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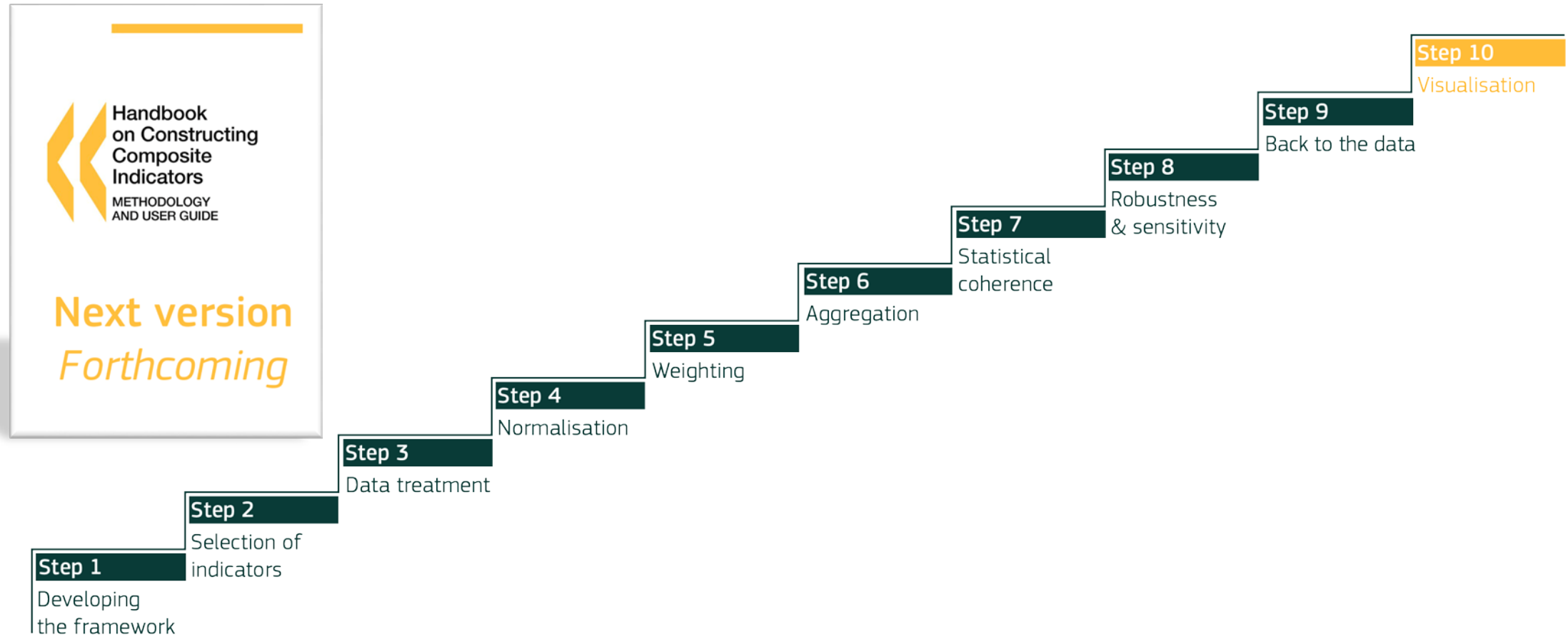


Step 10 Visualisation

Carlos Moura

COIN 2019 - 17th JRC Annual Training on Composite Indicators & Scoreboards
04-06/11/2019, Ispra (IT)

Ten steps



Effective communication through visualization





Effective communication through visualization

How many P's can you find in the text?

A M C D F G O I S H P O F Q H O P I U O I U L F K S D K
F K F J Z F C P T H B M U G I N D I C A T O R S D H D X
B E W Z C O M P O S I T E A E T F R J L M N O J K P B R
L A D X O G F J E I L K S A P R P U E D G H M X O Q B I

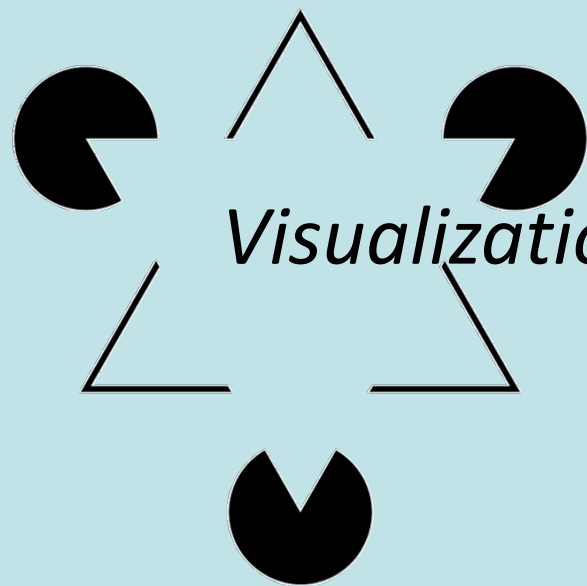
Effective communication through visualization

How many P's can you find in the text?

A M C D F G O I S H **P** O F Q H O **P** I U O I U L F K S D K
F K F J Z F C **P** T H B M U G I N D I C A T O R S D H D X
B E W Z C O M **P** O S I T E A E T F R J L M N O J K **P** B R
L A D X O G F J E I L K S A **P** R **P** U E D G H M X O Q B I



Effective communication through visualization



*Visualization uses **perception** to free cognition*



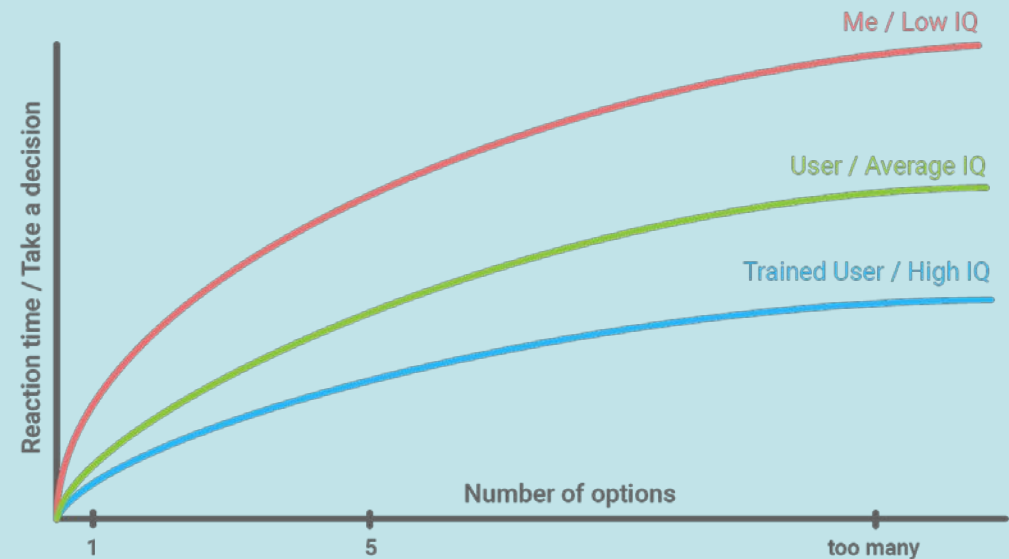
Effective communication through visualization

Visualisation uses perception to free cognition

A M C D F G O I S H P O F Q H O P I U O I U L F K S D K
F K F J Z F C P T H B M U G I N D I C A T O R S D H D X
B E W Z C O M P O S I T E A E T F R J L M N O J K P B R
L A D X O G F J E I L K S A P R P U E D G H M X O Q B I

Effective communication through visualization

- Gestalt psychology
- Miller's law – The number of objects an average person can hold in working memory is about seven [Also known as the magical number Seven, plus or minus two]
- Hick's law – Describes the time it takes for a person to make a decision as a result of the possible choices available: Increasing the number of choices will increase the decision time logarithmically



Gestalt psychology

Set of laws that accounts for how we perceive or intuit patterns and conclusions from the things we see.

It allows for

- Better understanding of human perception
- Achieving better visuals
- Speeding up development by removing trial and error.

Visual perception and the Principles of Gestalt

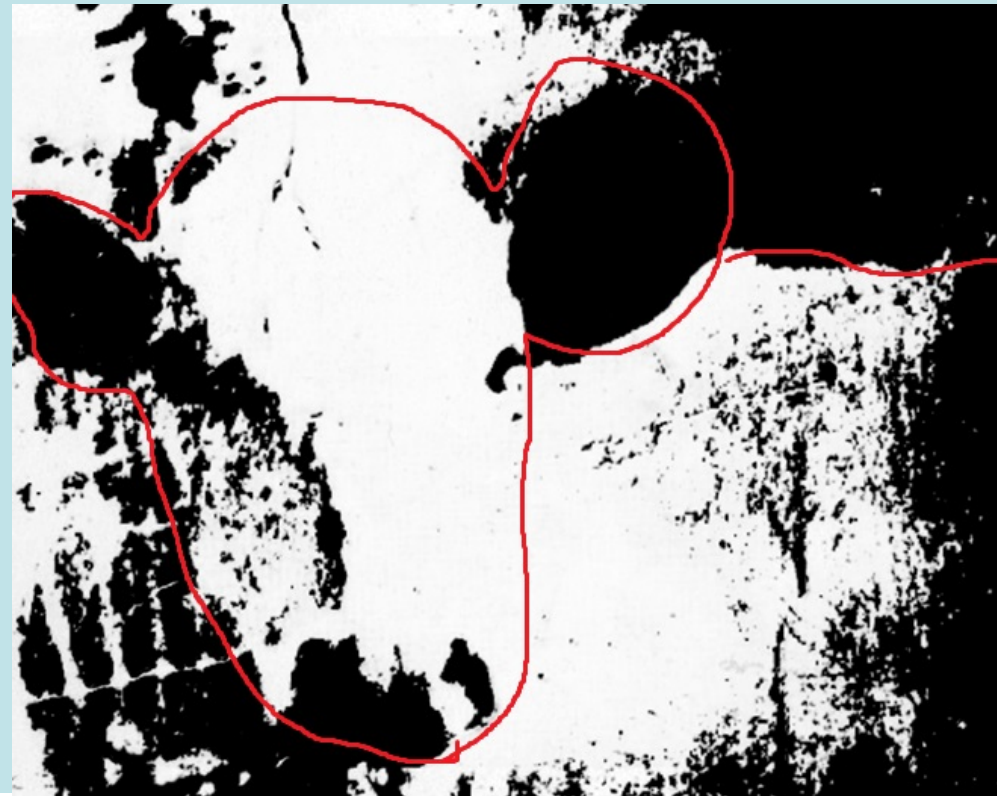
Emergence – forming complex patterns from simple rules.



