
Infographic Design

„Infographics design has been a recent popular design and visualization tool preferred by many clients and designers alike to communicate their messages in a visually interesting and engaging style while providing important data and information. However, today's work is not always meeting the standards of what proper data and information design should be. Precedents created by renowned designers and scientists have already used information design and visualization techniques since the last century to document and visualize crucial information and events. They were able to create masterpieces of information and data designs that achieved excellence in terms of being unique & visually appealing, containing compelling data, and communicating the intended message clearly.

Infographics design has been a recent popular design and visualization tool preferred by many clients and designers alike to communicate their messages in a visually interesting and engaging style while providing important data and information. However, today's work is not always meeting the standards of what proper data and information design should be. Precedents created by renowned designers and scientists have already used information design and visualization techniques since the last century to document and visualize crucial information and events. They were able to create masterpieces of information and data designs that achieved excellence in terms of being unique & visually appealing, containing compelling data, and communicating the intended message clearly.“

- https://pdfs.semanticscholar.org/8390/58a6b0229332227f4ffe8e3c859875e71fbf.pdf

Data Visualization

Data visualization is the graphical display of abstract information for two purposes: sense-making (also called data analysis) and communication. Important stories live in our data and data visualization is a powerful means to discover and understand these stories, and then to present them to others. The information is abstract in that it describes things that are not physical. Statistical information is abstract. Whether it concerns sales, incidences of disease, athletic performance, or anything else, even though it doesn't pertain to the physical world, we can still display it visually, but to do this we must find a way to give form to that which has none. This translation of the abstract into physical attributes of vision (length, position, size, shape, and color, to name a few) can only succeed if we understand a bit about visual perception and cognition. In other words, to visualize data effectively, we must follow design principles that are derived from an understanding of human perception.

As the saying goes, "a picture is worth a thousand words" - often more - but only when the story is best told graphically rather than verbally and the picture is well designed.

Human Perception
Model of Perceptual Processing

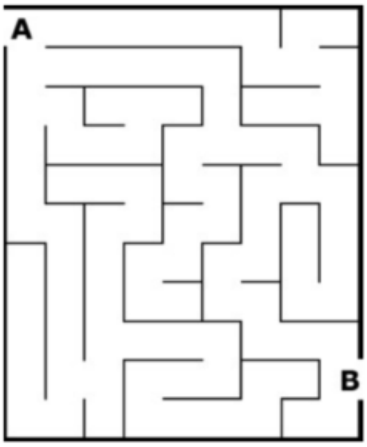
Numerous other models exist;
This is a simplified 3-stage model: But there are many subsystems involved in human vision!

• **Stage 1** – rapid parallel processing to extract lowlevel properties of a visual scene –Detection of shape, spatial attributes, orientation, color, texture, movement –Billions of Neurons work in parallel, extracting information simultaneously –Occurs automatically, independent of (cognitive) focus – Information is transitory (though briefly held in a shortlived visual buffer) –Often called “preattentive” processing.

• **Stage 2** – pull out structures via pattern perception –Visual field is divided in simple patterns: e.g. continuous contours, regions of the same color / texture –Object recognition –Slower serial processing

• **Stage 3** – sequential goal-directed processing – Information is further reduced to a few objects held in visual working memory – Used to answer and construct visual queries –Attention-driven - forms the basis for visual thinking – Interfaces to other subsystems: • Verbal linguistic: connection of words and images • Perception-for-action: motor system to control muscle movement

Example



- Route between the two letters?

• **Stage 1:** automatic parallel extraction of colors, shapes, position etc.

