Module II. Technical

6. Info graphic course

Topic 2. Realization of an infographic

Lesson 2.
Visual representation of data and information

Co-funded by the Erasmus+ Programme of the European Union

OCITY
Creativity + Innovation & Technology

This lesson has been prepared with the aim of facilitating students in choosing how to **properly represent** data and information in a **graphical way**, when creating an infographic.

Specifically, we will focus on the **most common visualization techniques** and on **some frequent mistakes** related to them.

In this lesson, we will learn:

The way of **encoding data and information in pictures**, in order to correctly visualize and present a topic when creating an infographic.

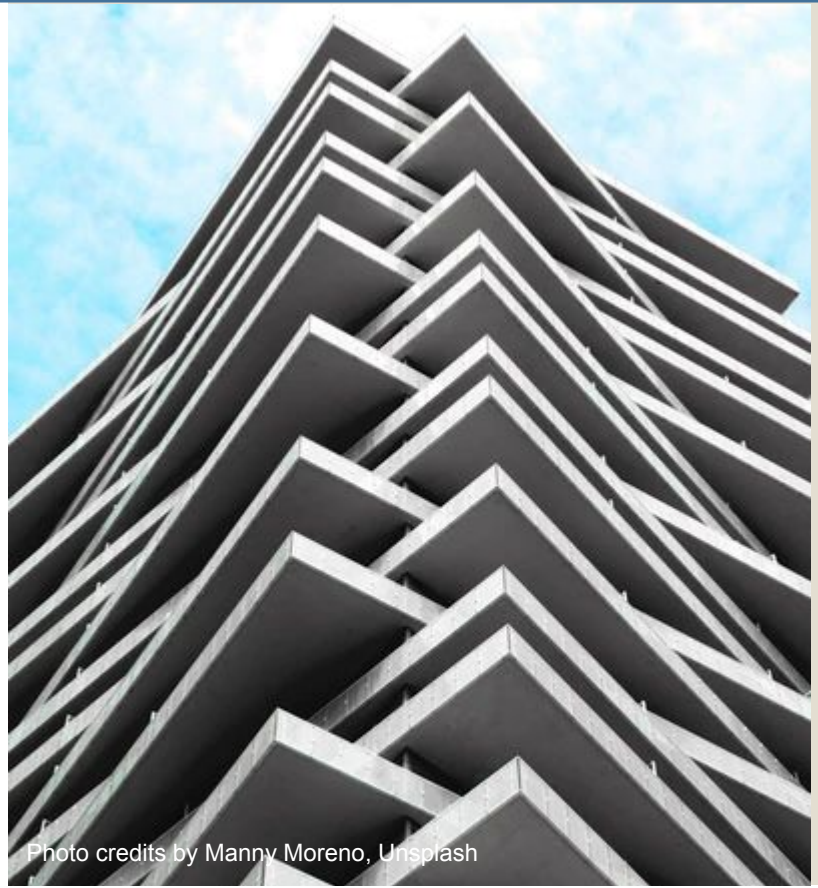


Photo credits by Manny Moreno, Unsplash

Most common visualization techniques

When dealing with the **representation of data and information** there are several visualization techniques that can be used. **Visualization techniques organize data** in a structured way with the aim of showing patterns and relationships that allow people to obtain information.

Knowing the characteristics of each of them is important, not only to **decide how to visualize** data after collecting them, but also to learn **how to read them**, avoiding misleading.

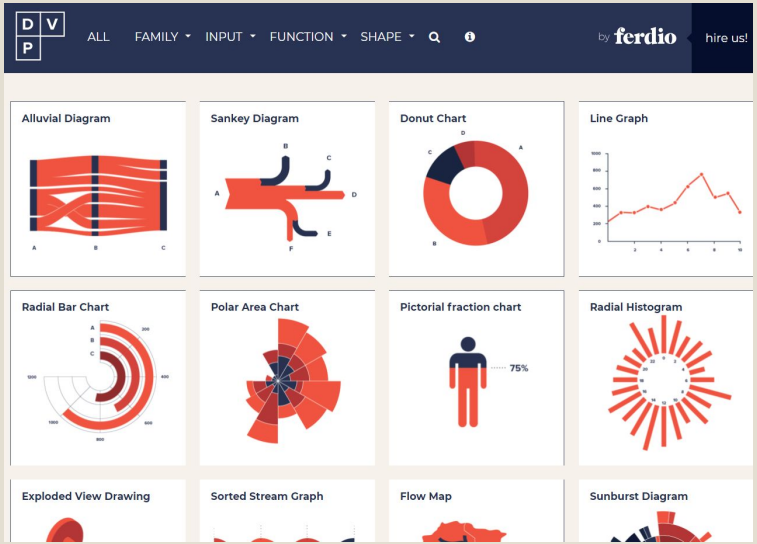
Following, some most common visualization techniques are introduced.

Photo credits by Héctor J. Rovas, Unsplash

For a complete description and **more typologies of techniques**, visit:

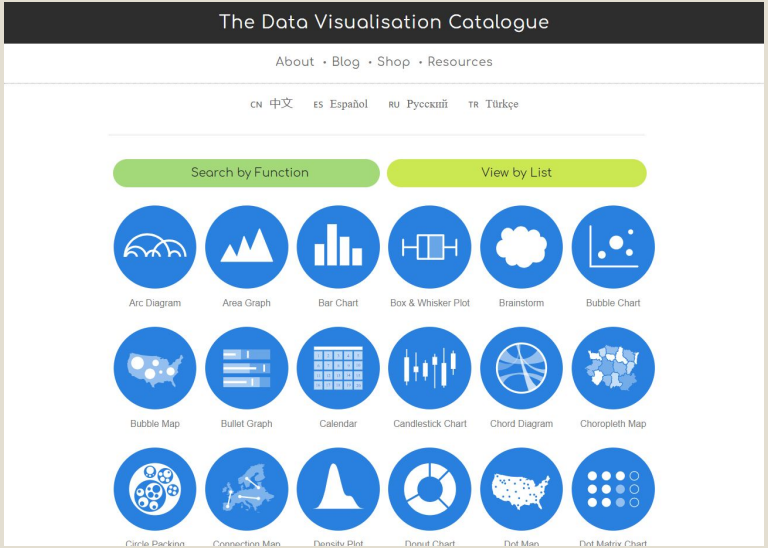
Dataviz projec

https://datavizproject.com/

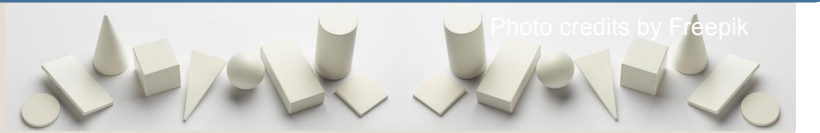


Dataviz catalogue

https://datavizcatalogue.com/



The bar chart



- It is useful to show discrete, numerical comparisons across categories. It answers the **question of "how many?"** in each category.
- It can use either **vertical or horizontal** bars.
- **The lengths of the bars** are proportional to the values they represent.
- **One axis** of the chart represents the **specific categories** being compared and **the second one** a discrete **value**.
- You can **order** the bar in chronological order and you can **colour** the different bars.
- Be aware that **labelling can be problematic** when there are a large number of bars.
- A similar type of chart is a **stacked bar chart** that represents multiple datasets on top of each other.

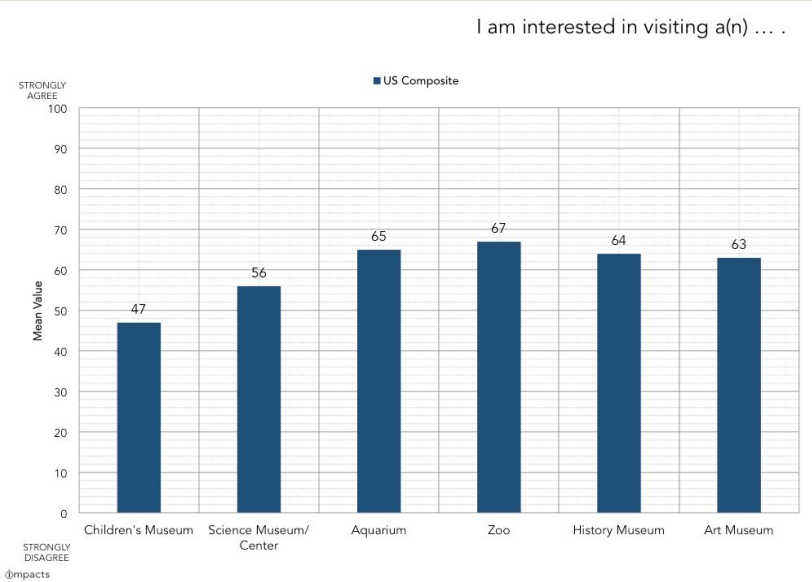


Fig. 1

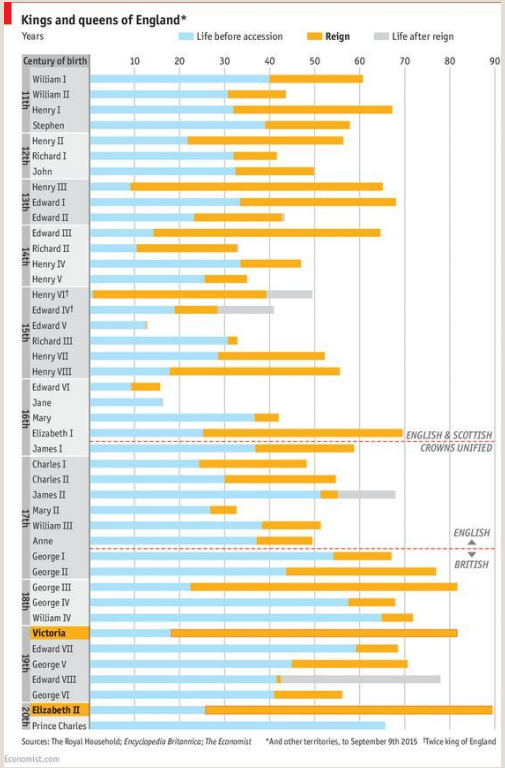
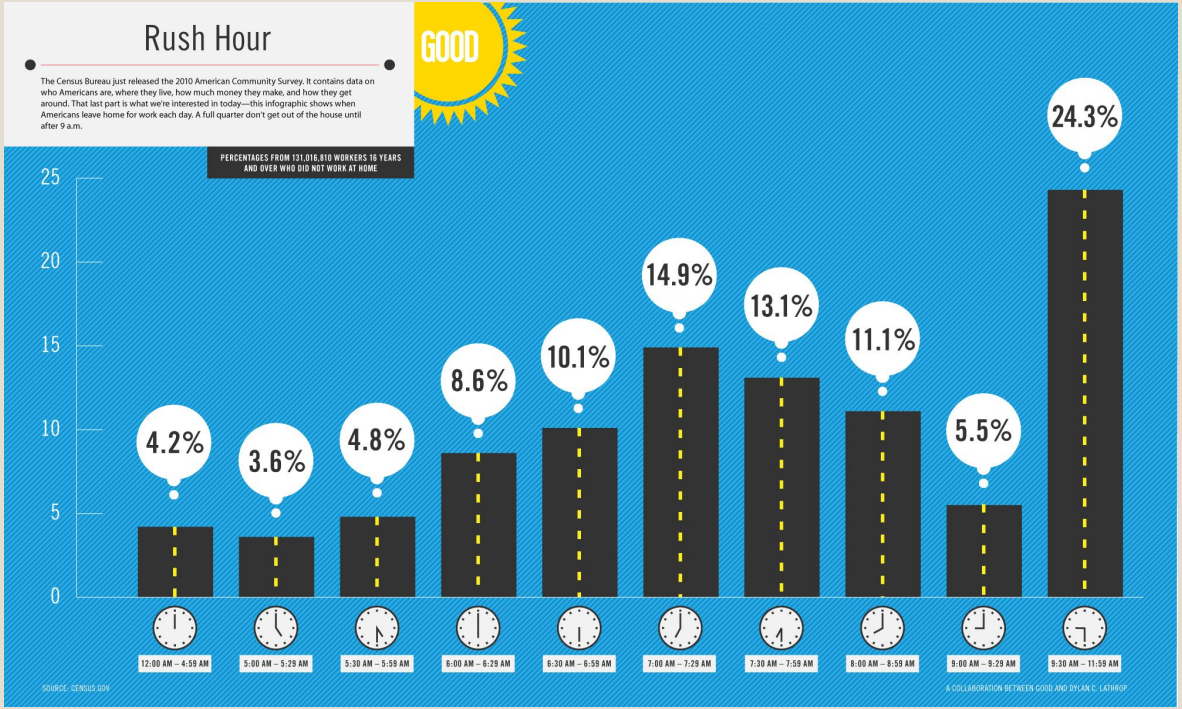


Fig. 2

Fig. 1 - Example of bar chart (vertical). Source: https://www.colleendilen.com/2019/07/17/unwelcoming-uninteresting-and-unengaging-heres-whats-up-with-perceptions-of-childrens-museums-data/

Fig. 2 - Example of stacked bar chart. Source: https://ar.pinterest.com/pin/186477240799577645; https://www.economist.com/graphic-detail/2015/09/09/queen-elizabeth-ii-takes-the-crown

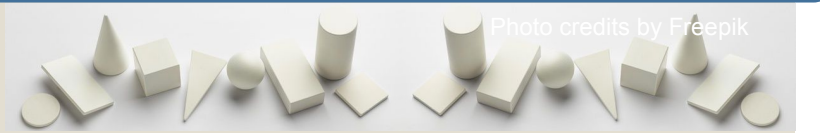
Fig. 3



Example of bar chart (vertical).

