

Human perception

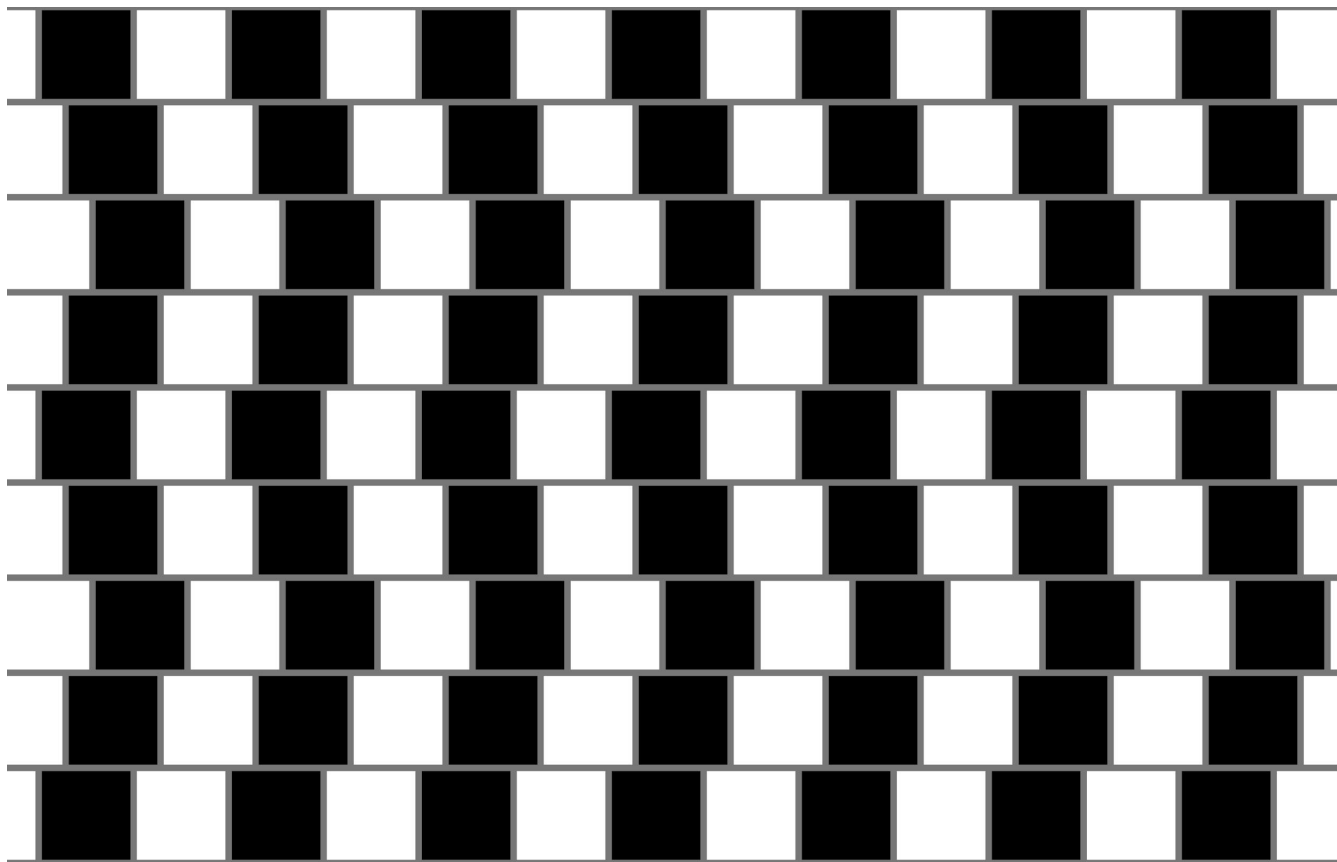
Chen He

Slides acknowledgements: **Luana Micallef**, and **Michael Porath** (UC Berkeley).

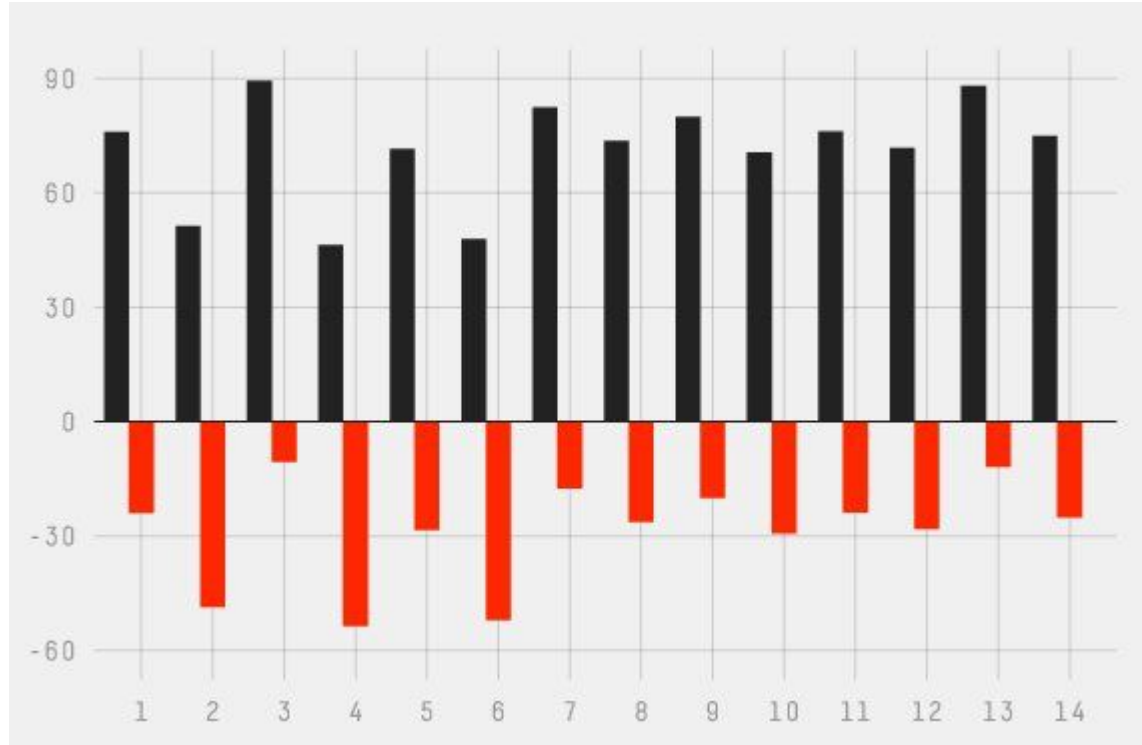
Slides mostly based on **Ware, C.**, **Information visualization: perception for design.**

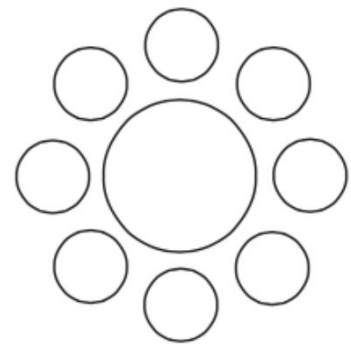
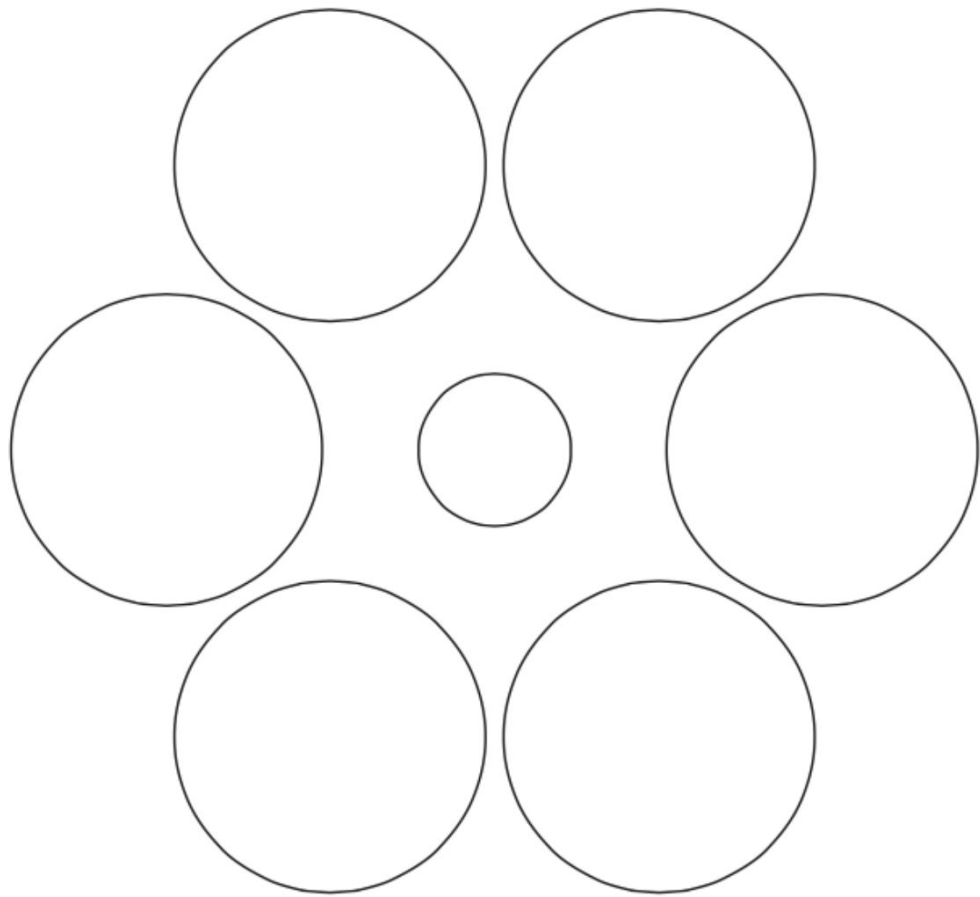
DG: Design Guideline

