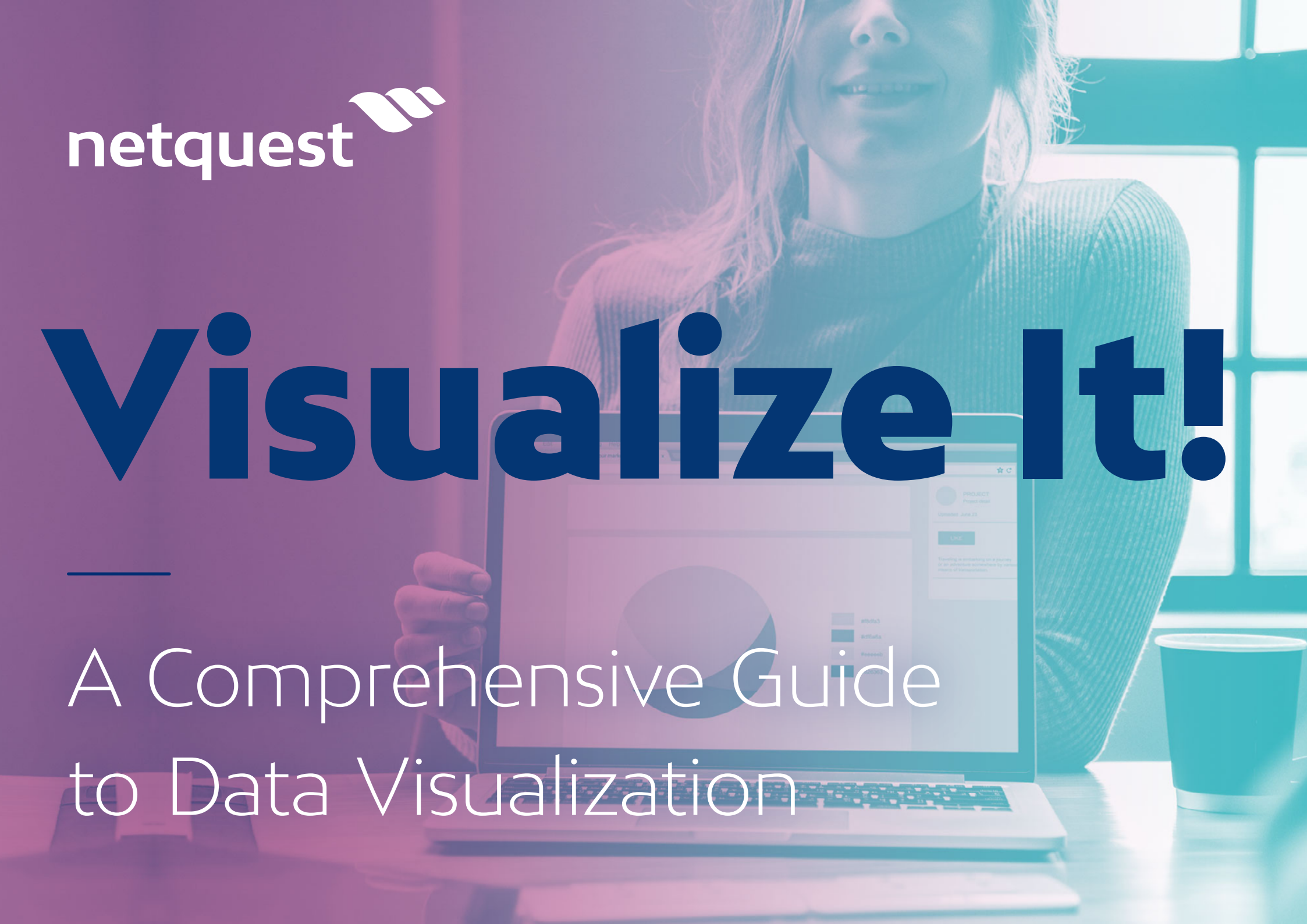
netquest

Visualize It!

A Comprehensive Guide to Data Visualization



What's inside...

1. Introduction

Introduction
Data visualization

The ways we structure and visualize information are changing rapidly and getting more complex with each passing day. **Thanks to the rise of social media, the ubiquity of mobile devices, and service digitalization, data is available on any human activity that utilizes technology**. The generated information is hugely valuable and makes it possible to analyze trends and patterns, and to use big data to draw connections between events. Thus, data visualization can be an effective mechanism for presenting the end user with understandable information in real time.

Every company has data, be it to communicate with clients and senior managers or to help manage the organization itself. It is only through research and interpretation that this data can acquire meaning and be transformed into knowledge.

This ebook seeks to guide readers through a series of basic references in order to help them understand data visualization and its component parts, and to equip them with the tools and platforms they need to create interactive visuals and analyze data. In effect, it seeks to provide readers with a basic vocabulary and a crash course in the principles of design that govern data visualization so that they can create and analyze interactive market research reports.

What is data visualization?

Data visualization is the process of acquiring, interpreting and comparing data in order to clearly communicate complex ideas, thereby facilitating the identification and analysis of meaningful patterns.

> Data visualization can be essential to strategic communication: it helps us interpret available data; detect patterns, trends, and anomalies; make decisions; and analyze inherent processes. All told, it can have a powerful impact on the business world.

The data visualization process

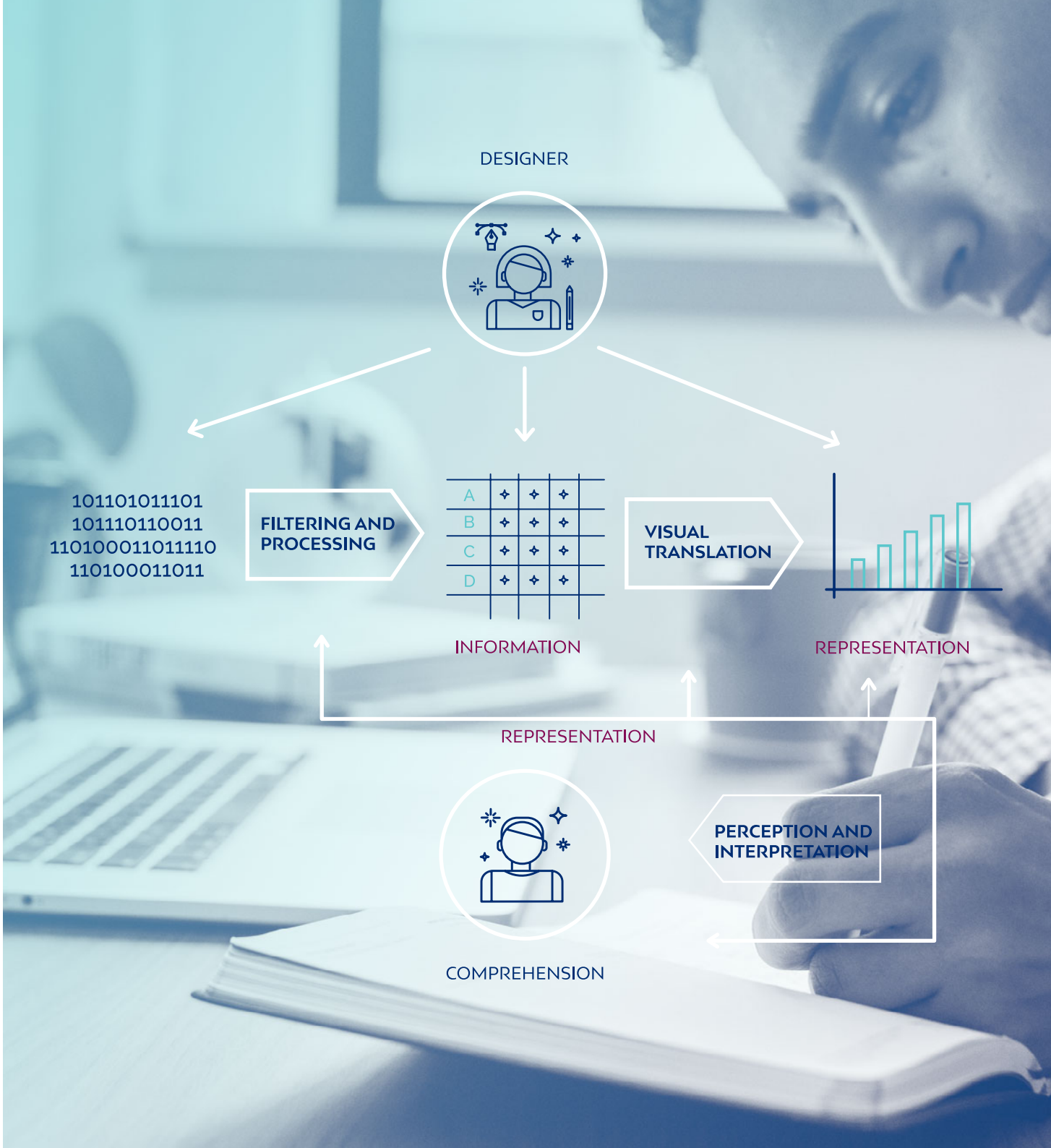
Several different fields are involved in the data visualization process, with the aim of simplifying or revealing existing relationships, or discovering something new within a data set.

Visualization process[1]

Filtering & processing. Refining and cleaning data to convert it into information through analysis, interpretation, contextualization, comparison, and research.

Translation & visual representation. Shaping the visual representation by defining graphic resources, language, context, and the tone of the representation, all of which are adapted for the recipient.

Perception & interpretation. Finally, the visualization becomes effective when it has a perceptive impact on the construction of knowledge.



1 Pérez, J. and Vialcanet, G. (2013). Guía de visualización de datos aplicada al marketing digital: Cómo transformar datos en conocimiento (p.5-6).

Why is data visualization so important in reports and statements?

We live in the era of visual information, and visual content plays an important role in every moment of our lives. A study by SHIFT Disruptive Learning demonstrated that **we typically process images 60,000 times faster than a table or a text,** and that our brains typically do a better job remembering them in the long term. That same research detected that after three days, analyzed subjects retained between 10% and 20% of written or spoken information, compared with 65% of visual information.

The rationale behind the power of visuals:

- The human mind can see an image for just **13 milliseconds** and store the information, provided that it is associated with a concept. Our eyes can take in **36,000 visual messages per hour**.
- **40%** of nerve fibers are connected to the retina.

All of this indicates that human beings are better at processing visual information, which is lodged in our long-term memory.

Consequently, for reports and statements, a visual representation that uses images is a much more effective way to communicate information than text or a table; it also takes up much less space.