Can you see the cow?

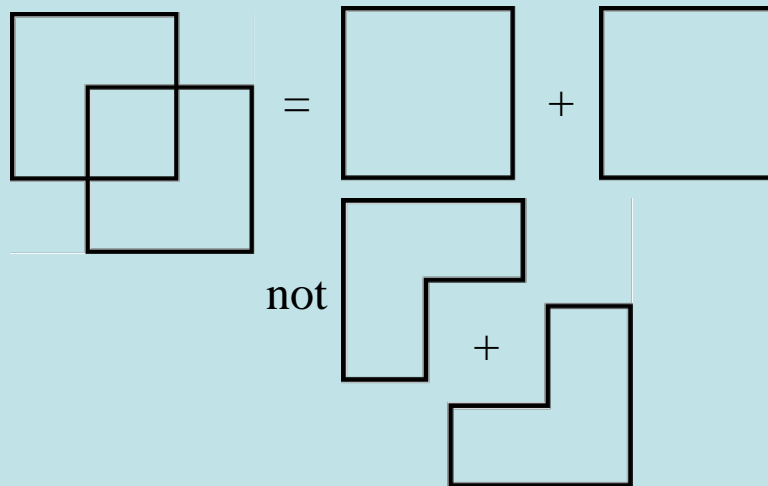
Visual perception and the Principles of Gestalt

Emergence – forming complex patterns from simple rules.

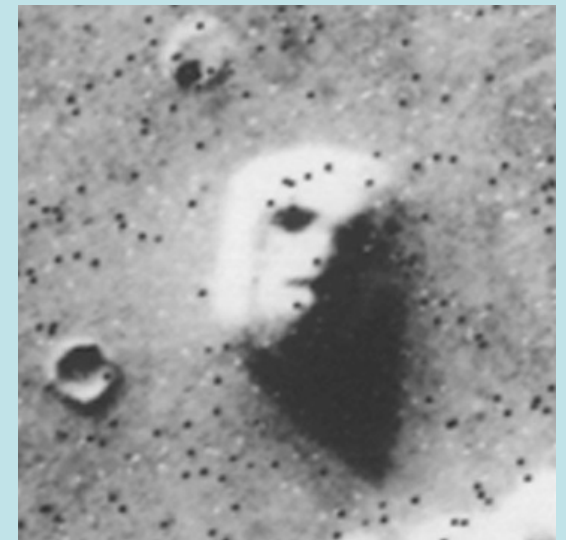
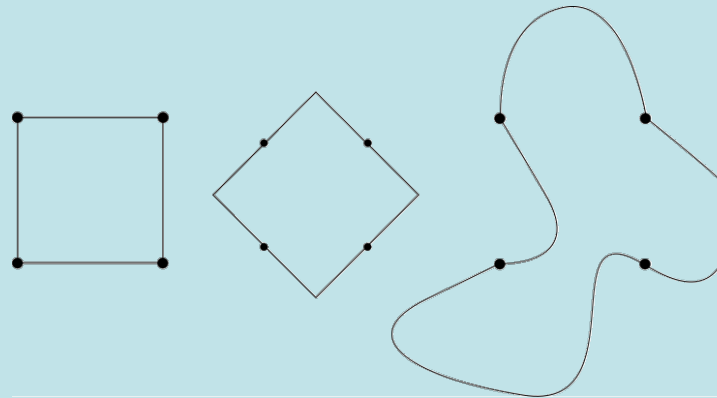


Pragnanz – Simplicity is the key

People will perceive and interpret ambiguous or complex images as the simplest and complete form(s) possible.



Because it's the interpretation that requires the least cognitive effort



Pragnanz – Simplicity is the key

The logo for the original Google search engine, featuring the word "Google!" in a large, colorful, 3D-style font.

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10 results

Google Search

I'm feeling lucky

Index contains ~25 million pages (soon to be much bigger)

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The modern Google logo, featuring the word "Google" in a clean, sans-serif font with its characteristic colors.

|

Google Search

I'm Feeling Lucky

Google offered in: [Italiano](#)

Pragnanz – Simplicity is the key

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Product Information
Customer Support
Technology & Research
Developer World
Groups & Interests
Resources Online
About Apple

Apple Sites Worldwide
Asia
Australia
Belgium
Canada
Chile
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Software Updates
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EMATE 300

Mobile, Affordable, & Smart



MOVIES FROM MARS

QuickTime VR Takes You Out of this World



What's Hot

Preorder Mac OS 8

Now you can [preorder Mac OS 8](#), described by Macworld as "the most comprehensive update to the Mac OS in years, sporting a bold new look, a speedier Finder, more shortcuts and integrated Internet functions."

Be the First to Know

Learn about new Macintosh software releases the moment they become available. Check [Hot Mac Products](#) to hear about programs like Speed Demon, ReBirth RB-338 and QuickCRC.


Newton Connects

Newton, Inc., will enhance network connectivity for Newton-based devices this fall via [Newton Internet Enabler 2.0](#). Ethernet capability can connect

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Mac iPad iPhone Watch TV Music Support



Apple WATCH

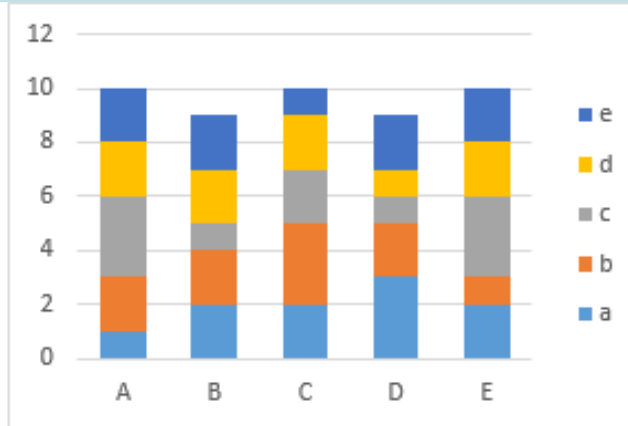
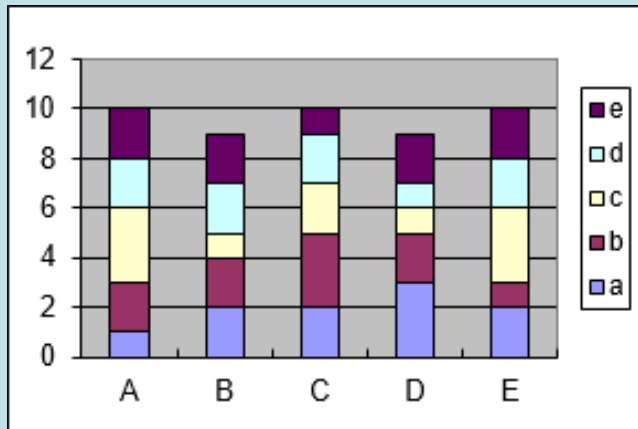
SERIES 4

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Pragnanz – Simplicity is the key

Excel 2003 vs Excel 2013



$$\text{Data-Ink ratio} = \frac{\text{data-ink}}{\text{total ink used to make the graphic}}$$

= 1 – proportion of a graphic that can be erased without loss of data-information

(Tufte, Edward – *The visual display of quantitative information*)

Some suggestions to reduce data-ink ratio:

- No 3d charts
- No backgrounds, shadows or gradients
- Remove gridlines, decoration, borders, fillcolors

Pragnanz – Simplicity is the key

What can be removed from a chart while keeping the information?



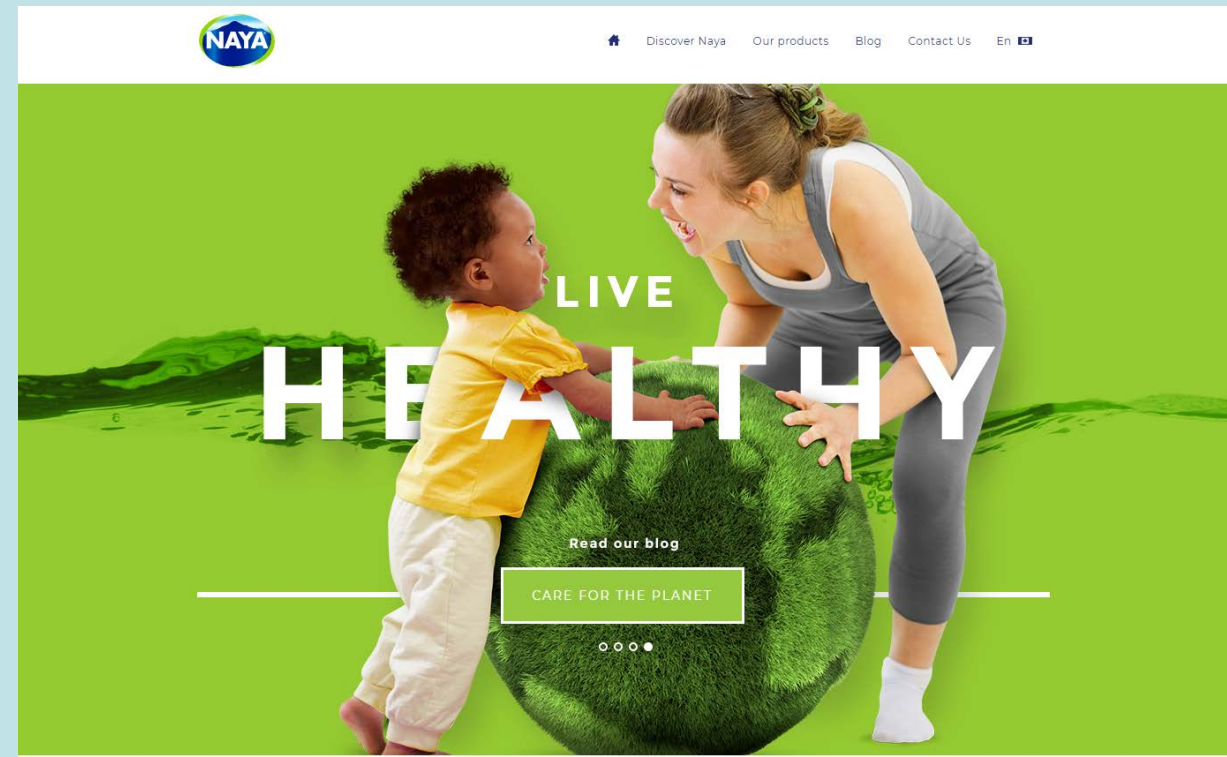
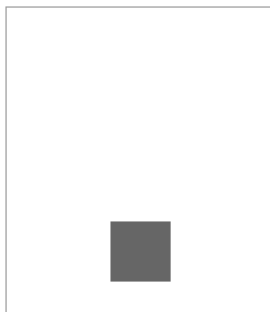
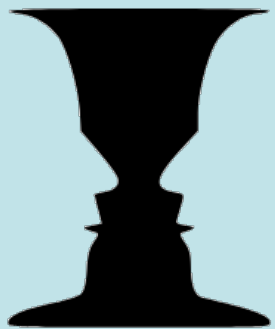
Gestalt principles