Fig. 3 - Source: https://www.good.is/infographics/infographic-out-the-door-late-americans-commute

The line graph



- It is useful to show **quantitative values** (typically on y-axis) over a continuous interval or time period (typically on x-axis).
- It represents information on a **Cartesian coordinate** grid as a series of data points called “markers” connected by straight lines. Markers can be put in evidence or not to highlight specific moments.
- It also allows us to represent **negative values**.
- When **correlated with other data** series individual lines can be compared to one another (no more of 3-4 lines on the same chart).
- Be aware that comparing **more than 3-4 lines** on the same chart can make reading **difficult.**

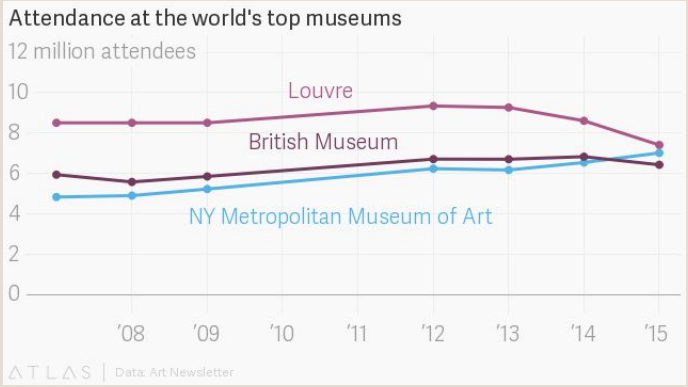


Fig. 4 - Example of line graph. Source:https://qz.com/1015412/new-yorks-metropolitan-museum-of-art-may-soon-surpass-the-louvre-as-the-worlds-most-popular-museum/

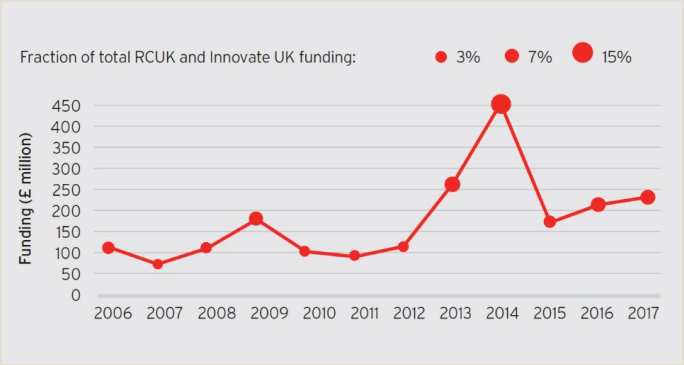


Fig. 5 - Example of line graph. Source:https://www.gov.uk/government/publications/creative-industries-sector-deal/creative-industries-sector-deal-html

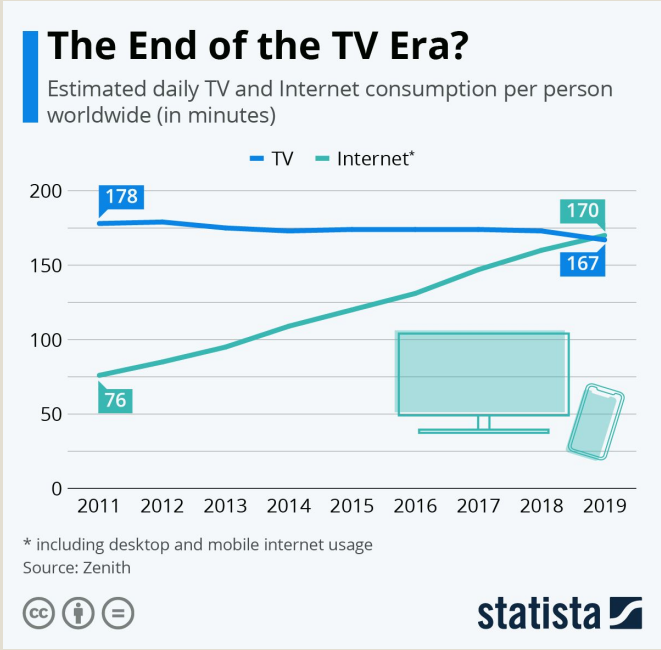


Fig. 6 - Example of line graph. Source: https://www.statista.com/chart/9761/daily-tv-and-internet-consumption-worldwide/

The pie chart

- It is useful to **quickly show** numerical proportions and percentage between categories by representing the proportional distribution of the data.
- The chart is a **circle divided into proportional segments** (sectors). The area of each sector is proportional to the quantity it represents of each category. **The sum** of all the sectors (then of all the data) results in the full circle (equal to 100%).
- Usually a **legend** is put aside to make more clear the categories represented in the chart.
- It is suited to show a **few values**, so avoid using it for large amounts of data.
- Be aware that it is **not suited** to make accurate **comparisons** between categories (especially without showing numerical values).

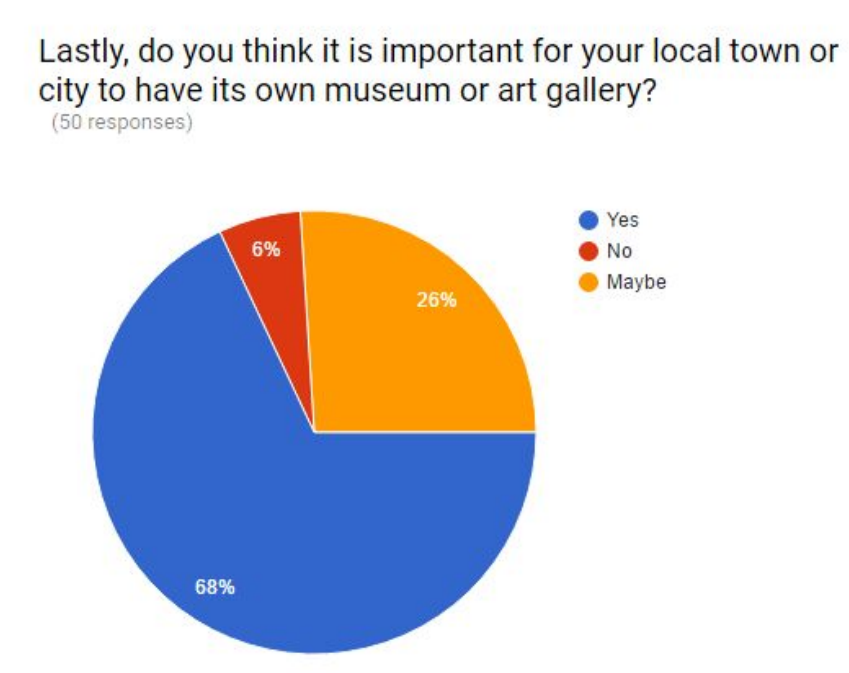


Fig. 7 - Example of pie chart. Source: https://medium.com/@miaeveliina/how-can-we-encourage-those-who-rarely-visit-museums-to-do-so-more-often-441c27cf4770

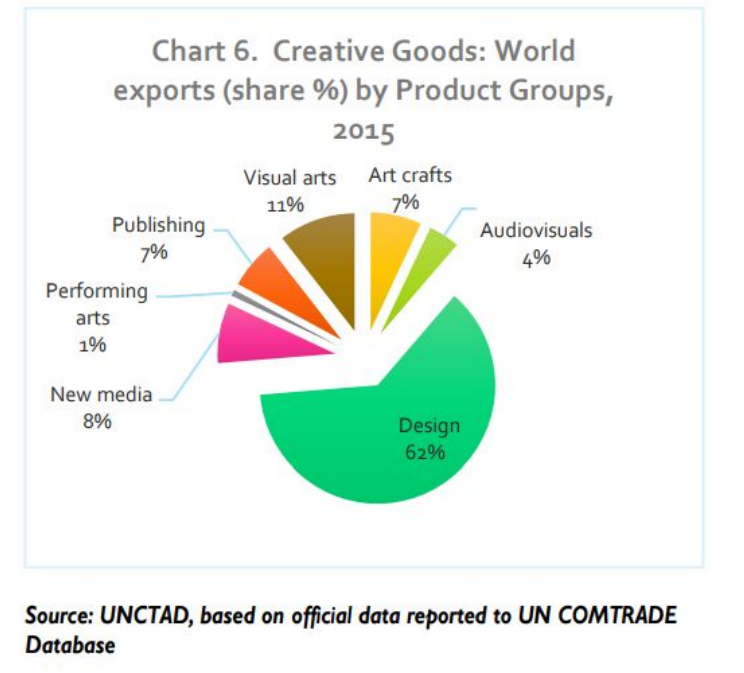


Fig. 8 - Example of pie chart variation. Source: https://europeansting.com/2019/04/19/5-things-you-need-to-know-about-creativity/