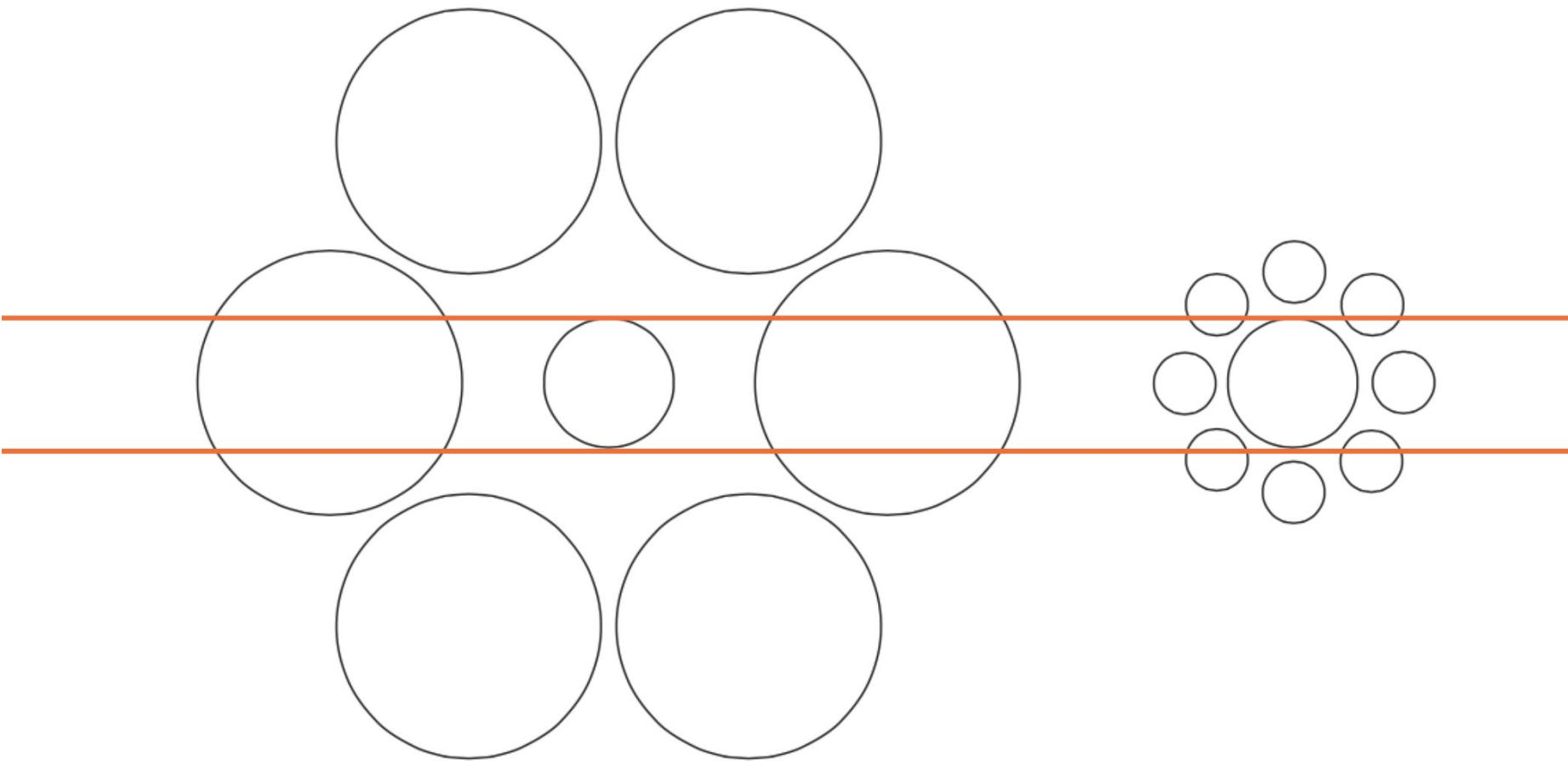
The Café Wall Illusion

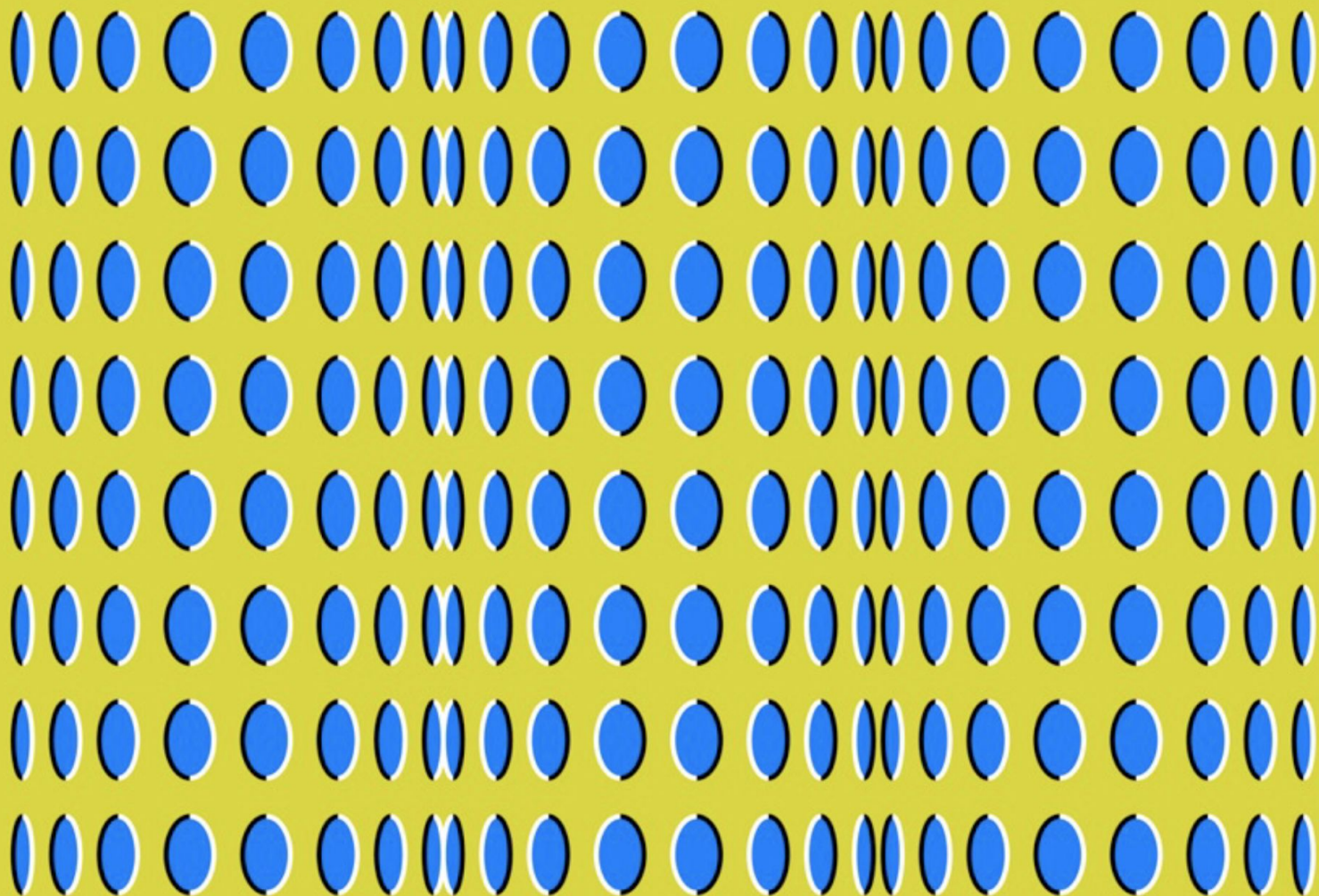


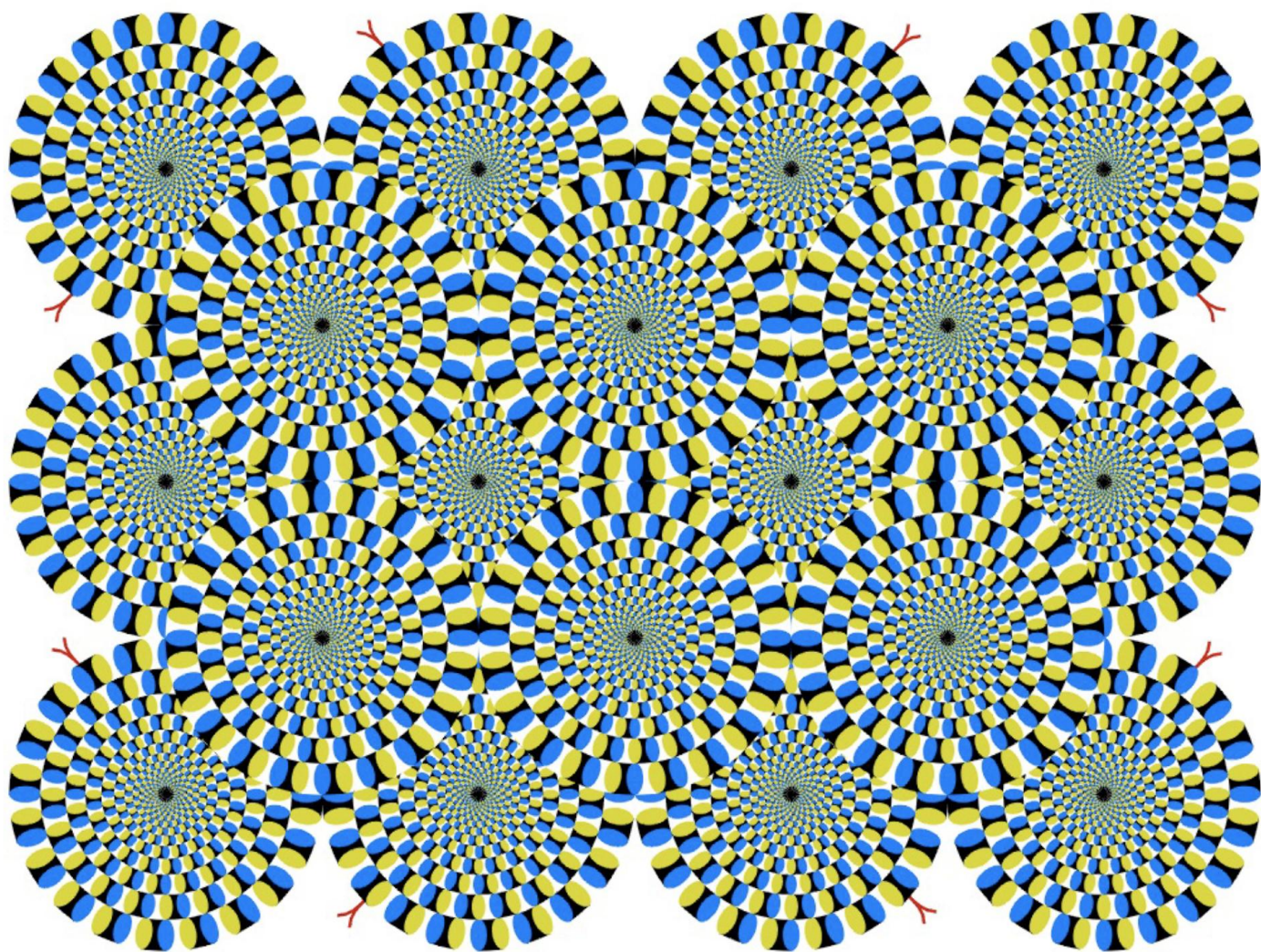
The Café Wall Illusion







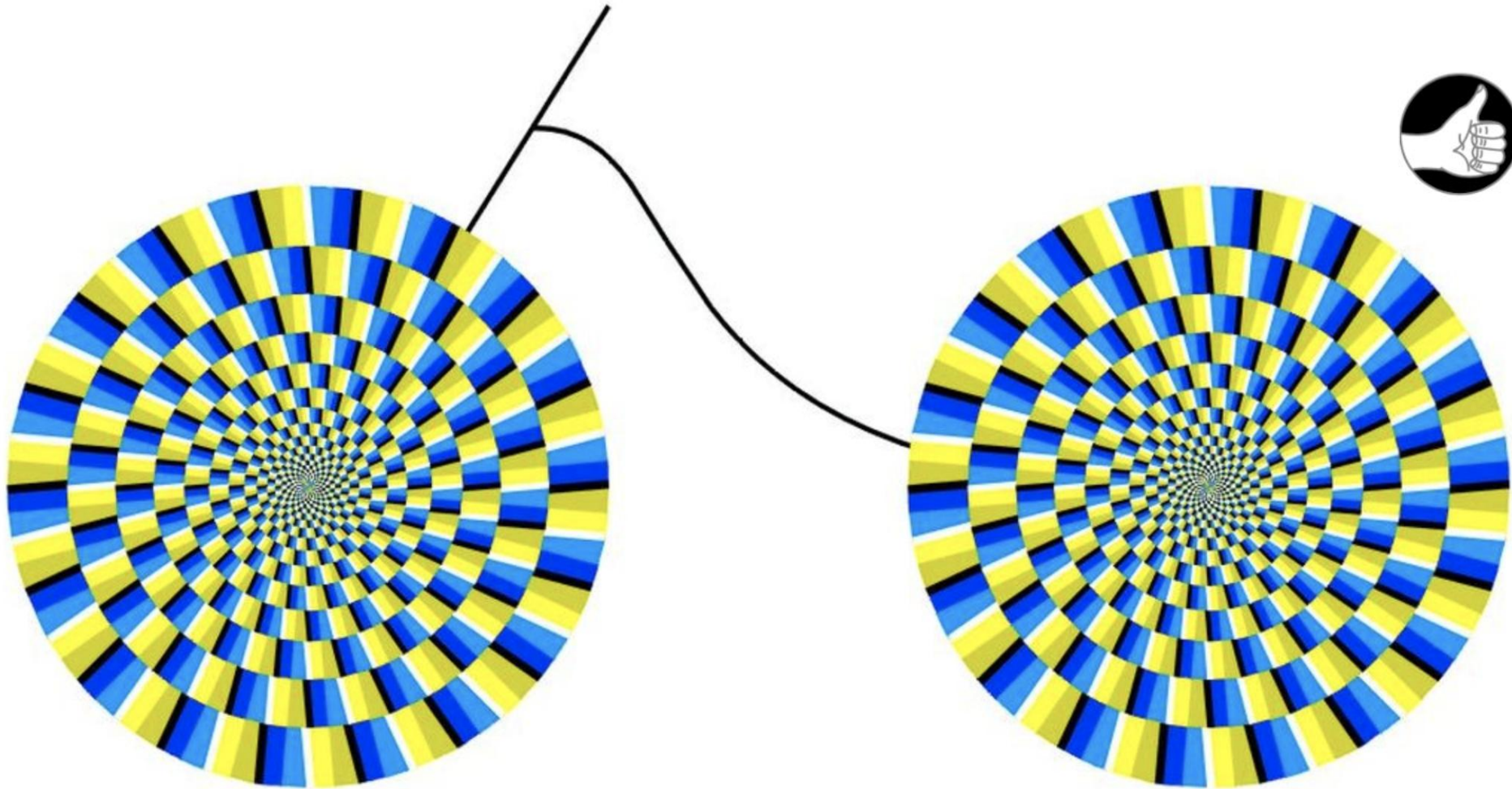




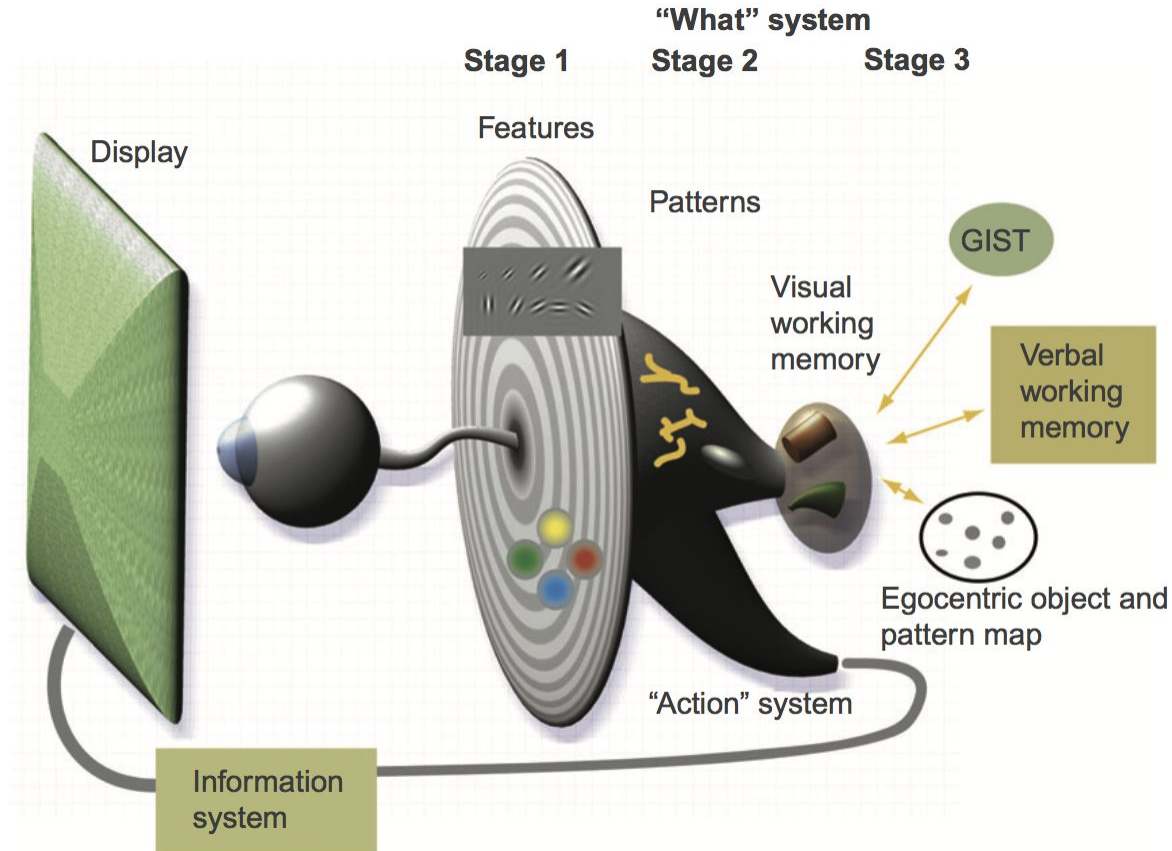
Illusory motion

High-contrast colors;

The arrangement of color bands repeated in small asymmetric patterns.



Visual information processing



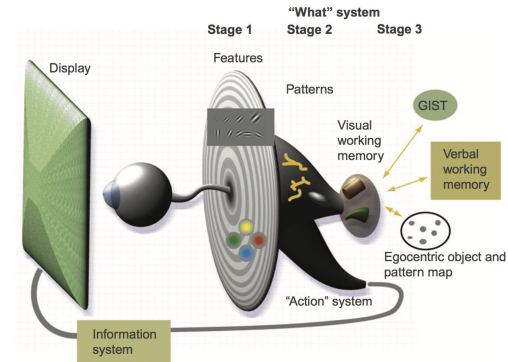
Stage 1 Extraction of basic features of the visual scene.

Rapid parallel processing.

Extraction of features, such as orientation, color, and texture.

Transitory nature of information.

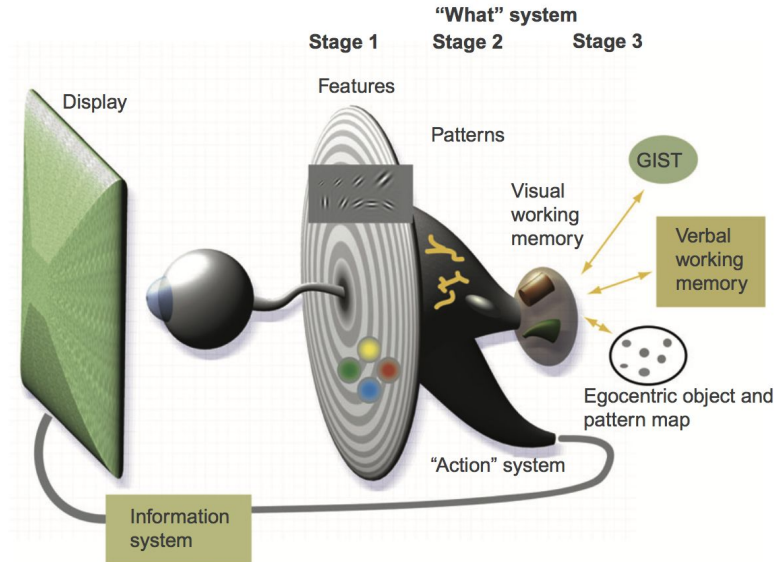
Bottom-up, data-driven model of processing.



Stage 2 Pattern perception.

Influenced both by

the massive amount of information available from Stage 1 (**bottom-up**);
the **top-down** action of attention driven by **visual queries**.



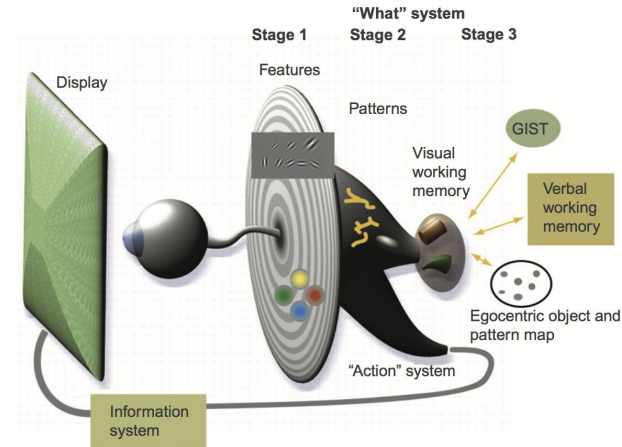
Stage 3 Visual working memory.

The objects held in visual working memory by the demands of active attention.

They are constructed from

the available **patterns** that may provide answers to the visual query;

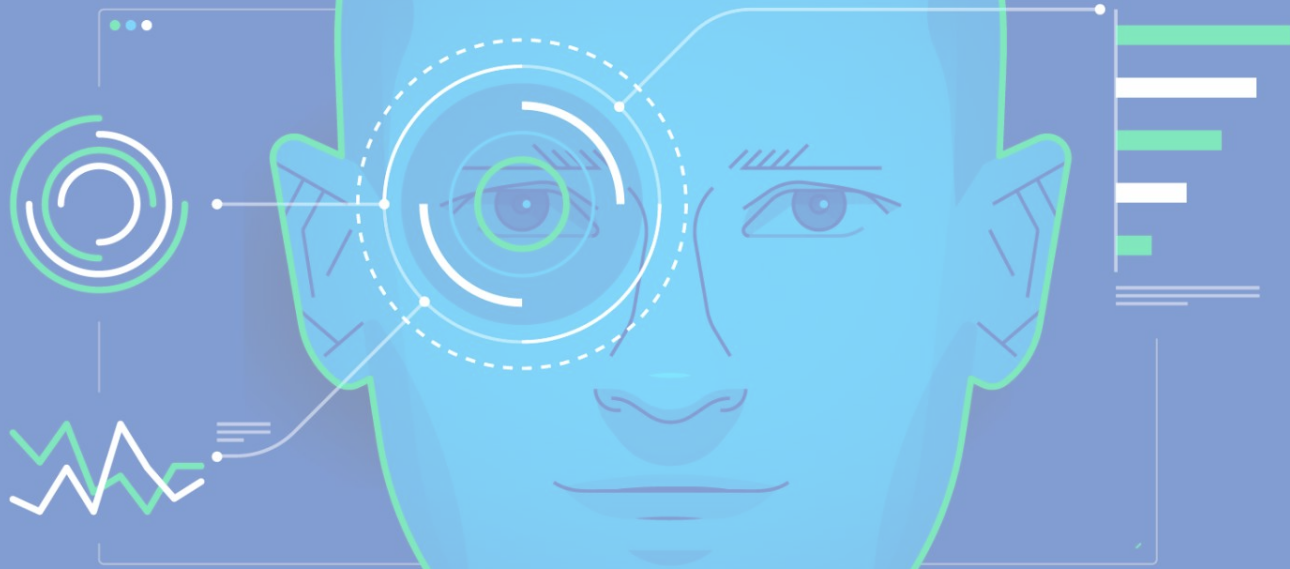
information stored in **long-term memory** related to the task.



Stage 3 Visual working memory -- Chunking

~~Seven items~~ four chunks, varied size of each chunk.

DG: **Group information** to increase the working memory capacity.



Preattentive processing

How many 3s?

1281768756138976546985604982826762

9809858458224509856458940980943585

9091030209905959595775050678904567

8845789809821677654876360912949686

How many 3s?

581**3**12062451046275777644**3**227882568

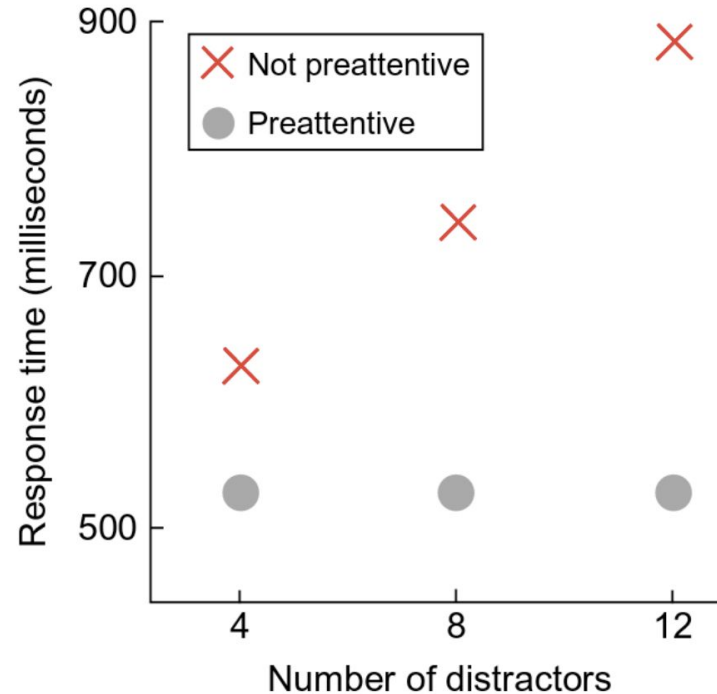
85400854815**3**2851714248582146284078

1041710**3**41052577585177276725911070

451252518271514012**3**882064857804410

Preattentive vs. Non-preattentive

Preattentive processing **speed** is **independent** of the **number** of **distractors**.

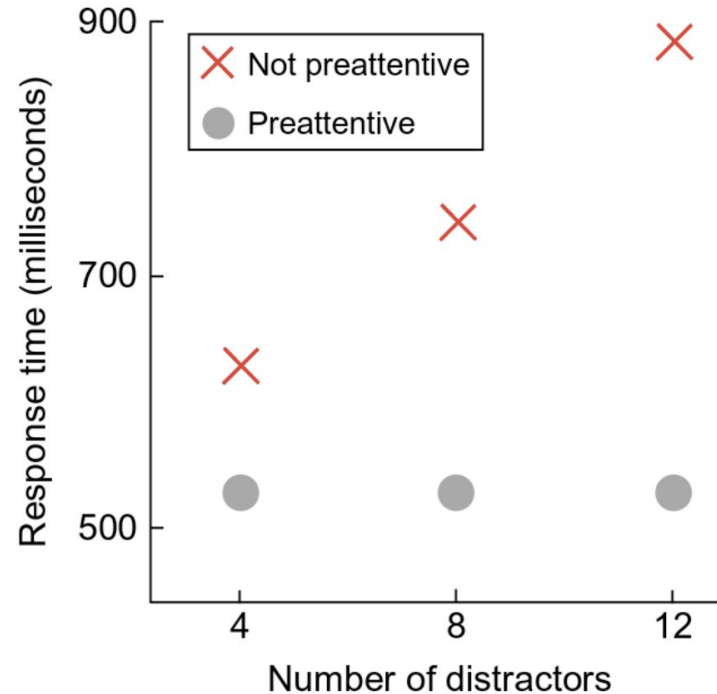


Preattentive vs. Non-preattentive

Difference in speed of individual item perception:

Preattentive $\leq 10\text{ms}$;

Non-preattentive $> 40\text{ms}$.



Preattentive features

Form

Color

Motion

Flicker

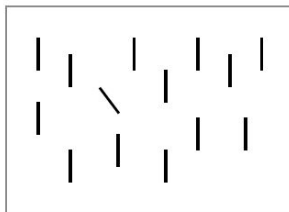
Direction of motion

Spatial position

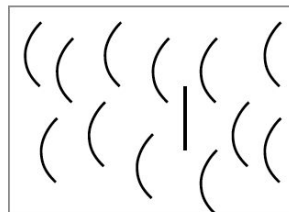
Two-dimensional position

Stereoscopic depth

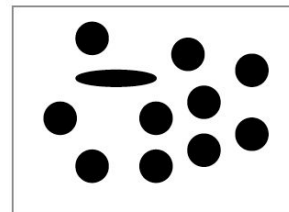
Orientation



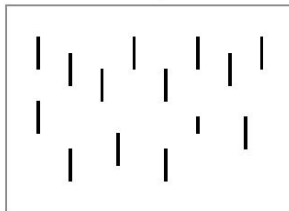
Curved/straight



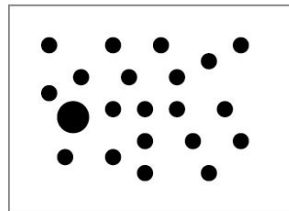
Shape



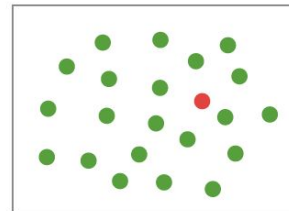
Shape



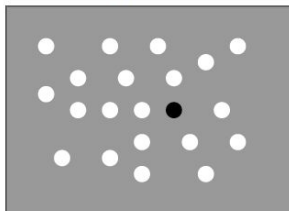
Size



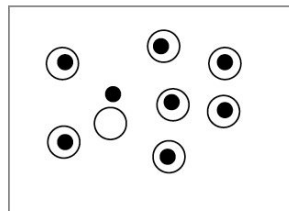
Color



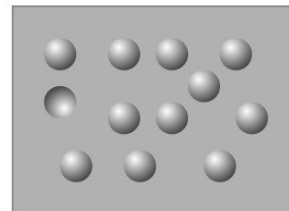
Light/dark



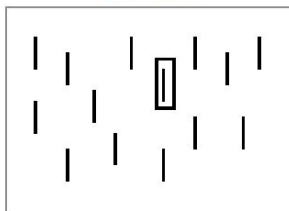
Enclosure



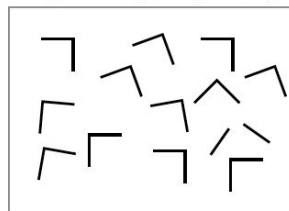
Convex/concave



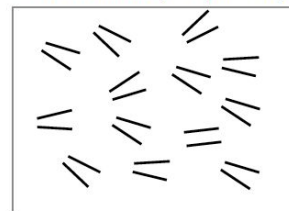
Addition



Juncture (not pre-att)



Parallelism (not pre-att)



Preattentive features

Not all preattentive effects are equally strong.

Degrees of pop out

Strongest effects: based on color, orientation, size, contrast, and motion or blinking.

Weaker effects: e.g., line curvature

Degrees of difference

E.g., Large color differences have more popout than small ones.

Preattentive vs. Non-preattentive

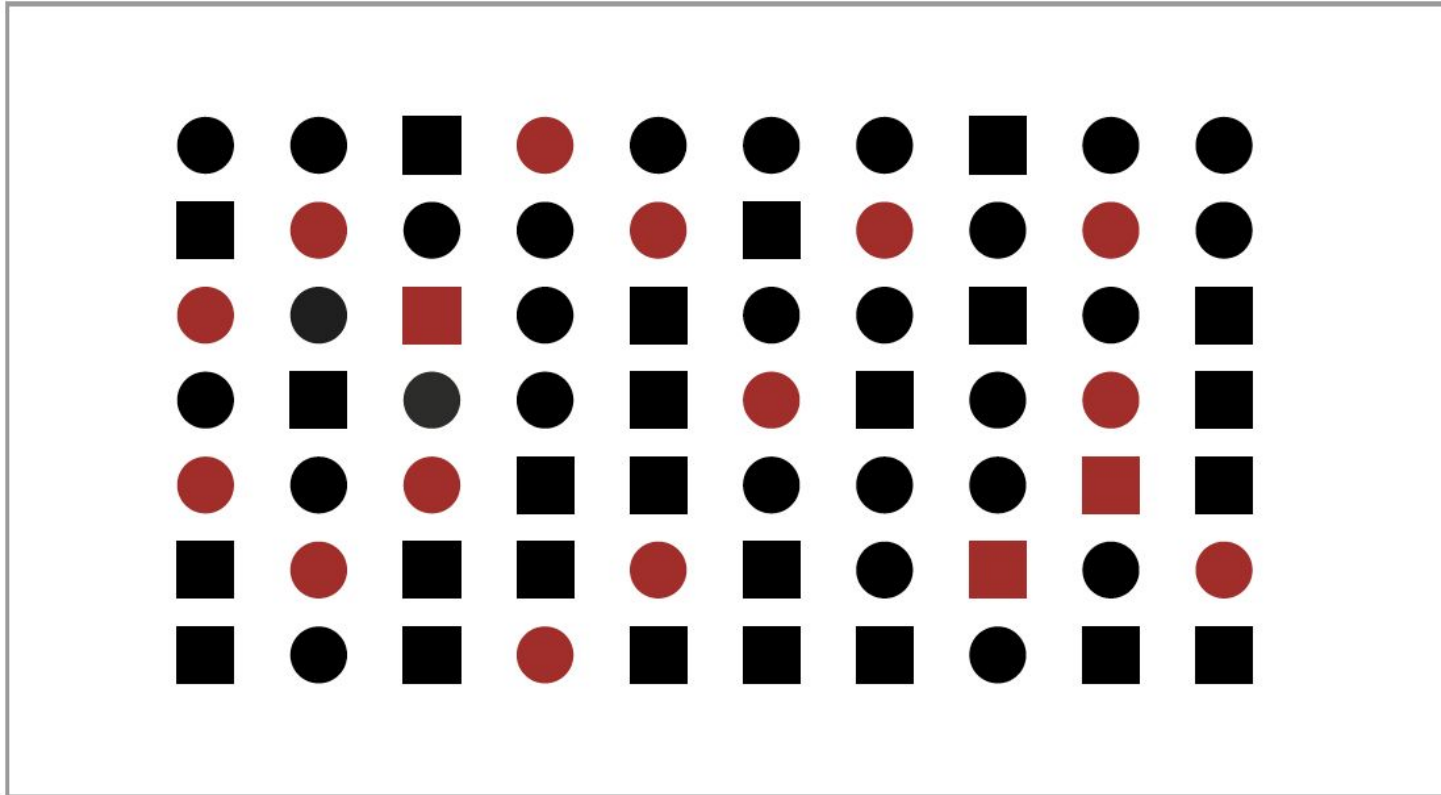
Implications to visualization design:

What can be perceived immediately?

What can mislead viewers?

DG: Use **strong** preattentive cues before **weak** ones where **ease of search** is critical.