• **Stage 2:** –Pattern finding of black contours (lines) between two symbols (letters)

• **Stage 3:** –Few objects are held in working memory at a time – Identify path sequentially (formulate new visual query)

- https://www.medien.ifi.lmu.de/lehre/ws1112/iv/folien/IV-W11-02-Perception.pdf

Gestalt school of psychology founded in 1912 formulated Gestalt laws
• “The whole is greater than the sum of parts” (Koffka 1935)

• Laws still useful today, but not the neural mechanisms proposed • Perception: An introduction to the Gestalt-theorie (Kurt Koffka, 1922): http://psychclassics.yorku.ca/Koffka/ Perception/ perception.htm

Data visualization for Human Perception

Data visualization is effective because it shifts the balance between perception and cognition to take fuller advantage of the brain's abilities. Seeing (i.e visual perception) which is handled by the visual cortex located in the rear of the brain, is extremely fast and efficient. We see immediately, with little effort. Thinking (i.e. cognition), which is handled primarily by the cerebral cortex in the front of the brain, is much slower and less efficient. Traditional data sensemaking and presentation methods require conscious thinking for almost all of the work. Data visualization shifts the balance toward greater use of visual perception, taking advantage of our powerful eyes whenever possible.

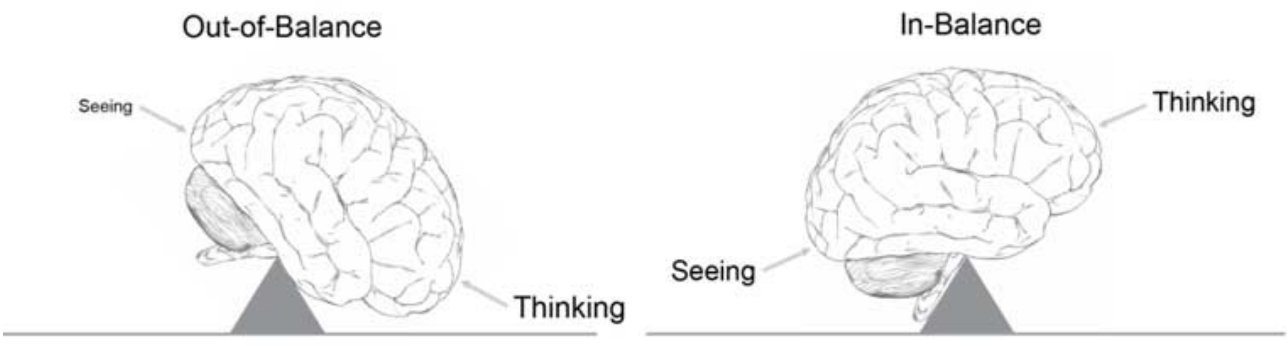


Figure 35.9

One of the earliest contributions to the science of perception was made by the Gestalt School of Psychology. The original intent of this effort when it began in 1912 was to uncover how we perceive pattern, form, and organization in what we see.

- https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/data-visualization-for-human-perception

Pictures for the Eyes and Mind
(Data visualization for Human Perception Example)

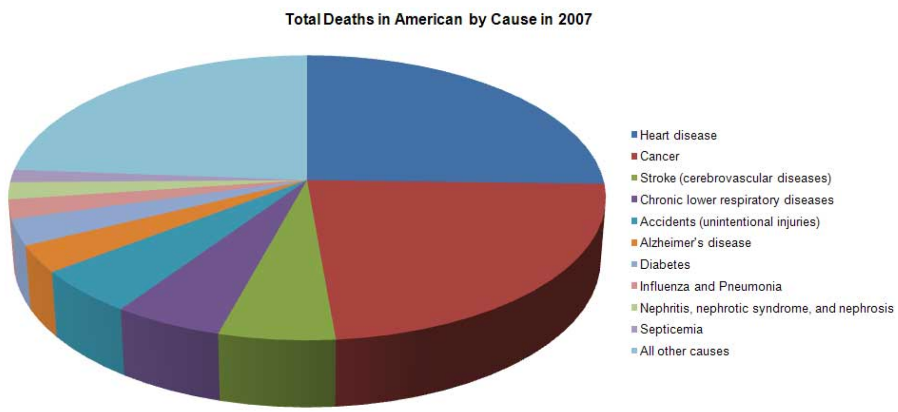
Data visualization is only successful to the degree that it encodes information in a manner that our eyes can discern and our brains can understand. Getting this right is much more a science than an art, which we can only achieve by studying human perception. The goal is to translate abstract information into visual representations that can be easily, efficiently, accurately, and meaningfully decoded. Consider a case when you need to help people understand the primary causes of death in America contained in the following table:

