When Anna Rosling Rönnlund wanted to represent human social and ethnic diversity, she did not want to rely on national or ethnic stereotypes. She asked photographers in 37 countries to collect images of the lifestyles and everyday possessions of more than 200 families to create Dollar Street, a visual tool which employs photos of everyday life as a type of data, using the images to represent a community’s socioeconomic conditions along a spectrum from poorest to richest.

In her TED talk, Anna said, “Imagine if the world lived along a single street, with the richest households on one end, the poorest on the other – and every door flung open to the public.” She was curious about how to visually represent the diverse lifestyles and daily habits of people around the world. For example in analyzing the astounding variety of “toothbrush” photographs, she displays the different types of toothbrushes used around the world in a sequence from the most humble to the most ostentatious. When we see these photographs, we understand this sequence visually represents the levels of poverty and wealth around the world. For example, in middle-class families each member of the

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Create to Learn

family has an individual toothbrush. Among the poorest people of the world, teeth are cleaned with a finger, using gentle rubbing and a bit of dirt as an abrasive; among the richest people, a personal electronic toothbrush is the norm.¹

Anna works for the Gapminder Foundation, a Swedish organization helping to fight ignorance with the use of facts, statistics, and the creative presentation of data. It investigates what the public knows and doesn’t know about basic global patterns and macro-trends. Through this, Anna’s father, Hans Rosling, founder of Gapminder, aims to reduce global ignorance. What a challenging and ambitious goal! They use clever ways to visualize data and information, presenting facts in an entertaining way. They believe that people in rich countries have preconceived ideas and outdated concepts about the health and lifestyle of people in less well-off countries. Rosling notes, “Most people understand the world by generalizing personal experiences which are very biased.” Our life experiences shape our world view. And at school, teachers may transmit outdated knowledge about people who live in other countries; in addition, the news media, because it exaggerates unusual events, may underreport slow and graduate changes in economic development around the world. These factors combine to produce systematic bias that affects our ability to really understand what is happening around us.

The communication process that Anna uses by showing examples of toothbrushes around the world is called data reduction, which is an approach to analyzing data by simplifying it in order to determine essential patterns. Data reduction may sound technical but it’s actually a type of storytelling. By representing people’s lifestyles through photographs of their toothbrushes, Anna uses synecdoche (pronounced: si-nect-di-kee), a type of metaphor, letting

![Figure 10.1 Images as data: Toothbrushes around the world. Illustration by Anna Rosling Rönnlund.](https://example.com/toothbrushes.png)
toothbrushes represent or symbolize the larger and more abstract concept of wealth. Synecdoche is a device used in effective communication that involves letting the part stand for the whole.

**Why Infographics Work**

There’s no doubt about it: infographics are eye-catching, engaging, and informative. They are easily shared on social media networks and have grown in popularity in recent times. According to Google Trends, which reports the frequency of keywords, the term, “infographic” became much more common beginning in 2011.

But infographics are not new. Before the rise of Internet culture, infographics were created by graphic designers who worked for the newspaper industry to add interest to dull pages. Even further back, statisticians during the Victorian era used graphs and charts to explain the relationship between variables and represent numerical information visually. The most famous scholar of infographics and data visualization is Edward Tufte, who began teaching journalists about statistics and wrote an influential book, *The Visual Display of Quantitative Information.*

Tufte’s work spawned a generation of graphic designers specializing in the creative and informative display of information.

Infographics are powerful because images are highly effective forms of communication and expression. We have long known that people process words and pictures differently. The concept of *dual coding theory* explains why infographics are effective for informing and persuading. Dual coding refers to the cognitive process involved in comprehending visual and verbal information. These forms are processed somewhat differently in the human mind. With an image, one sees the whole thing all at once; with words, we must move sequentially through a linear arrangement. Researchers still do not fully understand all the cognitive processes at work, but they have discovered that the brain does not differentiate between real-life experiences and still or moving images. We process images as if they were experiences.

Language is processed differently than images. Researchers who conduct eye-tracking studies have found that readers actually read 28 percent of the words on a computer screen. Simply adding color to a page increases readability. For reasons that are probably rooted deep in evolutionary history of the human mind, people find images to be easier to process than listening to or reading words.

Among the many approaches to visualizing data that are possible, graphic designers use dynamic content and comparison/contrast to control people’s attention and aid in their comprehension of numerical data that is presented visually.
Infographics vs. Data Visualization

These terms are sometimes used interchangeably but some important distinctions are worth considering. According to Hjalmar Gislason, founder and CEO of DataMarket, data visualization is the graphical representation of quantifiable data, usually by means of a chart, graph, or map types. Although they can be created by hand, they can also be generated by applying automated methods on top of the data. For example, when using Excel to examine numerical data, you can easily create a pie chart, a bar chart, or a line graph to explore patterns in the data that might be hard to notice only by reviewing the numbers.