Conjunctions of Features - Find red squares



Conjunctions of Features

Conjunction searches are generally **not preattentive**, although exceptions exist.

Space and color

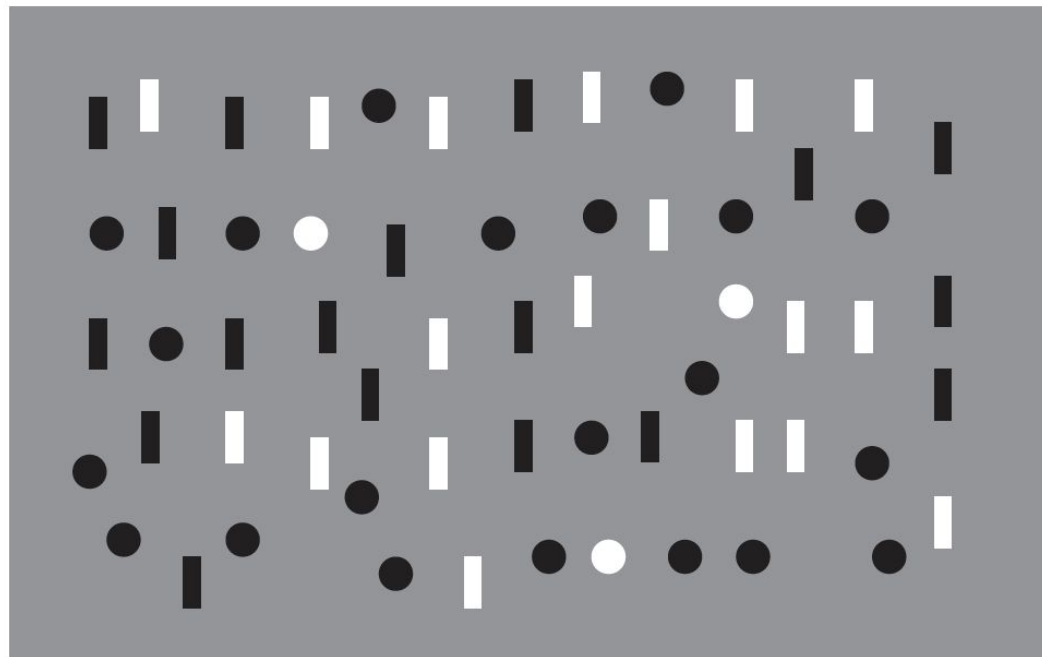
Stereoscopic depth and color

Stereoscopic depth and movement

Luminance polarity and shape -->

Perceived convexity and color

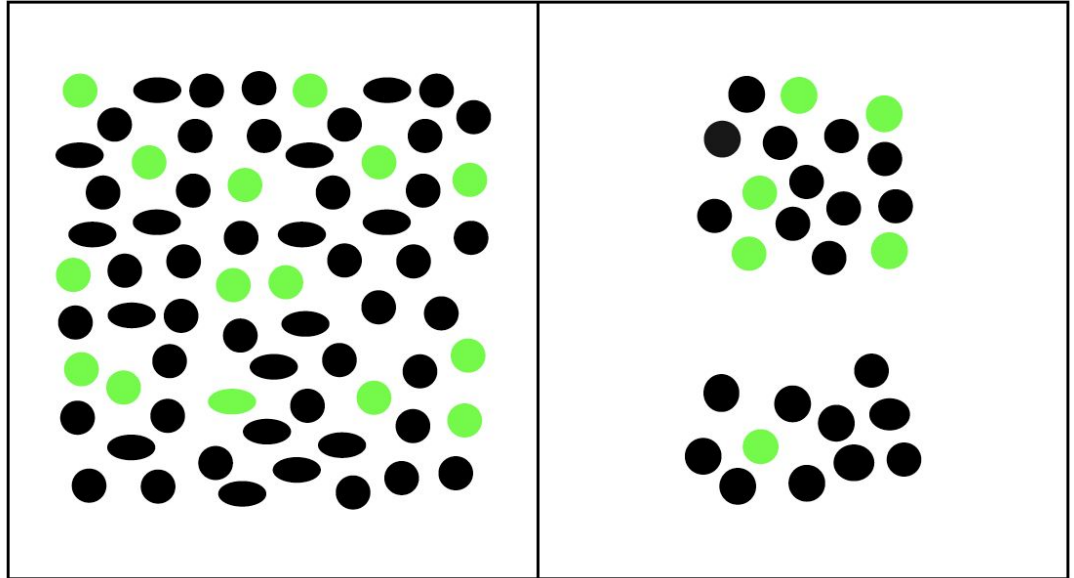
Motion and target shape



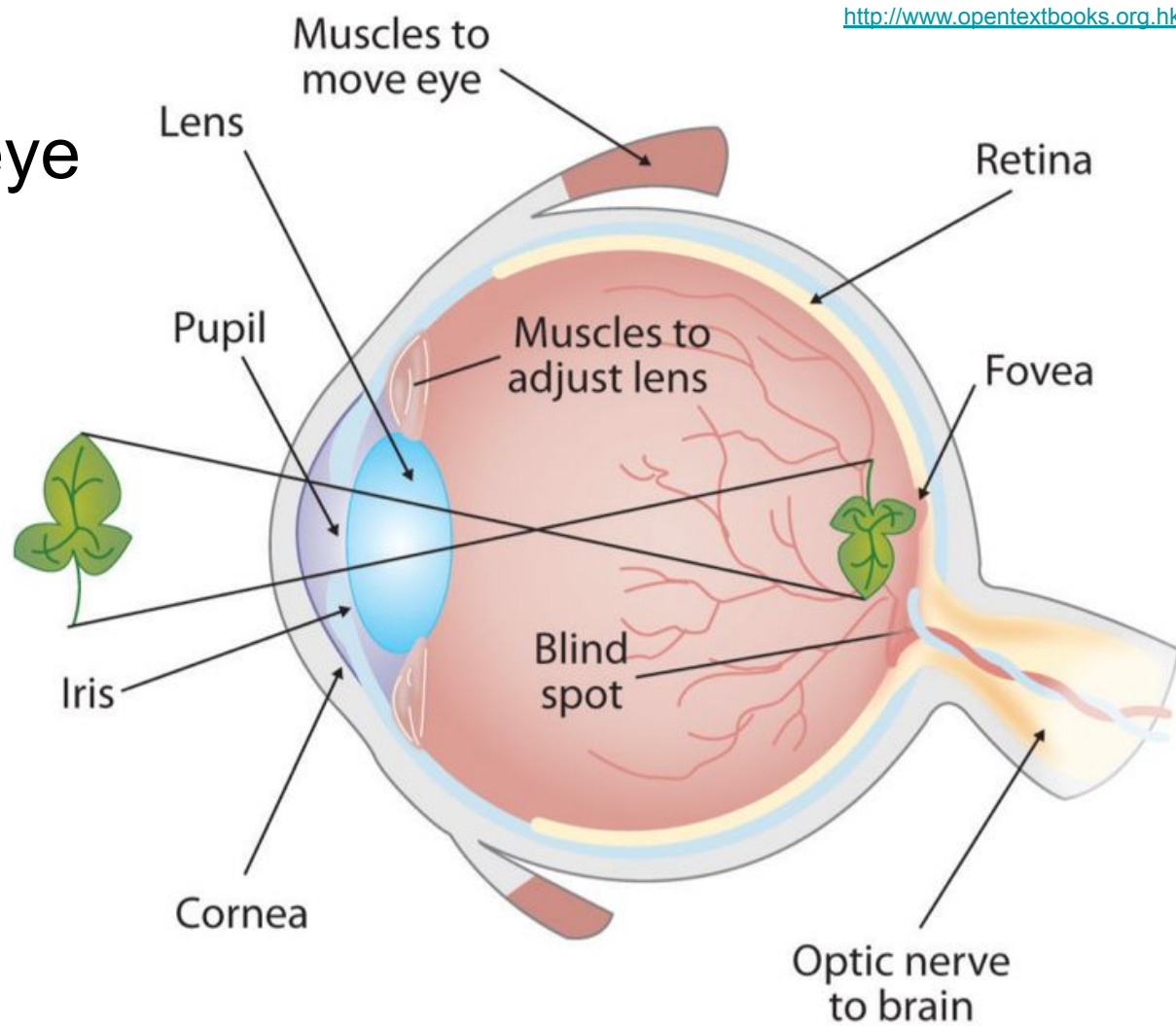
Please find white circles.

Conjunctions of Features

DG: When it is important to highlight two distinct attributes of a set of entities, consider coding one using **motion or spacial grouping** and the other using a **property such as color or shape**.



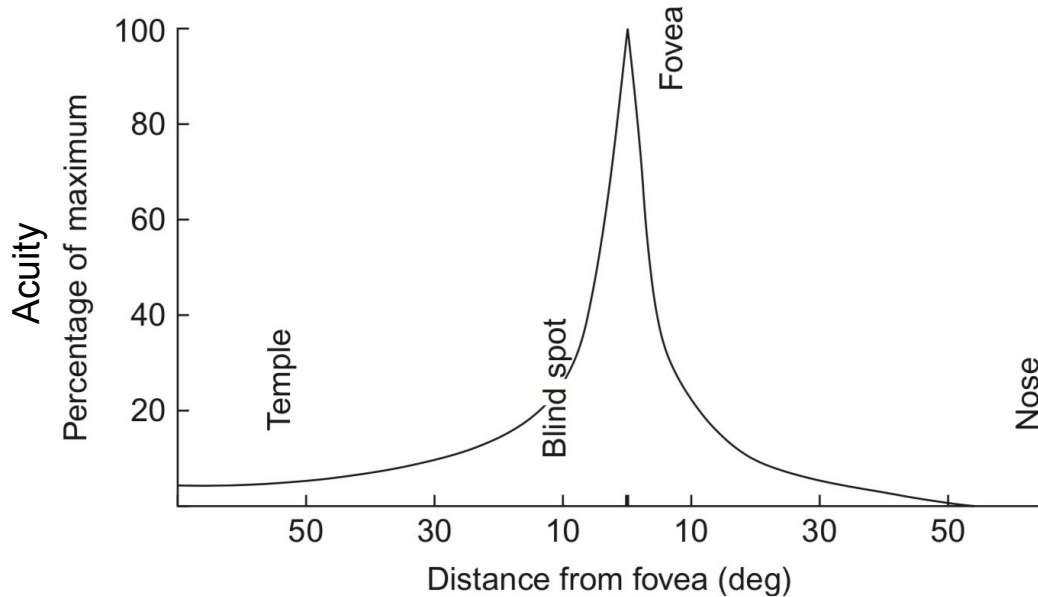
The human eye



Visual acuity

Acuity outside of the fovea drops rapidly:

we can only resolve about 1/10 of the details at 10° from the fovea



Visual acuity + Low capacity of visual working memory

How can we see the world in all its complexity and detail?

Actually we do not... it is an illusion...

We see details in a **need-to-know, just-in-time** fashion through **eye movements**;

We "perceive" knowledge about the environment stored in **long term memory**.

Peripheral vision

Top-down: Provide cues to guide eye movements.

Looking for strawberries in a supermarket, a blurry reddish patch at the edge of our visual field draws our eyes and our attention.

Bottom-up: Good at detecting motion.

A moving animal in the corner of our eyes.



Visual acuity vs. UI design

Peripheral vision: Everything on the screen that is not within 1-2 centimeters of the click location (assuming normal computer viewing distance).

The screenshot shows the Informaworld website interface. At the top, there is a navigation bar with links for 'HOME', 'ABOUT US', and 'CONTACT US'. Below this, there are search options for 'eBooks', 'Journals', 'Reference Works', and 'Abstract Databases'. The Taylor & Francis logo is visible on the left. A search bar is present with a dropdown menu set to 'entire site'. Below the search bar, there are links for 'SIGN IN', 'Register', 'Why Register?', and 'Got a Voucher?'. A red error message is displayed: 'Error: Username/Password combination was not recognised. [hide message]'. The 'My Account' section is highlighted, with sub-tabs for 'My Account', 'Register', 'Subscriptions', 'Purchases', 'Shopping Cart', 'Alerts', 'Marked Lists', and 'Saved Searches'. The 'Register' tab is active, showing options for 'Personal Registration' and 'Institutional Registration'. A 'Sign In' form is visible at the bottom, with fields for 'Username:*' and 'Password:*'. The 'Sign In' button is circled in red and labeled 'Fovea'. A callout box labeled 'Error Message' points to the red error text.



Visual acuity vs. UI design

Peripheral vision: There was something red up there before, and there still is.
If the page title were any other color besides red, the red error message would be more likely to be noticed.



RETURNING CUSTOMER LOGIN

Login ID not found.

Login ID:

Password:

Remember my Login ID for faster logins.

LOGIN

RETURNING CUSTOMER LOGIN

Login ID not found.

Login ID:

Password:

Remember my Login ID for faster logins.

LOGIN

Create a Free Email Address

[Already a Member? Click here](#)

* First Name: Fred



* Last Name: Smith



* Desired Email Address: anonymous

@aol.com

3-16 letters or numbers. It must start with a letter.

* Password:

....|

Password Strength



Please enter a Password that is 6-16 characters using only letters and numbers.

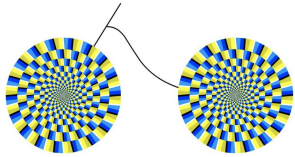
6-16 letters or numbers.

[Help for creating a secure password.](#)

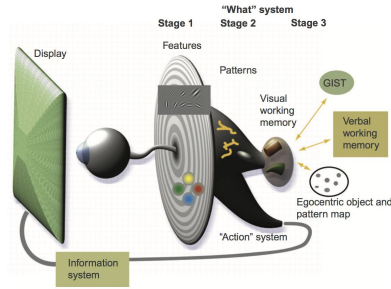


So far, we talked about...

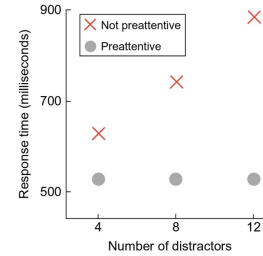
Optical illusions



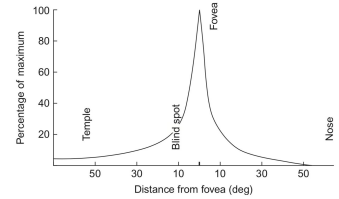
Visual processing model



Preattentive processing

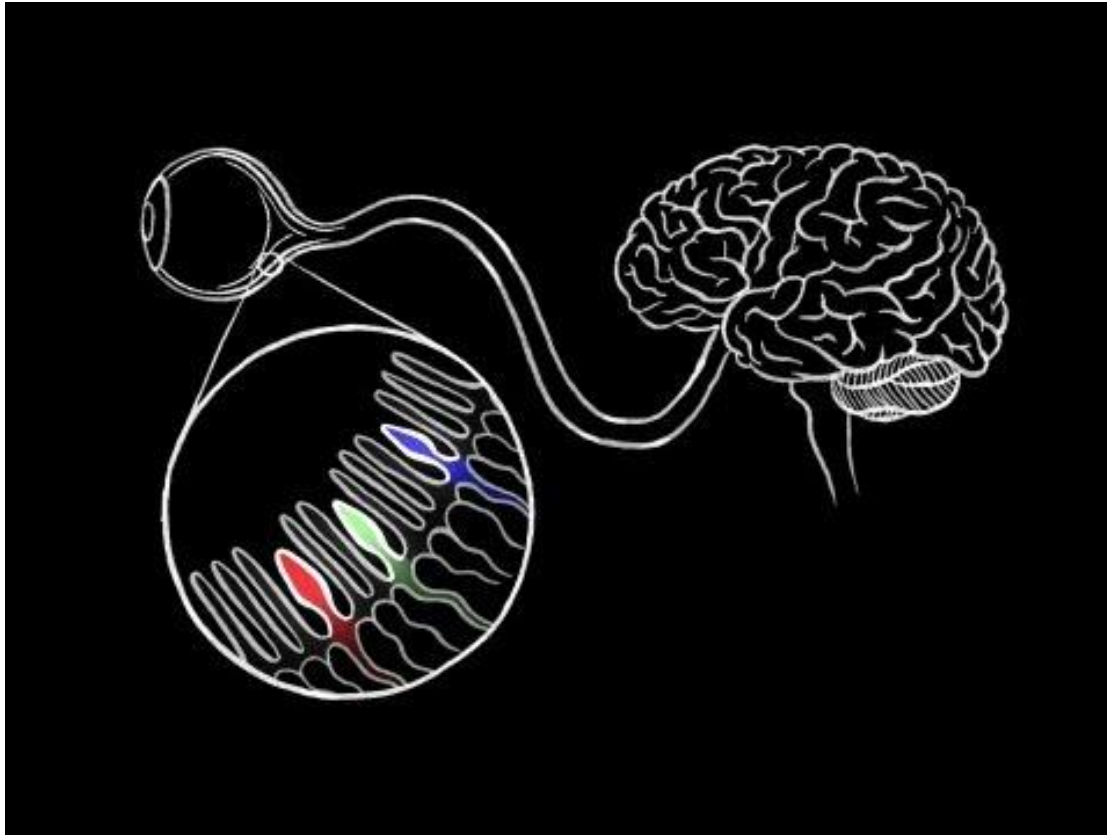


Visual acuity



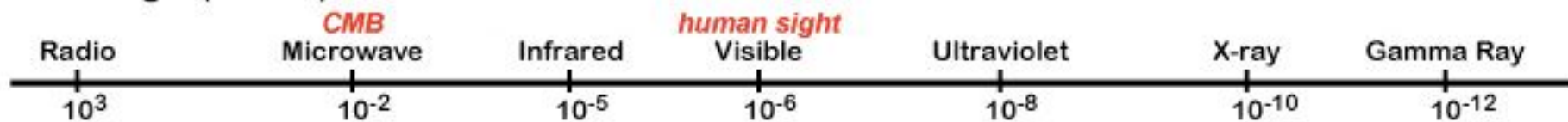
Color

How we see color?



The Electromagnetic Spectrum

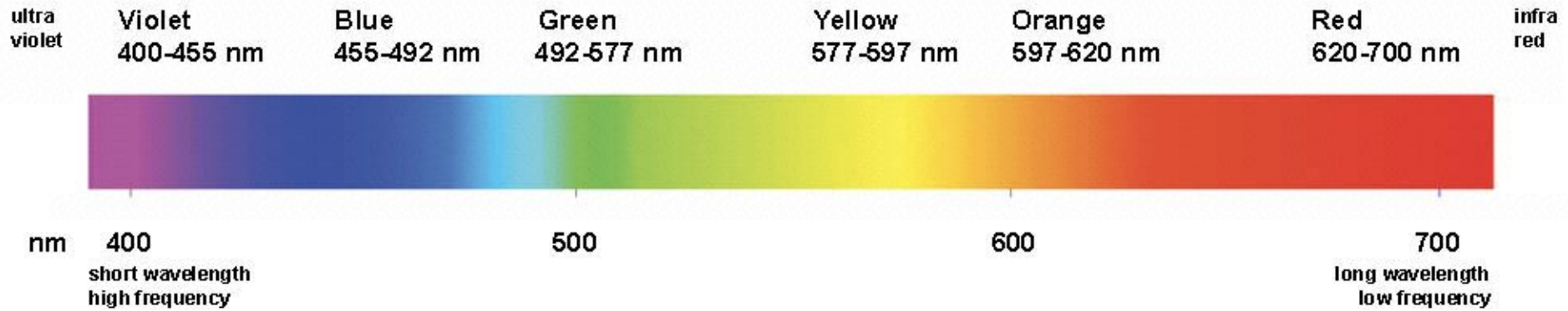
Wavelength (meters)



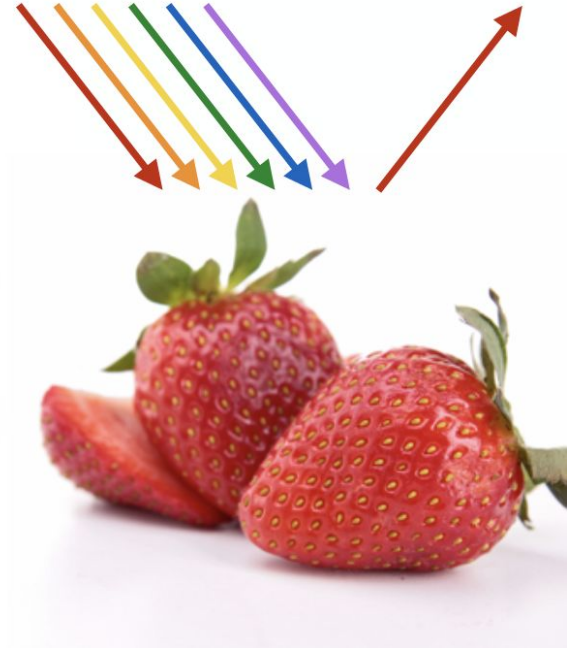
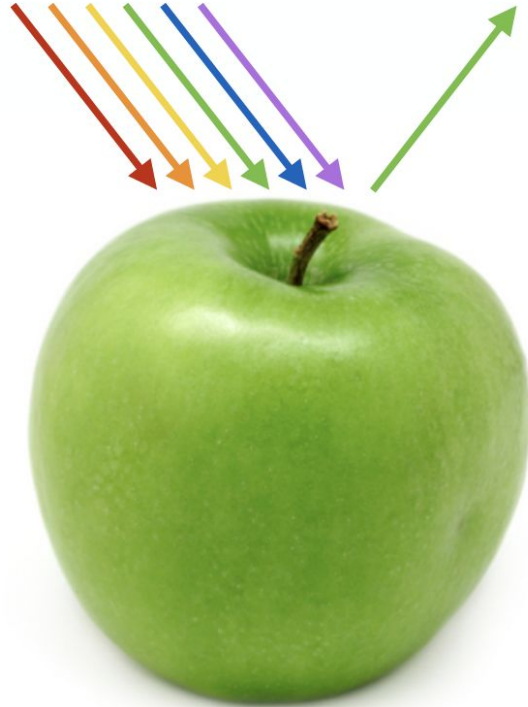
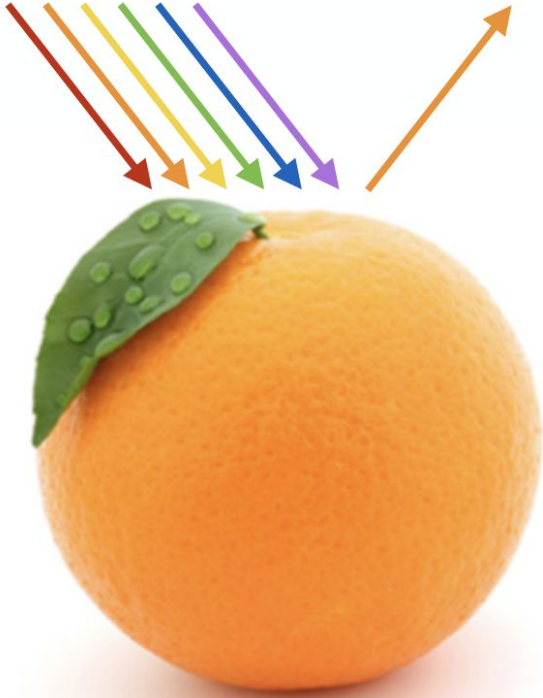
Frequency (Hz)