Causes of Death	Deaths per Year
Heart disease	616,067
Cancer	562,875
Stroke (cerebrovascular diseases)	135,952
Chronic lower respiratory diseases	127,924
Accidents (unintentional injuries)	123,706
Alzheimer's disease	74,632
Diabetes	71,382
Influenza and Pneumonia	52,717
Nephritis, nephrotic syndrome, and nephrosis	46,448
Septicemia	34,828
All other causes	577,181
Total	2,423,712

To achieve this goal, the display should achieve the following:

- Clearly indicates how the values relate to one another, which in this case is a part-to-whole relationship - the number of deaths per cause, when summed, equal all deaths during the year.
- Represents the quantities accurately.
- Makes it easy to compare the quantities.
- Makes it easy to see the ranked order of values, such as from the leading cause of death to the least.
- Makes obvious how people should use the information - what they should use it to accomplish - and encourages them to do this.
- The traditional way to display this information graphically involves a pie chart, illustrated below.

How well does this pie chart satisfy our criteria for effectiveness? Let's consider each of the



requirements.

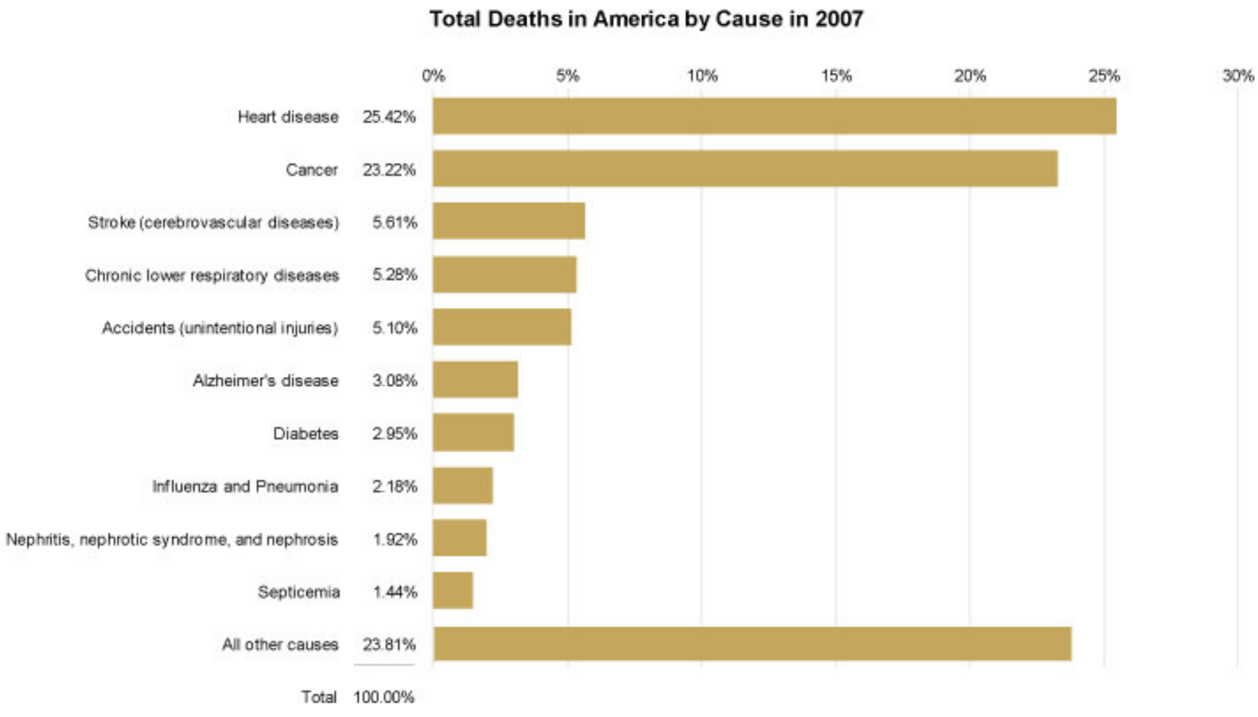
- Clearly indicates the nature of the relationship? Yes. The primary strength of a pie chart is the fact that it clearly indicates a part-to-whole relationship between the values.