This means that **data visuals are more attractive, simpler to take in, and easier to remember.**

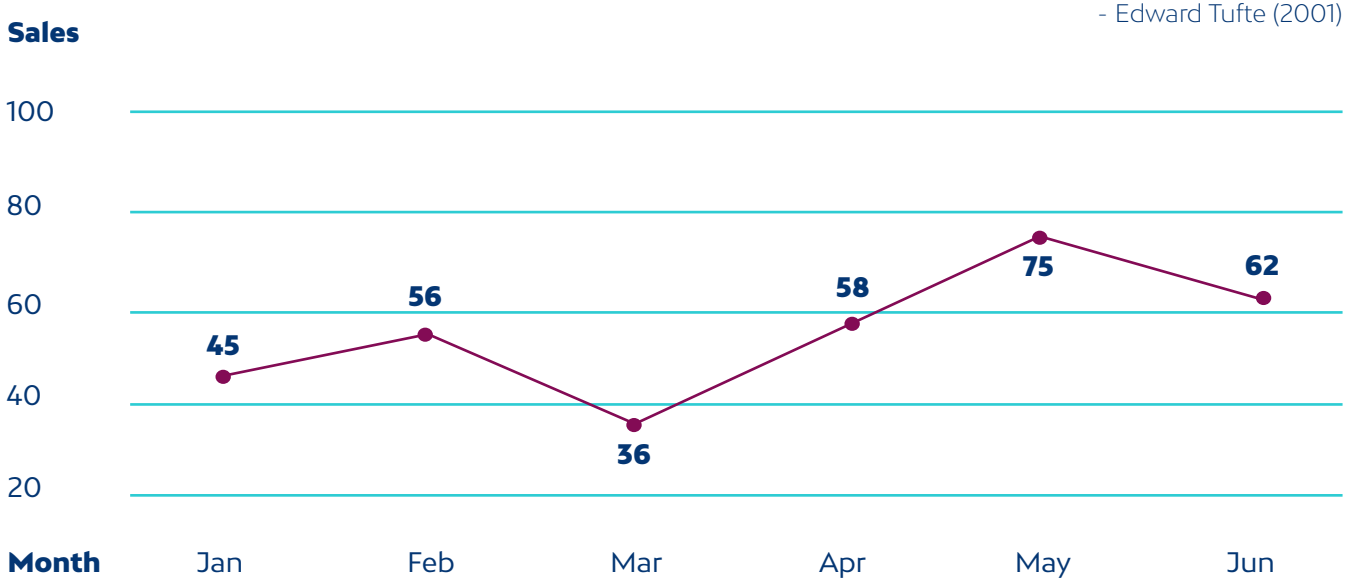
Try it for yourself. Take a look at this table:

Month	Jan	Feb	Mar	Apr	May	Jun
Sales	45	56	36	58	75	62

Identifying the evolution of sales over the course of the year isn't easy. However, when we present the same information in a visual, the results are much clearer (see the graph below).

The graph takes what the numbers cannot communicate on their own and conveys it in a visible, memorable way. This is the real strength of data visualization.

> **Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space."**
>
> - Edward Tufte (2001)

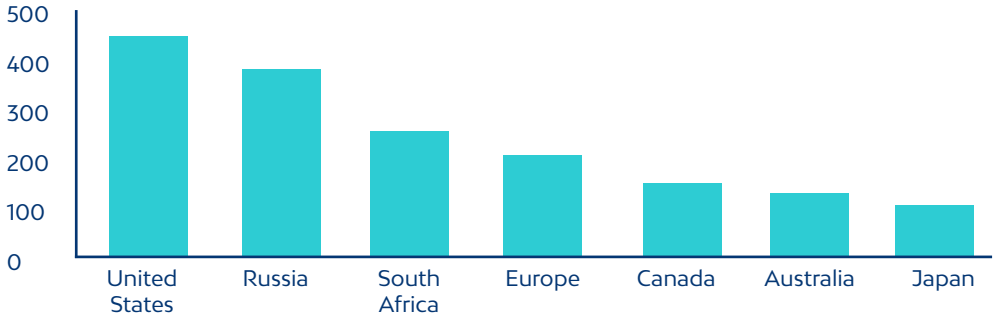


Data visualization chiefly helps in 3 key aspects of reports and statements:

1) Explaining

Visuals aim to lead the viewer down a path in order to describe situations, answer questions, support decisions, communicate information, or solve specific problems. When you attempt to explain something through data visualization, you start with a question, which interacts with the data set in such a way that enables viewers to make a decision and, subsequently, answer the question.

For example: This graphic below could clearly explain the country with the greatest demand for a certain product compared globally, in a concrete month.



2) Exploring

Some visuals are designed to lend a data set spatial dimensions, or to offer numerous subsets of data in order to raise questions, find answers, and discover opportunities. When the goal of a visual is to explore, the viewers start by familiarizing themselves with the dataset, then identifying an area of interest, asking questions, exploring, and finding several solutions or answers.

For example: an interactive graphic from *The Guardian*[2] invites us to explore how the linguistic standard of U.S. presidential addresses has declined over time. The visual is interactive and explanatory, in addition to indicating the readability score of various presidents' speeches.

3) Analyzing

Other visuals prompt viewers to inspect, distill, and transform the most significant information in a data set so that they can discover something new or predict upcoming situations.

For example: this interactive graphic about learning machine[3] invites us to explore and discover information within the visual by scrolling through it. Using the machine learning method, the visual explains the patterns detected in the data in order to categorize characteristics.

We'll close this introduction with a 2012 reflection by Alberto Cairo, a specialist in information visualization and a leader in the world of data visualization. For the author, a good visual must provide clarity, highlight trends, uncover patterns, and reveal unseen realities:

"We create visuals so that users can analyze data and, from it, discover realities that not even the designer, in some instances, had considered."

2 Available at: https://www.fusioncharts.com/whitepapers/downloads/Principles-of-Data-Visualization.pdf
3 Available at: http://www.r2d3.us/visual-intro-to-machine-learning-part-1/

2. Data types, relationships, and visualization formats

Data types, relationships, and visualization formats

There are a number of methods and approaches to creating visuals based on the nature and complexity of the data and the information. **Different kinds of graphics are used in data visualizations, including representations of statistics, maps, and diagrams.** These schematic, visual representations of content vary in their degree of abstraction.

In order to communicate effectively, it is important to understand different kinds of data and to establish visual relationships through the proper use of graphics. Enrique Rodríguez (2012), a data analyst at DataNauta, once explained in an interview that...

> **A good graphic is one that synthesizes and contextualizes all of the information that's necessary to understand a situation and decide how to move forward."**

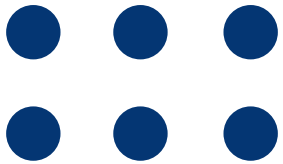
2 kinds of data

Before we talk about visuals themselves, we must first understand the different kinds of data that can be visualized and how they relate to one another.
The most common kinds of data are[4]:

1) Quantitative (numeric)

Data that can be quantified and measured. This kind of data explains a trend or the results of research through numeric values. This category of data can be further subdivided into:

- **Discrete:** Data that consists of whole numbers (0, 1, 2, 3...). For example, the number of children in a family.
- **Continuous:** Data that can take any value within an interval. For example, people's height (between 60 - 70 inches) or weight (between 90 and 110 pounds).

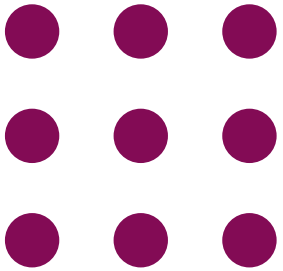


Quantitative

2) Qualitative (categoric)

This kind of data is divided into categories based on non-numeric characteristics. It may or may not have a logical order, and it measures qualities and generates categorical answers. It can be:

- **Ordinal:** Meaning it follows an order or sequence. That might be the alphabet or the months of the year.
- **Categorical:** Meaning it follows no fixed order. For example, varieties of products sold.



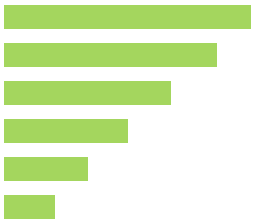
Qualitative

5 Source: Hubspot, Prezy, and Infogram (2018). Presenting Data People Can't Ignore: How to Communicate Effectively Using Data. | p.10 of 16 | Available at: https://offers.hubspot.com/presenting-data-people-cant-ignore.

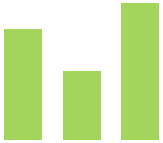
7 data relationships

Data relationships can be simple, like the progress of a single metric over time (such as visits to a blog over the course of 30 days or the number of users on a social network), or they can be complex, precisely comparing relationships, revealing structure, and extracting patterns from data. There are **seven data relationships** to consider:

Ranking: A visualization that relates two or more values with respect to a relative magnitude. For example: a company's most sold products.



Nominal comparisons: Visualizations that compare quantitative values from different subcategories. For example: product prices in various supermarkets.



Correlation: Data with two or more variables that can demonstrate a positive or negative correlation with one another. For example: salaries based on level of education.

Series over time: Here we can trace the changes in the values of a constant metric over the course of time. For example: monthly sales of a product over the course of two years.

Deviation: Examines how each data point relates to the others and, particularly, to what point its value differs from the average. For example: the line of deviation for tickets to an amusement park sold on a rainy versus a normal day.

Partial and total relationships: Show a subset of data as compared with a larger total. For example: the percentage of clients that buy specific products.

Distribution: Visualization that shows the distribution of data spatially, often around a central value. For example: the heights of players on a basketball team.

11 formats

There are two types of visualizations: static and interactive. Their use depends on the search and analysis dimension level. **Static visuals can only analyze data in one dimension, whereas interactive visuals can analyze it in several.**

As with any other form of communication, familiarity with the code and resources that are available to us is essential if we're going to use them successfully our goal. In this page, we present the different kinds of graphics that we can use to transform our data into information. This group of visualization types is listed in order of popularity in the "Visualization Universe" project by Google News Lab and Adioma, as of the publication of this report.

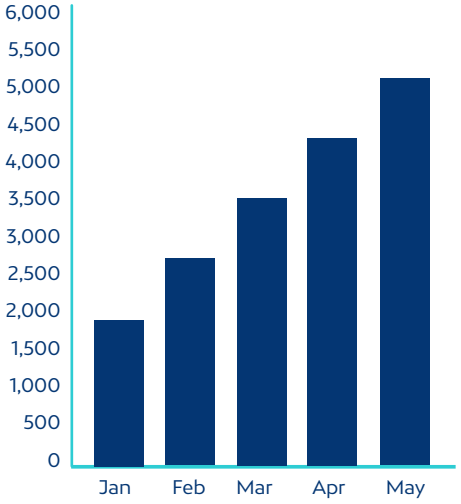
1. Bar chart

Bar charts are one of the most popular ways of visualizing data because they present a data set in a quickly understood format that enables viewers to identify highs and lows at a glance.

They are very versatile, and they are typically used to compare discrete categories, to analyze changes over time, or to compare parts of a whole.
The three variations on the bar chart are:

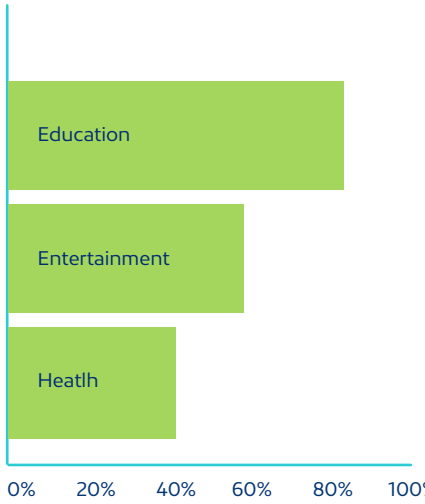
Vertical column

Used for chronological data, and it should be in left-to-right format.



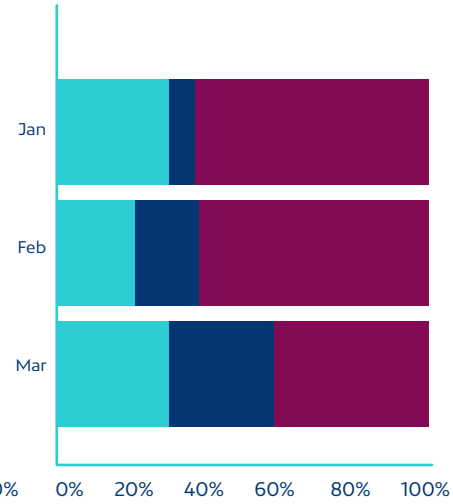
Horizontal column

Used to visualize categories.



