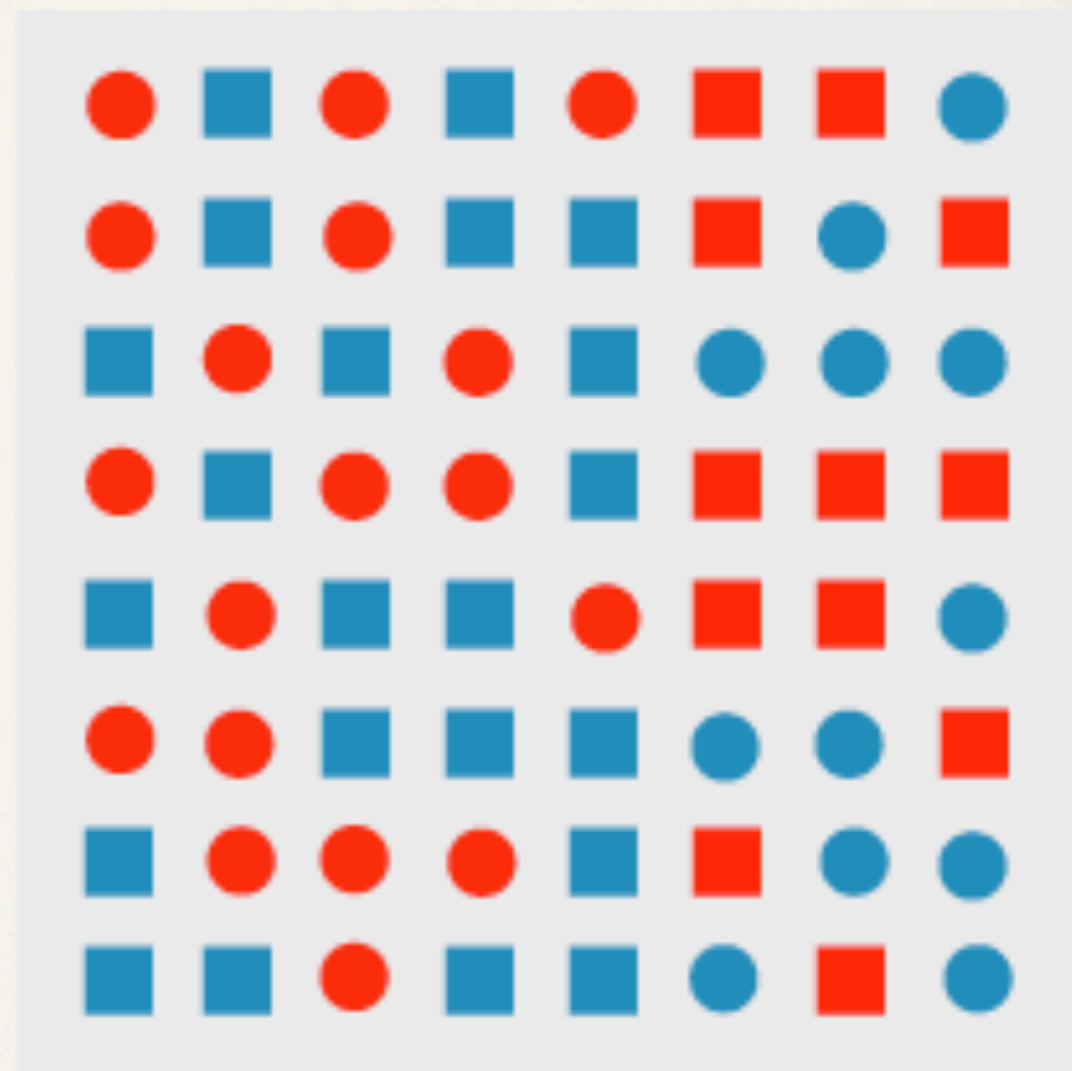
Is there a red circle?



Is there a red circle?



Is there a boundary?



Preattentive vs Attentive

pre-attentive

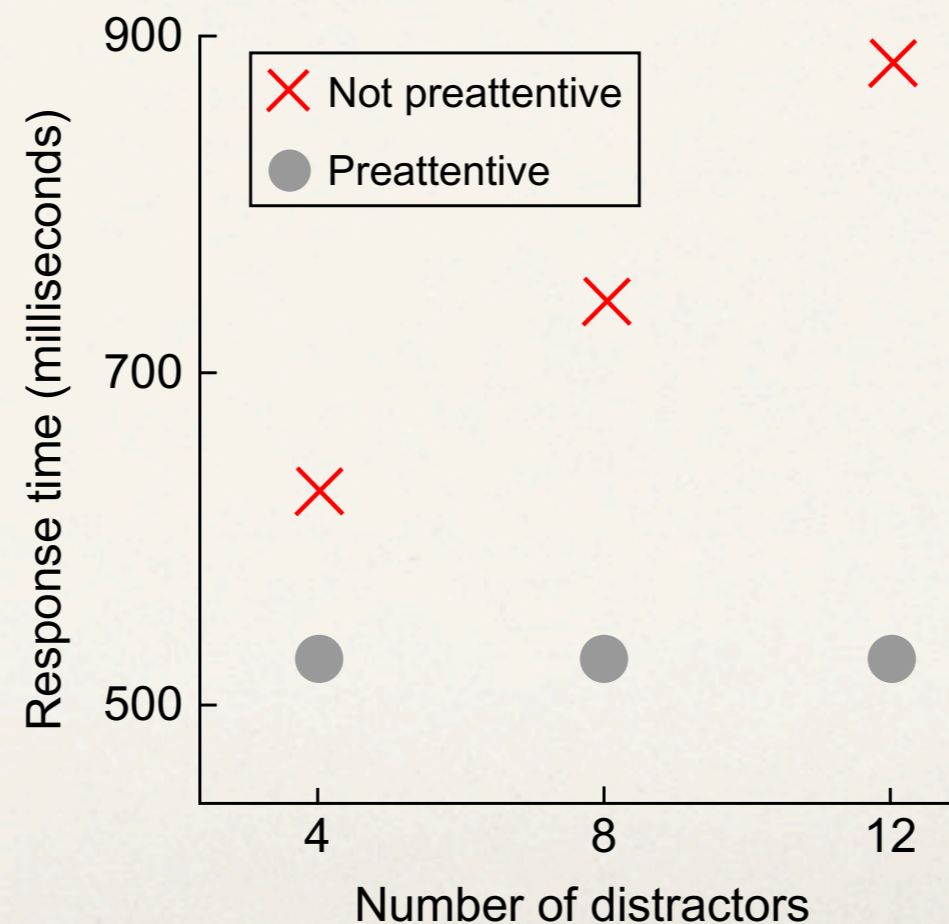
≤ 250 ms

parallel

attentive

> 250 ms

serial



Uses for preattentive processing

target detection: is a target present? where is it?

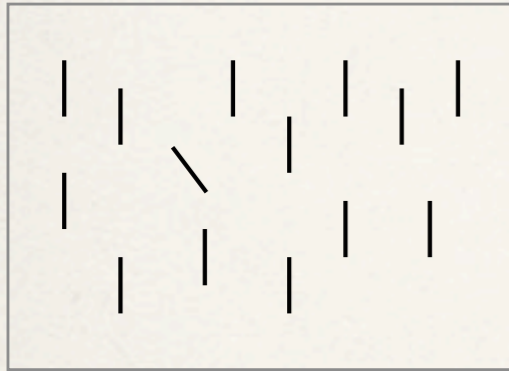
counting: count the number of targets

boundary detection: identify regions where the elements have a common visual property

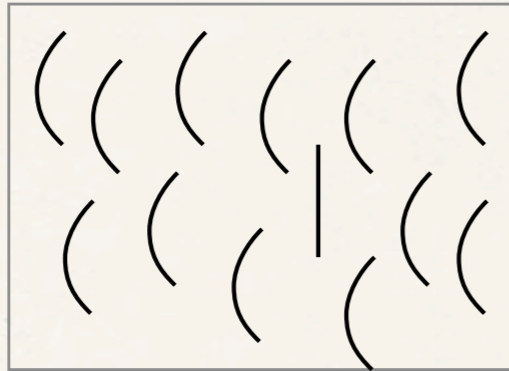
tracking: following a target as it moves in time and space

