MIREIA RIBERA | ACCESSIBILITAT DIGITAL | EXPERIÈNCIA D'USUARI | VISUALITZACIÓ DE DADES

Presentation and Visualization. Perception (I)

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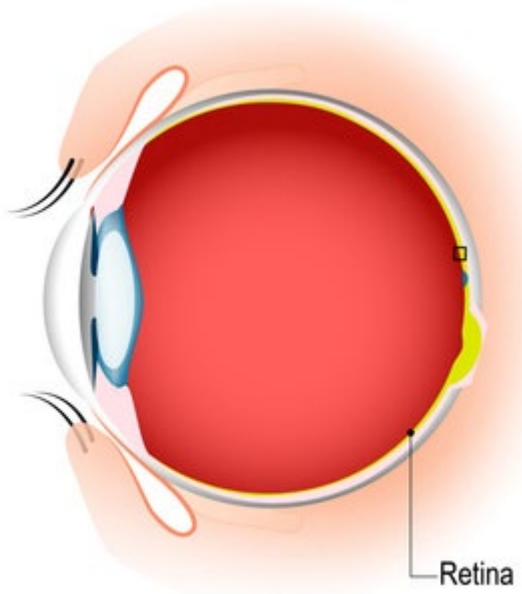
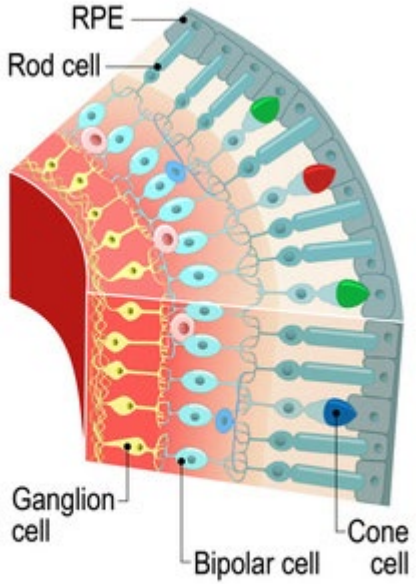
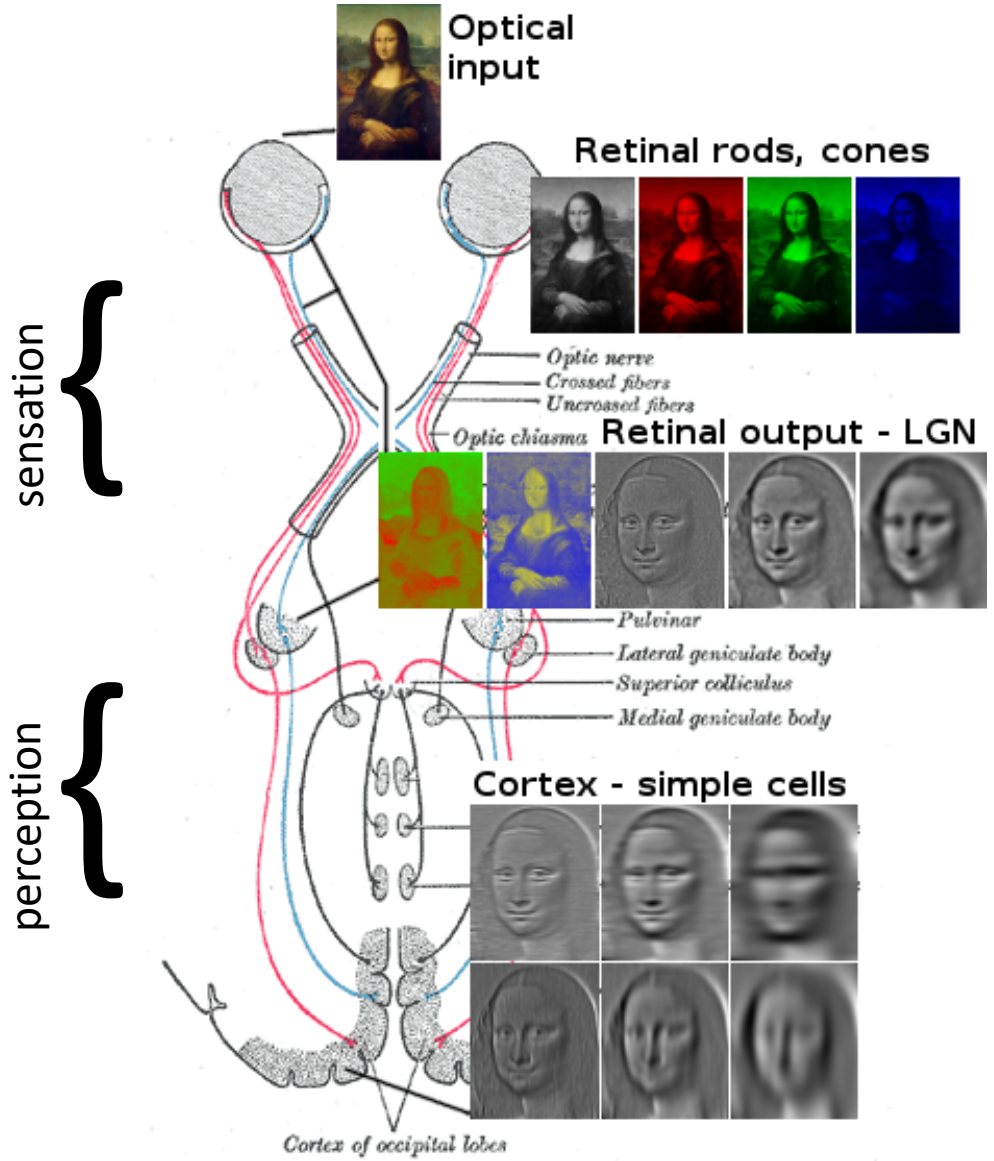
The eye and the visual process



iStock.com/metamorworks

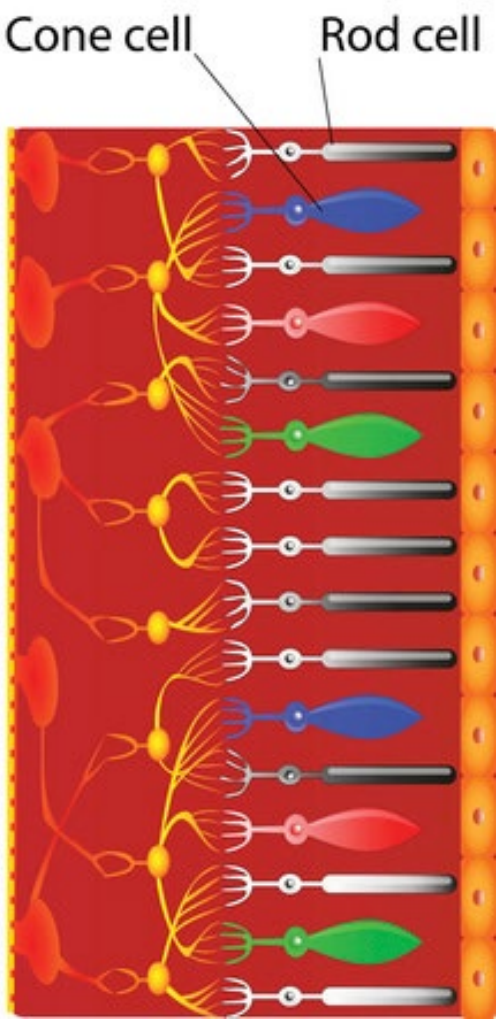


SECTION OF RETINA



Cones and rods

We have 120 million rods arranged throughout the retina, except the fovea (peripheral vision).
We have 6.4 million cones located in the fovea (central vision).
There are cones that detect short (blue), medium (green) or long (red) light waves.



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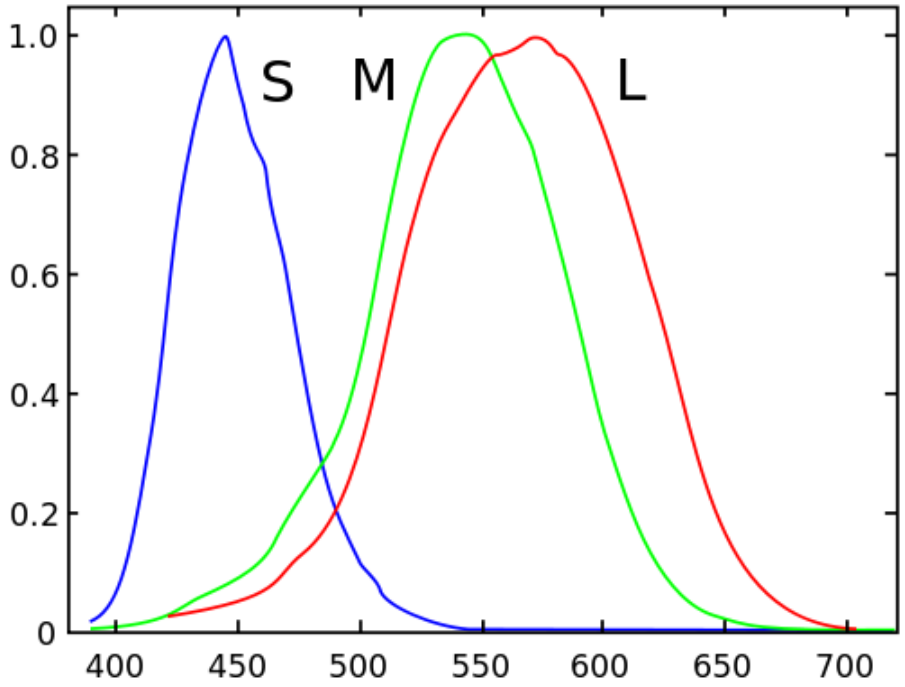
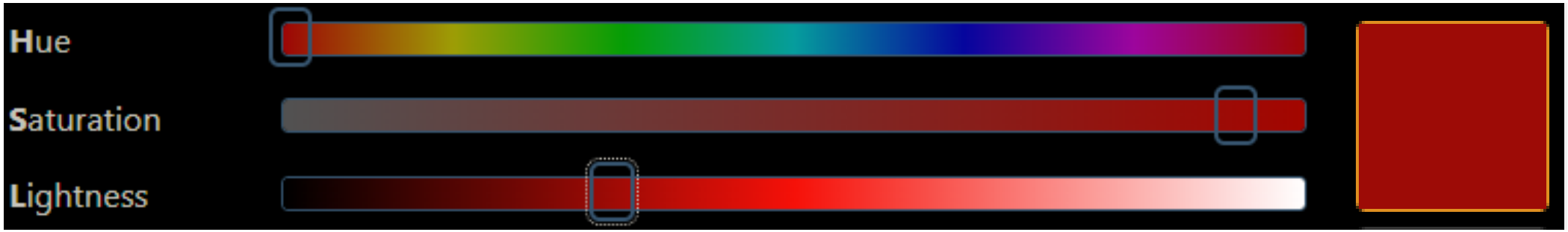


