Leveraging Data Visualization to Communicate Effectively

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Publisher's Note

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Use the left-hand contents menu to navigate, or the green bar at the bottom of the page to page forward and back.

If you have comments, suggestions, or corrections for this textbook, please send them to palsave@palni.edu.

Prologue

This book is devoted to sharing knowledge and scenarios where visualizations can help you better understand data. Humanity generates an estimated 2.5 quintillion bytes per day. To put it in perspective, "2.5 quintillion pennies laid out flat would cover the Earth five times" (Chardent, N., 2023, para 2). Data overload is a growing issue; your ability to leverage technologies like business intelligence and advanced analytical tools is a valuable skill. But where do you start?

Common data visualization techniques are not rocket science, and most organizations have the tools and platforms they need to make data-driven decisions. Essentially, everyone should become a data analyst for their organization.

This textbook introduces students to the principles of effective data visualization with audience comprehension in mind. Readers are introduced to effective chart types and how to select and design visualizations that clearly convey data patterns and trends. Using best practices for labeling, scaling, and annotating visualizations, it provides techniques to effectively communicate information that supports data-driven decisions, transforming data into actionable insights. The textbook also covers common pitfalls and biases in data visualization.

Students will develop skills to evaluate patterns, identify trends, and analyze data. They are guided through hands-on exercises, case studies, and projects to create a variety of visualizations using tools such as Excel, Power Business Intelligence (BI), Ishikawa, SWOT, PESTLE, decision trees, and more. The subsequent visual data are then applied to effectively communicate in various settings with diverse audiences.

Potential Audience for This Textbook

This book is intended for graduate students from a variety of academic backgrounds seeking practical application of data-driven design and decision-making for a *business* setting. Using grounded theory, the textbook addresses ways to leverage data to tell a story effectively and ethically.

Storytelling with data is not an inherent skill, and it is easy to get lost in a plethora of visualization choices. In some cases, students become enamored of technology and lose sight of good design principles, leading to the likelihood that the audience will become disconnected from the story. This textbook teaches a variety of decision-making tools, including ways to visualize data to minimize complexity and maximize audience understanding.

Besides creating dashboards in Excel, this book introduces students to *quick insights* using Power BI to see emerging patterns and trends. Additionally, students will learn to create interactive dashboards and use various techniques to add context. Students will also learn to publish dashboards to multiple audiences through the Power BI app. Students are always amazed when working with a large dataset to discover correlations and outliers that they didn't know existed.

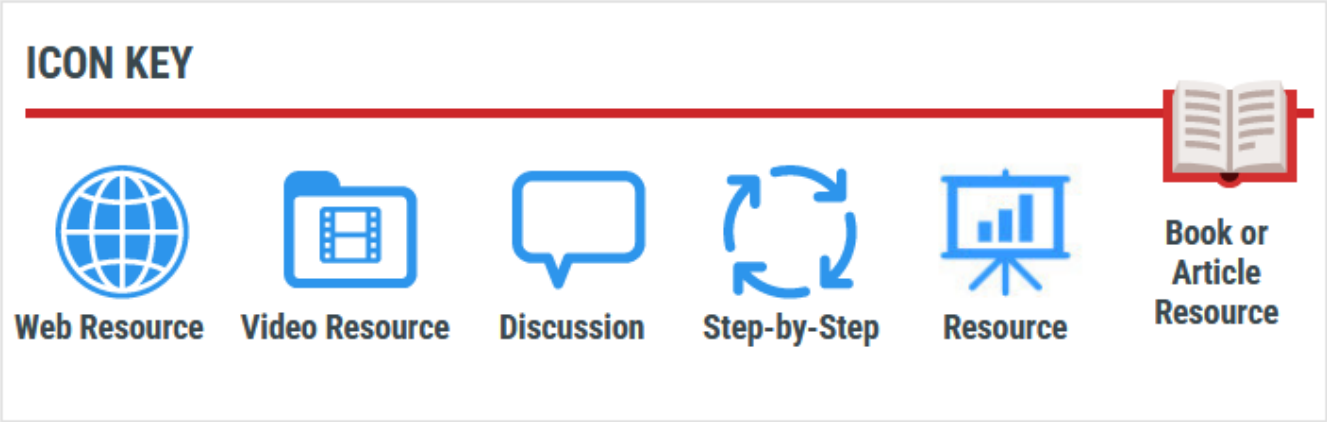
This book was possible because of the Private Academic Library Network of Indiana (PALNI) and the PALSave: PALNI Affordable Learning textbook creation grant. The book, *Leveraging Data Visualization to Communicate Effectively*, uses an icon set throughout to alert students of specific resources, including accompanying data files, YouTube video demonstrations, rich discussions of the "why" behind the visualization, step-by-step instructions (both in text and video), and links to open textbook references.

How to Use This Book

The electronic format of the book is the best format available. All parts of the book are organized using key icons, and

any section can be reviewed in a stand-alone format (in case instructors want to pick and choose components for their courses). Additionally, the end of each chapter contains links to textbook references for further exploration.

THE ICON KEY. The icon key helps the reader quickly identify the types of resources available.



Links associated with icons throughout the textbook will not be repeated in the reference section.

- **Web Resource** icon indicates a resource on the web.
- **Video Resource** icon indicates that there are videos related to the topic that can be found on YouTube or other video platforms. Many of these YouTube videos were developed by the authors.
- **Discussion** icon indicates a rich discussion section that connects the theory to the application.
- **Step-by-Step** icon demonstrates a process to learn a key visualization technique. Some of the step-by-step demonstrations are also shown in YouTube videos.
- **Resource** icon indicates resources that accompany the book and can include presentation files.
- **Book or Article Resource** icon links to books, book chapters, and articles that are open and available as resources.
- **Files** icon indicates Excel, dataset, or PowerPoint files available.

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Writing a book is both challenging and more rewarding than we expected. One person who made this easier was Anne Kolb. Both authors would like to acknowledge Anne Kolb for her editing, her work on the asset tracker, and her gracious suggestions.

1. Communicate Results

Data saturation is everywhere. We've often had the belief that more is better; however, that actually isn't true in the case of data. The rapid rise in our ability to collect data hasn't been matched by our ability to support, filter, and manage data. As an example, think about the first problem that people complain about when a city experiences great growth—the roads are too crowded. The infrastructure can't keep up.

—Sarah Spivey, Forbes 2020 World's Most Influential Chief Marketing Officers

What Do You Think?

Michelle, the CEO of a midsize engineering company, was in another one of those meetings she had grown to dread in the three months she had been running the growing and in-demand firm. Dane, one of her brightest lead engineers, was supposed to be explaining a new product line to the management team. The line would be unveiled in the next few months. Appearing somewhat nervous, Dane had been allotted just 20 minutes on the official meeting agenda but had already spent 15 minutes discussing the project's background. Nearly every decision-maker in the room was already familiar with the need for the project and had been for some time. At 10 minutes in, Michelle, squirming a bit in her seat, knew he would never get to the crucial part that everyone desperately needed to hear. Specifically, the management team needed to understand the functions of the new product line. They also needed to understand the benefits for existing clients and how to market in an organization-wide, all-hands-on-deck capacity.

Michelle, a successful executive who had come up through the sales side, had been handed the reins of the organization after the start-up founders decided to take a step back from the day-to-day operations. The founders, who were also engineers, had been impressed by the powerful way that Michelle had described her vision for the organization over a series of get-to-know-you meetings. Michelle was energetic and succinct and used visionary language that portrayed a vivid story of the company's future. She credited these abilities to her work experience sharing data with clients who appreciate efficiency and effective reporting. This day, Michelle had purposely given Dane, the best engineer on her team, a 20-minute slot. She had already summed up what she thought he needed to do effectively to bring the team up to speed.

Dane struggled through the background information, unaware he was repeating information most decision-makers in the room already knew. The voluminous slide deck he prepared was full of data and excessive bullet points, and each page appeared identical to the next as he droned on and on to the room of important insiders. Michelle, who prided herself on understanding the details of company initiatives and products, found herself struggling to follow along. Her attention drifted off, and other audience members were noticing. She worried about moving Dane along in the presentation, fearing it might aggravate his nervousness and cause the meeting to go further adrift. She also noted that Dane's presentation was reflective of many such presentations that lost their focus in presenting important ideas, relevant data, or discernible takeaways for audiences. As Dane continued, Michelle wondered if there was something different her team could do to be more influential during these important moments. . . .

How does this case relate to your own experiences at work, home, or school? What do you think Dane could have done differently with his pitch? What outcomes or goals should Dane have kept in mind? Who is the audience in this case, and how do you think they felt? Why should Michelle be concerned about the communication of her team? Do you have any suggestions for her moving forward?

Introduction

Michelle's quandary about the missed opportunities for better communication in her organization is not an isolated example. Her situation may have invoked some sympathy from your own experiences and feelings of frustration as you thought through a range of similar struggles. Those struggles may have included memories of a work meeting where communicators never got to the point or a class lecture that contained information that seemed indecipherable. It may have also included a close friend or loved one who aimlessly guided their half of a conversation to everywhere except a finish.

The failure of presenters to share important information seems almost like a rite of passage in many leadership tenures and organizational cultures. Failure to reach an audience in these situations seems almost the rule instead of the exception. As a result, the need for a speaker to reach an audience is more important than ever, particularly when the goal of their message is to gain buy-in, to reach a decision, or for action to be taken on the part of the audience members.

This text provides readers with tools to communicate their ideas and data clearly. Clarity is key to connecting audience members to important information. Throughout this text, you will see additional resources and learning objectives to guide the journey. While not everything can be learned in this text (applied practice is needed), the information will provide a solid foundation for readers to discover tools that work for them and that reach their intended audience. To that end, the following chapter unpacks essential communication models on which the following processes are based, accompanied by discussions surrounding audience analysis. This chapter then turns to the powerful use of persuasion and storytelling to deliver our messages.

Chapter 1 addresses the following learning objectives.

Learning Objectives

At the end of this chapter, students should be able to:

1. LO 1: Identify communication models that predict connection and identification between speaker and audience.
2. LO 2: Describe the various aspects of audience perception and of speaker and message, and conduct key analysis before creating or delivering a presentation.
3. LO 3: Flex between direct and indirect persuasion models to deliver influential communication.
4. LO 4: Listen critically to identify powerful narratives and use effective storytelling to frame meaningful messages.

Key Terms: channel, context, direct and indirect persuasion, environment, feedback, message, narratives, presentation software, sender, source, storytelling

Download Chapter 1 PowerPoint (20 MB).

1.1 Communication Models and Management of Information

> It is the responsibility of the sender to make sure the receiver understands the message.
> —Joseph D. Batten, leadership scholar

Considering the Complexity of Communication in a Busy Sender-Receiver World

Source: Group of signs image generated by Google Gemini—Public Domain

Too often in our communication experiences, we find ourselves overwhelmed with information as we struggle to assign meaning to the plethora of messages we are receiving. As our opening case already displayed, these moments can incite a flurry of emotions and confusion. Those familiar with travel or navigation can appreciate the feeling of being in "uncharted waters" despite having a clear travel plan or destination.

In such moments it is easy to miss important parts of the message necessary for understanding. Think through your personal experience in situations where others are sending you messages. You may spend a lot of time trying to determine the actual message you are receiving. You might also wonder about the messenger—their motives and how you fit into the messenger's plans. Additionally, you may spend time thinking about a potential response and how others will process your response. Those moments may feel confusing, and we may find ourselves with more questions than answers . . . and a strong desire to put off any decision at all. Many audience members are reluctant to voice their confusion out of fear of embarrassment—their own or the speaker's.

The Communication Process as an Ongoing Play Between Sender and Receiver

In situations like this, it's common to feel responsible for our failure to understand. However, it's essential to recognize that understanding is a joint responsibility between the messenger and the recipient. The way the message is conveyed plays a critical role. Assumptions about the recipient's knowledge, vocabulary and terminology, or bias can hinder effective communication. As authors, we view communication as a multifaceted and dynamic process that occurs between individuals within their environment and amid the context of their circumstances. Imagine communication as a complex theater performance—a play unfolding between two people.

The Communication Process: A Play by Mitchell and Deckard

The play starts with a **sender**, a coequal actor in our play and otherwise known as an individual seeking to impart information to the **receiver**. The sender and receiver approach each other with their own unique culture, experiences (pro-

fessional and personal), perceptions, biases, and knowledge. We can call those background considerations **context**. Both the sender and receiver may be aware of, indifferent to, or oblivious to the differences between themselves and others. Together, sender and receiver operate on a **channel** of communication that includes a plethora of tools that can be issued verbally or conveyed nonverbally through facial or body language, written word, or items they produce. As you can see, there are a great deal of factors present for every communicator as they convey their **message**, which ideally is the information they seek to impart to their coequal actor on this proverbial stage.

While we all enjoy a play with a happy ending, this acting is a bit more complex. It includes some other details that we must first decipher. First, returning to those concepts of verbal and nonverbal, we must consider the reactions that the sender and receiver give each other during this communication process. We call those reactions **feedback**, and it includes words, facial expressions, and body language expressed by either party while processing the message. Feedback can be abundantly clear or very subtle, with the potential for both characteristics to occur within seconds of each other during our communication play. We also must consider another concept, **noise**, as it becomes an important element of the communication process and is prominent in our play. Noise refers to anything in the context, channel, or message that delays, disrupts, distracts, or prevents the otherwise normal flow of communication. Noise can be caused by anything, whether we notice it or not.

By the way, the ongoing communication doesn't necessarily follow a script; it's an infinite play. Achieving success in this communication play can be hindered by many distractions. What is the audience noticing? Let's revise the concept of "noise" within our play. Imagine the receiver of the message arriving at a 9 a.m. meeting after a difficult and distressing morning. Upon arriving at work, they are bombarded by four hot-button problems requiring immediate resolution. Simultaneously, their office mates and email inboxes demand attention. To add to the stress, they skipped breakfast due to a family matter that couldn't wait until after work. And guess what? That same urgent matter will likely require additional attention during their nonexistent lunch break. All these profound factors contribute to the noise that disrupts communication between sender and receiver in our play. Sometimes, the noise is barely discernible to the sender, or perhaps the sender faces similar challenges while trying to convey their message through the channel.

Introducing the Credible Speaker and Ethos, Pathos, and Logos

Note: Author Photograph

The factors that make communication complex also highlight the need for practitioners to consider their messages for audience-centeredness, clarity, and organization. Aristotle, a Greek philosopher and scholar, encouraged a combination of ethos, pathos, and logos. He contended that the well-rounded speaker could reach audiences in highly effective ways via these three appeals. **Ethos** refers to the credible speaker—their experiences and character as the reputation that audience members come to know and trust. **Pathos** considers the emotion a speaker conveys in their words and, more importantly, how those feelings are considered by audience members. **Logos** describes the logic or reasoning through evidence that a speaker utilizes to reach their audience. Logos can be the very structure of an argument, or it can consider the best types of evidence to use with a particular audience. Together, these three appeals act as strong pillars that support the speaker, their connection with the audience, and their argument.

Ethos, Pathos, and Logos. You can learn more about the use of ethos, pathos, and logos from this video produced by the Texas A&M Writing Center. Tamu Writing Center. (2020, Jun 12). *Ethos, Pathos & Logos*. [Video]. YouTube.

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Aristotle: A Complete Overview of His Life, Work, and Philosophy. Aristotle's life and work extend into a wide swath of learning and philosophy. This article by Viktoriya Sus for the *Collector*, which produces daily articles on ancient history, philosophy, art, and artists by leading authors, explores this influential thinker. Sus, V. (2023, May 16). Aristotle: A Complete Overview of His Life, Work, and Philosophy. The Collector. https://www.thecollector.com/aristotle-life-works-philosophy/

1.1 Exercise 1: Identify Ethos, Pathos, and Logos in an Appeal

Learning Objective #1—Identify communication models that predict connection and identification between speaker and audience

Consider the last request you heard. Think back through the last 24 hours of your day and the last time someone asked you to consider something or do something of significance. What evidence of ethos, pathos, and logos did you hear in their appeal? Do you think the sender of the message intended their appeal to have those aspects? How do you think they specified their appeal to you as an audience member?

Communication Models That Decipher the Complex Communication Process

If you sense that this text on data visualization and storytelling leans heavily toward audience focus, trust your senses. Effective communication, where sender and receiver manage to relay the desired message despite the distraction of noise, must start by considering the audience before creating the message. This consideration should occur even in the split seconds available in the bustle of life. That said, regarding communication, an audience-centered approach has not always been the case despite Aristotle's advice on ethos, pathos, and logos.

As communication models from the last century illustrate, we've only recently begun to fully consider the complex interplay of sender and receiver. The **Linear Model**, offered by Sharron and Weaver (1949) relied solely on the messenger for analysis. Osgood and Schramm's **Interactive Model**, offered in 1950, considered the receiver of the message but did not fully capture the nuance of verbal and nonverbal communication in a busy model. Both the Linear and Interactive Models reflect times in society where speakers, rather than audience, had the most agency in communicating widely. The **Transactional Model**, introduced by Barnlund in 1970, recognized the subtlety of complex interactions where sender and receiver continuously decipher each other's language. It also accounts for the constant presence of nonverbals including facial expressions and body language within the context, field of experiences, and relational dimensions present in the sender and receiver exchange. Table 1.1 provides a summary of these models.

Table 1.1: The Evolution of Communication Models in the Last Century

Model	Description	Characteristics
Linear Model (1949) (Shannon and Weaver)	The sender is central; communication flows one way from sender to receiver. Model heads one way, regardless of audience, audience perception, or audience reaction.	Sender-centric One-way flow Simplicity
Interactive Model (1954) (Osgood and Schramm)	Acknowledges the receiver but lacks depth in understanding verbal and nonverbal cues. Communication is almost like synchronized, sequential dance moves with one participant being studied at a time.	Sender and receiver interaction Verbal and nonverbal nuances Busy model
Transactional Model (1970) (Barnlund)	Recognizes dynamic interplay between sender and receiver. This model allows for a complete and nearly infinite process where sender and receiver of communication continuously evaluate verbal and nonverbals of each other.	Mutual influence Continuous deciphering Nonverbals matter (facial expressions, body language, context)

Explore the Transactional Model on your own through the link found in the following resource. Communication coach Alexander Lyon shares a good introduction to better understand the communication process and learn more about the Transactional Model. As you consider the video, think about the relational dimensions and fields of experience in your regular communication at home, school, or work. Lyon, A. (2017, Sep 4). *Transactional Model of Communication*. Communication Coach. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-2

Step-by-Step Instructions for Considering the Transactional Model of Communication

Keep the following in mind while receiving messages to ensure you capture all the information being communicated intentionally and unintentionally:

1. **Observe:** Note how the sender enters the conversation. What was their body language before communicating? What nonverbals were displayed during their message, after they were done, and while you were responding? Be aware of the context, field of experiences, and relational dimensions present in this channel.

2. **Listen:** What is the person saying? How are they saying it? What do they intend for you to hear?
3. **Confirm:** As needed, confirm the message you believe you are receiving to get greater clarification and, in some cases, to validate what they are telling you. Remember: Your own nonverbals such as nodding and looking intently show signs of interest.
4. **Note:** Is there information they are not sharing? Do you need further information before responding? Before asking, it may be good to ask if they are open to your questions.
5. **Respond:** Once satisfied with your understanding of what they are saying and after gaining additional information, if necessary, is it important to respond immediately? While responding, observe nonverbals and listen for affirmation or questions they may have for you.

Please note this process may happen quickly, interchangeably, and with several layers of sender and receiver feedback.

Before turning away from the transactional communication model, it is important to note that all communication, including the complex deciphering of the sender and receiver process, can be overwhelming and not perfect. All communicators need to give themselves permission to unpack these experiences through trial-and-error learning.

Exploring Cognitive Overload and the Buffet Effect

Christoper Schimming at the Mayo Clinic (2022) formally identifies "noise" as information overload. They indicate the phenomenon, which they call **cognitive overload**, occurs when the brain has too much information to process. Cognitive overload can be overwhelming to the individual experiencing the phenomenon. It can also lead to a point of paralysis where the receiver chooses not to do anything, incapable of deciphering or acting upon the information received. The situation is compounded if the person is relied upon to make a judgment based on the information. It is easy for both parties to become frustrated. This condition is exacerbated by constant sources of data and information through television or streaming shows, movies, social media, and the internet, to name a few. As teachers, your authors have even noticed that our lectures and exercises compete with iPhone text messages and emails. It's important to fully understand the symptomatic reactions to cognitive overload and their effects as detailed in Table 1.2.

Table 1.2: Reactions to Cognitive Overload With Explanations

Reactions to Cognitive Overload	Reaction Explained
Paralysis	You are unable to deal with the topic or information because it appears more complex than manageable.
Anger	If information is not consistent with what you know or feel, you may get angry as your beliefs, knowledge, or experiences get challenged. Repeated efforts to address an issue with this information may make it worse.
Passivity	You decide to go along because forming an opinion on the topic may be too overwhelming.
Understanding	You may process information by relying on the knowledge or input of others who are more trusted. You may also rely on your trusted ways of learning to slowly gain the knowledge you need to arrive at an opinion or a decision.

Finally, when considering cognitive overload, we should also consider that many senders have arrived equipped with information-heavy messages filled with data, graphs, and exuberant amounts of PowerPoint slides due to what we call the **Buffet Effect**. If you have ever enjoyed the plentiful choices of an elaborate buffet, you know that at the onset, the choices seem irresistible and delicious. However, those of us who decided to try many (or even all those choices) know it is impossible to do so without feeling the aftereffects of our choices. In such a moment, the food once considered for its nutrition and sustenance has instead become something that causes indigestion, sleepiness, or lethargy. Simply put, we don't need all those buffet choices. Instead, we need food items that will give us the requisite calories, energy, and ability to conquer our day.

Source: Veggie Buffet by takoradee—CC BY-SA

Applying the Buffet Effect to communication, senders preparing their messages may have adopted a similar approach as the restaurant owners hosting a lavish buffet, although with less appeal for the receivers. Instead of making strategic choices about evidence to support their claims, senders may have decided to add a bit of everything to their argument. They may include elements of excessive background along with undecipherable and endless graphs and statistics. If given 15 minutes to talk, they may have used every minute and still not gotten their information across. We can easily see how the Buffet Effect, reinforced by access to information, can lead to cognitive overload.

1.1 Exercise 2: Monitoring the Buffet Effect in Communication Experiences

Learning Objective #2—Describe the various aspects of audience perception and of speaker and message, and conduct key analysis before creating or delivering a presentation

Consider a time when the Buffet Effect happened in your own communication experience. You can consider this cognitive overload from the point of the sender or receiver. How did you feel during this experience? Was this feeling the sender's intention?

The Use of Figurative Language

You've probably noticed we use *figurative language* in this text. As two teachers authoring a text on data visualization and storytelling, this was intentional. A term like Buffet Effect, a metaphor for how cognitive overload can affect messages, is an example of figurative language. As communicators and teachers, we see this as a valuable resource. Beyond metaphor, we can include simile, personification, and hyperbole as powerful language tools.

Source: Forward Arrow Road Sign by George Hodan—Public Domain

To learn more about how to power up your audience-centered language, check out DifferenceBetween.com, where expert authors tackle a variety of subjects.Sethmini. (2021, June 18). Difference Between Simile Metaphor Personification and Hyperbole. https://www.differencebetween.com/difference-between-simile-metaphor-personification-and-hyperbole/

Before turning away from the Buffet Effect, it's important to note that practices that offer too much information can be the exception instead of the rule. In this text, we will talk about different types of evidence, tools, tips, and best practices to effectively reach your audience. The remainder of this chapter will explore strong persuasive tips and storytelling to frame the reasoning behind the message. Before doing that, however, let's turn next to audience analysis.

1.1 Self-Assessment: Buffet Effect

Learning Objective #1—Identify communication models that predict connection and identification between speaker and audience

Look at your calendar for the last three days. Make a list of all the meetings you had and think about the communication in those meetings. Particularly consider the appeals and requests from senders and receivers. Place an × next to those meetings where the cognitive overload or Buffet Effect was evident. If the Buffet Effect was not present, place a + next to the meeting. Then for each × and + meeting, describe the following information.

For × meetings, what went wrong? What did you not understand? What should the sender have done differently?

For + meetings, what went well? What was the sender asking of you? What did the sender do to be so effective?

1.2 Exploring and Unpacking Audience Perceptions

It all starts with being curious and humble: putting yourself in the shoes of your audience.
—Samara Johansson, strategic marketing specialist

Managing Fear Among Unknown Audience Members

Source: Batsheva theater crowd in Tel Aviv by David Shankbone—CC BY-SA

In this section we explore the audience and how to gain information about them. The audience can often be the most fearful aspect of our communication experience. After all, most of the appeals we make as senders involve leaving the decision-making strictly in their hands. While most of us have a fear of the unknown, we often have a greater fear of how an audience will react to anything we are offering. We might ask: Will they like me? Am I dressed appropriately? What do they know about the subject I am discussing? Will they accept the information I provide? Will someone ask a hard question? Of course, it is perfectly human for every communicator to face dwindling confidence levels and feel a tinge of panic by simply considering these questions.

This fear of public speaking may include fear of being seen as nervous, anxiety about panic setting in, toxic perfectionism, and terror at the thought of going forth on your own. It could also include defensive thinking and behavior, detachment from thoughts and feelings, and even rationalizing a career or class change to justify not speaking in public (SocialAnxiety.com, 2021).

Fear of public speaking can happen to anyone when not managed. A notorious incident took place when Michael Bay, a successful movie producer and director, left the stage at a Samsung product rollout after a teleprompter failed. You can watch the video and consider what went wrong, how you might have reacted in that same situation, and obvious details that Michael missed in the flurry of the moment. How could this difficult experience have been different?

CNET. (2014, Jan. 6). *Michael Bay quits Samsung's press conference.* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-3

Regaining Confidence Through an Affirming Set of Guides

Many individuals walk into communication experiences with a variety of baggage. After years of working with students who were struggling with confidence, we came up with four recommendations to help communicators. Many of those students were overwhelmed by anxiety, which never permitted them to consider their audiences. We hope this confidence-affirming guide as shown in Figure 1.1 helps you too as you prepare for audience analysis.

Figure 1.1—Every Communicator's Guide to Better Confidence

Note: Author Illustration (2024)

To get practice speaking in front of others, consider visiting a Toastmasters International Club. Toastmasters is an organization that helps individuals develop communication skills and overcome public speaking anxiety through a variety of tools and techniques in a safe learning environment. To find a club, visit https://www.toastmasters.org/Find-a-Club/.

Step-by-Step Instructions to Take Inventory of Your Assets

A healthy way to see the tremendous gifts you bring to any organization or moment is to look exhaustively at the various things you've accomplished. Use this exercise to develop those skills by which you can teach others and share with audiences.

List 3 examples of experiences you have in the following categories:

1. **Work (professional):** Just as it sounds. What work activities bring you to this moment?
2. **Work (formative):** These jobs may not be your current professional trajectory, but they made you who you are as you were developing into the professional you've become.
3. **Education:** Which key learning experiences played a role in your development?
4. **Home internship:** Think through the roles in the family business, chores, duties, or other activities.
5. **Training:** Beyond education or experience, did you have specific training that equipped you for what you presently do?
6. **The good:** Think about the other things that have happened to you, personally or professionally, that were positive.
7. **The bad (and ugly):** These were negative at the time, but they are now part of your story, and you learned from them.
8. **I can . . . !** It could be a hobby, trait, skill, or interest you have that is awesome. When you do it, you do it well.

Beyond Fear: Learning About Different Types of Audience Members

Let's explore some special considerations regarding audience types. We all walk into a situation with life experiences that guide us, inform our cultural experiences and judgments, and assist us as we meet new people and make sense of those meetings. Rhetorical scholar Kenneth Burke termed such moments and judgments, particularly as they engage our persuasive processes, as **identification**. Identification is the way that communicators relate with each other based on background, differences, tone, speaking styles, and so on. While this identification might sound like individuals will only relate to those who have similar experiences, this is just a starting point. As we meet more people and learn of their differences, our identification bubble expands through common ground.

Unpacking Kenneth Burke's theory on identification can take some time, but this resource can help. The process also requires self-awareness of our own characteristics and identities. Once we become more aware, we can find common ground with our audiences and will be in better shape as communicators.Writing with Andrew. (2021, Oct 4). *Finding Common Ground With Identification* | Kenneth Burke's Rhetoric of Motives. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-4

A key part of that identification process is recognizing the differences inherent in all audiences. Specifically, we must consider the audience's demographic and psychographic aspects. According to Land et al. (2020), **demographics** consist of the characteristics of a population. **Psychographics** consist of a buyer's habits, hobbies, spending habits, and values. Both demographics and psychographics are key to our preparation and can be predictive of an audience member's openness to our message. That said, it is imperative to remember that audiences vary despite common characteristics. Approaching all groups as if they are the same can lead to unfair biases that may be off-putting to audience members. While keeping in mind demographics, psychographics, and maintaining flexibility in our approaches, let's list key aspects of each, as shown in Table 1.3.

Table 1.3: Demographic and Psychographic Aspects

Demographics	Psychographics
✓Age	✓Values and Beliefs
✓Gender	✓Attitudes
✓Economic Background	✓Political Affiliation
✓Ethnicity	✓Interests
✓Location	✓Personality Traits
✓Education	✓Lifestyle

Learn more about demographics and psychographics in this quick video. As you listen to John Fallon, note how diverse and expansive your audiences can be while considering these aspects.Fallon, J. (2012, Aug 3). Audience Demographics and Psychographics. [Video]. YouTube.

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1.2 Exercise 1: Explore Demographics and Psychographics of Audience Members

Learning Objective #2—Describe the various aspects of audience perception, of speaker and message, and conduct key analysis before creating or delivering a presentation

Consider the list of demographics and psychographics. What are some of the ways that communicators reach you via these important and powerful categories? What are things they ignore? Document both and draft out the following alongside each identified demographic and psychographic miss: What opportunities were lost, what appeal could have been added, and what are the repercussions of the miss?