Preattentive features

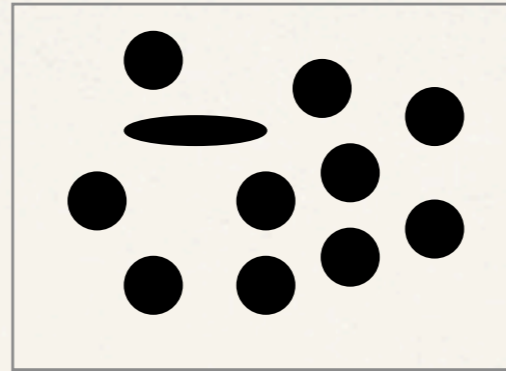
Orientation



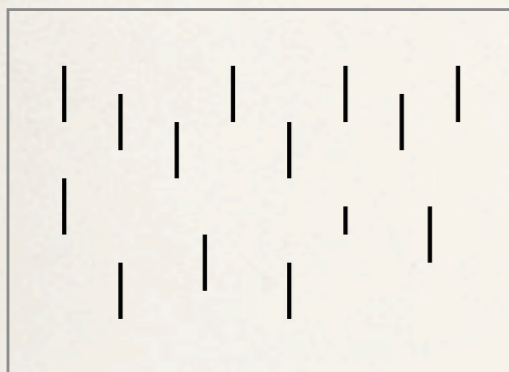
Curved/straight



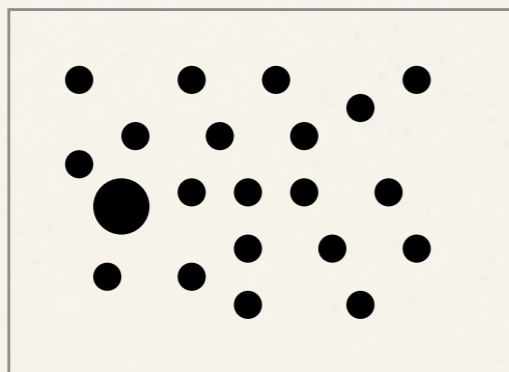
Shape



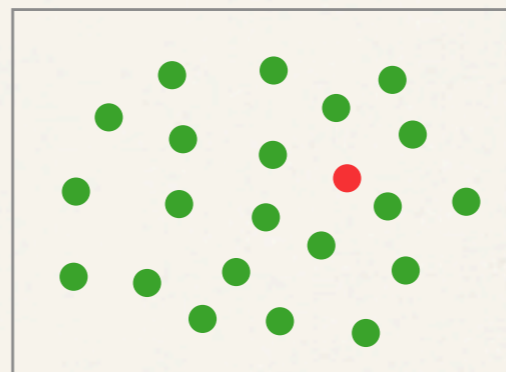
Shape



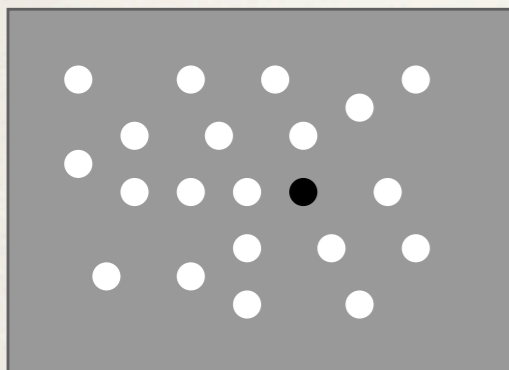
Size



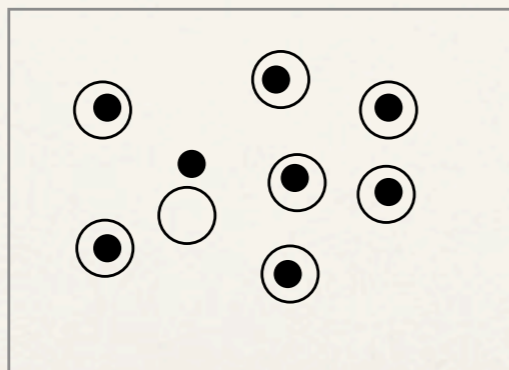
Color



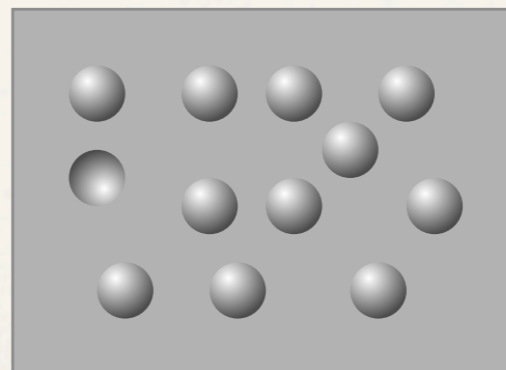
Light/dark



Enclosure



Convex/concave



Others

spatial position
intensity

closure

intersection

3D depth cues

flicker

motion direction

motion velocity

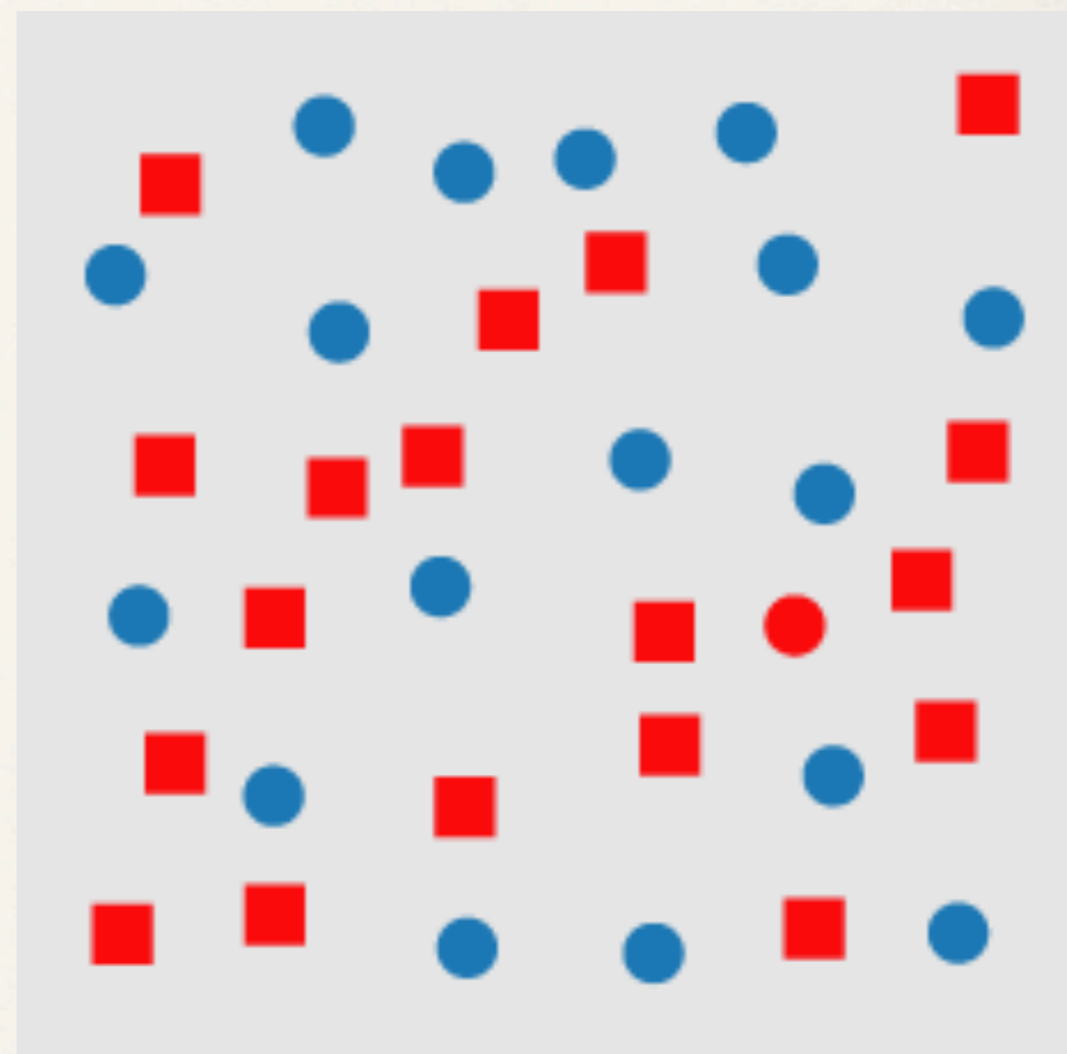
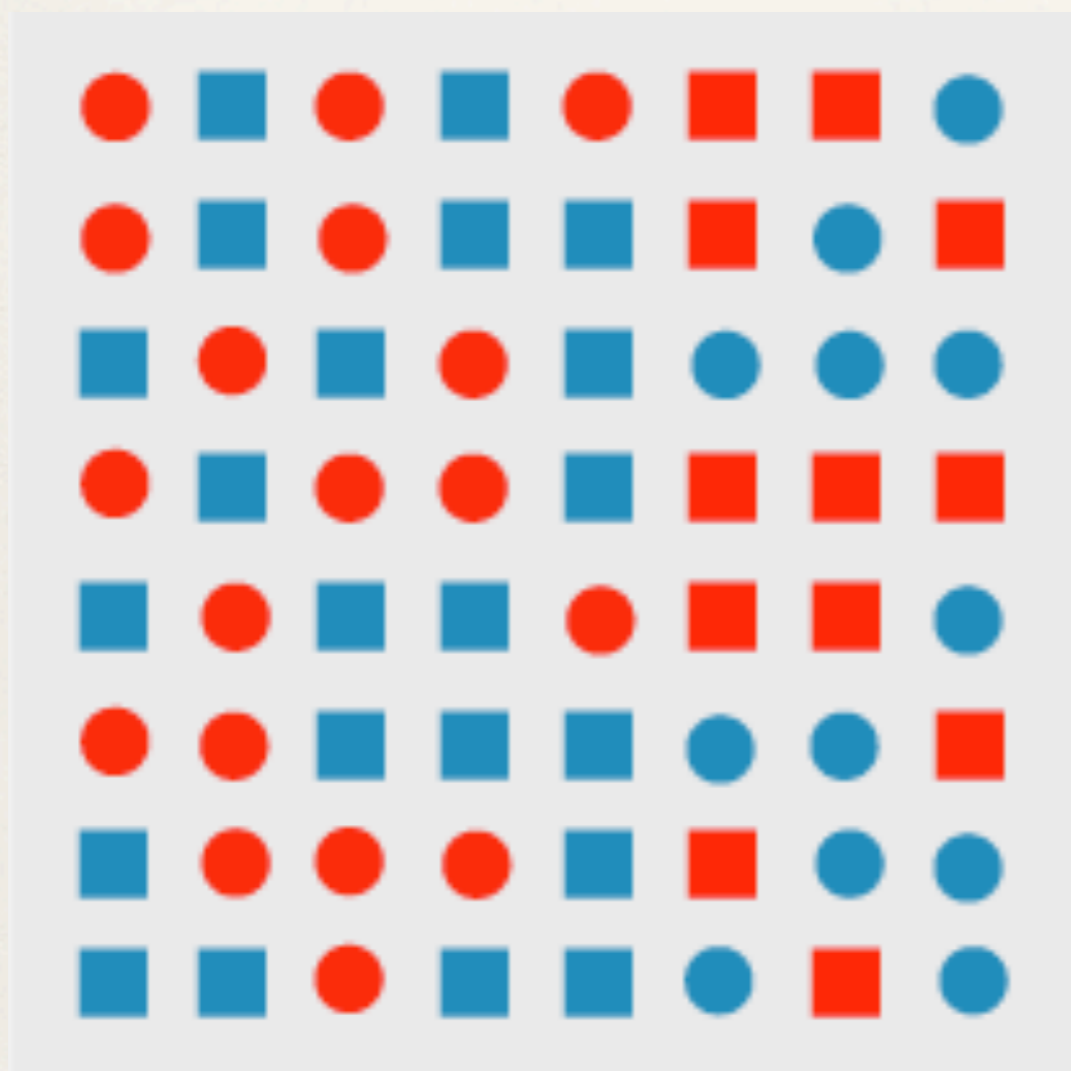
lighting direction