An infographic combines one or more data visualizations with some graphics or text to point out relationships, show a process, tell a story, or persuade. To create an infographic, an individual must have a communicative purpose and an intended target audience, applying a creative process with some understanding of the underlying data and its context.

Controlling Attention with Dynamic Content

Infographics and data visualizations can be presented in static or dynamic formats. In a dynamic format, information is presented in ways that change over time or enable people to interact to display data in a particular way. For example, at the Faces of Fracking web site, photojournalist Sarah Craig profiles the people and communities on the front lines of fracking, including those in favor of it and those opposed to it. Fracking, or hydraulic fracturing, is the industrial practice of extracting oil and gas by blasting water, sand, and chemicals at high pressure underground. In one data visualization about fracking in California, created with her colleagues Anna Flagg and Antonio Bruno, as you read the article, a series of interactive animations are revealed that illustrate key ideas using a map that displays various types of data.

The movement on the screen, in the form of a dynamic animation, really underlines the key ideas (Figure 10.2). As you look at a map of greater Los Angeles, home to more than 500 oil and gas wells, you see black dots representing the number of times (477) that high-intensity fracking techniques have been used in the past year. As you read that 72 million pounds of toxins were released as a result of local fracking in 2013 alone, an animated chart displays the increase in toxins over a one-year period. In this way, dynamic data presentations control attention by using the power of interactivity and animation to build a tight connection between verbally presented information, numerical data, and visual representations.
Controlling Attention with Comparison/Contrast

Comparison and contrast is a timeless rhetorical tool to advance an argument, represent ideas, or develop a persuasion message. Nathan Yau, data visualization expert and author of *Visualize This*, used data from Google Maps to compare and contrast the number of bars as compared to the number of grocery stores in the United States. In the legend, shown in Figure 10.3 and reproduced in black and white, colors are used to represent a ratio. When there are more bars than grocery stores in a particular location, that region is colored in brown (to remind us of a beer bottle, perhaps?) When there are more grocery stores than bars, that region is shown in green. Dark brown represents that there are three times more bars than grocery stores. A legend is an essential component of data visualizations because they help us understand how to interpret the visual symbols. In this case, the map’s use of color is the primary way that numerical information (the ratio of bars to grocery stores) is represented.

He discovered that in many parts of Wisconsin, there are three times more bars than grocery stores, as Figure 10.4 clearly reveals. In the southeast, the presence of many bright green dots shows that there are far more grocery stores than bars.

![Figure 10.2](image2.png)

**Figure 10.2** The faces of fracking: Dynamic data visualization.

![Figure 10.3](image3.png)

**Figure 10.3** A legend helps readers interpret the visualization.
Unlike most of the country, Wisconsin has 2.7 times the bars as grocery stores.

Figure 10.4 Ratio of bars to grocery stores in the United States.
stores than bars there. By developing a creative to compare and contrast using ratios, he was able to reveal patterns that offer insight to aspects of American culture and geography.

People’s Engagement with Visualization

People who create infographics as a career often have a background in art and design, media and communication, computer science, or statistics. Many talented designers are highly transparent about their creative processes, offering explanations of how they created various infographics and data visualizations on their blogs or web sites. For example, at the website Flowing Data (www.flowingdata.com) you can see examples of information scientists, statisticians, designers, data scientists, and others who explain their strategies for analyzing and exploring data using visualization techniques.

While we know a lot about the people who create infographics and data visualizations, we know much less about how ordinary people use, interpret, and understand them. Researchers at Seeing Data (www.seeingdata.org) have examined what factors influence why people engage with some visualizations and not others. Researchers have found that the content of a visualization may affect the engagement level and the emotions activated in responding to it. People need a broad range of skills in order to interpret the content of data visualizations, including reading skills, a conceptual understanding of statistics and mathematical concepts, motivation and critical thinking skills. When we interact with a data visualization, we bring our background knowledge, beliefs and interests to the interpretation process.

People tend to find infographics to be more believable when they confirm what is already known. This phenomenon is called the confirmation bias and it’s the tendency to search for, interpret, favor, and recall information that matches our pre-existing beliefs. It’s one of many cognitive biases that shape the way we interpret information. Because it takes time to read and make sense of an infographic, some visualizations can be challenging. Busy people may not be willing to take the time required to interpret a visualization. However, people can have an “aha!” experience when they encounter information in an infographic that contradicts their pre-existing knowledge, especially if it is high in novelty and surprises them in some way.

Can You Trust an Infographic?

People tend to trust data visualizations from a university or think tank more than news sources that are not thought of as “quality” newspapers. Of course, not all infographics are trustworthy. It’s been said that humans process visual
information much faster than verbally presented information. Of course this makes sense. But how much faster?