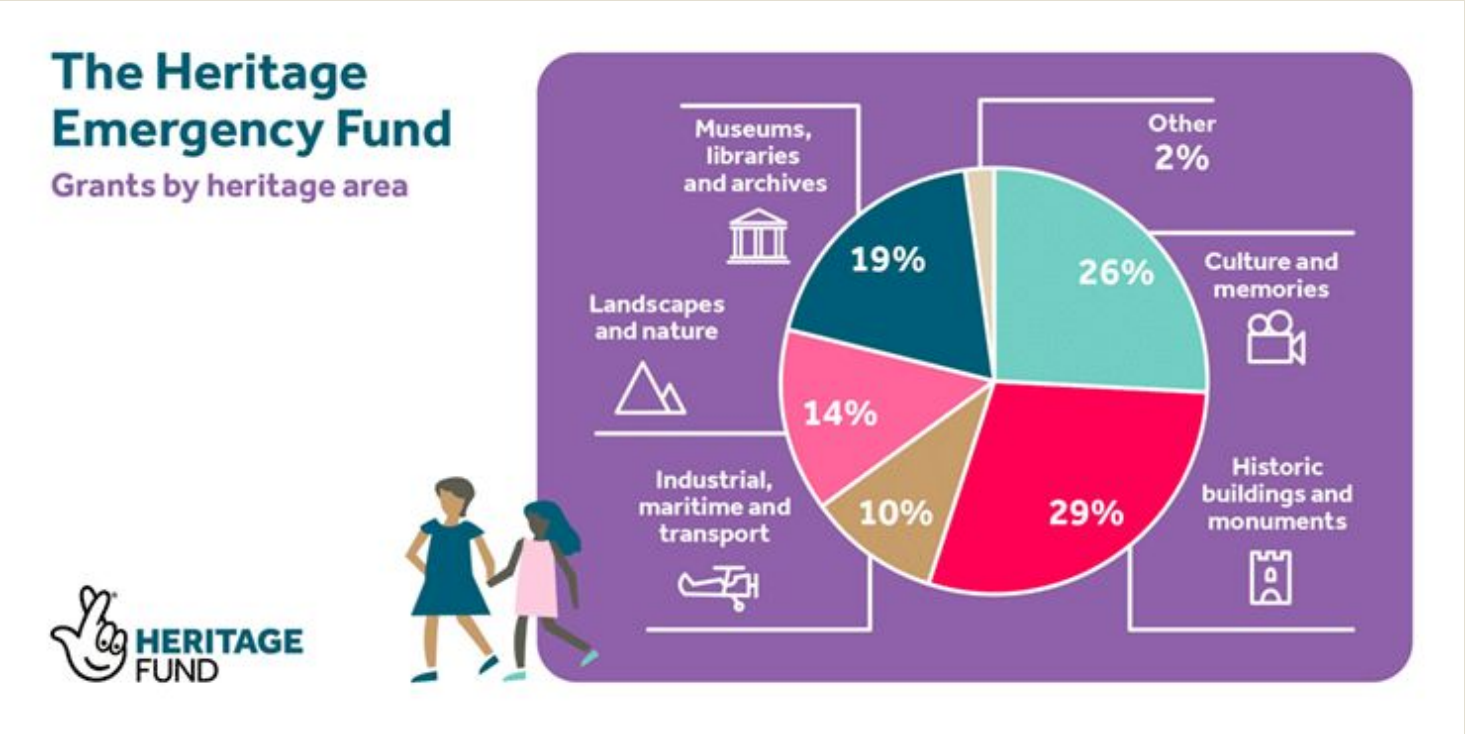
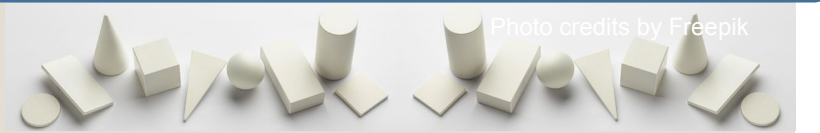


Fig. 9 - Example of pie chart. Source: https://www.heritagefund.org.uk/news/heritage-emergency-fund-supports-hundreds-organisations-across-uk

The area chart



- It is useful to show the development of **quantitative values over an interval** or time period.
- It is like a line graph, but **with the area below the line filled in** with a certain colour or texture.
- A **similar** type of chart is a **stacked area chart** that represents multiple data series that start each point from the point left by the previous series in order to compare the variation of multiple data categories over time.
  It can be useful to use different **colours** to create **contrast**.

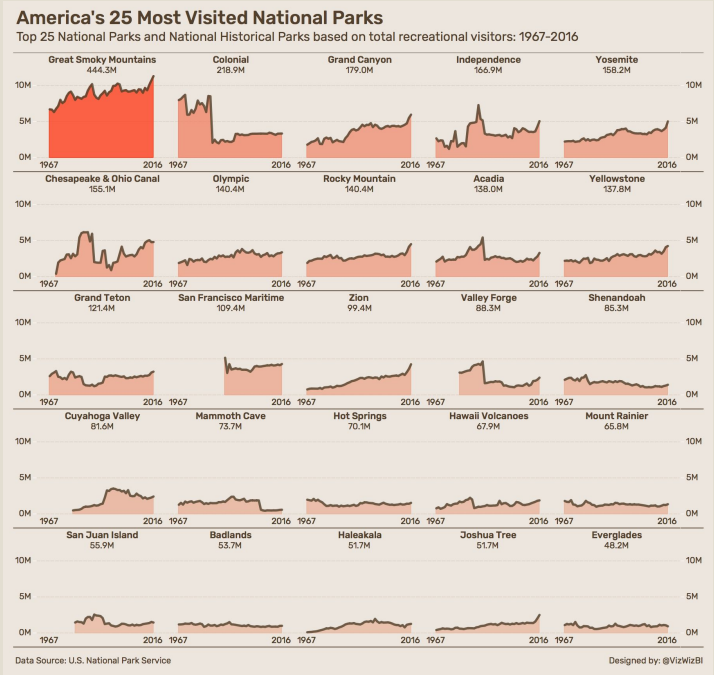


Fig. 10 - Example of area chart. Source: https://www.vizwiz.com/2017/06/mm-23.html

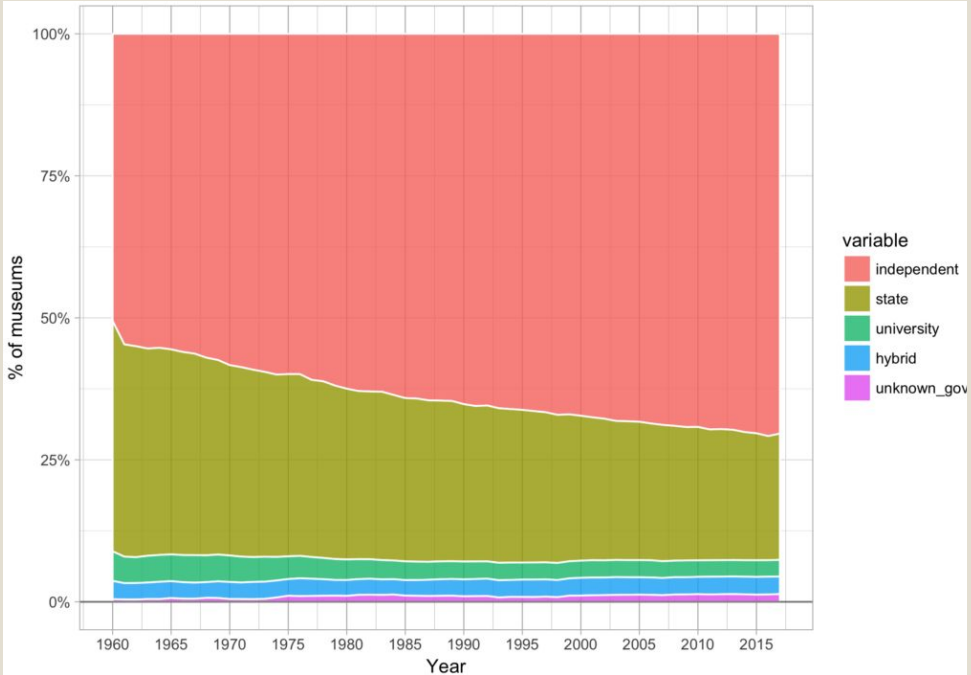
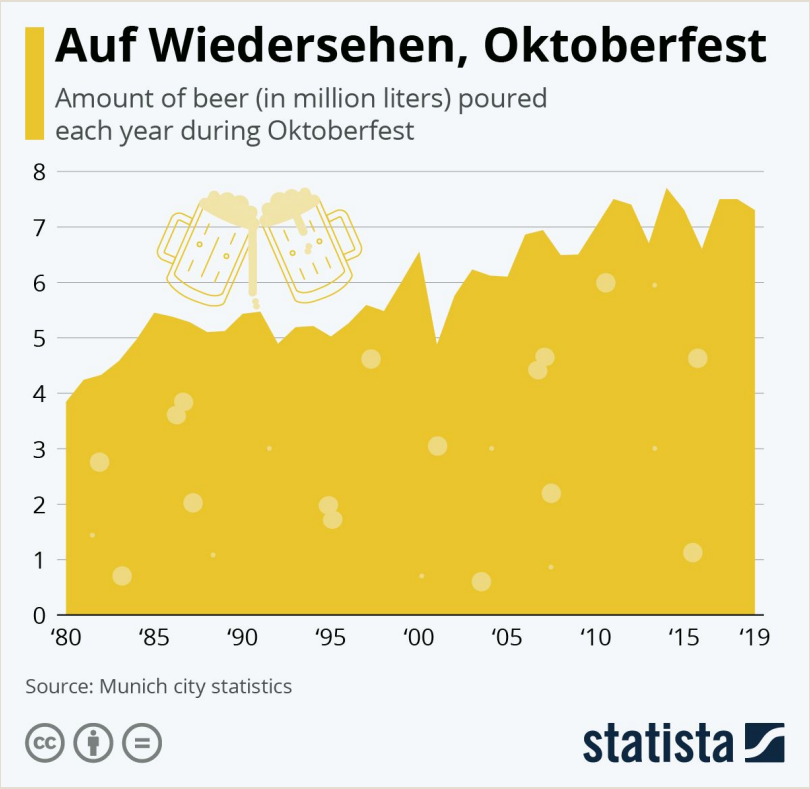


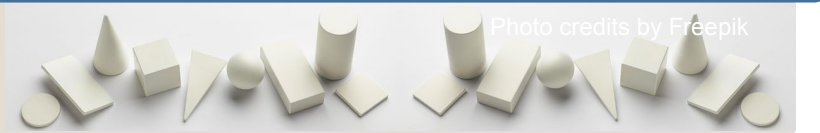
Fig. 11 - Example of stacked area chart. Source:http://blogs.bbk.ac.uk/mapping-museums/2018/02/23/museum-closure-pre-findings



Example of area chart.

Fig. 12 - Source: https://www.statista.com/chart/21456/beer-poured-at-oktoberfest/

The radar chart



- It is useful to **compare multiple quantitative variables**, for displaying performance, since it shows which variables are scoring high or low within a dataset.
- It displays multivariate data in the form of a **two-dimensional chart** of three or more quantitative variables represented on axes starting from the same centre. All axes are arranged radially.
- All the variables in a dataset, plotted along their individual axis, are connected together **to form a polygon**.
- It is suited for comparing values on a **single straight axis**.
- Be aware that having **multiple polygons** or many axes (variables) in one chart makes it hard to read, **confusing**, and too cluttered, especially if the polygons are filled in.