- Represents the quantities accurately? No. Pie charts encode values redundantly through the use of three visual attributes: the area of each slice, the angle formed by each slice at the center of the pie, and the length of the each slice along the pie's perimeter. Even when the area, angle, and perimeter of each slice is calculated properly, it fails in that we cannot perceive any one of these attributes accurately. Visual perception in humans has not evolved to support accurate decoding of areas, angles, or distance along a curve.

- Makes it easy to compare the quantities? No. Because we cannot perceive the values accurately, we also cannot compare them easily or accurately. Furthermore, in this particular pie chart, because a legend has been used to label the slices, we are forced over and over to look up the meaning of the slices we wish to compare by finding the right color, which is often difficult to discriminate. The fact that this pie chart has been rendered in 3-D also complicates the simple act of comparison because the perspective skews the relative size and shape of the slices, making slices on the bottom appear larger and more salient than similarly sized slices on the top.

- Makes it easy to see the ranked order of values? No. Even though the slices are displayed in ranked order from the highest value (heart disease) at the top and continuing clockwise to the smallest, excluding the final "All other causes" slice, this ranking isn't obvious, because it's difficult to compare the slices. For example, the red cancer slice appears to be larger than the blue heart disease slice due to the 3-D effect, which has given it more visual weight. Effects such as the 3-D rendering of this pie chart are sometimes used to intentionally mislead.

• Makes obvious how people should use the information? Partially. Although the pie chart succeeds in encouraging people to compare the slices to understand the relative contributions of each part to the whole, it fails to support this operation effectively.
Given the ways in which this pie chart has failed to match human perception, let's consider an alternative form of display. The following bar graph displays the same set of values, but in a way that can be more readily perceived.