Full stacked column

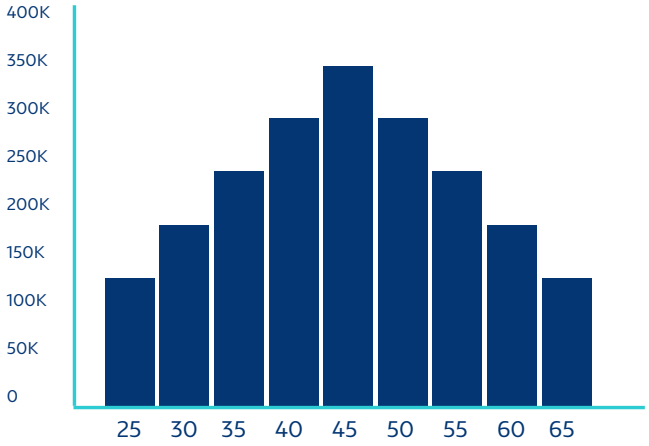
Used to visualize categories that collectively add up to 100%.



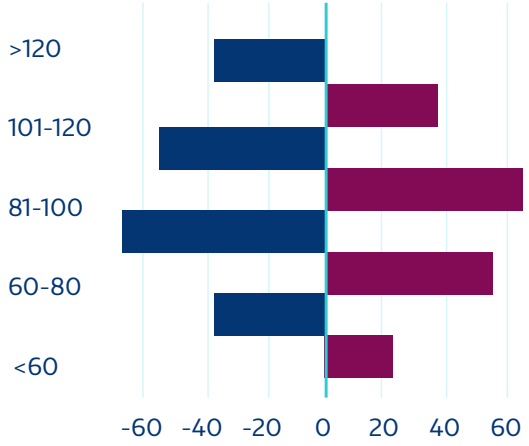
2. Histograms

Histograms represent a **variable in the form of bars, where the surface of each bar is proportional to the frequency of the values represented.** They offer an overview of the distribution of a population or sample with respect to a given characteristic.
The two variations on the histogram are:

- **Vertical columns**
- **Horizontal columns**



Vertical columns



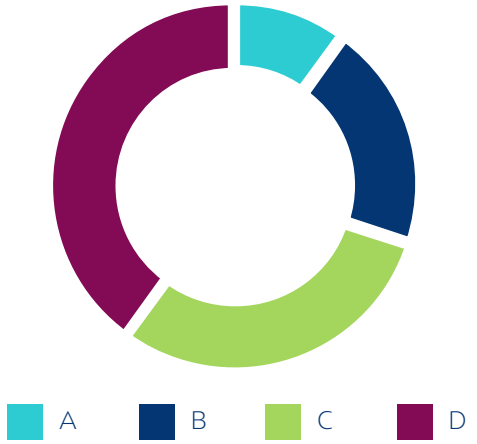
Horizontal columns

3. Pie charts

Pie charts consist of **a circle divided into sectors, each of which represents a portion of the total.** They can be subdivided into no more than five data groups. They can be useful for comparing discrete or continuous data.
The two variations on the pie chart are:

- **Standard:** Used to exhibit relationship between parts.
- **Donut:** A stylistic variation that facilitates the inclusion of a total value or a design element in the center.

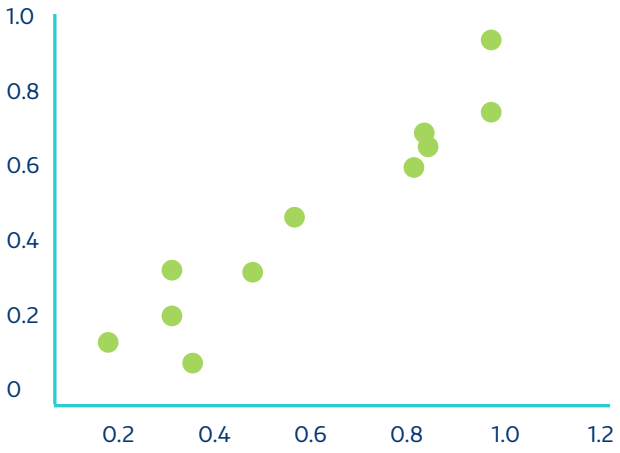
Standard pie chart



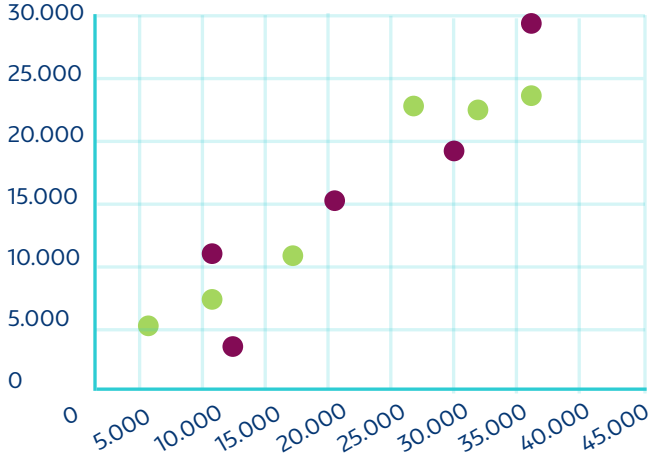
Donut pie chart

4. Scatter plots

Scatter plots use the spread of points over a Cartesian coordinate plane to show the relationship between two variables. They also help us determine whether or not different groups of data are correlated.



Scatter plot

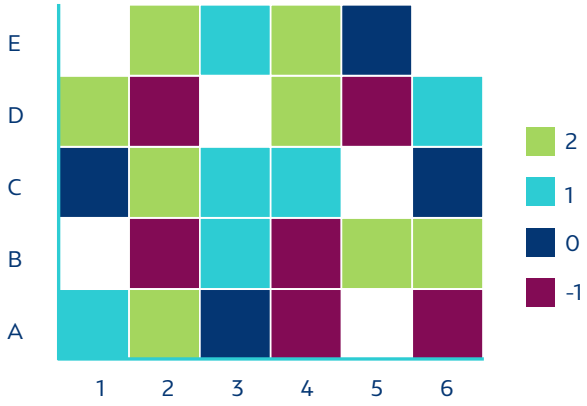


Scatter plot with grid

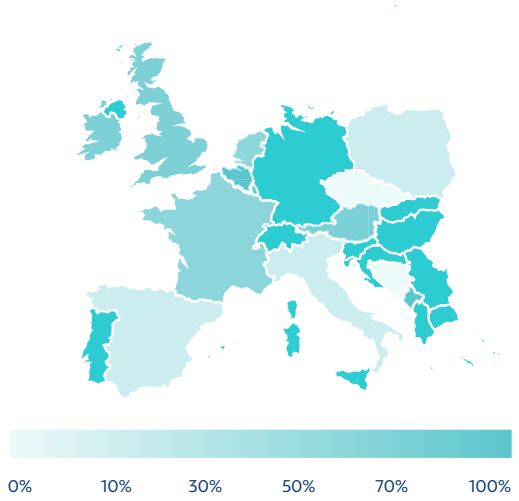
5. Heat maps

Heat maps represent individual values from a data set on a matrix using variations in color or color intensity. They often use color to help viewers compare and distinguish between data in two different categories at a glance. They are useful for visualizing webpages, where the areas that users interact with most are represented with "hot" colors, and the pages that receive the fewest clicks are presented in "cold" colors. The two variations on the heat map are:

- **Mosaic diagram**
- **Color map**



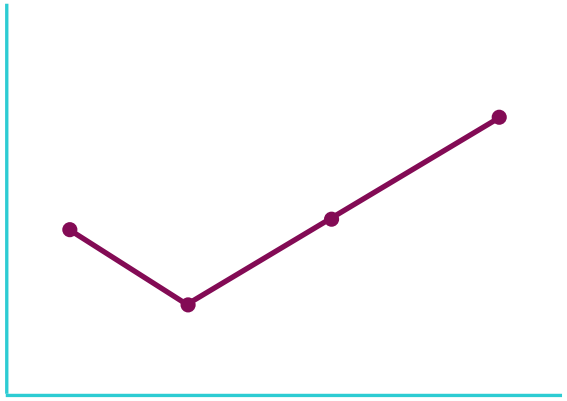
Mosaic diagram



Color map

6. Line charts

These are **used to display changes or trends in data over a period of time.** They are especially useful for showcasing relationships, acceleration, deceleration, and volatility in a data set.

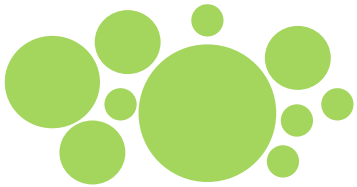


Line chart

7. Bubble charts

These graphics **display three-dimensional data and accentuate data in dispersion diagrams and maps.** Their purpose is to highlight nominal comparisons and classification relationships. The size and color of the bubbles represent a dimension that, along with the data, is very useful for visually stressing specific values. The two variations on the bubble chart are:

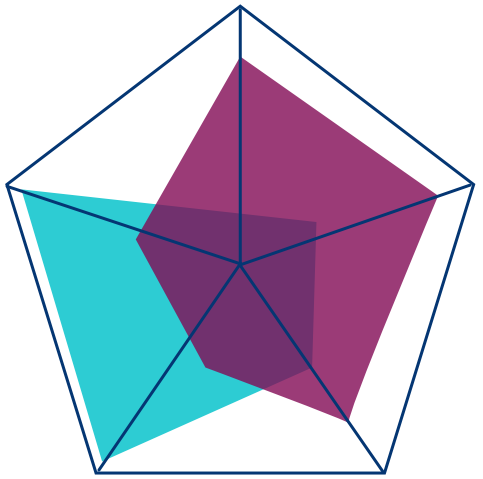
- **The bubble plot:** used to show a variable in three dimensions, position coordinates (x, y) and size.



- **Bubble map**: used to visualize three-dimensional values for geographic regions.

8. Radar charts

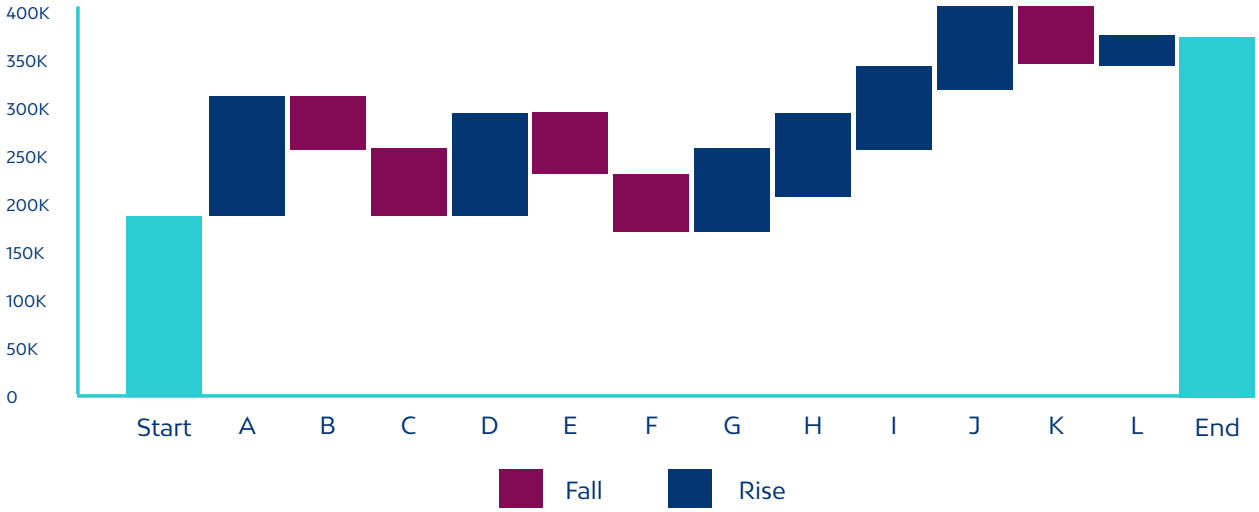
These are **a form of representation built around a regular polygon that is contained within a circle, where the radii that guide the vertices are the axes over which the values are represented.** They are equivalent to graphics with parallel coordinates on polar coordinates. Typically, they are used to represent the behavior of a metric over the course of a set time cycle, such as the hours of the day, months of the year, or days of the week.