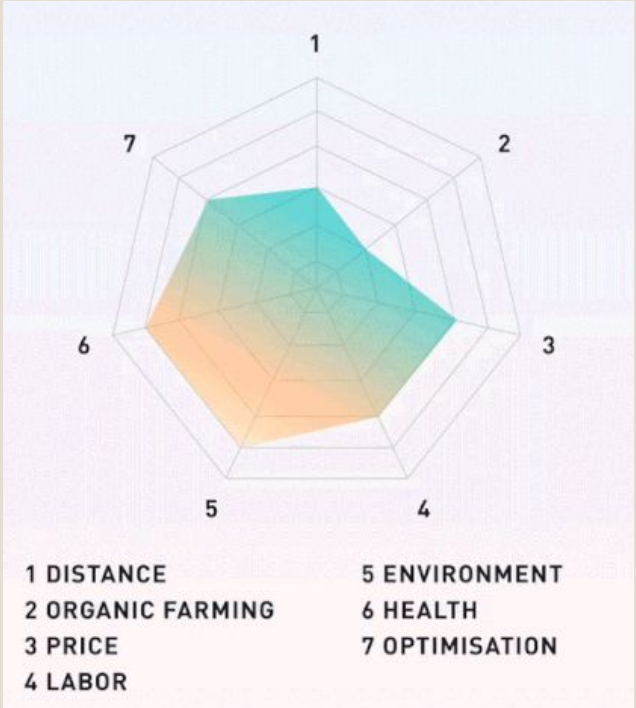


Fig. 13 - Example of radar chart. Source: http://www.thuynguyen.de/goodfood

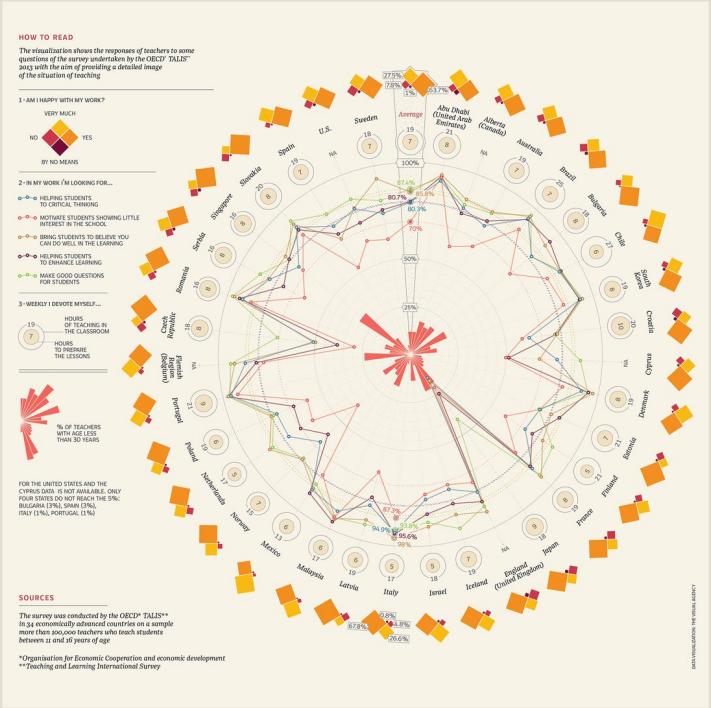
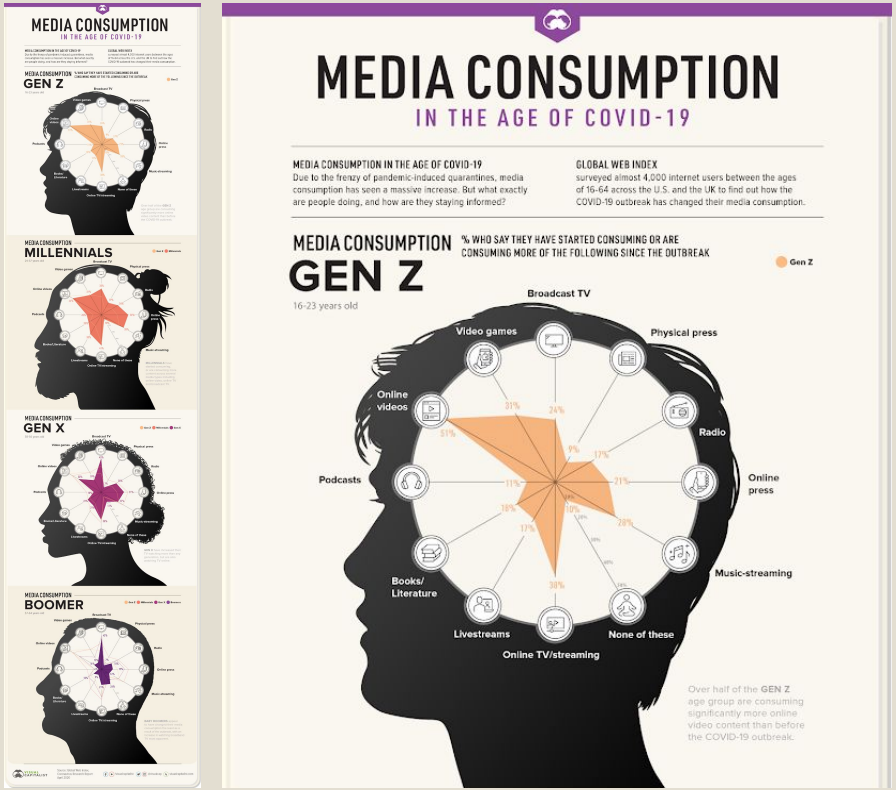


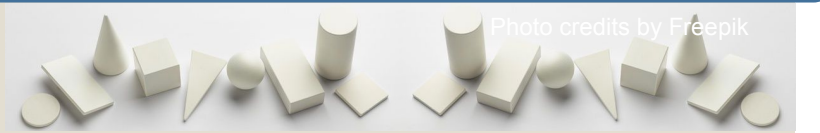
Fig. 14 - Example of radar chart. Source: https://www.informationisbeautifulawards.com/showcase/549-what-teachers-think



Example of radar chart (and detail).

Fig. 15 - Source: https://www.visualcapitalist.com/media-consumption-covid-19/

The scatter plot



- It is useful to observe the distribution of data and find **links among variables**.
- It is a type of mathematical diagram representing a dataset on a **Cartesian plane**.
- The position of each point is determined by the value of two variable on the **horizontal axis** (x-axis) and on the **vertical axis** (y-axis).
- The use of **colours** and shapes can add a third variable to the graph (better if it is explained by a legend), or simply help visualizing the variation in the values.
- It best suits paired numerical data where one variable likely **impacts** the other one.
- Be aware that **correlation** is not causation.
- A similar type of graph is **bubble chart** that replaces data points with bubbles, displaying three dimensions of data (size in addition to the two variables determining position).

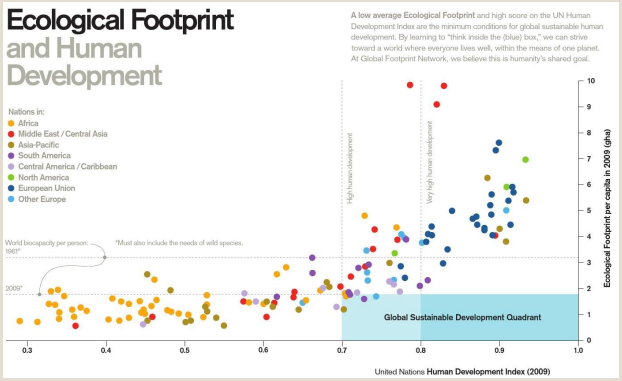


Fig. 16 - Example of scatter plot. Source: https://issuu.com/globalfootprintnetwork/docs/2012_annual_report_new_110613a/22

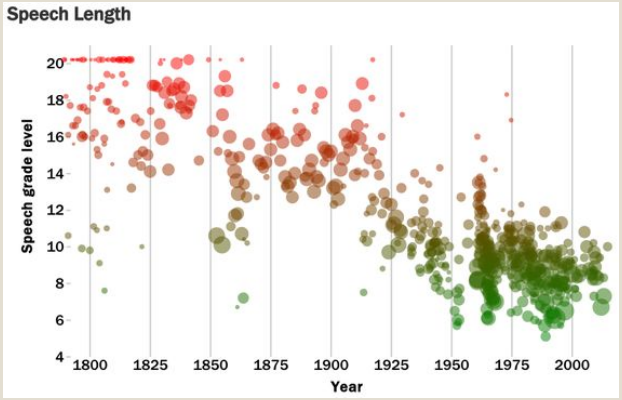


Fig. 17 - Example of bubble chart. Source: https://www.theatlantic.com/politics/archive/2014/10/have-presidential-speeches-gotten-less-sophisticated-over-time/381410/

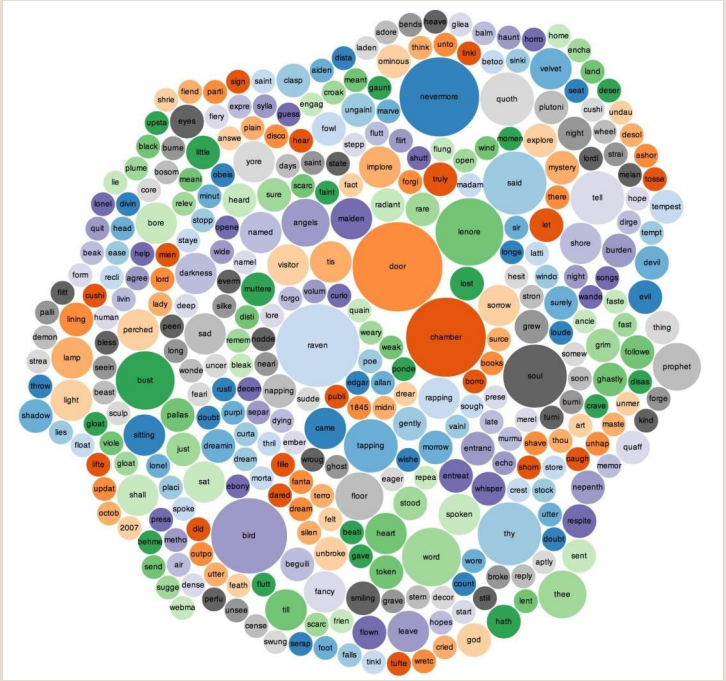
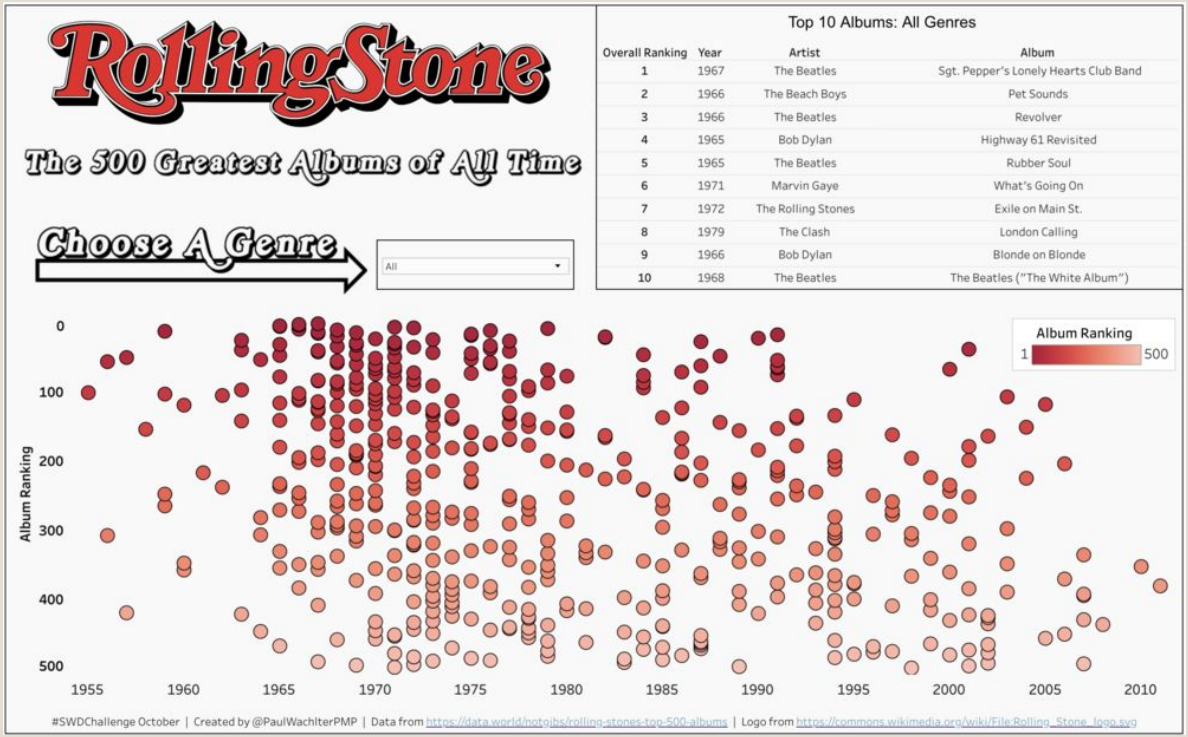


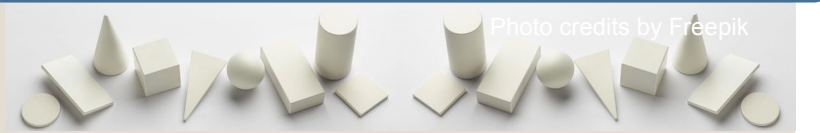
Fig. 18 - Example of clustered bubble chart. Source: https://datarep.tumblr.com/post/56879205177/nevermore-word-density-of-edgar-allan-poes-the



Example of scatter plot.

Fig. 19 - Source: https://public.tableau.com/profile/paul.wachtler#!/vizhome/SWDChallengeOctoberRollingStone500GreatestAlbums/500GreatestAlbums

The network diagram



- It is useful to represent the **relationships and interconnections** between specific elements that are part of a **network**.
- It connects **nodes** (typically little dots or circles, but icons can be used too) through links (typically lines) with other nodes or clusters to represent their connections and identify the type of **relationships between them**.
- An **additional variable** can be introduced by varying the node size or link stroke weight proportion.
- It can also use **arrows** instead of simple lines to show the direction of the relationship (one-way or two-way).
- Be aware that it is suited for a **limited dataset**, since it is hard to read when there are too many nodes.