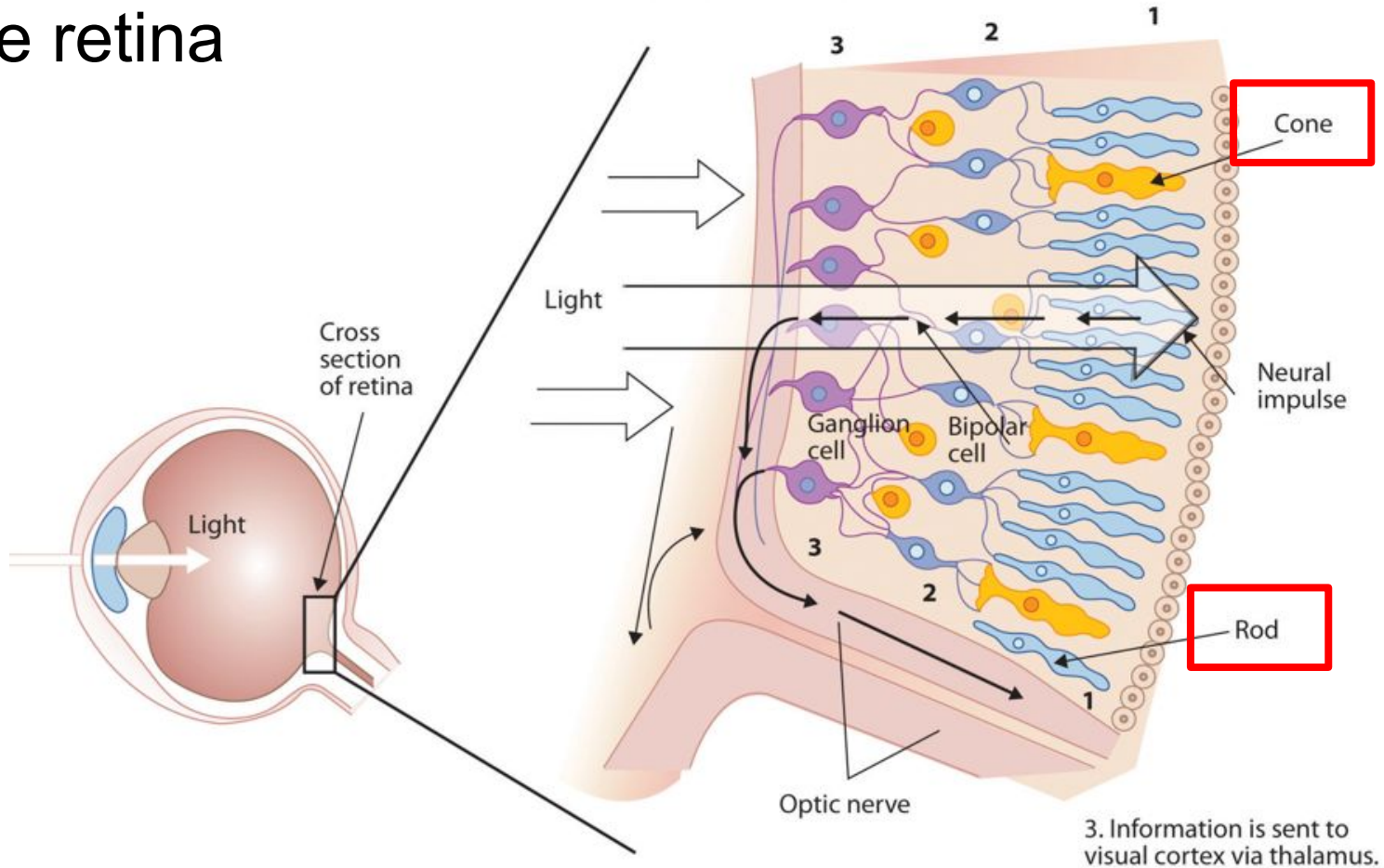
Human visible light



How we see color?



The retina



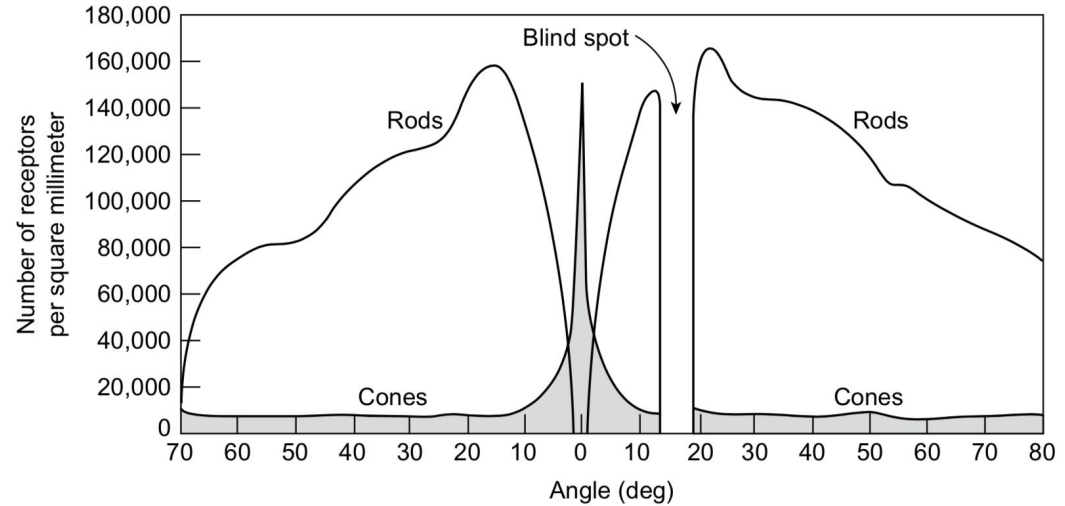
The retina -- receptor cells

Rods:

Sensitive to overall brightness;
Sensitive to low light levels;
~100 million in each eye.

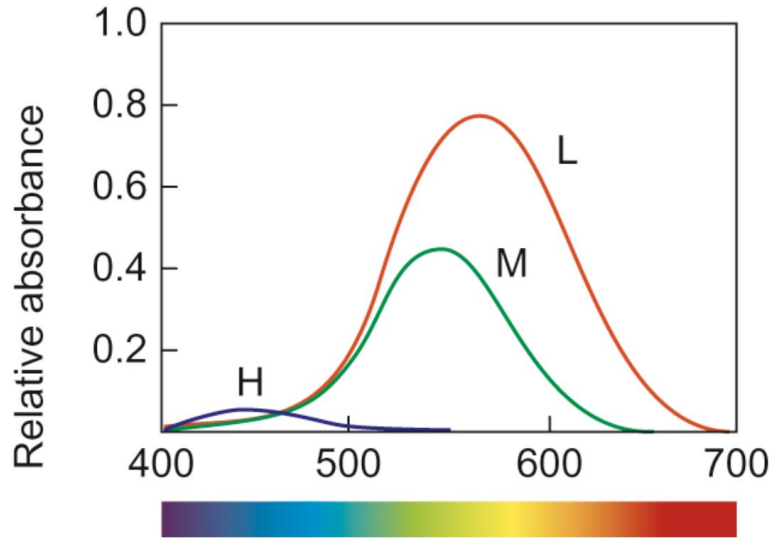
Cones:

Sensitive to different light frequencies (color);
Sensitive under normal working light levels
~6 million in each eye.

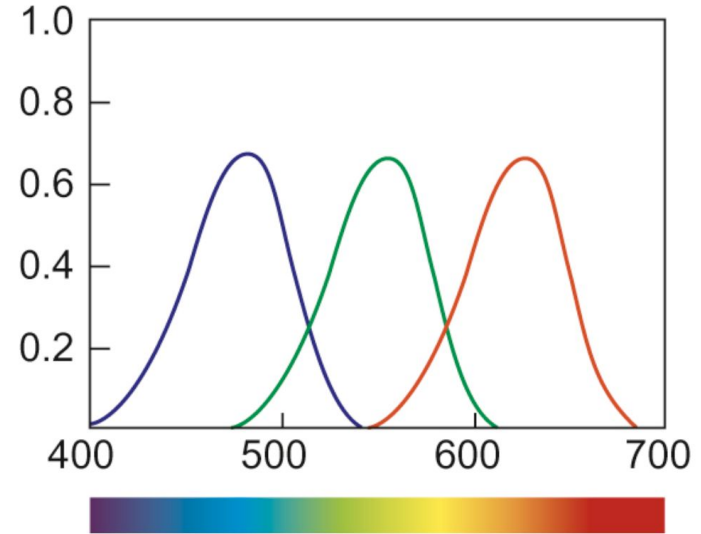


Trichromatic theory -- how eye receives signals

- (A) Three types of cones are sensitive to certain ranges of light wavelengths.
- (B) Artificial red, green, and blue receptors.



(A) Wavelength (nanometers)



(B) Wavelength (nanometers)

Opponent process theory -- how brain processes signals

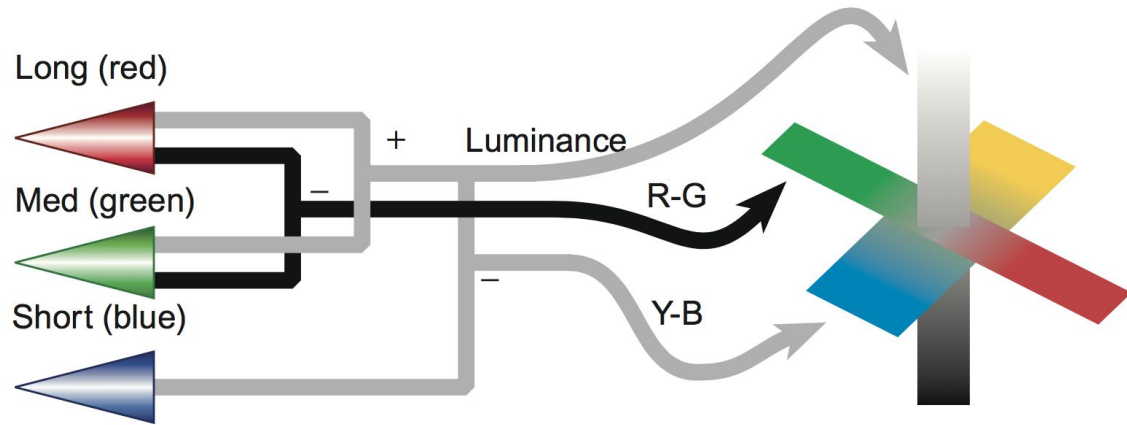
Neurons in the visual cortex detect **differences** between the response cones.

Three opponent channels:

Red vs. green

Blue vs. yellow

Black vs. white (luminance)



Opposite colors are never perceived together:

No reddish green or bluish yellow

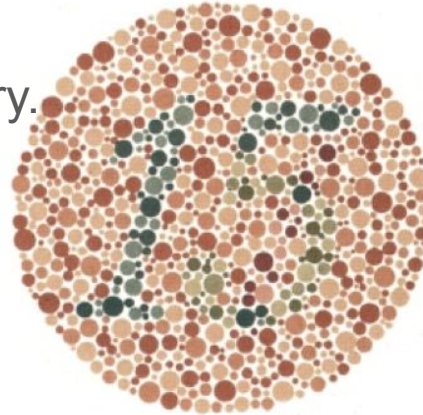
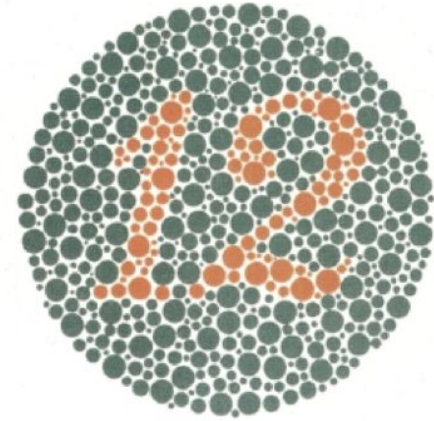
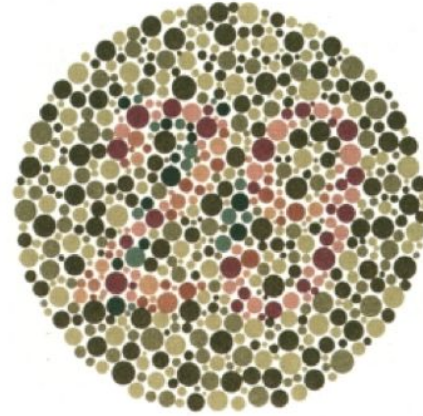
Color blindness

Caused by faulty cones or faulty pathways.

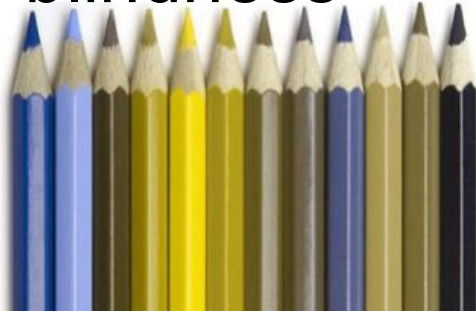
Red-green most common:

8% of males, and 0.5% of females.

Can be explained by opponent process theory.



Color blindness

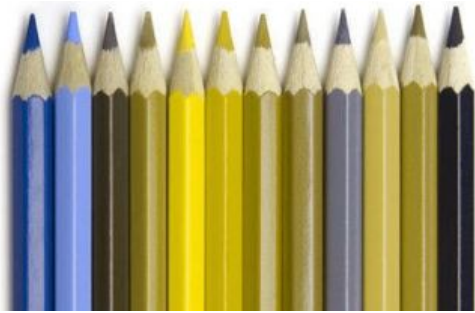


Lacking cones
sensitive to:
Cannot
distinguish:

Protanopia

long-wavelength red

red and green



Deuteranopia

mid-wavelength green

red and green



Tritanopia

short wavelength blue

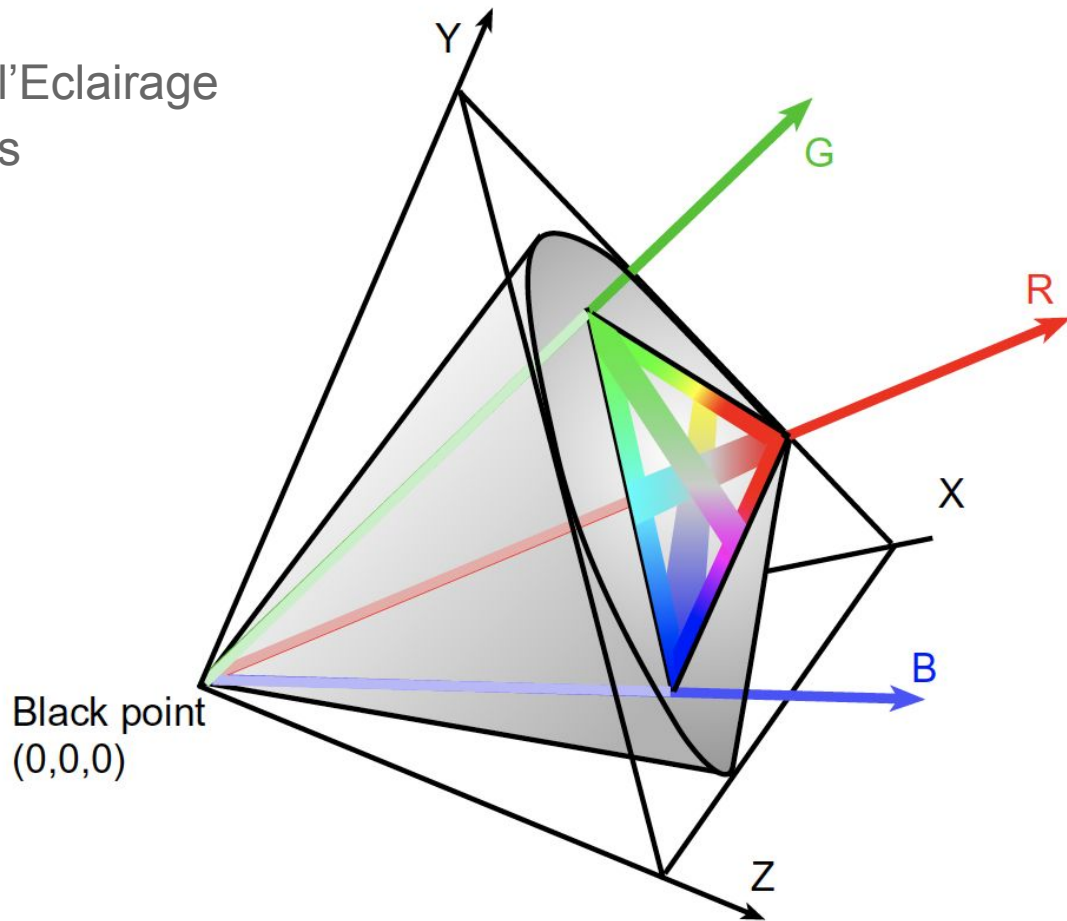
blue from green and yellow from violet



Normal

Color spaces - Representing colors in 3D spaces

Commission Internationale de l'Eclairage
(CIE) system of color standards



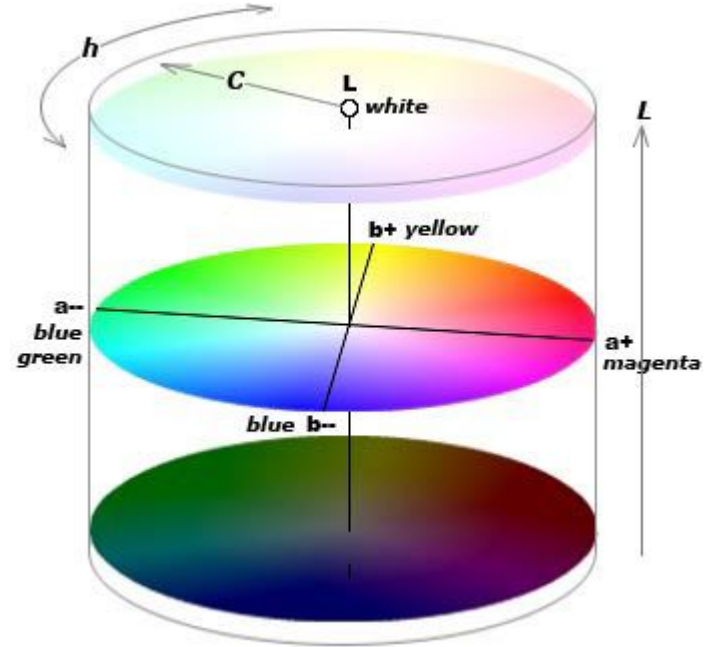
Color spaces - CIE $L^*a^*b^*$

L^* : lightness;

a^* : green–red color components;

b^* : blue–yellow color components.

Perceptually uniform: the same amount of numerical change corresponds to about the same amount of visually perceived change.