Radar chart

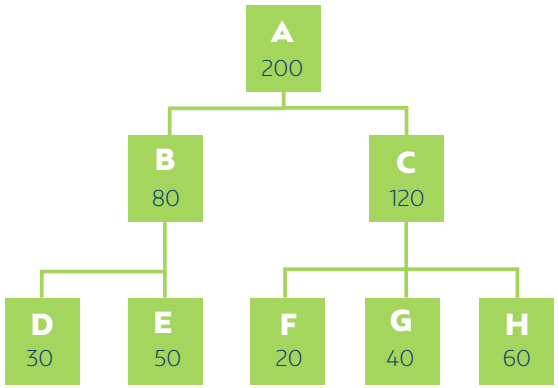
9. Waterfall charts

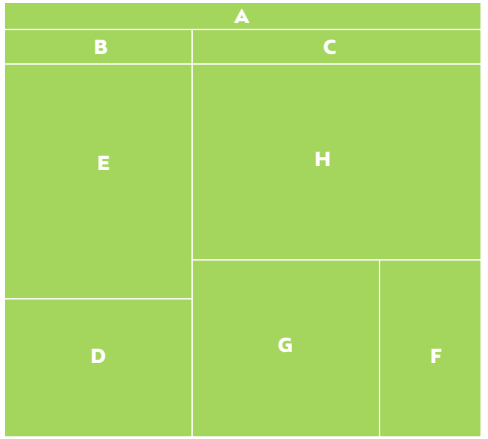
These **help us understand the cumulative effect of positive and negative values on variables in a sequential fashion.**



10. Tree maps

Tree maps **display hierarchical data (in a tree structure) as a set of nested rectangles that occupy surface areas proportional to the value of the variable they represent.** Each tree branch is given a rectangle, which is later placed in a mosaic with smaller rectangles that represent secondary branches. The finished product is an intuitive, dynamic visual of a plane divided into areas that are proportional to hierarchical data, which has been sorted by size and given a color key.

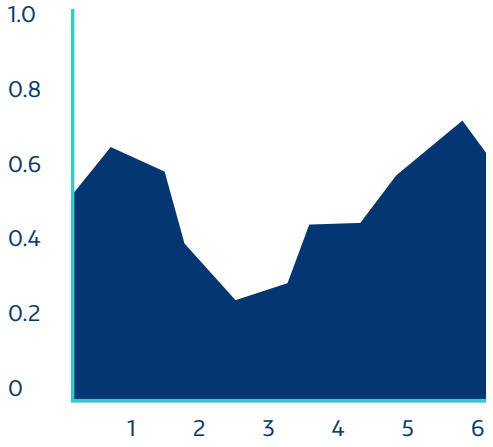




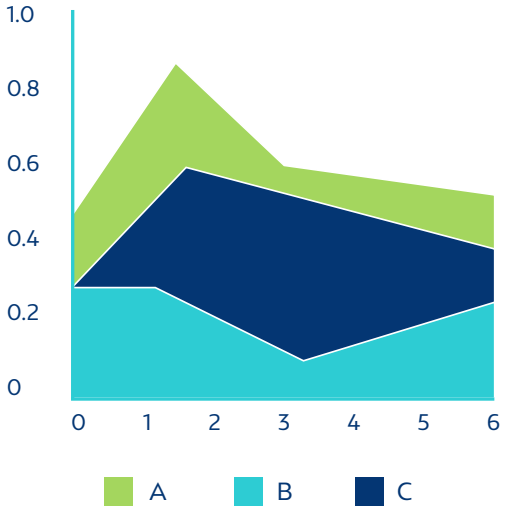
11. Area charts

These **represent the relationship of a series over time, but unlike line charts, they can represent volume.** The three variations on the area chart are:

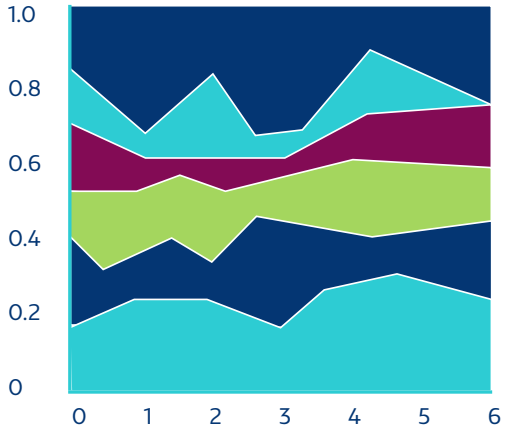
- **Standard area:** used to display or compare a progression over time.
- **Stacked area:** used to visualize relationships as part of the whole, thus demonstrating the contribution of each category to the cumulative total.
- **100% stacked area:** used to communicate the distribution of categories as part of a whole, where the cumulative total does not matter.



Standard area



Stacked area



100% stacked area

Selecting the right graphic to effectively communicate through our visualizations is no easy task. Stephen Few (2009), a specialist in data visualization, proposes taking a practical approach to selecting and using an appropriate graphic:

- **Choose a graphic** that will capture the viewer's attention for sure.
- **Represent the information** in a simple, clear, and precise way (avoid unnecessary flourishes).
- Make it easy to compare data; **highlight trends and differences.**
- **Establish an order** for the elements based on the quantity that they represent; that is, detect maximums and minimums.
- **Give the viewer a clear way to explore the graphic** and understand its goals; make use of guide tags.

3. Basic principles for data visualization

Basic principles for data visualization

Graphics with an objective: seeking your mantra

The goal of data visualizations is to help us understand the object they represent. They are a medium for communicating stories and the results of research, as well as a platform for analyzing and exploring data. Therefore, having a sound understanding of how to create data visualizations will help us create meaningful and easy-to-remember reports, infographics, and dashboards. Creating suitable visuals helps us solve problems and analyze a study's objects in greater detail.

The first step in representing information is trying to understand that data visualization.

Ben Shneiderman gave us a useful starting point in his text "The Visual Information-Seeking Mantra" (1996), which remains a touchstone work in the field. This author suggests a simple methodology for novice users to delve into the world of data visualization and experiment with basic visual representation tasks.[5]

5 Shneiderman, B. (1996). The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations. Visual Information Seeking Mantra (p. 336). Available at: https://www.cs.umd.edu/~ben/papers/Shneiderman1996eyes.pdf

Shneiderman introduces his famous mantra on how to approach the quest for visual information, which he breaks down into three tasks:

1. Overview first: This ensures viewers have a general understanding of the data set, as their starting point for exploration. This means offering them a visual snapshot of the different kinds of data, explaining their relationship in a single glance. This strategy helps us visualize the data, at all its different levels, at one time.

2. Zoom and filter: The second step involves supplementing the first so that viewers understand the data's underlying structure. The zoom in/zoom out mechanism enables us to select interesting subsets of data that meet certain criteria while maintaining the sense of position and context.

3. Details on demand: This makes it possible to select a narrower subset of data, enabling the user to interact with the information and use filters by hovering or clicking on the data to pull up additional information.

The chart on the right side summarizes the key points to designing such a graphic, with an eye to human visual perception, so that users can translate an idea into a set of physical attributes.

These attributes are: **structure, position, form size, and color.** When properly applied, these attributes can present information effectively and memorably.

Layout and design: communicative elements

In order to begin designing our reports and statements, it is essential to understand that visual representations are cognitive tools that complement and strengthen our mental ability to encode and decode information[6]. Meirelles (2014) notes that: **"All graphic representation affects our visual perception, because the elements of transmission utilized act as external stimuli, which activate our emotional state and knowledge."**

Thus, when our mind visualizes a representation, it transforms the information, merges it, and applies a hierarchical structure to it to facilitate interpretation.

For this reason, in order to have an efficient perceptive impact, it is important to adhere to a series of best practices when creating reports and infographics. As with any other form of communication, success depends largely on the business's familiarity with the established code and the resources available. Space, shapes, color, icons, and typography are a few of the essential elements of a striking visual with communicative power.

6 Meirelles, I (2014). "La información en el diseño," (p.21-22). Barcelona: Parramón.

Structuring: the importance of layout

All visual representations begin with a blank dimensional space that will eventually hold the information which will be communicated. The process of spatial coding is a fundamental part of visual representation because it is the medium in which the results of our compositional decisions and the meaning of our visual statement will be visualized, thereby having an impact on the user.

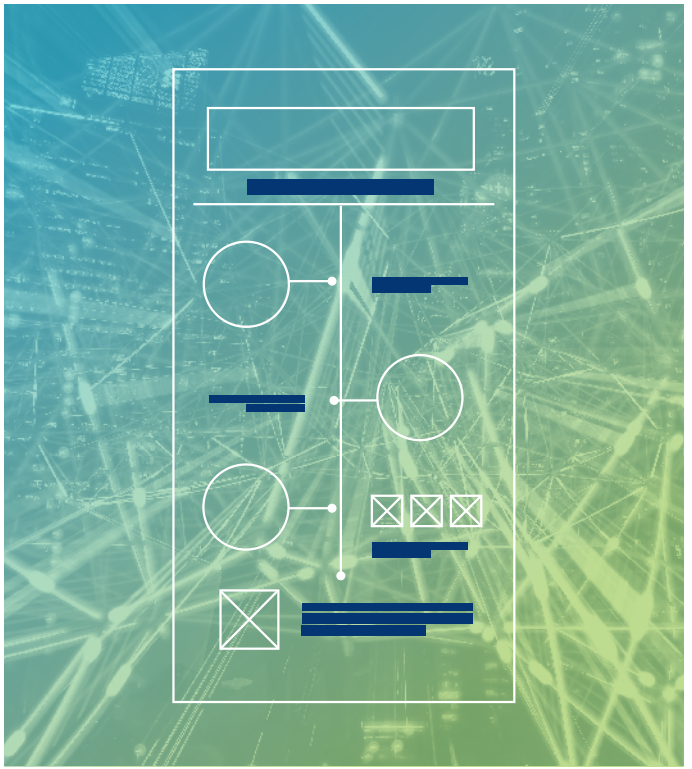
Edward Tufte (1990) defines "layout" as a scheme for distributing visual elements in order to achieve organization and harmony in the final composition. Layout planning and design serve as a template for applying hierarchy and control to information at varying levels of detail.[7] In his book *Envisioning Information*, Tufte offers several guidelines for information design:

- Have a properly chosen format.
- Give a broad visual tour and offer a focused reading at different detail levels.
- Use words, numbers, and drawings.
- Reflect a balance, a proportion, a sense of relevant scale, and a context.

Spatial encoding requires processing spatial proportions (position and size), which have a determining role in the organization of perception and memory.