3D orientation

Impact of distractors

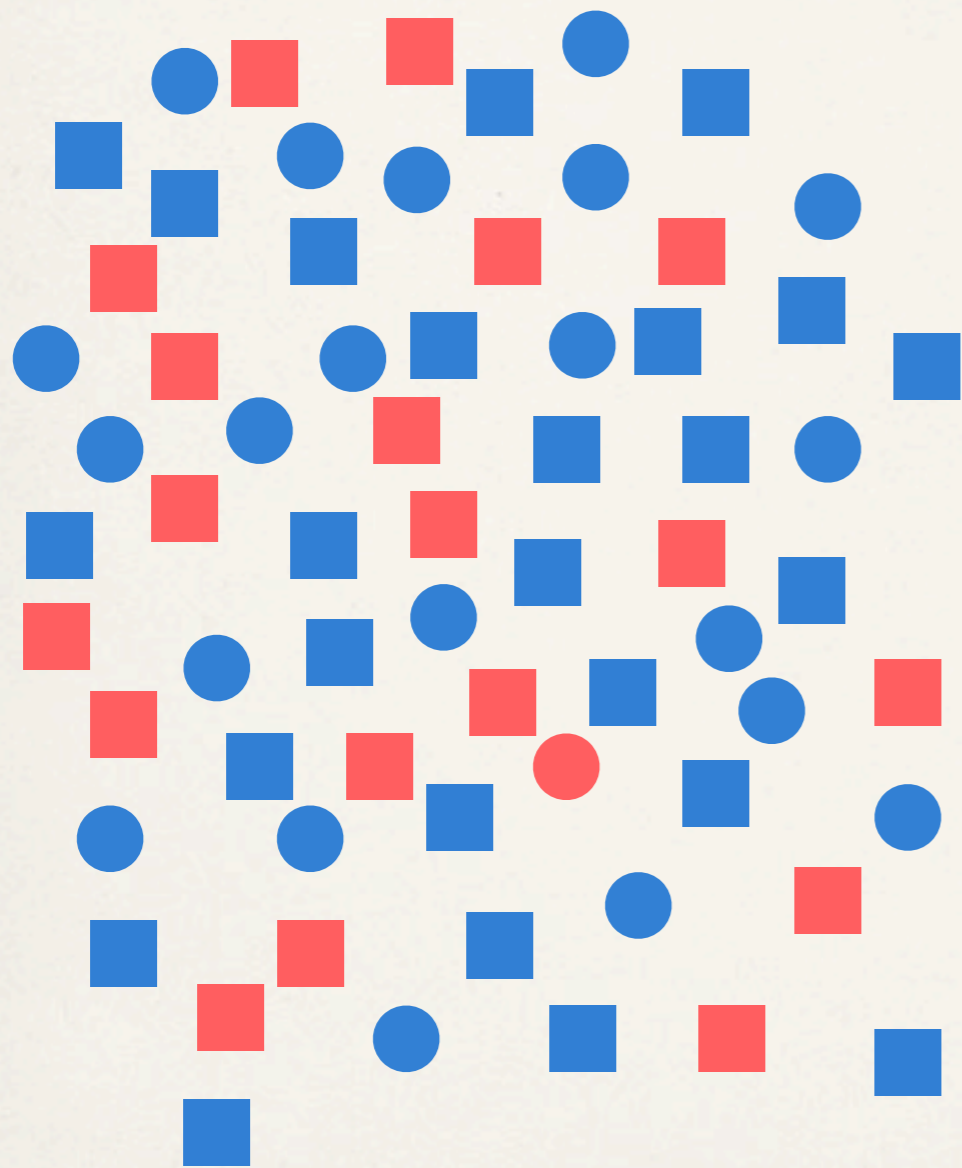


Preattention conjunctions

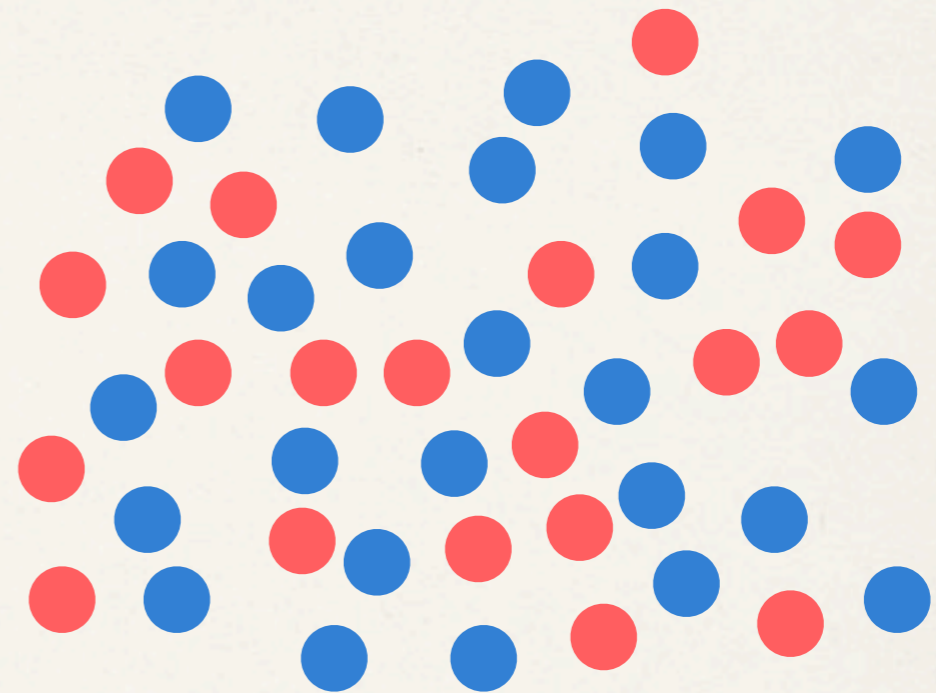


Most conjunctions are not preattentive

Preattention conjunctions

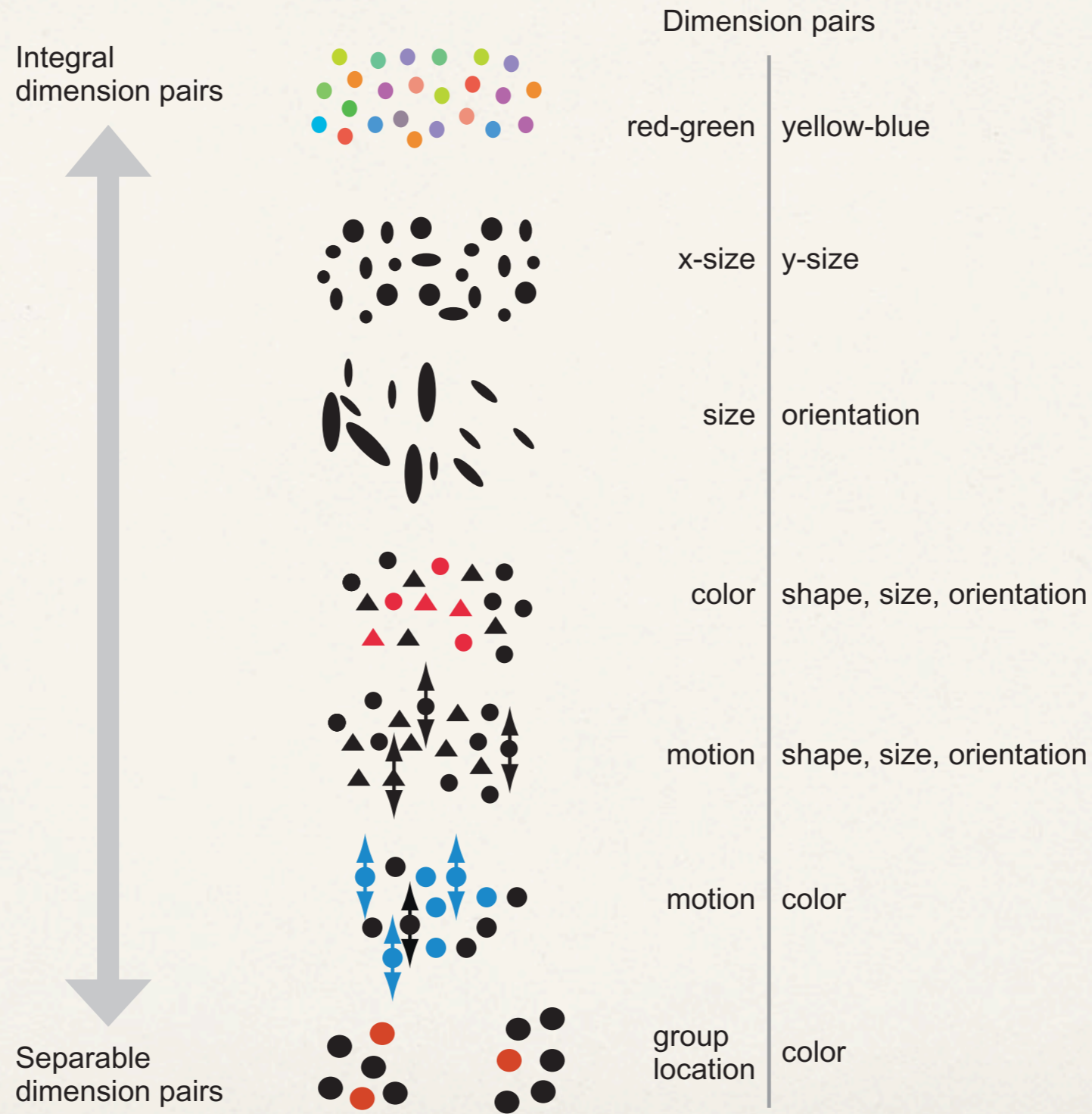


Color and shape



Color and position

Integral - Separable attributes



Preattention conjunctions

Conjunctions that can be preattentive

space + color

motion + shape

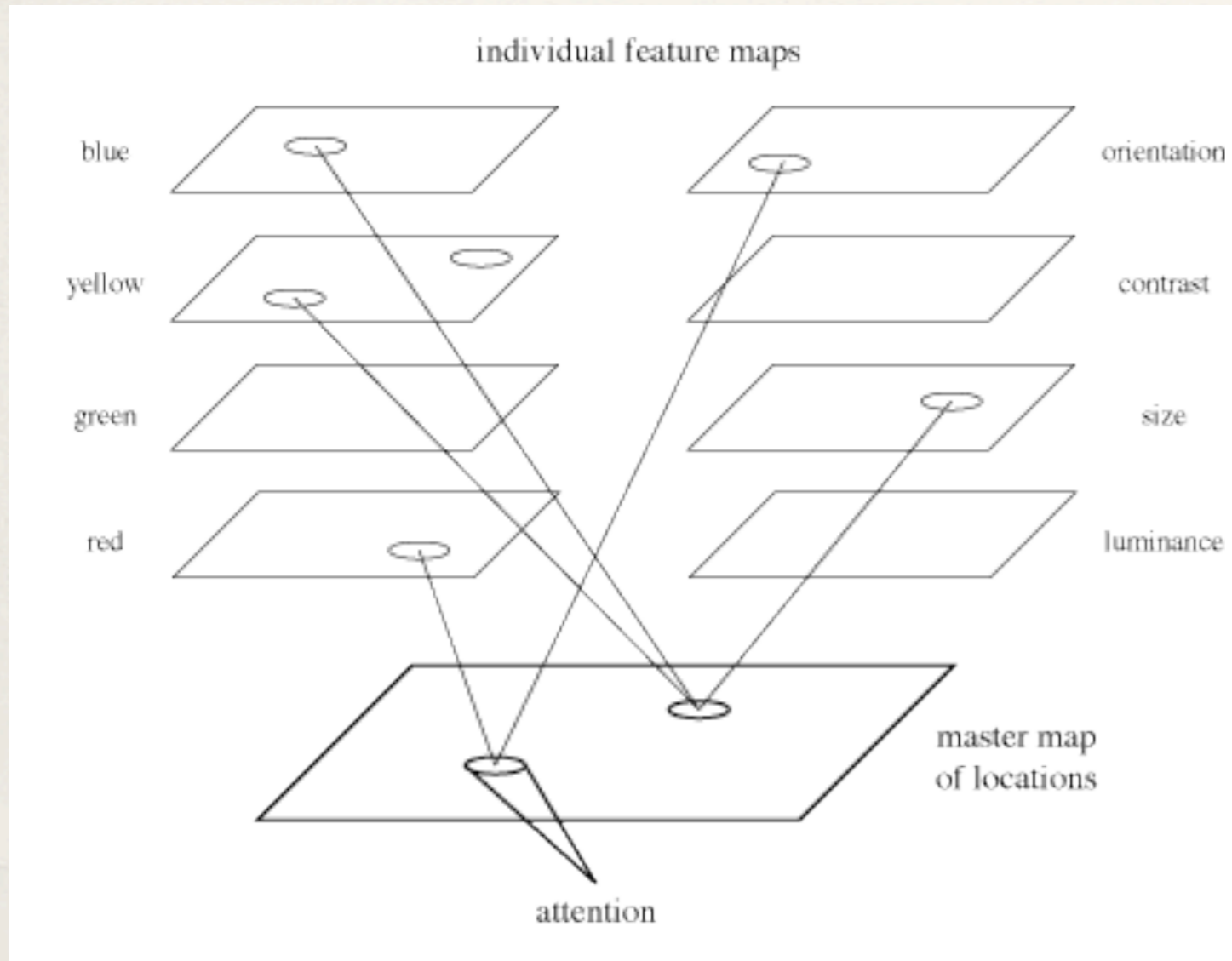
motion + color

stereoscopic depth + color

convexity/concavity + color

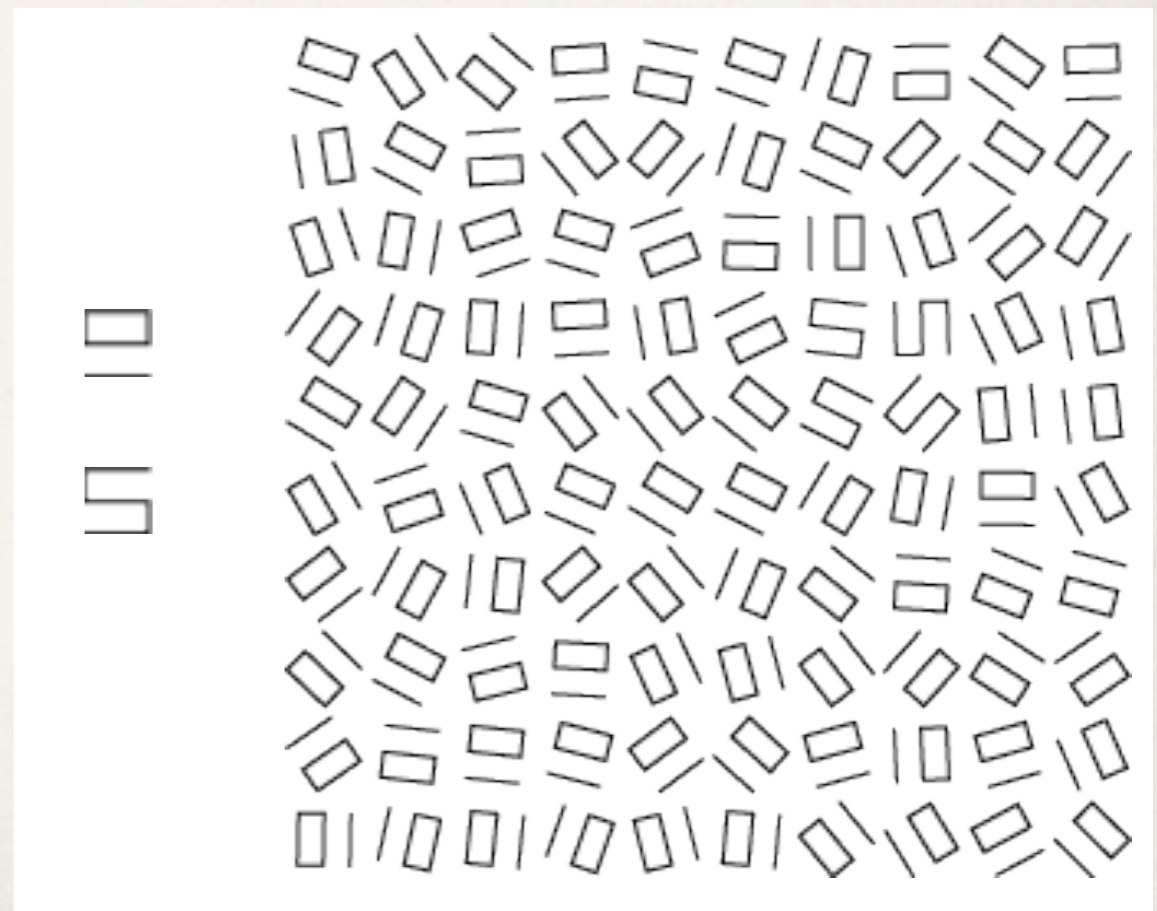