Diversity and Bias

As you may be starting to understand via this chapter and through your own experiences, audiences are all different, and in any consideration, this is a wonderful thing. As a popular colleague of ours often says, "different" does not mean deficient—it just means different. Recognizing **diversity**, otherwise known as our differences among various demographic and psychographic traits, can be powerful for communicators. Even more impactful is when we assemble and recognize diverse teams or unite them through the communication we offer. In fact, Forbes (2021) indicated that simply boosting diversity in our workplaces can increase creativity and innovation, create greater organizational opportunities for professionals, and lead to better overall decision-making.

We also must recognize the bias that influences our perspectives, practices, and resulting modes of communication. **Bias** is a prejudice in favor of or against one thing, person, or group compared to another, usually in a way that can impair or eliminate fairness. For instance, as midwestern university authors working at global institutions, we are likely to have differing perceptions from the global gathering of students and faculty we regularly meet. This can include our concept of time, customs such as greetings, or how we build trust.

The important first step in confronting bias is recognizing that we all have certain predilections that favor certain cultural experiences. If that bias remains unchecked, it can be detrimental to how we connect and communicate with others. In Chapter 8, we will explore to a greater extent how we communicate across gaps to reach diverse audiences, including those of different genders, cultures, and generational demographics.

In the meantime, keep reflecting on the fact that bias is real, and account for it. Often the term *bias* raises concerns for individuals. That said, by considering how bias (e.g., our natural experiences or cultural backgrounds) may influence our communication, we prepare for healthy audience interactions.

In this section we discussed bias that can account for an individual's perception, but there is also research bias. The University of Wisconsin–Green Bay Libraries produced a great online resource to get you thinking about research bias. Check it out and see why bias is such a problem in our communication and research, as it undermines our arguments, research, and work when left unchecked. University of Wisconsin–Green Bay Libraries—Research Guides. (2024, Jan 16). Identifying Bias. https://library.uwgb.edu/bias

Conducting Audience Analysis Toward Successful Communication

Now that we have accounted for bias while considering the demographics and psychographics of diverse audiences, let's determine how to move forward with our messages. Peter Cardon (2021), an expert on effective business communication, wrote about key components for audience analysis. First, as communicators looking to have influence, we should identify any **benefits** our message contains for audience members. Similarly, we also must recognize any **constraints** posed by our communication within the existing system structure. The term **system structure** refers to the overall organization and interconnections within a communication system. It includes how different components interact and influence the flow of information. A good example of a constraint is the limitation on the number of characters when writing a tweet.

Next, what are the recipients' **values** and **priorities**? These key determiners help us fiercely home in on our audience. After values and priorities are analyzed, we should review our own **credibility** on the subject. Remember, we often undersell our abilities, experience, and knowledge in this area, and this can be a core mistake of an otherwise strong message. We should also estimate and **anticipate audience reactions** to our message. Remember that communication is an imprecise tool; however, anticipating a response that has not yet been received can lead to a better understanding of your audience. Finally, we should simultaneously keep **secondary audiences** in mind as we prepare our message. Secondary audiences may not be the front line for our message, but they certainly factor into how decisions are made at multiple levels.

Now that you know the initial planning steps for your message, how often have you used audience analysis in your current strategy? It is common for many communicators to do one or more of these steps. It is also common that many otherwise highly skilled and talented individuals do none. How do you think their communication improves by performing this analysis?

Custom-tailoring your public speaking. Communication coach Alexander Lyon discusses tips for prioritizing the audience and why.Lyon, A. (2022, Feb 14). *How to Analyze an Audience for Public Speaking. Communication Coach Alexander Lyon.* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-6

Beyond the audience analysis, there are specific steps to ensure our message resonates with our audience. Rather than relying on guesswork, we can directly investigate opinions. Consider any one or more of the steps in Exhibit 1.1 for potential audience analysis tools.

Exhibit 1.1—Potential Tools for Audience Analysis

✓What information is readily available? Find out via

- internet
- social media accounts

- current audience members you know and trust who will be most effective

✓**If applicable, ask the organizer.**

- What does the group want to know?
- What is the physical setup where you'll be communicating and expectations?
- If appropriate, where has past communication gone wrong?
- Are there other organizational culture components that are important to them?

✓**Survey the crowd.**

- What do they know?
- What would they like to know?
- What do they expect to know when you are done?

✓**Utilize a focus group.**

- Create or survey a similar demographic or psychographic group.
- If the information is case-sensitive, try some broad ideas.
- Consider this formally and informally to scale.

Audience analysis can be a complicated endeavor. As always, no one may do it identically or perfectly for every situation. That said, diligence in seeking information about your audience, as well as their interests, can be highly beneficial to a communicator. Managing our confidence, accounting for audience diversity, and recognizing bias, maximizes your preparation skills.

1.2 Self-Assessment: Audience Analysis

Learning Objective #2—Describe the various aspects of audience perception and of speaker and message, and conduct key analysis before creating or delivering a presentation

Applying what you know, identify opportunities for improvement in the following scenario: Kyla arrived where she was giving a presentation. She had made sure to arrive early, not knowing anything about the audience and wanting to get a look five minutes before she was due to talk to the community group. As she looked around, she noticed that the location was not a building but rather a park. Would this space accommodate her 30-slide PowerPoint deck or have the technology needed to view the slides? She nervously approached the group and saw an overwhelming number of senior audience members gathering in the shelter house. Kyla, a community activist, had been arguing for months that Congress should lower social security payouts to balance the budget. Now she wondered if that subject was appropriate for this audience. . . .

1.3 Powerful and Influential Presentations

Words have power.
—Seanan McGuire, author

Seeing the Infiniteness of Sources for Our Persuasive Influence

Anytime you observe the word *influence*, we encourage you to consider the word *persuasion*. **Influence** is the capacity to affect the character, development, or behavior of someone or something, or the effect itself. *When we use influence, we persuade.* The definition of **persuasion** points to the process in which one or more persons try to influence another person or group's behaviors. Some teaching scholars make the argument that both influence and persuasion can be separated from other forms of communication that may take on more objective natures void of subjectivity. While we appreciate the sentiment, we would point out that selecting objective communication involves subjectivity that suggests influence and persuasion.

Note: Author Photograph

Textbooks, including this one, are arranged by decisions about what information to include/exclude and how it should be portrayed. In our classrooms, our campuses have made very subjective decisions about what a higher education classroom should look like, just as teachers and students alike have decided how best to appear, dress, and be present in such an environment. On the way to the classroom, we are bombarded by persuasion in advertisements, podcasts, and social media feeds that portray a life those posting wish it to be displayed. Everything, as it turns out, knowingly and unknowingly, has some element of persuasion. With this notion in mind, we should seek to make our influence impactful, dynamic, and with the most efficient communication possible. In the following section, we will discuss potential structures to format influential, persuasive, and audience-centered presentations. We will also discuss learning tools for that process, including presentation software to augment our argument.

1.3 Exercise 1: Identifying Persuasion in Our Everyday Life

Learning Objective #3—Flex between direct and indirect persuasion models to deliver influential communication

Be mindful of the persuasion in your life. We defined persuasion in the opening of Section 1.3. With that in mind, list the top 10 things that have persuaded you in the last 24 hours. What made your list? What does that reveal about you as an audience member? Was that persuasion effective? Was there anything you now recognize as subtle persuasion?

Leading to Direct and Indirect Persuasion

We discussed ethos, pathos, and logos at the start of our chapter. Ethos refers to the credible speaker while pathos refers to the important emotional connection between sender and receiver in the communication process. Logos, which consists of the evidence we assemble to support our argument, also includes the way we construct that message. Constructing a message effectively speaks to the very influence and persuasion we referred to in this chapter.

Ethos, pathos, and logos become powerful tools to account for in an argument. However, for a communicator, it is important to note that simply including elements of those three is not necessarily the most effective way to reach an audience. Communicators should also understand the varying degrees ethos, pathos, and logos can be used depending on the audience. For instance, how we present our ethos (credibility) will be different depending on the receiver. Our pathos (emotional connection) may center on shared values in a professional setting whereas personal pathos might center on family bonds. Certain groups, such as cultures that value relationships and trust in decision-making, may not be as receptive to evidence at the onset of a presentation before establishing a relationship.

In the case of transactional communication, flexibility is key to prioritizing the audience. Some audiences need a direct approach when asked to act. **Direct persuasive approaches**, where the solution or answer is upfront, are often effective in the United States with audiences that are familiar with U.S. business culture. Other audiences, such as those in Chinese organizations, may find direct approaches to be off-putting and unsettling. Such audiences will likely prefer **indirect persuasive approaches** that reflect their processes (e.g., learning background, time to consider potential solutions, followed by determining logical next steps).

We will talk more about audience and cultural differences in Chapter 8. For now, let's examine direct and indirect approaches to persuasion to gain familiarity with two powerful techniques. As always, keep in mind that no uniform method is a sure bet for all audiences. Instead, take these tools and determine the best way to craft your communication.

Direct Persuasion in Action With Busy Deciders

Direct persuasive approaches work well when audience members want their answers up front. We often call these audience members **deciders**. These leaders may fully understand the problem and the solution but have not yet committed to a specific change.

Business scholar Barbara Minto (2021) developed a way to reach such deciders in a highly effective way while training new sales associates; she called it the **Pyramid Principle**. Its adaptation, naming, and usage have been commonplace in business communication. The process involves an introduction of the problem called the Situation, Complication, Question, and Answer, or SCQA. It is followed by the What, Why, and How. Exhibit 1.2 better explains the function of this adapted version of the Pyramid Principle.

Exhibit 1.2—Adapted Pyramid Principle

Adapted Pyramid Principle

Introduction

Situation (S): Set the scene for the present circumstances.

Complication (C): Name the problem or opportunity that needs to be fixed.

Question (Q): Pose the question being asked for the problem that sets up the solution.

Answer (A): Briefly provide the named solution you will explain in the body of the presentation.

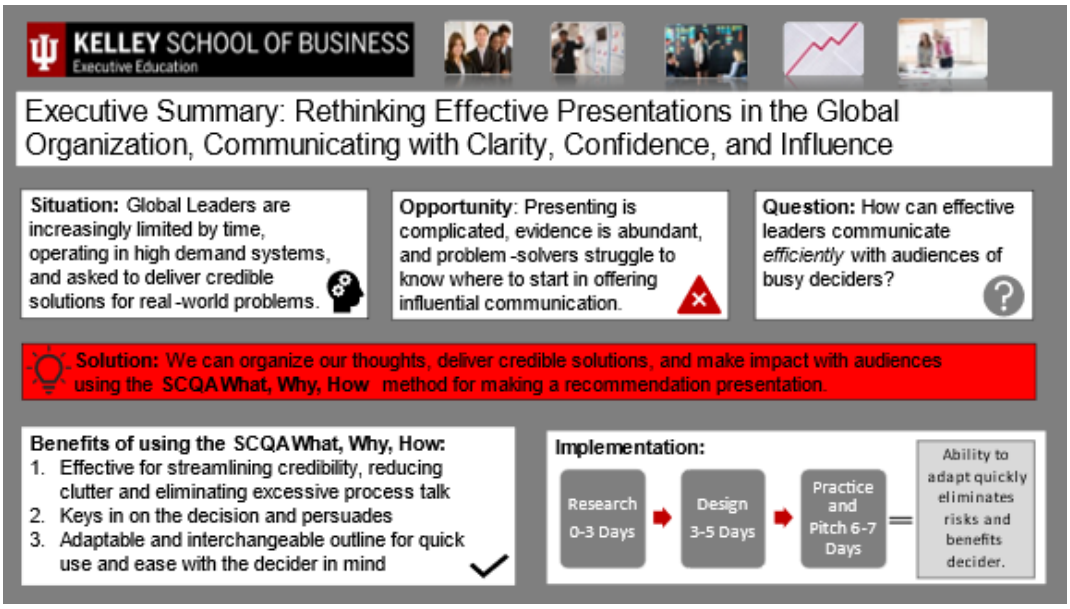
The SCQA should consist of no more than 20% of the total presentation. We don't want to dwell on a background the audience of deciders already knows.

Body

- **What:** Expand upon an answer or idea. Name the component parts the audience needs to understand.
- **Name three whys** to support adopting the "what." Keep at least one financial in nature, particularly in business.
- **Describe how** to make the solution happen.
- Discuss the **timeline** for completion. With visuals, this can be very appealing.
- State the **risks** to adopting your solution, then discuss how those risks could be mitigated.

The Pyramid Principle can be hard to decipher for eager audiences. Exhibit 1.3 showcases an example of how the pyramid components work in practice.

Exhibit 1.3—Showcasing the SCQA Structure



Note: Author Illustration (2025)

Learn about Barbara Minto's background, motivations, and the experience that lead to a breakthrough in practical communication. McKinsey Alumni. (2024). Barbara Minto: "MECE: I invented it, so I get to say how to pronounce it." Alumni News. https://www.mckinsey.com/alumni/news-and-events/global-news/alumni-news/barbara-minto-mece-i-invented-it-so-i-get-to-say-how-to-pronounce-it

1.3 Exercise 2: Implementing a Direct Persuasive Model

Learning Objective #3—Flex between direct and indirect persuasion models to deliver influential communication

Putting the Pyramid Principle into Practice. Review the Bailey's Orchard case scenario using the SCQA What, Why, How method. You may approach the case as any relevant convincer to any relevant decider. Keep in mind that solutions to the scenario may seem obvious to you but unclear to others, hence the power of using a direct persuasion tool.

Case Scenario—Bailey's Orchard

Bailey's Orchard is a small produce store on the outskirts of town that features seasonal goods, bakery items, and home-craft specialties produced by local artisans. The store, in operation since 1947, is located five miles from downtown Harrison City and seven miles from a thriving university. Bailey's is rooted in their traditional way of doing business and just recently got an electronic cash register in addition to their pen and paper inventory system. Bailey's does not use social media and certainly does not advertise. In fact, 80% of their business comes from repeat customers living in the community surrounding the store. Their biggest competitor, Taylor's Pumpkins and Specialties, is located 15 miles from Harrison City and 17 miles from the university, with 55% of their yearly sales coming from university students buying pumpkins alone. The manager of Bailey's is Mariah, and she often closes a quiet shop while wondering if they could be doing something more. . . .

Indirect Persuasion and Monroe's Motivated Sequence

Now that we have addressed direct persuasive approaches, we should also consider indirect persuasion and how it applies to our argument. Indirect persuasion is appropriate for audiences who may already be familiar with the topic but have not yet made up their mind. It also resonates with potential allies toward a solution or open-minded individuals. **Monroe's Motivated Sequence** is a method of persuasion and is based on Dr. Allan Monroe's studies related to psychology. Monroe made the case that humans, when presented with a dilemma, are inclined to respond to the need. His sequence allows the author to offer a solution after presenting the problem. It also offers communicators a complementary vision of what they present.

Exhibit 1.4—Monroe's Motivated Sequence

Monroe's Motivated Sequence

Attention: In this phase, we connect with the audience. This might be a story, example, rhetorical question, startling statistic, and so on that reels the audience in. The important thing is to get their attention.

Need: This is the problem that frames our sequence. What is the thing that needs to be solved? This should be thorough.

Satisfaction: Monroe was careful not to call this *solution*, though that is just what it does. Satisfaction is the sender's solution to remedy the problem and take the burden away, therefore satisfying the need.

Visualization: This crucial step allows the audience to see what life will look like when the change is adopted. It allows them to dream and visualize the solution.

Action: The last step is to give the audience the crucial steps to get started.

Monroe's Motivated Sequence has many uses in persuasion and can take on many different forms. Anyone watching commercials may have noticed its characteristics of quick and repetitive use, such as here with Ruby Space Triangles. Global Shop Direct. (2023, Feb 15). *RUBY Space Triangles—As Seen on TV*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-7

It can also be seen in this more formal presentation on cell phone use by Comm Studies.Comm Studies. (2020, Nov 30). *Persuasive Speech: Monroe's Motivated Sequence*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-8

Persuading and Influencing Through Presentation Software

Finally, having the proper means to display the information for our arguments, whether that be through direct or indirect persuasion, is a fundamental responsibility of the author. This means we are duty-bound as communicators to support our message with appropriate visualization. While this text will refer to data visualization throughout the remaining chapters, it's important to start by understanding what that means within presentation software. **Presentation software** will allow you to display your ideas and persuasion in a convenient and organized way.

We've compiled a list of presentation software for you to consider. This list is not exhaustive; you may have your favorite. As visualization designers, we would note two things. First, we recognize that some software is more common to us because we became familiar with it through its availability, learning, and organizational use. Second, we should all be cognizant that trying new software may be beneficial to slide preparation and design. Table 1.4 shows only a partial list!

Table 1.4: Slide Preparation—Host of Choices

Visme	Prezi	Keynote	Google Slides
Microsoft PowerPoint	Ludas	Slides	Slidebean
Beautiful.ai	Genially	Canva	Venngage
Flowvella	Haiku Deck	Microsoft Sway	Zoho Show

It is important to note that for your presentation software to be effective, it must work for you. Its usage should be convenient and efficient, supportive of your ideas, and not distracting. Beyond this, you should consider what we hold as the primary rule of slide design: Everything you create should strive to be consistent aesthetically with the culture of your audience and their visual consumption. Essentially, if it works well for the audience, the design works well for your needs.

Strategies for Effective Slide Visuals

First, **you should outline your design** before creating slides. This ensures that the number of slides is consistent with your time limits as a presenter. Next, your slide deck should have a title slide that **states the name of the presentation** along with your own. It can also offer imagery that supports the idea you are presenting. Consider adding a **visual agenda bar** that allows audience members to see your place in the presentation as it advances. This reminds audience members of your place in the presentation, what has been covered, and what will be covered next.

Visual animations can be **appealing**, and they lend support to your idea—be sure they do not distract from your presentation. **Color templates and fonts** should be consistent, and where possible, add **claim headings** at the top that summarize each slide. Remember to only display information **relevant to the presentation** in the most effective way. Too much or too little can be distracting. Also, information that does not need to be in the presentation but could be supportive during questions may be placed in **appendix slides** at the end of your deck. Finally, if you have a company **logo**, you could consider placing it at the top right of your slides throughout the deck. Remember, accommodating the audience means providing the most important parts for their consideration.

PowerPoint Storytelling using SCQA. Learn how to create compelling presentations. Analyst Academy. (2021, Nov 17). *PowerPoint Storytelling: How McKinsey, Bain and BCG Create Compelling Presentations*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-9

Watch a funny video from Don McMillan. This video is a classic on how slide design first emerged and was abused by many presenters. Enjoy this while also learning a few lessons on what might annoy your audiences. McMillan, D. (2009, Nov 9). *Life After Death by PowerPoint (Corporate Comedy Video)*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-10

1.3 Self-Assessment: Presentations

Learning Objective #2—Describe the various aspects of audience perception, of speaker and message, and conduct key analysis before creating or delivering a presentation

Applying what you know, complete the following statement.

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1.4 The Power of Storytelling

> Story is probably the most fundamental and important element of entertainment in the world. It's a basic building block. It comes into play in virtually every creative medium. Storytelling is the oldest profession. Don't believe what you've heard. People were telling lies long before another business was invented.
>
> —Jim Shooter, former editor-in-chief, Marvel and Valiant Comics

Rethinking Our Communication for the Frame and Narrative of Storytelling

Once upon a time there were two teachers who decided to write a textbook about data visualization and storytelling. . . . Sound familiar to you? It is because we all have been absorbing stories from the very start of our lives. As authors, we have found that whenever we discuss **storytelling**, certain audience members start to get a little nervous. Some business leaders, for example, don't see a place for storytelling in their vast networks of official decision-making where bulky slide decks and Excel spreadsheets abound. Others see storytelling as something reserved for personal time and not at all part of their communication.

We push back on the notion that storytelling doesn't belong in communication. In fact, we think it is more effective and supplies both the shared sense-making and underlying communication of all that we do. As an example, the same business that denies the use of storytelling may simultaneously pay millions of dollars for advertising in commercials that feature entities and characters that are fictitious. The breakroom of the organization may also contain a few people making sense of the new addition to the company handbook. We can almost hear Lisa explaining to Kim what happened to Jerry at last year's holiday party that prompted the handbook's update. The same employees will arrive at work fresh from listening to story-filled ballads in music, podcasts, news, and biographies. They most assuredly spent the night before binge-watching streaming shows on cable, television, and smartphones. Perhaps they even curled up with a good book. Storytelling is occurring for nearly everyone. The question remains how we use it for ourselves.

Source: Image used under license from Freestock.com

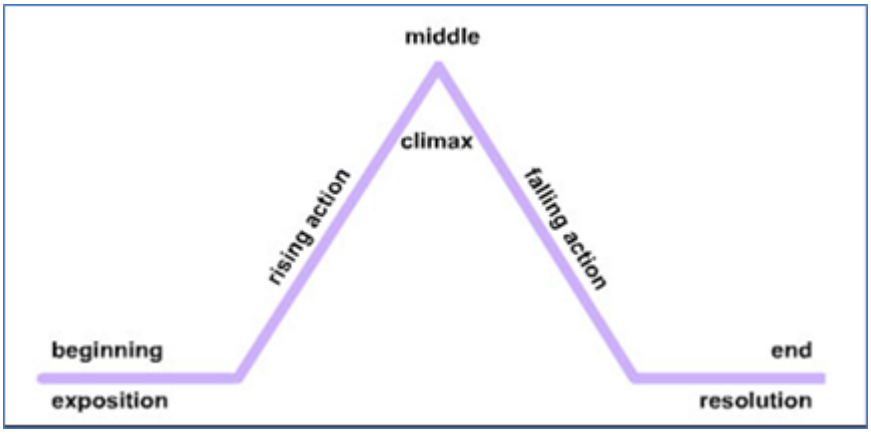
Think about your own last 24 hours of story consumption. List all the forms you engaged in (biographies, books, gossip, movies, music, podcasts, poems, streaming shows, and workplace conversations).

For our purposes, storytelling and narrative become fluid terms in practice that we place under a banner of storytelling. Storytelling describes processes by which communicators account for past experiences, support ideas with framing, offer certain dream-casting visions for the future, justify values through real-world or fictitious examples, and discuss leadership through verbal or written artifacts that describe those who have gone before, lead today, or are yet to come (D'Abate & Alpert, 2017, Hansen, 2012). Further, we see storytelling as relating and meaning-making. This supports the work of narrative scholar Walter Fisher (1985), who first crafted this notion that stories connect the sender and receiver. In summary, our influence, arguments, and ideas are a form of storytelling too. This doesn't mean we will replace our Excel sheets with "Once upon a time . . . ," but it does mean we will examine how storytelling may help us reach audiences.

Freytag's Pyramid for Storytelling

The fundamentals of storytelling are made more common to us by our constant absorption of them on a daily basis. Aristotle himself noted that a story has a beginning, middle, and end. Later, Gustave Freytag, a German novelist and playwright, developed a pyramid in the late 1800s that explains the familiar action of the story. Called Freytag's Pyramid, it has since been adapted to describe the familiar patterns (see Figure 1.2) we see in many stories to this day. In the beginning, we have the **exposition** or starting point of the story that sets the scene and establishes the characters. Next, the **rising action** builds up the key moments in which the protagonist must face a crucial moment, otherwise known as the **climax** or turning point. Next, the **falling action** ensues, which often contains the winding down of drama following the climax as characters and circumstances fall into their new places. The **resolution** or denouement is considered the end, where events conclude, takeaways and lessons are applied, and meaning is derived from the action.

Figure 1.2—Freytag's Pyramid for Storytelling



Note: Author Illustration (2024)

See Freytag's Pyramid in action via a familiar children's story. You can quickly see this very common framework represented in simple stories. After you are done, think through the last movie you saw. Did it follow Freytag's Pyramid?Tolzin, T. (2015, Jun 8). *Freytag's Pyramid.* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=5#oembed-11

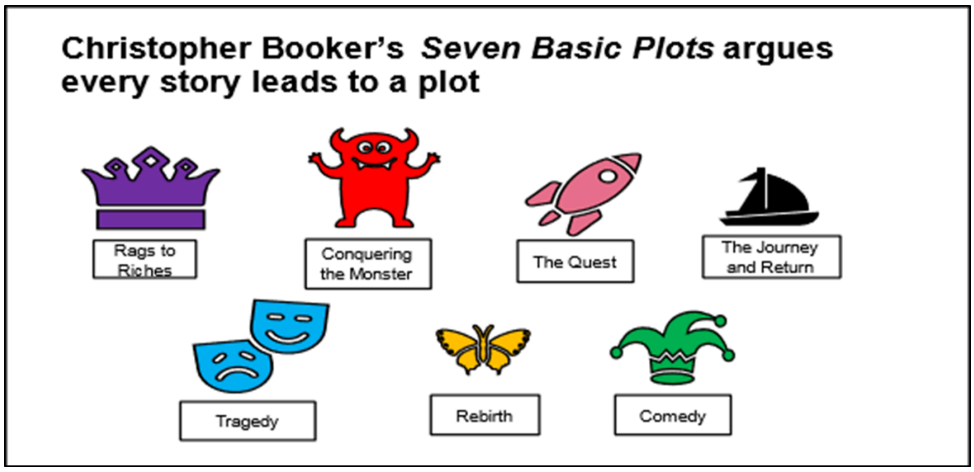
Introducing Narratives to Frame Powerful Messages

Establishing the building blocks of storytelling alone does not help us connect our communication with storytelling. In fact, there are times we might be called to utilize only a part of a story to convey the idea of our message. To discuss this further, let's examine narratives as described by Fisher (1985). **Narratives**, known as Narrative Paradigm Theory, operate from the basis that every speaker, both knowing and unknowing, is a storyteller and that we connect to each other via these devices often and openly. In fact, as authors, we encourage students and interested practitioners to examine how often others communicate using stories, imagery, descriptive narratives, or even looser examples of **figurative language** such as metaphor or simile. Example: "I am so hungry, I could eat a horse!" While most audience members doubt that we want to eat a horse when we make such a declarative statement, they do understand the implied meaning in our message.

Seven Basic Plots to Every Story

As communicators, we often rely on such devices to better explain ourselves. In fact, we regularly utilize **common narratives** between sender and receiver. Christopher Booker, an English journalist and author, studied stories from across the globe featured in books, movies, music, plays, and poems. Entitled *The Seven Basic Plots: Why We Tell Stories*, Booker (2004) recounted the common plots within most stories (as shown in Exhibit 1.5). These plots include overcoming the monster, rags to riches, the quest, journey and return, comedy, tragedy, and rebirth. While most of our own stories have purposes of their own, there are certainly elements of each that can be utilized to describe our experiences.

Exhibit 1.5—Christopher Booker's Seven Basic Plots



Note: Author Illustration (2025)

Plot	Description
Rags to Riches	An unrecognized hero overcomes adversity to be lifted out of obscurity.
Conquering the Monster	The hero overcomes a menacing threat to their environment, others, and self.
The Quest	Human imagination guides the hero forward on a yet-to-be-experienced adventure.
The Journey and Return	The hero is transported from their world into others, then home again to reflect on the journey.
Tragedy	Difficult figures or entities are brought down to their untimely demise by a fundamental flaw they often cannot otherwise correct or see.
Rebirth	A hero experiences a new life or purpose after difficult and overwhelming setbacks.
Comedy	An unlikely hero or community rises through challenges and is seen for their accomplishments.

You may still be struggling with how these narratives fit into your everyday storytelling academically, personally, or professionally. To get your creative juices going, we will provide some examples.

- A rebirth story: Jim talks about the time he overcame the disruptions to his life while learning to manage his alcoholism.
- A tragedy narrative: Suyeon discusses a brilliant yet fundamentally flawed supervisor, who was cruel to his subordinates and in turn was promptly dismissed after costing the company a lot of money.

- Journey and return: Ingrid might discuss her college experience in her valedictory address. While doing so, she tells a story about the graduates' future; she might borrow from quest narratives.
- Rags to riches narrative: Sports teams that win Cinderella Story championship games or stories like Oprah Winfrey's rise to fame.

Step-by-Step Instructions to Plot Your Own Basic Story

Take a story that is important to you, could be meaningful to others, and which you would be willing to share, and construct a story using just one of the plots. Refer back to Freytag's Pyramid on story structure. Keep in mind a **basic story needs a beginning, middle, and end**. After constructing the story, find someone and share it with them. How did it go? What was it like to formally use the narrative? What were some benefits or weaknesses to this method?

Ten Great Stories Every Leader Should Tell

Beyond those plots, author Paul Smith (2019) provided insight into common stories that organizational leaders should utilize to connect with audience members. We have found these stories depicted in *The 10 Stories Great Leaders Tell*, much like the previously discussed plots, to be insightful, interesting, and refreshing for eager audiences in workplace cultures. These stories, described in Table 1.5, range from founding stories to the customer profiling of who we serve stories. These 10 stories match the functions of most organizations to such a degree that at times they seem universal. The work of Smith (2019) responds to the prevailing drive for professionals to engage in more storytelling while making it predictable, recognizable, and most importantly, structured for those doing the work.

Table 1.5: Story and Theme of 10 *Stories Great Leaders Tell*

Story	Theme
Where we came from	A founding story
Why we can't stay here	A case-for-change story
Where we're going	A vision story
How we're going to get there	A strategy story
What we believe	A values story
Who we serve	A customer story
What we do for our customers	A sales story
How we're different from our competitors	A marketing story
Why I lead the way I do	A leadership-philosophy story
Why should you want to work here	A recruiting story

It's important to remember that Smith's stories can be powerful tools to **frame** your argument. Frames follow the structure of your argument and serve as a connecting theme or narrative to reinforce your ideas.

- For example, if you are developing a new product and pitching it within your organization, you could utilize the *who we serve* or *what we do for our customers* frames to discuss the idea. We might create the idea of Julia, an 18–24-year-old female-identifying consumer who has an interest in apparel. Using Julia as our frame, we could describe her demographic, the buying power of that demographic when amassed globally in the billions, and how they are currently underserved for such products.
- A founder of a start-up could utilize a *where we came from* frame to discuss the history of the organization and returning to some of the fundamentals of customer service that helped create their products. They could also point to some much-needed innovation by using a *why we can't stay here* frame or talk about the future through a *where are we going* story.