7 Tufte, E. (1990). Envisioning Information. Cheshire: Graphics Press.

Furthermore, the visual hierarchy of elements plays a role in this encoding process, because the elements' organization and distribution must have a well-defined hierarchical system in order to communicate effectively (Meirelles: 2014). **In a sense, visualizations are paragraphs about data, and they should be treated as such.** Words, images, and numbers are part of the information that will be visualized. When all of the elements are integrated in a single structure and visual hierarchy, the infographic or report will organize space properly and communicate effectively, according to your user's needs.

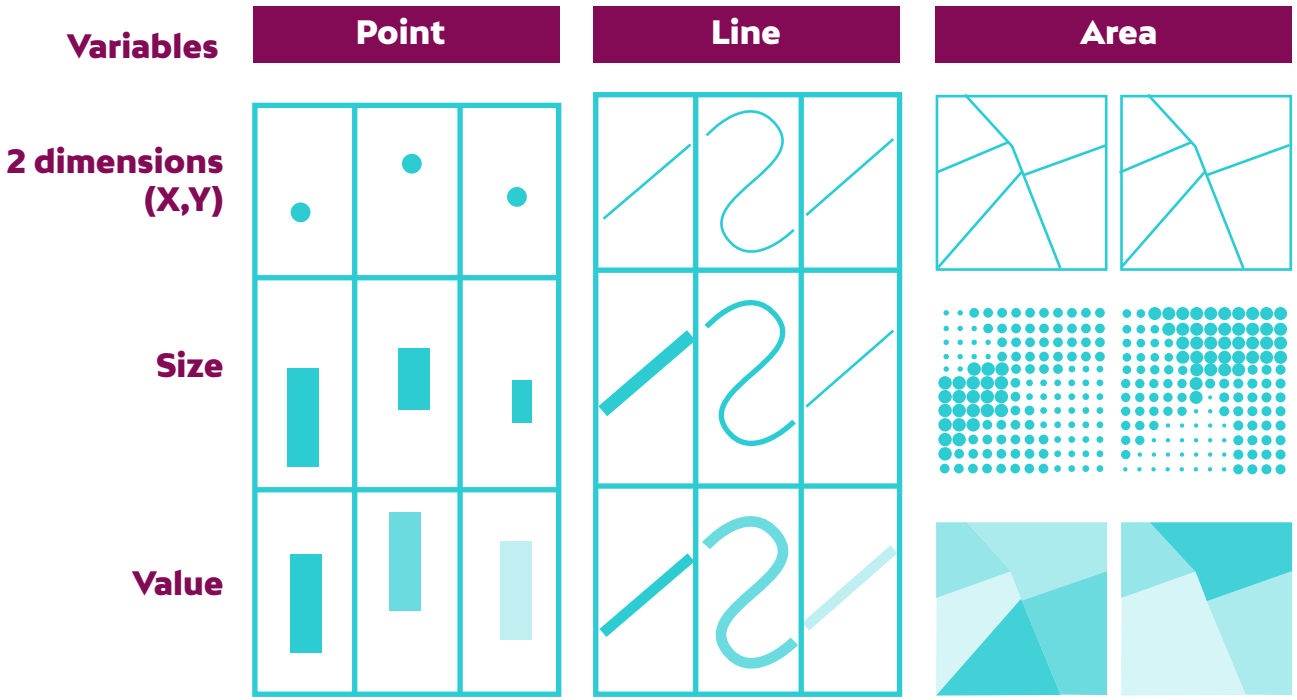


Visual variables and their semantics

Visual variables are the building blocks of visual representation. They conform to an order and spatial context in order to convey a quantitative message. These resources can be used to categorize meaningful properties and amplify the message being represented. Let's take a look at their semantics:

- **Point:** Has no dimensions and indicates a place.
- **Line:** Has one dimension and indicates length and direction.
- **Plane:** Has two dimensions and indicates space and scale.

Jacques Bertin, cited in Meirelles (2014), used the term **"visual variables"** for the first time in his book Semiologie Graphique, where he presented them as a system of perceptive variables with corresponding properties of meaning. He offered a guide for combining graphic elements in an appropriate way according to their order, position, orientation, size, texture, and value.



Visual variables

Using consistent and attractive color schemes

Color is one of the most powerful resources for data visualization, and it is essential if we are going to understand information properly.

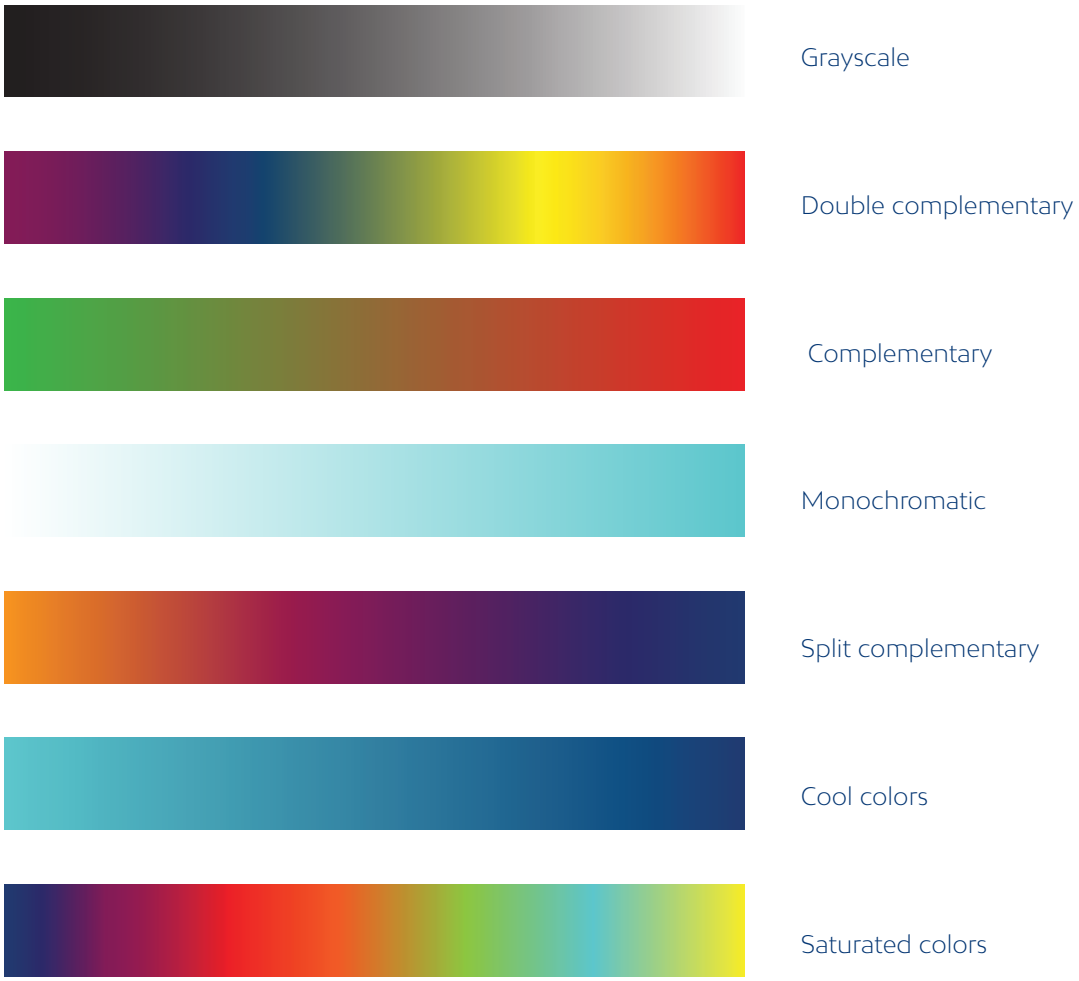
Color can be used to categorize elements, quantify or represent values, and communicate cultural attributes associated with a specific color.

It dominates our perception and, in order to analyze it, we must first understand its three dimensions.

Hue: this is what we normally imagine when we picture colors. There is no order to colors; they can only be distinguished by their characteristics (blue, red, yellow, etc.).

Brightness: the color's luminosity. This is a relative measure that describes the amount of light reflected by one object with respect to another. Brightness is measured on a scale, and we can talk about brighter and darker values of a single hue.

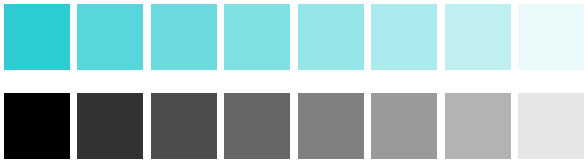
Saturation: this refers to the intensity of a given color's hue. It varies based on brightness. Darker colors are less saturated, and the less saturated a color is, the closer it gets to gray. In other words, it gets closer to a neutral (hueless) color. The following graphic offers a brief summary of color application.



Isabel Meirelles (2014) notes that selecting a color palette in order to visualize data is no easy task, and she recommends following Cynthia Brewer's advice uses **three different kinds of color schemes**, based on the nature of the data:

1. Monochromatic sequential palettes or their analogue

These palettes are great for ordering numeric data that progresses from small to large. It is best to use brighter color gradients for low values and darker ones for higher values.



Thus, brightness levels can be used as a visible, coherent aspect of a graphic scheme. Sequential color schemes make it possible to create a smooth, low-contrast design. This color scheme is better for an image than for data visualization.

TIP: To create a color hierarchy in a sequential scheme, choose one dominant color and use the others with moderation; alternatively, you can simply use two softer versions of the dominant color, which will naturally make them feel lower on the hierarchy.

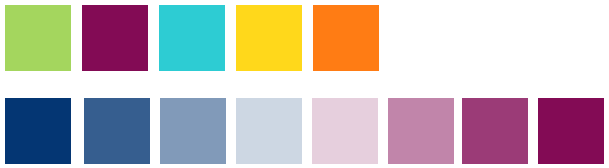
2. Diverging palettes

These are more suitable for ordering categorical data, and they are more effective when the categorical division is in the middle of the sequence. The change in brightness highlights a critical value in the data, such as the mean or median, or a zero. Colors become darker to represent differences in both directions, based on this meaningful value in the middle of the data.

TIP: Try to emphasize the most important information using arrows and text, circles, rectangles, or contrasting colors. This way, when you visualize your data, your analysis will be more understandable.

3. Qualitative palettes

These are better for representing ordinal or categorical data to create primary visual differences between categories. Most qualitative schemes are based on differences in hue, with differences in brightness between the colors.



TIP: The qualitative color scheme is perfect for visualizing data because it affords a high degree of contrast and helps you draw attention to important points, especially if you use one predominant color and use the second as an accent in your design.

Finally, don't forget to use palettes that are comprehensible to people who can't see color. Color blindness is a disability or limited ability that makes it difficult to distinguish certain pairs of colors, such as blue and yellow, or red and green. One strategy for avoiding this problem is to adapt designs that use more than just hue to codify information; create schemes that slightly vary another channel, such as brightness or saturation.