light direction + color

Preattention theories

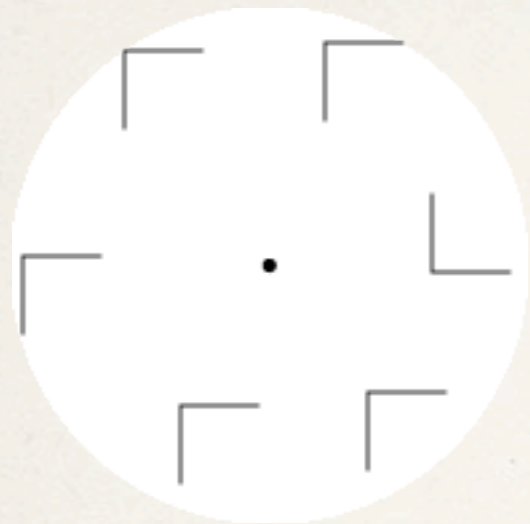


Feature Integration Theory

Texton Theory



Preattention theories



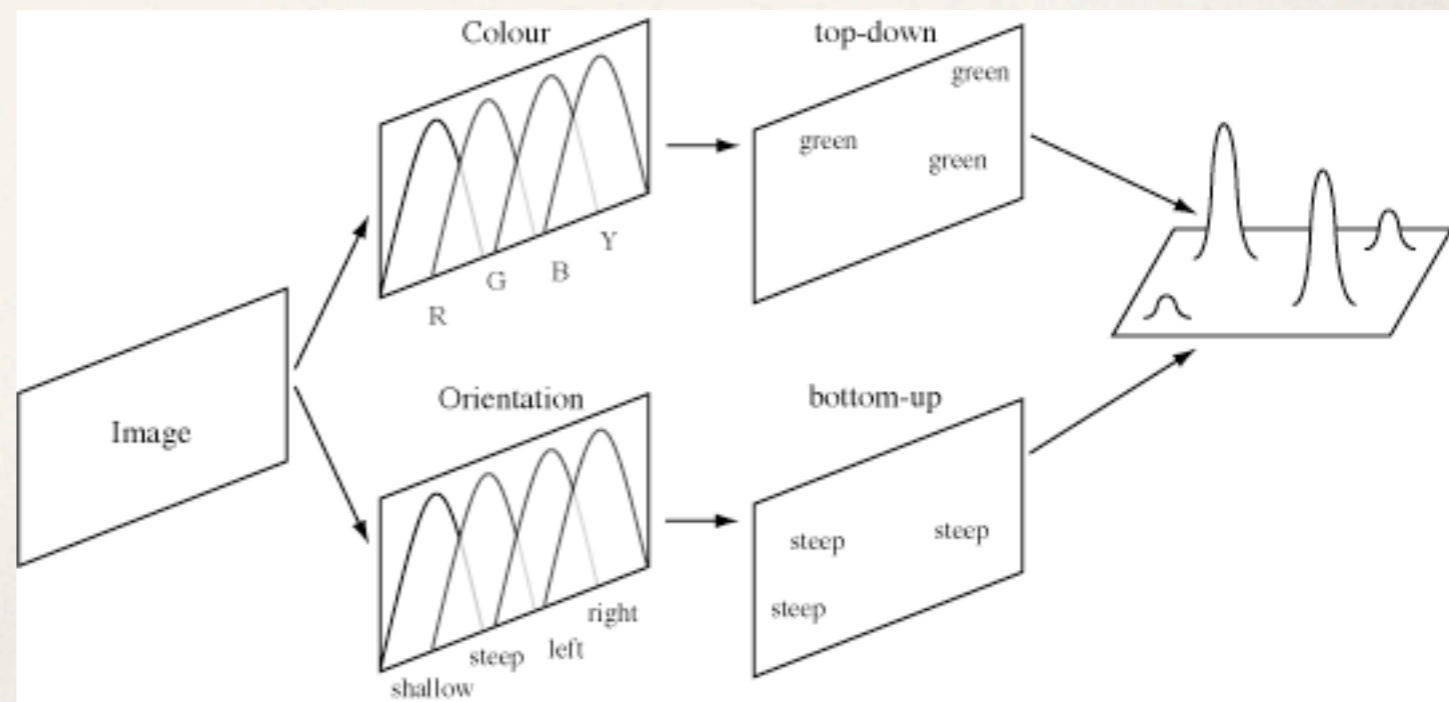
high N-N similarity



low N-N similarity

Similarity Theory

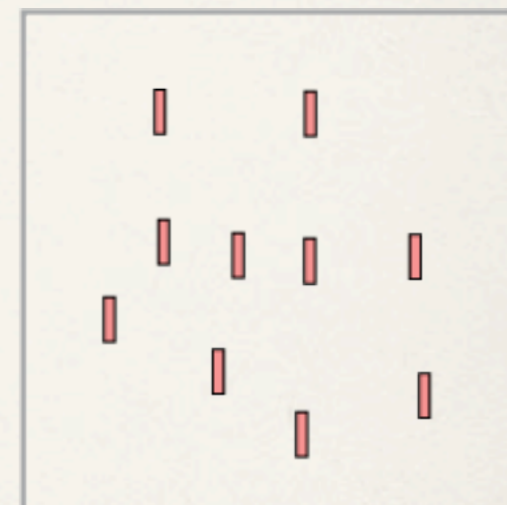
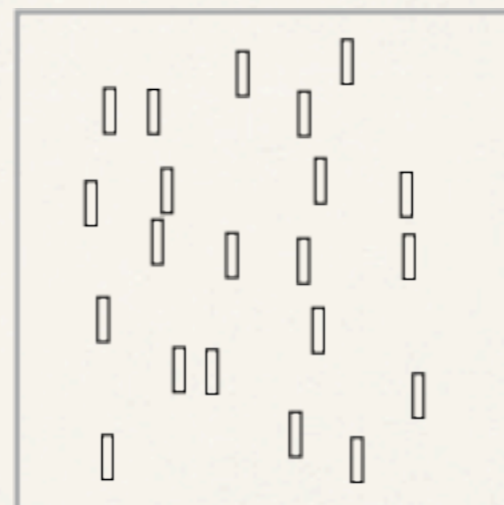
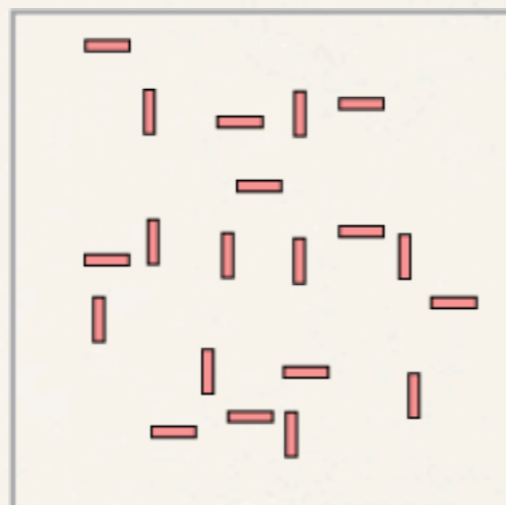
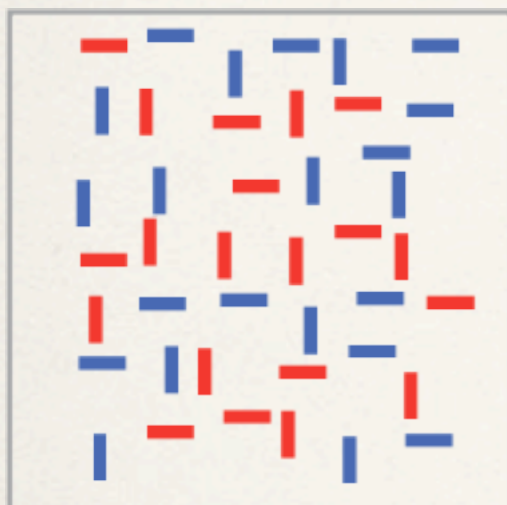
Guided Search Theory



<http://www.csc.ncsu.edu/faculty/healey/PP/>

Preattention theories

Boolean Map Theory



Gestalt laws of grouping