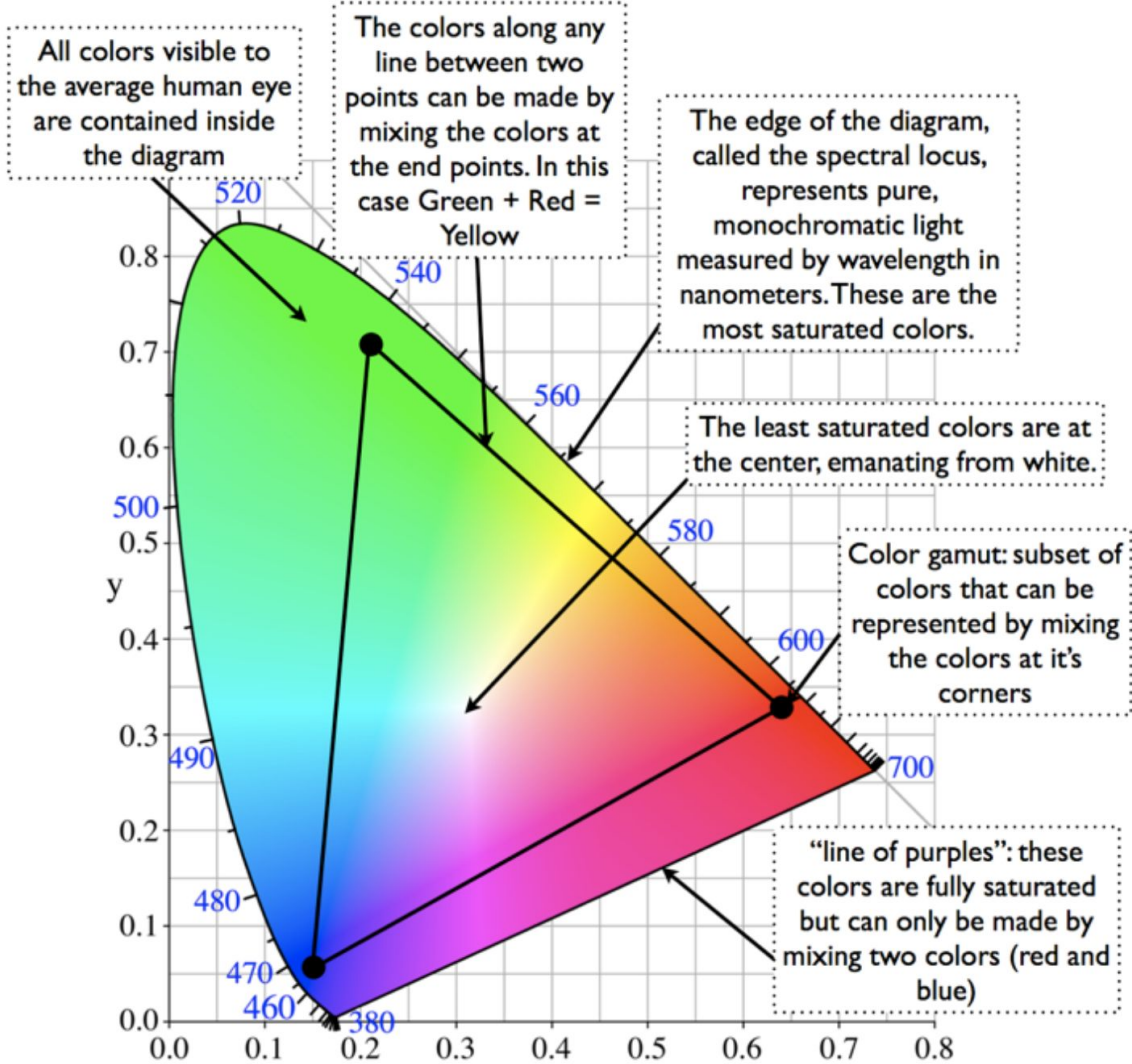
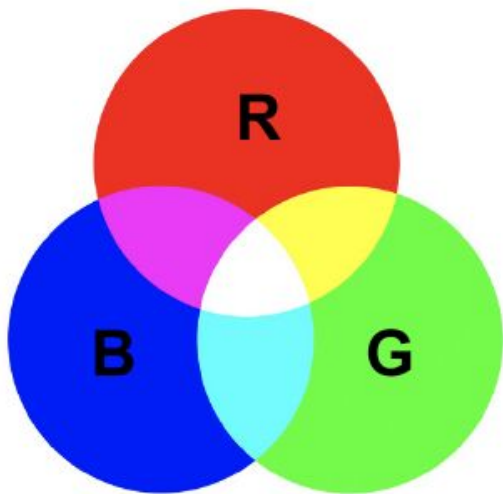
Color space: RGB

For monitors

Additive model

Not intuitive

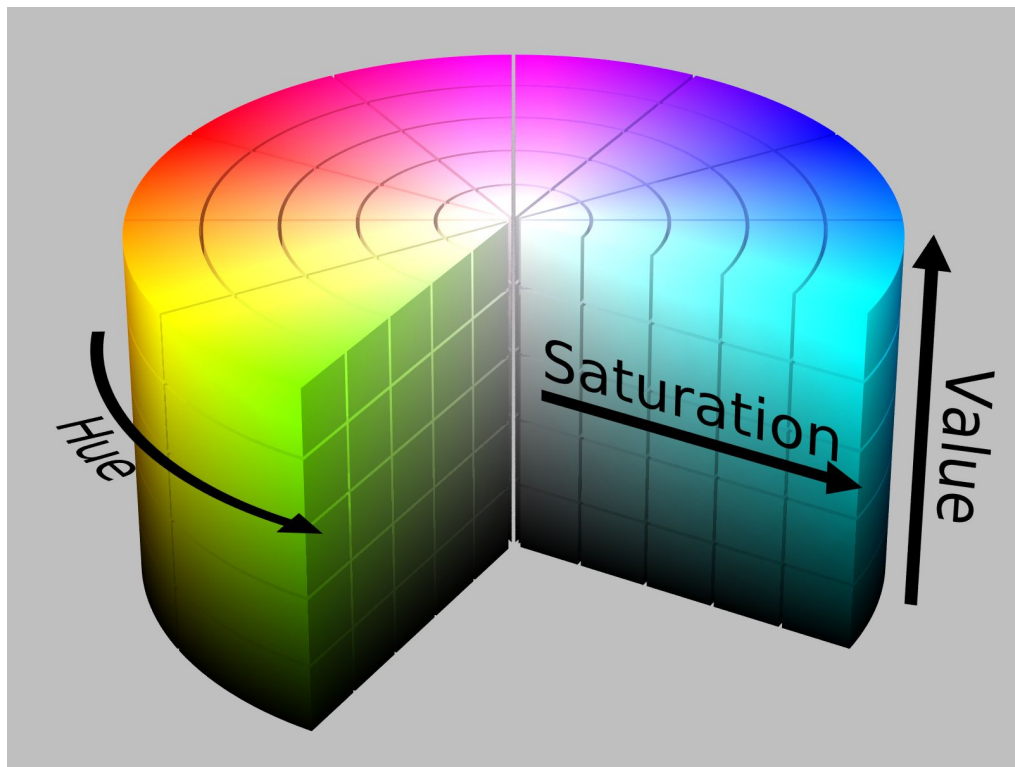
Not perceptually uniform



Color space: HSV/HSB

Hue: what people think of as color;
Saturation: amount of white mixed in;
Value: amount of black mixed in.

A more intuitive alternative
representation of RGB.



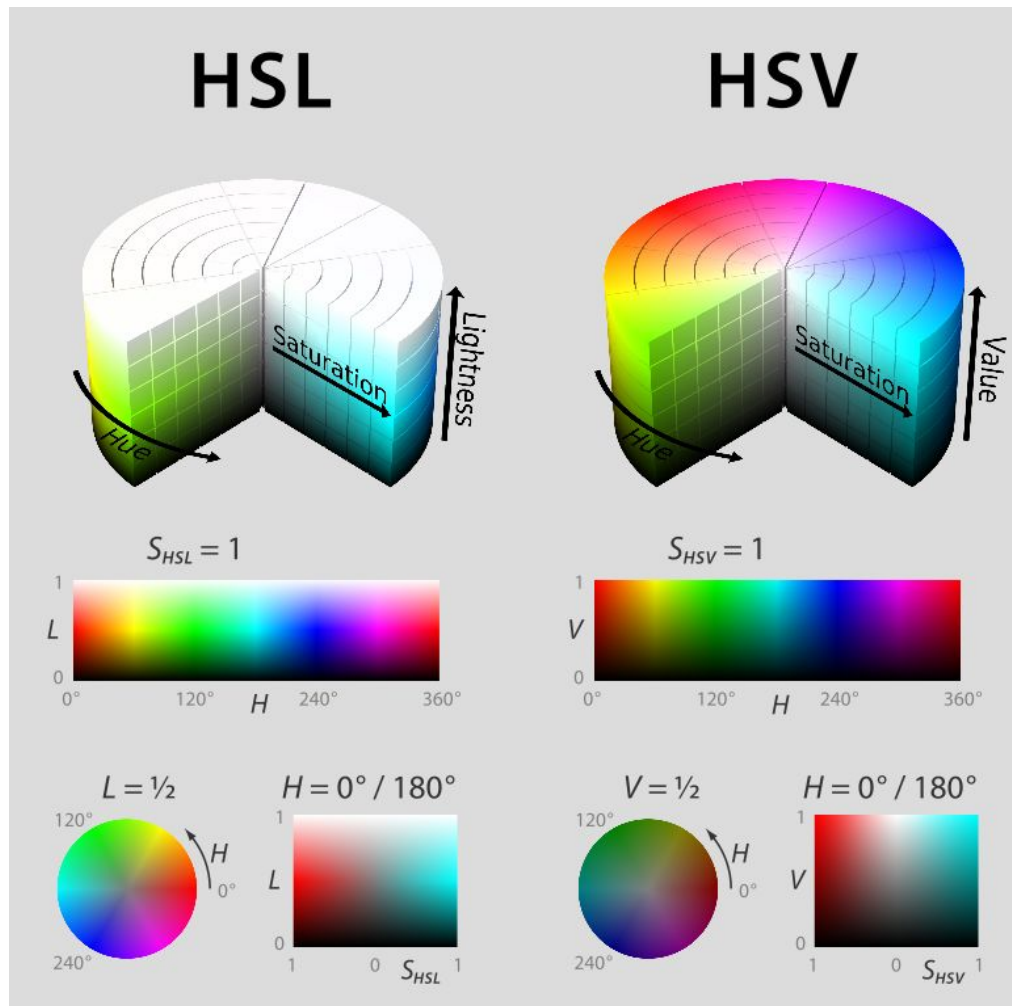
Color space: HSL

Hue: what people think of as color;

Saturation: degree to which hue differs from neutral gray;

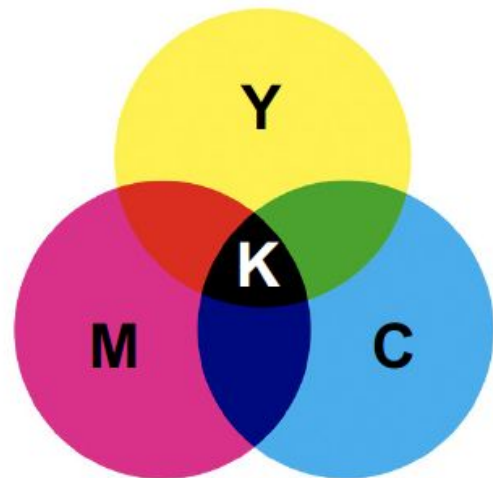
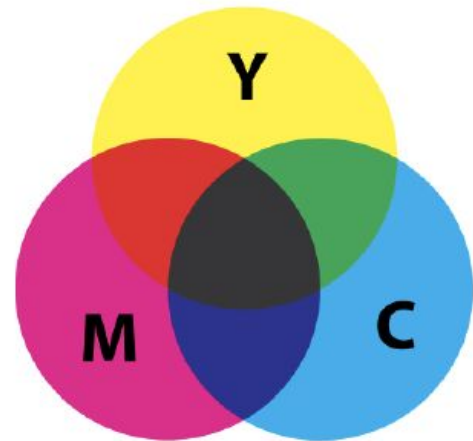
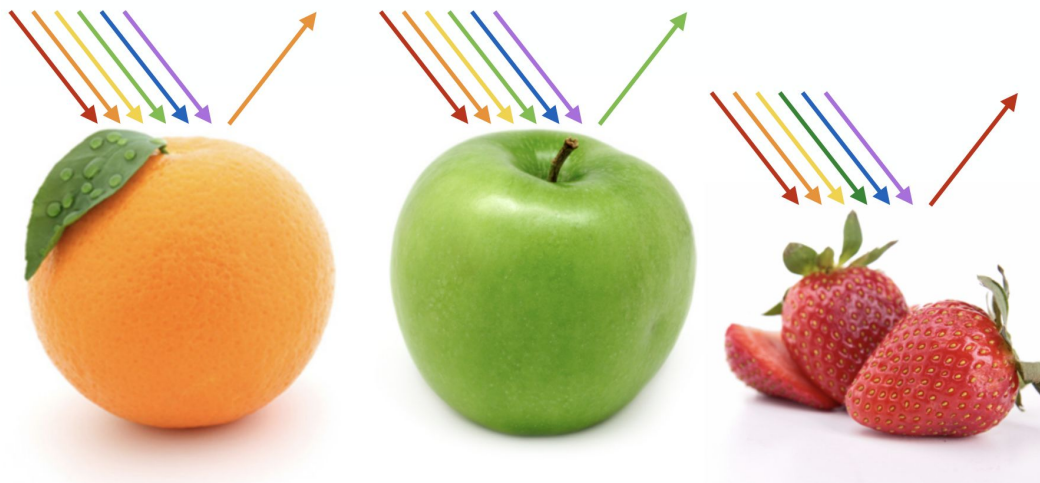
Lightness: amount of black or white mixed in.

An alternative to RGB.



Color space: CMYK















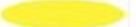
























Cyan, Magenta, Yellow, and Key.
For printing.
Subtractive model.

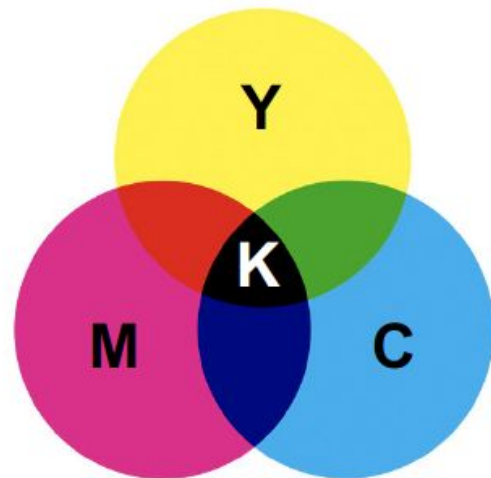
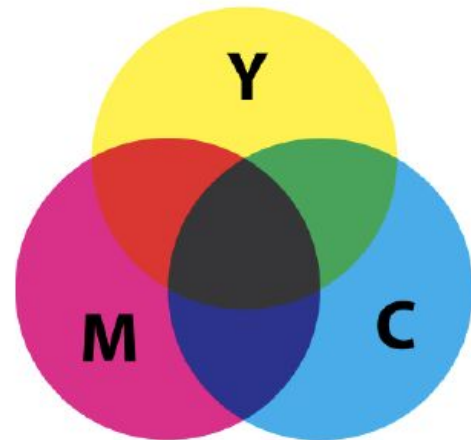


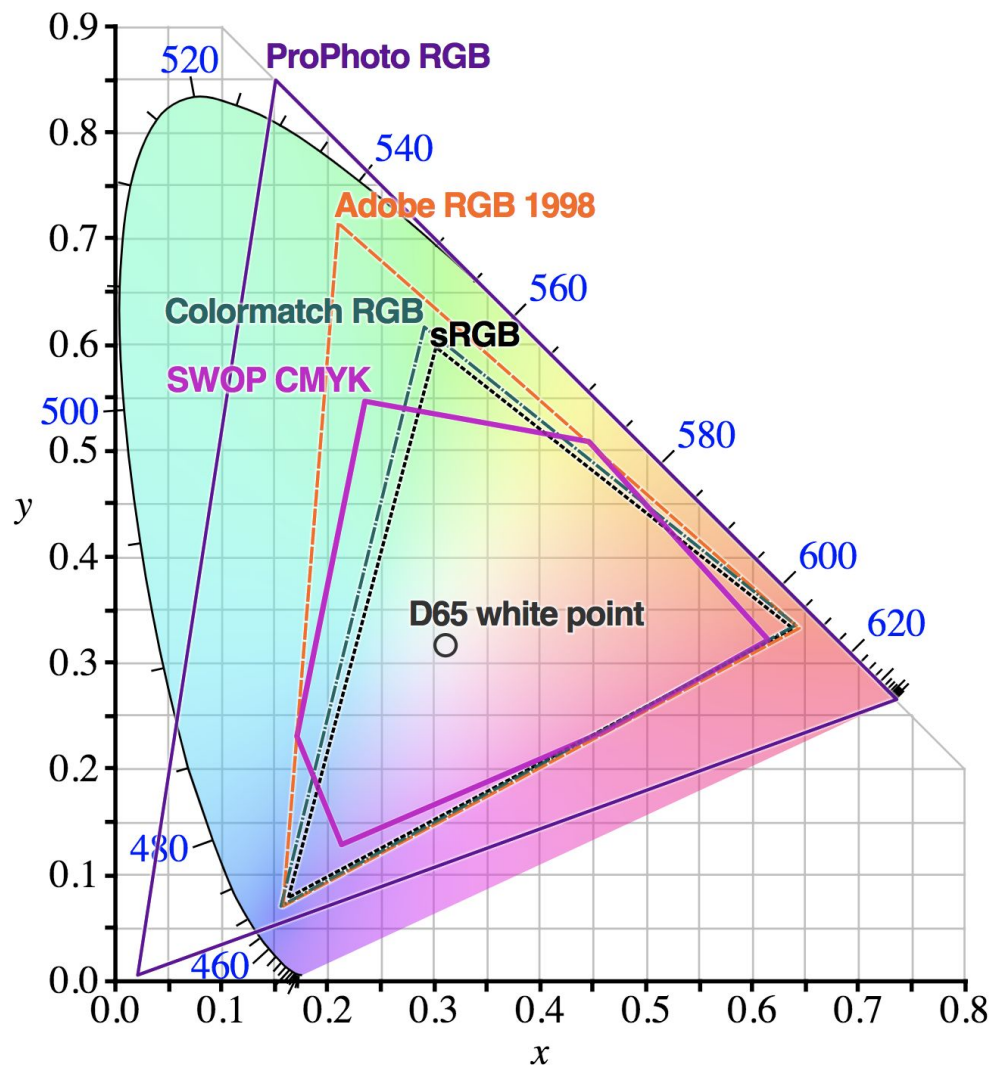
Color space: CMYK

For printing

Subtractive model

	Ink Color	Absorbs	Reflects	Appears
Single Ink			 	
			 	
			 	
Over-Prints		 		
		 		
		 		
		  	(no light)	 *
	(no pigment)	(no light)	  	





Colorbrewer2.0 -- Color advice for cartography

The screenshot displays the ColorBrewer 2.0 interface. At the top right, the logo reads "COLORBREWER 2.0 color advice for cartography". The main navigation bar includes links for "how to use", "updates", "downloads", and "credits".

Number of data classes: 3

Nature of your data: sequential diverging qualitative

Pick a color scheme:

- Multi-hue:** A grid of 12 color scheme options.
- Single hue:** A grid of 6 color scheme options.

Only show:

- colorblind safe
- print friendly
- photocopy safe

Context:

- roads
- cities
- borders

Background: solid color

3-class BuGn

HEX

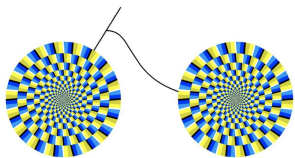
- #e5f5f9
- #99d8c9
- #2ca25f

EXPORT

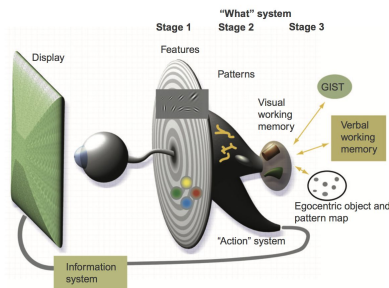
The map shows the United States with county boundaries. The color scheme is applied to the map, showing a gradient from light blue to dark green. The map is currently in a "Preview" mode, as indicated by the "EXPORT" button.

So far, we talked about...

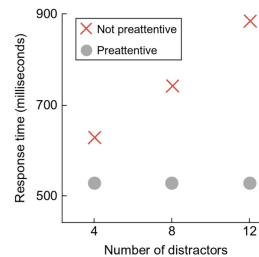
Optical illusions



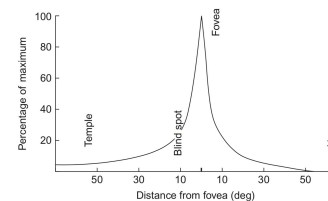
Visual processing model



Preattentive processing



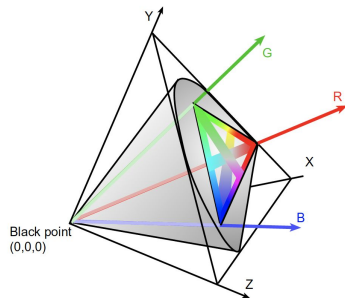
Visual acuity



Color vision

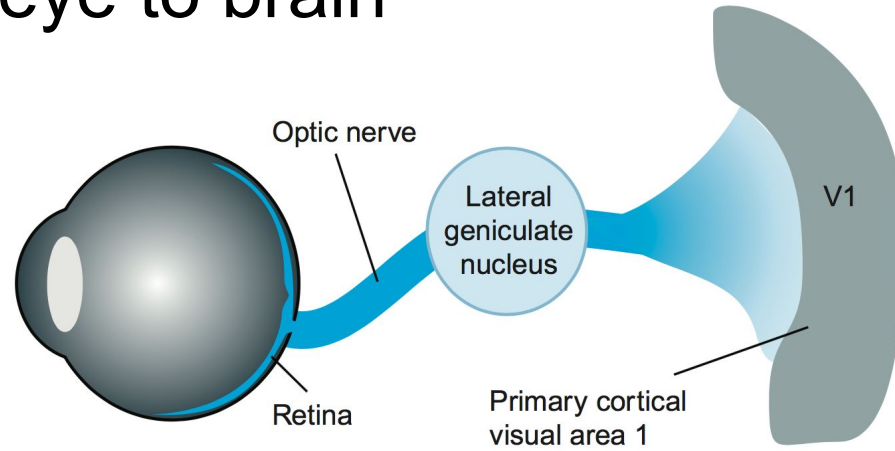


Color space



Brightness illusions

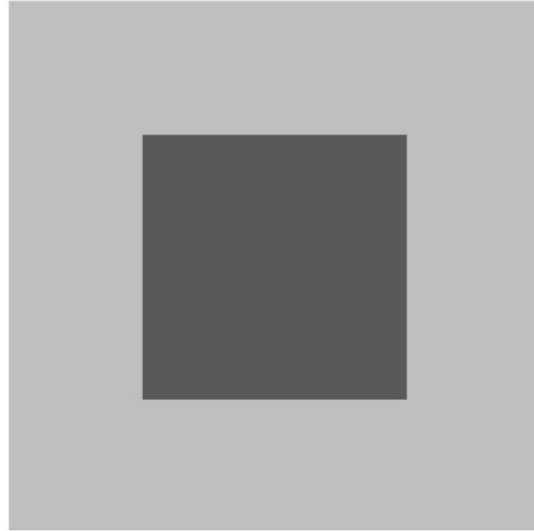
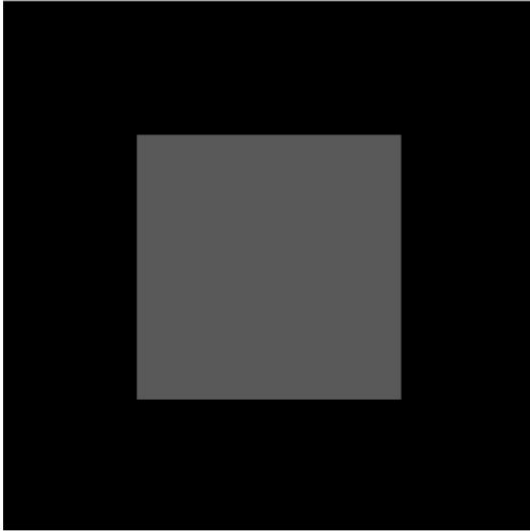
Signal from eye to brain



~~Amount of light falling on retina~~

Relative amount of light, i.e., how a particular patch of light differs from a neighboring patch.