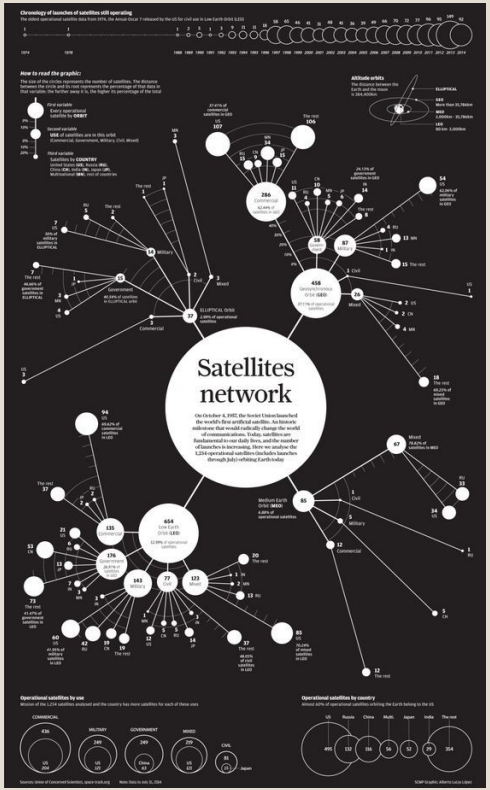


Fig. 20

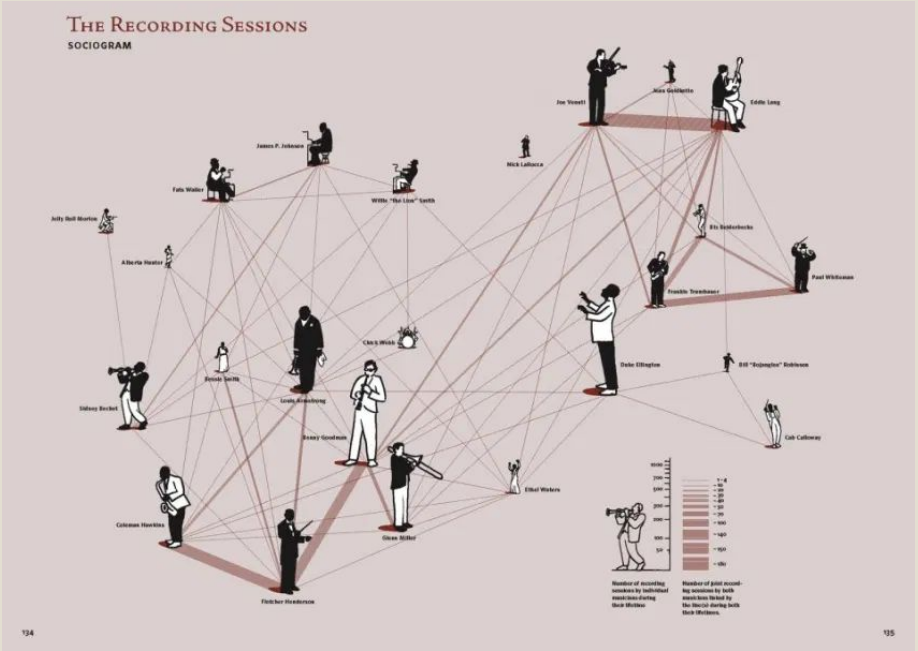
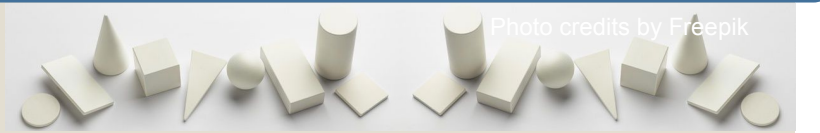


Fig. 21

Fig. 20 - Example of network diagram. Source: https://www.scmp.com/infographics/article/1670384/infographic-satellites-network

Fig. 21 - Example of network diagram (sociogram). Source: https://www.nippoldt.de/en/illustration/info-graphics

The tree diagram



- It is useful to represent the **hierarchical relationships** between different elements of an organization.
- It uses a **tree-like structure**.
- It usually start **from a root node** (i.e. the element that has no superior/parent) and **pass through branches** (i.e. line connections or relationships) to the other nodes (i.e. members that has both superior/parent and child nodes), till arrive to the **leaf nodes** or end-nodes (i.e. members that have no children or child nodes).
- It is suited to show **family relation** and descent, to classify elements (tassonomy) or species, etc.
- Be aware that it is **not suited** to represent **quantitative** variables.

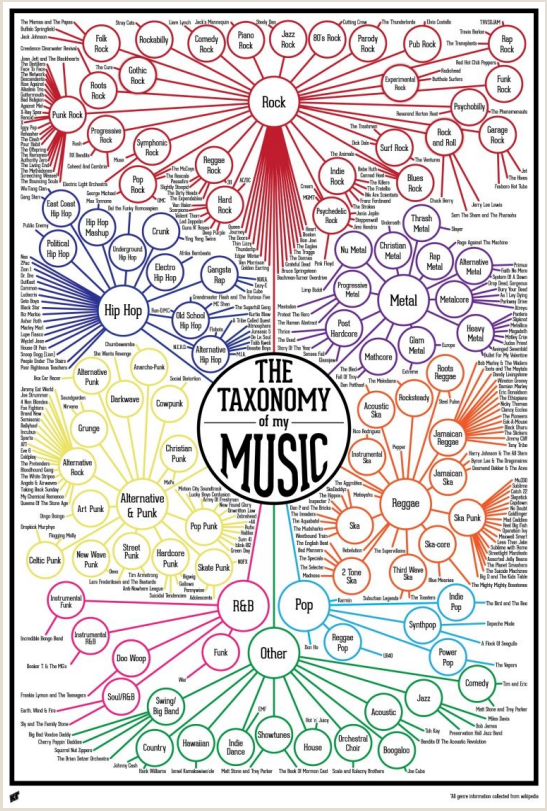


Fig. 22 - Example of tree diagram. Source: https://turnerkarl.wordpress.com/2012/10/11/finished-music-infographic/

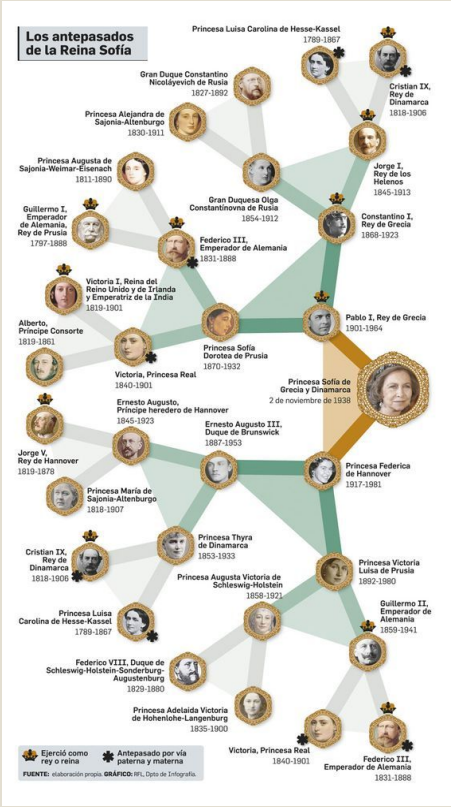
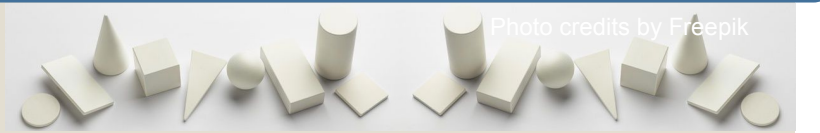


Fig. 23 - Example of tree diagram. Source: https://www.pinterest.it/pin/609111918343841828/; https://www.raquelferia.com/

The pictorial chart or Pictogram



- It is useful to give a more **engaging** and representational overall view of data or to help overcoming linguistic, cultural, or educational barriers, since icons can easily convey meaning.
- It uses **icons**, pictures, or pictograms
- The number of repeated pictograms or icons or their relative size, indicate a **quantitative value** compared to that of another category. Each icon can represent one unit or any number of units.
- It suits a **small set of discrete data**, since in large datasets it could be hard to count the values (i.e. counting each icon).
- Be aware that displaying **partial icons** can add confusion and make the icon hard to understand.
- It can present **variants** or be combined with other visualization techniques.

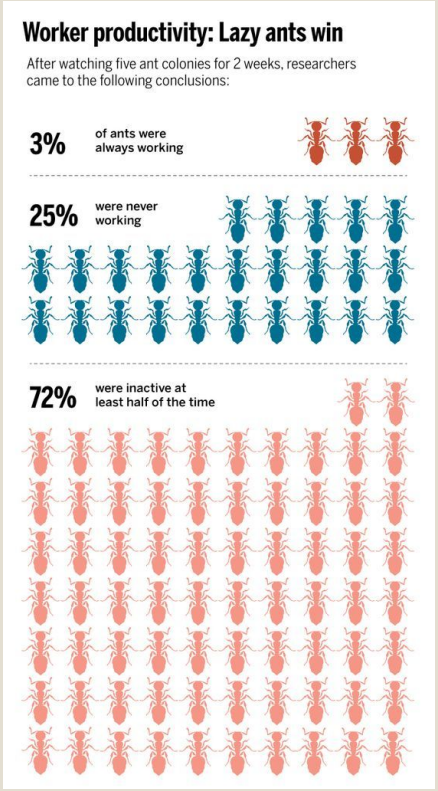


Fig. 24 - Example of pictorial unit chart. Source: https://www.sciencemag.org/news/2015/10/most-worker-ants-are-slackers

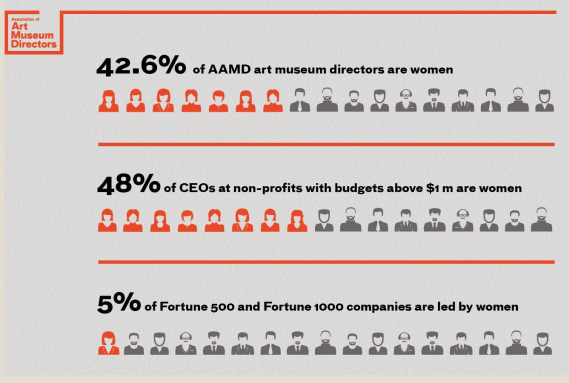


Fig. 25 - Example of pictorial fraction chart. Source: https://www.pinterest.it/pin/141793088242335582/; www.stonesoupcreative.com/portfolio/association-of-art-museum-directors

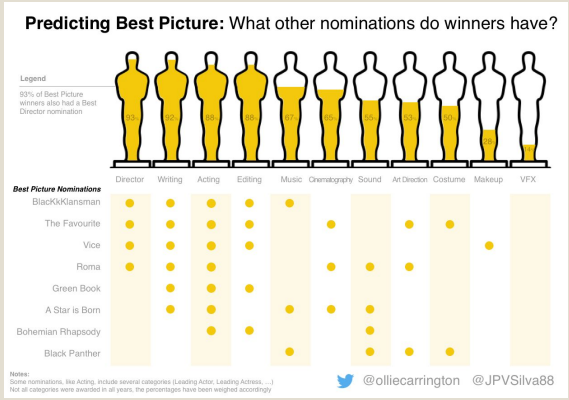
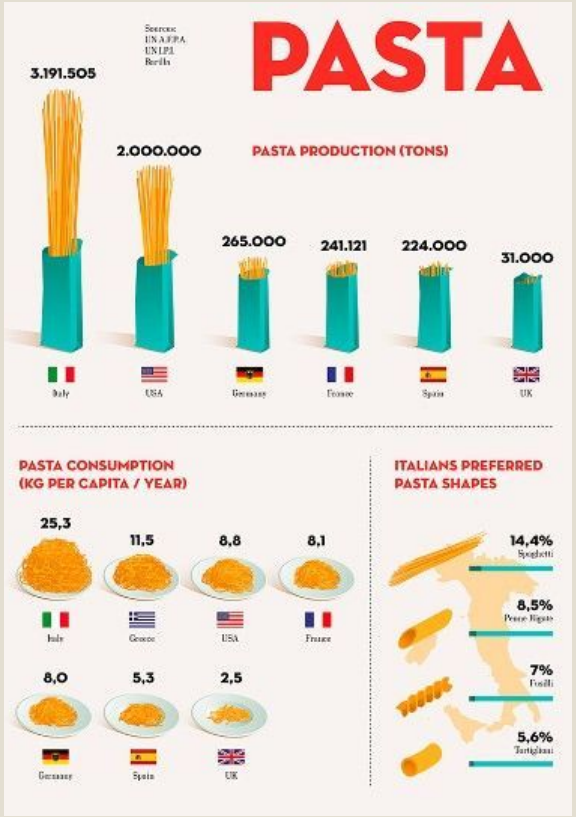


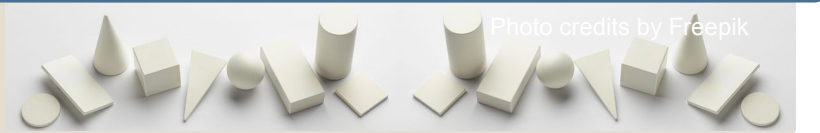
Fig. 26 - Example of pictorial fraction chart. Source: https://towardsdatascience.com/predicting-the-oscars-with-data-viz-e5bb0fd01766



Example of pictorial bar chart.