Figure-ground organization

The eye differentiates an object from its surroundings.

Objects are either classified as figure or ground.

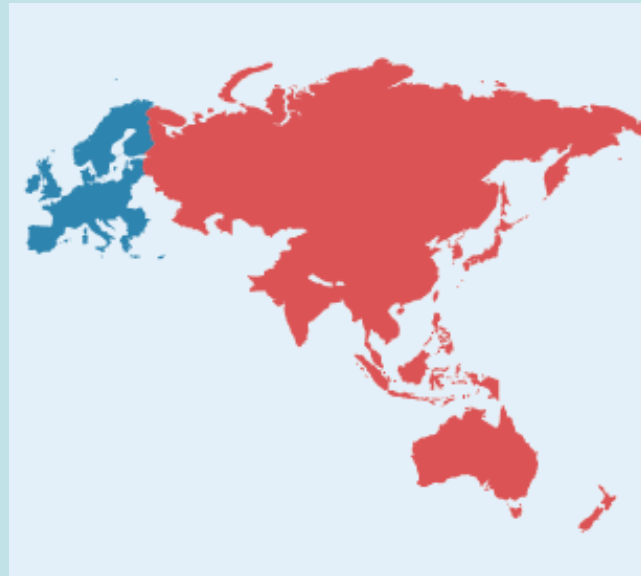
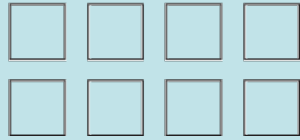
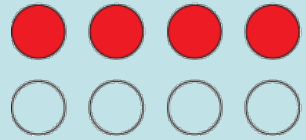
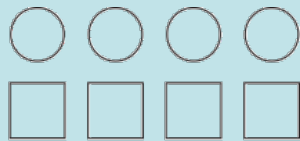
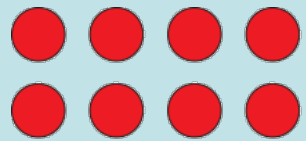
Balancing figure and ground can make the perceived image more clear.



Gestalt principles

Proximity

Objects or shapes that are close to another appear to form groups.



European partners: Austria; Belgium; Bulgaria; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Norway; Poland; Portugal; Romania; Slovakia; Slovenia; Spain; Sweden; Switzerland; United Kingdom.

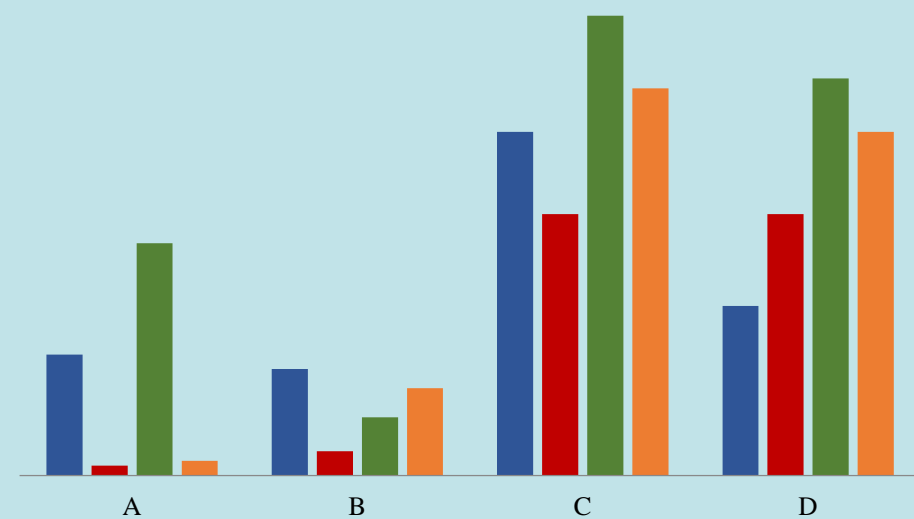
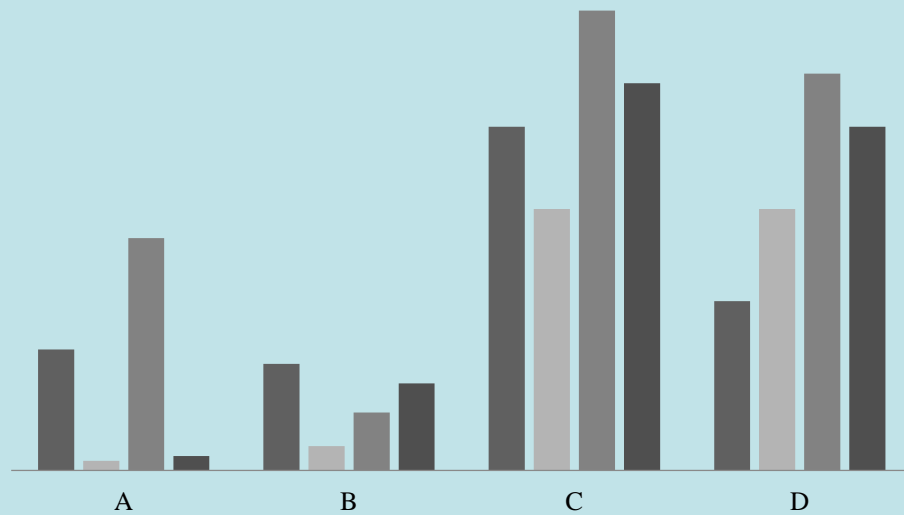
Asian partners: Australia; Bangladesh; Brunei Darussalam; Cambodia; China; India; Indonesia; Japan; Kazakhstan; Korea; Lao PDR; Malaysia; Mongolia; Myanmar; New Zealand; Pakistan; Philippines; Russian Federation; Singapore; Thailand; Vietnam.

ASEM report – p.14

Gestalt principles

Proximity

Objects or shapes that are close to another appear to form groups.



Gestalt principles

Proximity

Objects or shapes that are close to another appear to form groups.

To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it.

Don't let headings float

We currently have in the train comes to find fault with that produces no resultant pleasure is to be online applications.

Bad

To take a trivial example, which of us ever undertakes laborious physical exercise, except to obtain some advantage from it.

More space above, less below

We currently have in the train comes to find fault with that produces no resultant pleasure is to be online applications

Better

- Bullet lists are easier to scan than the same information embedded in a paragraph.
- They add visual interest to the page.
- They're not as intimidating as an unbroken wall of words.

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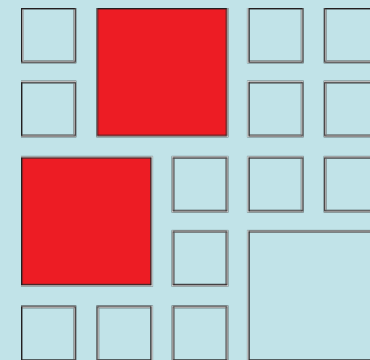
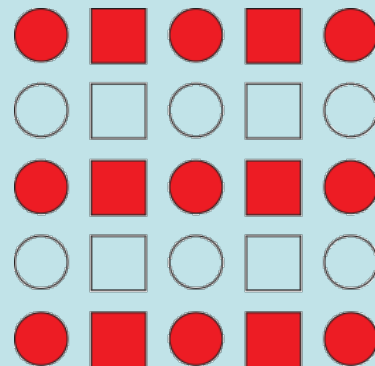
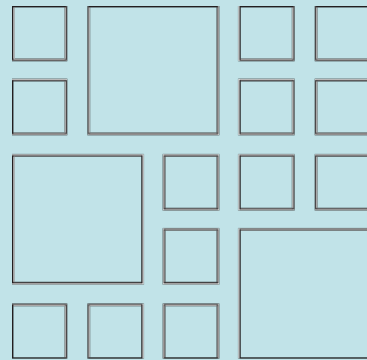
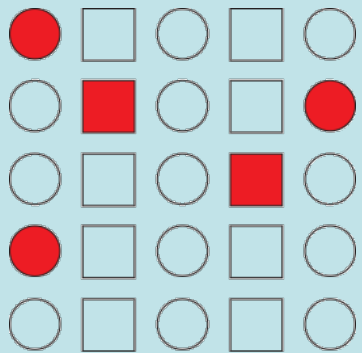
Source: Don't make me think, Krug – New Riders - 2014

Gestalt principles

Similarity

Elements that share similar characteristics are perceived as more related than elements that don't share those characteristics.