Colour dimensions



- **Hue o Chroma**, the name of the colour
- **Saturation**, the purity of colour
- **Luminosity**, while/black level. Most accurately perceived

Colour blindness

Normal vision

Deuteranopia (green is not perceived)

Protanopia (red is not perceived)

Titranopia (blue is not perceived)

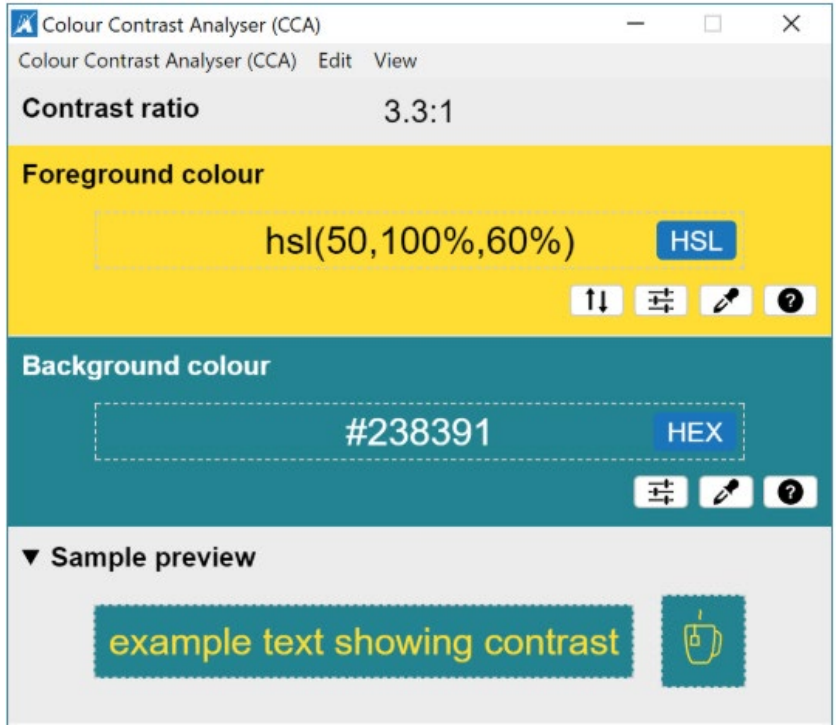
Achromatopsia (no colors perceived)

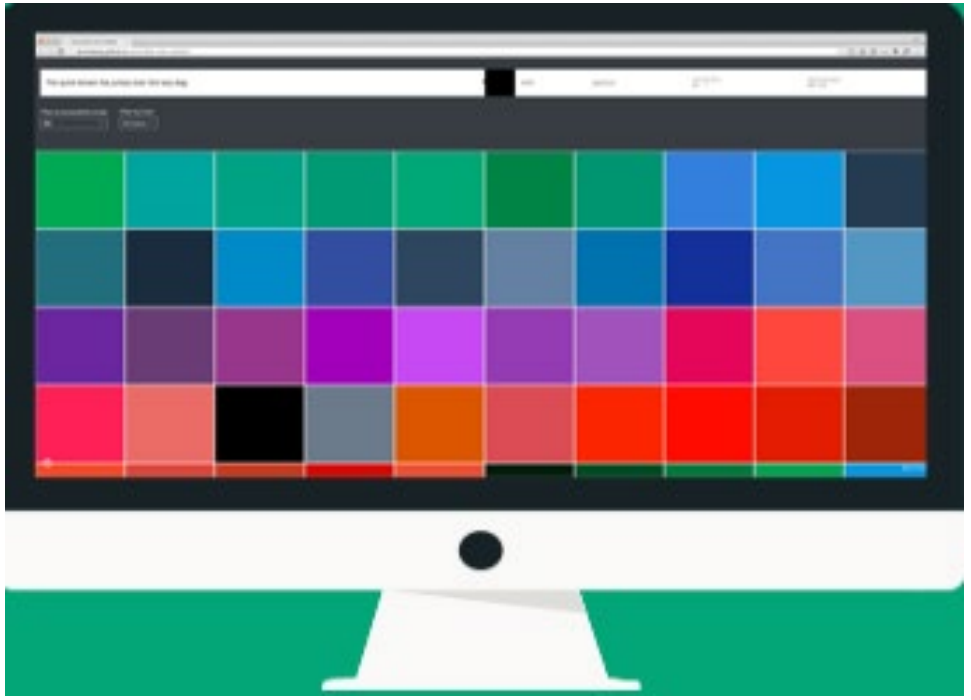
Source:Colour Blind Awareness

Age, Colour blindness and contrast

- Colour perception decreases with age
- Sight decrease affects both rods and cones
- As we have many more rods, elders perceive much better luminance differences than hue differences.
- It is therefore important to keep contrast differences in every colour system.