Proximity: things that are close to one another are grouped

Similarity: similar objects are seen as belonging together

Connectedness: physical connections to form relationships

Continuity: we construct visual entities from smooth, continuous visual elements

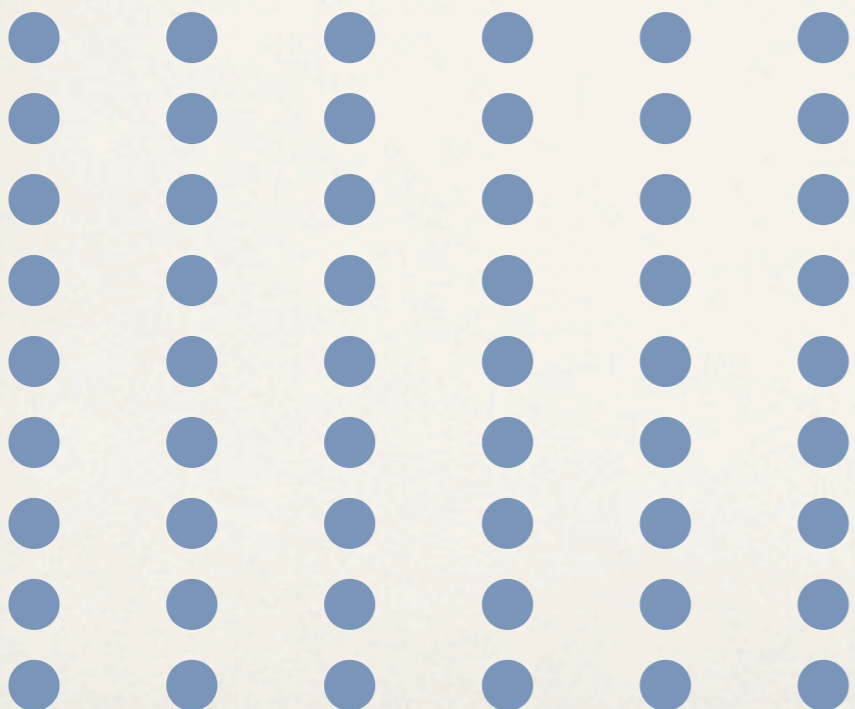
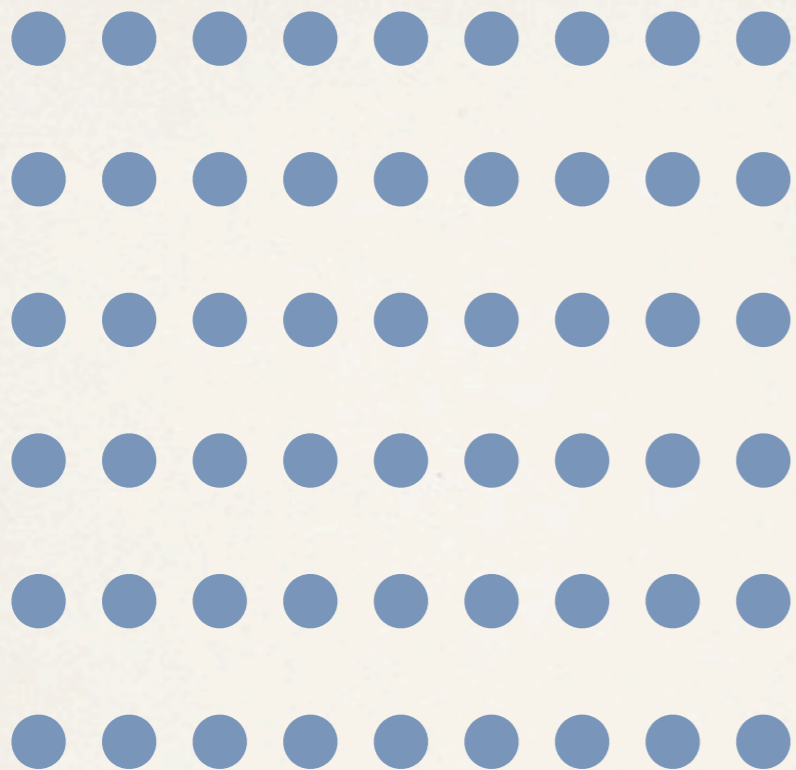
Symmetry: symmetric objects are perceived as being part of a whole

Closure: a closed contour is seen as an object

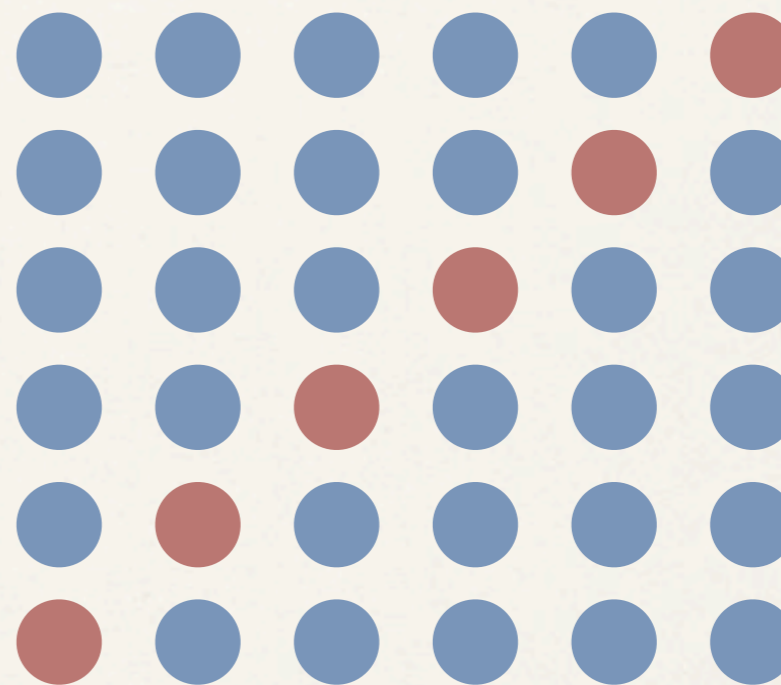
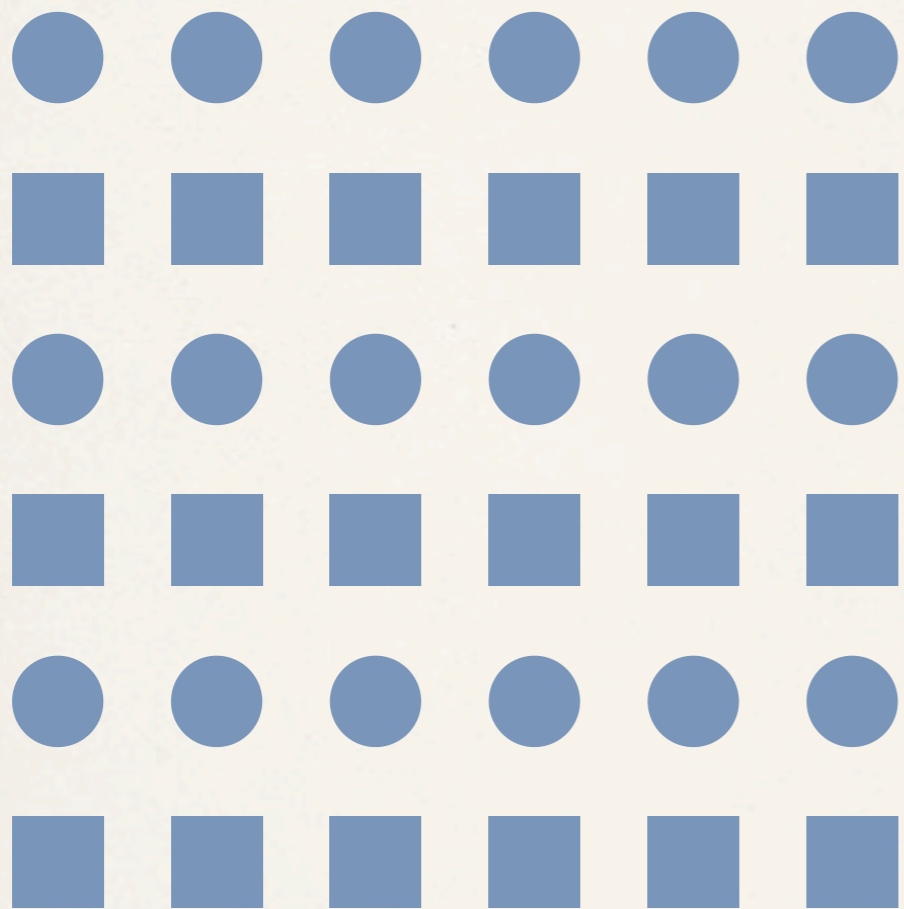
Relative size: smaller components of a pattern are perceived as objects