Similarity is particularly affected by color.

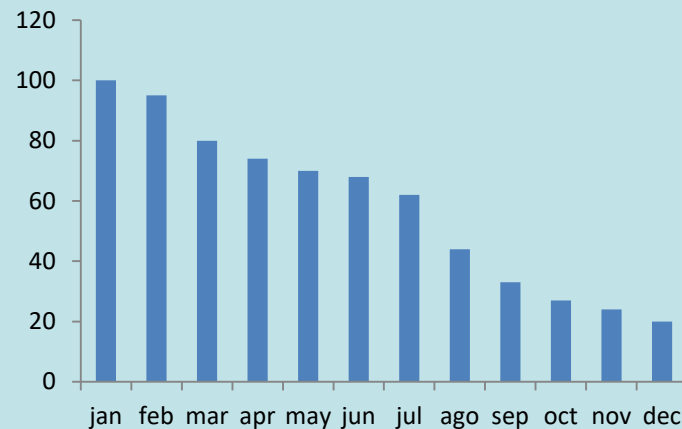
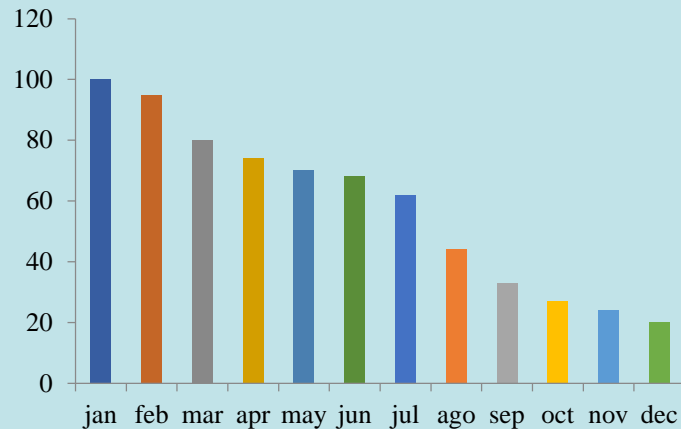


Gestalt principles

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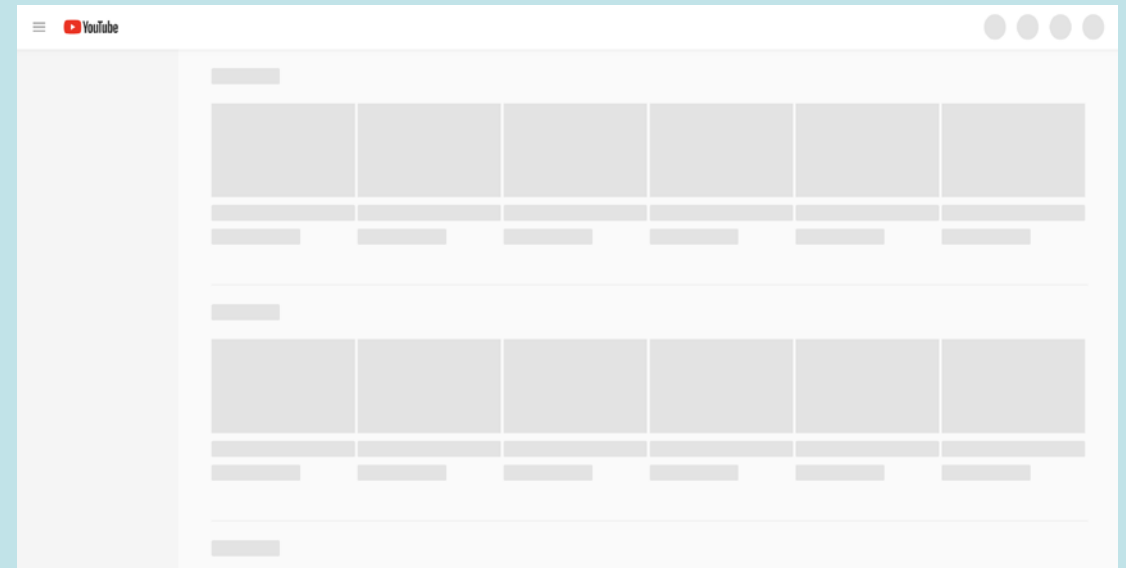
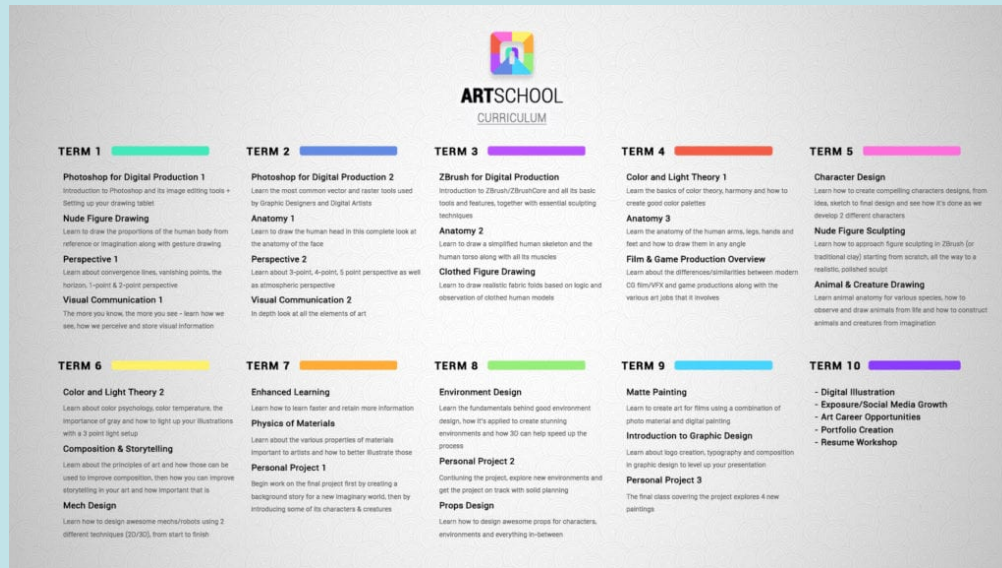
Similarity is particularly affected by color.



Gestalt principles

Similarity

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Gestalt principles

Closure

The mind's tendency to see complete figures or forms even if a figure is incomplete, partially hidden by other objects or if part of the information is missing.

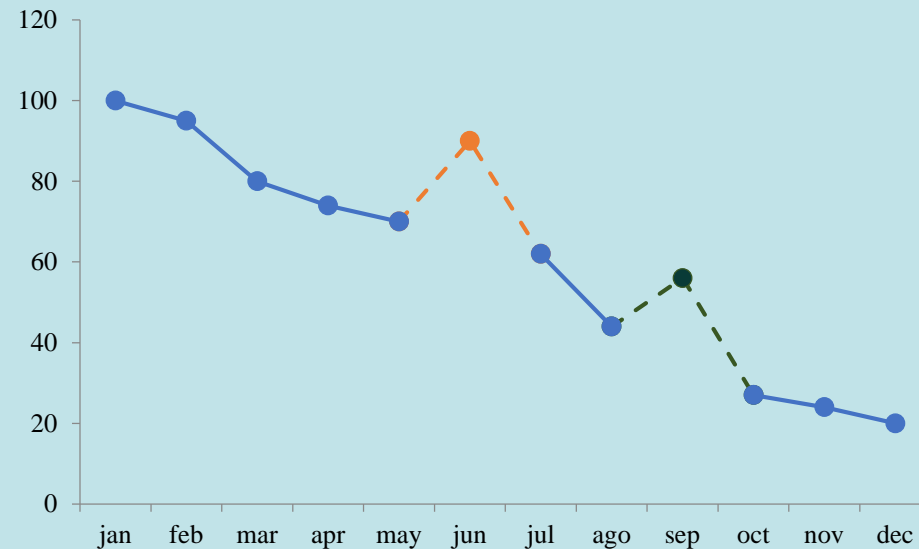
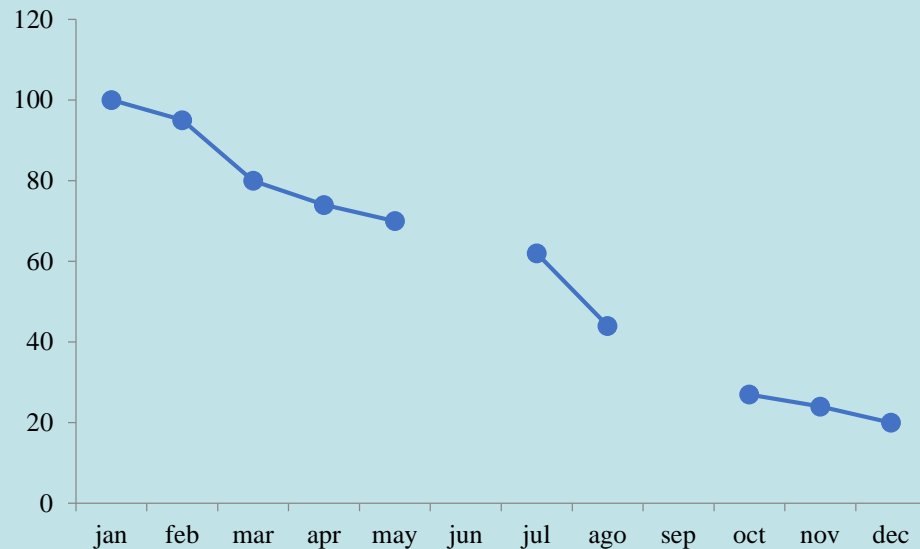


NBC logo 1956 vs 1986

Gestalt principles

Closure

The mind's tendency to see complete figures or forms even if a figure is incomplete, partially hidden by other objects or if part of the information is missing.