Contrast: some tools

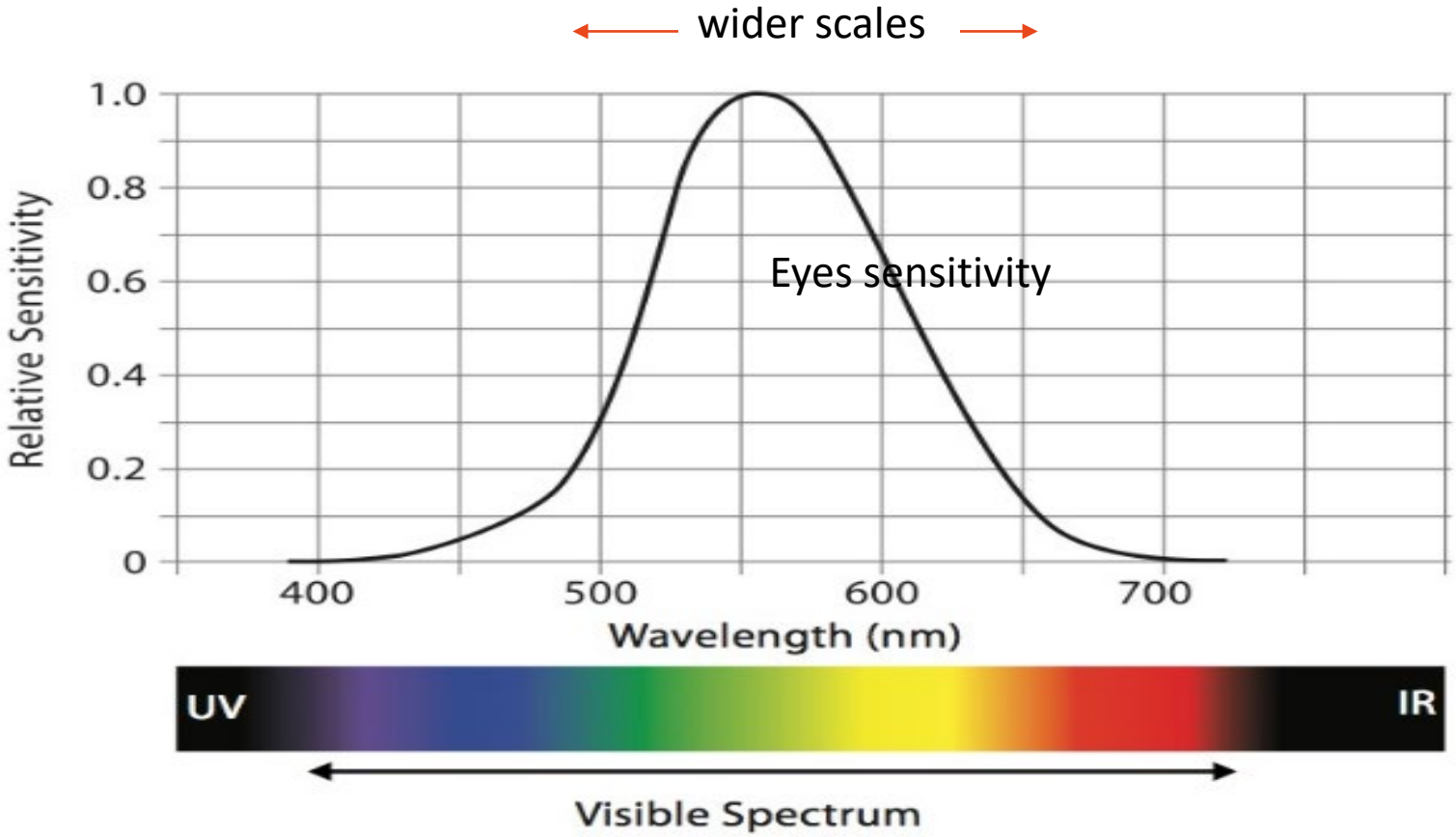


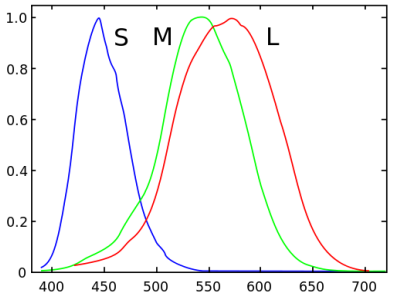


LINUX: https://contrast-ratio.com

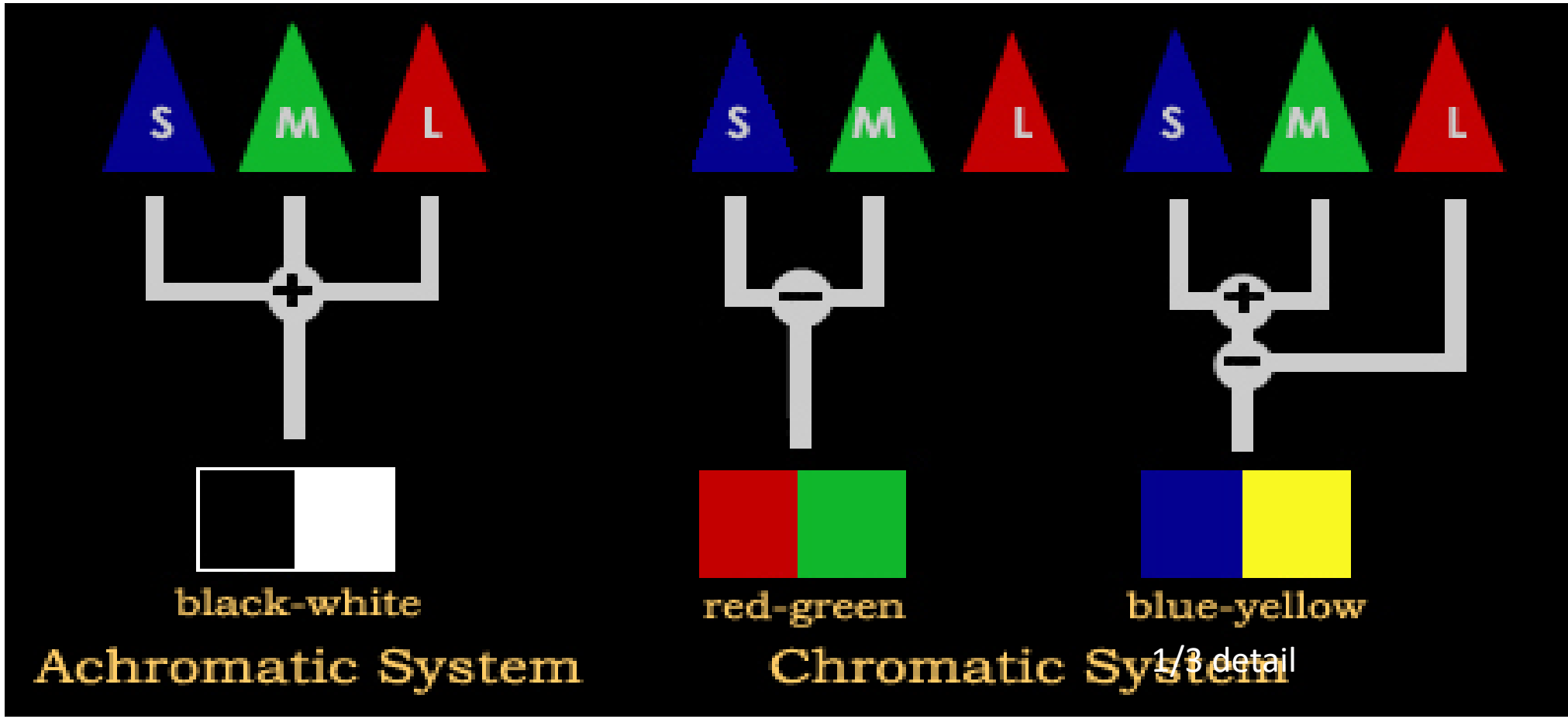
Carbon IBM's Design System: Accessible colour palettes for information visualization

Eyes' sensitivity





The opponent-process theory (Edwald Hering)

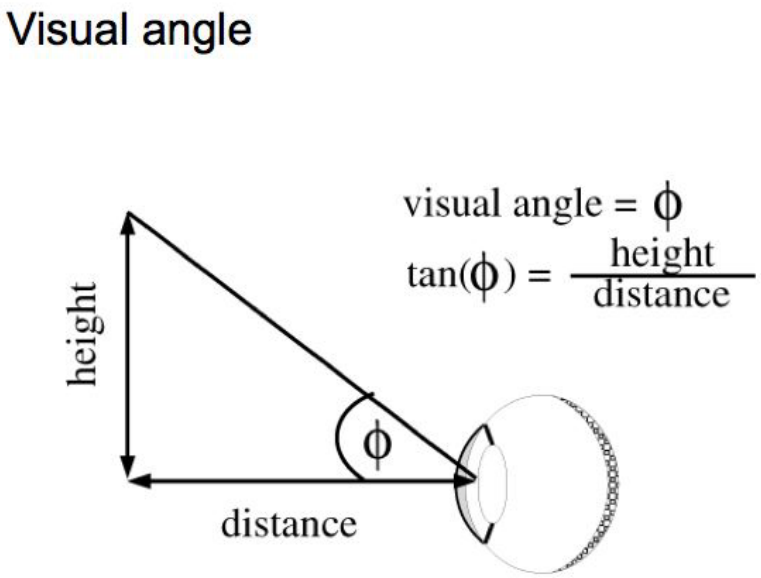


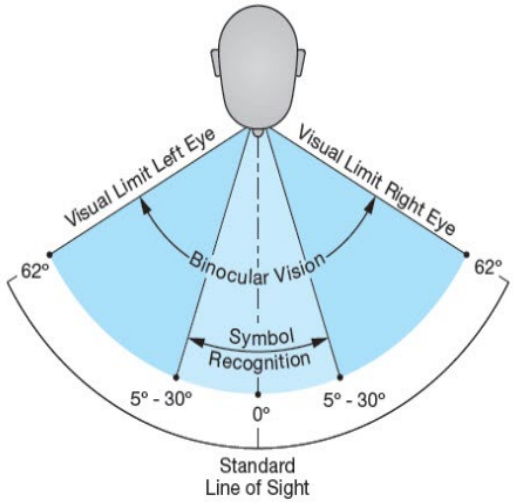
1/3 detail

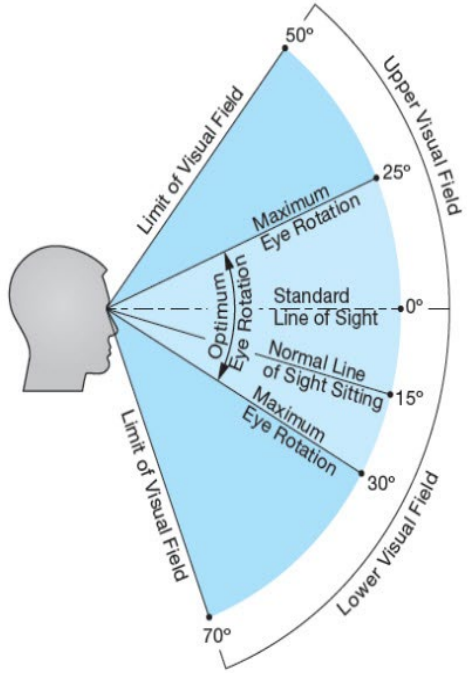
Class activity

- The Hue-test challenge http://www.xrite.com/hue-test/
- Simulating colour vision Silktide disability simulator