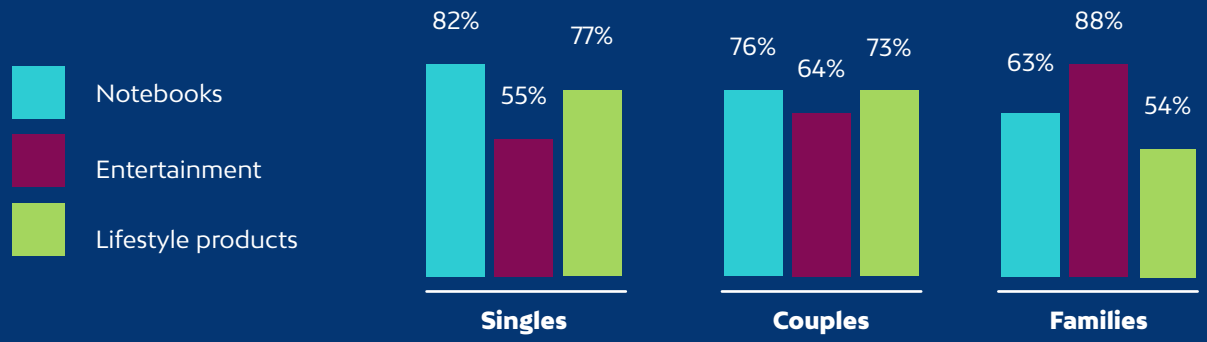
Use icons and symbols to aid in understanding and limit unnecessary tagging

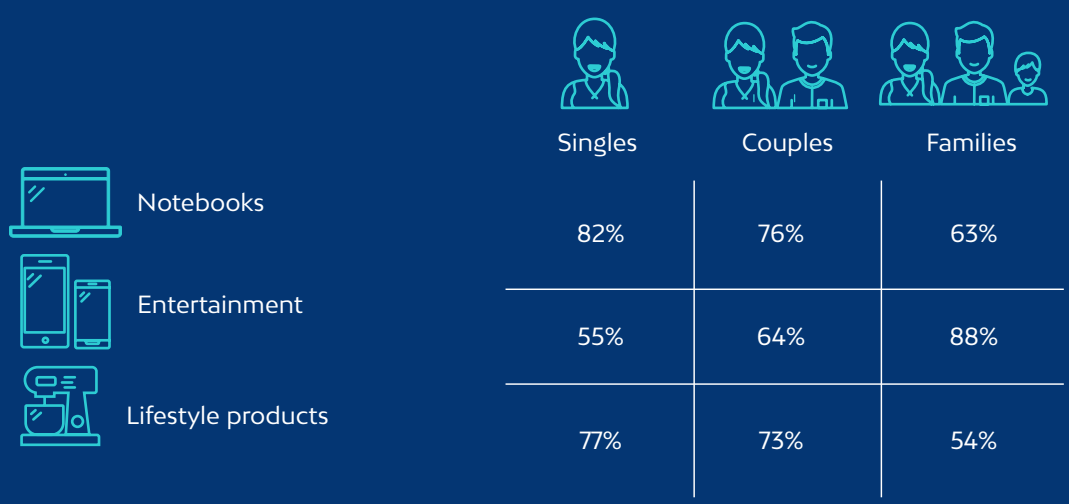
Symbols and icons are another avenue for visualizing information that goes beyond merely being decorative. They draw strength from their ability to exhibit a general context in an attractive, precise way. Icons illustrate concepts. Viewers can understand what the information is about by just glancing at the illustration.

Alexander Skorka (2018), chief evangelist for the Dapresy Group, recommends using symbols and icons because they simplify communication. **Symbols are self-explanatory, and our mind can process icons more easily than text**. It is important to consider that an icon's success depends largely on cultural context, so it is important to select universally understandable images.

That said, they certainly should not be complex illustrations. An icon with too many details could hinder viewers' understanding. Keep it simple: icons' meaning should be immediately clear, even when they're very small.

The ease with which we recognize icons enables us to process data faster than we can process information conveyed textually. Therefore, when designing information, it is wise to use both graphics and icons to convey proportions in greater detail.





The typography in our reports: effective applications

Typography plays an important role in the design of reports and statements. Selecting the right font strengthens your message and captures the audience's attention. Müller-Brockmann (1961), a graphic designer, defines typography as the proper visual element for composition. He notes that "the reader must be able to read the message from a text easily and comfortably. This depends largely on the size of the text, the length of the lines, and the spacing between the lines".[8]

Typography is an art form in and of itself, in which every font has its own characteristics, which should be strategically combined.

For people outside the world of graphic design, choosing a font and setting other typographical features can be tricky, but it doesn't have to be. Let's take a practical look at the steps you should take when determining your typography, and then consider the images and visual elements that best accompany your text. Considerations when setting your typography:

- **Determining the goal** of your report's content.
- **Select a font that strengthens that goal.** Fonts come in two types: with serifs or without (sans) serifs. Serif fonts have an extra stroke that conveys a sense of tradition, security, history, integrity, authority, integrity, and other such concepts. Sans-serif fonts stand out because they have a more polished, sophisticated feel; they convey a sense of modernity, order, cleanliness, elegance, avant-garde, and style.
- **Pay attention to legibility.** Remember that screen type does not appear in the same way as print type. It is best to choose a more responsive (sans-serif) font for on-screen texts, and fonts with serifs for printed reports. That said, there's an exception to every rule, and today there is a bounty of fonts that are perfectly suitable for both digital and print media.
- **Watch your weight (light, regular, bold).** When it comes to bolding your text, a value of two or three should be plenty. It is better to reserve the heaviest weight for headlines and then apply a stylistic hierarchy based on your content. Avoid fonts that only offer one weight or style, since their applications are limited.
- **Don't forget that some fonts use more memory than others.** Fonts with serifs generally monopolize more of your computer's brain power than sans-serif fonts. This is an important consideration in interactive reports, since a document that occupies more RAM will be less responsive.

Fonts have personalities that help us establish a more attractive visual tone for our audience. Familiarizing yourself with a few can go a long way. There are:

- Professional fonts
- Fun font
- Handwritten fonts
- Minimalist fonts

8 The Graphic Artist and his Design Problems (Gestaltungsprobleme des Grafikers), Teufen, 1961

Prioritize patterns in your visualizations: Gestalt

The basic elements of the visualization process also involve preattentive attributes. Preattentive attributes are visual features that facilitate the rapid visual perception of a graphic in a space. Designers use these characteristics to better uncover relevant information in visuals, because these characteristics attract the eye.

Colin Ware, Director of the Data Visualization Research Lab at the University of New Hampshire, has highlighted that **preattentive attributes can be used as resources for drawing viewers' immediate attention to certain parts of visual representations** (2004). According to Ware, preattentive processing happens very quickly—typically in the first 10 milliseconds. This process is the mind's attempt to rapidly extract basic visual characteristics from the graphic (stage 1). These characteristics are then consciously processed, along with the perception of the object, so that the mind can extract patterns (stage 2), ultimately enabling the information to move to the highest level of perception (stage 3). This makes it possible to find answers to the initial visual question, utilizing the information saved in our minds. Colin Ware, cited in Meirelles (2014), explains it as follows:

Bottom up information contributes to the pattern creation process →

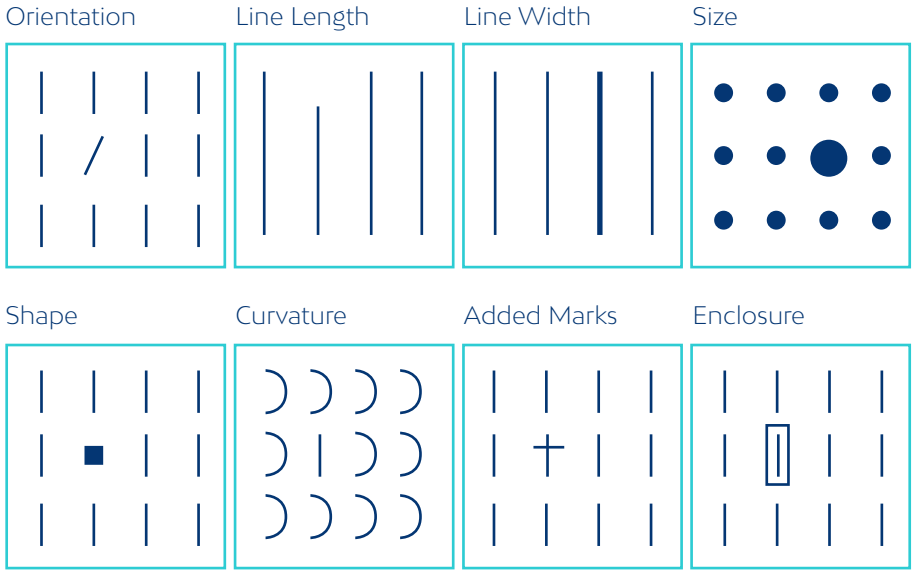
← **Top down process reinforces relevant information**

Preattentive attributes enhance object perception and cognition processes, leveraging our mind's visual capacities. Good data visualizations deliberately make use of these attributes because they boost the mind's discovery and recognition of patterns such as lines, planes, colors, movements, and spatial positioning.[9]

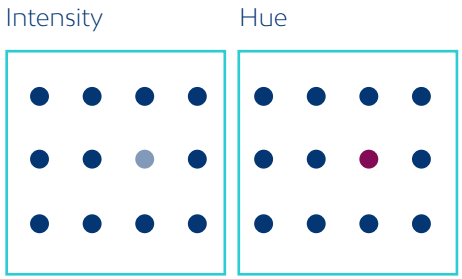
9 Dondis, D.A. (2015). La sintaxis de la imagen: introducción al alfabeto visual. Editorial Gustavo Gili: Barcelona
Meirelles, I. (2014). La información en el diseño. Barcelona: Parramón.

The visual below lists preattentive attributes that represent aspects of lines and planes when visualizing and analyzing graphic representation: shape, color, and spatial position.