1.4 Exercise 1: Identifying a Storytelling Narrative for Use

Learning Objective #4—Listen critically to identify powerful narratives and use effective storytelling to frame meaning messages

Which of these stories resonates most with you? If you found more than one that worked well with your organization or team, consider what venue, space, and timeline you might sketch out to reach more audience members. Be sure to document the results during your exercise and spread the word to others about their ease.

Think of how such stories can fit into your slides and data visualization. These narrative devices can be employed subtly, directly, or implicitly to reinforce your ideas without distracting the audience. Returning to the core of this chapter, utilizing story, frames, or narratives to encase your evidence fulfills the very notion of Aristotle's ethos, pathos, and logos.

Chapter 1 Summary

There has been a lot of information to process in this first chapter! You were introduced to multiple topics that provide a foundation for audience-driven communication through data visualization. Special attention was placed on the power of clarity to express ideas and data effectively.

This chapter opens with Aristotle's credible speaker utilizing ethos, pathos, and logos—the experiences, emotions, and motivations accompanying each speaker in their communication efforts. These factors make communication complex and dynamic. Communication models serve as tools to organize the complexities of the interplay of communication and to predict the connection between speaker and audience. The Transactional Model was highlighted specifically for its recognition of the experience between sender and receiver utilizing demographics and psychographics.

This chapter then turns to the powerful use of persuasion and storytelling to deliver effective messages. Strong communicators use a combination of direct and indirect persuasion models. Barbara Minto's (2021) Pyramid Principle, Monroe's Motivated Sequence, and SCQA were highlighted for their ability to frame powerful messages.

Our influence, arguments, and ideas are a form of storytelling. Storytelling in communication design is an effective tool for an audience-centered experience. Storytelling frameworks such as Freytag's Pyramid for organization and Christopher Booker's Seven Basic Plots for reasoning strengthen the speaker's intended message. An overview of different types of narratives is provided to spark ideas for designing messages.

Communicators need to analyze the intended audience. This chapter introduced you to the speaker's responsibilities throughout the design process as well as the presentation of data. The Buffet Effect describes the cognitive overload audiences might feel when looking at overwhelming (messy) data. Awareness of biases and audience perception are necessary for reaching diverse audiences. How a speaker uses their own biases within their message also plays a role.

Finally, having the proper means to display the information for our arguments, whether that be through direct or indirect persuasion, is a fundamental responsibility of the author. Storytelling through data, data visualization techniques, and presentation can connect the audience to a communicator's message. The following chapters will provide technical instructions for collecting, designing, and displaying data to tell your story!

Chapter 1 Case: Utilizing Communication Resources for Problem-Solving

In this case project, you work with an enrollment dilemma faced by an organization: the Humphrey School of Dentistry, a fictitious school with very real gender balance problems seen so often in many organizations. You are tasked with coming up with a solution featuring your recommendations for solving this case drawn from Chapter 1 resources. Discuss audience-centered communication, persuasion models, and storytelling. Think carefully about how each of these important

aspects of communication supports your recommendation. You should approach this case from the vantage of problem-solver and use any personal experience and research to support your efforts.

Case Objectives

1. Identify communication models that predict connection and identification between speaker and audience.
2. Describe the various aspects of audience perception and of speaker and message, and conduct key analysis before creating or delivering a presentation.
3. Flex between direct and indirect persuasion models to deliver influential communication.
4. Listen critically to identify powerful narratives and use effective storytelling to frame meaningful messages.

Case Guidelines

Please read the following case and use the prompts to craft a recommendation for the Humphrey School of Dentistry.

The Humphrey School of Dentistry is one of the finest dentistry schools in the world with a 150-year history, boasting some of the most successful graduating dentists to find top work placements in the field. Humphrey is known for its top-ranked career center and key internships for its students. Humphrey, part of the larger Acadia University system, is also known for the many programs, services, and campus activities it offers to its students and alumni. Humphrey regularly graduates 200+ dentists a year, only 35 of whom identify as female or non-gender-specifying graduates. These students represent a total of 17% of the overall graduating class, far smaller than the 34% of nonmales that make up the dental field.

Many Humphrey classrooms are filled with dental students who are overwhelmingly male. This statistic concerns Dean Gupta, a dentist and scholar as well as the first woman appointed to lead the Humphrey School in all its history. This very literal and observable gender imbalance is acutely noticeable to Dean Gupta as she walks across the Acadia University campus, which conversely has a campus student body composition that is 55% female. Dean Gupta is no stranger to gender imbalance from her own academic and professional experience and wants to see Humphrey actively work through this issue, and she has tasked your group with making a recommendation.

Use the following prompts to guide your completion of the case.

1. *Audience:* Evaluate the multiple audiences that may be present in this case. Consider expansively how we might determine those audiences internally or externally and potential ways to gain further information from those audiences as necessary.
2. *Data gathering and analysis:* Conduct research to collect the relevant data and information related to the case. Critically evaluate the data to ensure credibility and accuracy. Much like the case, your quest for information may be incomplete in part, but do the best you can to find necessary information to begin to formulate a recommendation.
3. *Recommendation:* Utilize evidence, research findings, insights from your data collection, and personal experience to formulate a solution for the Humphrey School and for Dean Gupta to evaluate. This recommendation can be as expansive or as limited as you determine it needs to be when considering what is most appropriate for the audience.
4. *Persuasion:* This initial case requires you to convince the Humphrey School, and more specifically Dean Gupta, about your recommendation. Given your knowledge of Dean Gupta and her role as an insider and decider, consider how direct persuasion via the Pyramid Principle will be effective. As you consider the implementation of your plan long-term after it has been adopted, is there a way that indirect persuasion via Monroe's Motivated Sequence

could be helpful?

5. *Storytelling and narrative*: Create a compelling narrative that effectively communicates the information discussed in your recommendation. Think expansively about how storytelling and narrative can play a part in helping convince audience members.
6. *Assessment*: Consider how the communication tools from Chapter 1 have assisted your problem-solving. Discuss the different ways that such tools can be helpful in your day-to-day organizational leadership personally and professionally.

Post your narrative. Be prepared to discuss how you use the communication tools in your own leadership.

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2. What Is Data Visualization?

Good business leaders create a vision, articulate the vision, passionately own the vision, and relentlessly drive it to completion.

—Jack Welch, former CEO of General Electric

What Do You Think?

Callie Noble started working at the United Way in 2018, and her first assignment was building reports for Vigo County about ALICE families. ALICE is an acronym for **A**sset **L**imited, **I**ncome **C**onstrained, **E**mployed. Essentially, an ALICE family earns more than the federal poverty level but less than the basic cost of living in the county. Callie has lots of great data, and her team worked diligently to create reports but soon realized that they needed to visualize their data to connect with their social media–based audiences to increase awareness of this issue. Their first report shows 2016 data. The research center shows information for 2023 and a 2024 update.

ALICE in Vigo County (2016). United Way Agency. Link to report

Research Center—Indiana (2024). United for ALICE. Link to Research Center

The report has lots of charts but fails to tell a story that makes the information personal to the viewer. The team sits down to brainstorm how they might make their data visualizations more effective when presented to the community through social media. Imagine you are part of the brainstorming session as you visit both sites. What are your suggestions for the team? How do you tell the story of an ALICE family?

Introduction

Source: Campfire image by generated by Copilot—Public Domain

According to Al Shalloway, CEO of Net Objectives, "[Data] visualizations act *as a campfire* around which we gather to tell stories" (Twitter, Feb 12, 2014). Probably not what you were expecting right? But you most likely have a vivid memory of a story you heard around a campfire. Does this memory trigger all kinds of senses that help you remember the story? According to statistics, 65% of the population consists of visual learners (Zopf et al., 2004).

The setting here is a campfire, but the real art comes in the storytelling: "Storytelling requires an understanding of your audience, your topic, and your goal" (Dale Carnegie, 2018, p. 6). Connecting your storytelling to your audience's senses helps them remember it. In business, the real magic emerges when the user can interact with visuals, drilling deeper into the data, generating more insightful questions. Sometimes, you don't know all the questions to ask until you start "playing and analyzing" the data. You can't drill deeper if the data are presented in a static manner or have barriers that hinder access. Every organization wants data-driven decisions. However, the deluge of the information age inundates us with tweets, emails, texts, direct messages (DMs), memes, news, and other data streams. Data surround us, but few know how to tell an effective story with them. So where and how do we start?

Chapter 2 addresses the following learning objectives.

Learning Objectives

At the end of this chapter, students should be able to:

1. LO 1: Evaluate a data storytelling project for effectiveness.
2. LO 2: Differentiate between effective and ineffective data visualizations.
3. LO 3: Apply design principles and use models (like CASS) to evaluate the infographic to ensure understanding of the information presented in charts and infographics.
4. LO 4: Differentiate between static, interactive, and video infographics.
5. LO 5: Design an effective infographic using a free application.
6. LO 6: Recognize bias and unethical uses of data.

Key Terms: AI, call to action, Canva, CASS template, data smog, design thinking, Gapminder, Iliinsky's four pillars of visualization, infobesity, infographic, infoxication, interactive infographic, relative frequency, Snapp, storytelling, Venngage

Download Chapter 2 PowerPoint (10 MB).

Download Chapter 2 Student Files (34 MB).

2.1 The Art of Storytelling When Data Are Complex

> Every great design begins with an even better story.
> —Lorinda Mamo, designer

We live in an era where an overwhelming amount of information surrounds us, creating a vast and constantly expanding sea of facts and figures. Decision-makers often find it challenging to navigate in this environment of excessive information, commonly referred to as "too much information" (TMI). The concept of information overload and the phrase "information explosion" gained recognition as early as the 1960s. Alvin Toffler, a renowned "futurist," popularized these terms in his book *Future Shock*, published in 1970.

With the advancement of technology, particularly the rise of HTML and the internet in the 1980s and 1990s, the channels for accessing and sharing information multiplied. From RSS feeds and email to instant messaging, tweets, blogs, and social media platforms like Facebook, the ease of creating and disseminating information led to a sense of being overwhelmed. This abundance of information often leads to distraction and loss of focus.

To describe the challenges faced by decision-makers in this environment, several terms emerged. *Infoxication*, *infobesity*, *data smog*, and *information anxiety* are some of the terms used to denote the combination of TMI, duplication of data, misplacement of data, and the resulting anxiety and difficulty in staying focused.

In summary, the exponential growth of available information, coupled with technological advancements and the proliferation of communication channels, has created a scenario where decision-makers face challenges in effectively processing and making sense of the overwhelming amount of data surrounding them.

When Data Find Their Voice

We know complex data hold immense potential to generate efficiencies, expand markets, and empower discoveries—driving software developers to find new ways of making data visualization easier to create. For example, when you upload an Excel file into Power Business Intelligence (BI), you can quickly get insights on those data with a click of a button. However, don't expect to throw lots of graphs on a slide deck and have the audience understand them as well as you do. The more complex a problem, the easier it is to leave your audience disengaged or yearning for clarity. It is at this juncture that the power of storytelling shines, offering a path through the tangle of complexity, transforming numbers and concepts into relatable "human" stories.

Effective storytelling requires the storyteller to unravel the intricacies and nuances of the data, but they must also possess the skill to distill the "complexity" into a narrative and visualization that resonates with the audience. The purposeful weaving of visualizations with effective storytelling creates the bridge to audience understanding, but more importantly, it sets the path so the audience is willing to take a journey of understanding and discovery. Cognitive psychologist Jerome Bruner suggests, "We are 22 times more likely to remember a fact when it has been wrapped in a story" (Harrison, 2015, para. 3). In the past two decades, organizations have embraced the importance of data visualization to the point where data visualization skills are required of all managers. Data are driving this change as decision-makers increasingly rely on data. Let's look at an example of how design thinking has become a tool for innovation.

Source: Airplane image generated by Copilot—Public Domain

At Boeing, managers of the Osprey program needed to improve the aircraft's takeoffs and landings, but every time the plane taxis off the runway or lands, the "sensors create a terabyte of data [and] ten takeoffs and landings produce as much data as is held in the Library of Congress" (Berinato, 2016, para 2). When Ryan Kiggins (2016) presented at the Global Product Data Interoperability Summit, he shared his role at Boeing, which included "design thinking trainer and facilitator" and why design thinking should become part of an organization's culture and mindset. But why link data visualization to it?

Incorporating design thinking into data storytelling and data visualizations can lead to a user-centric, engaging, and memorable experience that enhances clarity, comprehension, and impact. Stories like this reinforce why storytelling is so important.

There are compelling reasons to combine storytelling with data visualization using design thinking. Design thinking, a concept introduced by Tim Brown (2008) in his *Harvard Business Review* article, has become a widely adopted approach in various organizations to gain a deeper understanding of the user, customer, or client needs. According to Esther Han (2022) of Harvard Business School Online, "Design thinking is a mindset and approach to problem-solving and innovation anchored around human-centered design" (para 5). It *prioritizes* understanding the needs and experiences of users or customers (Kitch, 2023). It puts user needs at the center and provides a way to help storytellers understand their audience. The fundamental nature of design thinking lies in its five-stage process, often associated with creating a product. The five-stage process is (1) empathize, (2) define, (3) ideate, (4) prototype, and (5) test.

One of the key contributions of design thinking is the cultivation of **empathy**. How do you create empathy in storytelling? It starts with knowing your audience through user research, persona development, storytelling from the user's perspective, and incorporating elements that evoke emotional appeal.

Supporters of design thinking as part of the data visualization process are laser-focused on knowing the audience. One such supporter of design thinking is Google. According to Pferdt (2019), "At Google, design thinking helps us foster a culture of innovation, and lets our teams generate and test ideas creatively and effectively" (para. 3). Google storytellers use three principles of design thinking: (1) **empathy**: know your audience; (2) **expansive thinking**: consider different perspectives; and (3) **experimentation**: practice before an audience and be willing to embrace constructive criticism and/or feedback (Konrad, 2023). Essentially, using the three principles from Google's design thinking allows you to prototype your presentation. And keep in mind, a story that works for one audience might not work for another! And what happens when the data has to speak for itself?

> Data visualization is a process where complexity meets creativity, where data find their voice, and where storytelling becomes the compass.

Start with setting up the story so data can find their voice. In the realm of data visualization, the story lies in the weave of visual elements and words to form a cohesive narrative. The challenge lies in ensuring that our visualizations can still tell a compelling story even when we are not physically present to guide the audience. Data in their raw form seldom evoke emotions or captivate attention. Unlocking the power of visualization transcends numbers and statistics, giving data their own voice. The answer lies in carefully considering the elements that make up a compelling narrative. Design thinking encompasses design choices for a *specific audience* and thoughtful arrangement of visual elements to contribute to the story being told.

The following list conveys the compelling reasons to use design thinking when your main goal is to use data visualizations to tell a story, and you are not physically with the audience:

1. Contextualization

    Example 1: The design must be relevant to the audience and include real-life examples and ministories

that annotate the text. For example, using apps like ThingLink to pop up information. (Besides text, ThingLink can also pop up video or audio files.)

Example 2: Prerecorded video narrative to explain key insights, serve as a guide, and include a video description. For example, provide a link to a YouTube video to provide components of the story.

Example 3: Make sure the story arc takes your audience on an emotional journey. In Linda DeLuca's (2018) article "How Story Arcs Help You Design a Better Presentation," she presents six common story arcs. DeLuca doesn't share these six as the only structures available; instead, she suggests, "It's not as important to use a particular arc, but rather to understand that stories have shapes" (para. 12). So if you are **not** physically present for the storytelling, explore ways to **shape** the story arc. It might include background music, video, and short animated clips. A story arc structure connects to design thinking in the context but also in the retention and comprehension. In a story arc, the storyteller sets the context, establishes empathy, and connects with the audience. Think of the story arc as an overlay. It should create a foundation of understanding, just as design thinking emphasizes understanding the users and perspectives.

2. Engagement

   Example 1: Interactive platforms that allow the audience to explore. For example, a dashboard that allows the user to interact and learn more.

   Example 2: Interactive elements—tooltips, filters, and linked visualizations that provide additional information.

   Example 3: Expansive thinking where you have existing Q&A prompts (essentially thinking of the questions the audience will ask) or have a platform like Power BI that has live query capability.

   Example 4: Use foreshadowing to build anticipation and suspense by gradually revealing insights or trends in data. This aspect of engagement is somewhat game-like.

3. Emotional connection

   Example 1: Use expansive thinking to embrace creativity and innovation by incorporating metaphors, analogies, or storytelling devices like anecdotes, personification of data, and symbolism (visual cues that make sense like stoplight colors or gauges).

   Example 2: Use design thinking principles of prototyping. For example, finding data's true voice may require multiple iterations and feedback loops, essentially testing different visualizations to refine and evolve the data's voice to connect to the audience.

   Example 3: Considering ethical and social implications. By integrating ethical considerations, the data's voice can become more responsible, inclusive, and accountable.

4. Simplification and clarity (remove ambiguity)

   Example 1: By fostering collaboration and diverse perspectives, design (expansive) thinking ensures a more comprehensive and better representation of the data's voice. For example, a CPA can clearly understand all aspects of ratio analysis, but a nonaccountant might struggle with the interpretation. That's why it's important that an accountant creating a data visualization considers collaborating with nonaccountants, especially if the audience is mostly nonaccountants.

5. Guiding attention and focus

   Example 1: Use design thinking to identify desired outcomes. For example, if the organization uses key performance indicators (KPIs) in current reports, use KPIs in visualizations. Use components your audience will recognize.

   Example 2: Use design thinking to connect to feasibility by considering current goals and strategies.

6. Retention and comprehension

   Example 1: Use design thinking to consider the personalization of the user's experience. For example, a technique that uses personalization of data-driven storytelling is possible by responding to the user's cues to guide the individual user through the narrative. This just means that the user makes a choice

based on their preference and that decision drives the storytelling narrative. As a user, I gain comprehension of what I find important.

Example 2: Use design thinking to test your data visualization. For example, use a pilot audience to test your data visualization where you are not physically with the data visualization. Then use eye-tracking technology or analyze user interactions and engagement patterns. This can provide insights into where users focus their attention, how they navigate through content, and where they interact with elements.

Example 3: Use design thinking to test retention. For example, conduct a follow-up of your pilot audience with open-ended questions to gauge their recollection of key insights.

In data storytelling, the framework should start with a captivating introduction, a clear problem statement, a climax (like the most important findings or insights), supporting evidence, and a memorable conclusion that contextualizes the problem. The key thing to remember is that data storytelling is not the same thing as data visualization. Visuals are an element of the process.

Before we go further, let's look at a simple example to define what is meant by data, information, and insights shown in Table 2.1.

Table 2.1: Examples of Drilling to Insights

Example of Data	Example of Information	Example of Insights
Phoenix 97 7/1	On July 1st, the temperature will reach 97°F in Phoenix, Arizona	It will reach 97°F in Phoenix, Arizona on July 1st, which is 10°F below average compared to prior years

The main components of an engaging story include plot, characters, setting, theme, conflict, point of view, narrative style, conflict resolution, pacing, and dialogue. It is important to note that the framework you use to tell a story depends on the topic and the audience. At their basic core, **stories have a beginning, middle, and end**. This text will weave "telling stories" throughout each chapter as you learn to create dynamic data visualizations. It takes practice to be good at both and even more practice to integrate the two.

For more than two decades, data storytelling consultants have played a crucial role as intermediaries, bridging the gap between data and decision-makers. Their expertise lies in presenting the right information in a compelling manner. To gain insights into the possibilities of data storytelling, we can explore the examples shared by these consultants on their websites. Numerous consultants exist in the field, including Storytelling With Data, Duarte, and Juice Analytics.

Zach Gemignani (2023) of Juice Analytics showcases an intriguing blog topic titled "How to Summarize Data Using ChatGPT," which demonstrates the incorporation of artificial intelligence (AI) in storytelling. This highlights the growing trend of consultants embracing AI technologies to enhance their data storytelling capabilities. AI can assist in data analysis, pattern recognition, and even generating narratives, thereby augmenting the storytelling process.

Furthermore, it is worth noting that some consultants have evolved their focus to emphasize using data for social good. Examples include Viz for Social Good and Periscopic: Do Good With Data, where consultants aim to apply data storytelling techniques to address social and environmental challenges.

Overall, these consultants offer a wealth of resources and workshops.

Viz for Social Good. (2022). Connecting data enthusiasts with mission-driven organizations. https://www.vizforsocialgood.com/. This is a not-for-profit organization; expect to see everything from static infographics to video infographics, as well as the datasets for each project.

Storytelling With Data. (2023). We help people and organizations create graphs that make sense and weave them into compelling, action-inspired stories. https://www.storytellingwithdata.com. This organization shares 100s of videos and podcasts.

If the data storytelling is designed so the user can interact with the data (like through a dashboard), the creator may employ data-driven animations to enhance the narrative. To see an example of this, review Neil

Halloran's interactive documentary, "The Fallen of World War II." This type of storytelling is called *narrative visualization*.

Halloran, N. (2016, Oct 26). *The Fallen of World War II: An Interactive documentary*. http://www.fallen.io/ww2/

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#oembed-1

When to Not Use Data Storytelling

While visuals are an essential part of data storytelling, visuals are used to inform, explore, or analyze the data. For example, a weekly meeting that reports facts or a status report is most likely used to inform. Informative data are usually broad, while insightful data are deep. Some data communication doesn't work well with data storytelling. For example, if your dashboard updates continuously or is automated frequently (like daily), it's hard to tell a story because the data are changing. An interactive dashboard allows the user to explore and discover their own insights, and during this exploration stage, they don't need a data storyteller. Let's look at a comparison in Table 2.2 of when less storytelling is needed and when to use data storytelling.

Table 2.2: Is Storytelling Needed in Every Situation?

Less Storytelling Needed	Use Data Storytelling
Data are informative	Data are insightful
Purpose is exploratory	Purpose is explanatory
Data are concrete (raw data tables)	Concrete data for context
Data updated continuously	Abstract data visualizations for insight

Consider if your friend gave you the entire week's forecast if you asked, "Should I bring an umbrella today?" So what is the difference between concrete and abstract data? A few definitions are in order to support Table 2.2.

Concrete data in data visualization refers to the actual dataset that is being visualized. It includes the raw data points, their attributes, and their values. For example, a dataset would contain concrete sales figures for different products over time. In the context of storytelling with data, concrete data refers to the specific facts, figures, and statistics that are present to support the narrative. As a rule of thumb, always compare with prior periods (month, quarter, year) to easily see growth or contraction. Revenue trends are considered concrete data.

Abstract data in data visualization refers to the high-level representation and organization of data for visualization purposes. Essentially it involves transforming concrete data into a visual form that can be easily understood and interpreted. It entails selecting the appropriate visualization technique—like a chart, graph, map, or infographic—to convey

insight and patterns in the data. The abstract data capture the overall story or narrative that the visualization aims to communicate.

Data Storytelling Framework Templates

To assist with your storytelling skill, let's look at a few data storytelling frameworks. Frameworks adopt a model of storytelling and how data can be integrated within the story. The acronyms define a key focus area, provide structure, and ensure a logical flow that engages your audience. Some models will fit your situation and data better than others. In the next section, we provide an example of a modified framework template (context, audience, story, and situation) and how to use it. You can also find it in the PowerPoint file that accompanies this chapter.

Table 2.3: Data Storytelling Framework Templates

Source	Source Resource	Model Acronym	Model
LucidChart Blog	*How to Tell a Story With Data*	CAST	Context, Action, Subject, Takeaway Context
The Analyst Academy	*PowerPoint Storytelling*	SCQA	Situation, Complication, Question, Answer
Microsoft	*What Is Data Storytelling and Data Storytelling Examples*	HERO	Hypothesis, Evidence, Relevance, Outcome
Storytelling With Data	*The Structure(s) of Story*	DATA	Dramatic Arc, Tension, Alleviation
SEO Analytics	*PICA Protocol: A Visualization Prescription for Impactful Data Storytelling*	PICA	Purpose, Insight, Context, Aesthetics
Sykes, Malik, West, & Malik	*Stories That Move Mountains: Storytelling and Visual Design for Persuasive Presentations*	CAST	Content, Audience, Story, Tell
Mitchell & Deckard	*Leveraging Visualization to Communicate Effectively*	CASS	Context, Audience, Story, and Situation

Source: Sykes, M., Malik, A. N., West, M. D., & Malik, A. N. (2012). *Stories that move mountains: Storytelling and visual design for persuasive presentations*. John Wiley & Sons, Incorporated. ProQuest eBook Central Database.

A great resource or handout is available from the book, *Stories that move mountains: Storytelling and visual design for persuasive presentations*. Link: https://www.martinjsykes.com/storiesthatmovemountains

CASS: A Data Storytelling Framework Template

Review Figure 2.1 to see the modified (context, audience, story, and situation) CASS template. This framework combines several of the models and is a great template to evaluate existing data storytelling or build your own storytelling with data when you have a large dataset with several insights to share.

Context—Determines how the data will be shown (trends, correlations, comparisons), including variables, the need for variables to change, the "how" variables that need to change, and the "so what" (essentially, what are the consequences of change or no change?).

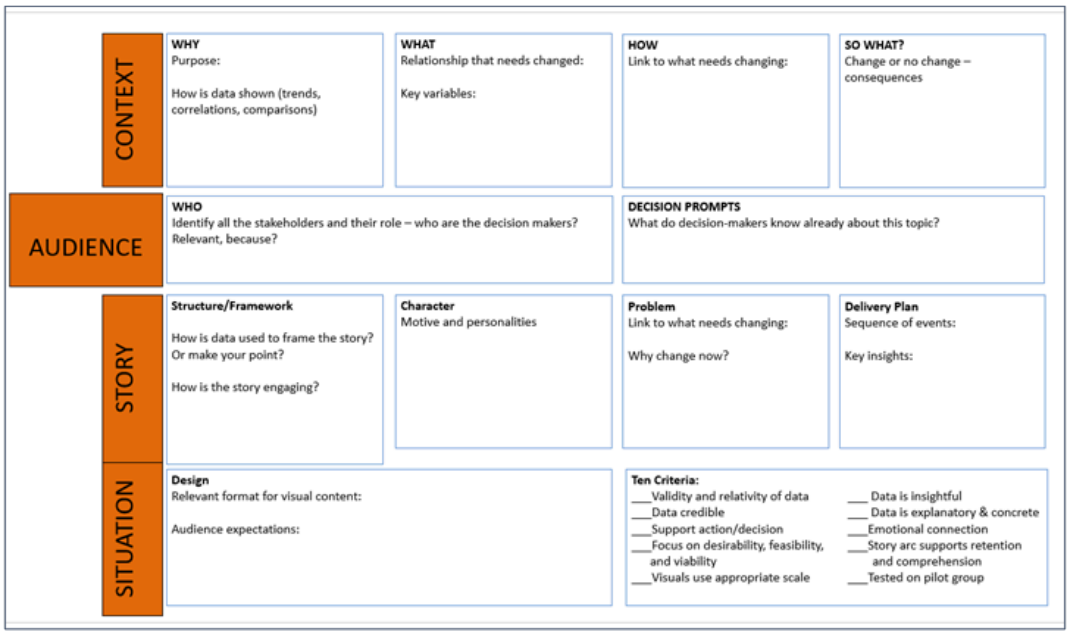
Audience—Who makes up the audience, and who are the decision-makers? How are the data relevant? What information do decision-makers already know about this topic?

Story—How are the data used to frame the story or make your point? How is the story engaging? What characters motivate the audience to make a change? How is the problem linked to changes, and why does it change now? What story structure sequences the events so the audience understands the key insights?

Situation—Is the design framed in a relevant format for the visual content, and does it meet the audience's expectations? Does data transformation engage and motivate the audience? How does the story frame the data? This framework has 10 key criteria for the data storyteller to consider:

1. Are the data valid and relevant (for this situation)?
2. Are the data credible?
3. Do the data support an action or decision? (#3 and #4 work together)
4. Do the data support desirability, feasibility, and viability?
    a. *Desirability* refers to the degree to which a data visualization or data storytelling approach meets the needs and expectations of its intended audience. It involves understanding the preferences, goals, and requirements of the users or audience.
    b. *Feasibility* refers to the practicality and achievability of implementing a data visualization or data storytelling concept. It involves considering the available resources, technical capabilities, and constraints.
    c. *Viability* refers to the sustainability and long-term success of a data visualization or data storytelling initiative. Viability considers factors such as the value proposition, potential impact, scalability, and alignment with the goals and objectives of the organization and its stakeholders.
5. Do all visuals use an appropriate scale (and avoid other manipulations)?
6. Are the data insightful? (Do they successfully transform concrete data into abstract visualizations?)
7. Are the data self-explanatory, and are there enough data to provide context?
8. Do the data support an emotional connection?
9. Does the story arc support retention and comprehension?
10. Was the data storytelling tested on a pilot group?

Figure 2.1—CASS: A Data Storytelling Framework Template



Note: Author adaptation of CASS template in Sykes et al. (2012)

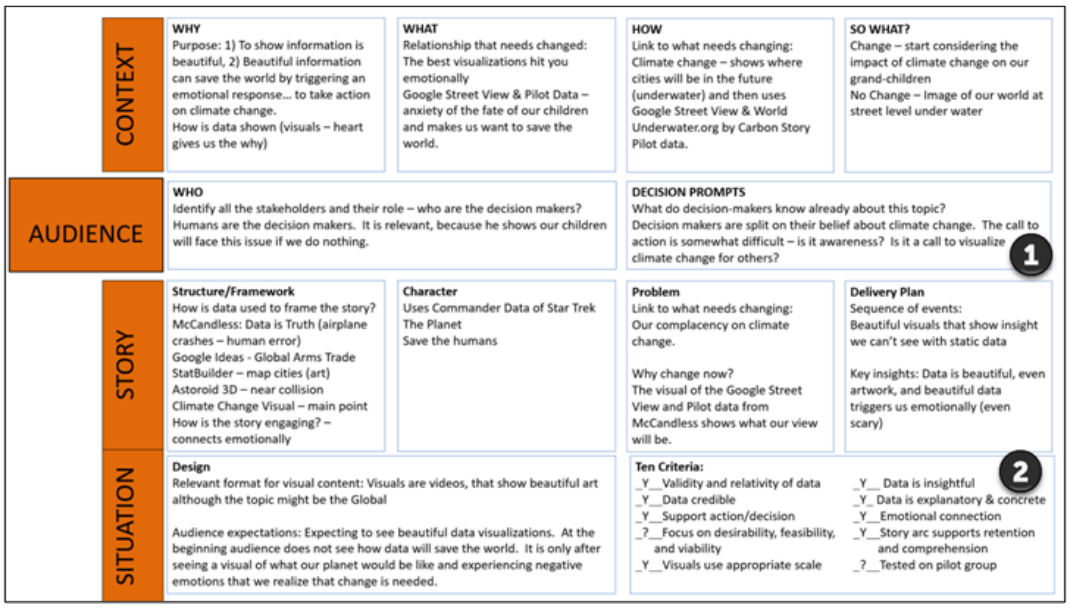
In order to see how this template can help you build your own or evaluate existing data storytelling with data visualizations, let's use Wes O'Donnell's *Information Is Beautiful: How Data Visualization Will Save the World* (2015) for an example. Please watch the video before you review the completed CASS template (Figure 2.2).