Common fate: objects that move together are perceived as being grouped

Gestalt laws - proximity



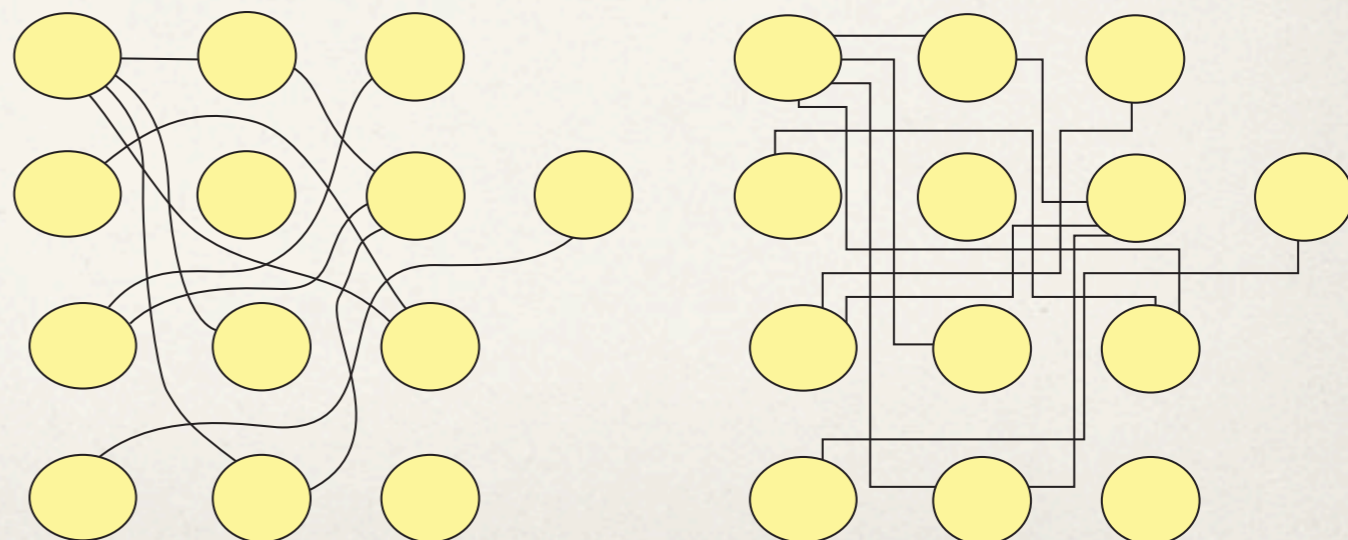
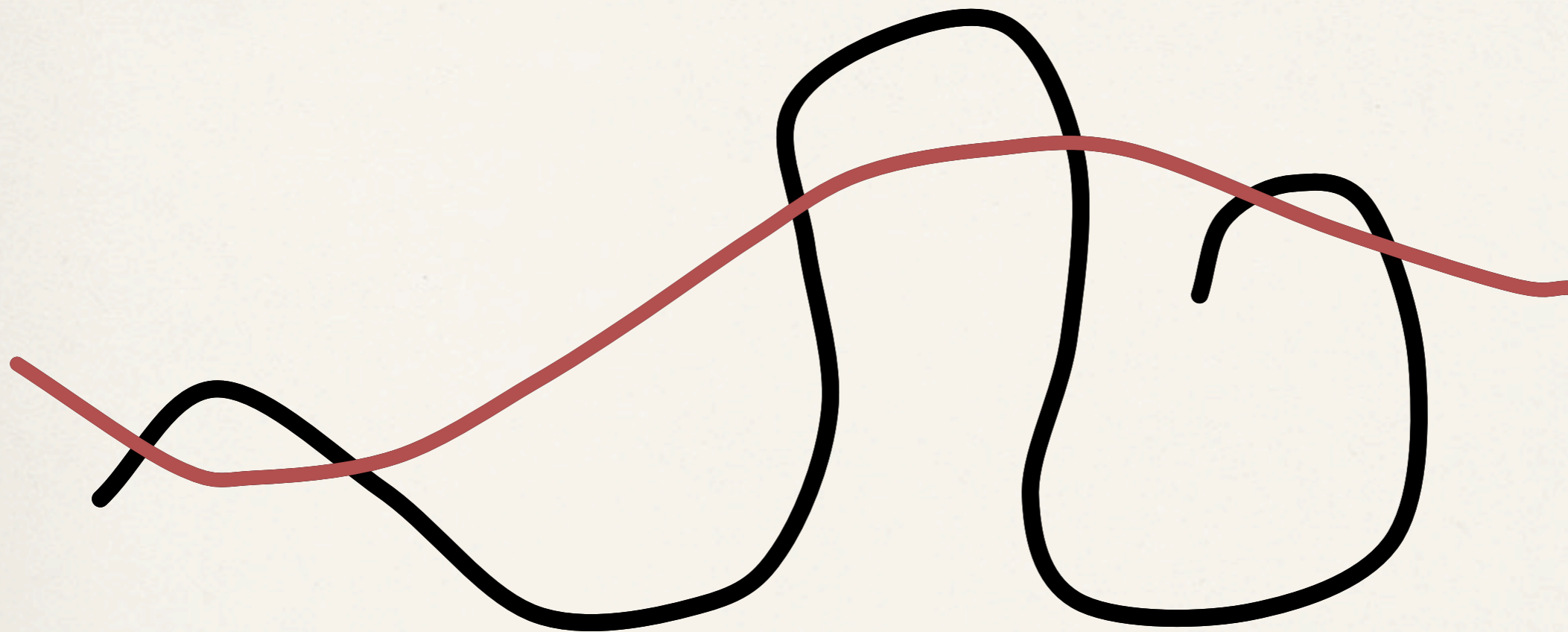
Gestalt laws - similarity