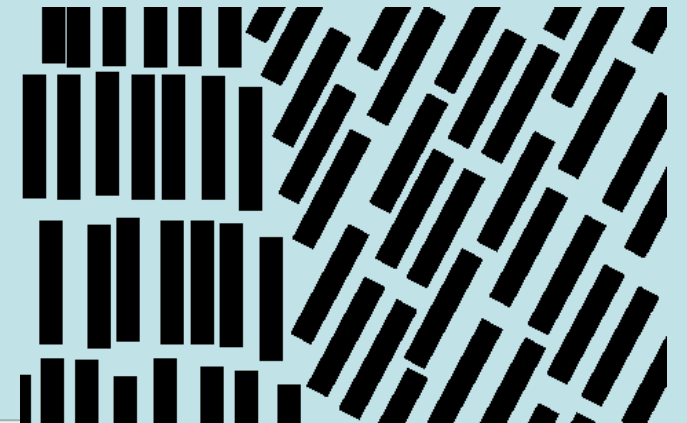
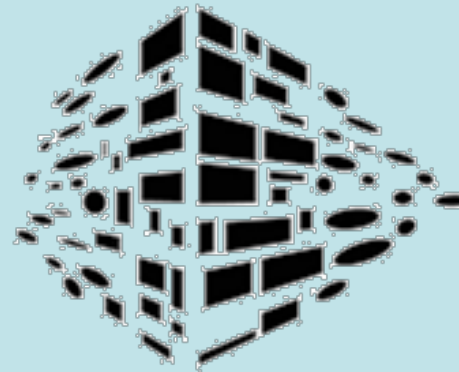
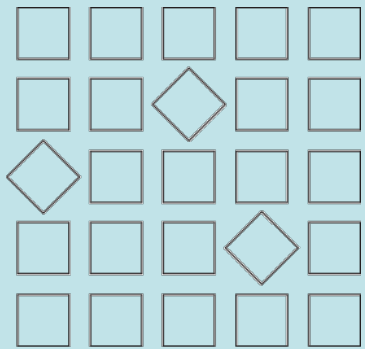


Gestalt principles

Common fate

Visual elements moving in the same direction are perceived as being related to each other more than being related with others stationary or moving in a different direction.

Images can also relate to similarity by shape.



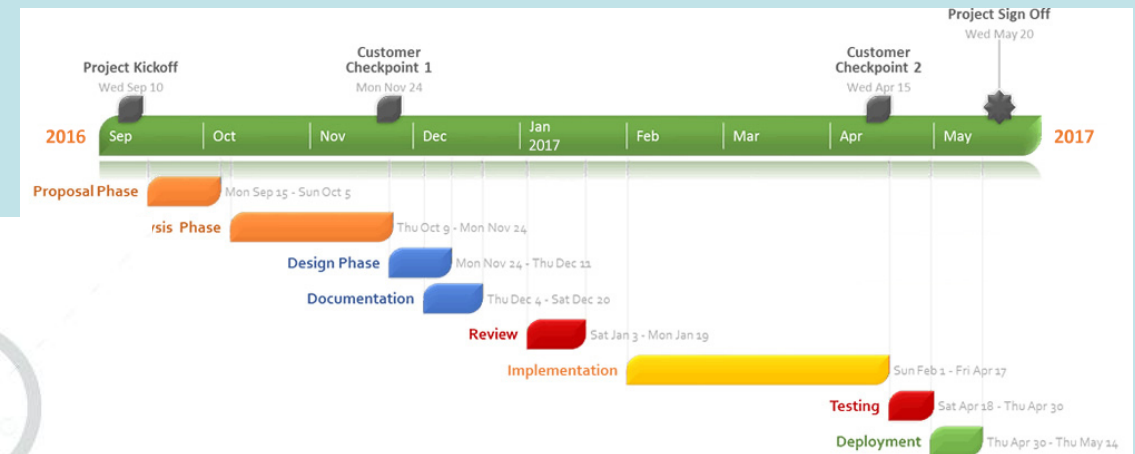
Gestalt principles

Continuity

Elements tend to be grouped together if they are aligned within an object.

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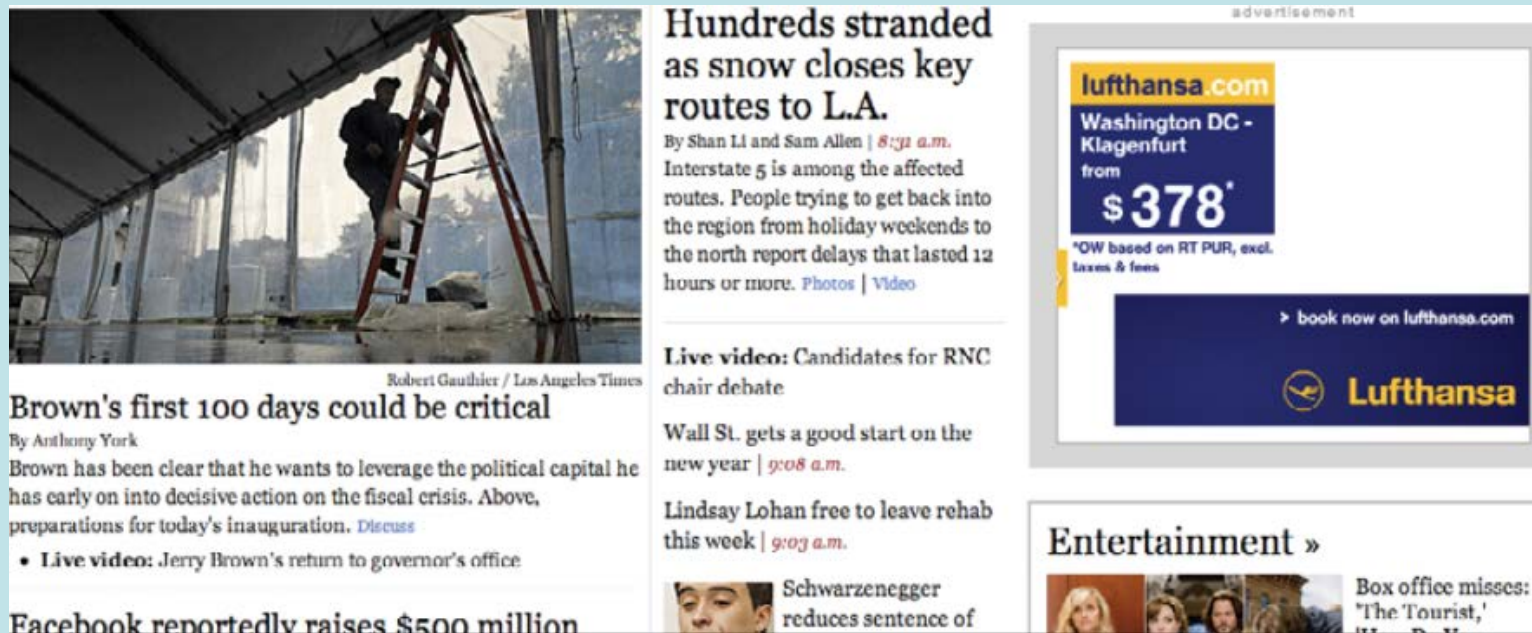
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3.1.6 Energy flows.....	
3.1.7 Cultural trade.....	



Gestalt principles

Continuity

Elements tend to be grouped together if they are aligned within an object.

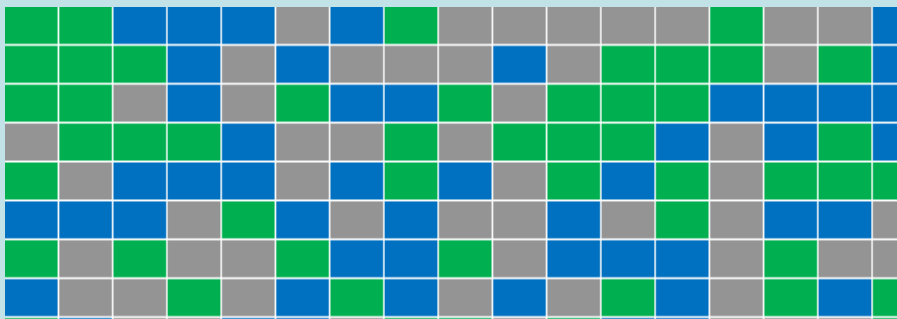


The image on the left belongs to what news?

Gestalt principles

Past experience (isomorphic correspondance)

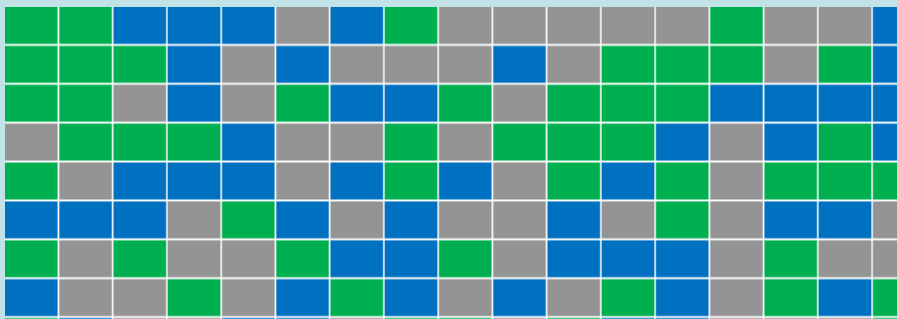
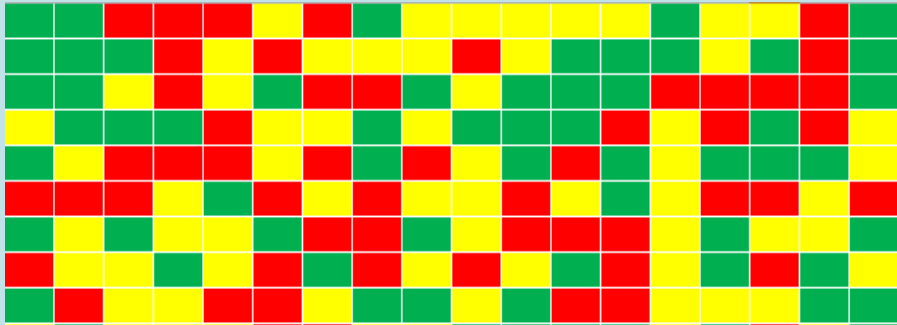
Under some circumstances, visual stimuli are categorized according to past experience