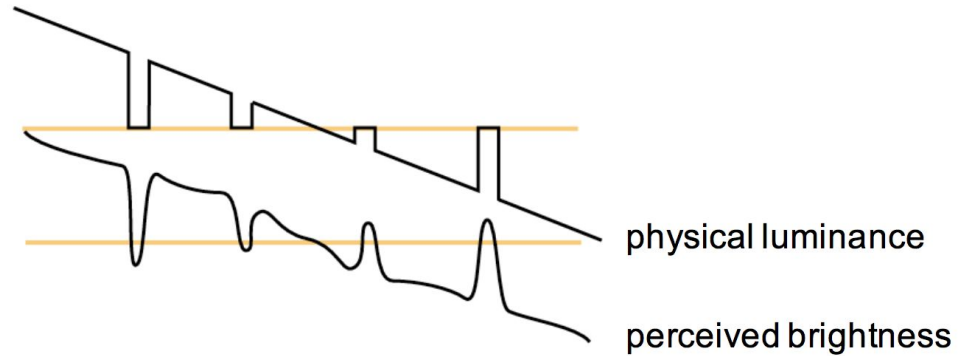
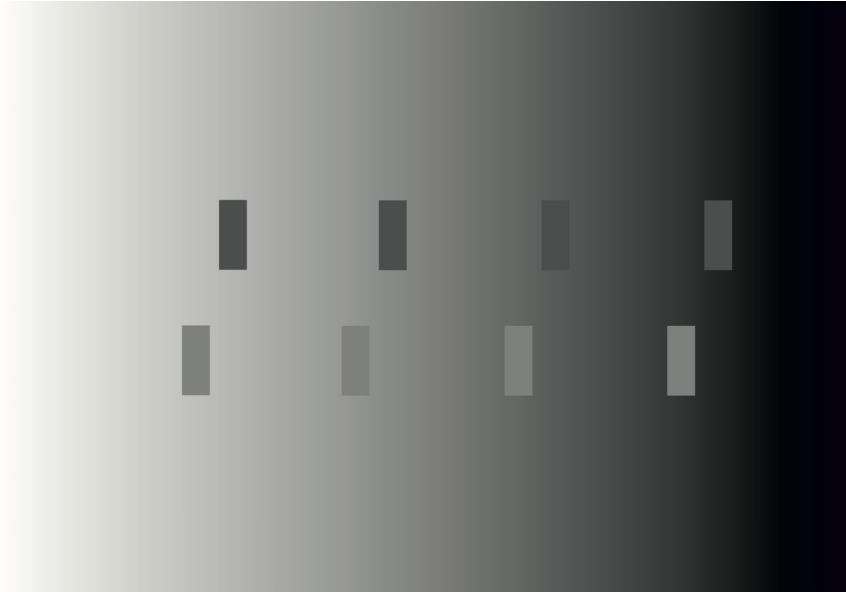
Simultaneous brightness contrast



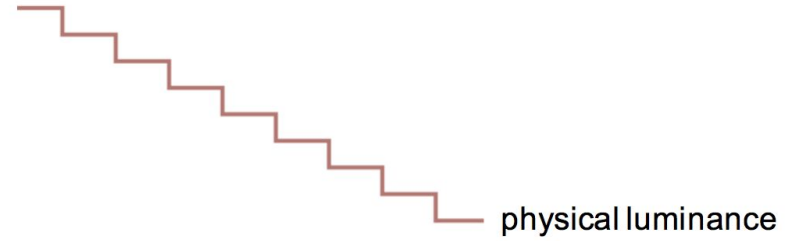
Simultaneous brightness contrast



Simultaneous brightness contrast



The Chevreul Illusion

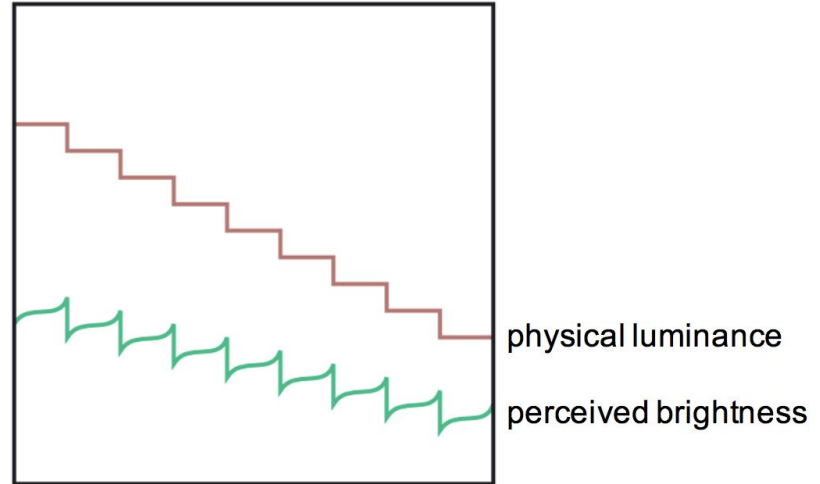


The Chevreul Illusion



physical luminance

The Chevreul Illusion



DG: Avoid using gray scale as a method for representing more than a few (two to four) numerical values.

Which one is brighter?

[144, 144, 144]



[128, 128, 128]



Which one is brighter?

[128, 128, 128]



[136, 136, 136]



Just noticeable difference (JND)

Weber's Law

The ratio of JND to initial stimulus I is relatively constant k .

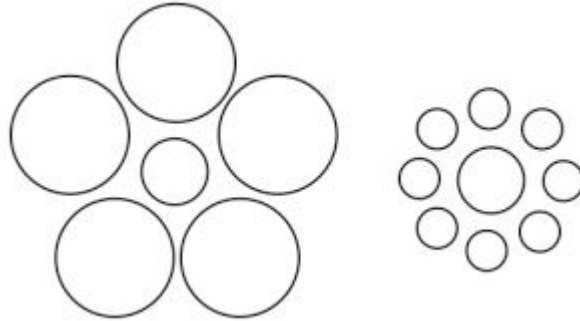
$$\frac{\Delta I}{I} = k$$

Just noticeable difference (JND)

Weber's Law

Ratio is much more important than magnitude.

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



Magnitude estimation

Magnitude estimation

How much longer is the lower bar?

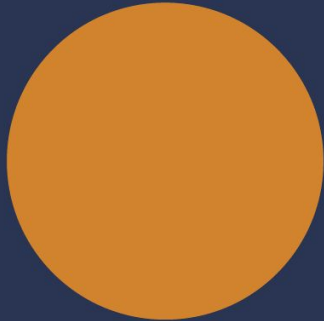


×4

Magnitude estimation

How much bigger is the right circle?

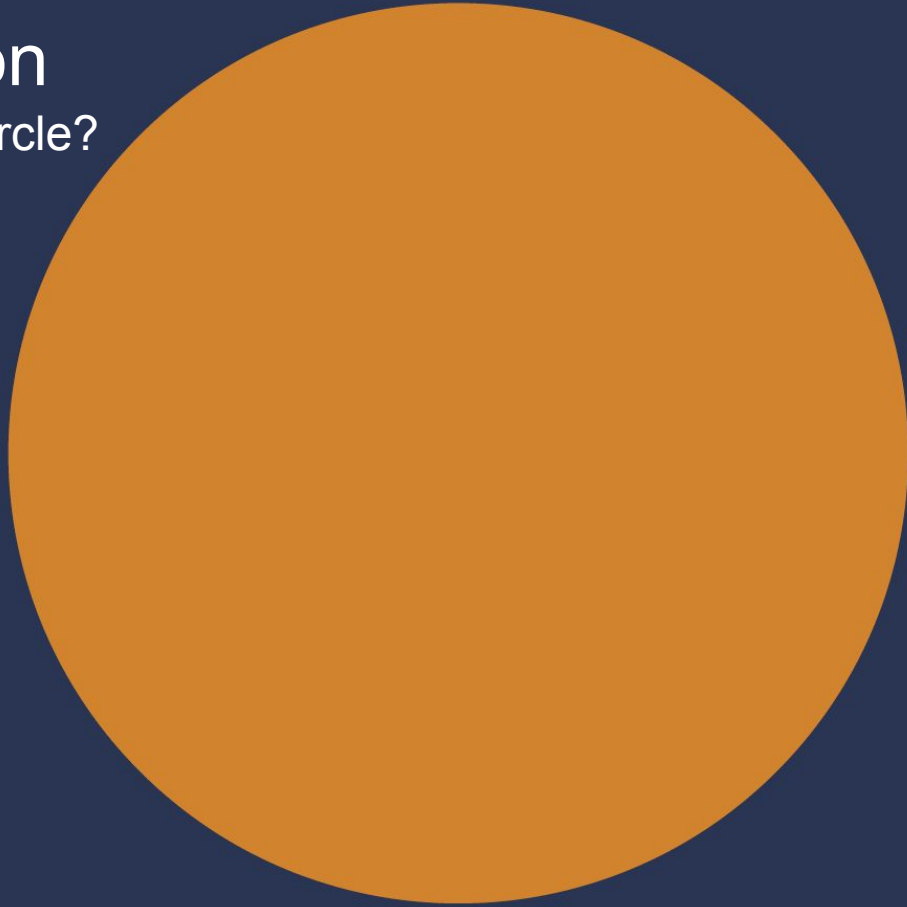
$\times 5$



Magnitude estimation

How much bigger is the right circle?

×9

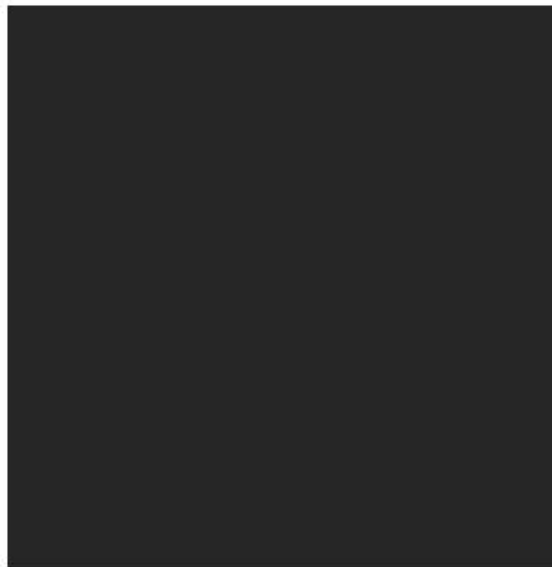


Magnitude estimation

How much darker is the right square?



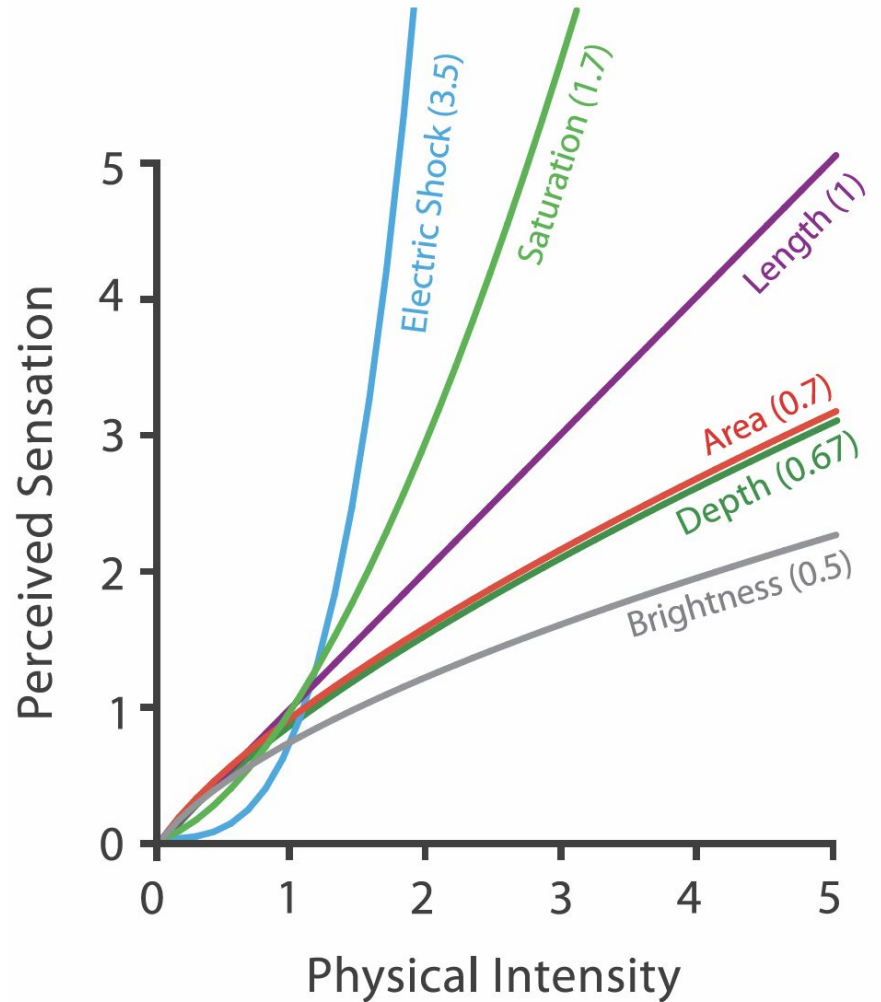
$\times 4$



Steven's Power Law: $S = I^p$

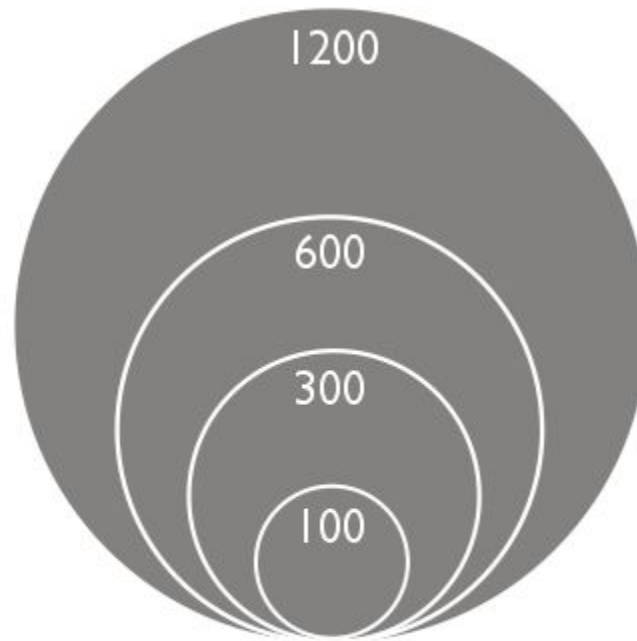
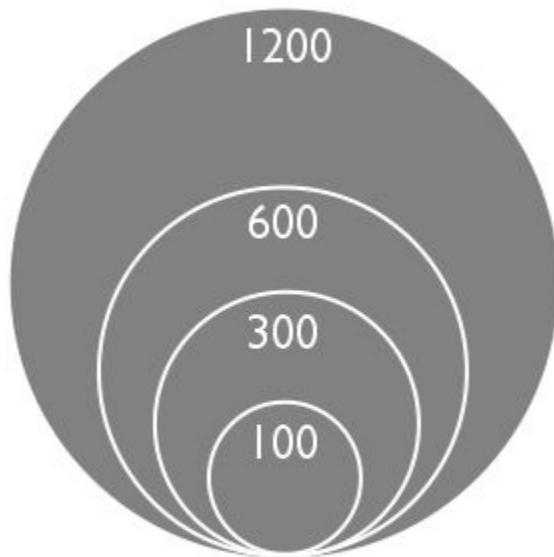
$p < 1$ under-estimate

$p > 1$ over-estimate



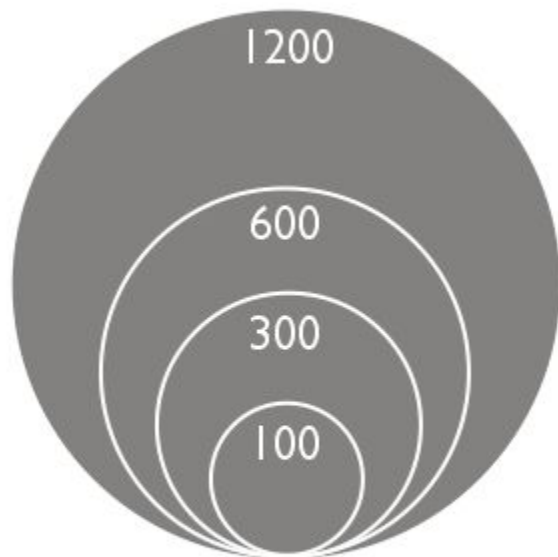
Sensation	Exponent
Loudness	0.6
Brightness	0.33
Smell	0.55 (Coffee) - 0.6 (Heptane)
Taste	0.6 (Saccharine) -1.3 (Salt)
Temperature	1.0 (Cold) – 1.6 (Warm)
Vibration	0.6 (250 Hz) – 0.95 (60 Hz)
Duration	1.1
Pressure	1.1
Heaviness	1.45
Electric Shock	3.5

Which one is more accurate?

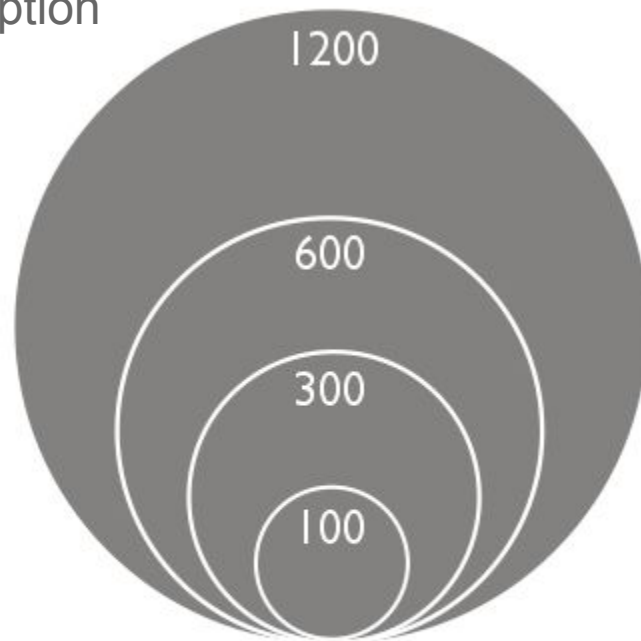


Apparent magnitude scaling

Compensating magnitude to match perception



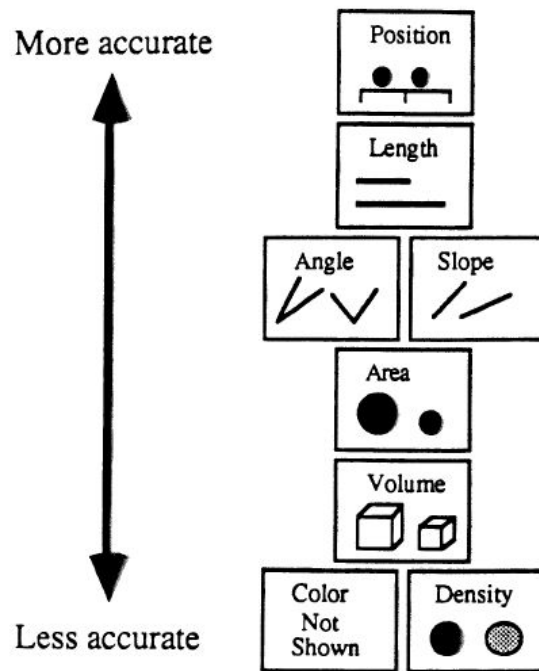
Absolute Scaling



Apparent Scaling
(Flannery's Compensation)

Encodings

Hierarchy of accuracy



Encodings




























Rankings of perceptual tasks

More Accurate

↑

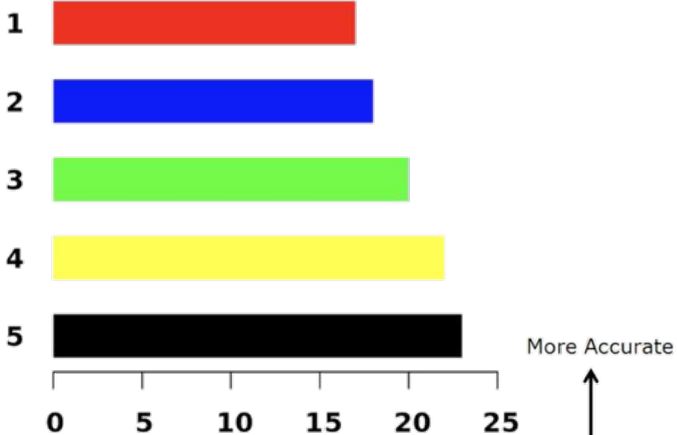
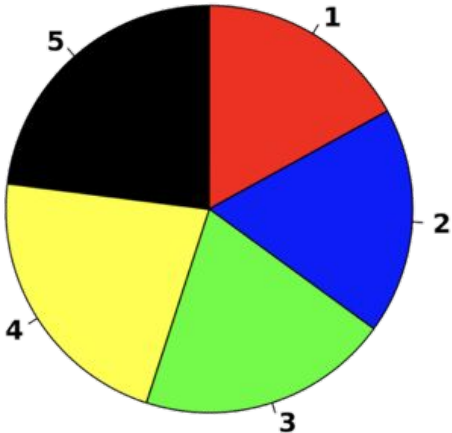
↓

Less Accurate

	Quantitative	Ordinal	Nominal
	Position 	Position 	Position 
	Length 	Density 	Hue 
	Angle 	Saturation 	Density 
	Slope 	Hue 	Saturation 
	Area 	Length 	Shape 
	Density 	Angle 	Length 
	Saturation 	Slope 	Angle 
	Hue 	Area 	Slope 
	Shape 	Shape 	Area 

Encodings

Angle & Area < Position & Length



More Accurate
↑
↓
Less Accurate

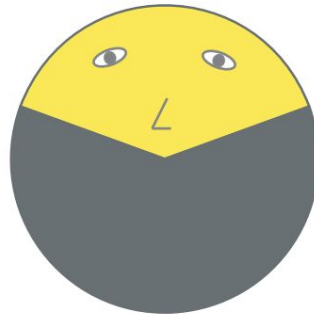
Quantitative	Ordinal	Nominal
Position	Position	Position
Length	Density	Hue
Angle	Saturation	Density
Slope	Hue	Saturation
Area	Length	Shape
Density	Angle	Length
Saturation	Slope	Angle
Hue	Area	Slope
Shape	Shape	Area

Save the Pies for Dessert

Stephen Few, Perceptual Edge
Visual Business Intelligence Newsletter
August 2007

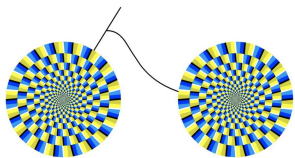
Not long ago I received an email from a colleague who keeps watch on business intelligence vendors and rates their products. She was puzzled that a particular product that I happen to like did not support pie charts, a feature that she assumed was basic and indispensable. Because of previous discussions between us, when I pointed out ineffective graphing practices that are popular in many BI products, she wondered if there might also be a problem with pie charts. Could this vendor's omission of pie charts be intentional and justified? I explained that this was indeed the case, and praised the vendor's design team for their good sense.

Here sits the friendly pie chart:

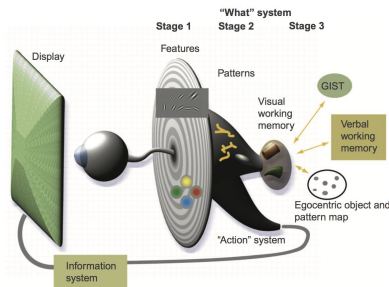


So far, we talked about...