A copy of the CASS template is available in the PowerPoint file that accompanies this chapter.

Wes O'Donnell, (2015), *Information Is Beautiful: How Data Visualization Will Save the World.* TED[x] Muskegon (x = independently organized TED event) Length: 14:37 minutes

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#oembed-2

Figure 2.2—CASS Completed Template Using Information Is Beautiful: How Data Visualization Will Save the World



Note: Author completed template using Wes O'Donnell's Ted Talk (2025)

Note: This completed template is also available in the accompanying resources for Chapter 2.

1. You will notice a few items with questions in the CASS template. The first issue is in the audience section. Under the decision prompt, where or what is the call to action? Is the purpose to build an awareness of how climate change will impact our great-grandchildren?

2. The 10 criteria help determine the data validity, credibility, and so on. There are two areas where it is unclear. The first item still in question is "focus on desirability, feasibility, and viability," which may be an issue because it is not clear whether a call to action is made or is not clearly stated. The second item is "tested on pilot group." Wes O'Donnell's presentation was made at an independent TED Talk in Muskegon; however, it's unsure if he tested his presentation on a pilot group.

Fun Fact: If you recognize Wes O'Donnell's name, he is an occasional TV cohost on *Mysteries Decoded*!

2.1 Exercise 1: Use the CASS Framework Template to Assess Data Storytelling

Learning Objective #1—Evaluate a data storytelling project for effectiveness

The following three examples are data storytelling projects that use big datasets. **Choose one** of the examples and assess it using the CASS data storytelling framework in Figure 2.1. There is a PowerPoint file to accompany this exercise (Link: "CASS Template—Case 2.1").

Example 1: Hans Rosling's "200 Counties, 200 years in 4 Minutes—BBC News"

One or more interactive elements has been excluded from this version of the text. You can view

— *them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#oembed-3*

Example 2: UN Sustainable Development Report 2022: From Crisis to Sustainable Development: The SDGs as Roadmap to 2030 and Beyond—Choose Explore Data. Link: https://dashboards.sdgindex.org/

Example 3: Matthew Klein, Bloomberg View (2014) How Americans Die. Link: https://www.bloomberg.com/graphics/dataview/how-americans-die/

Post your CASS template to the discussion board and point out areas where you struggled to answer the template questions.

2.2 The Good, the Bad, and the Ugly of Data Visualizations

> The purpose of visualization is insight, not pictures.
> —Ben Shneiderman, American computer scientist

The purpose of this section is to compare the good, the bad, and the ugly of data visualizations, but let's discuss and define the terms *good*, *bad*, and *ugly* in a data storytelling context.

Good **data visualization** represents projects that effectively communicate and clarify complex data. It avoids issues found in a bad data visualization or an ugly data visualization. Reviewing the CASS template in Figure 2.1, a *good* data visualization has these characteristics about data:

1. data tell the truth, and visuals use appropriate scale;
2. data are valid, accurate, relatable, and credible;
3. data are insightful, explanatory, and concrete;
4. data are transparent and supports the action or decision; and
5. the consumer of the data is provided with relevant context that impacts the data (e.g., maps are representative of population density centers).

Bad data visualization represents projects that are incomplete or contain misleading information or incorrect conclusions. Data storytellers should never lie or misrepresent the data. In bad data visualizations, storytellers might exaggerate or downplay certain data points, distorting the story. Other characteristics of bad data visualization are when storytellers cherry-pick, manipulate (like compressing the scale), mislabel, or intentionally hide some data. Some bad data visualization projects cross the ethical line.

An **ugly data visualization** refers to a project that usually has overly cluttered charts, excessive labels, ambiguous color schemes, and crowded graphs. In some cases, it might have correct data, but the wrong type of chart was used. Some storytellers might be inconsistent without realizing it. If the inconsistency is intentional, it moves from ugly to bad.

A good data visualization **storytelling project** provides contextualization, engagement and an emotional connection, clarity to complex data, and guides attention and focus. In addition, the story should flow logically with a story arc structure and summarization that supports comprehension and retention. Every data visualization storytelling project should be designed to create a compelling and impactful narrative that effectively communicates data-driven insights to your audience. Data projects can be static and simple (like infographics) or complex with interactive elements.

Did You Unintentionally Mislead Your Audience?

You work with charts every day, but did you realize you could mislead your viewer by using count instead of frequency? The best way to demonstrate this is to show you! Comparative bar charts provide a visual comparison of univariate, categorical data for two or more groups.

Each year the *Princeton Review* conducts a survey. One of the questions is asked to parents and students. It is, "Ideally, how far from home would you like the college you (your child) attend(s) to be?" As you might expect, parents and students do not agree. Let's look at the frequency table along with the relative frequency table. **Frequency** measures how often a particular event occurs (essentially the count). In Figure 2.3, 2,878 students and 1,230 parents voted that an ideal college is less than 250 miles from home. **Relative frequency** indicates a proportion in relation to the total (shown as a percentage).

Figure 2.3—Showing Count and Frequency for Students and Parents

Ideally How far from home would you like the college you (your child) attend(s) to be?	Students	Parents
Less than 250 miles	2878	1230
250 to 500 miles	2970	812
500 to 1,000 miles	1949	340
More than 1,000 miles	1485	236
Total	9282	2618

Ideally How far from home would you like the college you (your child) attend(s) to be?	Students	Parents
Less than 250 miles	0.31	0.47
250 to 500 miles	0.32	0.31
500 to 1,000 miles	0.21	0.13
More than 1,000 miles	0.16	0.09
Total	1.00	1.00

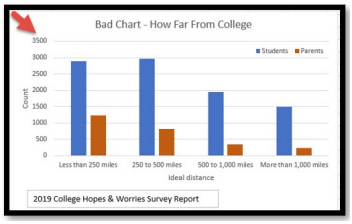
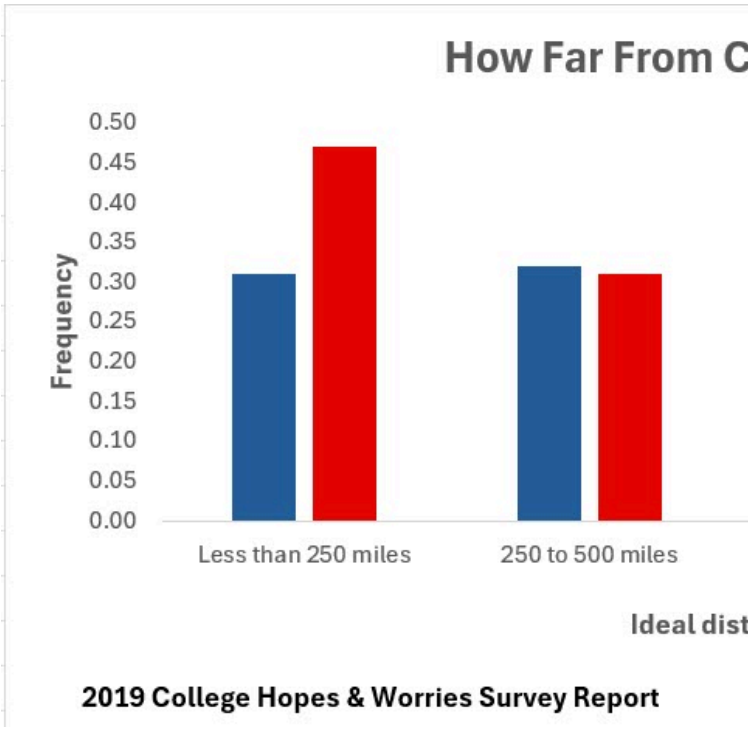
**The Princeton Review 2019 college Hopes & Worries Survey Report*

Note: Author adaptation of data from Princeton Review College Hopes & Worries Survey Report (2019)

So 2,878/9,282 = **.31** (or 31% of students voted for a college less than 250 miles from home).
And 1,230/2,618 = **.47** (or 47% of parents voted for a college less than 250 miles from home).

Now let's look at the two charts. Both charts have a clear title, an appropriate legend, and appropriate labels, and the column colors make sense. But using **count** is inappropriate since the sample size is not the same.

Exhibit 2.1—Use a Relative Frequency Table for Intended Representation

Bad Chart—misleading information	**Good Chart**
	
This chart uses count and because the sample size is quite different, can lead the audience to a different conclusion.	Use relative frequencies on the vertical axis instead of the frequency (coun ingful comparison when sample sizes are not the same.

Next, let's look at some charts that work with the same data but represent the good, the bad, and the ugly (Exhibit 2.2). These charts were created in Power BI and show the results of a year of revenue for eight salespeople. The key point here is that you can use very powerful software to create your dashboard and still have bad and ugly data visualizations if you don't use the right charts, correct scales, or good design protocols.

Exhibit 2.2—The Good, the Bad, and the Ugly in Power BI Charts

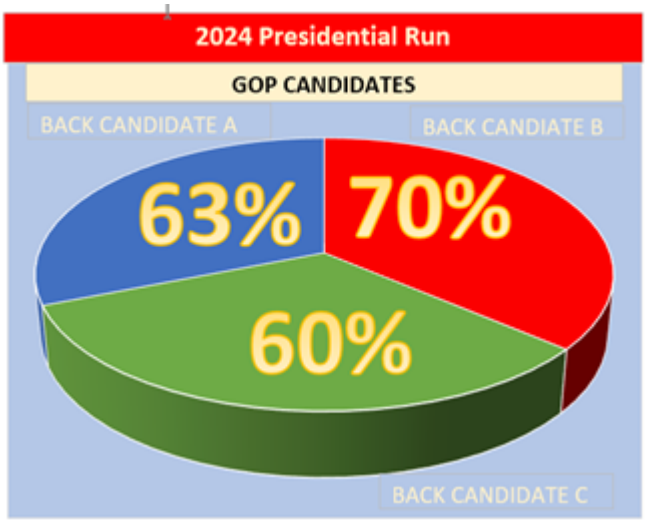
The Good	The Bad	The Ugly
All bars are labeled and sorted properly.	One salesperson's name is not shown, no dollar amount. Too many slices—pie chart not the best option.	This chart is best to show an increase and decrease and it does not work well for this kind of data.

There is room for improvement in all the charts. For example, if this is a stand-alone chart on a slide, adding the year and company name would be appropriate. However, if the chart resides on a dashboard, the year and name can be at the top of the dashboard and the chart doesn't need them.

Does Your Pie Graph Add Up to 100%?

Figure 2.4 was modeled from a chart shown on a news broadcast in 2012. The names shown on the broadcast are removed. Although the intent was to show the closeness of the race, **pie charts should always add up to 100%**. Notice that this one does not. This one also falls under the category of bad and ugly: bad because the pie chart doesn't add up to 100% and ugly because the colors might unintentionally sway the audience to think more positively of one candidate over another. The colors used here duplicate the chart shown during the news broadcast. Both pie charts and doughnut charts should be avoided. Your audience will struggle to estimate a quantity from angles, and matching labels to the slices can be especially difficult if you have small percentages—and that small percentage might be important!

Figure 2.4—Example of a Bad and Ugly Chart



Note: Author Illustration (2024)

Did Your Image Size or Proportion Mislead Your Audience?

Figure 2.5 shows another misleading graphic where size matters. The news station misled the audience because the size was not depicted in actual proportions. The following was a graph showing gas prices with the highest price in California and the lowest in Mississippi. But notice the misuse of proportion.

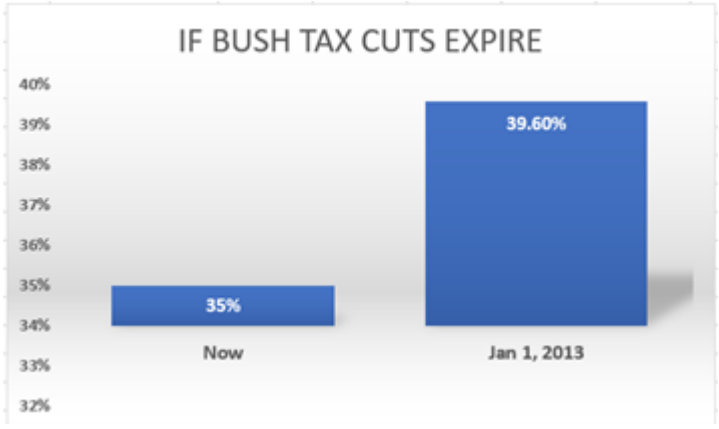
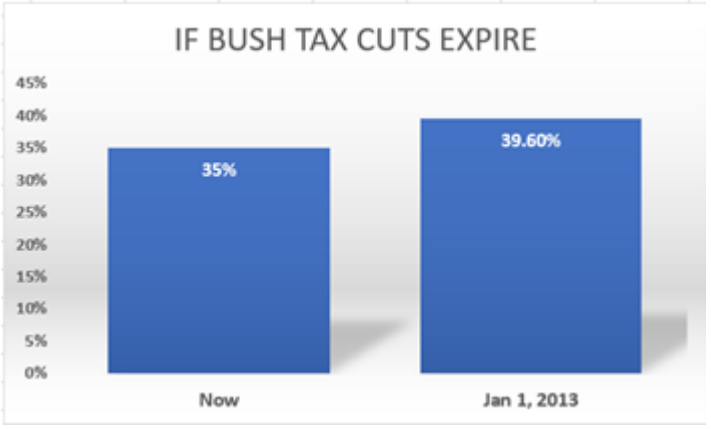
Figure 2.5—Misuse of Proportion: Bad Chart

Note: Author Illustration (2024)

Did the Scale Used in the Graph Mislead Your Audience?

The same news channel produced a graph that did not have the scale set to zero. In Exhibit 2.3, the chart on the left shows the axis scale starting at 32% and the chart on the right shows the scale starting at 0.00%. I'm sure you can see that the chart on the left is misleading!

Exhibit 2.3—Example of Misleading Scale for a Tax Rate Increase

Bad Chart—Misleading	Good Chart—Starts With 0.00 Scale
	

Now that you have seen examples of good, bad, and ugly data visualizations, let's see if you can differentiate them in the following exercise.

2.2 Exercise 1: Critical Evaluation of Good and Bad Data Visualizations

Learning Objective #2—Differentiate between effective and ineffective data visualizations

Part 1: Find three examples of bad and/or ugly data visualizations (just type "bad data visualizations" in the search box of your browser to find examples). Screenshot the examples and indicate why they fit this category. What changes would you make to correct them?

Part 2: Type "bad visualization + Purdue Pharma" in the search box of your browser. Share your findings in a discussion. Did Purdue Pharma cross an ethical line?

2.3 The Four Pillars of Visualization Work Better With Context

> Visualization and belief in a pattern of reality activates the creative power of realization.
> —A. L. Linall Jr.

Now that you have seen how good, bad, and ugly data visualizations are prevalent, let's take a step into becoming a data storyteller. If you've been creating PowerPoints at your organization, you have certainly told a story. But how well did you tell that story? Did you use the best visualization techniques to tell it? Creating your own infographic or data visualization may start with available templates (much like PowerPoint slide decks or infographic templates in an infographic app). Do you remember the first time you learned PowerPoint? Did you explore *one* PowerPoint theme design *after another* or have trouble modifying an existing slide deck to make it "fit" your purpose? When you start creating your own data visualizations, don't be surprised at how often you need to fall back on good data visualization design techniques like those presented by Noah Iliinsky. Noah Iliinsky, a data visualization expert, cautions how quickly a presenter can get off track.

When Larry Swanson of Content Strategy Insights asked, "Are there benchmarks, or how do you know you're on track?" Iliinsky answered, "It goes back to purpose, know your customer and what they care about" (Swanson, 2020, Podcast 89—24:32). You must start with the purpose and be able to check off the "why," "who," and "what does my audience need" to understand (What actions do you want to support? What is the most important takeaway message? How will it be consumed?). The more specifically you drill down to **purpose**, the better. As shown in Exhibit 2.4, before building an interactive data visualization, make sure to embrace Noah Iliinsky's four pillars of visualization with an added component of context.

Exhibit 2.4—Iliinsky's Four Pillars Plus Context

Iliinsky's Four Pillars of Visualization	**Plus *Context***		**Equals**	**Elevated Understanding**
•Purpose, •Content (what to visualize), •Structure (how to visualize it) •Format (appeal and focus).	+	CONTEXT	=	The audience will understand better and remember longer.

In this case, *context* means making the topic easier to understand by giving extra information about the time, place,

situation, history, background, and so on. That's part of the storytelling process! So how does storytelling relate to interactive data visualizations?

Iliinsky, N. (2018, Apr 12). *Four Pillars of Visualization—English version*. StarsConf. San Diego, USA. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#oembed-4

Knaflic, C. (2015, Nov 2). *Storytelling With Data: A Data Visualization Guide for Business Professionals*. Wiley Publishing. ProQuest eBook Central Database.

Wexler, S., Shaffer, J., & Cotgreave, A. (2017). *The big book of dashboards: Visualizing your data using real-world business scenarios*. Wiley Publishing. ProQuest eBook Central Database.

Another data visualization expert is David McCandess. David McCandess, at his *Information Is Beautiful* website, shares a graphic that interacts when you roll your mouse over certain areas to give you more details. McCandess considers all the aspects of data visualization but includes more of the storytelling components than Noah Iliinsky.

McCandess, D. (2023). What Makes a Good Visualization? *Information Is Beautiful*. https://www.informationisbeautiful.net/visualizations/what-makes-a-good-data-visualization/

According to McCandess (2020), to have a successful visualization you need (1) good and accurate information, (2) the goal of visualization, (3) the story or concept that accompanies the visualization, and (4) the actual visual form that works best for the visualization.

2.1 Self-Assessment: Four Pillars of Visualization

Learning Objective #3—Apply design principles and use models (like CASS) to evaluate the infographic to ensure understanding of the information presented in charts and infographics

Watch the YouTube video "Four Pillars of Visualization" by Noah Iliinsky.

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An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#h5p-3

2.3 Exercise 1: Using the Four Pillars to Help the United Way Team Explain ALICE

Learning Objective #3—Apply design principles and use models (like CASS) to evaluate the infographic to ensure understanding of the information presented in charts and infographics

In the "What Do You Think?" scenario beginning this chapter, a United Way team is brainstorming ways to present social media infographics that explain ALICE families and what that means. They also want a call to action to request donations.

How would you complete the four pillars + context (see Exhibit 2.4) to help the ALICE team present their data in a social media post?

2.4 Infographic Basics

> The greatest value of a picture is when it forces us to notice what we never expected to see.
> —John Wilder Tukey, American mathematician and statistician

To begin, let's look at the simplest data visualization—an infographic. An infographic is a graphical representation intended to communicate information in a concise and meaningful way. Most infographics are "static," but the trend is moving toward interactive infographics.

You have probably used infographics more than you think! According to an old study by Levie & Lentz (1982), people following directions with text **and illustrations** do 323% better than people following directions without illustrations (p. 195–232). Perhaps you've assembled something using diagrams—think about your experience if the instructions were all text describing what needed to be done. Did the visual help you understand each step?

You expect infographics to take visual form in social media, but don't be surprised to see them in scientific communication to explore datasets and communicate findings on websites, theses, dissertations, and resumes (Jaleniauskiene & Kasperiuniene, 2023).

The designs of infographics range from very simple to complex, but all include content and visual elements. It takes practice before it becomes a basic digital skill. Studies across several disciplines (computer science, education, health sciences, digital marketing and media management, sociology, mathematics, ESL, and sports management) show that students who learned to create or analyze infographics "gained metacognitive strategies, better recall, enhanced

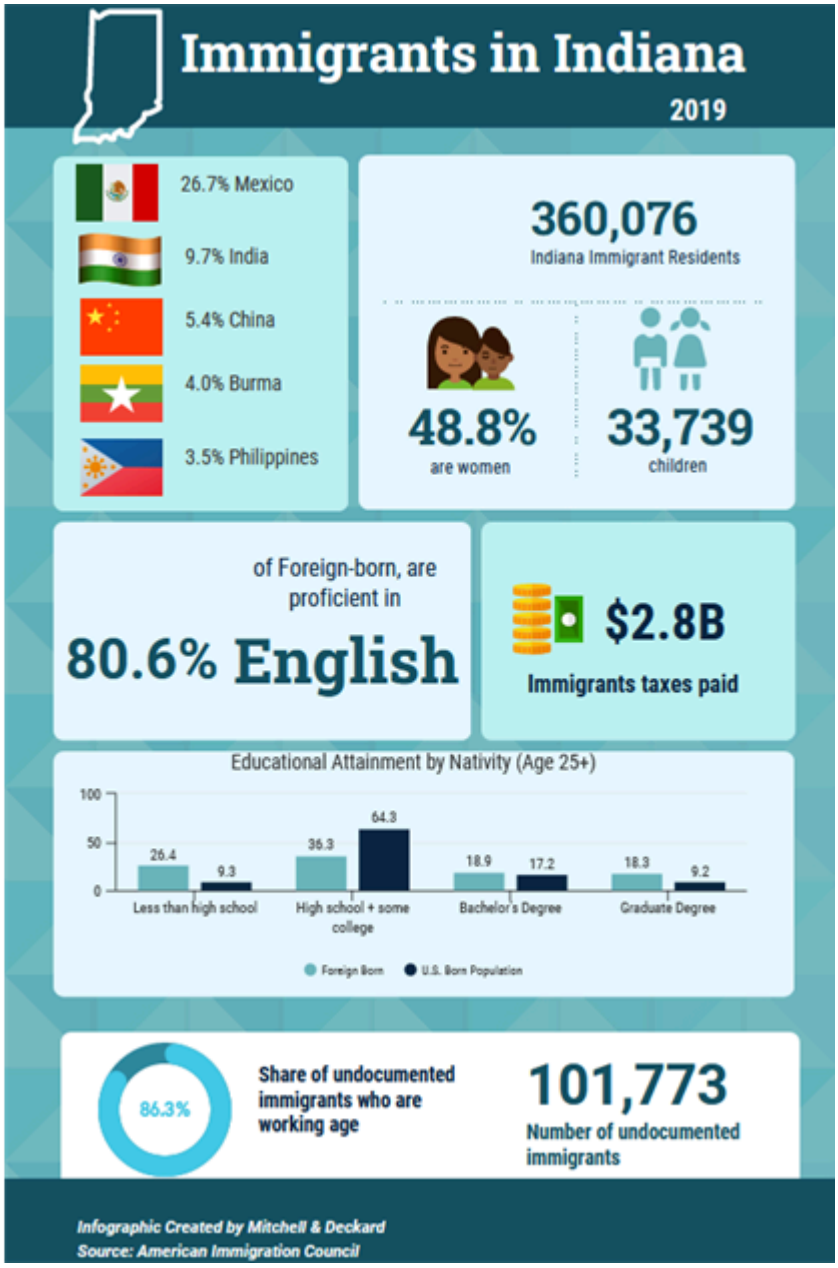
depth of understanding, better communication skills, and saw the process as engaging and enjoyable" (Jaleniauskiene & Kasperiuniene, 2023, p. 200)!

According to Beegle (2013), the "best infographics build a narrative in much the same way a story does, starting with the premise and then revealing something new at each turn" (p. 65). In Figure 2.6, the infographic reveals layers of information about immigrants. The use of flags brings the user focus to the immigrant's country of origin. There are charts to show the education attainment level and the percentage of immigrants who speak English proficiently. In addition, the infographic indicates how much immigrants contribute to Indiana's economy through taxes paid. As you look at this chart, what other information would you consider including or would you want to know?

The Simplest Evaluation of an Infographic

The first step to creating an infographic and then evaluating it is a simple process of informing yourself using the 5 Ws (who, what, when, where, and why). Use the 5 Ws to help convey information in a relevant way. In this illustration (Figure 2.6), let's go through the 5 Ws.

Figure 2.6—How to Use the 5 Ws to Review an Infographic



Note: Author Illustration (2024)

Who?—immigrants in Indiana

What?—raise awareness

When?—2019 data

Where?—Indiana

Why?—bring awareness of education levels and contribution to Indiana's economy

This illustration was made in the app Venngage, using source information from the American Immigration Council. All infographic software has a variety of icons that are available for use, but it also includes great charting tools.

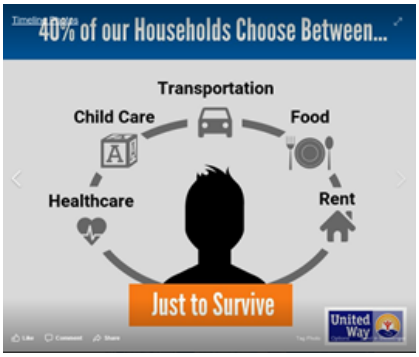
The next step is analyzing some existing infographics. Just doing a search on infographics will yield all kinds of ideas in both design and content. Notice the use of color, symbols, and images. Ignore interactive infographics for now.

Try to gain a sense of an infographic that tells a story that prompts emotional tension. As you search for an infographic you like, see if you can pick out the 5 Ws. If you find one that you don't understand, see if you can do a little research to

find the context. An infographic is not good if it doesn't meet the definition (*communicating information in a concise and meaningful way*). It's like hearing a story without knowing all the characters. And more importantly, **infographics should contain a driver or "call to action."**

To illustrate the importance of context, look at Exhibit 2.5, where both infographics are from the Wabash Valley United Way's Facebook presence. Are these graphics designed to raise awareness (**educational**) or do they call you to *do* something?

Exhibit 2.5—Do These Infographics Have a Call to Action?

United Way of the Wabash Valley Facebook post, August 31, 2018	United Way of the Wabash Valley Facebook post, November 11, 2018
 Source: United Way of the Wabash Valley—Used with permission	 *Source: United Way of the Wabash Valley—Used with permission*
It took a minute to understand that ALICE = **A**sset **L**imited + **I**ncome **C**onstrained + **E**mployed	This message is clear, and a good start to a call to action.
This is the related message: Over 30,000 families in the Wabash Valley are ALICE or struggling working poor. Join the Fight to help us make a difference in the lives of ALICE!	This is the related message: This isn't just a household problem; it's a community problem. How can our community thrive when over 40% of our households don't earn enough to achieve a "survival budget" and must make tough choices on what to pay? Do they pay the electric bill, or do they pay the rent?

Note that these infographics are specific to the Wabash Valley in Indiana; therefore, someone from a different state might not understand the context of ALICE since not all states have adopted the ALICE project. If you visit the United Way of the Wabash Valley, you will find reference to their bold goal—to move 10,000 families out of financial struggles and into stability along with a very visual strategic plan.

Strategic Plan. (2023). United Way of the Wabash Valley. Terre Haute, IN. https://uwwv.org/storage/2018/01/Strategic-Plan.pdf

Dozens of high-quality infographics help communicate the context of this report. The corresponding Facebook pages include a variety of infographics related to the strategies of the United Way.

Key Components to Evaluating an Infographic

Keep in mind that "80% of learning takes place visually; the average person retains only 20% of what is read when it's delivered in text-only format; images on Facebook are liked 200% more than text [*and perhaps most important for your organization*]; websites register a 12% increase in traffic after publishing an infographic" (Beegel, 2014, p. 8–9). But per-

haps the most important characteristic of an infographic is presenting complex information in a way that is easily understood.

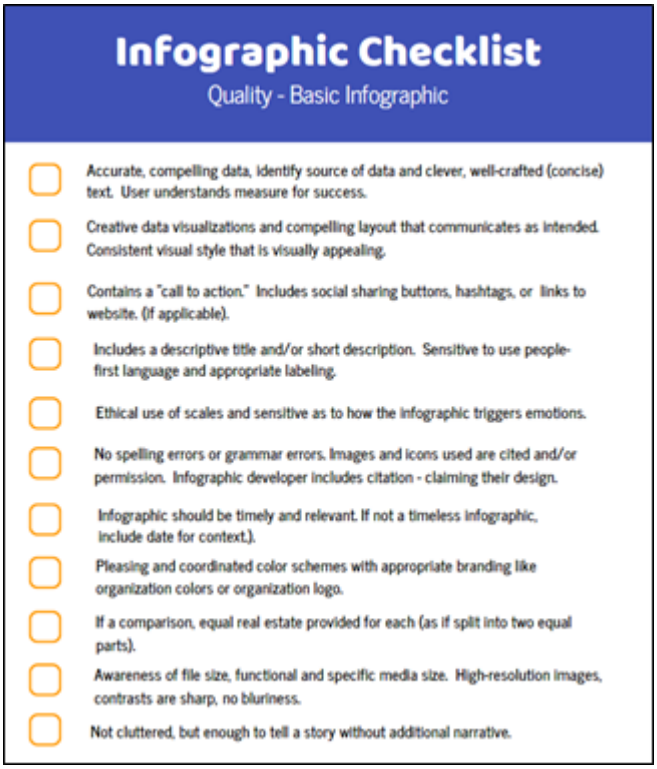
The *Encyclopedia of World Problems & Human Potential* (UIA.org) identifies the **proliferation of information** using new terms like infoxication, infobesity, and data smog. Interestingly, the UIA connects this problem to the UN Sustainable Development Goal #12, Responsible Consumption and Production, and the UN Sustainable Development Goal #16, Peace, Justice, and Strong Institutions. *So what do data smog, infoxication, and infobesity have to do with infographics?*

All three terms describe information overload. An infographic can cut through information overload, separate the signal from the noise, and break down complex information into bite-sized chunks making it easier for your infographic audience to understand and retain key insights without feeling overwhelmed by the sheer volume of information available.