Gestalt laws - connectedness

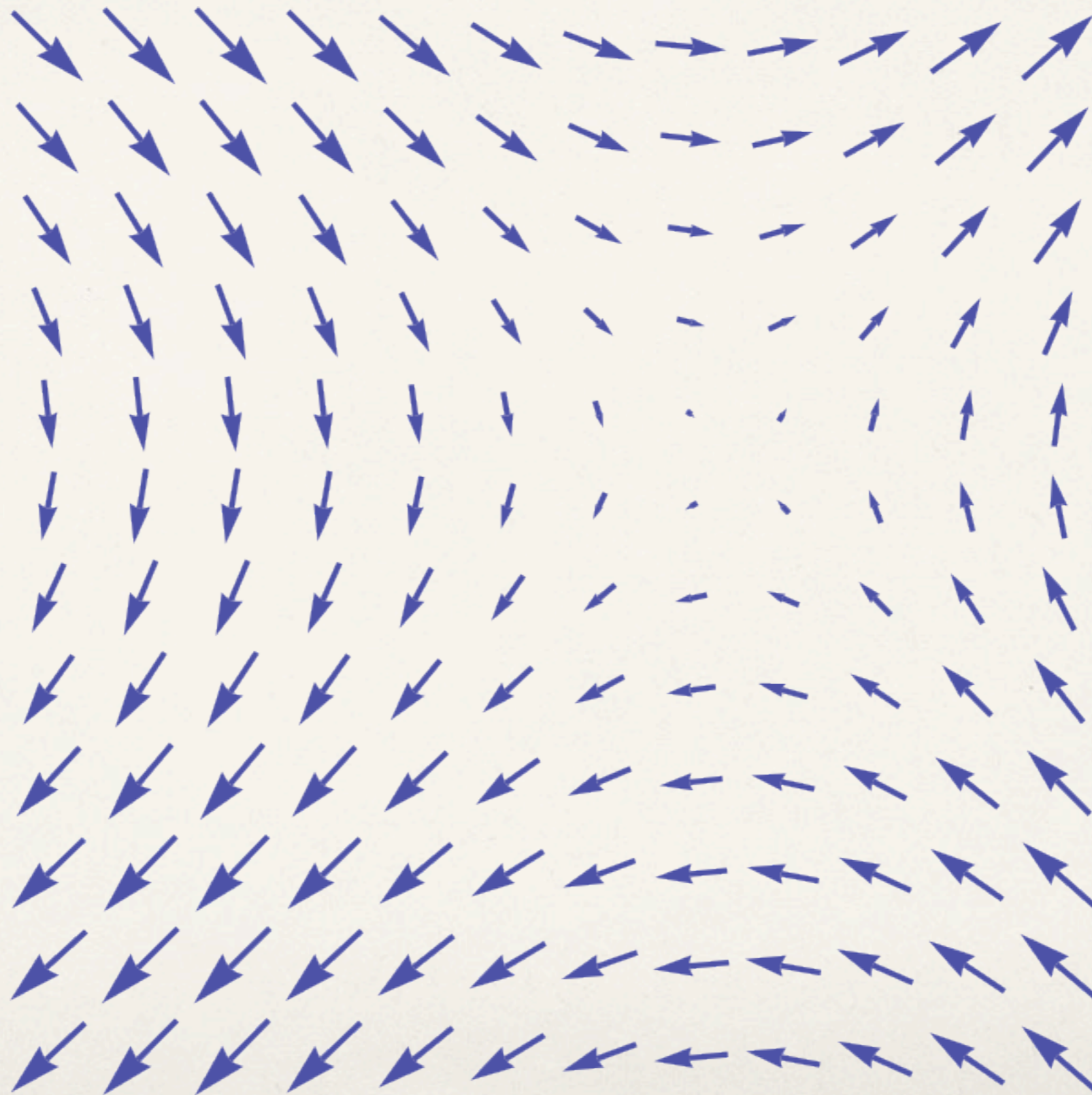


Gestalt laws - continuity

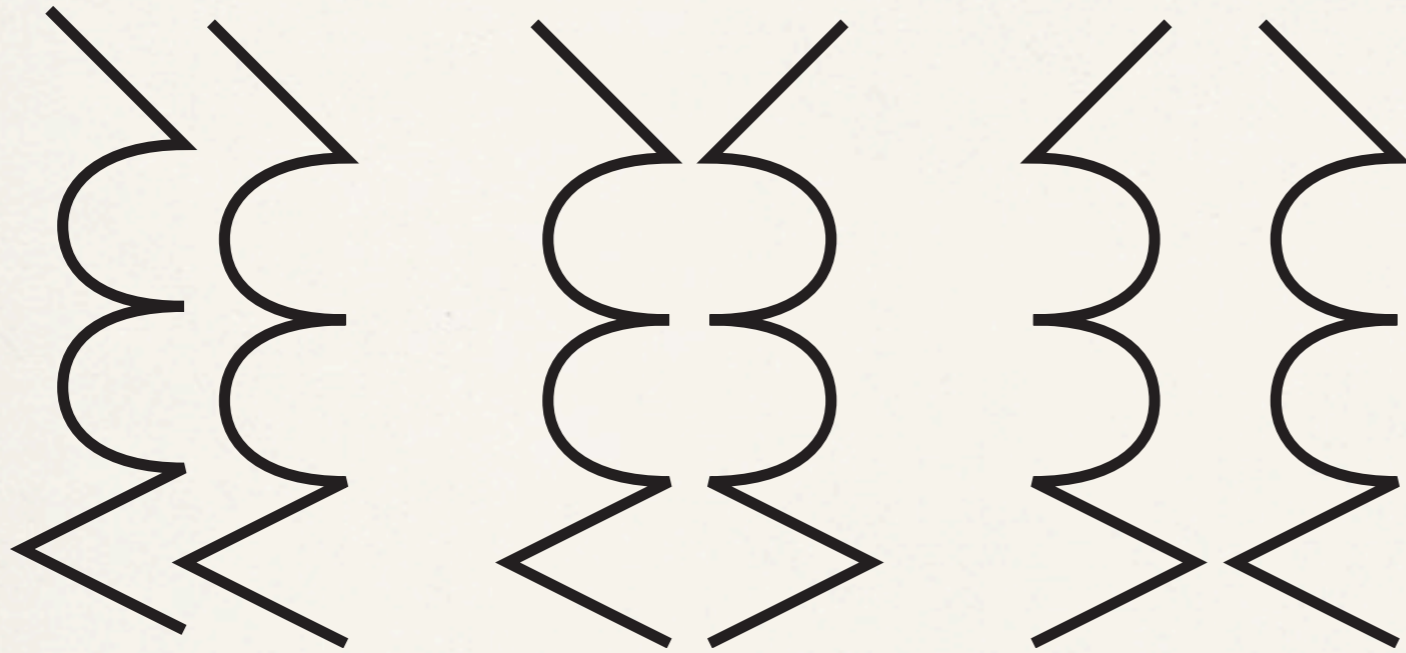


Ware, "Information Visualization: Perception for Design"

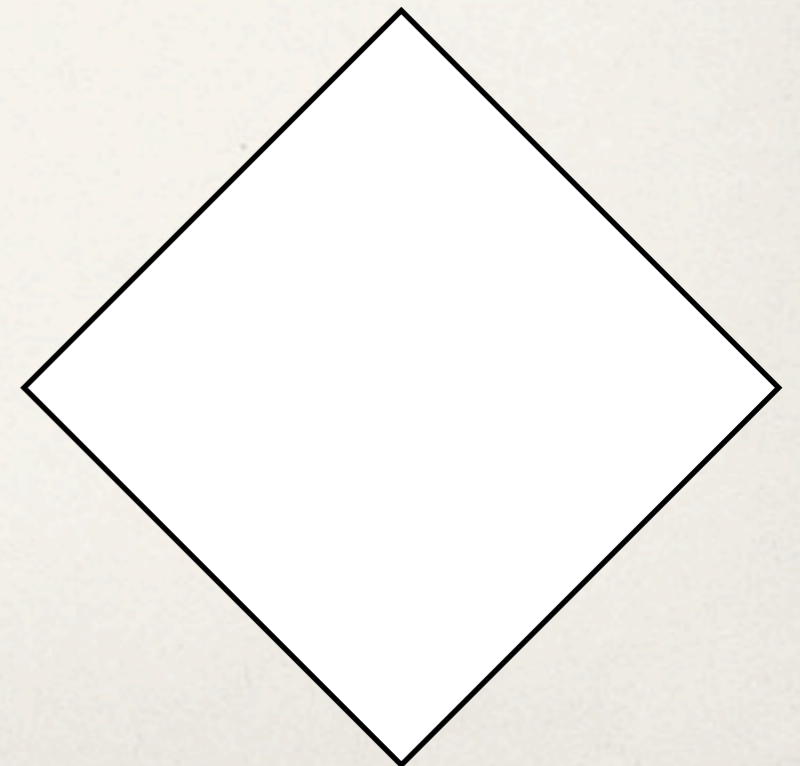
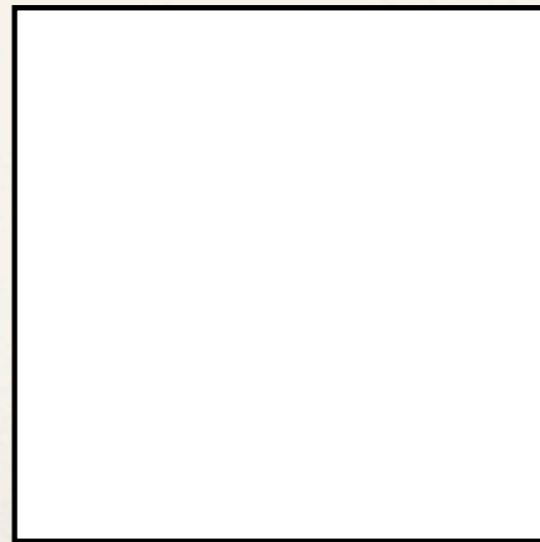
Gestalt laws - continuity