Visual angle and Useful field of view



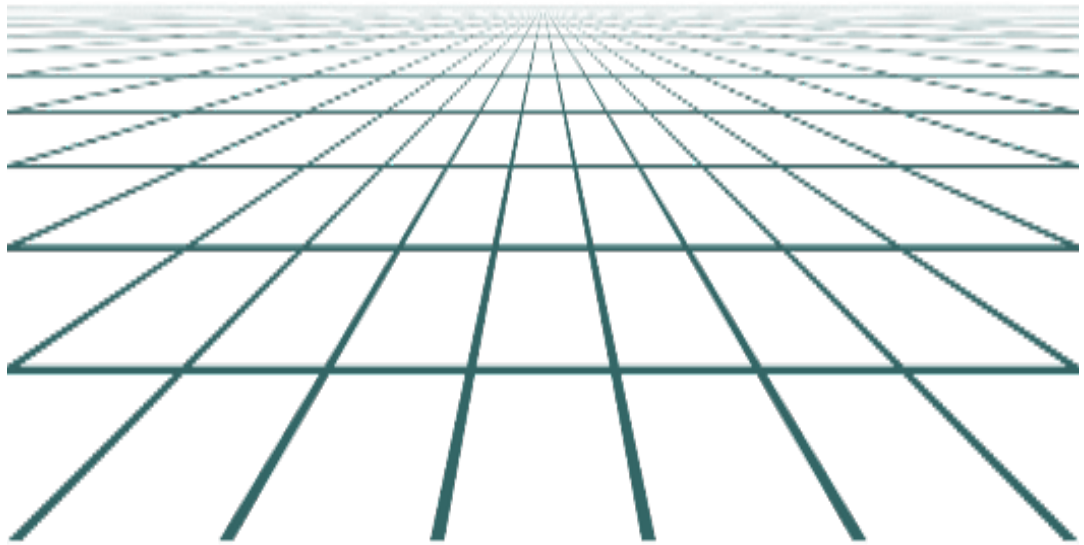


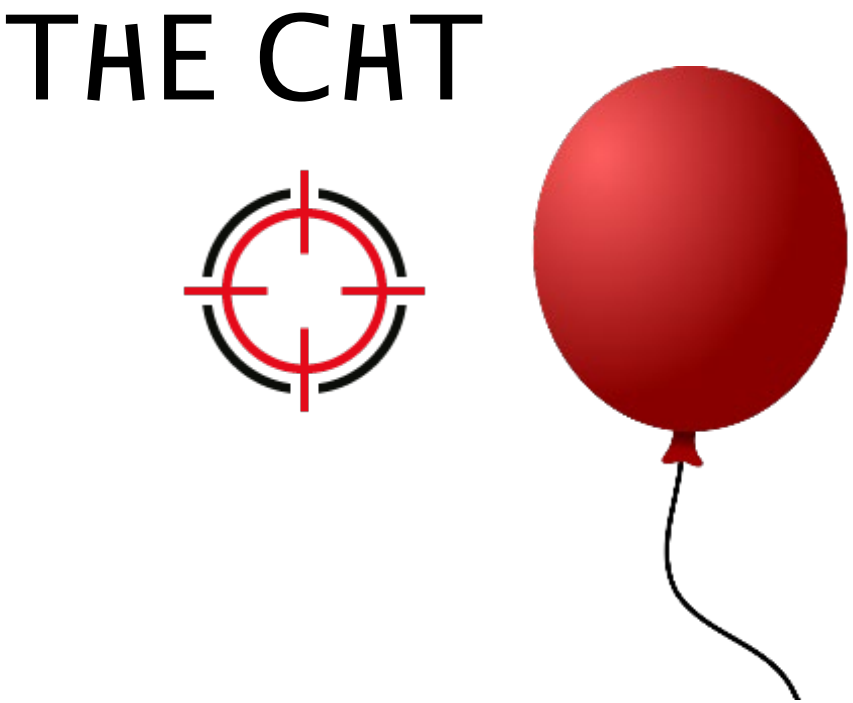


Source: http://www.cns.nyu.edu/~david/courses/perception/lecturenotes/eye/eye.html

From eyes or from mind?

iStock.com/ ImpaKPro





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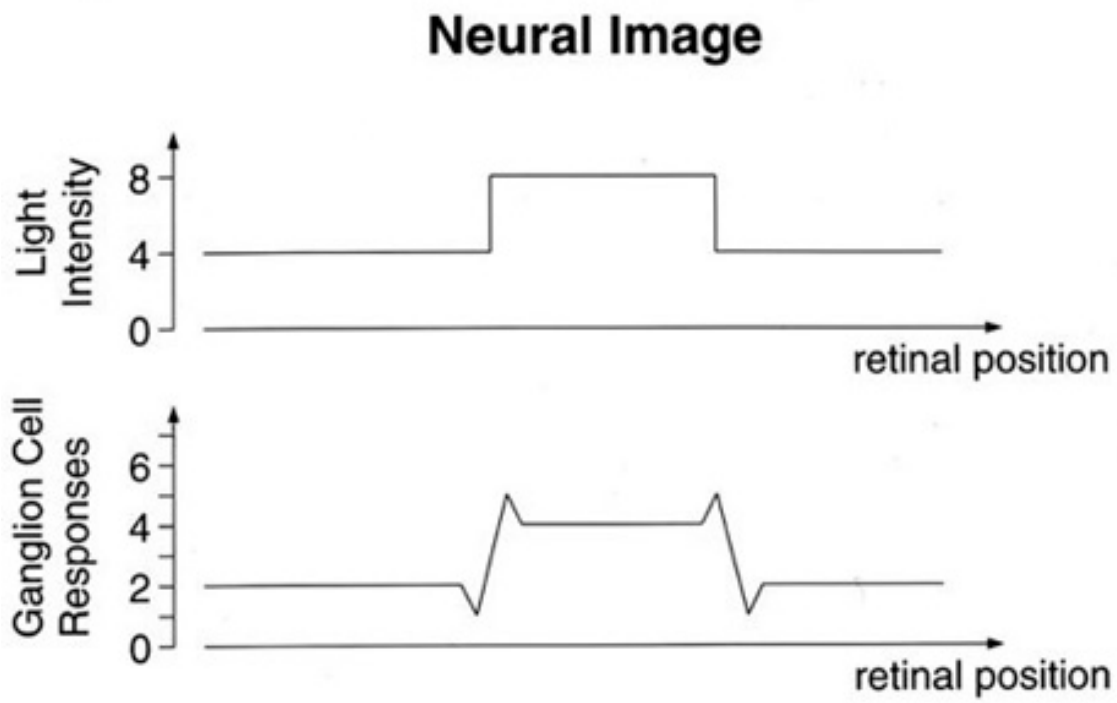
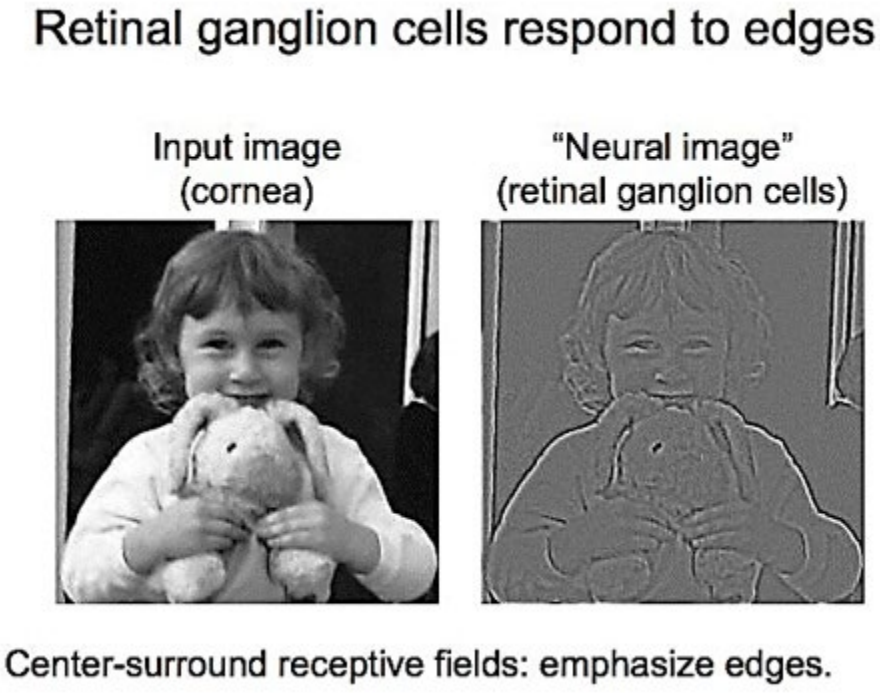
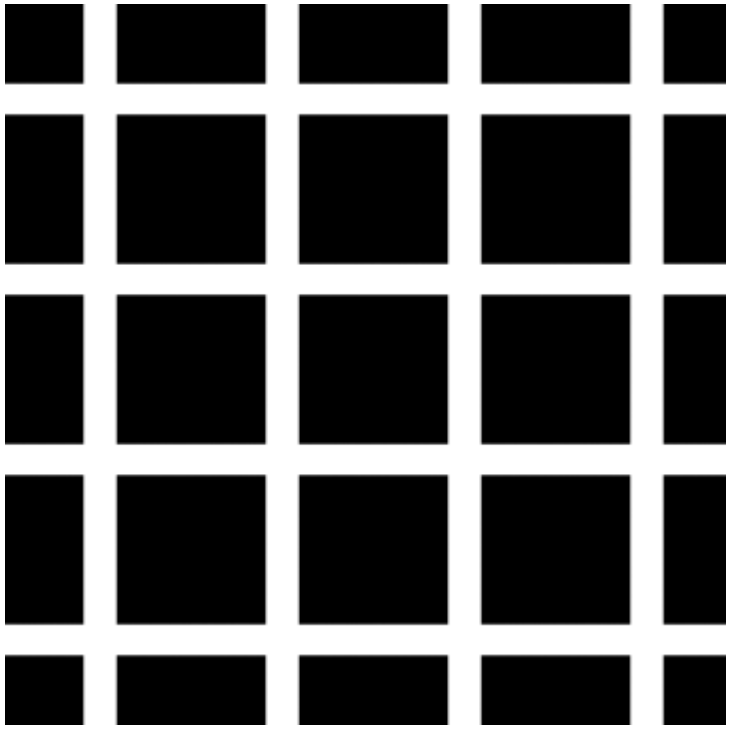
Economy of effort