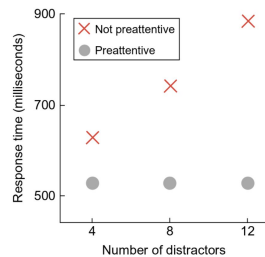
Optical illusions



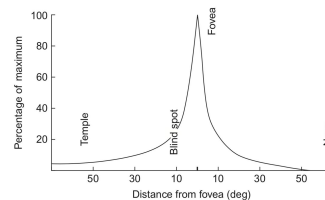
Visual processing model



Preattentive processing



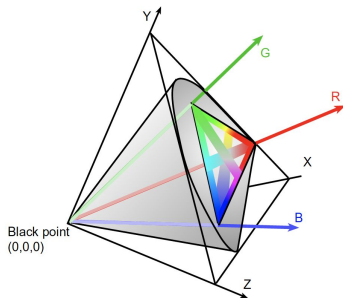
Visual acuity



Color vision



Color space



Brightness illusions



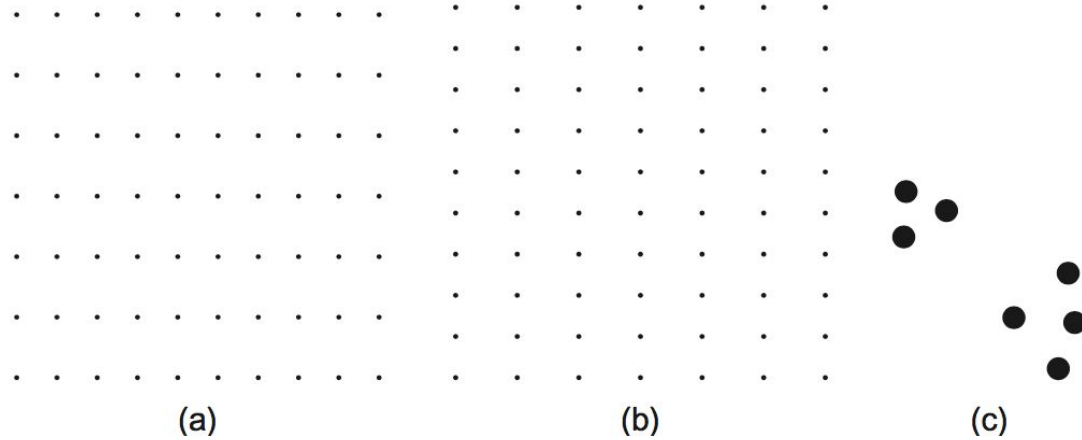
Magnitude estimation

	Quantitative	Ordinal	Nominal
Position	●●	●●	●●
Length	==	●●	●●
Angle	∠	●●	●●
Slope	∕∕	●●	●●
Area	●●	==	●●
Density	●●	∠	==
Saturation	●●	∕∕	∠
Hue	●●	●●	∕∕
Shape	●●	●●	●●

More Accurate ↑
↓ Less Accurate

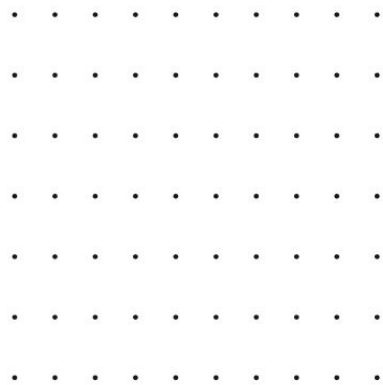
Gestalt laws - Principles of grouping

Gestalt laws -- Spatial proximity



DG: Place symbols and glyphs representing related information **close together**.

Gestalt laws -- Spatial proximity



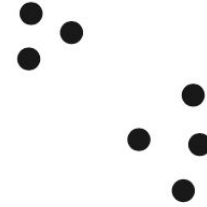
(a)

Rows of dots



(b)

Columns of dots

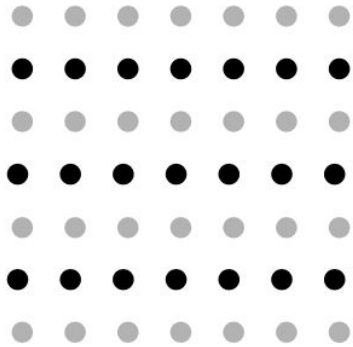


(c)

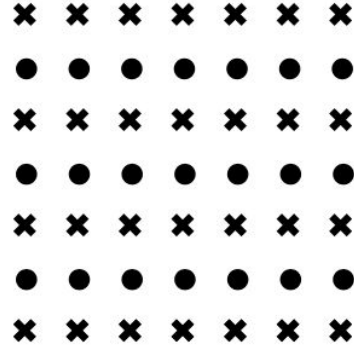
Two clusters

DG: Place symbols and glyphs representing related information **close together**.

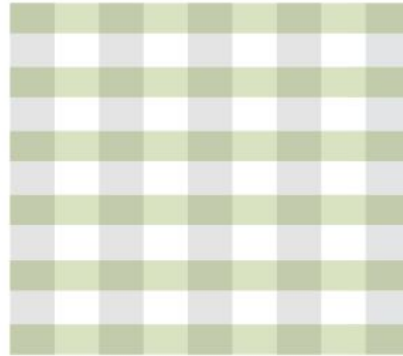
Gestalt laws -- Similarity



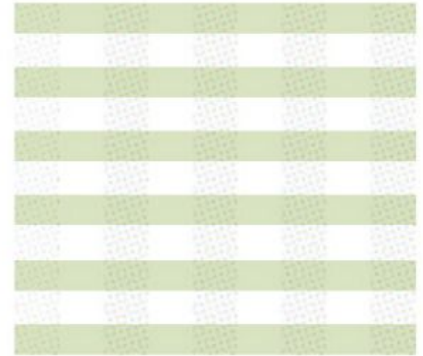
(a)



(b)



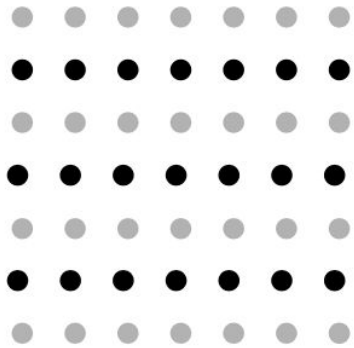
(c)



(d)

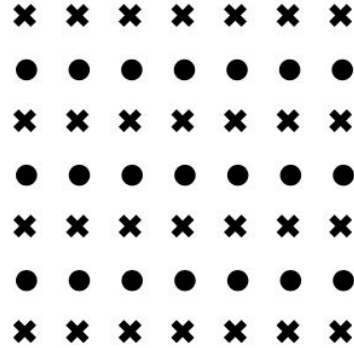
DG: When devising a grid layout of a data set, consider coding rows and/or columns using low-level visual channel properties, such as color and texture.

Gestalt laws -- Similarity

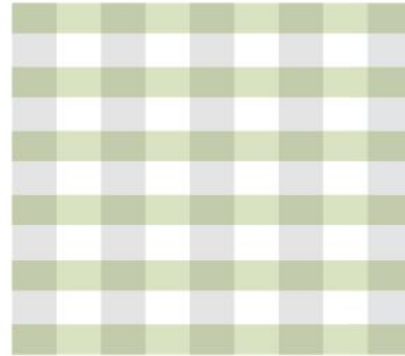


(a)

Rows

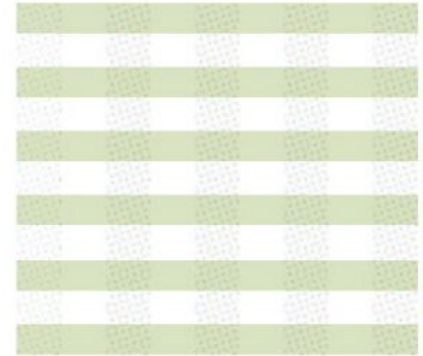


(b)



(c)

Color



(d)

Color and texture

Easier to distinguish rows / columns

DG: When devising a grid layout of a data set, consider coding rows and/or columns using low-level visual channel properties, such as color and texture.

Gestalt laws -- Proximity and similarity in use

Settings:

Format for:

Paper Size:
8.50 in x 11.00 in

Orientation: Portrait Landscape Wide

Scale:



Title (Mr, Ms, Dr etc):

First name:

Last name:

Job title:

Institution/Organisation:

Number and Street:

City:

State/County:

Zip Code/Postal Code:

Country:

Work phone:

Home phone:

Fax:

How did you find out about this Web site:

Other:

Please select the option which most closely describes you as a customer:

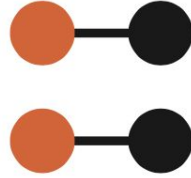
E-mail:



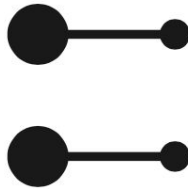
Gestalt laws -- Connectedness



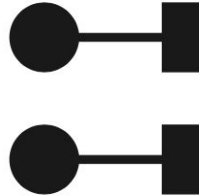
(a)



(b)



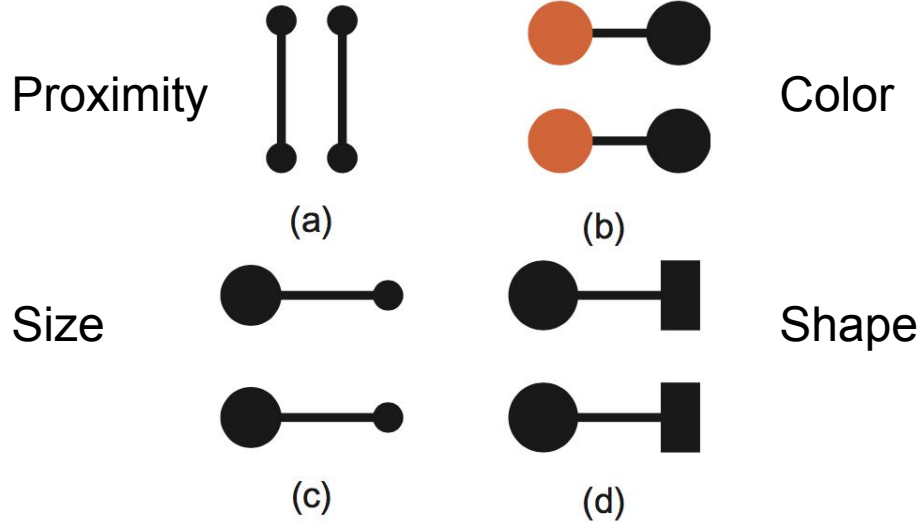
(c)



(d)

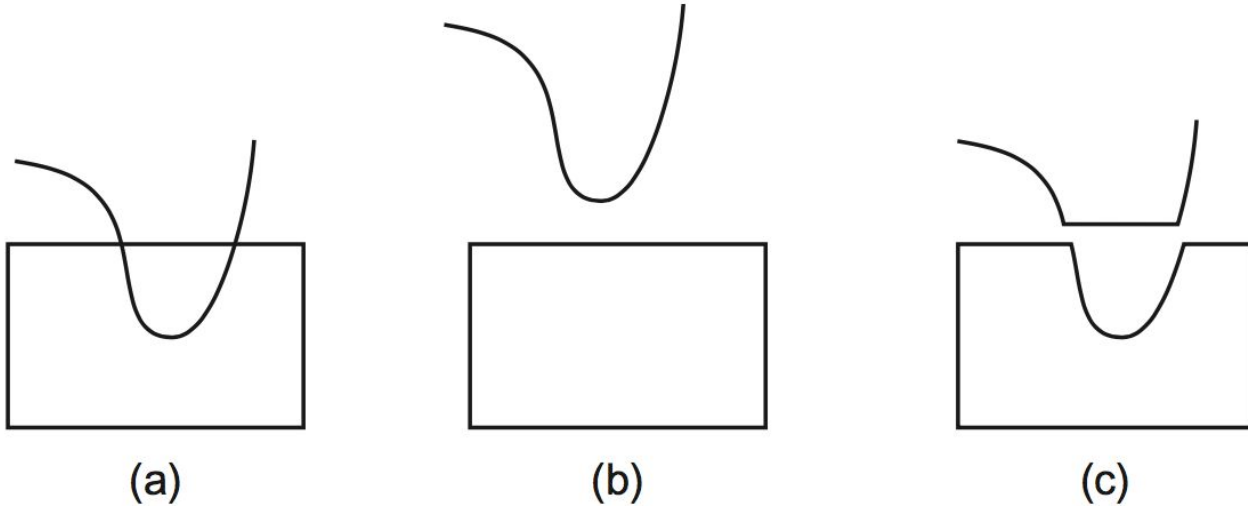
DG: To show relationships between entities, consider linking graphical representations of data objects using lines or ribbons of color, e.g., node-link diagram.

Gestalt laws -- Connectedness



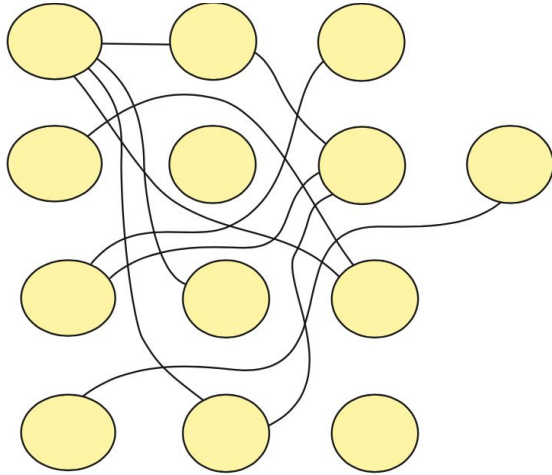
DG: To show relationships between entities, consider linking graphical representations of data objects using lines or ribbons of color, e.g., node-link diagram.

Gestalt laws -- Continuity

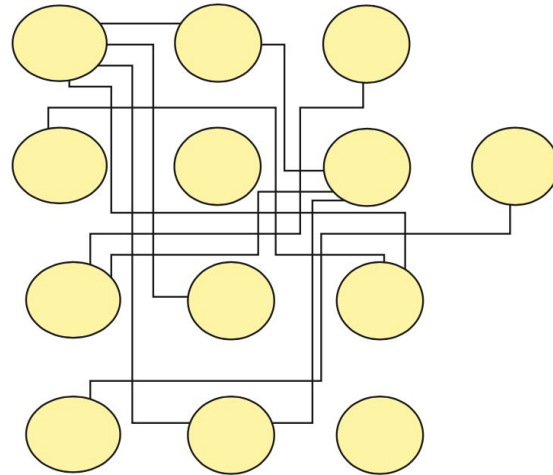


We are more likely to construct visual entities out of visual elements that are **smooth and continuous**, rather than ones that contain **abrupt** changes in direction.

Gestalt laws -- Continuity



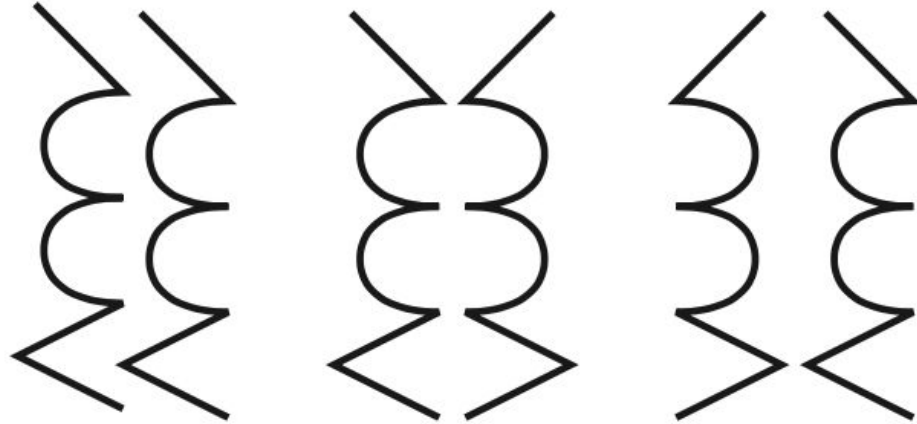
(a)



(b)

It should be easier to identify the sources and destinations of connecting lines if they are **smooth and continuous**.

Gestalt laws -- Symmetry



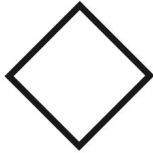
Two objects vs. A holistic figure

DG: Consider using symmetry to make pattern comparisons easier, but be sure that the patterns to be compared are small in terms of visual angle (<1 degree horizontally and <2 degrees vertically).

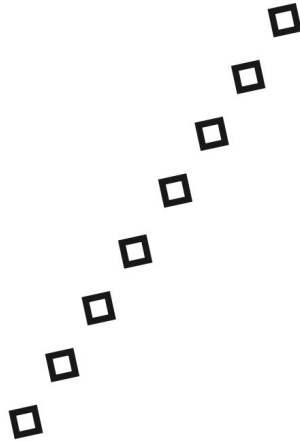
Gestalt laws -- Symmetry



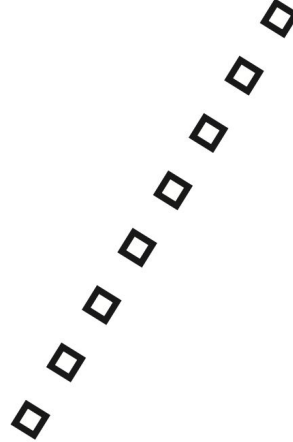
(a)



(b)



(c)



(d)

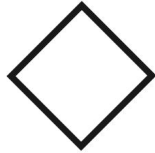
DG: Symmetrical relations should be arranged on **horizontal** or **vertical** axes unless some framing pattern is used.

Gestalt laws -- Symmetry



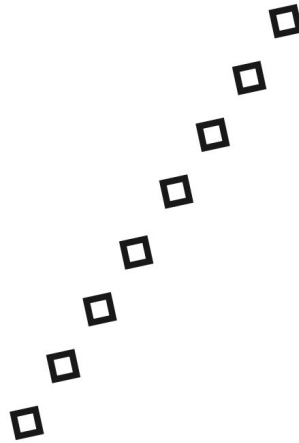
(a)

Square



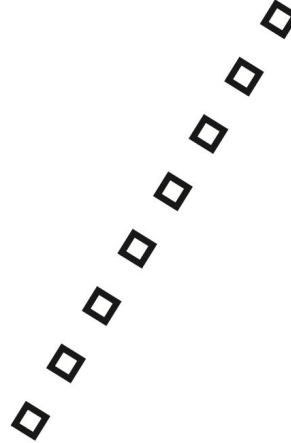
(b)

Diamond



(c)

A row of diamonds and squares



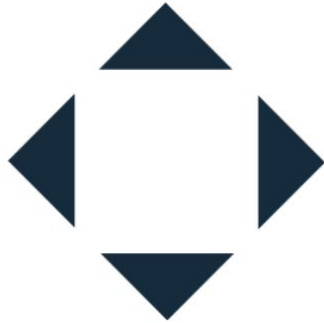
(d)

DG: Symmetrical relations should be arranged on **horizontal** or **vertical** axes unless some framing pattern is used.

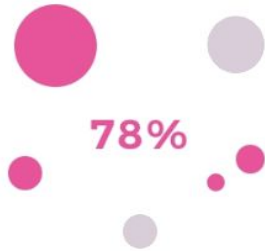
Gestalt laws -- Closure

Objects are often perceived as a **whole** thing, even when they are **incomplete**.
Reduce complexity and increase engagement.

Our minds quickly **fill the gaps** and help us to find the meaning and intention of a particular thing.

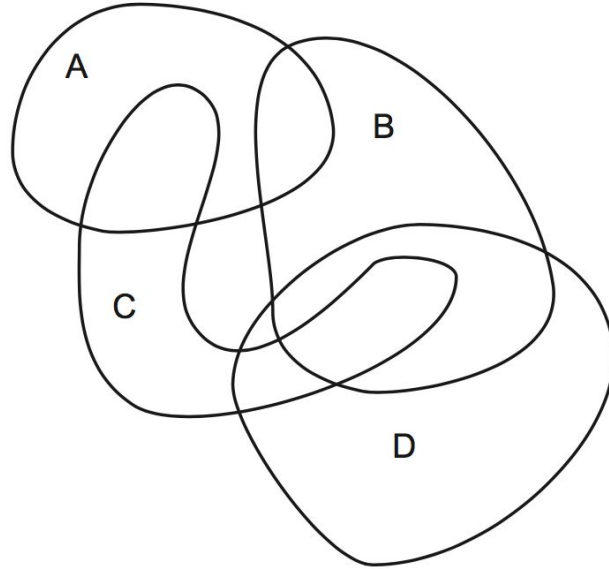


Gestalt laws -- Closure



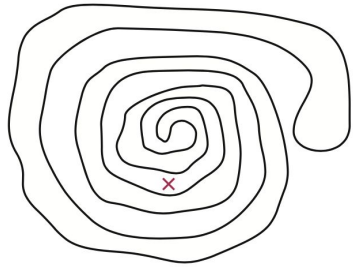
Gestalt laws -- Closure and Common region

A closed contour tends to be seen as an object.

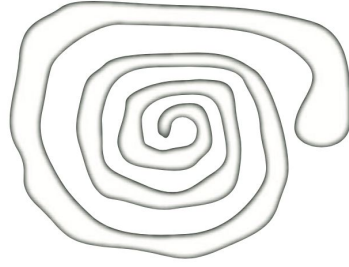


DG: Consider putting related information inside **a closed contour**. A line is adequate for regions having a simple shape.