Fig. 27 - Source: https://iwantdata.tumblr.com/post/127783551330/pasta-infographics

The word cloud or tag cloud



- It is useful to display a **large amount** of keyword **metadata** (tags) from a given body of text, for example from a website, and quickly perceive the most prominent terms or analyse speeches.
- It usually visualizes free form text as single **words arranged in the shape** of a cloud, but they can be arranged in any format.
- It visually represents **text data** using font size or colour to show importance. Colour can also be used to display another data variable.
- It is especially used for **aesthetic reasons**.
- Be aware that **long words** are emphasised over short words and that it is not suitable for an accurate analysis.

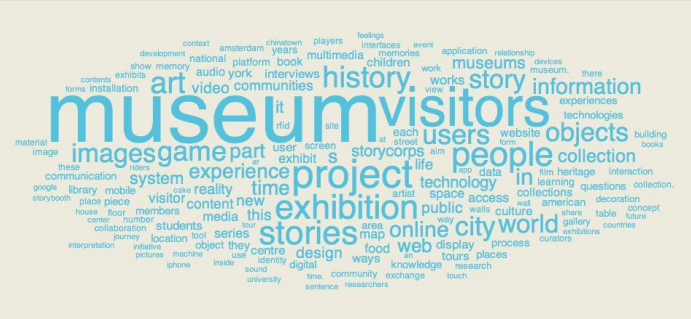


Fig. 28 - Example of word cloud. Source: http://marcinignac.com/projects/mela-representing-museum-technologies/

Fig. 29 - Example of word cloud. Source: https://literarylondonartprints.co.uk/Literary-London-Map

The maps

- Maps are especially useful for showing **geographical data**, usually combined with other variables and dataset.

- There are **different kinds of maps** with specific features, each of them suitable for a different goal in visually representing data and information.

- Here we will focus on:
  - **Choropleth map**
  - **Pin map**
  - **Connection Map**

The choropleth map

- **Choropleth map** is a thematic map that divides geographical areas or regions that are coloured, shaded or patterned in relation to a data variable. It provides an easy way to visualize values over a geographical area for showing variation or patterns.

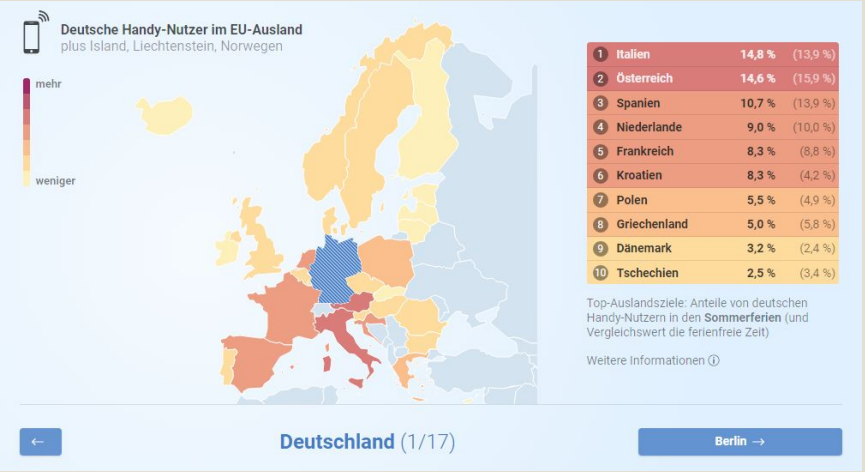


Fig. 30 - Example of choropleth map. (Title translation: Top Summer Travel Destinations for Germans).
Source: https://interaktiv.morgenpost.de/eu-roaming-ferien/

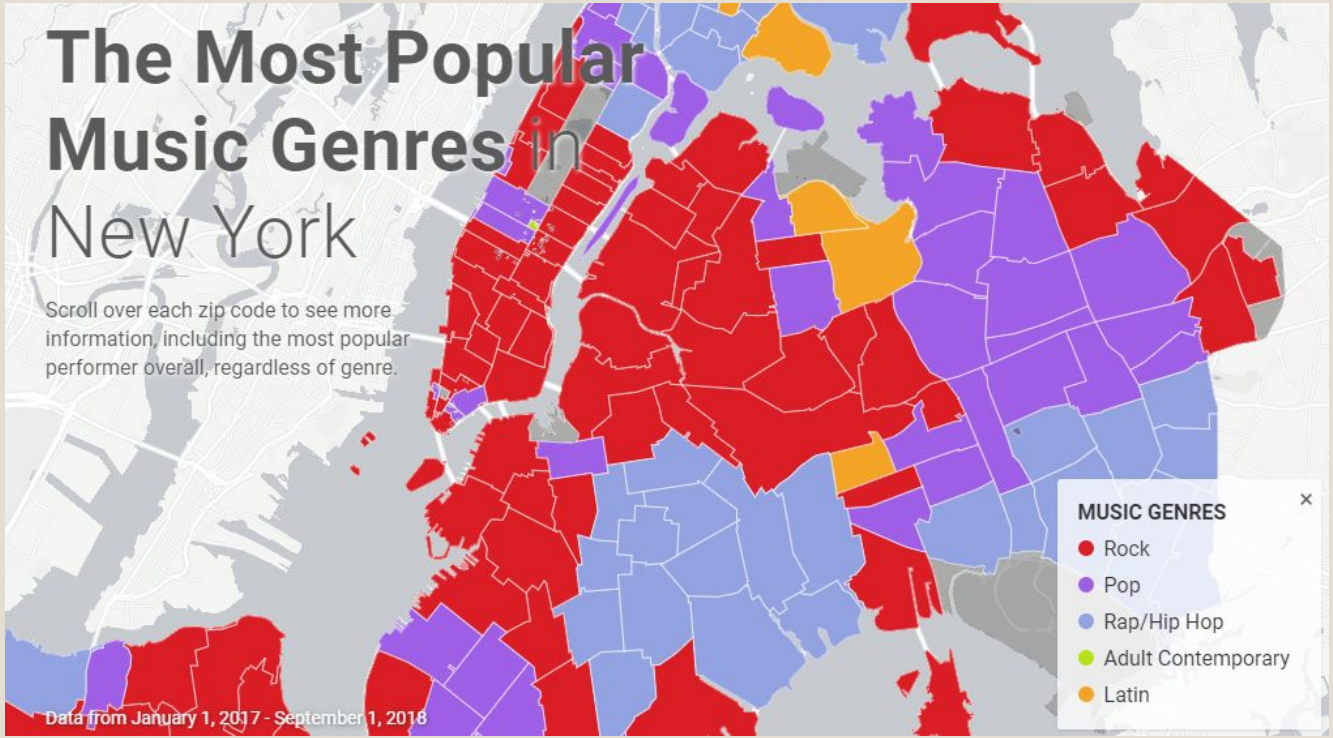


Fig. 31 - Example of choropleth map. Source: https://www.vividseats.com/blog/most-popular-music-new-york/map

The pin map

- **Pin map** displays **geospatial data** on a map by pinning locations and giving them labels/descriptions. It can be combined with colours, icons, or other charts.
- It is **different from dot map** (or point map), which is instead a technique for representing the geographical **distribution of data** by plotting points of the same size on a geographical region.

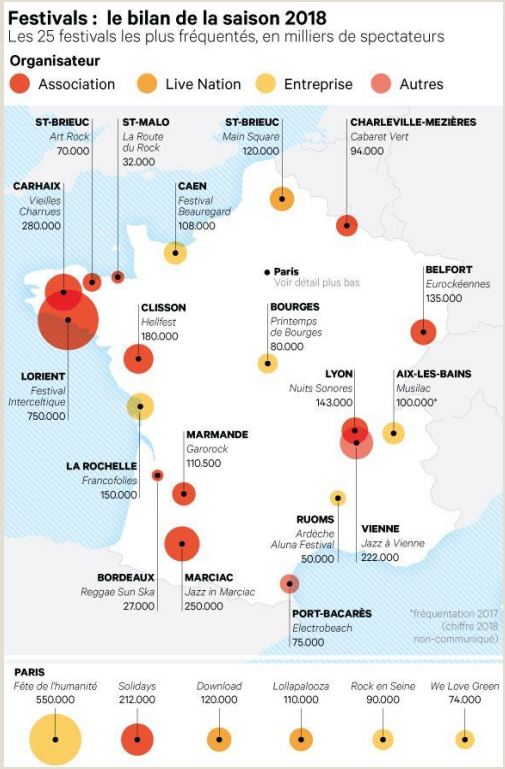


Fig. 32 - Example of pin map. Source: https://twitter.com/EchosGraphiques/status/1034786035438374912/photo/1; https://start.lesechos.fr/societe/culture-tendances/se-reperer-dans-la-galaxie-des-festivals-en-une-infographie-1177741

Example of pin map.

Fig. 33 - Source: https://www.charmingpuglia.com/en/best-beaches-in-puglia.php

The connection map

- **Connection Map** displays networks combined with geographical data for visualising **flows** and any kind of connections between different locations. It can be combined with thickness of lines, colours or patterns, or other charts to add numeric values to the representation.
- It is different from **flow map**, since the connection map displays **no quantitative values** between the connections.