Infographic Basic Components

Regardless of the type of infographic, every infographic should have the same basic components or considerations, and Figure 2.7 provides a good checklist to assess a basic infographic. The checklist is a compilation of Beegle (2014) and Wallace (2015).

Figure 2.7—Infographic Quality Checklist for Basic Infographics



Note: Author Illustration (2024)

Infographic Components—Sound or Video

Other basic components will apply if you create an infographic with motion, sound, or interaction. If you move past the static infographic, consider these *additional* components as shown in Table 2.4.

Table 2.4: When to Add Sound or Video

(Beegle, 2014, p. 29–32)

Use sound or voice narration to . . .	**Use (or add) video to . . . .**
✓Establish a mood	✓Keep the user on a linear path set by the designer.
✓Create a sense of authority	✓Explain more complex concepts (like the workings of a mechanical device)
✓Connect to viewers	✓Make it more personal
✓Provide emotional depth	✓Testimonial (like for branding)

2.2 Self-Assessment 1: Basic Design

Learning Objective #3—Apply design principles and use models (like CASS) to evaluate the infographic to ensure understanding of the information presented in charts and infographics

You've been asked to compare the performance of two companies in the same sector.

An interactive H5P element has been excluded from this version of the text. You can view it online here:

https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#h5p-4

2.4 Exercise 1: Apply the 5 Ws of an Infographic

Learning Objective #3—Apply design principles and use models (like CASS) to evaluate the infographic to ensure understanding of the information presented in charts and infographics

Find three infographics related to immigration in your state. See if you can answer the 5 Ws: who, what, when, where, and why. Share the image(s) and discuss the 5 Ws on the discussion board. Is there a call to action?

2.4 Exercise 2: Evaluate a Static Infographic

Learning Objective #3—Apply design principles and use models (like CASS) to evaluate the infographic to ensure understanding of the information presented in charts and infographics

Part 1: Find a static infographic from your organization. Use the basic design criteria listed in this section to evaluate it. Share the image and discuss what changes you would make to improve it. **Part 2:** Now use the CASS template to review the same infographic. What differences are observed?

Types of Infographics

There are a variety of infographics, and the type of infographic you build will be driven by what works best for your message. Let's review a few of these with examples.

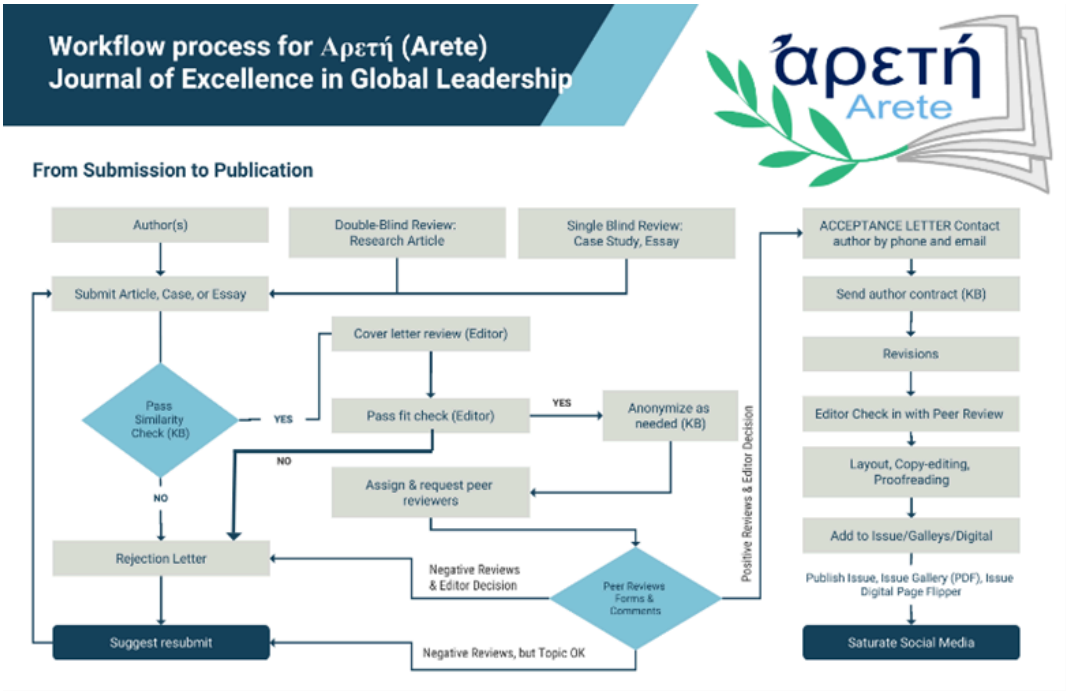
- **Statistical infographics:** This type of infographic uses charts, multiple types of graphs, and people icons representing numbers to present statistical data in a clear and concise manner. For example, assume you want to look at pay between men and women in the United States. Start with the Bureau of Labor Statistics data. The 2020 data show a gap in earnings where women earned 82.3% of men's pay (Bureau of Labor Statistics, 2023). What other statistics might you want to highlight?

Earnings from Current Population Survey (CPS). Link to U.S. Bureau of Labor Statistics: https://www.bls.gov/cps/earnings.htm

Examples of statistical infographics will be shared in Chapter 3 of this textbook.

- **Process infographics:** This type of infographic shows a step-by-step visual guide to explain a process or instruction. So infographics that show a flowchart, a timeline, or step-by-step instructions would fit here. For example, the flowchart shown in Figure 2.8 shows the process for submission of an article to a journal and all the steps necessary for publication in a peer-reviewed journal.

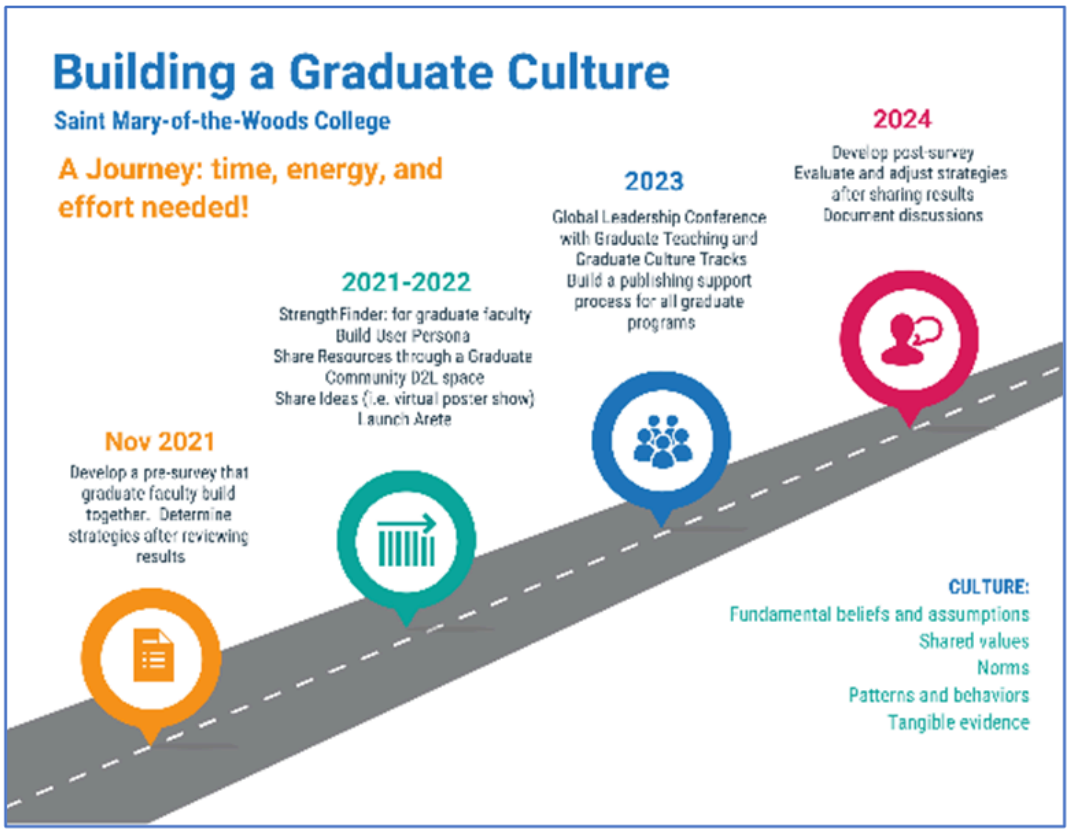
Figure 2.8—Example Process Infographic



Note: Author Illustration (2022)

- **Timeline infographics:** These types of infographics have a chronological layout to represent historical events, and time-related information. They can also be interactive where the user sees additional details by hovering over some part of the timeline. For example, in Figure 2.9, hovering the mouse over the icon in 2021–2022 explains what faculty gain by understanding their top five strengths from taking Gallop's Strength Finder test.

Figure 2.9—Example of Timeline Infographic



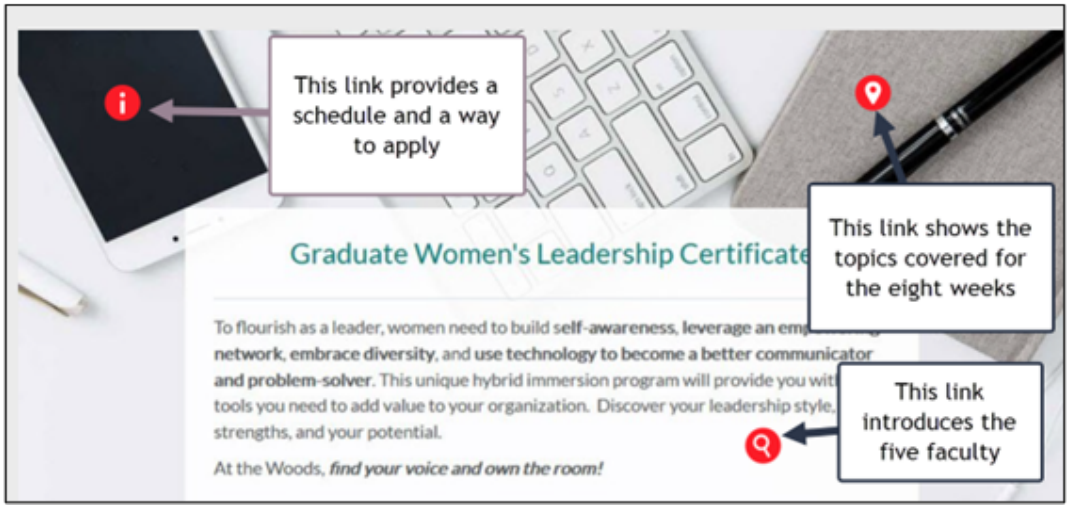
Note: Author Illustration (2025)

- **Interactive infographics:** These types of infographics are most often interactive allowing the user to interact and dive deeper into the information. Interactive infographics work well for large datasets (like census data).
  An example of a simple interactive infographic starts with a basic infographic but adds interaction using an app called **ThingLink**. Essentially, when the user hovers over or clicks the icon, the user is given additional information. Figure 2.9 shows a static version of the infographic, but the pop-up links can provide additional information, even video!

ThingLink: An app-based program to engage and inform your audience. Link: http://www.thinglink.com

What is ThingLink? ThingLink is an app-based program for annotating digital items. You add an icon to tag your item and can incorporate rich media. The multimedia editor allows a user to quickly create interactive images, videos, and self-guided tours. A user can also create a branching scenario for training, and even develop augmented reality (AR)! ThingLink is a great app for creating road maps or walking tours to incorporate text, audio, and videos. Figure 2.10 shows a basic use of ThingLink.

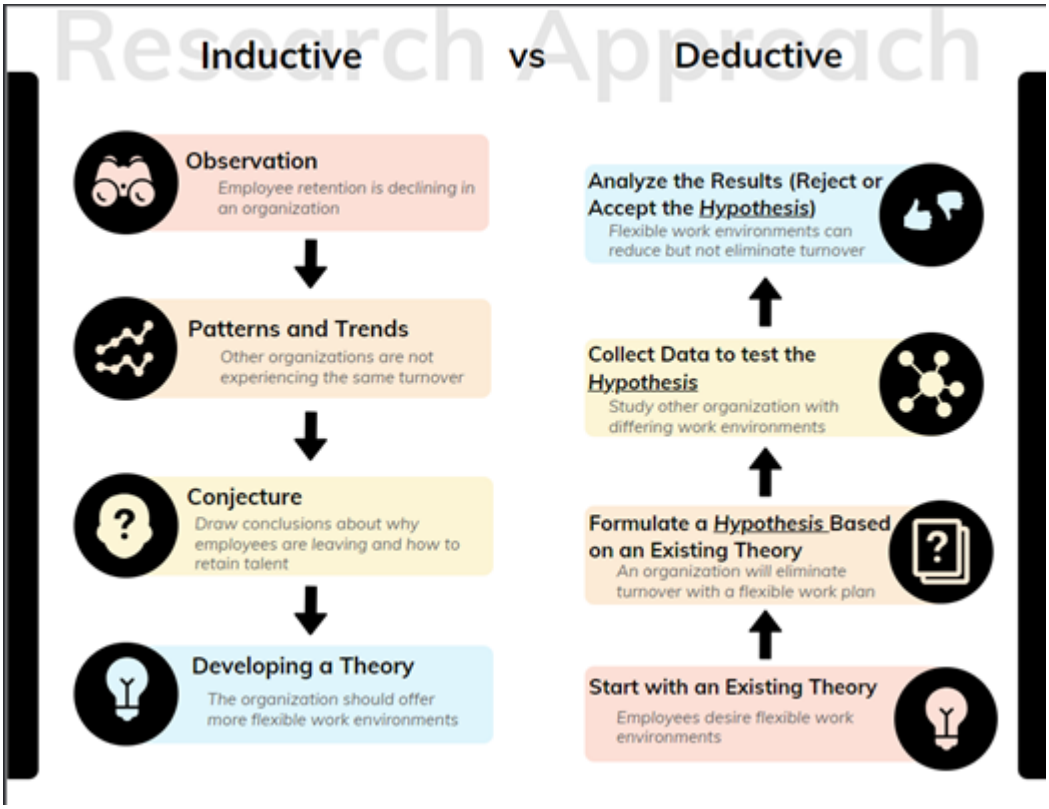
Figure 2.10—Example of Interactive Infographic Using ThingLink



Note: Author Illustration (2020)

- **Comparison infographics:** These types of infographics compare two or more concepts side-by-side using visuals to highlight similarities and differences.
  An example of this type of infographic might be management versus leadership skills, comparing two companies, or comparing two products. Some comparison infographics will include a Venn diagram, so the user sees the overlap between the two categories. Figure 2.11 compares inductive to deductive reasoning.

Figure 2.11—Example of a Comparison Infographic



Note: Kuhlman & Mitchell Illustration (2022)

Another good example of a comparison infographic is a SWOT (**S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats) or PESTLE (**P**olitical, **E**conomic, **S**ocial, **T**echnological, **L**egal, and **E**nvironmental). PESTLE is used to gain a macro picture of an industry. More about SWOT and PESTLE will be discussed in the next chapters.

- **Geographical infographics:** These types of infographics use maps to visualize information. For example, the infographic in Figure 2.12 shows male and female participants by country. See how much easier it is to determine the information with a map instead of a table of numbers? This infographic was created in Power BI.

Caution: Most Excel dashboards use a type of filtering called "slicers." The same application in Power BI is more powerful because everything serves as a filter. No matter where you click, you drill down into more information. As you build a dashboard in either Excel or Power BI, you may want to consider restricting some of the filtering that loses focus of the purpose. Restrictive filtering just means that you lock down certain features (or hide some filters) so the user doesn't get lost or misinterpret the data.

Maps are powerful, and the more powerful the map, the greater the need to know the source, understand how the legend represents the information, and whether you have clusters or patterns of data that are obscured by the boundaries of the map (Buzzelli, 2020). For example, in using a traditional map (to show vote numbers), states are not uniform in population, so showing a state fully red or fully blue doesn't show what might be happening in specific cities. This issue is called a "modified areal unit problem." (Buzzelli, p. 171). This is why the popular vote seems to contradict the Electoral College winner. For this reason, some map creators transform a traditional map into a choropleth map where the "size of the states are rescaled according to their population" (Newman, 2016, para. 3).

Wiseman, A. (2015, Jun 25). When Maps Lie: Tips from a geographer on how to avoid being fooled. Bloomberg. https://www.bloomberg.com/news/articles/2015-06-25/how-to-avoid-being-fooled-by-bad-maps

In Figure 2.12, users can drill down by clicking on any circle in the country to find out even more detail on where the surveys originated (i.e., the state).

Figure 2.12—Example Showing Geographic Data in Power BI Infographic

Country	Female	Male	Total
Afghanistan	500	500	1000
Algeria	485	537	1022
Argentina	612	388	1000
Australia	563	439	1002
Austria	616	385	1001
Bangladesh	519	480	999
Bolivia	587	411	998
Bosnia Herzegovina	580	424	1004
Botswana	594	406	1000
Brazil	598	405	1003
Cambodia	673	327	1000
Cameroon	515	485	1000
Canada	510	491	1001
Chile	592	411	1003
China	1363	1211	2574
Colombia	632	368	1000
Costa Rica	552	448	1000
Croatia	591	401	992
Czech Republic	587	418	1005
Egypt	503	517	1020
Estonia	651	353	1004
Finland	542	458	1000
France	580	421	1001
Georgia	546	454	1000
Germany	528	469	997
Ghana	490	510	1000
Greece	561	439	1000
Total	43973	36364	80337

Note: BRIQ Dataset—Author Illustration (2024)

Video Infographics Are Powerful

One of the most powerful ways to use infographics is to "show" your viewers rather than just narrate (tell) information.

The "show approach" simplifies communication and avoids misunderstandings. And sometimes you need a video infographic rather than a static infographic.

One of the most powerful *narratives*, videos, and interactive infographics available is an animated data-driven documentary written and directed by Neil Halloran, called *The Fallen of World War II*. This documentary is deeply researched and has won several awards including 2016 Best American Infographics. This video infographic has been viewed over 9 million times.

Halloran, N. (2016, Oct 26) The Fallen of World War II: An Interactive documentary. http://www.fallen.io/ww2/

So now that you've watched this interactive documentary, what kind of tools do you need to create a video infographic?

Infographic Online Apps

Canva is located at www.canva.com (Great infographics, beautiful templates, and a limited *free plan*). To create an interactive infographic beyond hyperlinks, you will need to pair it with another app like ThingLink: www.thinglink.com

Venngage is located at www.venngage.com (Great infographics, a wide variety of templates). Venngage also has a getting started free plan that is limited. To create an interactive infographic beyond hyperlinks, use an app like ThingLink.

Other popular tools for creating infographics include Visme, Snappa, Piktochart, Renderforest (online infographic video maker), and for the Power BI users, PureViz Infographic. PureViz is PBI Certified and an add-in to Power BI, and it is powerful!

But don't forget—there's one product you might overlook, and that's PowerPoint! Microsoft provides dozens of infographic templates, and PowerPoint slides can be saved as images of any size.

PowerPoint Presentations that include infographics. Link: https://create.microsoft.com/en-us/templates/infographics

Complex Interactive Infographic Using Large Datasets

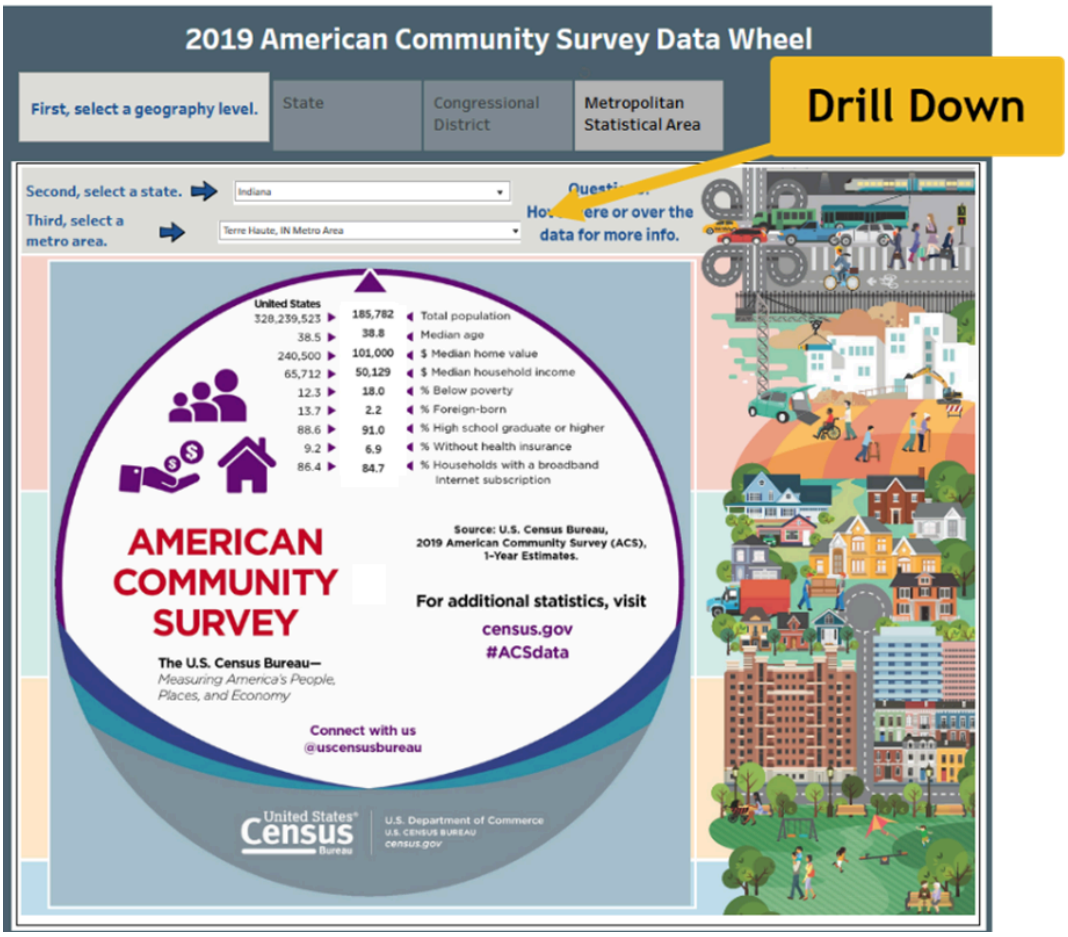
A complex interactive infographic is much more expensive to produce and requires some special skills if it draws data from a database. An example of an interactive infographic without all the bells and whistles can be found at Census.gov. The one pictured in Figure 2.13 pulls from 2019 census data. Essentially, a user selects a state, a congressional district, and a metro area. Only urban areas exceeding 50,000 in population are available. This interaction is on the low end of the scale and is more like an interactive "report" instead of an interactive infographic.

The dataset is from an American Community Survey sponsored by the U.S. Census Bureau from 2019, and it provides a comparison between the metro area (in this case Terre Haute, Indiana) and the United States. It provides the total population, median age, median home value, median household income, below-poverty percentage, foreign-born percentage, percent high school graduate or higher, percentage without health insurance, and percent of households with a broadband internet subscription.

United States Census Bureau (2020). 2019 American Community Survey Data Wheel. https://www.census.gov/library/visualizations/interactive/2019-acs-data-wheel.html

See if you can find your city or region!

Figure 2.13—Interactive Infographic Draws Data From a Database



Source: U.S. Census Bureau—2019 American Community Survey (Interactive)—Public Domain. Author Annotations Added

When should you use an interactive infographic? See Table 2.5 for more information.

Table 2.5: When to Use an Interactive Infographic

(Beegel, 2014, pp. 29–34; Mitchell, 2018)

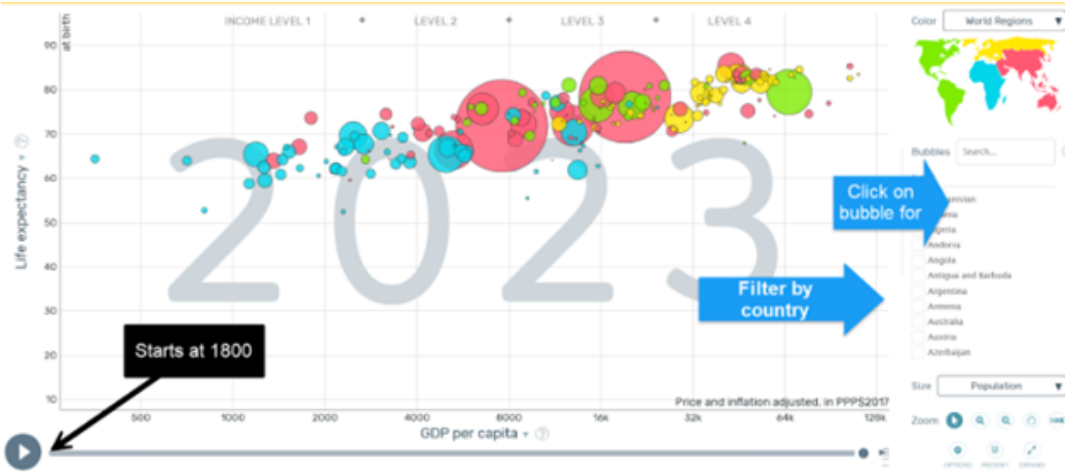
Use an interactive infographic when . . .	**All interactive infographics should meet the following criteria . . .**
✓An abundance of data (more than 10,000 records)	✓Be intuitive both in design and controls
✓Complex processes	✓Organized well
✓Large, detailed maps	✓Extensive user control
✓Data impacts readers differently	✓Drill down—multiple pages or view

Use the Gapminder Tool

Does your organization need an interactive infographic? Consider checking out the interactive data map at Gapminder (www.gapminder.org). It is a complex set of data that looks at life expectancy versus income per person, GDP per capita

in dollars per year, across years and countries. For example, in 2015, Afghanistan had a life expectancy of 53.8; whereas the United States had a life expectancy of 79.1 years. On this infographic (as shown in Figure 2.14), on the actual website you click the "play" button to see it populate the data from 1800 to 2022.

Figure 2.14—Gapminder Interactive (and Animated)



Source: Bubbles Chart by Gapminder (2023) —CC BY. Author Annotations Added

To find out more about Gapminder and the free tools available, visit and explore the sites listed.

Try the Gapminder tool with your own data (includes step-by-step tutorial). Tutorial Link: https://vizabi.org/tutorials/2017/04/03/show-your-data/

Motion Chart Gadget Link: https://www.gapminder.org/upload-data/motion-chart/

Link to Public Data at Google: https://www.google.com/publicdata/

According to Gapminder.org (2023), "Gapminder Tools is free and comes with built-in data. . . . The offline version also allows you to create your own animated bubble charts, line charts and so on. Also have a look at Google's free Motion Chart Gadget and Public Data Explorer, where you can visualize your own data" (FAQ, para. 1).

Government Datasets and Infographics

There are several datasets from different states that are open and available to the public. For example, New York agencies publish open data weekly (opendata.cityofnewyork.us). New York features thousands of datasets ranging from restaurant inspections to Central Park's squirrel census. Almost every state has some type of interactive data dashboard. For example, Arizona's Judicial Branch leverages Power BI to show interactive dashboards on a variety of subjects.

Many foreign governments have interactive infographics that include a broad range of topics you would expect—unemployment rates, COVID, postsecondary education, education completion rates, and others. For example, Health Education England (HEE) has dozens of dashboards related to COVID, mental health, and many more. Many of these foreign government agencies use Power BI. And as certain issues reach global attention, expect to see dataset collaboration. For example, many countries are collaborating with the United Nations to contribute refugee information through an operational data portal.

Arizona Judicial Branch. (2023). Azcourts.gov. Statistics: Interactive Data Dashboards. https://www.azcourts.gov/statistics/Interactive-Data-Dashboards

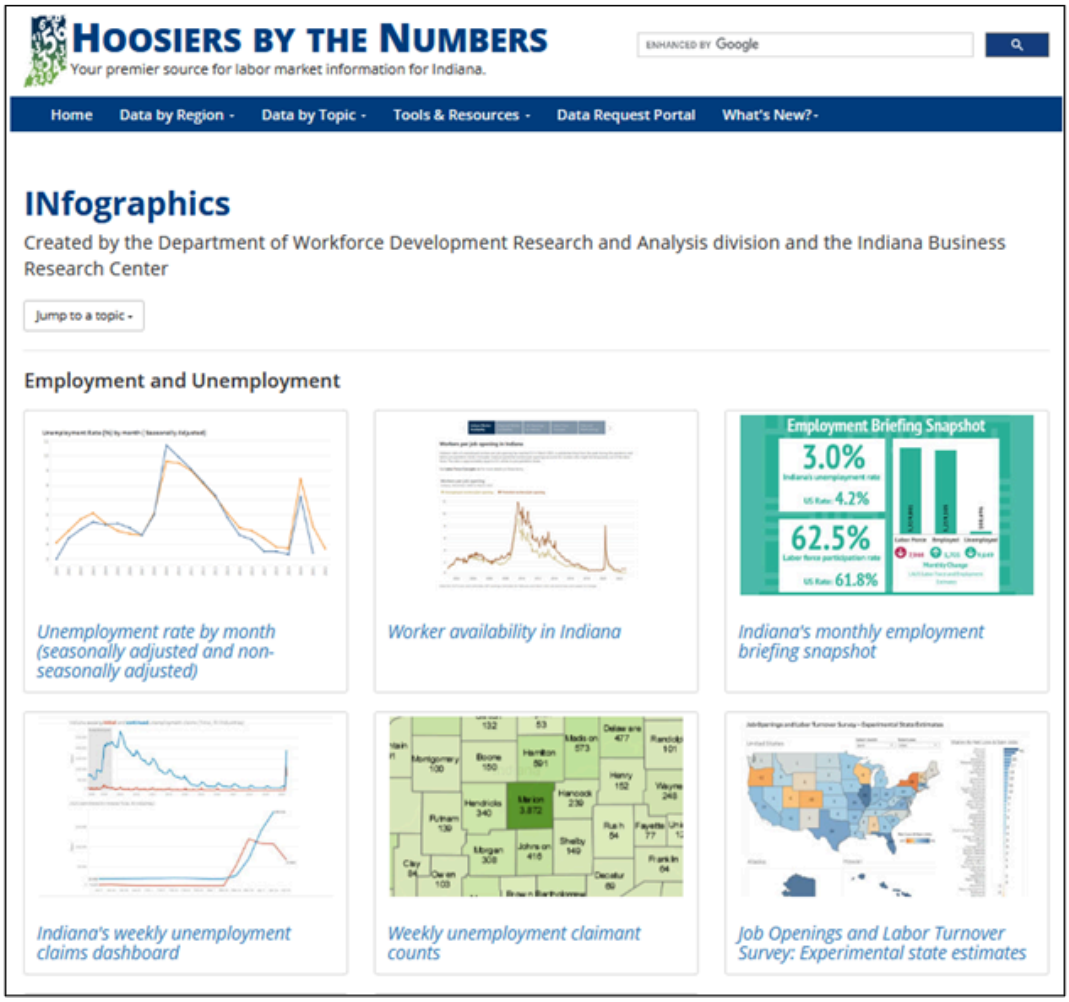
Hoosier by the Numbers Located: www.hoosierdata.in.gov. Powered by STATS Indiana and hosted by the Indiana Department of Workforce Development

Operational Data Portal: Refugee Situations. (2023). The UN Refugee Agency (UNHCR). https://data2.unhcr.org/en/countries/

Almost every state and agency have similar infographic categories. Explore Indiana's *Hoosiers by the Numbers*. Indiana generates dashboards based on search criteria and this site contains dozens of Indiana ready-made infographics. See Figure 2.15 for more details.