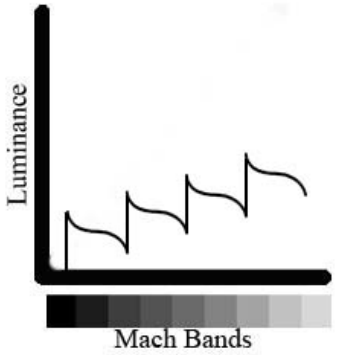




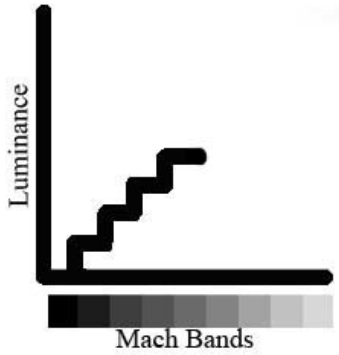
Fuente: Heeger, 2006

Biased signals sent to neurons



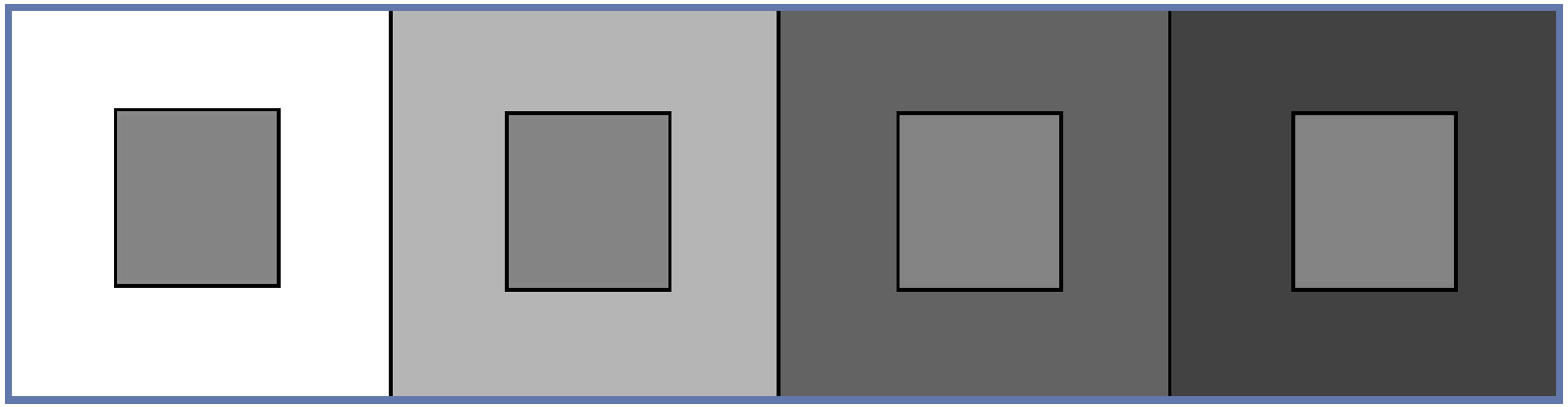


Perceived

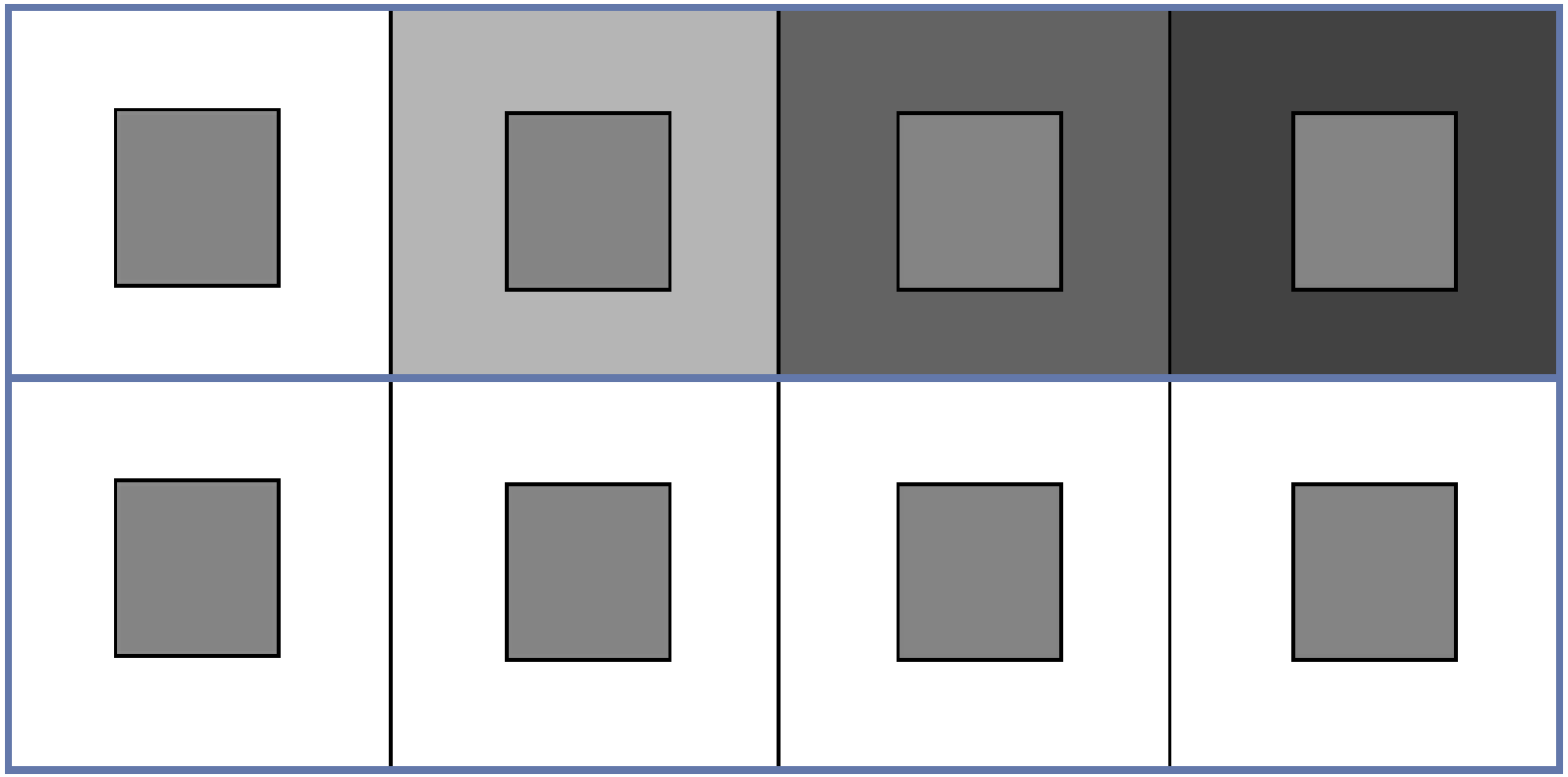


Actual

Perception is relative



Perception is relative (II)



How many 5 are there?

38572093982372819683729382 7

38291235838349273012289483 9

90902010203289375927309142 8

93830976296581743186924102 4

How many 5 are there? (II)

385720939823728196837293827

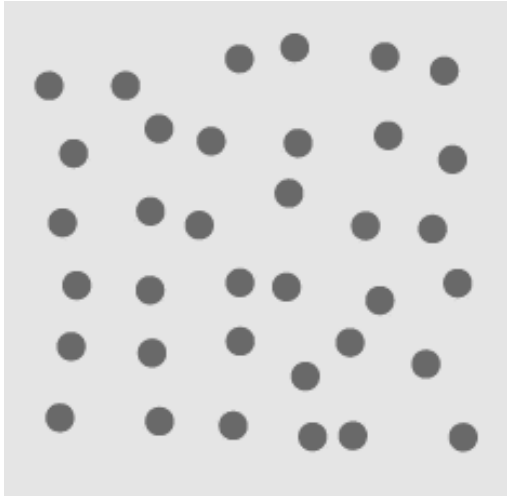
382912358383492730122894839

909020102032893759273091428

938309762965817431869241024

Preattentive properties

- Certain visual properties are detected immediately by low-level visual system
  - Immediately is <200-250 ms
- They “pop-out” without requiring serial search
- Not affected by distractors