Fig. 34 - Example of connection map. Source: https://www.ricksteves.com/europe/spain/itinerary

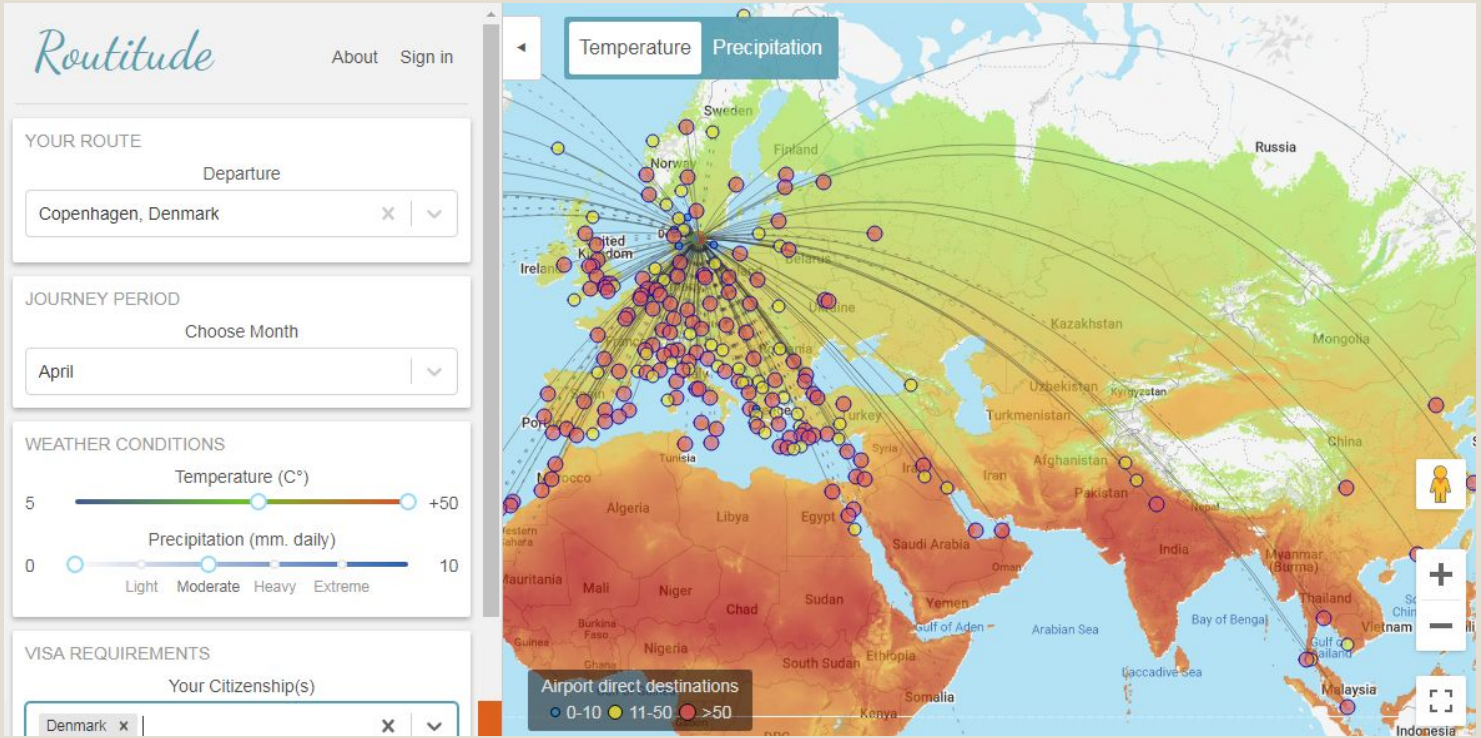
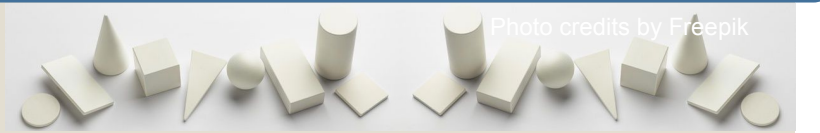


Fig. 35 - Example of connection map. Source: https://www.anychart.com/blog/2019/08/09/top-data-visualizations-dataviz-weekly/; https://www.routitude.com/map

The timeline



- It is useful to display a list of events in **chronological order** to communicate time-related information for analysis, tell a story or view of history.
- It can work on a **scale** or simply displays a sequence of events either for analysis or to visually **present a story** or view of history.
- It can be combined with other visualization techniques, for example to show how quantitative **data changes over time**.

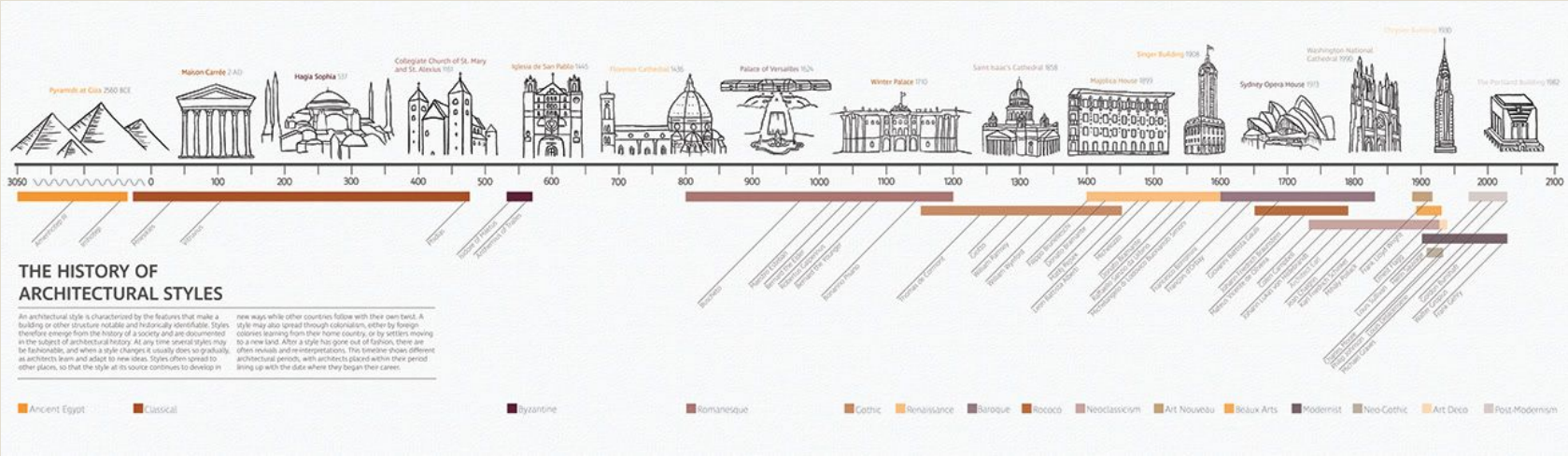


Fig. 36 - Example of timeline. Source: https://www.behance.net/gallery/59219581/Architecture-History-Timeline

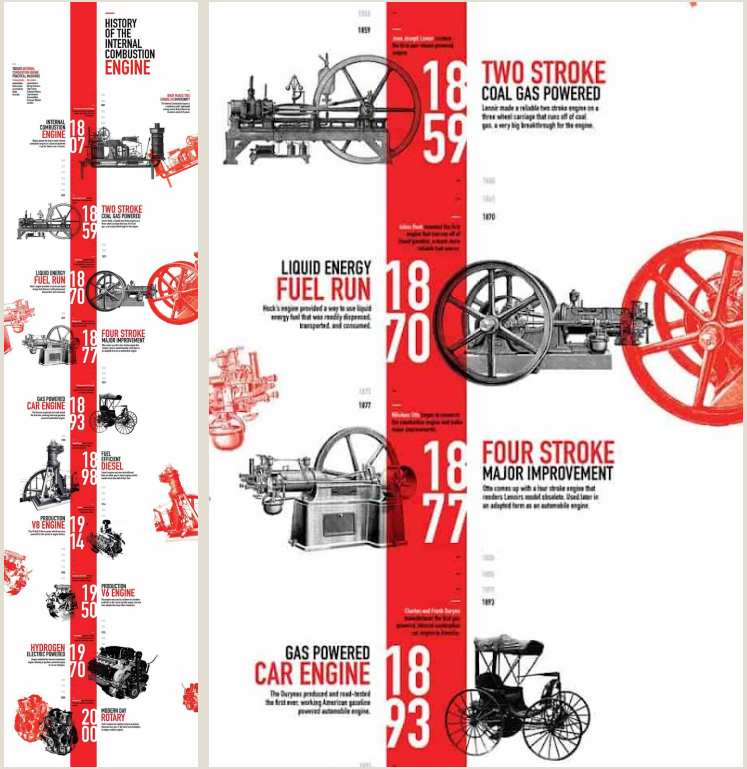


Fig. 37

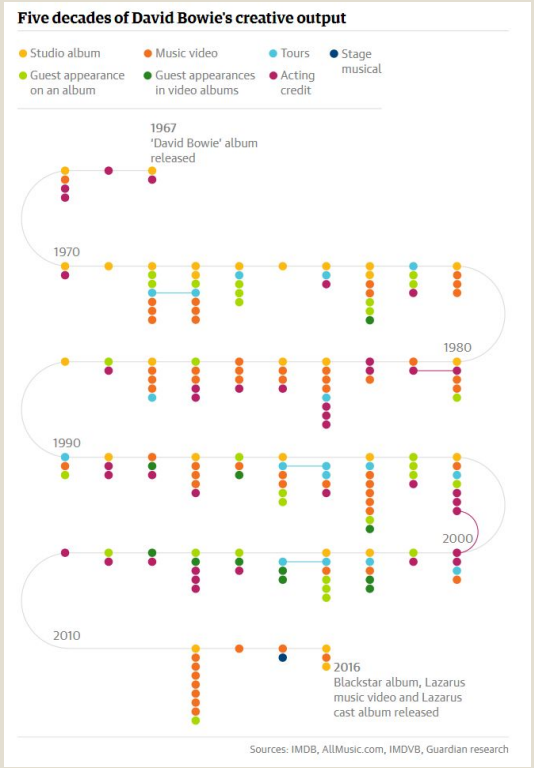


Fig. 38

Examples of timelines.

Fig. 37 - Source: https://www.bluecompass.com/blog/best-infographic-designs-of-2015-that-are-sure-to-be-a-hit-in-2016-infographic

Fig. 38 - Source: https://www.informationisbeautifulawards.com/showcase/1809-david-bowie-s-50-year-creative-output-at-a-glance

There are **many other graphical techniques** that you can use to encode numbers in pictures, including some very suitable for infographics, such as typography with icons, especially useful to help understanding the text.

The use of **typography** is better suited for representing **standalone information** (a number is frequently used to emphasize a single data).

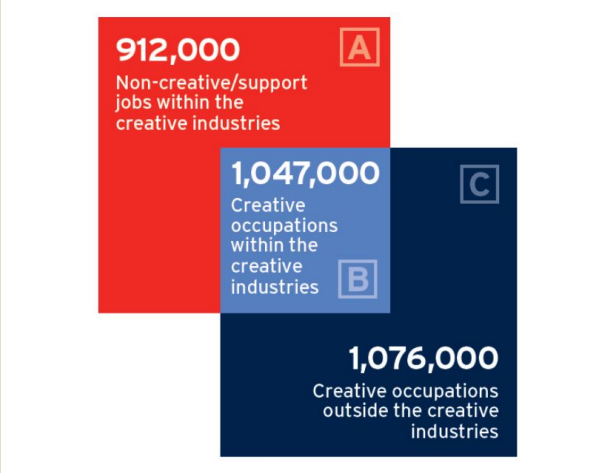


Fig. 39 - Example of text and numbers. Source: https://www.gov.uk/government/publications/creative-industries-sector-deal/creative-industries-sector-deal-html

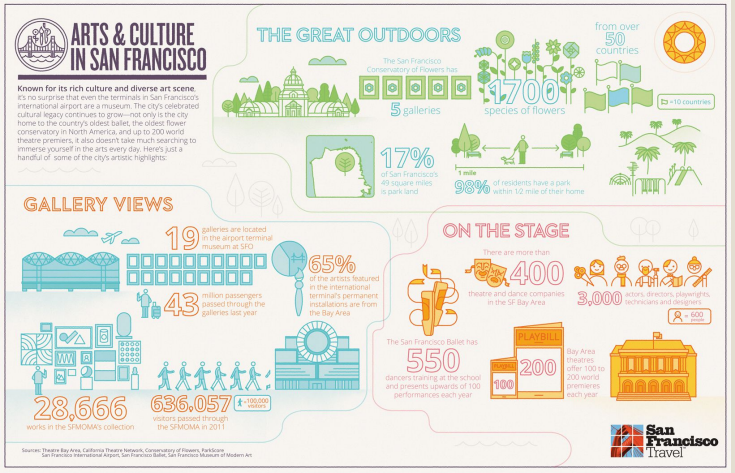


Fig. 40 - Example of text, numbers, and icons. https://www.good.is/infographics/infographic-arts-and-culture-in-san-francisco1

Illustration diagrams can be used to explain concepts or describe something. They are usually accompanied by notes, labels, or a **legend**.