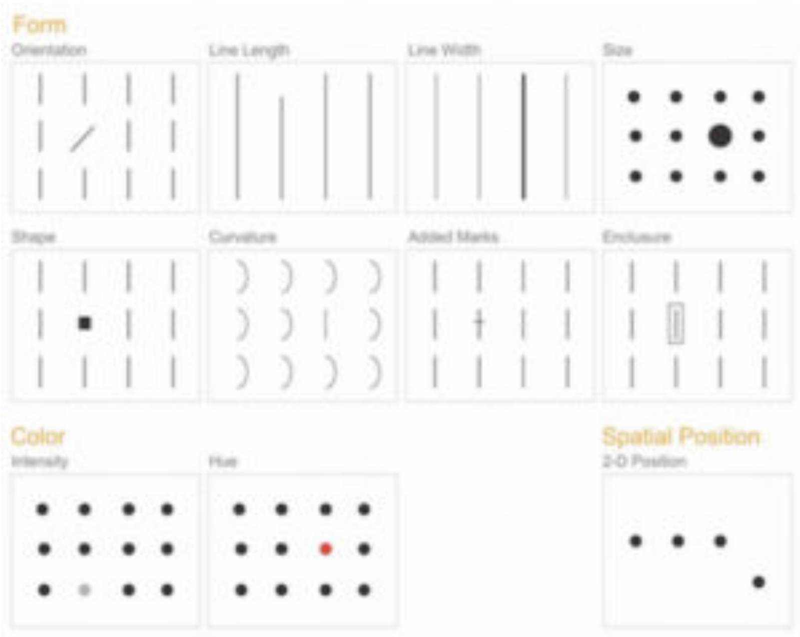


Gestalt school of psychology

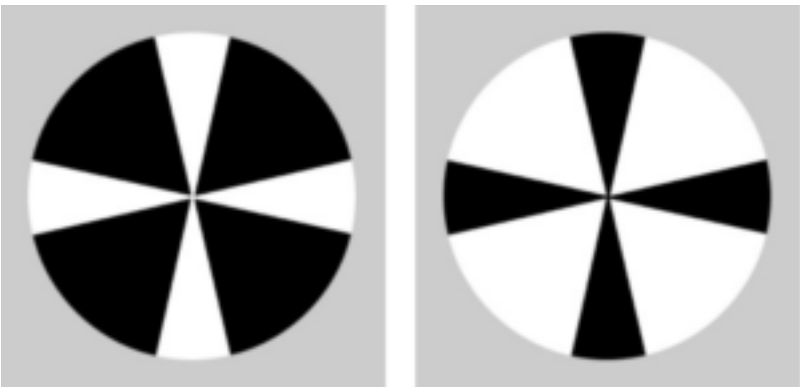
Gestalt school of psychology founded in 1912 formulated Gestalt laws
• “The whole is greater than the sum of parts” (Koffka 1935)

• Laws still useful today, but not the neural mechanisms proposed • Perception: An introduction to the Gestalt-theorie (Kurt Koffka, 1922): http://psychclassics.yorku.ca/Koffka/ Perception/ perception.htm

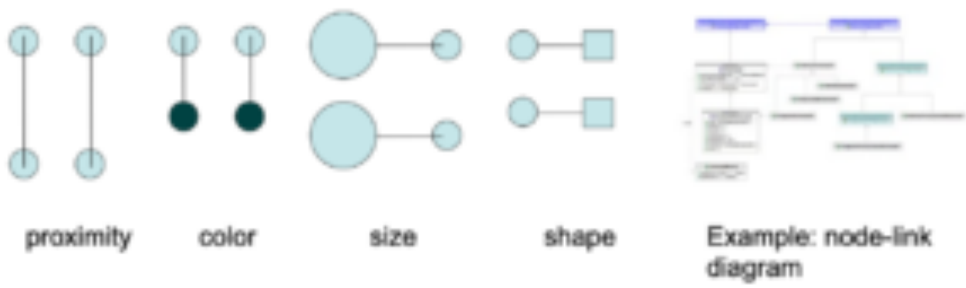
Visual Perception Elements, Techniques & Additives



• (Tapping the Power of Visual Perception, 2004, Stephen Few)



• Smaller components of a pattern tend to be perceived as an object



Psychology: Attention

Die einfachste Möglichkeit, Reize aus der Informationsflut auszuwählen, ist es, die sensorischen Rezeptoren in eine bestimmte Richtung auszurichten: im Englischen kann man hier die Unterscheidung treffen zwischen den passiven Formen "see" und "hear" und den aktiven Formen "look" und "listen".

Meistens sind es sogenannte Hinweisreize, die unsere Aufmerkssamkeit abrupt woanders hin lenken. Diesen Hinweisreizen stehen die sogenannten Informationsreize gegenüber, die unsere Aufmerksamkeit über unsere Erwartung steuern.

Orientierungsreaktion bzw. Orientierungsreflex

Bei einer plötzlichen Bewegung oder einem lauten Ton werden die Sinnesorgane derart angepasst, dass die Bedeutung des stimulierenden Ereignisses schnellstmöglich erkannt werden kann. Wir richten die Augen und den Kopf in Richtung der lauten Töne oder der plötzlich auftretenden hellen Lichter aus. Das System habituiert allerdings sehr schnell: die Stroboskope in der Disco lösen keine Orientierungsreaktionen aus.