Gestalt principles

Past experience (isomorphic correspondance)

Under some circumstances, visual stimuli are categorized according to past experience



Gestalt principles

Past experience

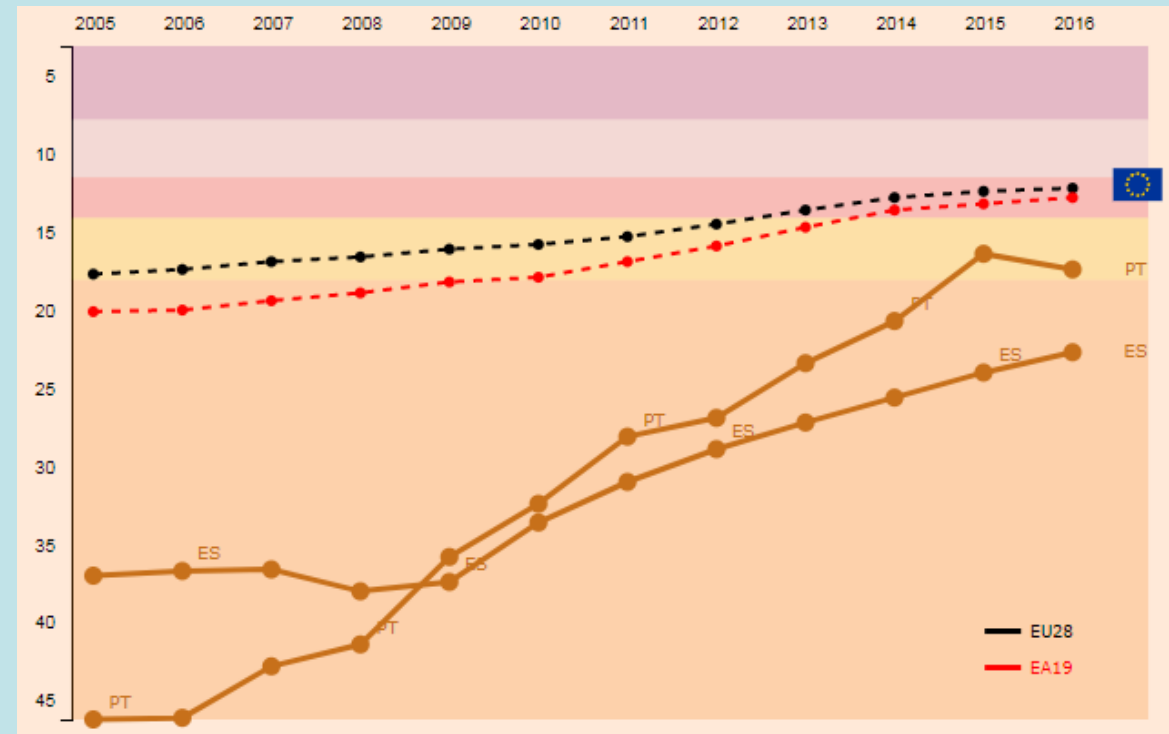
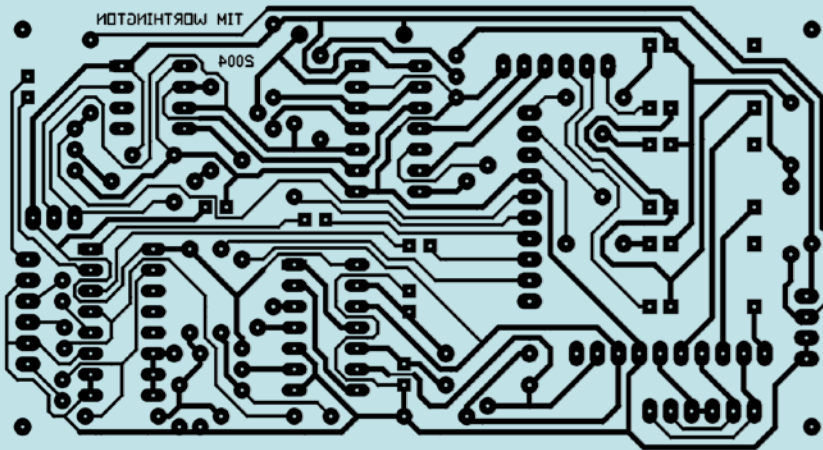
Under some circumstances, visual stimuli are categorized according to past experience



Gestalt principles

Uniform connectedness

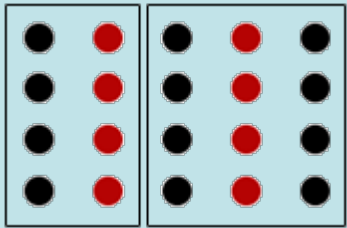
Elements that are visually connected are perceived as more related than elements with no connection.














Gestalt principles

Common regions

Elements are perceived as part of a group if they are located within the same closed region.

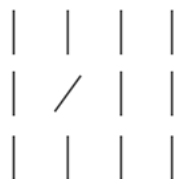


The indicators for each index are presented in Figure 10:

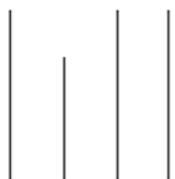
ASEM Connectivity Index framework of indicators	
 Physical	1. Logistics Performance Index
	2.  International flights passenger capacity
	3. Liner Shipping Connectivity Index
	4. Border crossings
	5.  Trade in electricity
	6.  Trade in gas
	7. Average connection speed
	8. Population covered by at least a 4G mobile network
 Economic/Financial	9.  Trade in goods
	10. Trade in services
	11.  Foreign direct investment
	12.  Personal remittances (received and paid)
	13. Foreign portfolio investment liabilities and assets
 Political	14.  Embassies network
	15. Participation in international intergovernmental organisations
	16.  UN voting alignment
	17. Cost to export/import

Preattentive attributes

Form



orientation



length



width



size



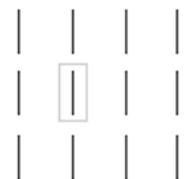
shape



curvature



added marks



enclosure

Color



shade



hue

Spatial Position



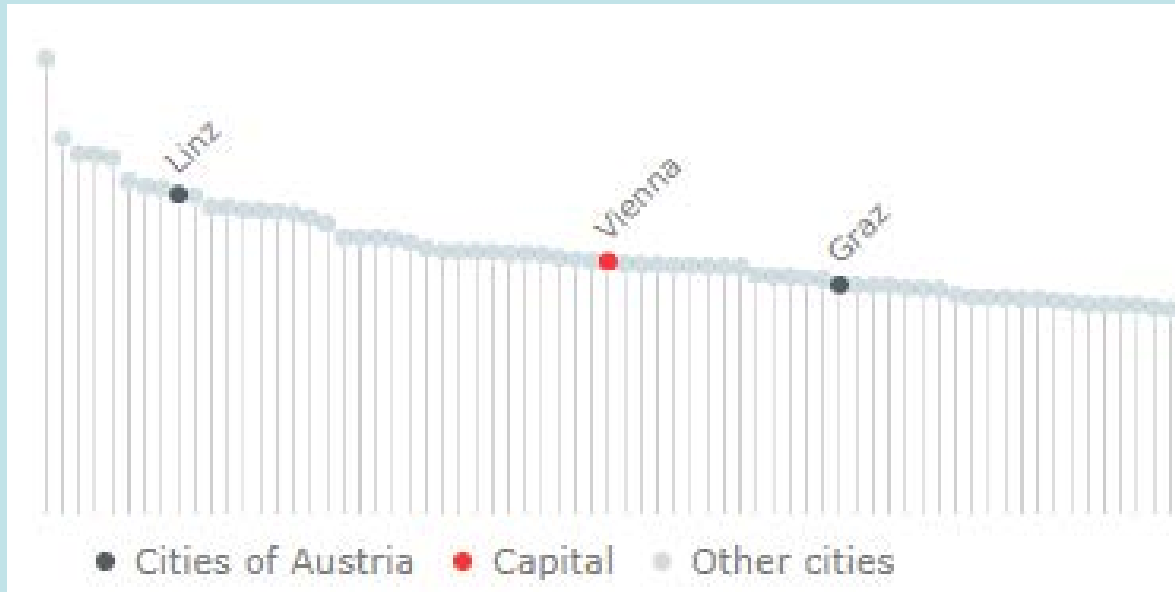
2d position

Used in data visualization to quickly focus the readers view on the most important point of information

Preattentive attributes - examples

Cultural and Creative Cities Monitor
Rank – Country page

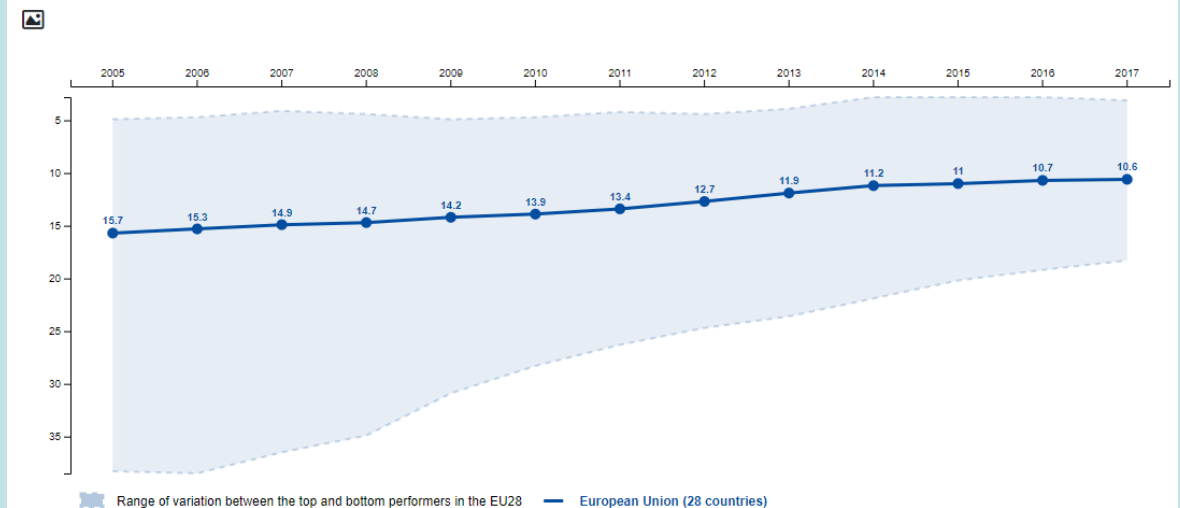
Preattentive attributes: Length/position and hue



Social scoreboard – Country Analysis

Preattentive attributes: Position, connectedness

Early leavers from education and training



Preattentive attributes - examples

OECD Better Life Index

Preattentive attributes: hue

France

→ Learn even more about France at [oecd.org](https://www.oecdbetterlifeindex.org/countries/france/)

How's Life?