Fig. 41 - Example of illustration diagram. Source: https://www.iberdrola.com/culture/sustainable-museum

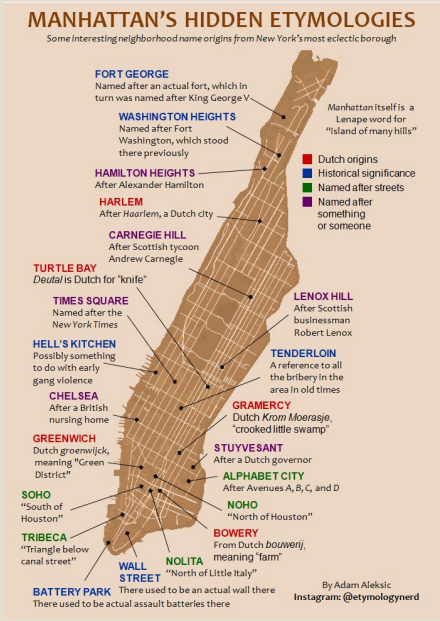


Fig. 42 - Example of illustration diagram. Source: https://vividmaps.com/manhattans-hidden-etymologies/

Even the use of **metaphors** is widespread for representing information in a **visual way**, since they translate complex and abstract models in **familiar symbols** pleasant to see.

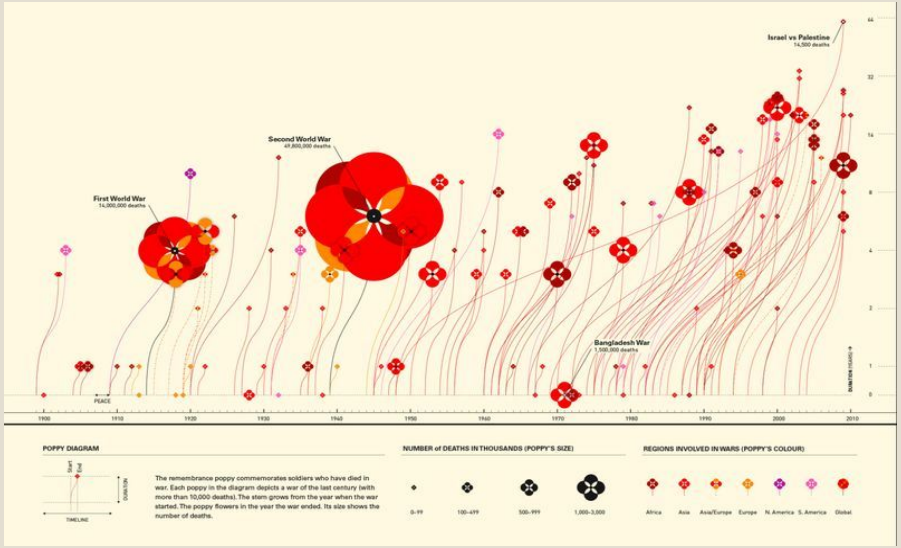


Fig. 43 - Example of the use of a metaphor. Source: https://centralillustration.com/illustration/valentina-defilippo#portfolio-10

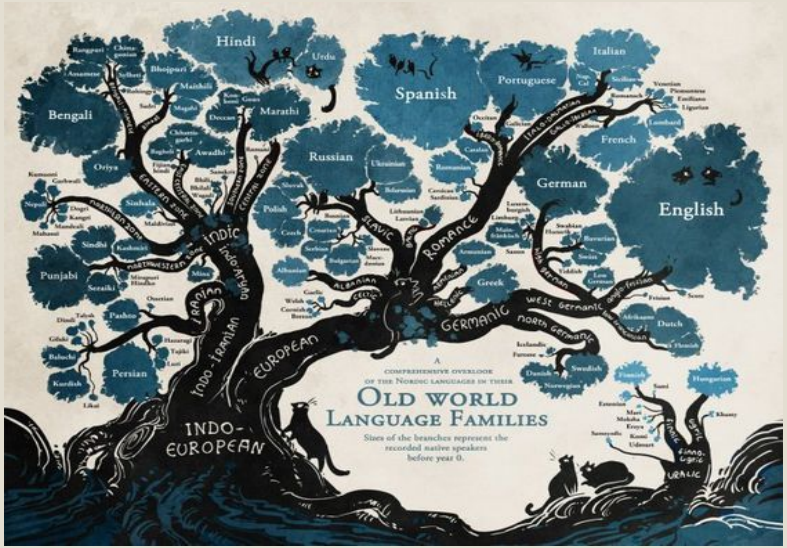


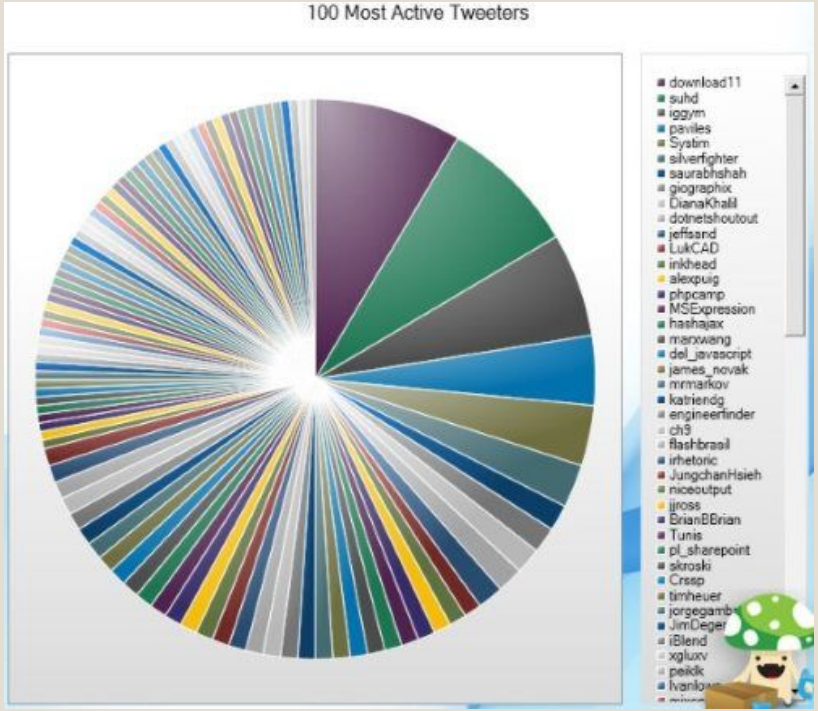
Fig. 44 - Example of the use of a metaphor. Source: https://audreydriscoll.com/2015/08/15/a-language-tree/

Photo credits by nakaridore, Freepik

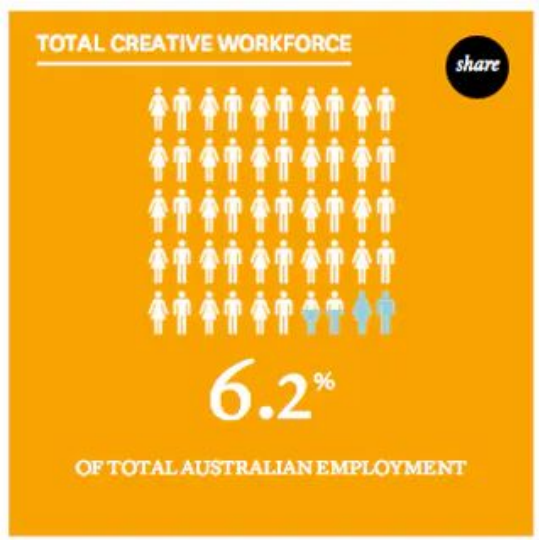
Examples of errors to avoid

Following a few examples of **infographics and data visualizations** where the visualization techniques are applied in a **misleading and incorrect way**.

In this figure, there are **too many categories** represented in the pie chart and the **same colours** are repeated for different slices **without any relation**. Moreover, no real value is given to understand the numerical proportion of the data. Indeed, the chart **can not be read** or even seen in its littlest parts.



Source: http://livingqlikview.com/the-9-worst-data-visualizations-ever-created/

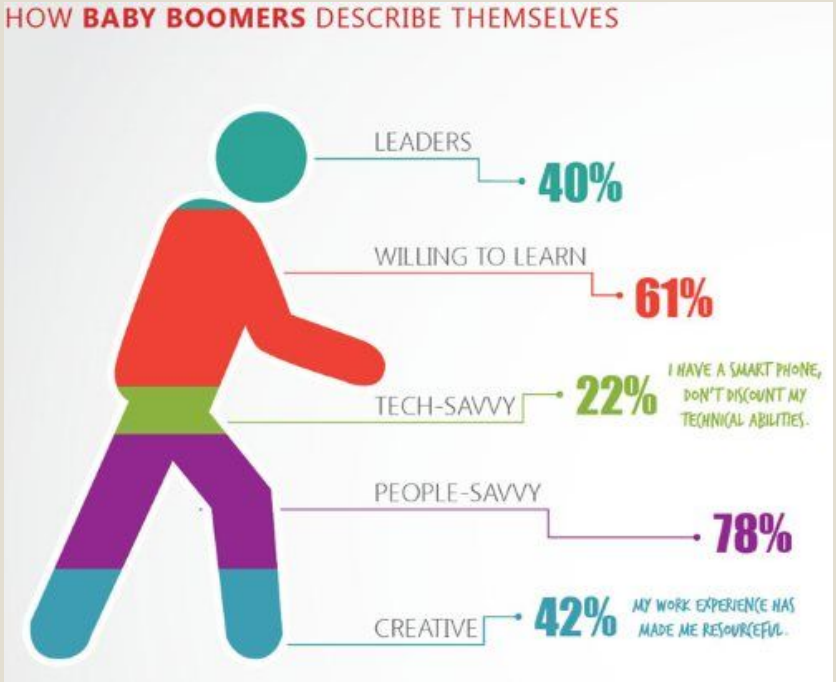


Source:
https://theconversation.com/we-can-rebalance-australias-economy-with-creative-industries-23458

In this case, it is **hard to match icons and percentages** at a glance. Moreover, the two half coloured icons create **some confusion** and lack of clarity on how they should be read.

Another pictorial fraction charts with a **lot of mistakes** both in data visualization and visual design.

One above all: **the sum of the percentages** shown is greater than the whole (243% instead of 100%), as the graph requires! Moreover, there is **no relation** between the shape used (a walking man) and the **topic** of the survey.



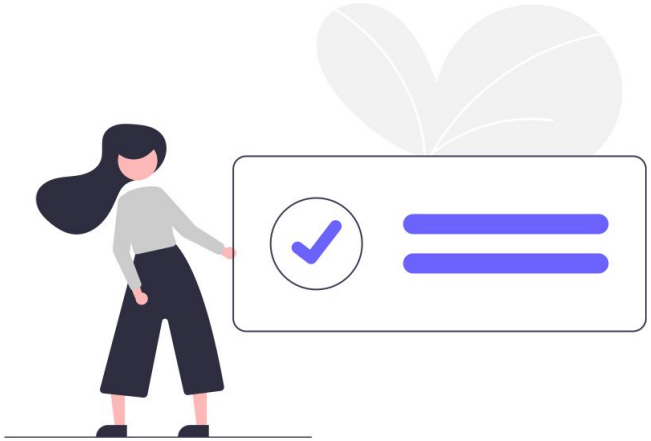
Source: http://livingqlikview.com/the-9-worst-data-visualizations-ever-created/

In this figure, there are **no values for Y-axis**, then we can not know the real numbers of market share increase/decrease.

Source: https://badvisualisations.tumblr.com/

In the end, **being aware** of different ways to graphically represent data and information, allows to **choose which type best suits a certain need**, taking into account that graphs, and statistics in general, **can be misleading** if incorrectly used.

Photo credits by Brendan Church, Unsplash



Conclusions

The knowledge learned in this lesson will allow students to learn how to encode data and information in pictures, in order to correctly visualize and present a topic when creating an infographic.

Thank you for your attention!

Content realized by Link Campus University

Co-funded by the Erasmus+ Programme of the European Union

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