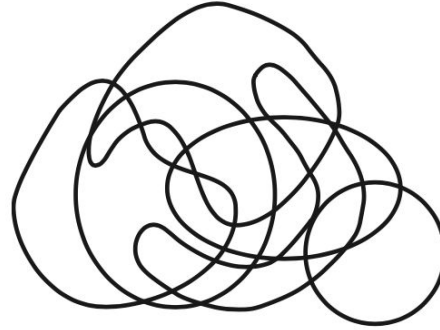
Gestalt laws -- Closure and Common region



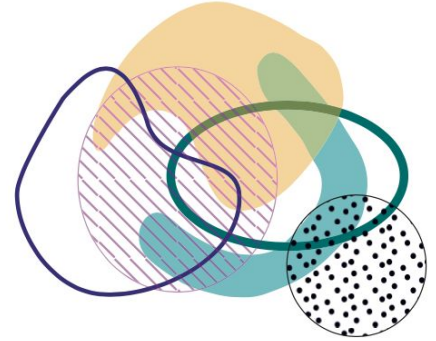
(a)



(b)



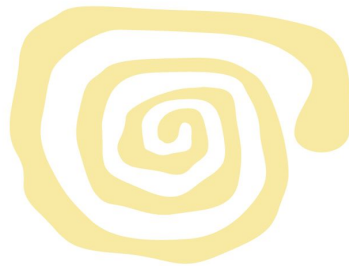
(a)



(b)



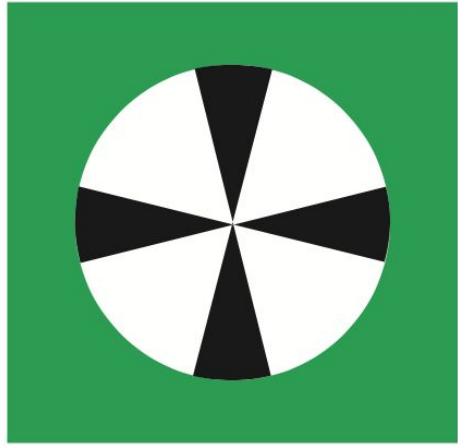
(c)



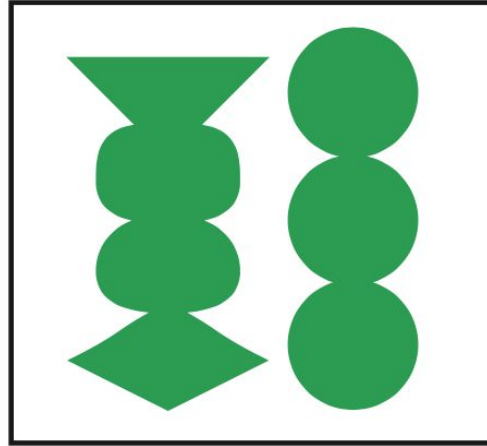
(d)

DG: To define multiple overlapping regions, consider using a combination of line contour, color, texture, and Cornsweet contours.

Gestalt laws -- Figure and Ground



(a)



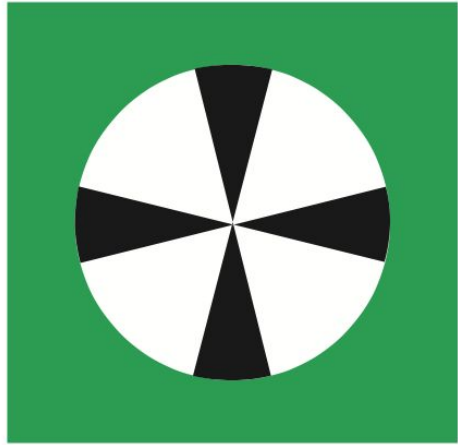
(b)



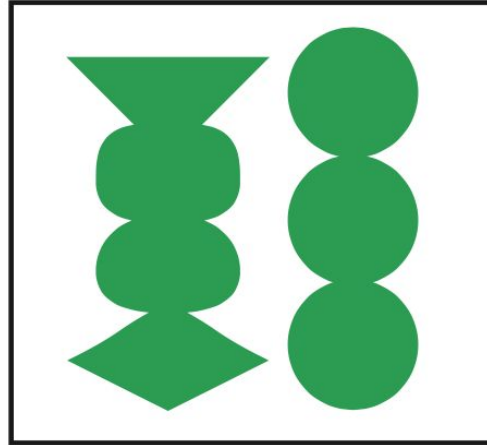
(c)

DG: Use a combination of closure, common region, and layout to ensure that data entities are represented by graphical patterns that will be perceived as figures, not ground.

Gestalt laws -- Figure and Ground



(a)



(b)



(c)

(a) The black areas are **smaller** and therefore more likely to be perceived as an object. It is also easier to perceive patterns that are **oriented horizontally and vertically as objects**. (b) The **green** areas are seen as figures because of several Gestalt factors, including **size and closed form**. The area between the green shapes in (c) is generally not seen as a figure.

DG: Use a combination of closure, common region, and layout to ensure that data entities are represented by graphical patterns that will be perceived as figures, not ground.

Gestalt laws -- Figure and Ground

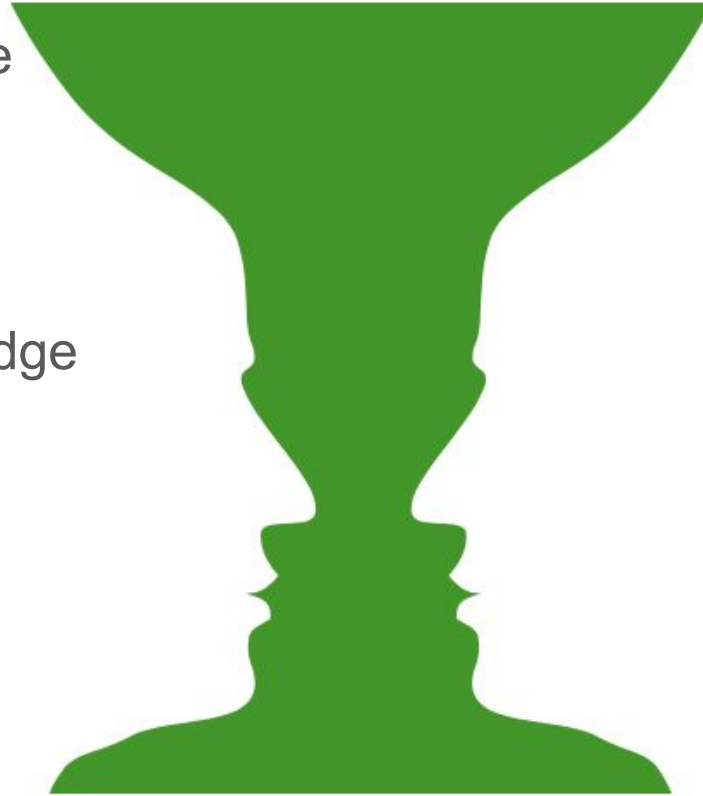


Gestalt laws -- Figure and Ground

Figure and ground are
equally balanced.

Vase -- Symmetry

Faces -- Prior knowledge



Gestalt laws -- Figure and Ground



Ande **Photos** *Documenting the HIV/AIDS Crisis in Sub-Saharan Africa*
Photographs by Karen Ande

EVENTS TAKE ACTION

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"These are the faces of children and their families living in a world of AIDS. Their spirit, their determination, and their resilience inspire all of us to join their fight. We are one world, and these children are our children, their destiny is our destiny. Each of us can make a difference." – Archbishop Desmond Tutu

Abundance and Chickens

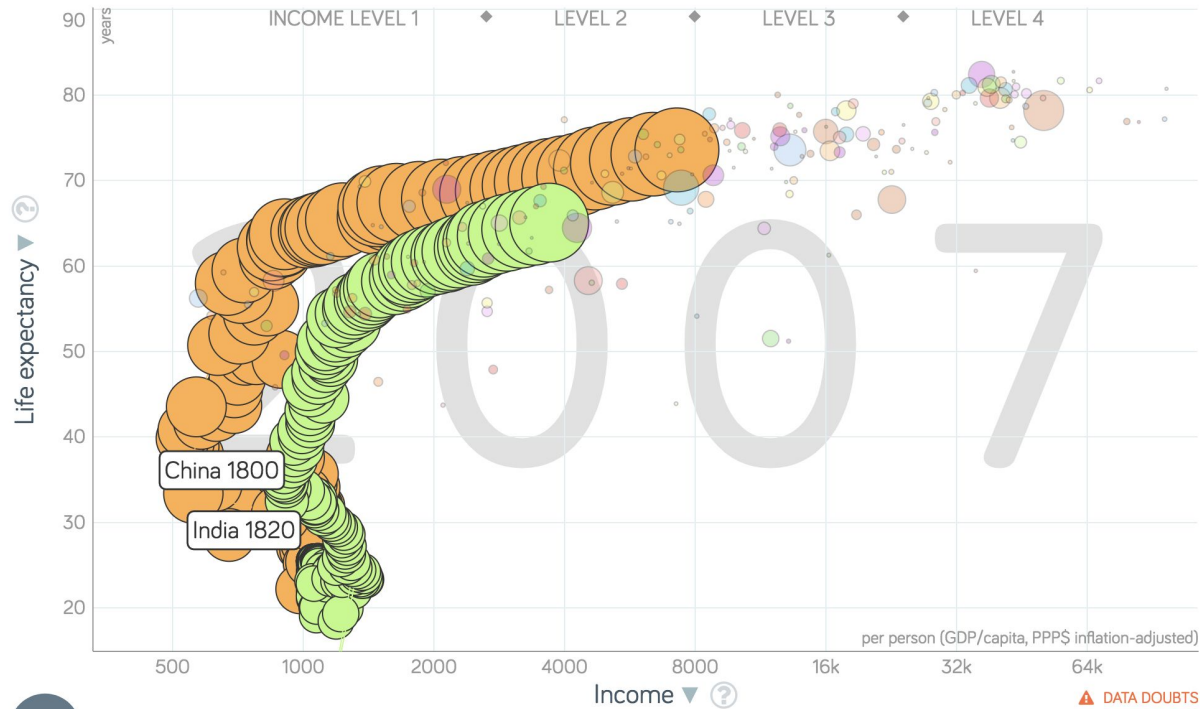
July 4th, 2008

Journalist Ruthann Richter and I met Joseph and William one morning in their two-room home in Naivasha, Kenya. Their rented house for which they paid \$15/month was simple, unpainted wood. The floor was dirt and the furnishings included chairs, a bed separated from the rest of the house by a torn sheet, a kerosene burner and shelves that contained pots, plastic utensils and a flowered teakettle.

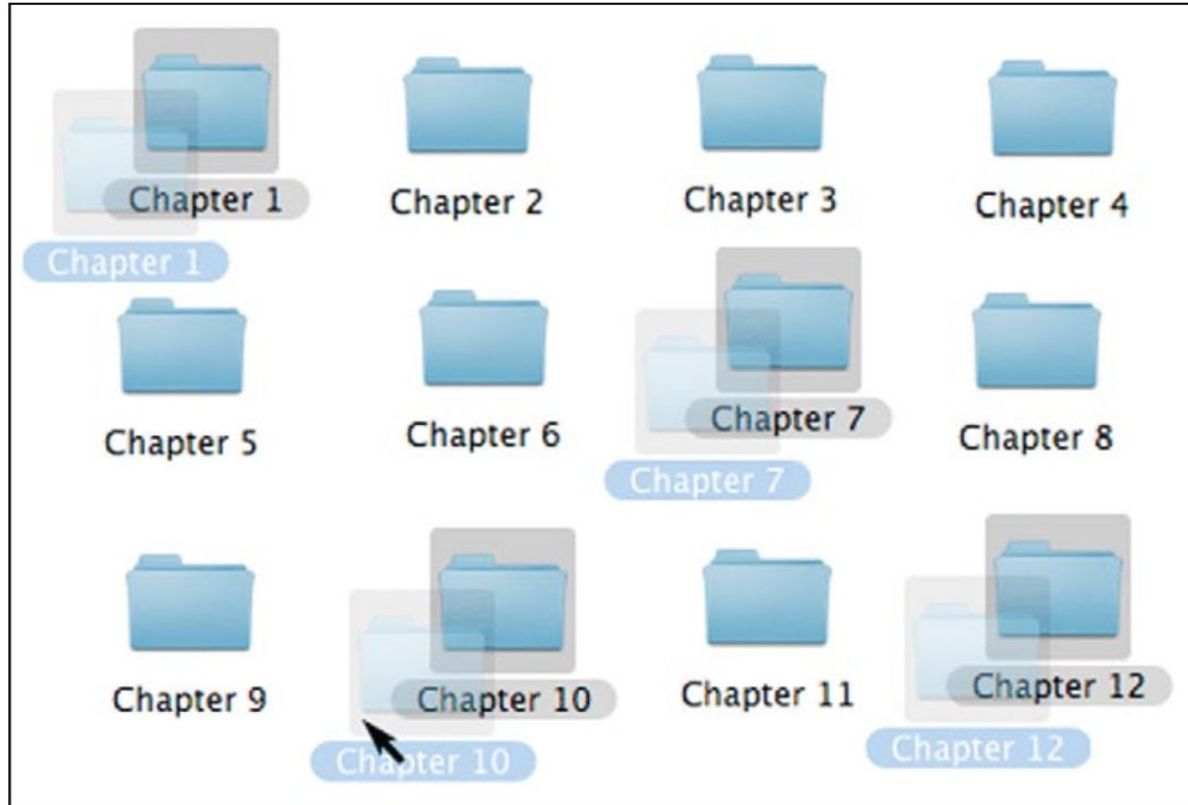


Gestalt laws -- Common fate

Objects that move together are perceived as grouped or related.



Gestalt laws -- Common fate & similarity

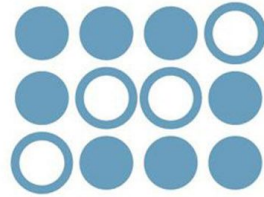


Gestalt laws - Principles of grouping

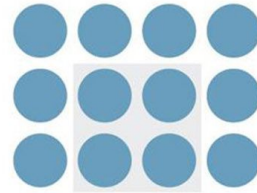
Proximity



Similarity



Enclosure



Connection



Continuity



Symmetry

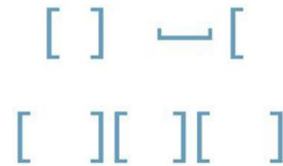


Figure & Ground



Closure



Common Fate



Affordance

The perceivable possibilities for action. (Gibson, Psychology, 1979.)

The possibilities in the world for how an agent (a person, animal, or machine) can interact with something. (Don Norman, HCI, 1988)

Affordance

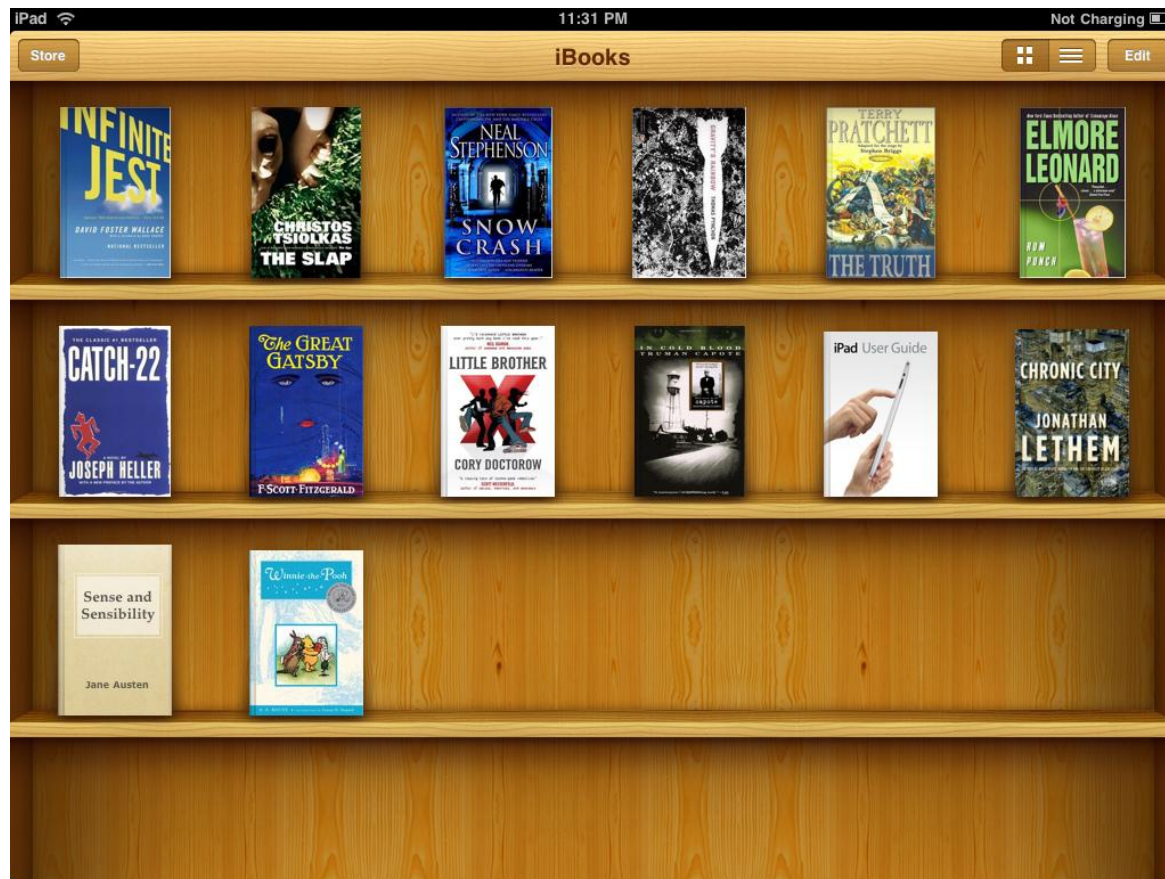


Affordance



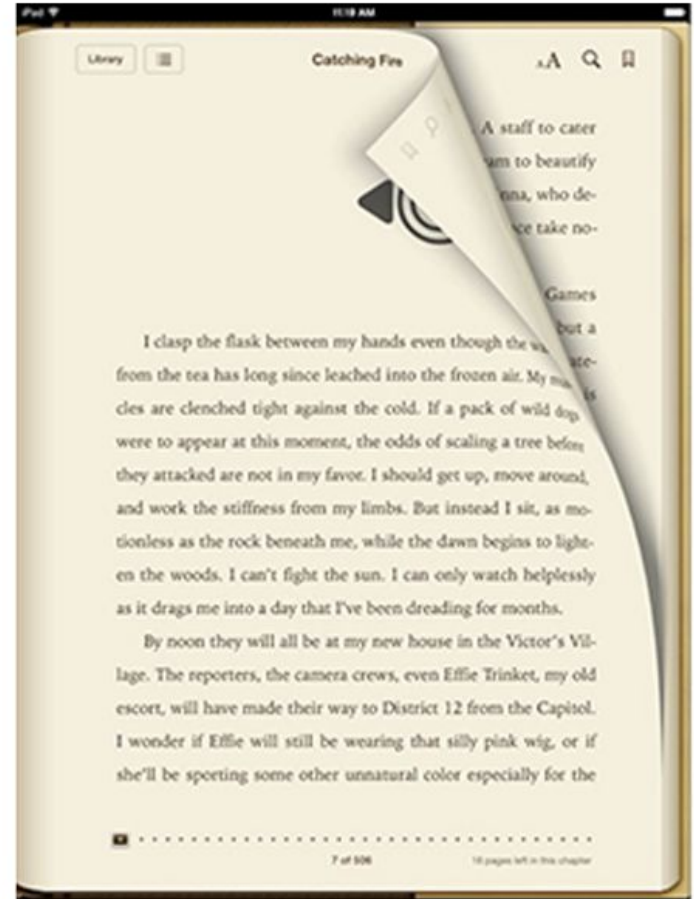
How to bring 'affordance' into graphical user interface?

Skeuomorphism



How to bring 'affordance' into graphical user interface?

Skeuomorphic interfaces: **mimicking objects from the real world** with high fidelity (Derboven et. al. 2012, p.498)



How to bring 'affordance' into graphical user interface?

Evolving ability of perceiving affordances.

From **Skeuomorphism** to **flat design**;

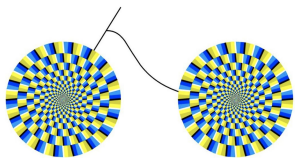
From **intuitiveness** to **simplicity**;

From **usability-oriented** to **function/content oriented**.

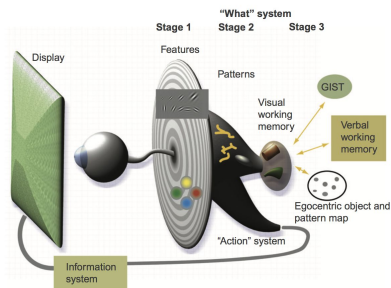


Recap

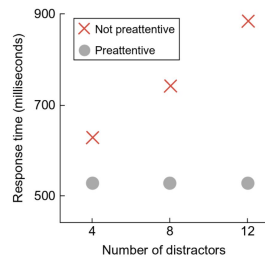
Optical illusions



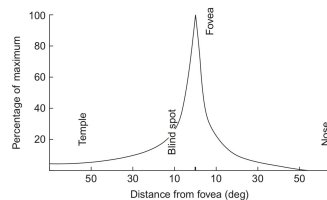
Visual processing model



Preattentive processing



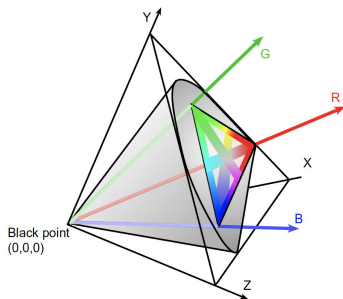
Visual acuity



Color vision



Color space



Brightness illusions



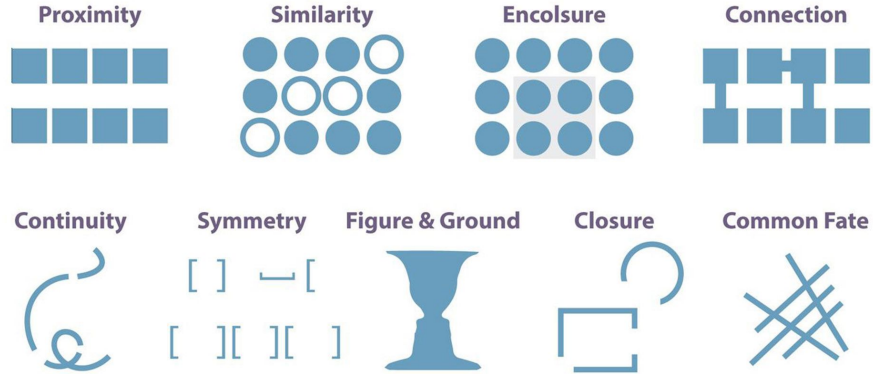
Magnitude estimation

	Quantitative	Ordinal	Nominal
Position	●●	●●	●●
Length	==	●●	●●
Angle	∠	●●	●●
Slope	∕∕	●●	●●
Area	●●	==	●●
Density	●●	∠	==
Saturation	●●	∕∕	∠
Hue	●●	●●	∕∕
Shape	●●	●●	●●

More Accurate ↑
↓ Less Accurate

Recap

Gestalt laws



Affordance



Recommended videos

National Geographic: Test Your Brain Episode 1 - Pay Attention

<https://www.dailymotion.com/video/xq1p3e>

National Geographic: Test Your Brain Episode 2 - Perception

<https://www.dailymotion.com/video/xq1rfl>

National Geographic: Test Your Brain Episode 3 - Memory

<https://www.dailymotion.com/video/x2vhzfh>