Source: Healey, 2012

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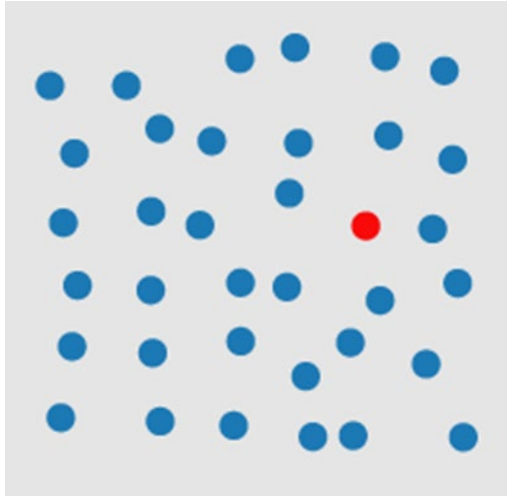
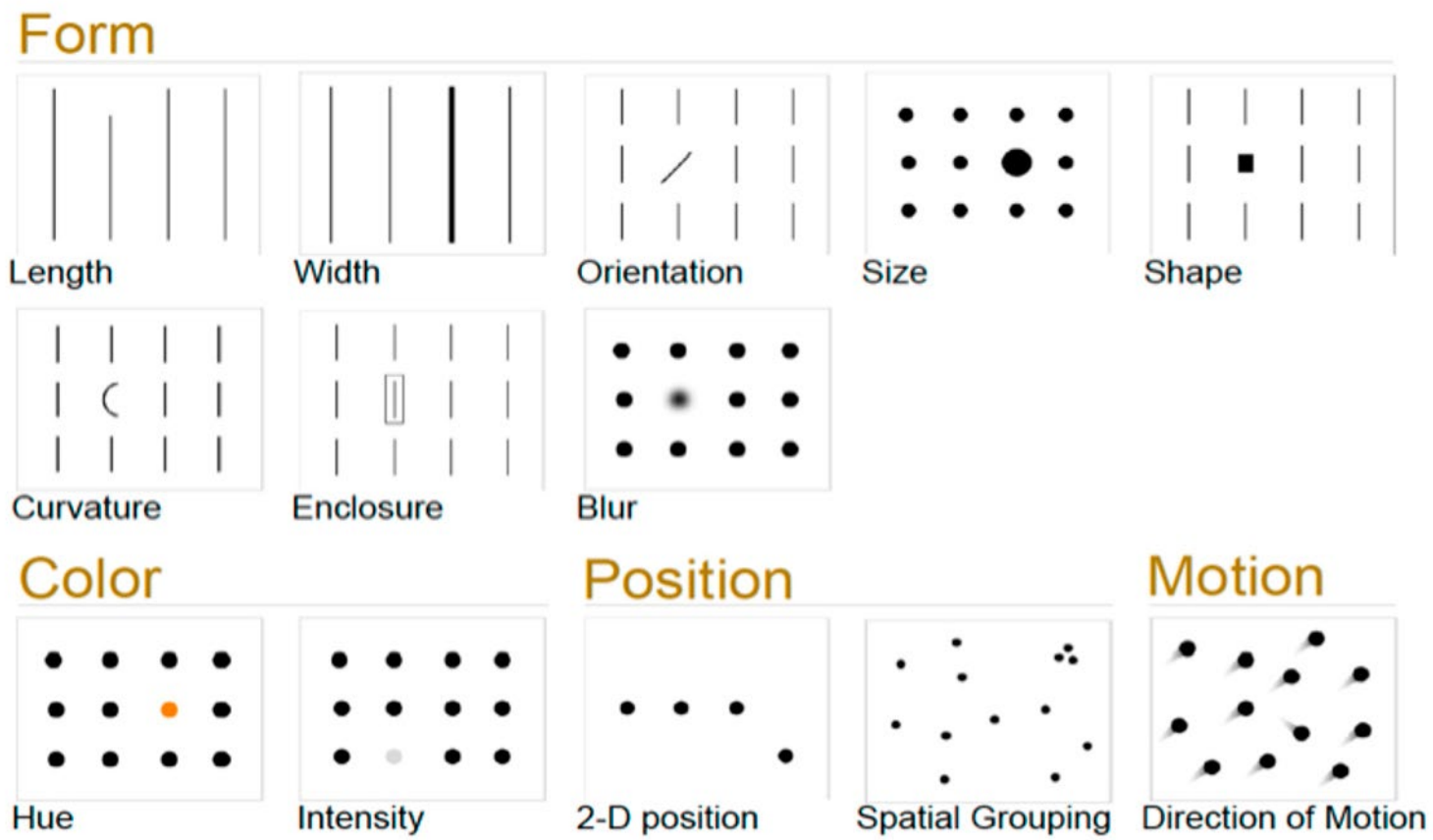


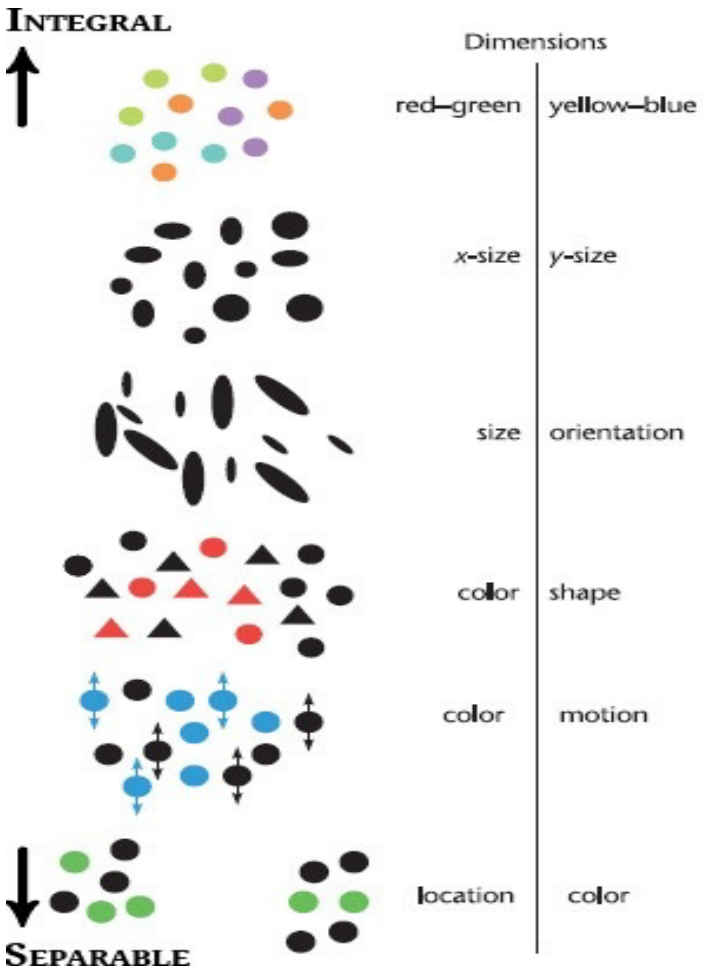
Source: Healey, 2012

Preattentive properties. Types



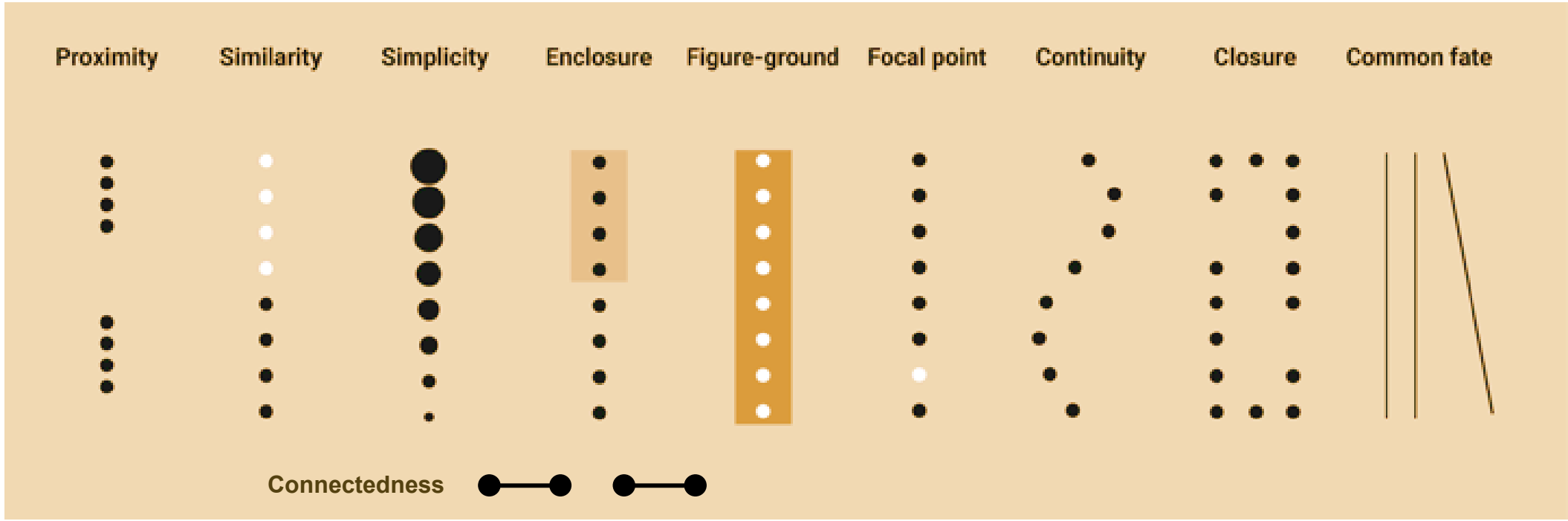
Source: Few, 2012

Combination of dimensions: integral and separable



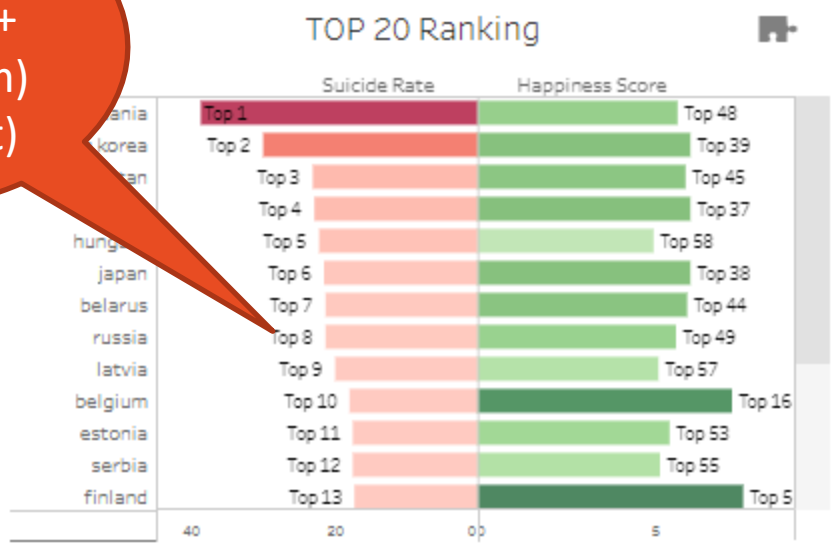
- Integral dimensions are seen together
- Separable dimensions are seen separately