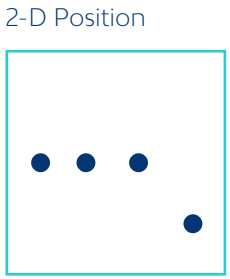
Shape

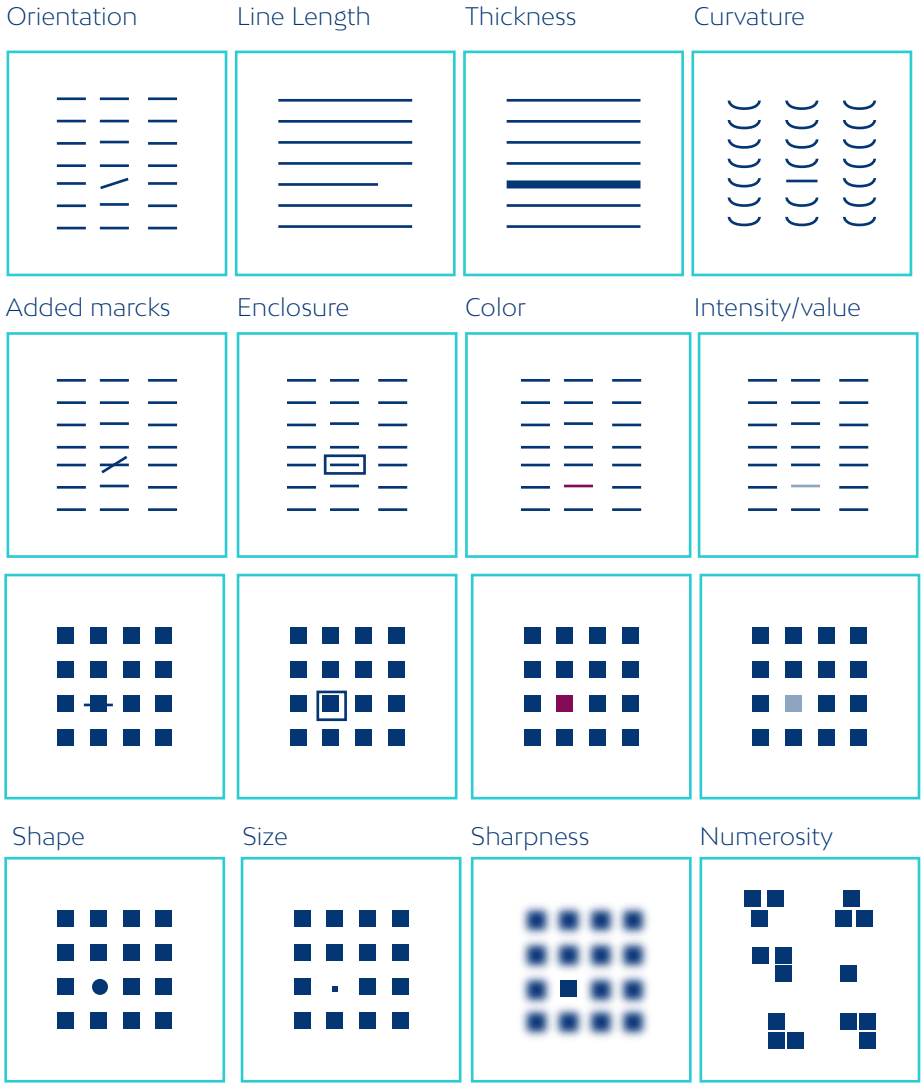


Color

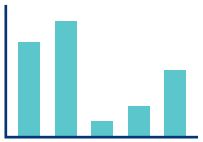
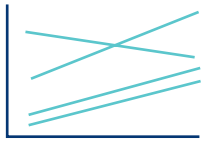
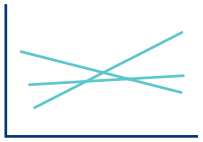
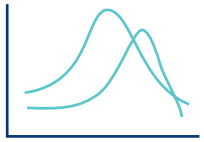
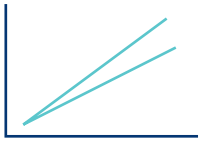
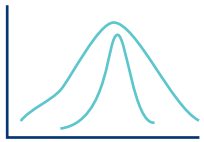
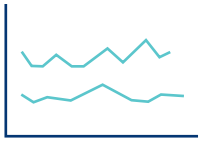
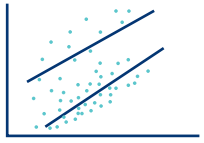
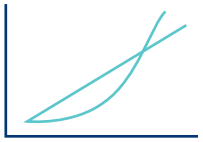
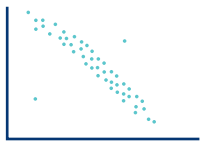


Spatial Position





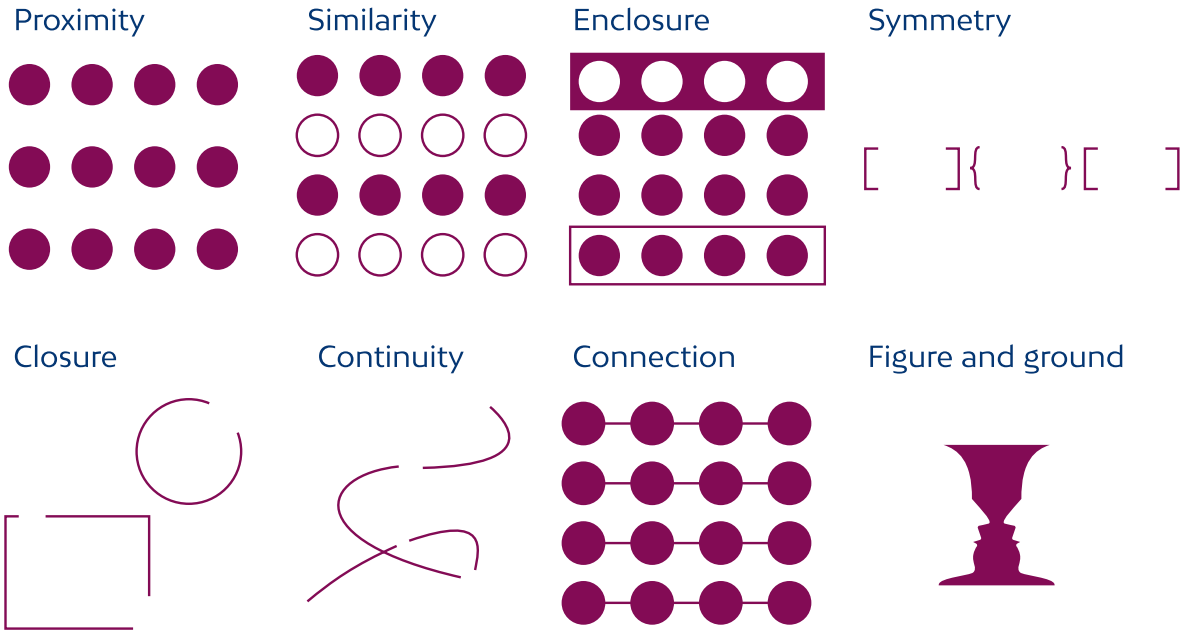
Detecting patterns is fundamental to structuring and organizing visual information. When we create visuals, we often want to highlight certain patterns over others. Preattentive attributes are the alphabet of visual language; analytic patterns are the words that we write by using them. When we see a good visualization, we immediately detect the preattentive attributes and recognize analytic patterns in the visualization. The following table summarizes a few basic analytic patterns:

Pattern	Example	Pattern	Example
High, low and in between		Non-intersecting and intersecting	
Going up, going down and remaining flat		Symmetrical and skewed	
Steep and gradual		Wide and narrow	
Steady and fluctuating		Clusters and gaps	
Random and repeating		Tightly and loosely distributed	
Straight and curved		Normal and abnormal	

Analytic patterns

We have seen how preattentive attributes and patterns make it possible to process and analyze visual information; they also enable us to improve pattern discovery and perceptive inferences and provide processes for solving visualization problems.

Gestalt's principles are the principles that enable us to understand the requirements posed by certain problems so that we see everything as an integral, coherent whole. It involves proximity, similarity, shared destiny, "pragnanz" or pithiness, closure, simplicity, familiarity, and discernment between figure and ground.



Gestalt's principles

According to Dondis (2015), Gestalt's principles help describe the way we organize and merge elements in our minds. They quiet the noise of the graphics so that we relate, combine, and analyze them. These principles come into play whenever we analyze any sort of visualization. Only position and length can be used to accurately perceive quantitative data. The other attributes are useful for perceiving other sorts of data, such as categorical and relational data.

We'll close this section with one piece of practical advice on how to effectively visualize data. Colin Ware in *The Visual Thinking: for Graphic Design* (2008) summarizes the importance of always being mindful of preattentive attributes and patterns when designing a visualization:

Good design optimizes the visual thinking process. The choice of patterns and symbols is important so that visual queries can be efficiently processed by the intended viewer. This means choosing words and patterns each to their best advantage."

4. Storytelling for social and market communication

Storytelling for social and market communication

As we saw at the beginning of this ebook, our mind tends to visualize information in order to satisfy a basic need: **telling a story.** It is one of the most primitive forms of communication, and it is inherent in every human being.

We cannot live without communicating, without expressing our personalities, emotions, and moods, our worries and fears.

Paul Maclean, cited in María Alejandra Rendón (2009), proposes a "Triune brain" theory, which addresses the structure and behavior of the human mind. For Maclean, the mind consists of three inseparable parts (or distinct brains); none of the three functions independently or separately. They are the reptilian brain, the emotional brain, and the neocortex.

The reptilian brain is home to our unconscious, also known as our instinctive side. It manages survival and our body's self-regulation. The second part, **the emotional brain**, is responsible for our emotional processes and basic motivations. Last but not least, **the neocortex** is our more rational, complex side. It is in charge of driving our systematic and logical thinking.

The triune model is a valuable tool for effectively communicating with our audience. It is one of many theories employed in neuromarketing to influence and persuade potential buyers. Understanding and mastering this theory enables us to extract information not just from the neocortex, but from the reptilian and emotional brains as well. This can be useful for qualitative market research methodology, since it utilizes a host of different techniques, including in-depth interviews, ethnographic research, and focus groups. This information is essential if we are aiming towards a scientific framework to talk about neuromarketing.

How, then, can we create stories that use data to communicate insights? Below, we explain three simple sequences for telling a story:

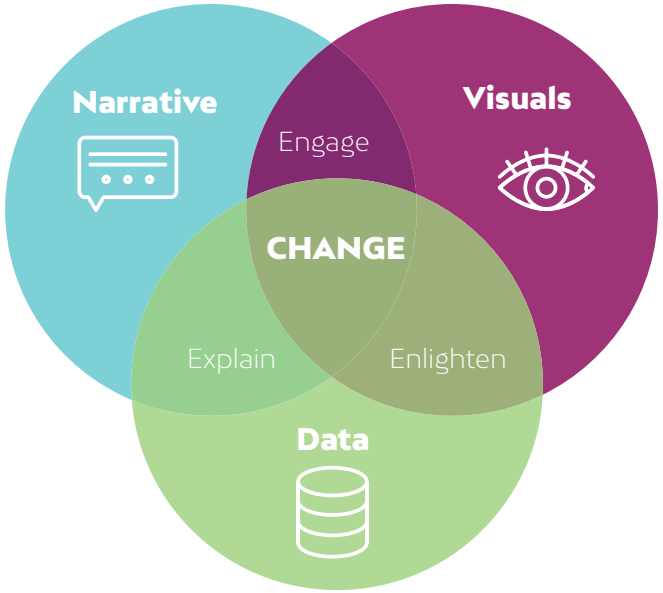
- Influencing people's emotions by telling a story (drawing in their attention).
- Persuading them through benefits that cover specific needs (benefits/engagement).
- Moving on to concrete steps (call to action).

If you can successfully visualize this sequence, you understand the foundation of all narratives. What that means is that every story we try to tell has a beginning, a developed plot, and a resolution, all building up to the invaluable call to action. If you have a clear notion of how to include the "story" element in your reports, statements, and dashboards, you will successfully create stories that use your data to share insights.

Data storytelling

We all love good stories, and data is one of the best tools for telling them. Millions of pieces of data are generated every day. They could be converted into great stories, but instead they are left unused. It's time to change all that. It's time to start telling stories that draw their power from data.

So-called "data storytelling" is nothing more than placing a structured focus on the way we use data to communicate insights. It relies on three key elements: narrative, visualization, and data.



What do we get when we combine these elements?

Data + Narrative

Data can be insights; they are drawn from study and analysis. Their nature can propose the narrative context.

Visualization + Data

Visualization shines a light on our data by enabling us to rapidly process large volumes of data in a visual system. As more data series are represented, we rely less on the verbal and more on the visual. Thus, we can enlighten our audience with insights that they may not have otherwise seen

Narrative + Visualization

The story must motivate. It must have a plot, highs and lows, and an arc of emotional connection in order to draw in and entertain our audience.

Data + Visualization + Narration =

Successfully using our data to tell a story, wield influence, and effect the desired change.

A basic recipe for storytelling in your presentations and final reports

In case you don't have a clear notion of how to include the "story" element in your data, we're going to outline a few points that will guide you, so that your presentations and reports manage to grab your audience's attention and have a major impact:

1. Find the story in your data. Write, write, and write. Write about the highlights of your research in different roles. Worry about presentation later.

2. Define the perspective. Who are you talking to? What's the best way to achieve your objective?

3. Create a hierarchy. What is the most important thing you are trying to convey? Establish different depths to your reading and data. Avoid irrelevant information.

4. Organize. Figure out the most suitable sequence for presenting your data. What relationships can you establish between different aspects of your data? What do some pieces of data mean relative to others? Are they the framework (data that reveals), the details (data that delves deeper), or the contrast (data that dramatizes differences)?