There’s an infographic online that claims that people process images 60,000 times more quickly than verbal information. But this turns out to be a very good example of how easy it is to lie with infographics. Darren Kuropatwa, an information literacy specialist, tried to trace the origins of this claim. He used advanced search strategies to find the origins of the term and was able to trace the information back to a presentation made by a woman from a college in the Philippines in the late 1990s who did not identify the source of the claim.10

This story reveals the second reason why infographics are so persuasive compared to other media forms. It’s precisely because we don’t generally have the same standards of verification for infographics as we do for other forms of expression and communication. Verification is the term used when the accuracy of information is checked by comparing it with multiple sources.

But even when information on an infographic is true, the visual presentation of it can still be highly misleading. At his web site, a law student, Tyler Vigen, has created some mighty attractive and compelling data visualizations, using publicly available sources to show some crazy patterns. For example, in one chart he shows that since 1999, the amount of US federal government spending on science is closely correlated with the number of suicides by hanging, strangulation, and suffocation. Another chart shows the strong correlation between the number of divorces in the State of Maine and the per capita consumption of margarine.11

How to Make an Infographic in Five Easy Steps

First, study the best infographics in order to gain clarity about your own preferences for the relationship between images, data, and language. You may review examples at the Best Infographics of 2015 and select one that serves as your mentor text. A mentor text is simply an example of a well-constructed form of media (in print, visual, sound, or multimedia form) that informs your own creative work.

Second, review the affordances of a variety of free and low-cost digital tools for creating infographics. Some examples include Infogr.am, Piktochart, and Easel.ly You can also make charts and graphs using Excel or Google Sheets. You can find links to these (and other) digital tools on the Create to Learn web site. Experiment with a couple of different tools first, before deciding which one to use. This will help you see how the platform structures the production process. If you’re looking for advanced tools for visualization, consider exploring Tableau, a platform for analyzing data.

Third, consider what data and information sources you want to visualize in relation to your target audience and your purpose. Today there are many free datasets available from the US government and other fascinating sources.12
People who drowned after falling out of a fishing boat correlates with Marriage rate in Kentucky

Correlation: 95.24% (r = 0.952407)

Figure 10.5 Spurious correlation.
Be sure you can clearly explain how people will encounter your infographic and your expectations for your audience’s behavior. What do you want them to know, think, feel, and do after interpreting it?

Fourth, consider your message content, audience, and purpose as you decide on an appropriate format and structure. Think about how you will attract and hold your viewer’s interest. You may want to create a style sheet for your infographic, where you identify the colors, fonts, and typefaces that you will use to create your project. A style sheet helps you ensure that your infographic is consistent with other related media you might create. For example, if your infographic will be embedded on a web page, you will want the colors and fonts to be consistent. If you are beginner, you might want to use a template to help develop your first infographic. Using a template can be a good way to appreciate the many choices involved in creating an effective message.

In this part of the design process, don’t be afraid to create several different versions of your infographic or data visualization. Professional designers generally create three (or more) versions for a client to review. In the design process, consider the balance between text, images, icons, and white space and the message. Of course, at all times, you will be keeping your message, purpose, and target audience in mind as you select images, graphics, colors, and fonts for your infographic.

Finally, you need to develop a strategy for citing the source of your information and data. By using citations and hyperlinks, you demonstrate the credibility and authority of the information you present. Also make sure to include a legend, title, and explanatory text. It’s generally wise to document the creative process used to create infographics; you may want to keep track of the decisions you made as you work through the discovery of finding the “story” that your data visualization reveals.

Analyzing an Infographic

Figure 10.6 shows a small section of a larger infographic by NeoMam Studios entitled “13 Reasons Why Your Brain Craves Infographics,” which offers a good example of what makes infographics so powerful. The image of an eye with electrical plugs coming out of it (like digital eyelashes perhaps?) has a lot of novelty, because it’s unlikely that you have seen an image exactly like this before. It illustrates the term “visually wired” and the bright red color attracts attention and creates a sense of excitement. As a metaphor for the brain’s predilection to attend to images, this image is effective.

Underneath this image, the sequence of three smaller graphic elements and information builds an argument using a combination of images, numbers, and words. Because of the principle of threes, the series of images looks balanced on the page. The font size gives clues to what’s important: those numbers tell the story.
The source of the information is suggested through the footnote, which adds credibility to the infographic by alluding to the information source without cluttering up the image. The use of mathematical shorthand (ms stands for millisecond) suggests that the creators of this infographic expect their target audience to have basic familiarity with scientific concepts.

The Value of Information

While many people think that data is factual and unbiased, it’s a product of human creativity and therefore inevitably inflected by the point of view of the people who created and collected the data. Gathering data involves selection...
and interpretation, which are subjective processes. Because most people are unaware of how data visualizations are designed, however, they are vulnerable to perceiving them as neutral or unbiased. But recall that since a key principle of media literacy is that all media messages are selective and incomplete, the ability to recognize and critically analyze the constructedness of infographics and data visualizations is more important now than ever.