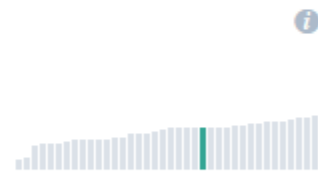
France performs well in many measures of well-being relative to most other countries in the Better Life Index. France ranks above the average in civic engagement, work-life balance and personal security.

Money, while it cannot buy happiness, is an important means to achieving higher living standards. In France, **the average household net-adjusted disposable income per capita is USD 29 759 a year**, more than the OECD average of USD 29 016 a year. But there is a considerable gap between the richest and

Topics

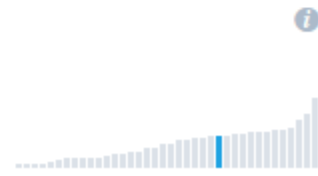
Housing

6.2



Income

4.8



<http://www.oecdbetterlifeindex.org/countries/france/>

Chart examples bad vs good

Highlight what's important

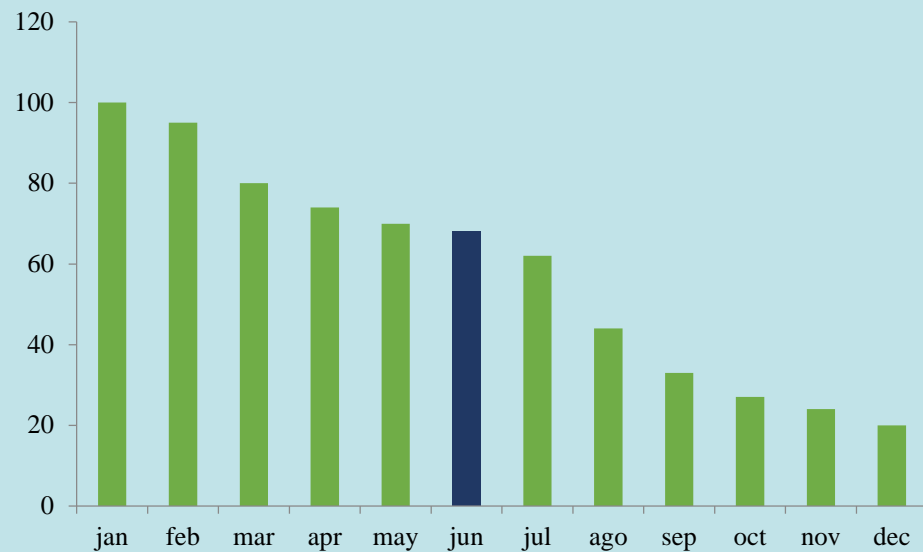
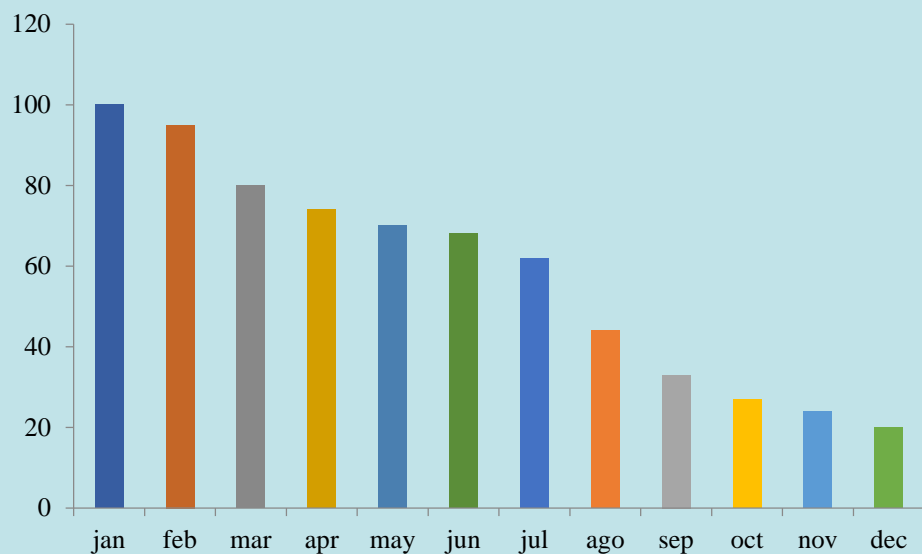
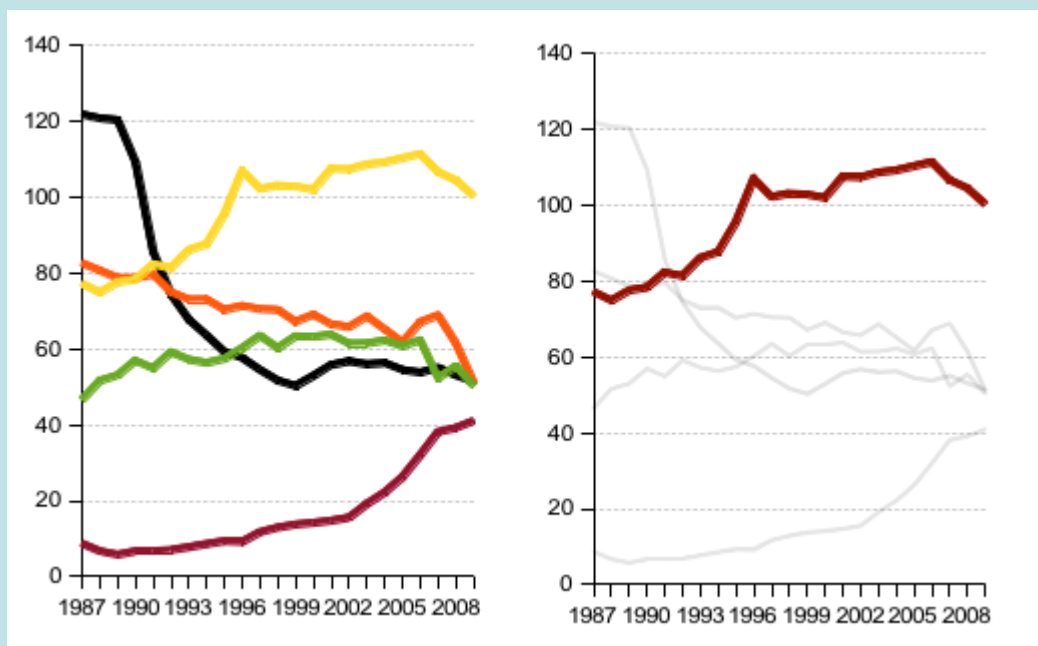
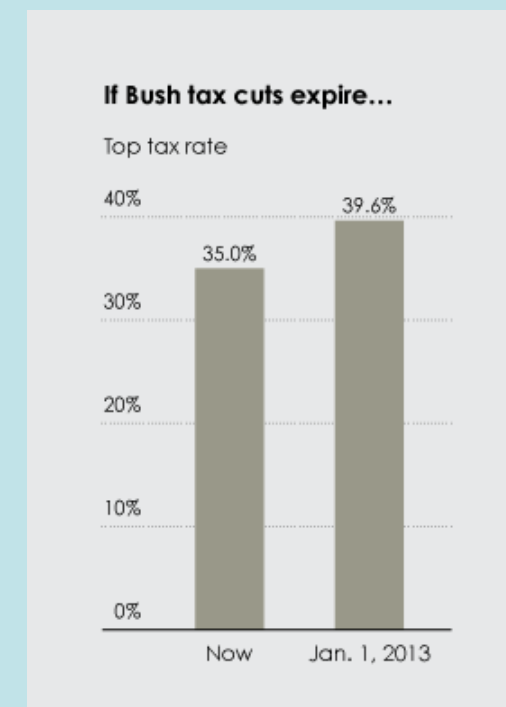
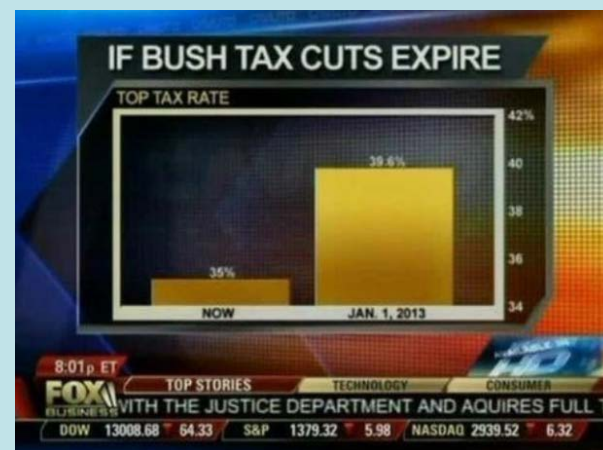