5. Plot. Generate interest; create tension. Depict the concept, crux, and resolution. Incentivize your audience to keep reading until the last page, so to speak. Establish relationships.

6. Use data to anchor your narrative. The story in your data ought to be simple; the vision drawn from the data comes with an implicit responsibility to be sincere and honest.

7. Design principles. Adhere to the best practices of design to visualize your data.

8. Review, review, review. Make sure that all of your analysis is precise.

9. Be familiar with your content and respect your audience.

10. Keep it short and sweet. Data-based storytelling is the product of hours of work. It's best to keep presentations short, with concrete ideas adapted to the audience so that your message is conveyed efficiently and smoothly.

5. Trends in market research and data visualization dashboards

Trends in market research and data visualization dashboards

Data visualization technologies and methods continue to evolve in important ways. This cutting-edge report reflects the most relevant alternatives available on the market that can be used to work in this field. In both the software industry and the academic sector, several paths for innovation and development are at the forefront, including: **scrollytelling**, **social-first data visualitzation**, and **virtual reality vizualisations**.

Scrollytelling

"Scrollytelling" is a technique that we've all experienced first-hand when viewing certain infographics or websites. As the name implies, **it aims to tell a story as users scroll through a graphic.** There are many libraries that can help generate this kind of visualization, including Waypoints, ScrollStory, ScrollMagic, and Graph-Scroll.js

These tools enable users to interact with content as they scroll through a webpage or zoom in on content, which changes and tells a story. By interacting with the visualization of the data, users can see more details, a timeline, or new elements, such as text, icons, or graphics. Russel Goldenberg, an expert in data and visualization, once explained how to implement this technique on his blog, expounding on the characteristics, advantages, and disadvantages of various graphic libraries whose code is intended to act as the foundation for this sort of project.

Social-first data visualization

The landscape of data visualization is constantly changing, as we have seen throughout this report. Needless to say, social networks now play an important role, since the constant flow of information enables us to draw more and more narrative stories from data obtained by Instagram, Snapchat, and YouTube. RJ Andrews, in his work "Info We Trust", notes that "It's almost like content stumbles onto social right now." He adds that, "it is something that has yet to be figured out in a compelling way, but the community is slowly becoming aware. Social can mean a lot of things" for the market and for market research.

It seems that RJ is not alone. UX designer and data enthusiast Catherine Madden expects to see more "snackable" visual content in 2017: "I want to see something that can be consumed on an Instagram feed that might hook someone into learning more that is also easy to share."

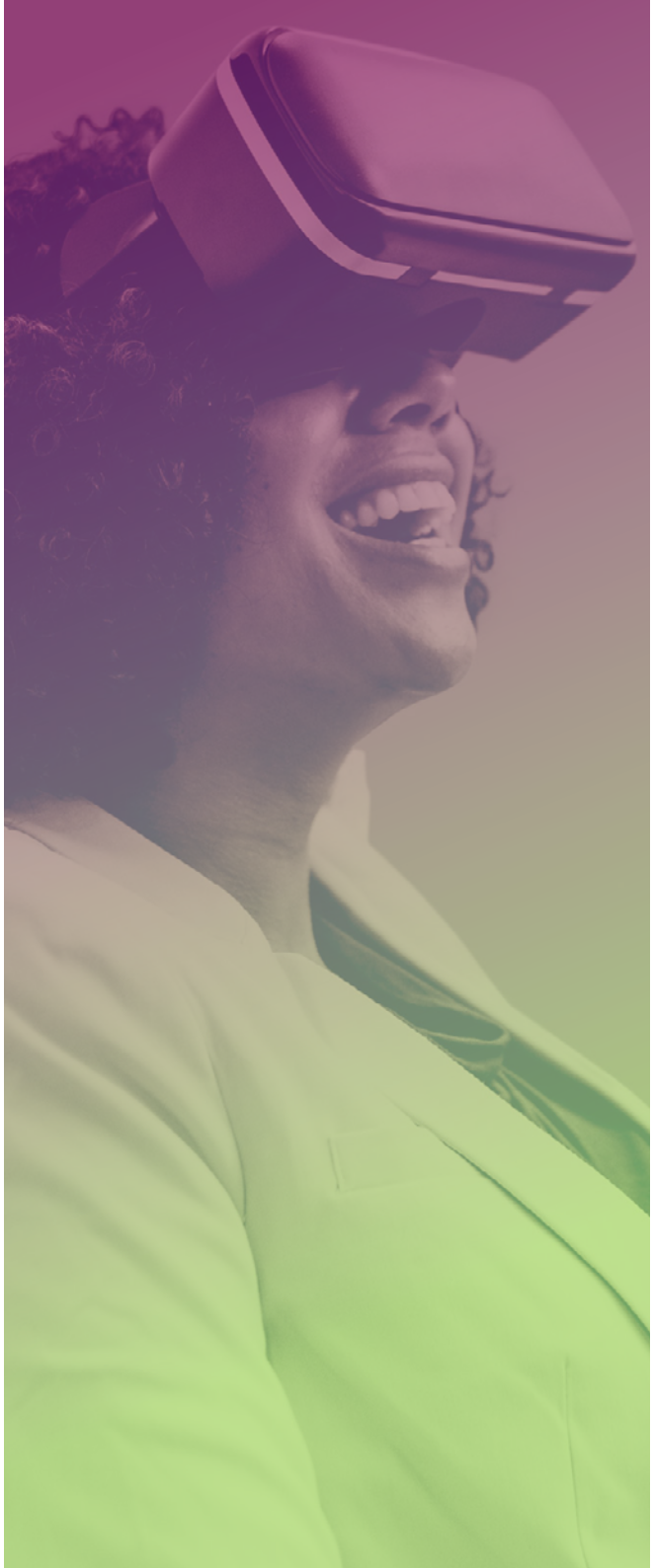
One great example of such an influencer is Mona Chalabi, Data Editor at Guardian U.S., who has over 50,000 Instagram followers. She has published a series of active content visualizations on gender, consumption, politics, and so on. Checking out her profile is "required reading" for anyone interested in learning about data visualization and social media.

The diversity of information has led to the emergence of tools that help us uncover—through published images—conversations about a given brand that are taking place online on a daily basis. One such tool is Brandwatch, a social intelligence platform for unearthing key ideas that are being discussed in the billions of conversations taking place online. This technique enables us to reveal key information about the consumer's individualized online experience.

Virtual reality visualizations

Virtual reality has the potential to revolutionize data visualization, especially when it comes to big data. Even in a two-dimensional image, there is already too much data for the human eye to capture. Now imagine a three-dimensional data visualization, which allows the user to fully interact with data in a 360-degree field of vision.

Virtual reality data visualizations are highly interactive, computer generated 3D projections. Although the concept of virtual reality is nothing new, the idea of immersive data exploration certainly is, and the exciting possibilities that it promises are endless.



What does the future have in store?

Visual data representation techniques and methods progress every day, as technology evolves and our body of theoretical knowledge grows. As this technology and this knowledge work in tandem, we will continue developing solutions for our problems and needs. From this report, we hope you have deduced that, in our current era, images are the most efficient language. We hope you now understand that tools and software can help us discover limitless graphic resources and develop new structures for communicating and conveying ideas. Consequently, we can confidently state that the applications of graphic representation are constantly expanding, and we must not forget that they are the objective of our communication strategies in market research.

Visualize It!

A Comprehensive Guide to Data Visualization

Melissa Matias | Visual Data Designer

ABOUT THE AUTHOR

Focused on creating data visualizations and market research dashboards leveraging data to enhance experiences. She is a passionate, curious person who enjoys collaborating in human-centered design projects around the world.

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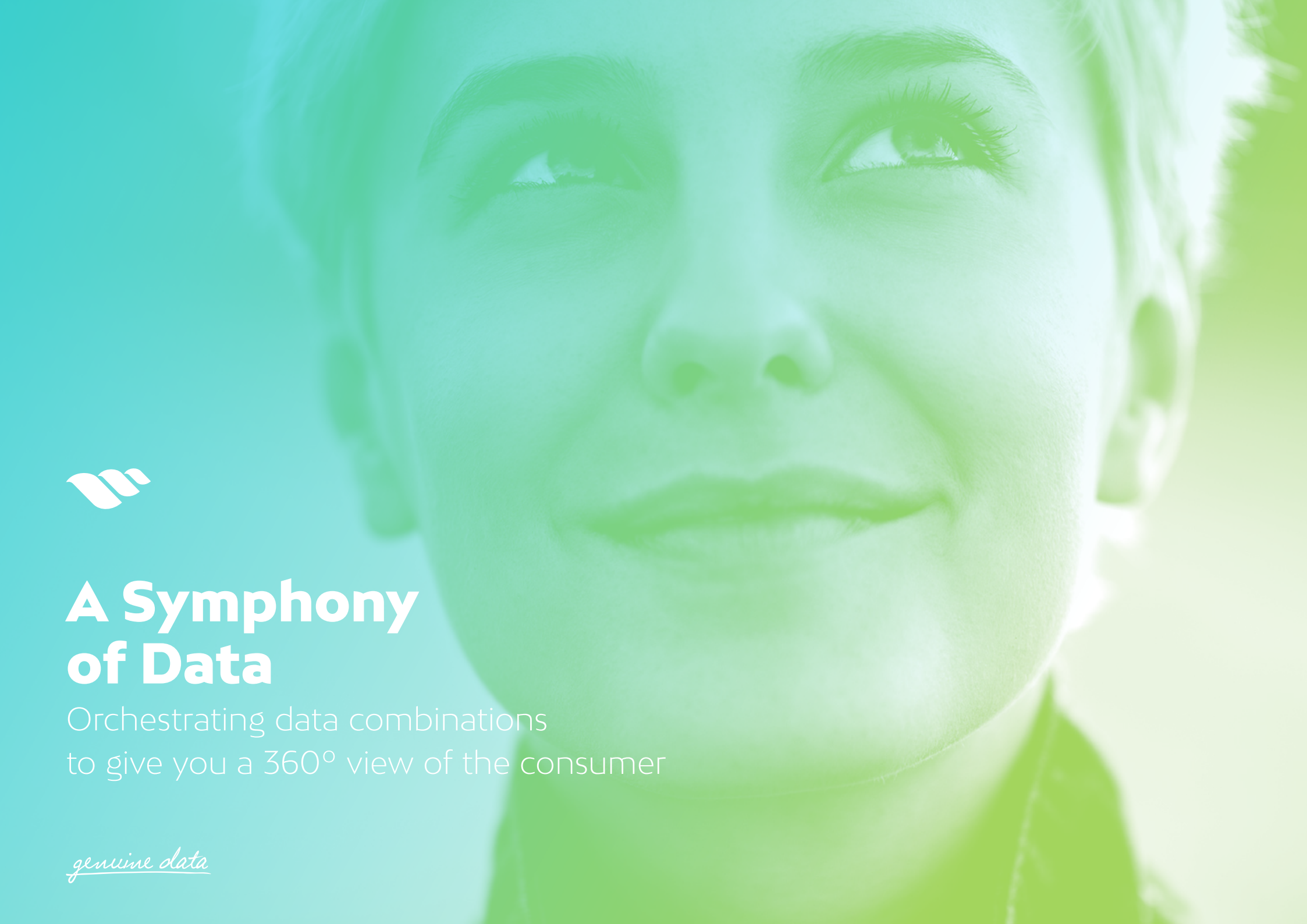
Thank you for reading.

Stay tuned with us.



A Symphony of Data

Orchestrating data combinations
to give you a 360° view of the consumer

genuine data