Hoosiers by the Numbers—NOTE: Choose the ***Tools and Resources*** at this site to find an entire section of ready-made infographics. Some of the infographics are pulled from several databases, including the U.S. Bureau of Labor Statistics; Indiana Business Research Center; Indiana Department of Workforce Development, Occupational Employment, and Wage Statistics; Indiana Postsecondary Education Data System (IPEDS); and several others.

Figure 2.15—Example of State Government



Source: Hoosiers by the Numbers INfographics by Department of Workforce Development Research and Analysis division and the Indiana Business Research Center—Public Domain

Federal Interactive Infographics

The federal government is rich in infographics. For example, the Federal Trade Commission has a Tableau Public account (essentially a third party makes the infographics but from the FTC's data). The FTC affectionately calls these Vizzes, not just infographics. As you would expect, this site contains fraud statistics, ID theft maps, and imposters' "do not call" complaints.

Federal Trade Commission. Link: https://www.ftc.gov/news-events/data-visualizations/explore-data

U.S. Government Accountability Office. Link to eight infographics of trends: https://www.gao.gov/infographic/infographics-eight-trends-affecting-government-and-society

This is only a sample of infographics and data visualizations available at government sites.

2.2 Self-Assessment 2: Compare Static and Interactive Infographics

Learning Objective #4—Differentiate between static, interactive, and video infographics

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#h5p-5

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#h5p-6

2.4 Exercise 3: Explore and Discuss an Interactive Infographic / Data Visualization

Learning Objective #4—Differentiate between static and interactive infographics

Find an interactive infographic or data visualization from this section. Take a screenshot of the interactive infographic / visualization and discuss how it is used. Also include the URL. What do you like, and what do you think needs improvement?

Discuss how an interactive infographic might be used (or possibly is already in use) at your organization. Use the basic design criteria listed in this section to evaluate it. If you already use an interactive infographic at your organization, share the URL.

2.4 Exercise 4: Interactive Infographic—How Would You. . . ?

Learning Objective #4—Differentiate between static and interactive infographics

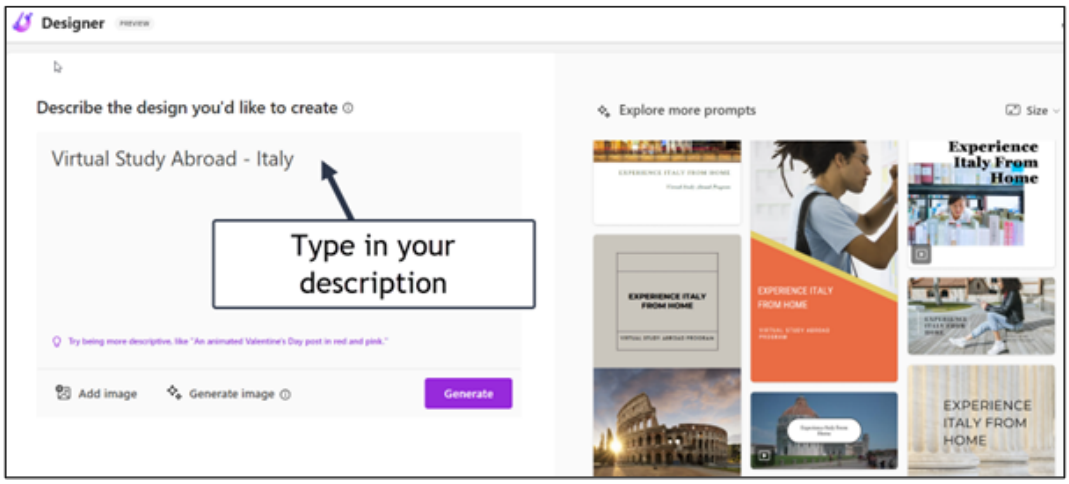
What are five ways an infographic about cancer patients could allow a viewer to interact with it? How could the data be segmented to provide additional interactivity?

Hint: Global Cancer Observatory (GCO) has infographics. GCO is sponsored by the World Health Organization.

Infographics, PowerPoint, and AI

Early in 2023, Microsoft extended its partnership with OpenAI, the maker of the ChatGPT tool. This means some interesting tools will be integrated with all office products and some new tools will be introduced. For example, one tool is the Microsoft Designer tool, an AI-powered design app. Just describe the design and use the Generate button, then choose one you like and customize as needed. See Figure 2.16 for more information!

Figure 2.16—Illustration of Microsoft Designer



Source: Screenshot of Microsoft Designer Interface © Microsoft Corporation. Author Annotations Added

If you market using social media like Instagram or Facebook, this is well worth the exploration!

Microsoft Designer—Stunning designs in a flash. Link: https://designer.microsoft.com

Don't settle for the basic PowerPoint themes and designs available when you select a new PowerPoint! Instead take a minute to explore the animated presentations and infographics available to you through templates at Microsoft, Canva, and Venngage. All three use a component of AI to help users find the perfect template for their topic!

Next, let's browse for infographic templates at Microsoft.

Step-by-Step Instructions for Finding Infographic Templates in PowerPoint

Note: Screenshots of PowerPoint interface © Microsoft Corporation, used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. In PowerPoint, click **File** and **New**.
2. At the *Search for online templates and themes*, type *infographics*. You will have a wide variety of choices, but for now, choose *Infographics* as illustrated in Exhibit 2.6. (Keep in mind that your experience will be slightly different depending on the PowerPoints you have recently opened.)

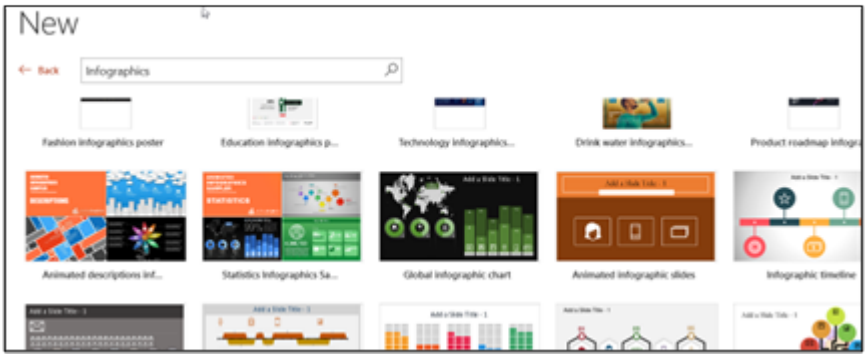


Exhibit 2.6—Example of Searching for PowerPoint Infographics

3. Scroll down until you find **Animated scale graphic**, and click it.
4. Choose **Create**, and it will download to your PowerPoint. Open the slide in presentation mode to see the animation. Notice that the slide deck includes the animated scale slide and an additional slide that has instructions to edit the slide if you need them. As shown in Exhibit 2.7, **Help** is on the right.

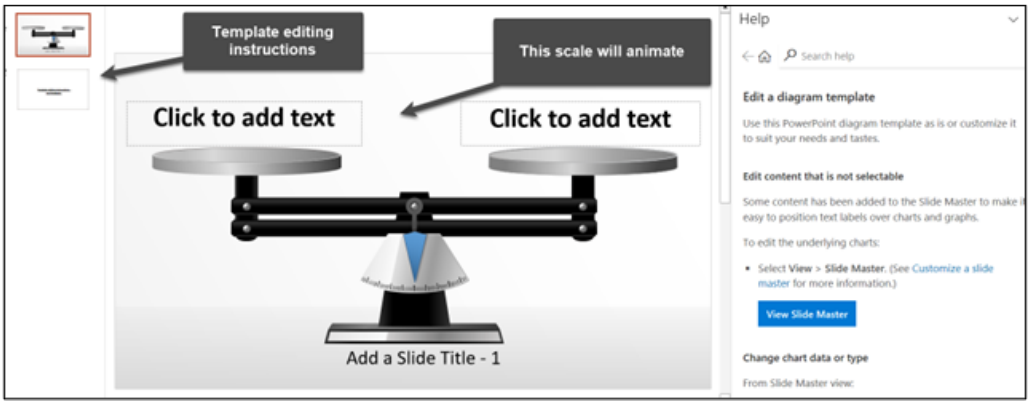


Exhibit 2.7—Example of Help for an Animated Slide From Microsoft

5. Remember to always look for templates at Microsoft first and then look in Canva or Venngage (they may call them presentations). Although there are other "free" sources available, when you do a search, these will usually cost you your email address.

Start Building Your Own Infographic

The real test of understanding an infographic is to create one of your own, but that means you need to pick an infographic app. A review of infographic software apps will yield a lot of results, so to save time, a comparison is made of three of the more popular infographic tools (Canva, Snappa, and Venngage). Use the tool that you like best!

Perhaps you are at a place in an organization where you would request someone else to design an infographic for you. Keep in mind that creating infographics is considered a basic digital skill, and graphic designers can create beautiful designs, but they won't know the data as well—and it is your story to tell. So let's explore how some of the infographic apps work!

Only "free" icons and "free" templates were used here. Notice that the designs are different, but the information is the same.

Steps to Creating an Infographic

The basic process for creating an infographic is as follows.

Step 1—Gather the data and/or conduct research

Step 2—Organize and conceptualize the data story (are you raising awareness or sounding a call to action?) Feel free to use the modified CASS template (Figure 2.1).

Step 3—Draft and revise the visualization.

Apply the general steps to the sample scenario.

Sample Scenario: Impact of Training Infographic

To build an infographic, let's use the following scenario. Jim Wallace, a department head at NovaDrive Solutions, requested that Alicia, Donald, and Diana attend a meeting. Jim, the supervisor, challenged each of them to create an informational infographic that highlights how professional training can increase productivity. Jim's goal is to enhance productivity across all departments by expanding the role of internal trainers. It's important to note that Jim holds the same level of authority as other department heads.

After conducting extensive research on how professional development can improve productivity and retain employees, Jim decided to conduct his own informal study. Two years ago, Jim utilized his training budget to support internal professional development instead of hiring an expensive external trainer. He opted for internal trainers, who are current employees of the company. These internal trainers are responsible for onboarding new employees, introducing them to the manufacturing process, and conducting quality control. As a result, employees have a strong rapport with them.

Although Jim has shared this information in several department meetings, no other department has attempted the internal training model. He aims to showcase his success and convince his peers to follow suit. Therefore, he hopes that the infographic will finally persuade them. Jim has chosen not to share this report with the vice president yet, as he wants to gain support from other department heads first.

The results of Jim's internal study, conducted in 2022, are as follows:

- The internal trainer provided four one-hour sessions to 10 employees over four months, totaling 40 hours of train-

ing invested.

- Each one-hour training session required three hours of preparation time for the internal trainer. Consequently, training 10 employees resulted in a total of 16 hours of preparation time.
- The evaluations from the 10 employees showed an overall rating of 4.8/5.0 and a confidence level of 5.0/5.0 that the training would enhance their productivity.
- In the subsequent year, these 10 employees worked a total of 20,000 hours. As a direct result of the training, their productivity increased by 1%, leading to a gain of 200 hours of work for the organization.
- Essentially, investing 56 hours in training resulted in 200 hours of increased productivity.

Jim asked Alicia, Donald, and Diana to create an infographic, even though Alicia expressed her concerns, saying, "You know we aren't graphic designers, right?" Jim responded, "Well, you are familiar with design thinking here at Nova, and you are the best presenters in my department. I believe you can figure it out!"

The following illustrations (see Exhibit 2.8) show infographics built in three different infographic software apps by Alicia, Donald, and Diana. This is the first draft from each employee.

Exhibit 2.8—Three Different Infographic Designs for the Same Scenario

Canva Design by Alicia	Snappa Design by Donald	Venngage Design by Diana
 Note: Author Illustration (2025)	 *Note:* Author Illustration (2025)	 *Note:* Author Illustration (2025)

Compare the three designs. Which do you like from a first-glance perspective? The supervisor, Jim Wallace, reviewed the three designs and gave the following feedback.

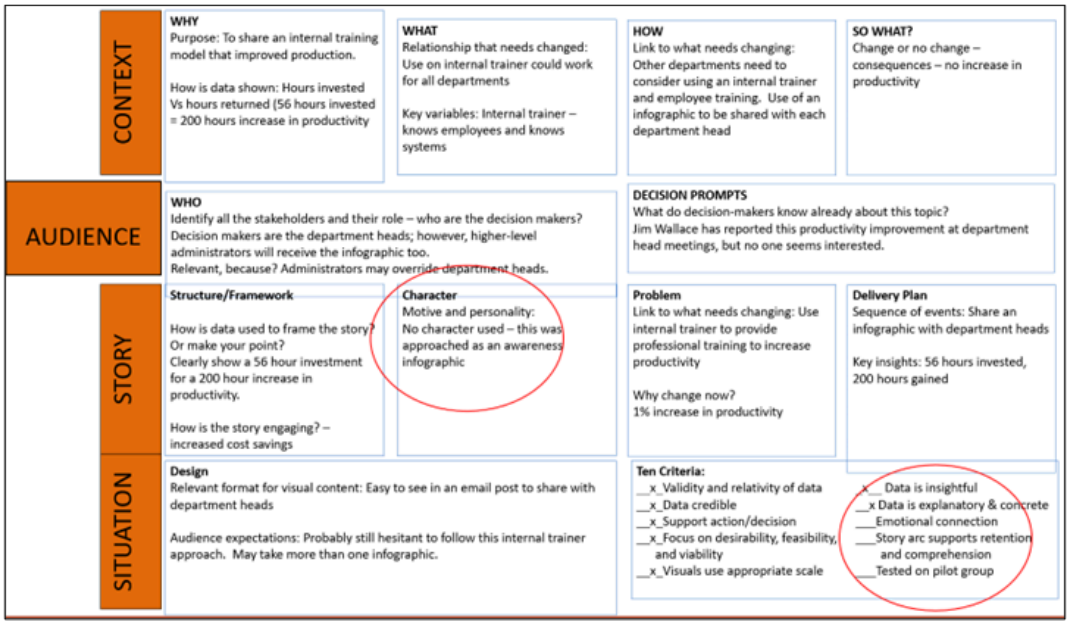
I like the contrast between the green, white, and black, but I don't see a call to action. The first one does not have a year or discuss the use of an internal trainer. The third one has a call to action, and I like the layout, but it lacks the same flow as the other two. Can the three of you work together and combine your work to make the best one?

Team Discussion: Alicia, Donald, and Diana

Jim's quick feedback had the three employees wondering what they should do next. The group brought their lunch to the team office and decided to use the modified CASS framework (see Figure 2.1) to evaluate the process. They soon realized that none of the infographics had a character or emotional connection. Diana asked, "Can we turn it into a competi-

tion?" Donald wondered, "What would motivate the department heads?" Alicia added, "Is the 1% increase in productivity perceived as minimal and not worth a change?"

Figure 2.17—Use of CASS to Evaluate the Wallace Infographics



Note: Author Completed CASS Template (2025)

2.4 Exercise 5: Create Your First Infographic

Learning Objective #5—Design an effective infographic using a free application

You have been approached by Jim Wallace's team: Alicia, Donald, and Diana to help revise the infographic.

1. First, review the scenario, the CASS evaluation (Figure 2.17), the infographic quality checklist (Figure 2.7), and the team discussion. Review the directions for each infographic software.
2. Second, create a free account at one or all three infographic apps (see Exhibit 2.8 for Canva, Snappa, or Venngage). Never give your credit card number for any reason; instead, choose the free option.
3. Third, redesign one of the infographics or design a new infographic. Include an image of the infographic in the discussion board and discuss the changes and why you made them. Discuss how Jim Wallace should tell the story. Feel free to expand on some of the team's comments.
4. Respond to your classmates' posts and provide constructive feedback.

Table 2.6: Comparison of Infographic Software Apps

Note: Author-Provided Data (2024)

App Name	Description	Price	Tutorials
Canva www.canva.com	Canva Infographic Maker: Lots of free templates that you can modify. If a teacher or students, even more available for free. Lots of icons and available content	Free to $12.99 per month OR Canva Pro $119.99/yr for one person Canva for Teams $149/yr. for 5 people	Lots of free tutorials—video and text
Snappa https://snappa.com	Snappa: For nondesigners. Drag-and-drop. Allows background images. Very easy to use. Great icons.	Free to $10 per month Team is $20/mo. Limited number of free "saves"	Video when you first log in
Venngage www.venngage.com	Infographics, but also posters, flyers, beautiful templates—lots of business templates	Free to $10 per month Premium	Has you pick three templates from the start, Venngage Academy

How to Create an Infographic in Canva

All infographic examples used free icons, free templates, and free images. For the "how to" section, find the following instructions for Canva.

Step-by-Step Approach to Use Canva

Note: Screenshots of Canva interface © Canva, https://www.canva.com/. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. **Type** www.canva.com in your browser.
2. Note that to sign up, it has you choose your experience. It may show teams available at your organization (for now, **skip** this option).
3. The pop-up will ask, "What will you be using Canva for?" Choices include teacher, student, small business, large company, nonprofit or charity, and personal. Choose the **selection that relates to your organization**. This question by Canva is their way of matching the templates that relate to you, but all the free templates are available to you regardless of how you answer this question.
4. The next screen depends on how you answered question three. For example, if you select "teacher," you will be asked "Where do you work?" with choices that range from elementary to higher education.
5. The next screen shows a category of over 50,000 templates. Choose the **template** section that matches your organization.
6. Once you are through the pop-ups and examples, you get to a section called, "What would you like to design?" as shown in Figure 2.18.

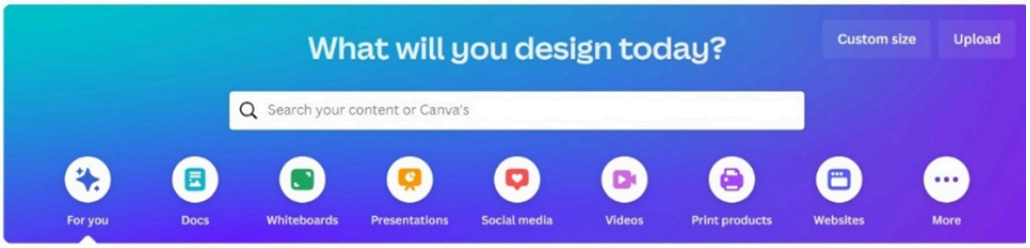


Figure 2.18—Canva Design Menu

7. It may also say "Design anything." Take the time to **explore** this section—Canva does much more than just infographics. You can create designs for almost any reason, any event, or any platform. If you click in the search bar, type **"business infographic + startup"** to see the template design used by Alicia (one of the three employees charged with designing an infographic). If you scroll down several rows of infographics, you will find the one labeled Business Startup Costs.
8. The Business Startup Costs template is 800 × 2000 pixels (not an ideal size for all social media platforms). Consider the best size to use for this situation. Canva will display lots of infographics in categories (i.e., business, education, charity, process, and timeline). Look for the ones marked free. Take time to **explore**. You do not have to use the exact template used in the comparison table.
9. To demonstrate, click the **Business Startup Costs** template to customize it. The tour pop-ups will demonstrate helpful tips. Once you have the template in design mode you will see a side and top menu. Some of the key elements are shown in Figure 2.19. Many of the design features are free, but things like "Add your brand fonts" or clicking "Brand Hub" will prompt you to upgrade. You don't need the upgrade to create an outstanding infographic. Choose only free options.

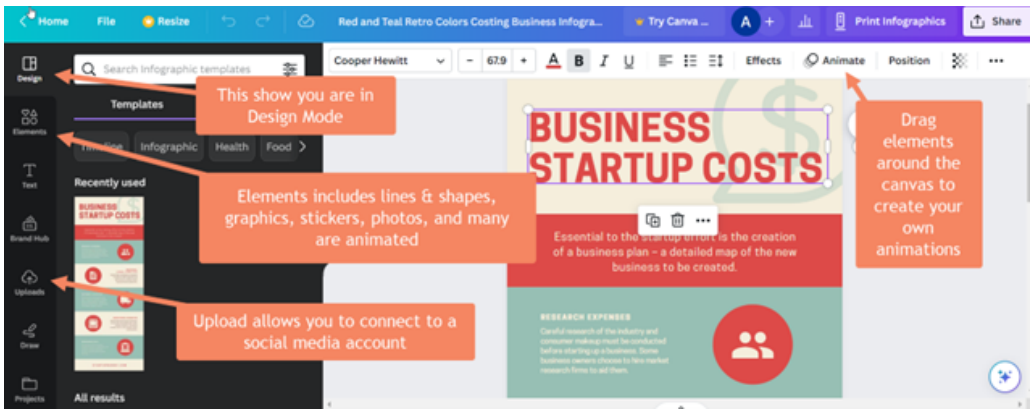


Figure 2.19—Canva Template in Edit Mode

10. As you **explore the menu**, note the resize button, the effects button, the animate button, and so on—click through them all so you know what they do.
11. Click on an **existing icon** and then click **elements**. Use the search bar to search something like **calendar** as shown in Figure 2.20. The crowns represent upgraded content, so choose items that are free.

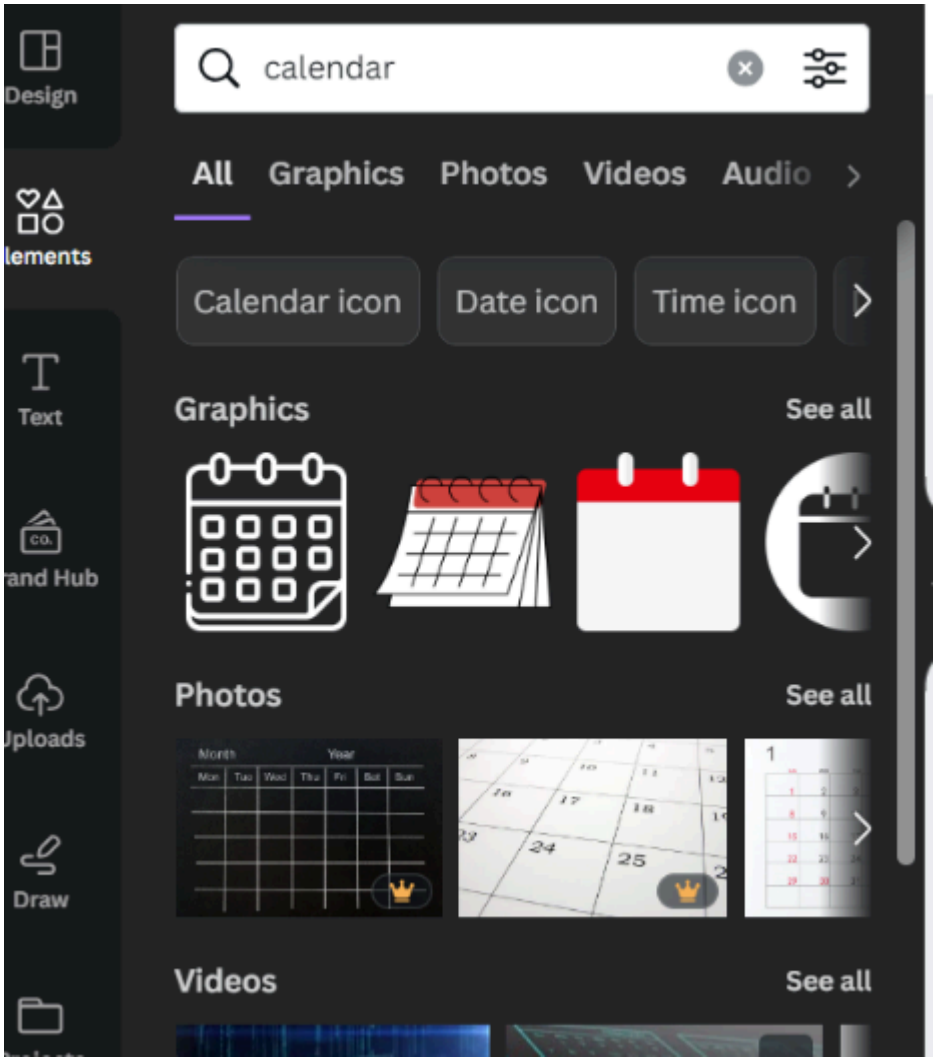


Figure 2.20—Icon Examples

12. Click on different parts of the template to **change the** text.
13. Review, proofread, and **conduct a quality check** with the infographic quality checklist (see Figure 2.7).
14. When you are done with your design, choose **File** and **Download**. It recommends a PDF format, but if you use the drop-down menu, you will see that you can download it in JPG, PNG, PDF standard, PDF print, SVG, MP4 video, and GIF formats.

Now that you have designed your first Canva, consider ways to make this Canva better by reviewing the checklist. How could you make it more concise?

Canva Design School—Courses are free. Link: www.canva.com/designschool/

Skills Factory. (Jan 2, 2023). *Canva—Tutorial for Beginners in 13 minutes! 2023 Full Guide.* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#oembed-5

How to Create an Infographic in Snappa

All infographic examples used free icons, free templates, and free images. For the "how to" section, find the following instructions for Snappa.

Step-by-Step Approach to Using Snappa

Note: Screenshots of Snappa interface © Snappa, https://snappa.com/. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. **Type** https://snappa.com/ and set up your free account. You may see a "Get Started Free" button.
2. To create a graphic, Snappa starts by having you set up your graphic size. A normal infographic is 800 pixels × 2000 pixels (see Figure 2.21).

Figure 2.21—Snappa Creation Process Starts With Size

3. But if you use this option, it will create a *blank* infographic, so **scroll down** to Blogging and Infographics and select the infographic shown (don't worry, you aren't tied to this infographic). This opens to dozens of free templates (see Figures 2.22 and 2.23).

Figure 2.22—Choose Infographic to See Dozens of Free Templates

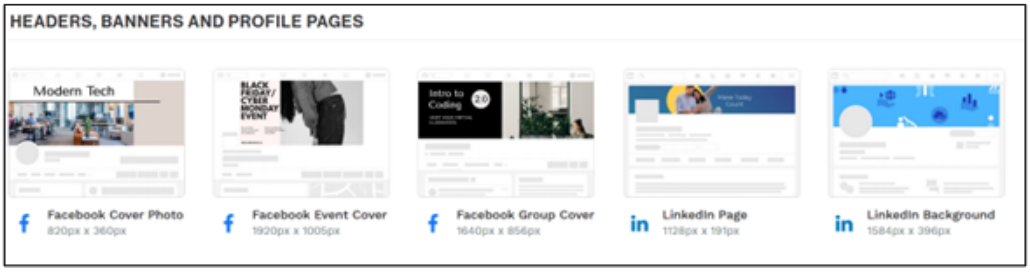


Figure 2.23—Headers, Banners, and Profile Pages

4. To use the template from Jim Wallace's team, scroll down to the template labeled **2020 Most Valuable Brands** (remember, you can use a different template if you prefer.). In Figure 2.24, notice a full menu that includes icons, vectors, photos, and uploads, a way to change the background, and easy replacement of text.

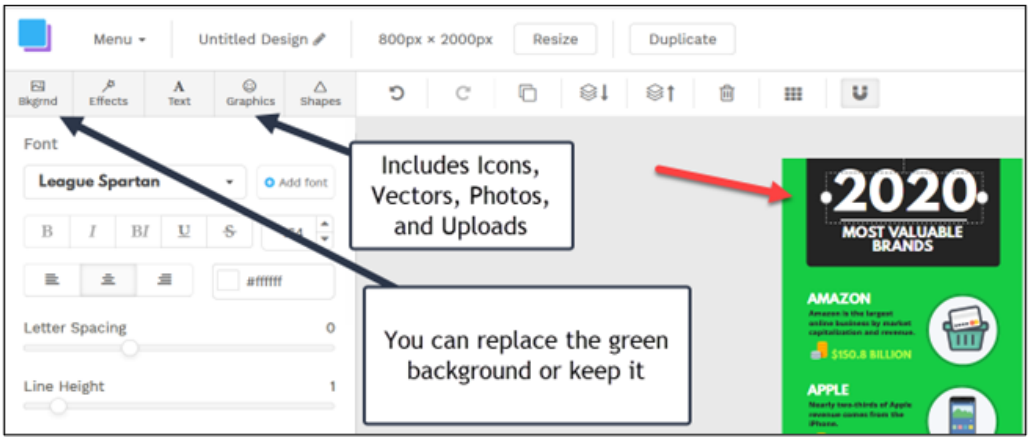


Figure 2.24—Snappa Design Menu

5. In the initial step, you saw sample templates with their sizes listed. For example, here are some featured designs and their size (this is only a fraction of what is listed at Snappa!).
   a. Facebook post (1200px × 900px)
   b. Instagram post (1080px × 1080px)
   c. blog featured image (1200px × 628px)
   d. LinkedIn post (1200px × 628px)
   e. infographic (800px × 2000px)
   f. ebook cover (1410px × 2250px)
   g. Zoom background (1920px × 1080px)
6. **Customize:** apply color, style, and specific elements.
7. Incorporate data visualizations through elements, charts, or graphs as needed. Is there a call to action?
8. Review, proofread, and conduct a **quality check** with the infographic quality checklist (see Figure 2.7).
9. **Download** and share as a PNG, JPEG, and so on.As you consider Jim Wallace's team, part of your strategy is to pick the right medium (and best size media) to reach your audience. So what size would you pick?