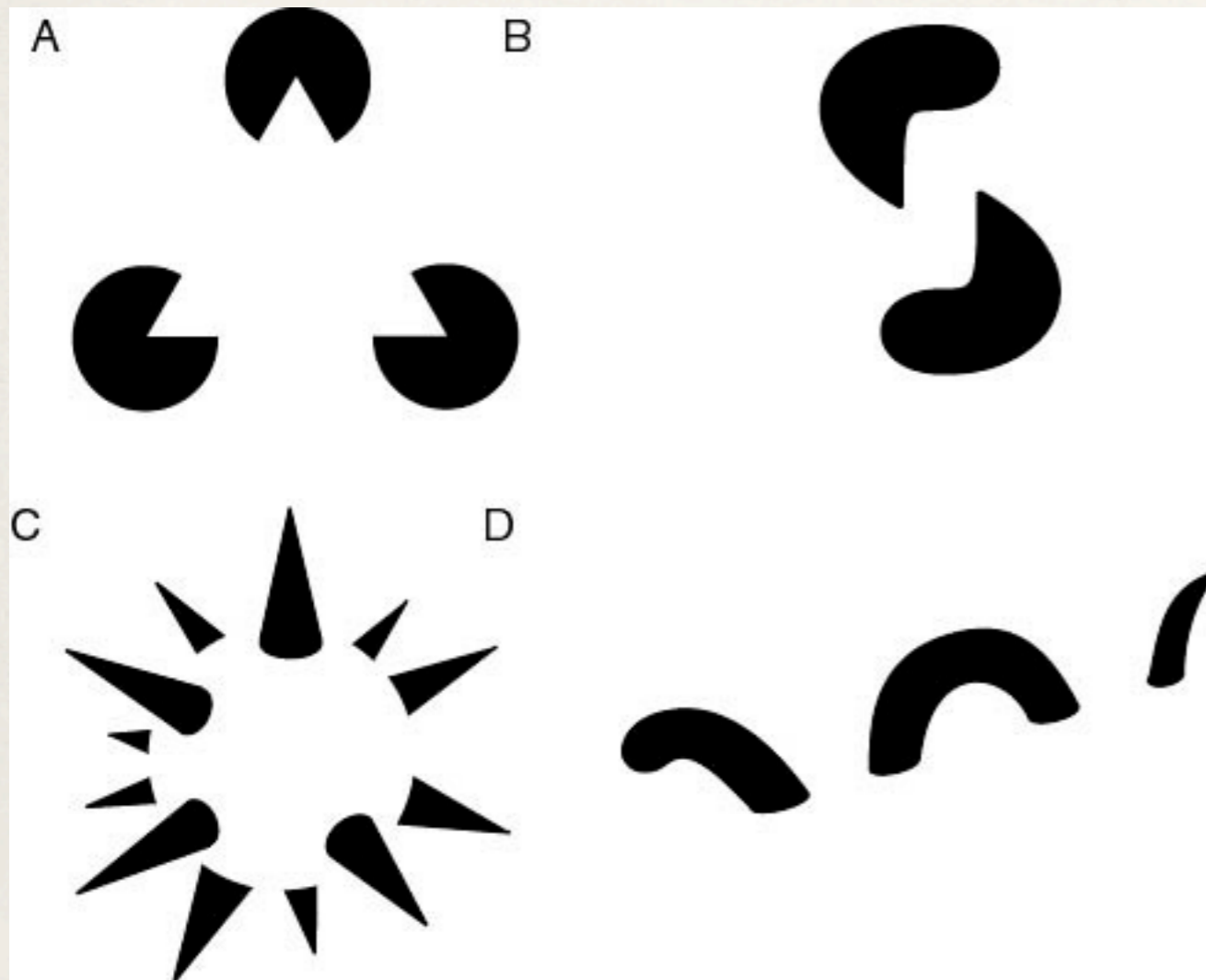
Gestalt laws - symmetry



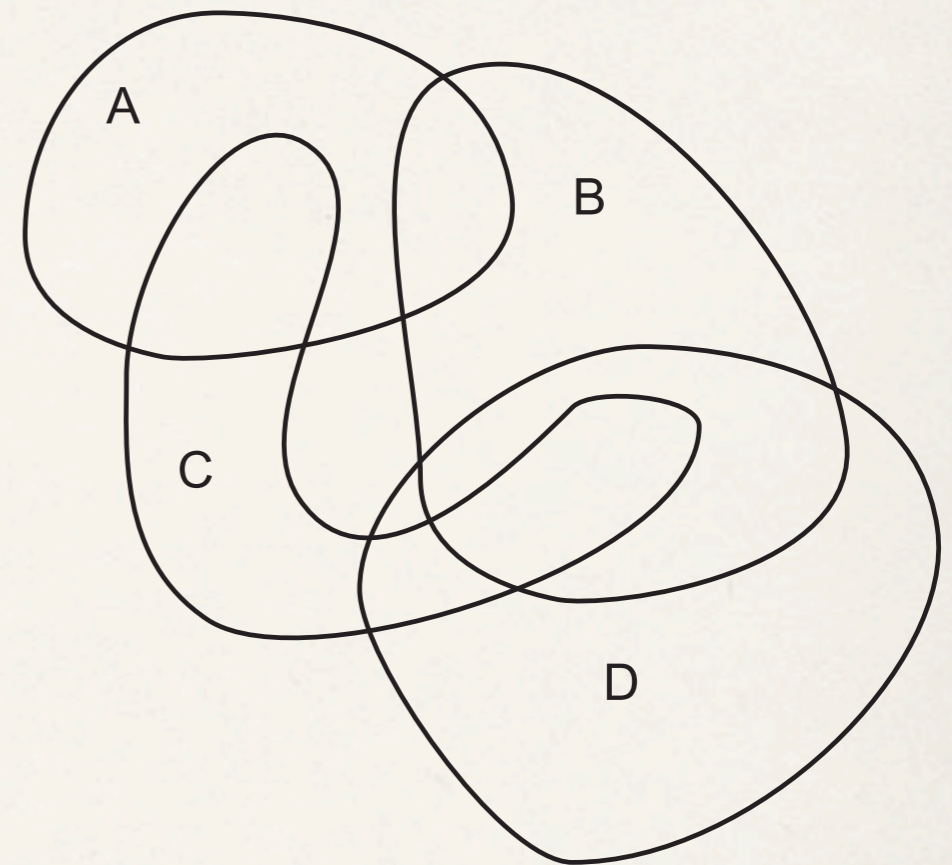
Ware, "Information Visualization: Perception for Design"



Gestalt laws - closure



Wikimedia Commons

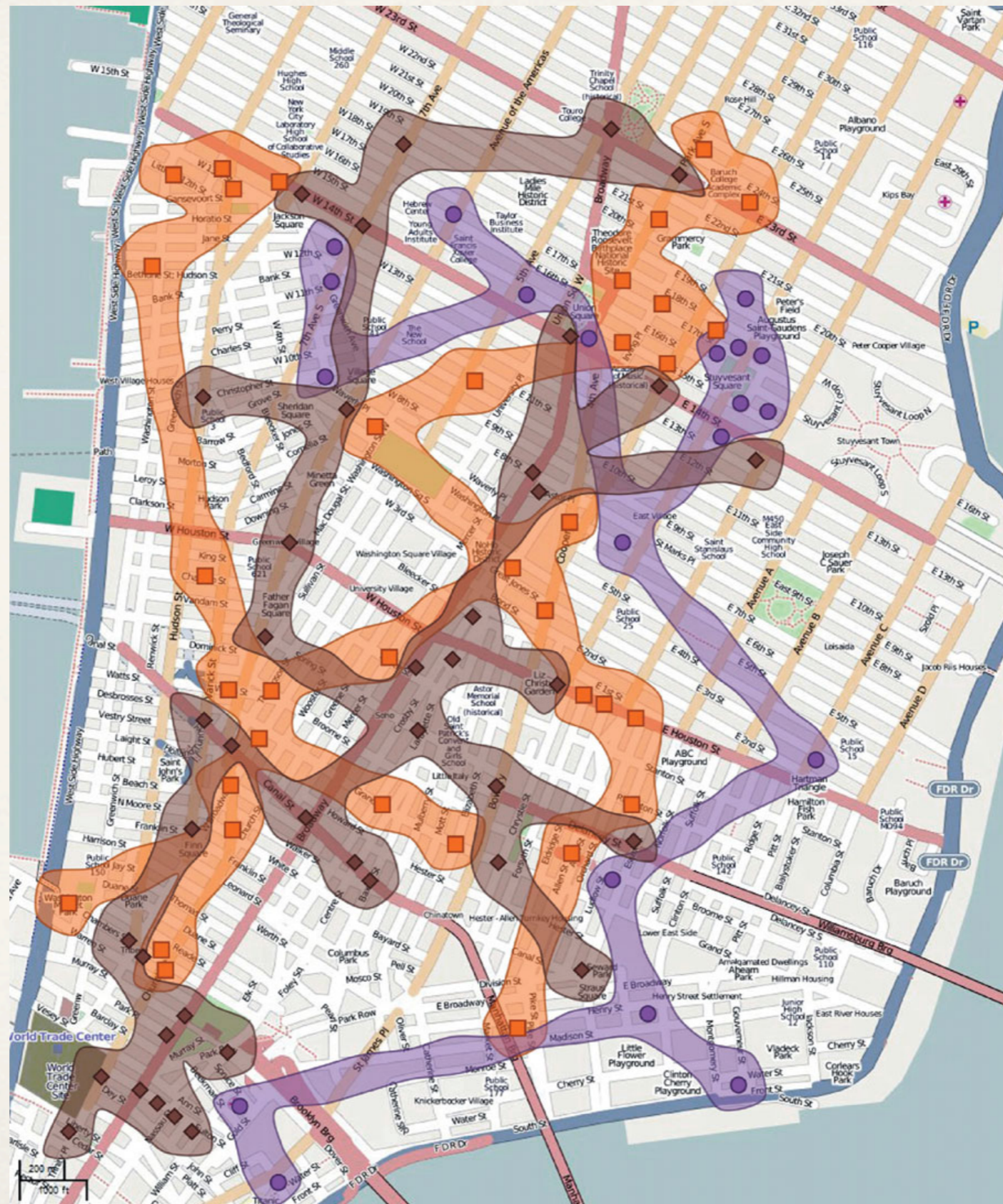


Ware, "Information Visualization: Perception for Design"



Wikimedia Commons

Gestalt laws - closure



Collins, Penn, Carpendale, "Bubble Sets: Revealing Set Relations with Isocontours over Existing Visualizations", 2009

Gestalt laws - relative size

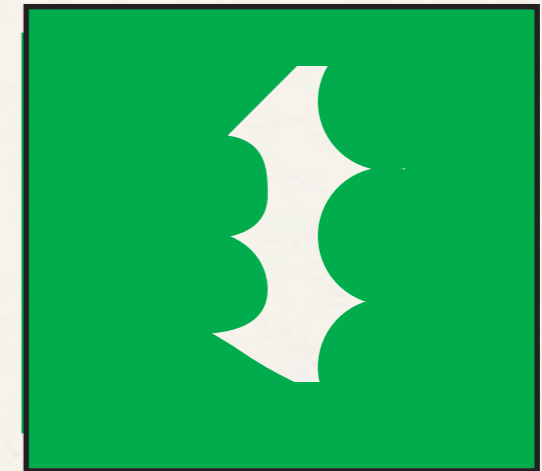
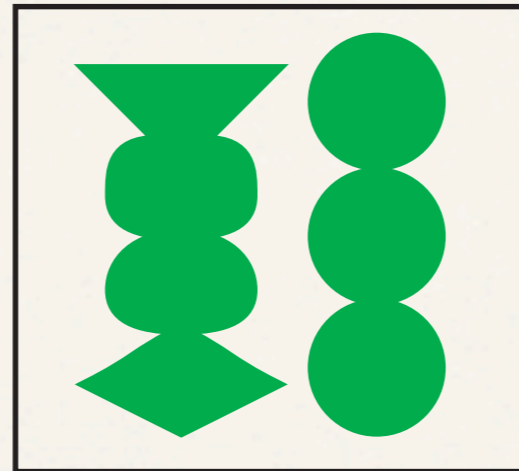
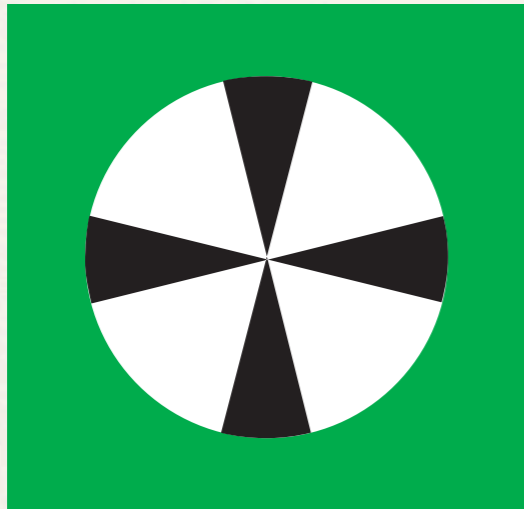


Figure vs ground

Gestalt laws - shared fate



Gestalt laws - shared fate



Change blindness



<http://www2.psych.ubc.ca/~rensink/flicker/download/>

Selective attention

<http://www.youtube.com/watch?v=Ahg6qcgoy4>

<http://www.youtube.com/watch?v=ubNF9QNEQLA>