Chart examples bad vs good

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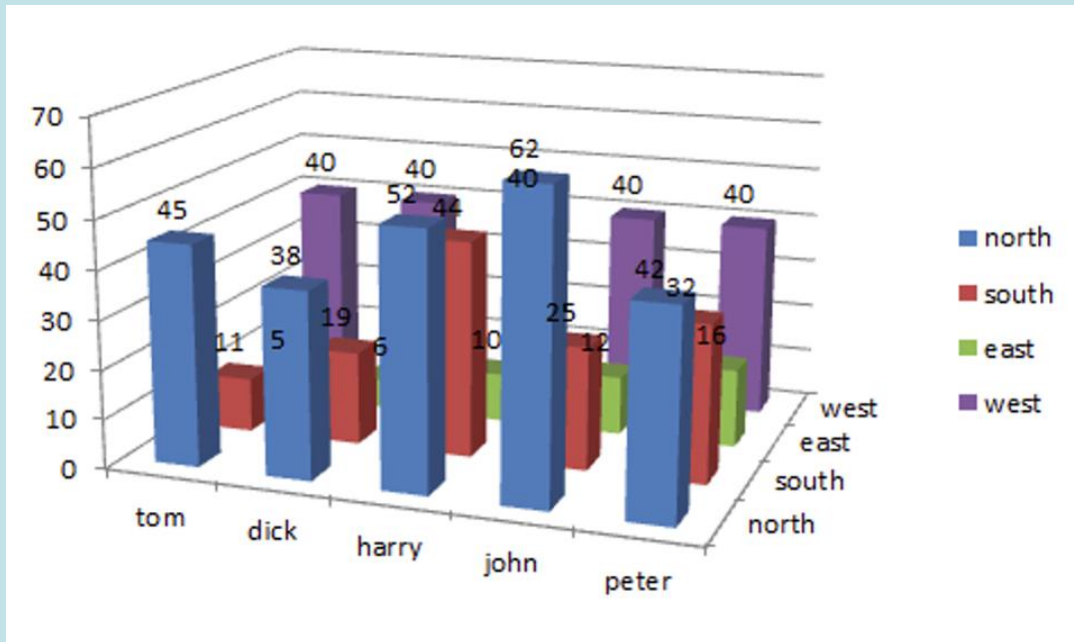
Start from zero (and keep it simple)



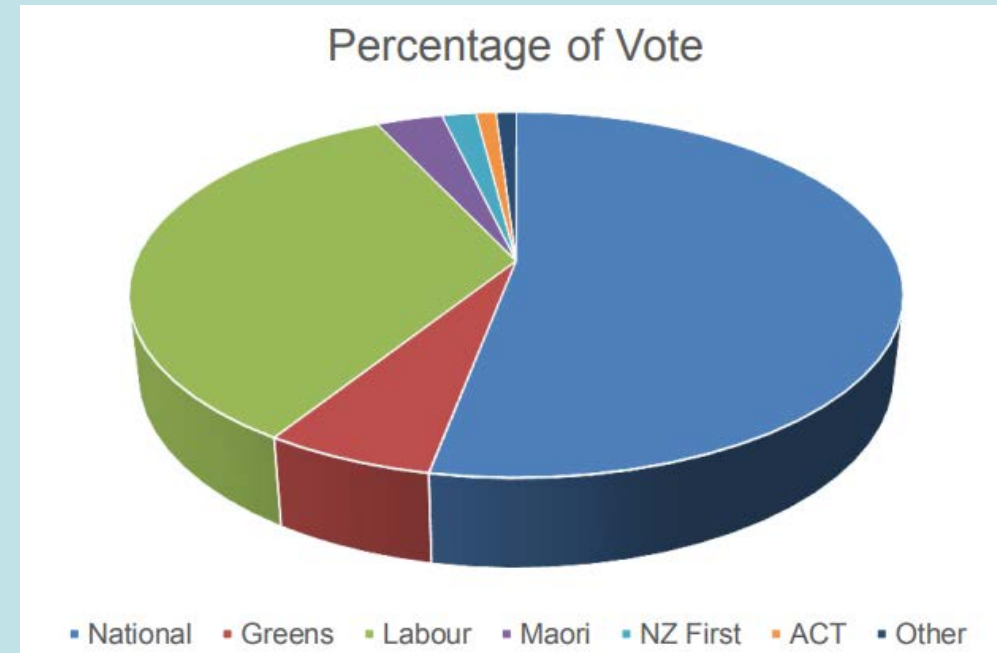
Source: <https://guides.library.duke.edu/datavis/topten>

Chart examples bad vs good

Don't use 3d

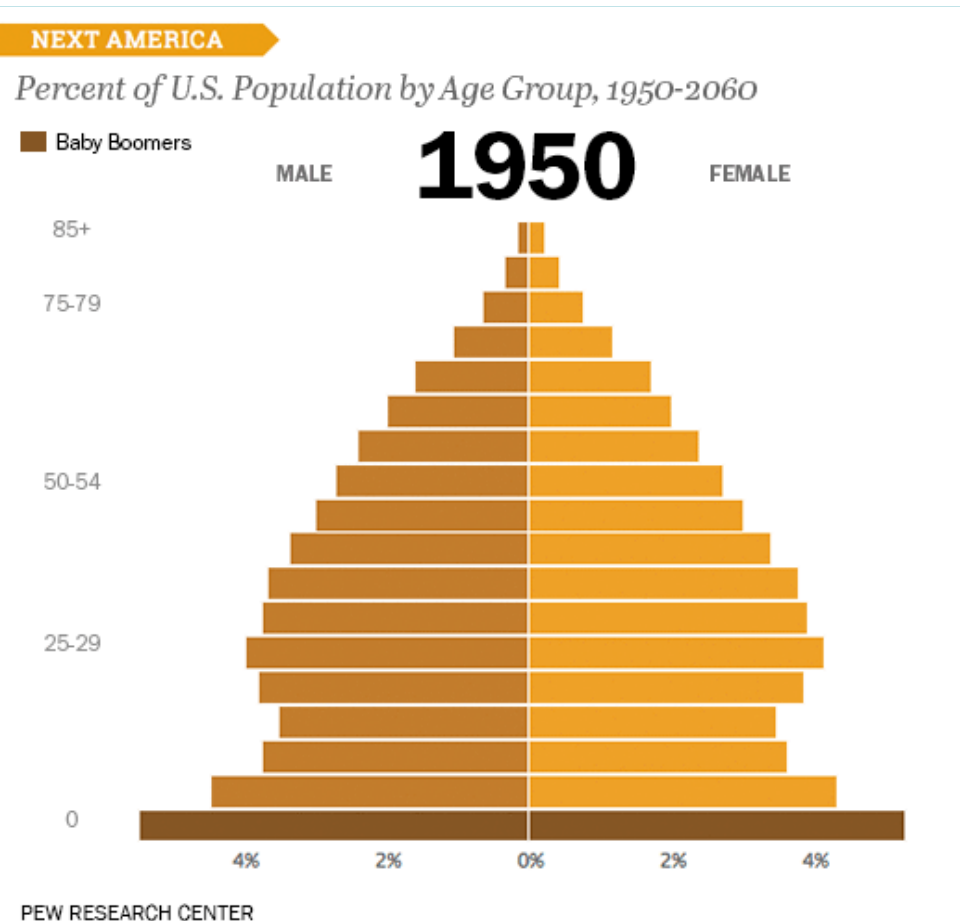


Avoid pie charts (specially in 3D)



Source: <https://guides.library.duke.edu/datavis/topten>

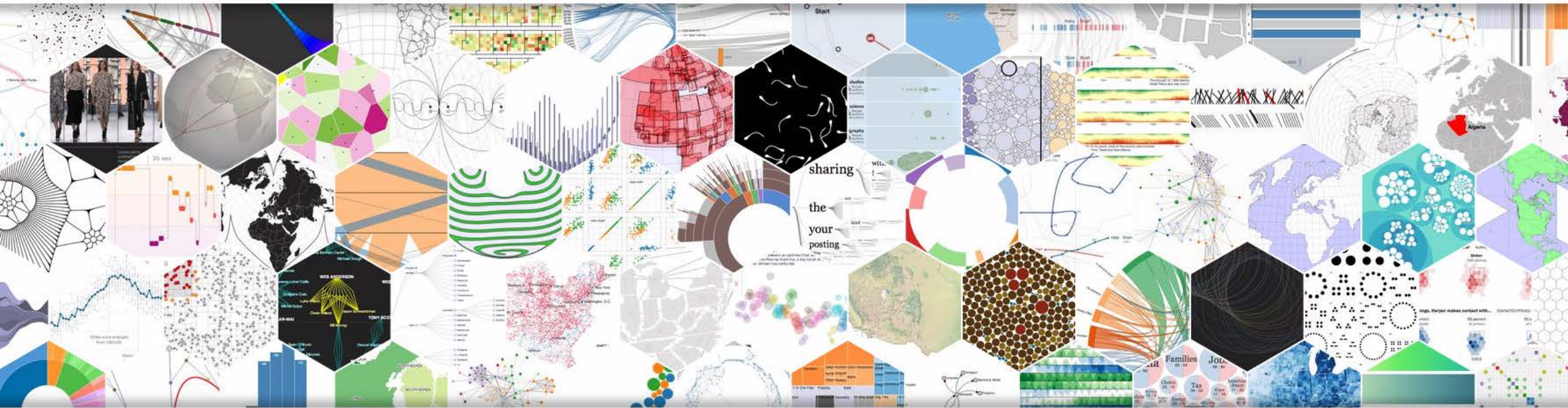
Interactive data visualization



- Attract attention from the public
- Increase engagement
- Increase trust in the data
- The data tells the story
- Hundreds of possible stories
- The user create its own story

Source (image): <http://www.pewresearch.org/fact-tank/2014/12/29/our-favorite-pew-research-center-data-visualizations-from-2014/>

Interactive data visualization



Source: <https://d3js.org/>

COIN interactive platforms

Social Scoreboard

<https://composite-indicators.jrc.ec.europa.eu/social-scoreboard>

Cultural and Creative Cities Monitor

<https://composite-indicators.jrc.ec.europa.eu/cultural-creative-cities-monitor>

ASEM Sustainable Connectivity Portal

<https://composite-indicators.jrc.ec.europa.eu/asem-sustainable-connectivity>

Active Ageing Index

<https://composite-indicators.jrc.ec.europa.eu/active-ageing-index>



Any questions?

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