Snappa Getting Started Videos. Snappa has both video and a knowledge base (help) that has a search feature. Link: https://kb.snappa.com/category/16-getting-started-videos

How to Make an Infographic in Venngage

All infographic examples used free icons, free templates, and free images. For the "how to" section, find the following instructions for Venngage.

Step-by-Step Approach to Use Venngage

1. **Type** www.venngage.com and sign up for a free account.
2. Once you log in, choose **Templates**.
3. Next, choose the category, **Infographics**, and in the search bar, type *achievement infographic* (or feel free to choose any infographic template). Figure 2.25 illustrates all the ways to customize the template.

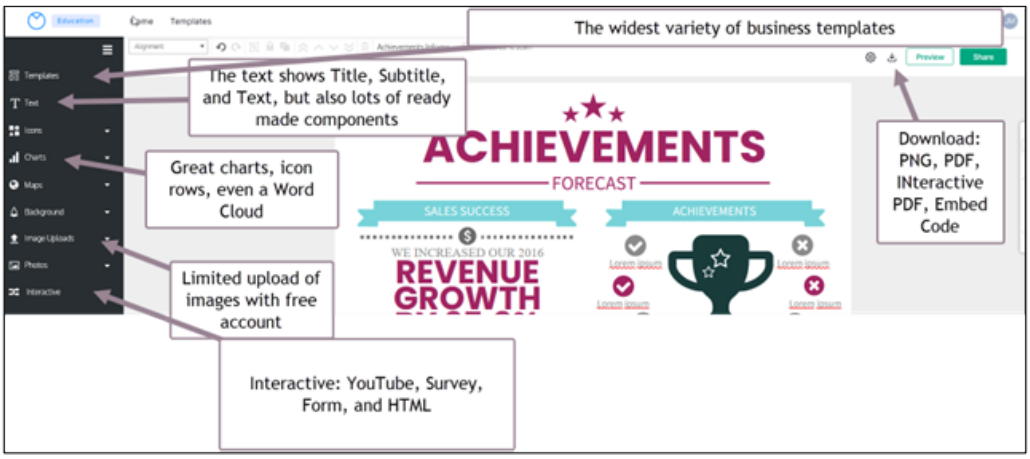


Figure 2.25—Edit Menu in Venngage
Source: Screenshot of Venngage Interface © Venngage, www.venngage.com. Author Annotations Added

4. **Customize** the template using the font, size, color, and alignment.
5. Make sure the content is appropriate for your audience.
6. **Insert** relevant icons or images.
7. Incorporate data visualization to *illustrate insight*.
8. **Review** infographic—Is there a call to action?
9. **Add** finishing touches (watermark, branding, check colors used for the organization).
10. Review and proofread, and use the quality checklist (Figure 2.7).
11. Save, share, and **download** your infographic. Make sure the infographic has a meaningful name. Feel free to share as a PDF, PNG, and so on.

There are many other features that are not noted in Figure 2.25, so take time to explore. All three apps change layouts and offer new features. Venngage now has an AI Card Generator! Now let's look at the next topic through the lens of artificial intelligence.

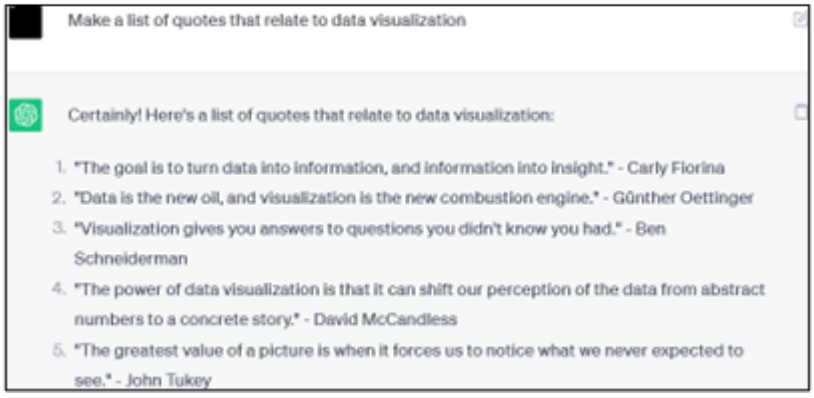
2.5 Leverage Visualizations With the Use of Artificial Intelligence

> Visualizations can help us navigate a sea of data, making the complex simple and the abstract tangible.
> —David McCandless

If you were a beta tester for OpenAI ChatGPT, you were probably amazed to ask the artificial intelligence bot a question and watched as the AI quickly provided a list of answer(s). Like any good researcher, you should use AI for the tool it is and confirm the accuracy of the information. It is not a source, but it can serve as a catalyst for the ideation process. The AI market is expected to grow exponentially and revolutionize every industry because of its ability to learn, recognize patterns, problem-solve, plan, and make decisions. It's already built into several tools that you use regularly, though you may not know it. For example, Microsoft Word uses AI-powered features like grammar and style suggestions and intelligent proofreading. Google extensively leverages AI across its products with the end goal of enhancing user experience. Even the **Hey Google?** assistant employs AI to understand and respond to our requests. AI is integrated into Google Maps, Google Photos, and most of Google's product lineup.

Infographic creators have discovered ChatGPT is great for ideation, writing listicles, and providing users with a starting place for innovation. For example, we asked ChatGPT to "Make a list of quotes that relate to data visualization," and it gave us 15 quotes identified by the person who said them. And we could refine this list by asking more specific questions. See Figure 2.26 for a partial list.

Figure 2.26—Use of AI ChatGPT for Listicles



Source: Screenshot of ChatGPT Interface © OpenAI, https://chat.openai.com/

AI relies on complex algorithms that can process enormous amounts of data faster than humans, but it's a "fuzzy front end of the innovation process that entails convergence-divergence dynamic that spans problems and solutions" (Kakatkar et al., 2020, p. 171).

You are exposed to more artificial intelligence than you realize. If you purchased a new automobile recently, it may have been equipped with an Advanced Drive Assistance System (ADAS). AI powers ADAS with a plethora of safety features including machine learning and computer vision to analyze sensor data from cameras, radar, lidar, and other sources all to make real-time decisions for the safety of the passengers. And the use of AI in cars continues to evolve.

Our journey in this chapter has focused on concepts that explain how data visualization can tell a story to connect with an audience. With AI playing a role in data visualization and storytelling, there are exciting possibilities in the future.

Here are just a few futuristic possibilities:

- Automated insights through analyzing patterns, correlations and outliers of large datasets that may have been overlooked.
- Dynamic and interactive visualizations since AI assists users in exploring data from different perspectives includ-

ing customizations that appeal to the user. AI's algorithms suggest appropriate visualization types based on the data and the story being told.
- Personalized storytelling to tailor narratives to specific audiences to enhance engagement and understanding.
- Real-time data visualizations allow users to monitor changing trends and patterns specifically helpful in fields like finance, social media analytics, and health care.

Automated data storytelling can't be far behind. If AI can assist in finding insights today, how close are we to asking ChatGPT "What's the story behind this data?"

ChatGPT-4 (the paid version) allows you to turn on Advanced Data Analysis and upload up to 10 different documents, and each document can be up to 500MB. It responds to your questions. To see more, feel free to watch the Flow State AI & Automation video.

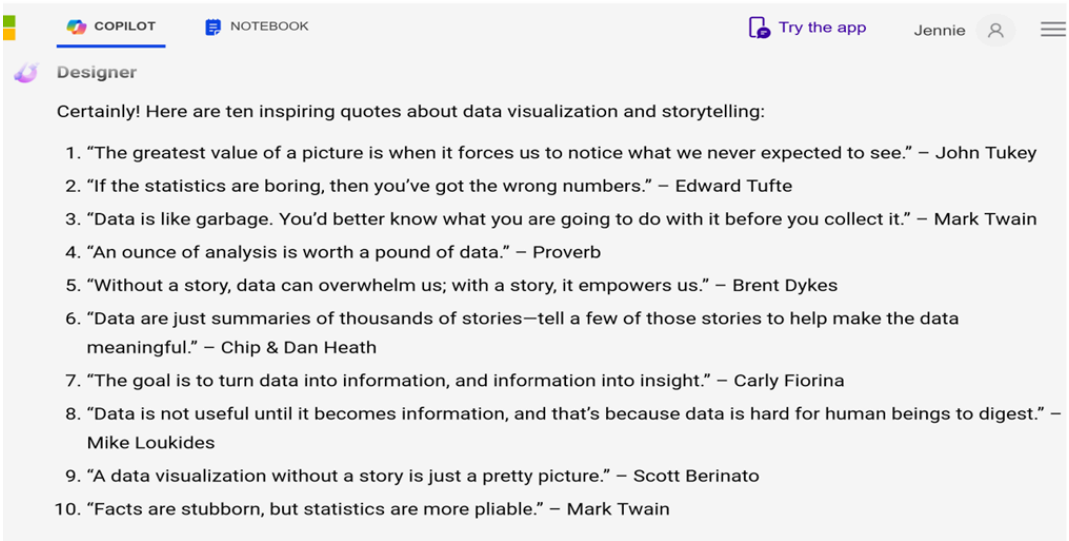
Flow State AI & Automation. (2023, Oct 25). *How to Use ChatGPT-4 Advanced Data Analysis—Analyze your Data with AI*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#oembed-6

Microsoft's AI—Copilot

Although ChatGPT is phenomenal, the free version was disconnected from the internet in 2022. Copilot is a great alternative. First of all, it is still connected to the internet. Secondly, it provides footnotes linked to sources of the information found. If you have explored ChatGPT, you will note that it sometimes just makes up things, and with no linked notes, it makes it difficult to find the sources to verify the information. Copilot also provides DALL-E 3 image generation for free. Here's the same list in Copilot (see Figure 2.27).

Figure 2.27—Copilot Listicles



Source: Screenshot of Microsoft Copilot Interface © Microsoft Corporation

2.3 *Self-Assessment: Bias and Unethical Use of Data*

Learning Objective #6—Recognize bias and unethical use of data

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=562#h5p-7

2.5 *Exercise 1: Use AI to Create a Listicle*

Learning Objective #6—Recognize bias and unethical use of data

Step 1: Create an account at http://OpenAI.com/chatgpt.

Step 2: For practice, put this prompt in the "Send a message" box: *Provide a list of free visuals that can be used for data visualization* (depicted in Figure 2.28).

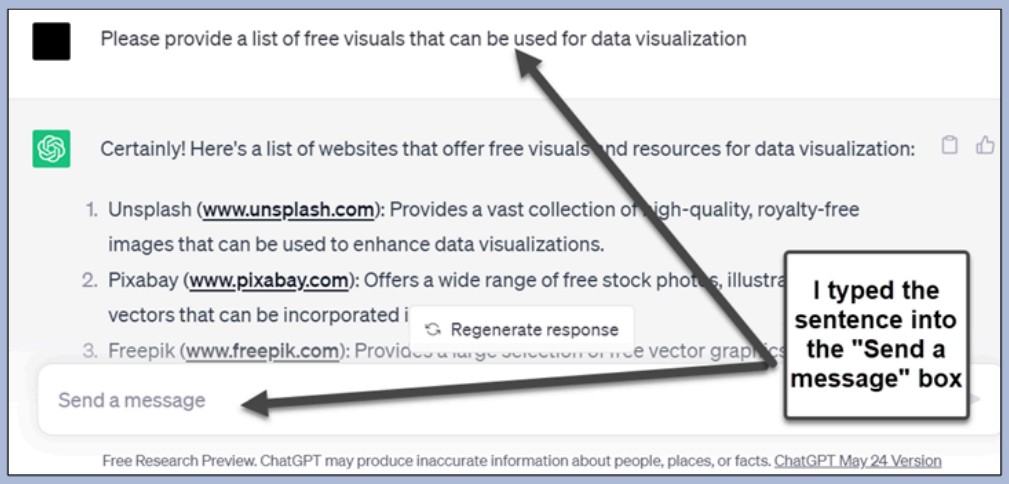


Figure 2.28—Question to Ask AI
Source: Screenshot of ChatGPT Interface © OpenAI, https://chat.openai.com/. Author Annotations Added

Step 3: Ask ChatGPT to write a different type of list by using this prompt: *Create a list of five arguments for using AI and five arguments for not using AI from an ethical standpoint.*

Step 4: Discuss your findings either in class or on the discussion board as directed by your instructor.

Chapter 2 Summary

This chapter lays the groundwork for understanding the significance of impactful data visualizations combined with engaging storytelling. In today's information-saturated world, persuading and captivating our audience becomes increasingly challenging. Data can truly speak when the data storyteller can unravel its complexities and weave a narrative that reveals insights. Design thinking, a human-centered approach that prioritizes the audience, becomes essential. Though what happens when you are not physically present to present your data visualization? Will the audience still hear the voice of the data? This chapter introduces design thinking for storytelling, highlighting contextualization, engagement, emotional connection, simplification and clarity, guiding attention and focus, and retention and comprehension as key strategies to employ when you are not in person as the storyteller.

Storytelling may not be necessary for every aspect of presenting data, but certain data holds vital insights, correlations, and outliers that demand a compelling story that engages the audience. It is crucial to approach both the story and the data visualizations with honesty, impartiality, and ethical considerations.

To evaluate your data storytelling, utilize one of the data storytelling framework templates. It's important to note that a single framework cannot fit every situation, but observing the similarities among different models can enhance your ability to evaluate data storytelling. Consider models like the CASS template (context, audience, story, and situation) or the simplicity of the 5 Ws. Plan to use an infographic quality checklist for evaluation.

You will sharpen your ability to discern between good, bad, and ugly data visualizations through the practice of evaluating data visualization designs. Remember that poor data visualizations may indicate manipulation, cherry-picking, or mislabeling of data. There is often an intention on the part of the storyteller to exaggerate or downplay certain points. Bad data visualizations typically cross ethical boundaries. Ugly data visualizations involve cluttered charts, ambiguous color schemes, inconsistent design, or improper chart types. Inexperience often leads to ugly data visualizations. On the

other hand, good data visualizations effectively communicate by contextualizing, engaging, and emotionally connecting with the audience, simplifying complex data, and guiding the audience's attention to data insights.

In addition to Iliinsky's four pillars of visualization (purpose, content, structure, and format), consider the context necessary for the audience to better understand and retain your data story. Remember to review and use all the tools available to determine the quality of your data visualization and the accompanying story.

This chapter introduces various types of infographics, including statistical, process, timeline, interactive, comparison, geographical, and video infographics. Take the time to explore examples of these infographic types and tools like Gapminder, which can tame large datasets and reveal unexpected insights. Furthermore, the chapter introduces three infographic software apps and provides step-by-step instructions for using each of the apps to create your first infographic. The final section of the chapter delves into the future of infographics, exploring the role of artificial intelligence in this field.

Chapter 2 Case: The Power of Infographics

In this culminating project, apply the knowledge and skills acquired in this chapter to create an engaging and informative infographic that relates to your organization or a topic that interests you. Combine your understanding of design principles, data analysis, and storytelling techniques to showcase your understanding of how infographics can effectively convey complex information in a visually compelling way.

Case Objectives

1. Evaluate a data storytelling project for effectiveness.
2. Differentiate between effective and ineffective data visualizations.
3. Apply design principles and use models (like CASS) to evaluate the infographic to ensure understanding of the information presented in charts and infographics.
4. Analyze and interpret data to extract key insights and develop an effective narrative.
5. Listen critically to identify powerful narratives and use effective storytelling to frame meaningful messages (Chapter 1, LO 4).
6. Design an effective infographic using a free application.

Case Guidelines

1. *Topic selection:* Choose from a topic of personal interest within your organization, or if you prefer, choose anything from environmental issues to historical events, scientific phenomena, social trends, and so on.
2. *Data gathering and analysis:* Conduct research to collect the relevant data and information about your chosen topic. Feel free to speak to a coworker. Critically evaluate the data to ensure credibility and accuracy. Indicate the significant insight that can be highlighted in the infographic.
3. *Design and visual presentation:* Create a visually appealing infographic using one of the digital tools (Canva, Snappa, or Venngage, or others approved by your instructor). Use good design to present a balanced infographic that enhances audience understanding.
4. *Self-assessment:* Use one of the frameworks (like CASS) to evaluate your infographic. Proofread it, and use the info-

graphic quality checklist.

5. *Storytelling and narrative*: Create a compelling narrative that effectively communicates the information presented in the infographic. The narrative should engage the audience, capture their attention, and guide them to draw meaningful conclusions or insights. Incorporate at least two lessons from Chapter 1.
6. *Target audience*: In a separate discussion, indicate the specific target audience your infographic was designed for and the audience's level of knowledge and interest that influenced how you designed the infographic.
7. *Presentation, reflection, and feedback*: Each student will present their infographic with a narrative/storytelling to the class. Then highlight the key insights and storytelling elements you used. Students should provide feedback to one another using the CASS template and the quality checklist as a guide. After the presentation and feedback, reflect on the design choice, data interpretation, and overall effectiveness.

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3. Leverage Data Visualizations to Show Trends and Insights

It is true that data visualization is part data science and part art. That being said, even the most creative art is supported by theories that explain why it works.

—Michiko I. Wolcott, CMC, 20-year veteran of consulting in data and analytics

What Do You Think?

Sarah, a marketing executive, is eager to present data findings to her VP, but struggles to interpret and communicate them effectively. Sarah has invited her colleague, Alex, to give the presentation. Alex is passionate about uncovering trends through data visualization. Any time a question comes up about working with the company's data, Sarah is always told, "Go ask Alex." Sarah forwarded her last year's data to Alex and scheduled a virtual conference call.

As Sarah joins the meeting, she is met with a complicated data visualization shared on her screen. Before she can even say "hello," Alex exclaims, "Sarah, I've spent hours analyzing the data, and I believe I've found some incredible trends that can help drive next year's marketing strategy!"

Sarah looks at the visualization and nervously responds, "That's great, Alex! But I must admit, this data visualization seems a little overwhelming. How can we simplify it for our presentation?" Alex turns on his camera, "I understand your concern, Sarah. We need to find a way to break down the complexity and present the trends in a clear and concise manner. How about we focus on the key insights and simplify the visualization to make it more understandable?"

Sarah, with a sigh of relief, responds, "Thanks, Alex, I like this plan! So what were the most significant trends discovered?"

Alex leans in, "Well, one trend that stands out is the correlation between our social media campaigns and website traffic. There is a substantial increase in website visits following each campaign launch."

Alex smiles and responds, "Let's use a line chart to showcase the website traffic over time, with clear markers indicating the dates of each social media campaign. This way, we can demonstrate the direct impact of our campaigns on generating traffic!"

Alex sees Sarah taking notes. She looks up, and he can see her excitement as she responds, "I can already visualize it. And I know the perfect story to include—we have a great testimonial from a customer about our July campaign to go with it. What other trends have you found?"

Alex showed Sarah three more insightful trends. The collaborative nature of their discussion heightened their determination to deliver a compelling and informative story with insightful data visualizations.

In this scenario, Alex and Sarah faced the challenge of presenting a complex data visualization that shows trends. Think about your own organization. Do you look for insight from your data to strategize goals for next year?

Introduction

In the age of information overload, harnessing the power of data has become paramount for organizations seeking a competitive edge. In the scenario, Sarah recognized the ability to extract meaningful trends and insights from complex datasets was a skill she needed—a skill that can translate into a strategic advantage. Alex was able to transform the raw data and suggest visuals, but it was Sarah who saw a need to incorporate a story. As they collaborated on visual narratives that would bring data to life, they brainstormed ways to make them more accessible (easier to understand) and engaging for their main decision-maker, their VP.

Within this chapter, we will delve into the principles and best practices of leveraging data visualizations to unveil trends and insights. We will explore various visualization techniques and tools, highlighting their strengths and applications in different contexts. Graphical displays of data make it easier to spot patterns and detect unusual values. Besides the graphical displays to help us understand our data, this chapter also introduces benchmarking, tools used to visualize and persuade, statistical analysis tools, and visuals to support decision-making.

We will also explore techniques to effectively communicate insights derived from data visualizations for diverse audiences, ensuring that the impact of the findings is maximized. So let's embark on a journey to leverage data visualizations, unravel the hidden stories within the data, and uncover trends and insights that can shape the future of our organizations.

Chapter 3 addresses the following learning objectives.

Learning Objectives

At the end of this chapter, students should be able to:

1. LO 1: Determine insights.
2. LO 2: Use benchmarking, decision-making, and strategic analysis tools.
3. LO 3: Interpret research industry trends and recognize bias.
4. LO 4: Create and use benchmarking frameworks to provide context for problems, support decisions, and measure performance.
5. LO 5: Create and use decision-making tools to provide context for problems, support decisions, and assess risk.
6. LO 6: Conduct preliminary statistical analysis, predictive statistics, and understand Six Sigma.

Key Terms: Balanced Scorecard, decision trees, descriptive statistics, Disruptor, Ishikawa, MarketLine, Pareto Diagrams, PEST, PESTLE, Porter's Five Forces, posters, regression analysis, Six Sigma, sparklines, SWOT

Download Chapter 3 PowerPoint (10 MB).

Download Chapter 3 Student Files (7.5MB).

3.1 An Introduction to Anscombe's Four Datasets

The goal is to turn data into information and information into insight.

—Carly Fiorina, former CEO of Hewlett-Packard

One of the best ways to see the importance of making a visual of data is to introduce the Anscombe datasets. In 1973, Anscombe built four datasets of 11 points each. Statistically they are very similar: Averages, variances, correlation, and even the linear regression formula are the same. Here are the four datasets slightly modified from the original. The modifications are highlighted in Figure 3.1.

Figure 3.1—Modified Anscombe's Quartet

	A	B	C	D	E	F	G	H	I
1		MODIFIED Anscombe Quartet							
2		I		II		III		IV	
3		x	y	x	y	x	y	x	y
4		10	8.04	10	9.14	10	7.46	8	6.58
5		8	6.95	8	8.14	8	6.77	8	5.76
6		13	7.58	13	8.74	13	12.74	8	7.71
7		9	8.81	9	8.77	9	7.11	8	8.84
8		11	8.33	11	9.25	11	7.81	8	8.47
9		14	9.95	14	8.1	14	8.84	8	7.04
10		6	7.24	6	6.13	6	6.08	8	5.25
11		4	4.26	4	3.1	4	5.39	19	12.5
12		12	10.84	12	9.13	12	8.15	8	5.56
13		7	4.82	7	7.26	7	6.42	8	7.91
14		5	5.68	5	4.74	5	5.73	8	6.89
15									
16	AVERAGE	9	7.50	9	7.50	9	7.50	9	7.50
17	VARIANCE	11	4.12	11.00	4.12	11	4.12	11	4.12
18	CORRELATION	0.816		0.816		0.816		0.816	
19	INTERCEPT	3.00		3.00		3.00		3.00	
20	SLOPE	0.50		0.50		0.50		0.50	

Note: The yellow highlighting are numbers that are slightly different from the original Anscombe's quartet dataset. When calculated, the **following statistical information is true for each of the four datasets**.

- The average x value is 9; the average y value is 7.50.
- The variance for x is 11 and the variance for y is 4.12.
- The correlation between x and y is .816.
- The linear regression is $y = .50x + 3$.

Figure 3.2—Formulas in Excel: Using Dataset I as an Example

	A	B	C
1			
2	Dataset I	I	
3		x	y
4		10	8.04
5		8	6.95
6		13	7.58
7		9	8.81
8		11	8.33
9		14	9.95
10		6	7.24
11		4	4.26
12		12	10.84
13		7	4.82
14		5	5.68
15			
16	AVERAGE	9	7.50
17	VARIANCE	11	4.12
18	CORRELATION	0.816	
19	INTERCEPT	3.00	
20	SLOPE	0.50	

To calculate the **average** (arithmetic mean) for Dataset I, use the formulas
=AVERAGE(B4:B14)
and
=AVERAGE(C4:C14).

To calculate the **variance** (measures the spread) for Dataset I, use the formula
=VAR(B4:B14)=VAR(C4:C14).

To calculate the **correlation** (measures the relationship between *x* and *y*) for Dataset I, use the formula =CORREL(B4:B14,C4:C14). The **.816** is the correlation coefficient. A value of 1 means a perfect positive relationship. A value of 0 means no relationship, and a value of –1 means a perfect negative relationship. Correlation tells you the degree (or strength) to which two variables move in relation to each other. Correlation measures association but not causation. In data analysis, you will see correlation as one of the statistical methods. The correlation (R) is not the same thing as **R Square** (R^2). R Square is the coefficient of determination and tells you how many points fall on the regression line.

To calculate the **intercept** at the y-axis in regression for Dataset I, use the formula = INTERCEPT(C4:C14,B4:B14). I like the name intercept, because it tells you where it will cross the y-axis. You will also see mathematicians refer to this as **alpha**.

To calculate the slope of regression for Dataset I, use the formula =SLOPE(C4:C14,B4:B14). You will also see mathematicians refer to this as **beta**.

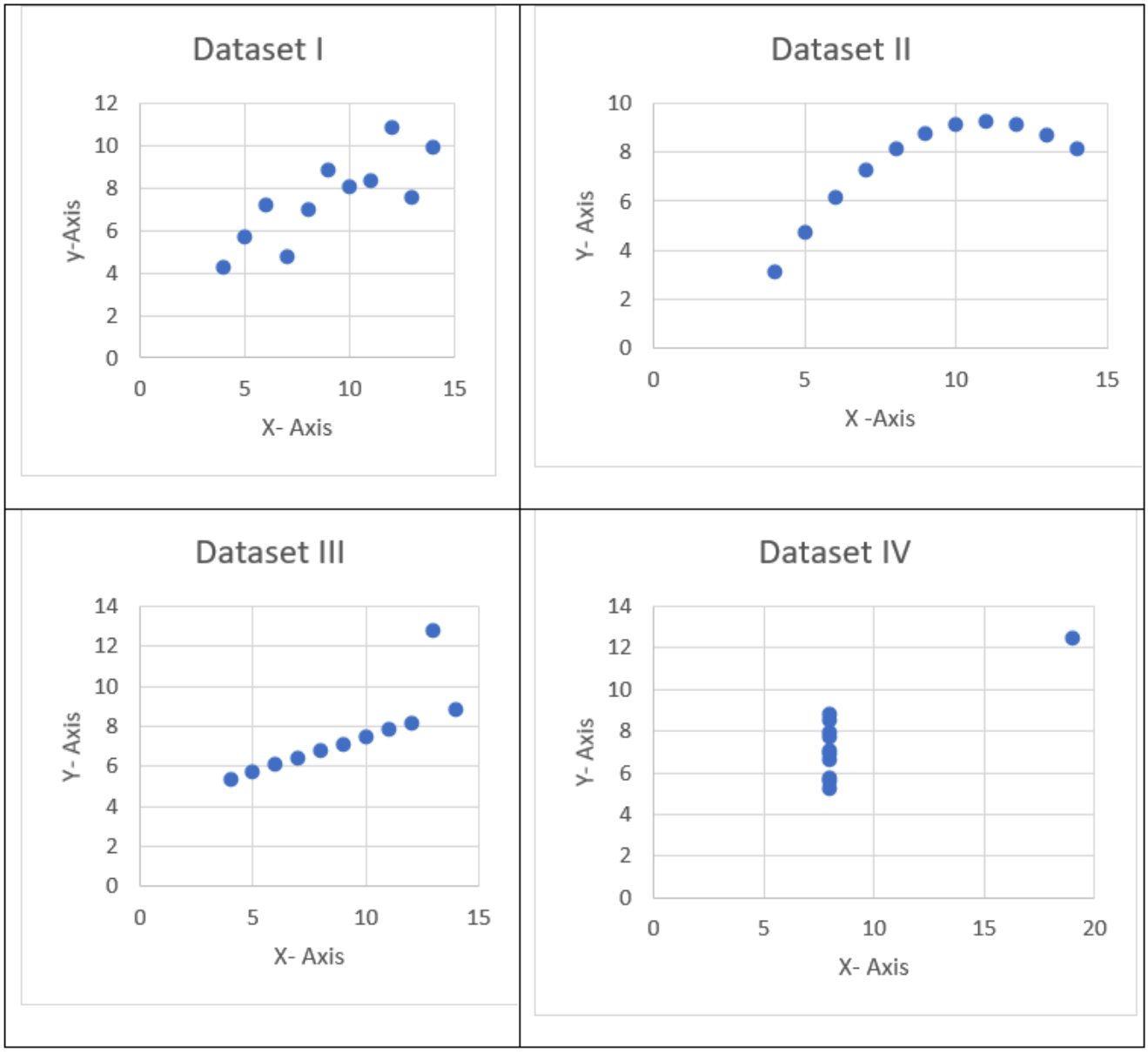
Regression line ($y = 3 + .50x$) with a goodness of fit at .816.

Think of a regression line where $y = a + b(x)$. x is the explanatory variable, and y is the dependent variable. The slope of the line is b, and a is the intercept on the y-axis.

A Scatterplot in Excel

A scatterplot displays values for two variables and is often used to investigate the relationship between two variables. A scatterplot can show a positive relationship, a negative relationship, or no relationship at all. A positive relationship (uphill pattern from left to right) means that as one variable increases, the other variable also tends to increase. A negative relationship (downhill pattern from left to right) means that as one variable increases, the other variable tends to decrease. If there is no relationship, there will be no clear pattern. Let's look at the scatterplot graphs for the four datasets in Figure 3.3.

Figure 3.3—Scatterplots of the Anscombe's Quartet



Keep in mind that all four datasets have the same average, variance, correlation, intercept, and slope.