Undoubtedly, the increase in visual information is occurring because of its overall perceived value in the information marketplace. But because so much information is available for free, many people do not have a good understanding of the scope and scale of the information business or the biases of the data that are embedded in the process of gathering and collecting it.

As a college student, you have access to a wealth of information resources from your college or university library. You may not be aware that the most valuable information lives behind a paywall, a digital fence that is a system designed to monetize online digital information by limiting access to people who have paid for information or have been authorized to use it. For example, if you want access to Nielsen ratings data to write a paper about the rise and fall of the Nickelodeon TV show *iCarly* by looking at the viewership data, you’ll need to attend a university whose library has paid $4000 a year for subscription access. Some university libraries may pay as much as $40000 per year for one scholarly journal on a specialized science topic in fields such as biology, pharmacy, medicine, engineering or law.

Visual information has tremendous value to users. As Figure 10.7 reveals, there has been significant growth over time in the use of visual images in books,
online, and in newspapers. When you compare a high school history textbook that your grandmother used compared to the one you may have used, you'll notice right away the use of graphic design elements: photographs, charts, bulleted lists, and other elements designed to increase novelty and compel viewer attention while simultaneously conveying information.

**Where Does Data Come From?**

The rise of big data has created a data deluge, as Hans Rosling describes it. It's a flood of information, that's for certain. The term *big data* first gained traction in 2013 and it is a term used to describe all the data that is produced by businesses, national, state and local governments, and even by people themselves as part of ordinary life. Data gets produced whenever you get a driver's license or go to the doctor's office. If you get arrested, a whole lot of data is created all through the process of your arrest, sentencing, and trial. When you comment on a YouTube video, your comment can be analyzed and contribute to big data by companies trying to figure out how to better market to you.

Hans Rosling uses data visualization to help people understand the world's problems. Data about local crime, for example, can be presented on a simple chronological list, or it can be mapped to show patterns of crime in various neighborhoods. Data like this is extremely valuable but only if we can interpret and make sense of it. That's why we need statistics and data visualization tools, because they help us “see” the patterns in the data that otherwise would be unavailable.

**The Ethics and the Economics of Information**

Data is a new kind of commodity. That's why some people refer to the idea of *data mining*, where people extract value from data by discovering the patterns that it holds. But the economics of information are still evolving. Who owns the data that you produce through the use of social media?

Researchers and business professionals use the term *passive data* to refer to the information that you produce without much conscious awareness, simply by purchasing, moving through space, and being connected to social media. One kind of data gets created simply as a byproduct of our everyday life with digital media and technology. For example, when you use your smartphone or laptop, of course you throw off data about your location, your relationships, your favorite types of music, your shopping and purchasing decisions, and other online activities. Your browser history which is collected by Google and
other companies, offers a treasure trove of information about how you spend your life online. This information has intrinsic monetary value but it often goes unnoticed by Internet users.

What makes big data different is the way in which information from many different sources, collected at different times and different places, can be combined through algorithmic analysis. Because data can be connected easily now, big data has the potential to change the relationship between businesses, organizations, governments, and individuals.

In 2012, the passive data you created in one single year was valued at about $60, a figure that represents the scale of the data-mining industry, which generated $156 billion in revenue in 2012. With users of the Internet expected to rise to five billion people by 2020 and a corresponding rise in the use of smartphones and devices, the data-mining industry is likely to increase dramatically in the coming years.13

Scholars recognize that these new forms of data require new thinking about ethical considerations, including surveillance as well as individual and group discrimination. It’s also possible that big data will lead to privacy harms, where the aggregation of data leads businesses or governments to make predictions and generalizations about you based on inferences from the coordinated use of multiple datasets. For example, perhaps your geolocation data from your smartphone and your grocery store receipts and your credit card data all lead to the conclusion that you’re consuming a lot of alcohol. If the data looks like you’re en route to becoming an alcoholic, that information might be valuable to a potential employer.

Are you likely to be able to profit from the data that you create? Sadly, individual users have little power in this economic model if they do not understand that the information they provide has value. Internet users can find ways to take control, however. Facebook users can export their personal data — but right now, there’s no retail market available for individual users to sell their data. Some people believe this approach — giving users more control — would reduce people’s fears about privacy violations.

Activity: Create an Infographic Resume

Create an infographic resume that depicts your life history, talents, and work and life experiences. First, identify key data, facts, and information and organize this information chronologically. Then select an online infographic tool, like Visualize.Me, Easel.ly, Infogram or Pictochart. Experiment with different ways to represent your information and create three versions. Post and share the infographic online and get feedback on how your work is interpreted by others.