Verdeckte Aufmerksamkeit

Im Unterschied zu offener Aufmerksamkeit findet die verdeckte Aufmerksamkeit ohne sichtbare Änderung von Augen-, Kopf- und Körperhaltung statt. Man schaut z.B. weiterhin gerade aus, beobachtet aber jemanden im Augenwinkel.

Visual Capture

Visuelle Stimuli ziehen generell mehr Aufmerksamkeit auf sich als auditorische! Dieses Phänomen nennt man "visual capture".

In einem Experiment von Yantis & Jonides (1984) hat sich gezeigt, dass das abrupte Erscheinen eines Reizes zu einer schnelleren Verarbeitung führt als langsames Erscheinen.

https://www.psychologie.uni-heidelberg.de/ae/allg/lehre/wct/w/w9_aufmerksamkeit/w920_orientierung.htm

Visual & Auditory Learning Effects

„Our study explored the influence of visual versus auditory learning on recall of a memory test. There were four groups in our study, two of which heard an article, and two of which read an article. All groups were then given a posttest to assess their recall. Two of the four groups took an immediate posttest, and the other two took a delayed posttest 45 minutes after hearing or reading the article. Visual learning outperformed auditory learning in both the immediate post-test condition, as well as in the delayed post-test condition. Overall, our study found that visual learning produced better recall than auditory learning.“

https://scholar.utc.edu/cgi/viewcontent.cgi?article=1171&context=mps

(2009, Visual versus auditory learning and memory recall performance on short-term versus long-term tests, Katie Lindner, Greta Blosser, Kris Cunigan, Milligan College)

Motion Design

Moving Infographics

Findings of Hesham Galal Hassan‘s „Designing Infographics to support teaching complex science subject: A comparison between static and animated Infographics“ (Iowa State University Capstones, Theses and Dissertations Iowa State University, 2016)

„In summary, my findings verify that both formats of the infographic, the animated and the static, were effective in increasing the knowledge and comprehension of the subject for both groups A and B. They do not, however, support my hypothesis, which predicted that the animated format would be more effective than the static format.
Participants in both groups were able to score more correct answers in the post-test questions reaching a higher figure of 68 correct answers out of 120 possible answers after reading or viewing the infographic. Compare this to the pre-test score of only 40 correct answers for both groups out of 120. Thus, infographics have the potential to be helpful in the teaching of the subject with a significant increase in the percentage of correct scores from 33% to 57%.
A possible reason for this could be that the visual explanation and graphics viewed by the participants were really engaging and created both a visual interest and provided compelling data about the subject.“

-https://pdfs.semanticscholar.org/8390/58a6b0229332227f4ffe8e3c859875e71fbf.pdf

Why Are Animated Infographics Still Better Than Static Ones?

Animated Infographics Explain Movements Better

Imagine you need to teach your students the working mechanism of a car engine. You can try presenting the system via a static infographic. In this case, what you can do with a static infographic is dividing the mechanism into steps and elaborating on those steps with a lot of words. You can’t avoid using many words here because the car engine system is complex and you have to explain how each part moves to serve their purposes. Your students have to imagine the movements, read words and listen to you the same time. Chances are they won’t be able to understand how a car engine really works.

This is where animated infographics come in handy because they are the best at depicting movements. Your students can see how the parts of a car engine move like in real life without having to imagine or make assumptions. Human brains are good at detecting movements and remembering them. Therefore, your students will not only understand the lesson but also remember it better.

Animated Infographics Are More Engaging and Viral
People are naturally more attracted to moving objects than static objects. When they see something moving, they will pay attention to it and watch it for at least several minutes to see what is unfolding. Movements make people curious, and that’s why many of us prefer watching movies to reading books. It is the story-telling characteristic of moving images that hold people’s attention, especially young students.

Animated infographics are generally shared more than static ones. People treat animated infographics like videos. And videos’ sharing rate on the Internet is always the highest.

- https://www.flearningstudio.com/animated-infographics-elearning/