Gestalt laws

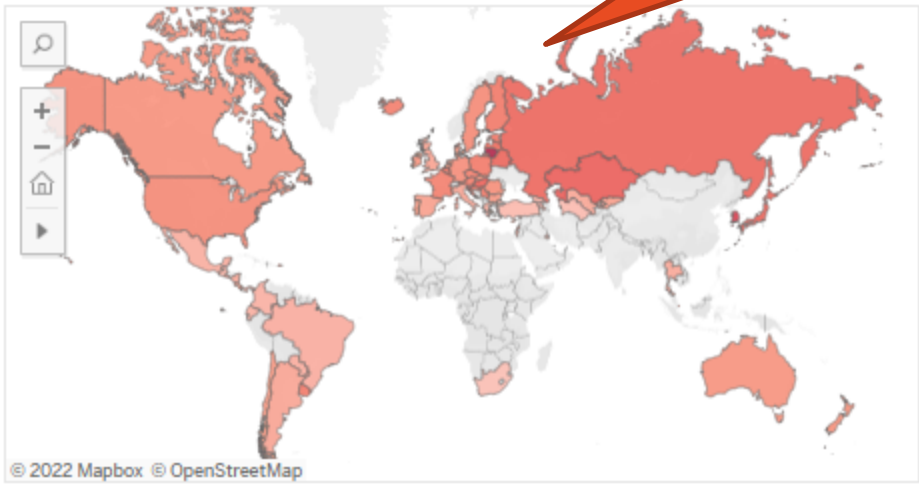


Source: van Dijk, 2022

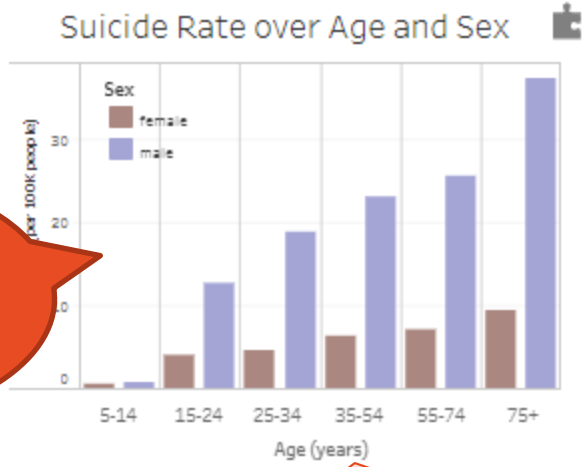
Color (Hue + Intensity) + length(Form) (redundant)

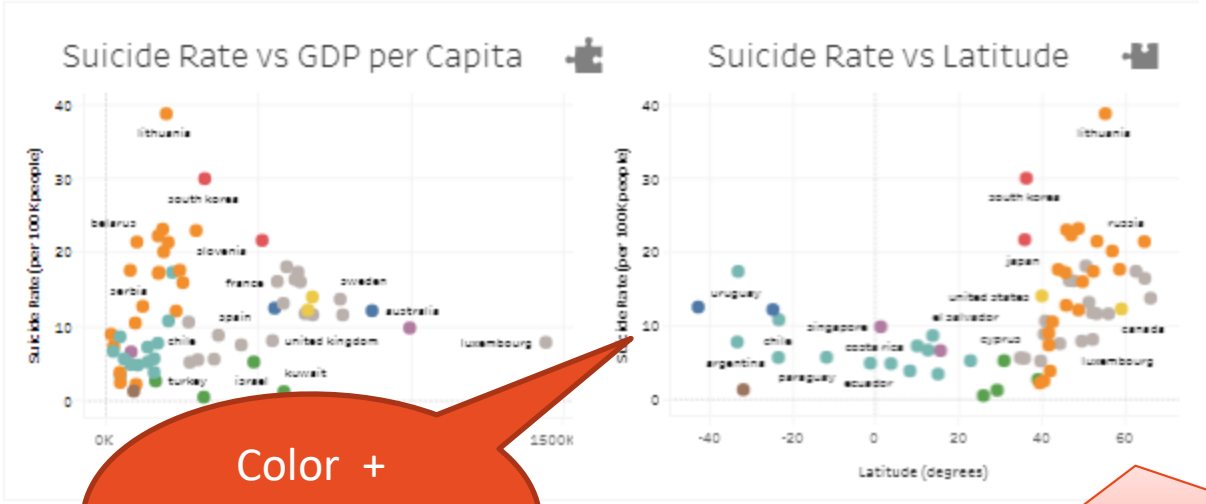


Color (Saturation + Luminosity) = Intensity



Color + length (Form) (separable)





What do women…? What age …?

Color + Position (separable)

How is Central and Eastern Europe GDP and suicide rate?

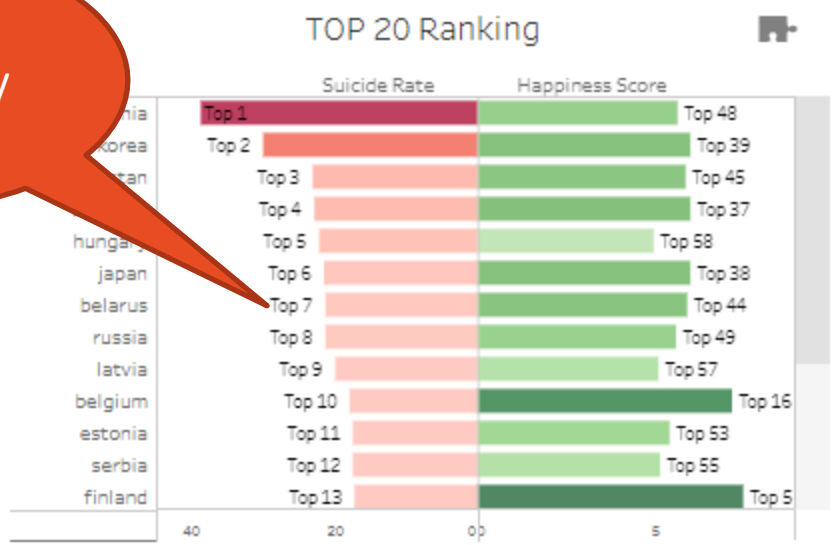
Symmetry

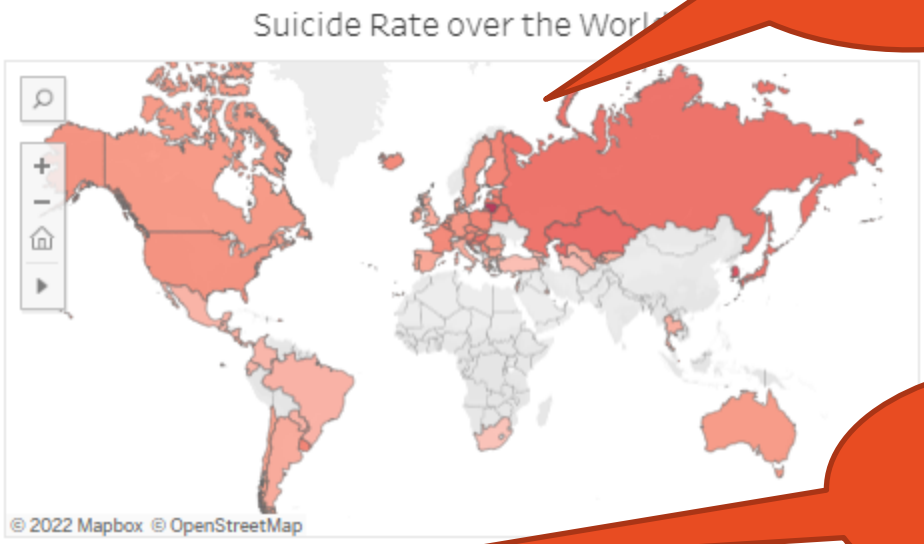
Similarity

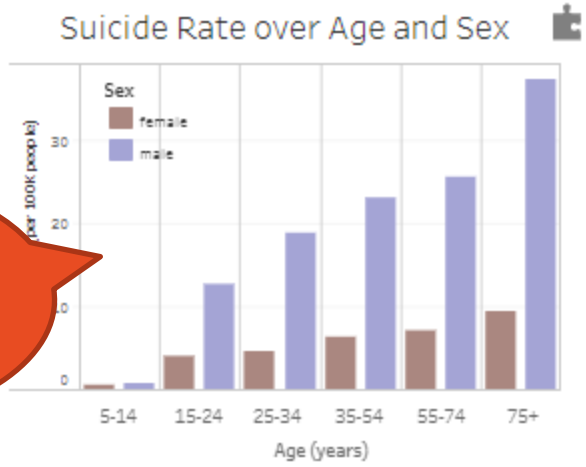
Closure

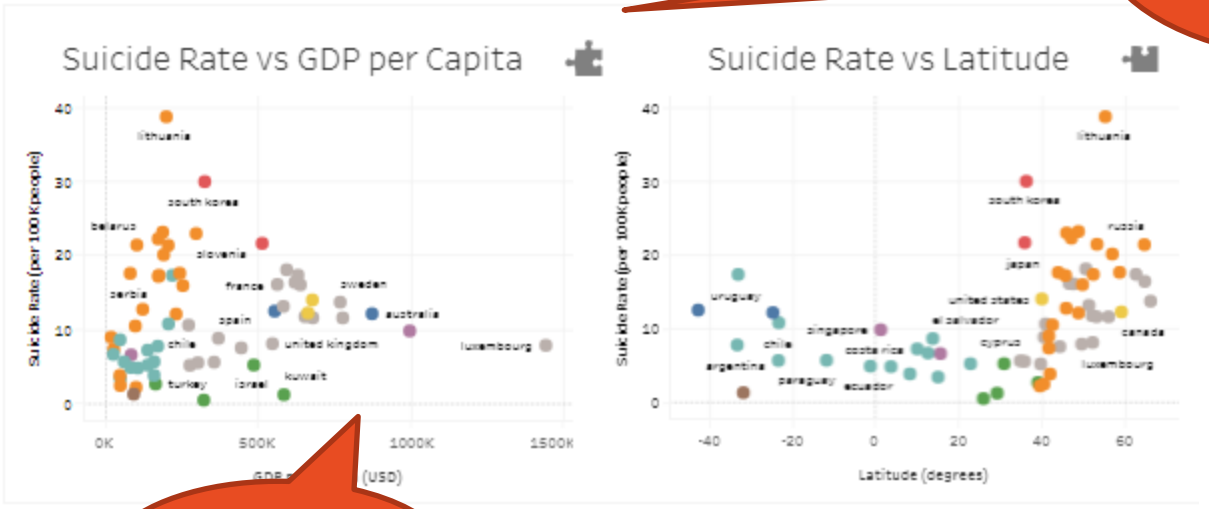
Similarity

Proximity









Combining preattentive properties + gestalt to represent quantity

- size*:*
  - *length or height,*
  - *area* (radius)*,*
  - never *volume*
- lightness, darker = bigger
- hue saturation, saturated = bigger
- vertical position, higher = bigger

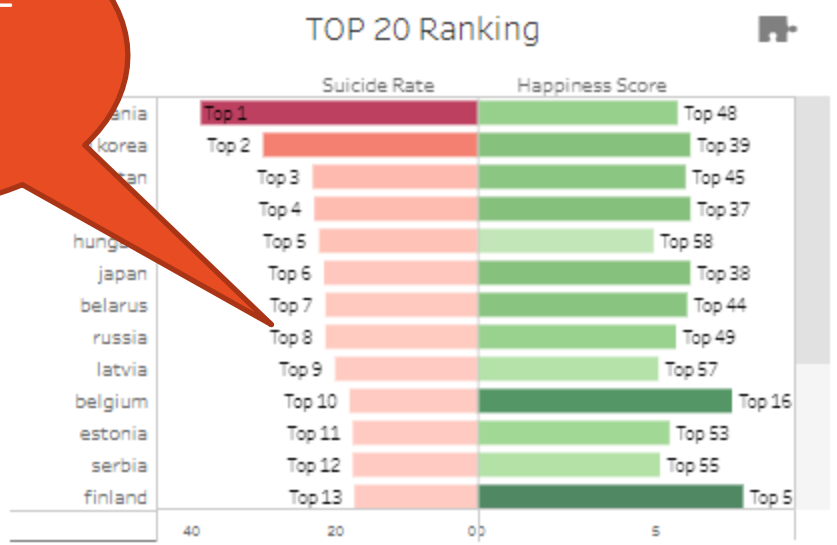
Combining preattentive properties + gestalt to represent INTENSITY

- Darker or more saturated,
- Bigger,
- Thicker

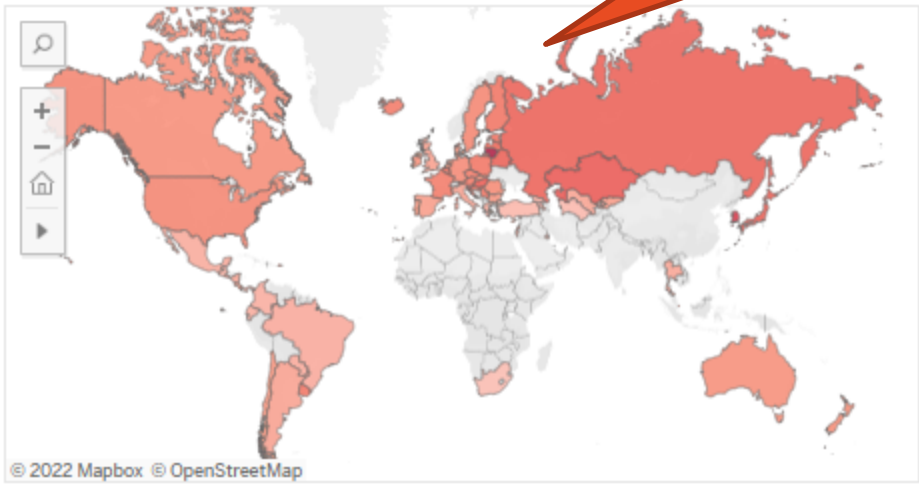
Combining preattentive properties + gestalt to represent VISUAL SALIENCE

- Distinct from the norm: in hue, orientation,
- Enclosure: by line or background colour,
- Added marks

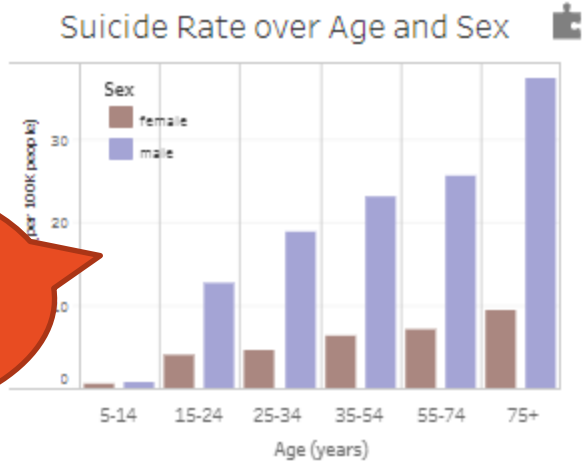
More saturated = bigger
Larger = bigger

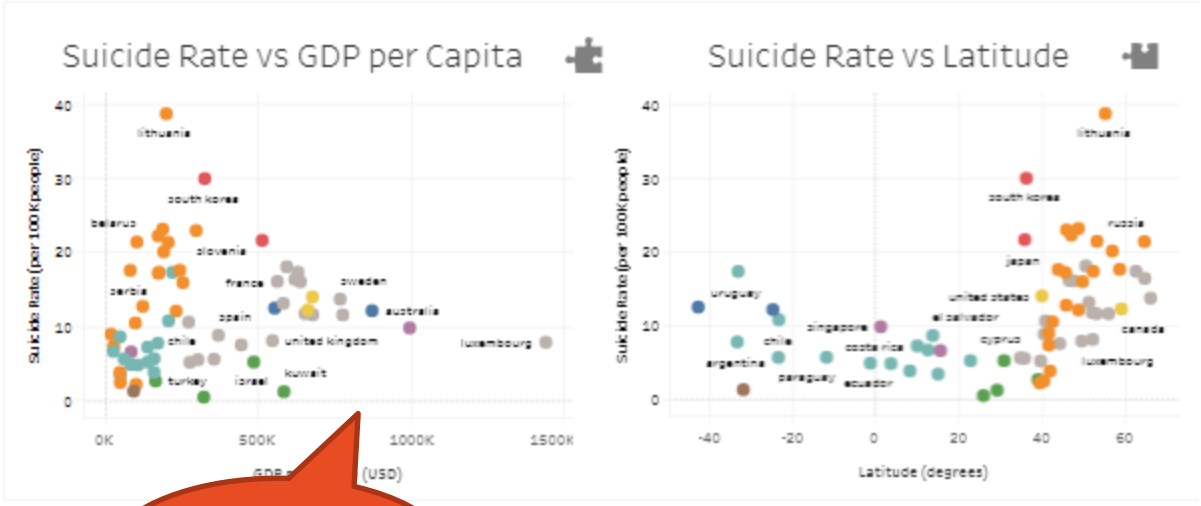


More saturated = bigger



Larger = bigger





Higher = bigger

Key ideas

1. Information visualization is a tool that uses our visual perception capacity to digest data and facilitate its understanding.

2. Preattentive properties allow maximum efficiency in data communication. Gestalt laws guide perception.

3. By combining both we can highlight and relate specific graphs and data.

Sources

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- Healey, CG (2012) Perception in Visualization. Department of Computer Science, North Carolina State University.
- Few, S (2012) Show Me the Numbers: Designing Tables and Graphs to Enlighten. Analytics Press.
- van Dijk, D. (2022) Mind your data visualization. Datylon BV.

Thank you for your attention

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