As you can see from Figure 3.4, the average, variance, correlation, and intercept are the same.

Figure 3.4—Anscombe's Quartet Comparison

	A	B	C	D	E	F	G	H	I
		MODIFIED Anscombe Quartet							
		I		II		III		IV	
		x	y	x	y	x	y	x	y
AVERAGE		9	7.50	9	7.50	9	7.5	9	7.50
VARIANCE		11	4.12	11.00	4.12	11	4.12	11	4.12
CORRELATION		0.816		0.816		0.816		0.816	
INTERCEPT		3.00		3.00		3.00		3.00	
SLOPE		0.50		0.50		0.50		0.50	

The average, variance, correlation, intercept, and slope calculated in Figure 3.4 would lead a researcher to think that each dataset would graph the same. Despite the similarities, we see very different graphs.

- In **Dataset I**, we see a set of points that appear to follow a roughly linear relationship with some variance.
- In **Dataset II**, we see a clear curve with no linear relationship (perhaps quadratic).
- In **Dataset III**, we see a tight linear relationship with one outlier.
- In **Dataset IV**, *x* appears to remain constant with one outlier.

This exercise supports the importance of visualization. You may want to explore the Excel file and look at each dataset. The average, variance, correlation, intercept, and slope formulas are calculated under each dataset, but you can also explore the linear regression completed for each dataset. Regression will be explained and explored later in this chapter.

Anscombe, F. J. (1973). Graphs in Statistical Analysis. The American Statistician. Vol 27. Issue 1 p. 17–21.

Mitchell, J. (2021, Apr 9). *Scatter plot in Excel and SPSS Version 27*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#oembed-1

This dataset is available for this chapter in Excel.

Step-by-Step—Create a Scatterplot in Excel for Dataset I

Note: Screenshots of Excel interface © Microsoft Corporation, used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. Open the "Chapter 3-Anscombe Quartet-Adj" data file and go to the **tab** *Anscombe Quartet-Adj*.
2. **Highlight** the X and Y columns of Dataset I (this is B4:C14).
3. On the **insert** menu, choose the **chart icon** that resembles a scatterplot and choose **scatter** as shown in Figure 3.5.

Figure 3.5—Scatterplot Chart Icons

The graph (shown in Figure 3.6) will need further work. It needs a title (e.g., Dataset I) and axis titles to label the x-axis (horizontal) and the y-axis (vertical).

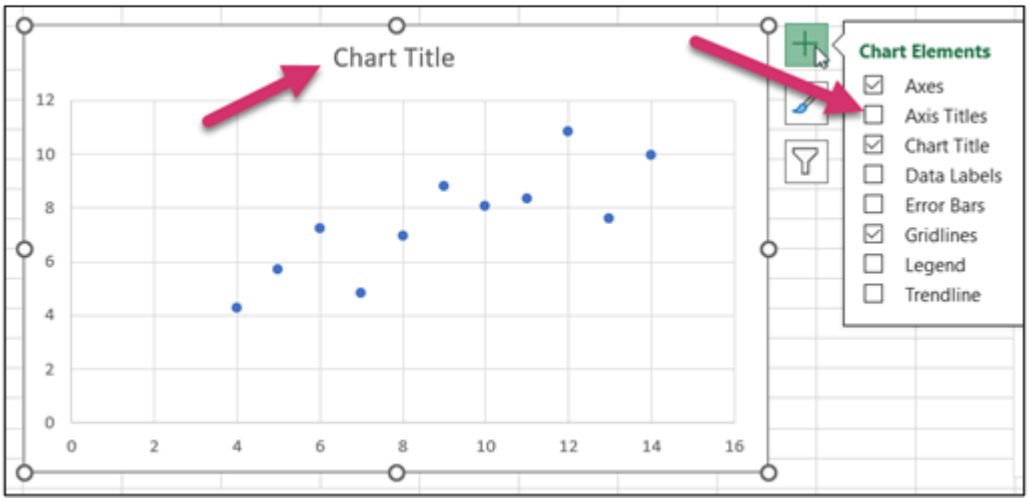


Figure 3.6—Draft Scatterplot Chart

4. The final graph shows a positive correlation, titles, bolded values, and even a trendline! This graph (Figure 3.7) demonstrates a positive correlation (as *x* increases, so does *y*).

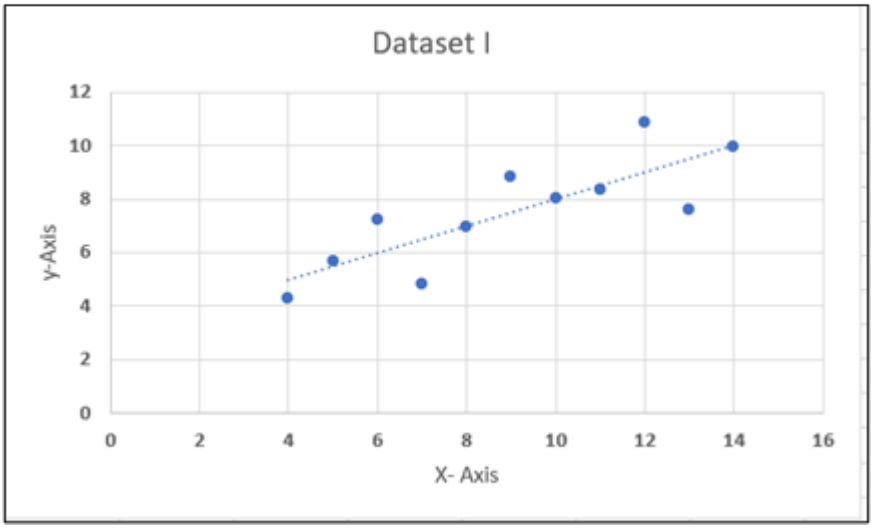


Figure 3.7—Scatterplot of Dataset 1 With Trends

Real-Life Example of an Impactful Scatterplot

Prior to 2010, estimating the age of unidentified crime victims was done by examining teeth and bones. A groundbreaking study, *Estimating Human Age From T0Cell DNA Rearrangements*, was conducted in 2010 by examining the age and blood test measure. The study included 195 people ranging in age from a few weeks to 80 years old.

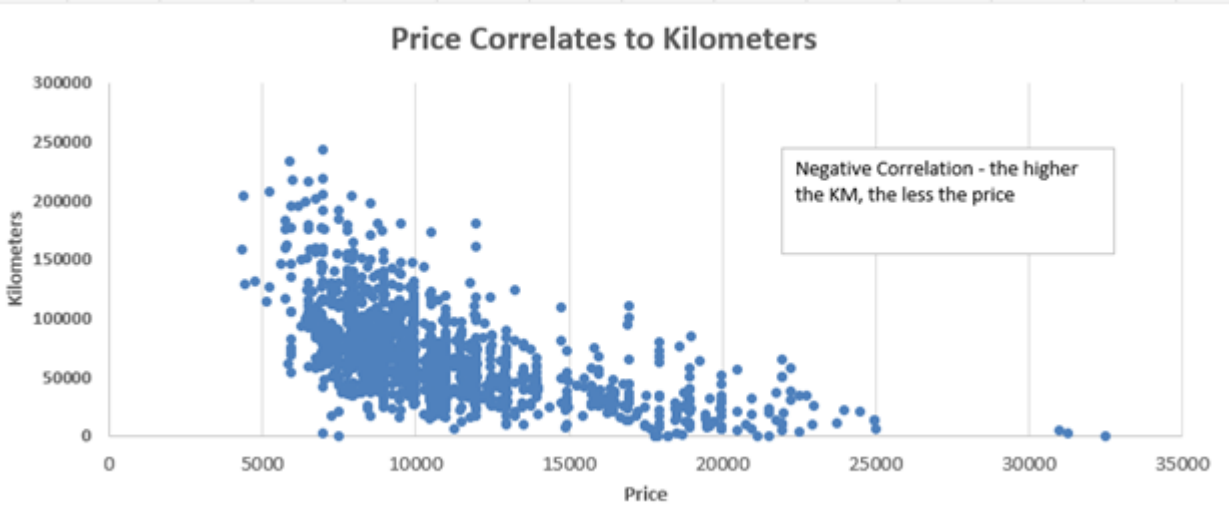
Please visit:

Zubakov et al. (2010). Estimating human age from T-cell DNA rearrangements. Current Biology Vol 20 #22. https://www.cell.com/action/showPdf?pii=S0960-9822%2810%2901286-8

- **R2 = 0.835** and means that approximately 83.5% of the variability in age can be explained by the linear relationship between age and blood test measure.
- **alpha = −33.65** is the y-intercept (note this is negative).
- **beta = −6.74** is the slope (note this is negative).
- **Equation**: The linear equation is $y = -33.65 - 6.74(x)$, so as a crime investigator, a victim with a blood sample of −11 would mean the age of the victim is 40.49 calculated as $\hat{y} = -33.65 - 6.74(-11) = 40.49$ **years**

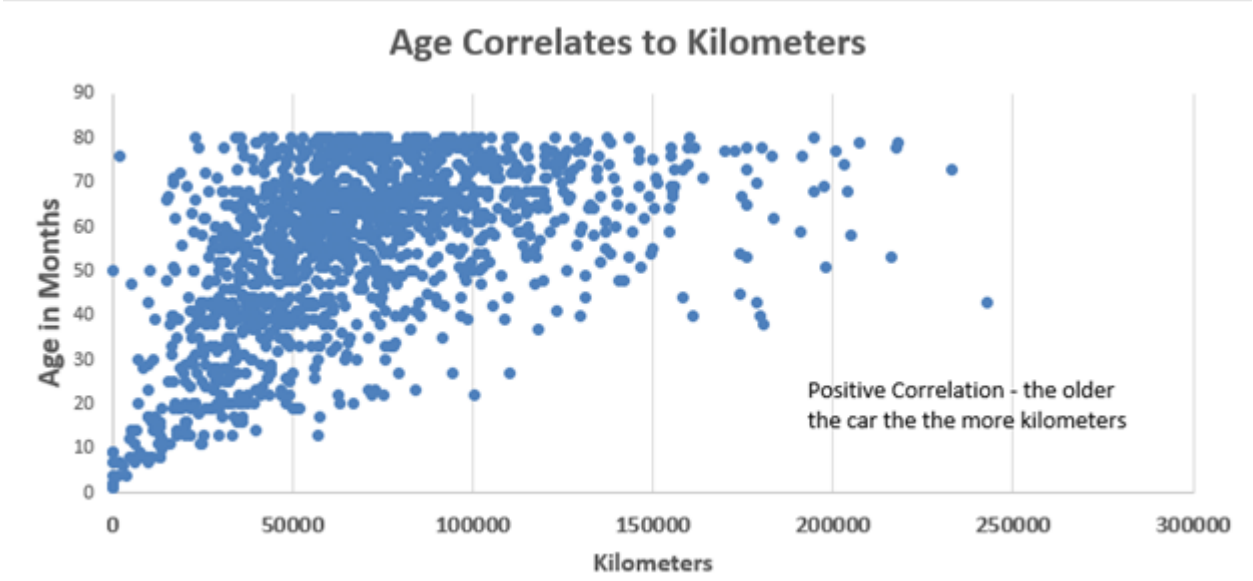
Correlations can be positive or negative. Let's look at a negative correlation of a single brand of car and how price correlates to the number of kilometers. It makes sense that the more kilometers on the car, the less the price. See Figure 3.8a.

Figure 3.8a—Negative Correlation – Scatterplot of Age of Car Compared to Price



If we were to compare the car's kilometers to the age of the car, we would see a positive correlation as shown in Figure 3.8b.

Figure 3.8b—Positive Correlation – Scatterplot of Age of Car Compared to Kilometers



3.1 *Self-Assessment Insights of Anscombe*

Learning Objective #1—Determine insights

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-8

3.1 *Exercise 1: Discussing Terms Used in Anscombe's Quartet*

Learning Objective #1 Determine insights

Your company requires all employees to complete a training series on culture. Everyone has access to the same online training conducted by a third party. Individuals can spend as little or as much time as they need, since employees may rewatch videos or revisit content. At the end of the series, every employee takes an online exam. After completing the training, the third-party vendor

provides the following information to HR as shown in Figure 3.9. The vendor indicates that most employees would only need to spend seven hours to earn a passing grade of 70%.

Figure 3.9—Training Datasets

Training Datasets: Indicates individual hours completed before taking an exam							
Science Department		Finance Department		Research and Development		Marketing Department	
Hours Training (x)	Score (y)	Hours Training (x)	Score (y)	Hours Training (x)	Score (y)	Hours Training (x)	Score (y)
7	76%	6	60%	5	65%	6	62%
8	80%	10	95%	9	95%	9	95%
6	55%	5	50%	3	50%	3	35%
10	90%	10	92%	8	92%	7	71%
3	35%	10	94%	9	94%	11	94%
7	71%	3	30%	2	30%	1	30%
8	82%	6	68%	5	68%	7	68%
5	95%	3	50%	4	55%	6	55%
6	67%	8	81%	7	81%	9	81%
10	94%	7	70%	6	70%	8	70%

Note: Author-Created Data (2024)

This report is available in the Chapter 3 Excel file.

Your supervisor has asked you to analyze this data for insights.

1. What are the averages, variances, correlation, intercept, and slope?
2. Using the regression formula $y = a + b(x)$, what score should you earn if you spend 7 hours in training depending on the department?
3. Does this report agree with the vendor's claim that individuals who study 7 hours will pass the exam? Create scatterplot graphs. Which one is close to the trend line?
4. Present your findings, including your Excel sheet, either in class or on the bulletin board as directed by your instructor.

3.2 The Simplest Graphics—Sparklines, Icon Arrays, Combo Charts, and Word Clouds

> The art of data visualization lies in capturing the essence of trends, distilling complexity into simplicity, and enabling minds to grasp the pulse of change.
>
> —Anonymous

What are sparklines? **Sparklines** are small, condensed visual representations of data that are great for a quick overview of trends and patterns. They are not detailed like full-fledged charts or graphs, but they offer several insights. They are so tiny that they fit within one cell of a spreadsheet!

The easiest way to understand these is to see an example, so let's look at POM University ticket gross revenue and ticket net income for 2010 through 2023, shown in Exhibit 3.1. Note how the sparklines show the trend all from within one cell for each row.

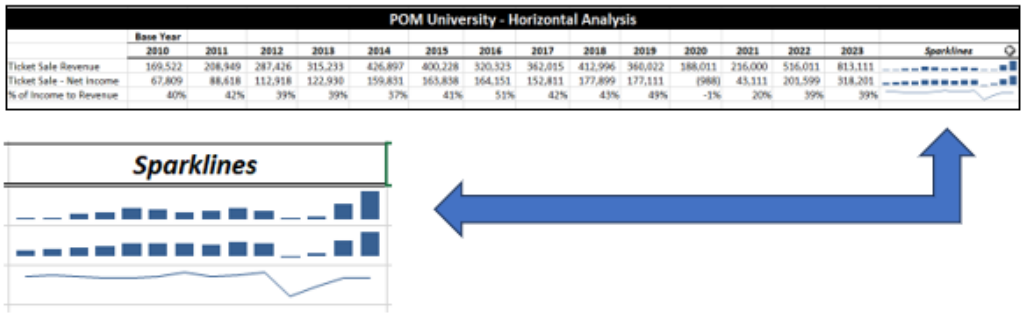
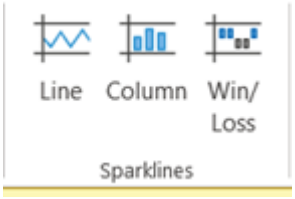


Exhibit 3.1—POM University Sparklines

POM University's gross revenue and ticket sale net income between 2010 and 2023 show a healthy rise of income and net income until 2020–2021 (during COVID-19). The sparklines show the trend of the gross revenue and net income as well as the horizontal analysis.

There are three different types of sparklines: line, column, and win/loss.



Perhaps as you review the sparkline, you might ask "What about the percentage of income to revenue?" In 2010, we see a 40% profit margin, which increased to 51% in 2016. However, the percentage dropped in the COVID-19 years and has still not reached baseline (2010) performance. How can you bring these details to the attention of your audience? One way would be to combine graph types using a combo graph; but first, let's show the step-by-step process to create sparklines.

Step-by-Step Approach to Create a Sparkline in Microsoft Excel

Note: Screenshots of Excel interface © Microsoft Corporation, used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. Prepare your data. **Open** an Excel document and type in the months and revenue data shown in Figure 3.10.

	A	B	C	D	E	F	G	H	I
1	Create a Sparkline								SPARKLINE
2	Months	January	February	March	April	May	June	July	
3	Revenue	$68,000	$88,000	$91,000	$66,000	$56,000	$62,000	$73,000	
4									

Figure 3.10—Excel Data for Sparkline Chart

2. **Select** the cell where you want to insert the sparkline (in this case, cell I3).
3. Go to the **Insert** tab in the ribbon.
4. Click on the **Sparklines** button in the Chart group. A drop-down menu will appear with the three types of sparklines (as illustrated in Figure 3.11). Choose the **Line** chart to show the revenue trend.

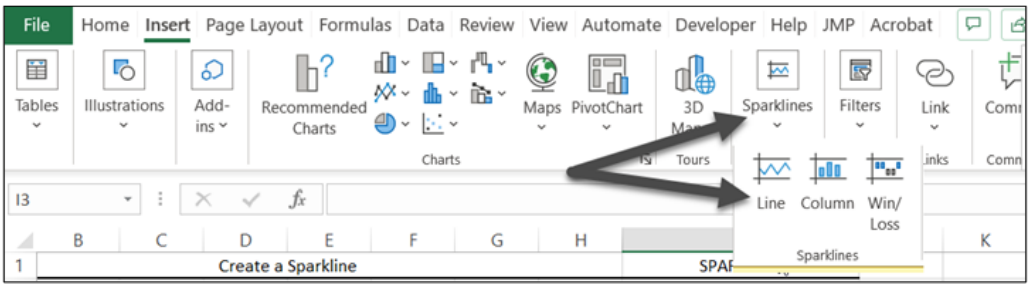


Figure 3.11—Sparklines

5. Once you choose a **sparkline**, a window will pop up for the data range (B3:H3) and the location range (see Figure 3.12). Then **click OK** and see your sparkline. Try each type so you can see how they chart.

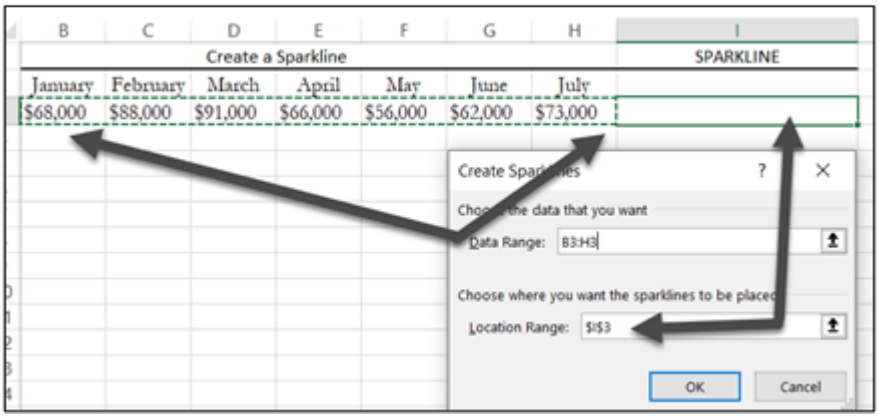


Figure 3.12—Create a Sparkline for Revenue

6. **Customize** the sparkline by clicking on the sparkline in cell I3 as shown in Figure 3.13. This will add an extra tab **Sparkline** on the main menu If you choose it, you will see lots of design and format options.

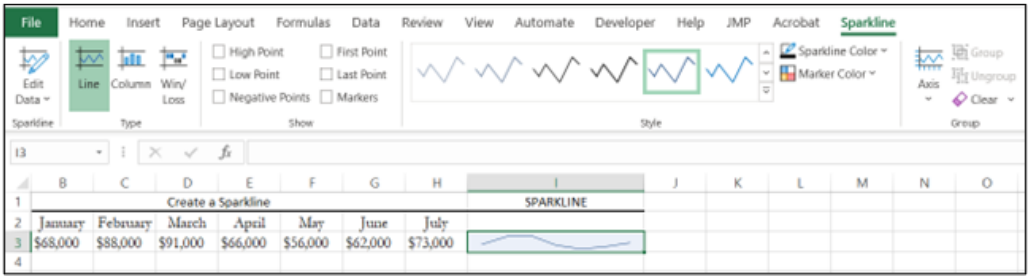


Figure 3.13—Customize the Sparkline

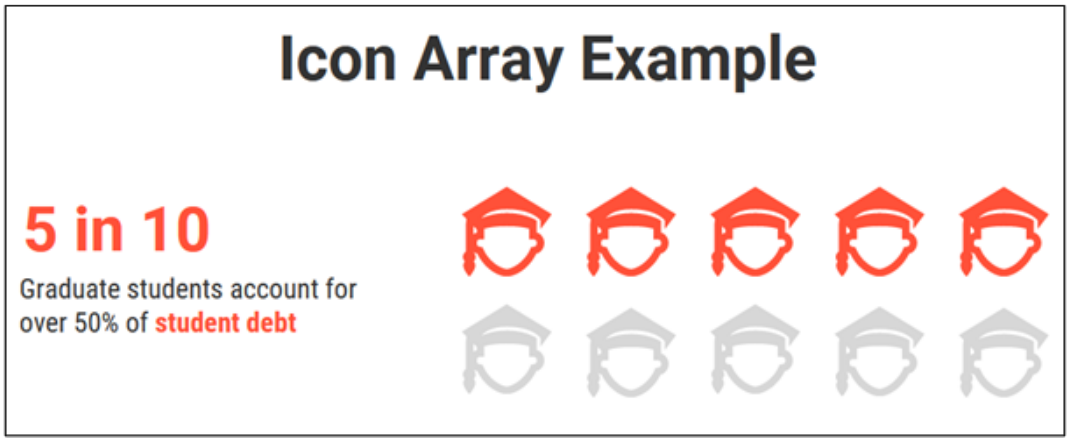
With sparklines, you can identify trends including seasonal patterns or volatility. They offer a quick visual cue. Now let's talk about a slightly more interesting graph, an icon array.

Using Icon Arrays

An **icon array** uses small symbols to represent individual data points. They are useful for frequencies or proportions.

Figure 3.14 shows an example created in Venngage (see Chapter 2). There are specific uses of color, specific icons, and color coordination of the icons.

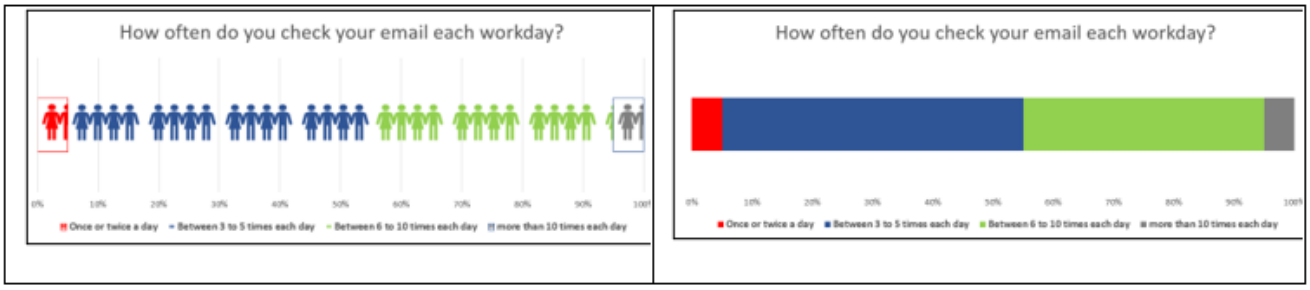
Figure 3.14—Icon Array Example Using Venngage



Note: Author Illustration (2025)

Exhibit 3.2 shows an example of starting with a horizontal stacked bar chart often used to represent the results of survey questions. In this example, instead of bars, you see icons representing the results. Notice that the colors also represent information to the viewer. Red represents concern, and gray represents a "gray area" where employees check their email too often.

Exhibit 3.2—Icons in a Horizontal Stacked Bar Chart—a Comparison



Try your hand at creating an icon chart in this step-by-step approach.

Step-by-Step Approach to Create an Icon Array in Excel: Adding Icons to a Horizontal Stacked Bar Chart

Note: Screenshots of Excel interface © Microsoft Corporation, used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. Let's start with some simple survey results that were collected at an organization. Essentially, the survey question was "*How often do you check your email each workday?*"
The summarized results of the survey: 5% checked their email once or twice each day; 50% checked their email between 3 and 5 times each day; 40% checked their email 6 to 10 times each day; and 5% checked their email more than 10 times each day. Set up your Excel sheet as shown in Figure 3.15 (or use the Excel workbook for Chapter 3).

	A	B	C	D
1	Survey Question: How often do you check your email each workday?			
2	Once or twice a day	Between 3 to 5 times each day	Between 6 to 10 times each day	more than 10 times each day
3	5%	50%	40%	5%

Figure 3.15—Excel Email Survey Results

2. **Highlight** A2:D3 and choose **Insert** on the main menu and then **column or bar chart**.

3. Scroll down to "More column charts" and choose **Bar** and select the **stacked bar chart** (as illustrated in Figure 3.16).

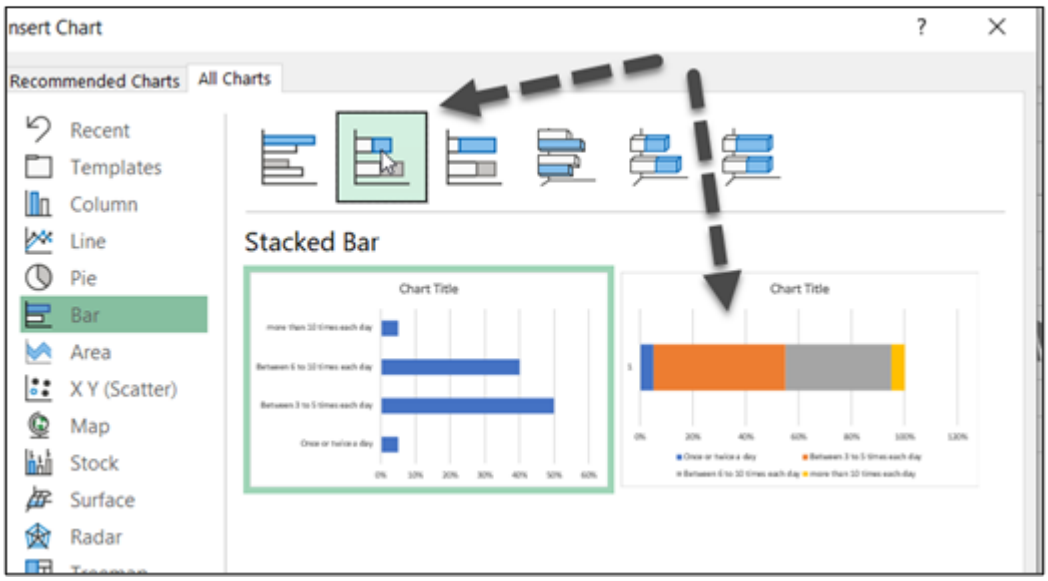


Figure 3.16—Choose a Stacked Bar Chart

4. Select **OK**.

5. **Customize:** The chart, as illustrated in Figure 3.17, needs customization to reflect the following colors, add a title, and clean up the axis titles.

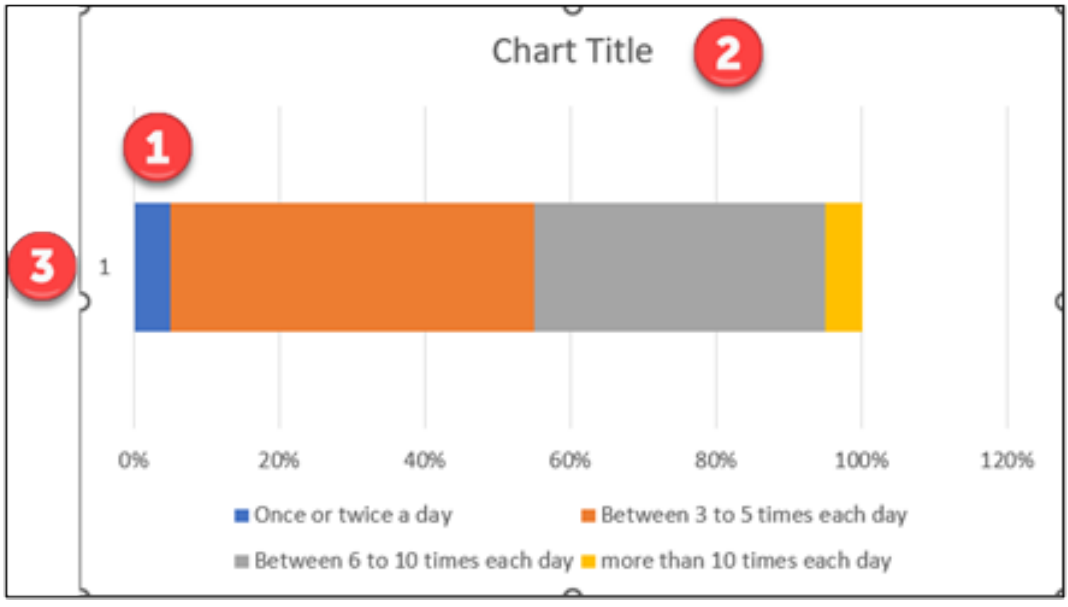


Figure 3.17—Customizing the Chart

Right-click on the color you wish to change. Choose **Format Chart Area** and change color to show red, yellow, green, and gray. Use these colors to take advantage of the audience's understanding of traffic lights (red, yellow, and green).

Change the chart title to *How often do you check your email each workday?* Further customize it to bold and larger font.

Remove axis titles if present. Feel free to further customize the legend. Make sure the legend colors match the new colors. The stacked bar chart is the most commonly used chart for survey data. If you wish to make a bold statement, add the 50% and 40%, especially if these two categories of responsiveness are within the organization's policy about checking email.

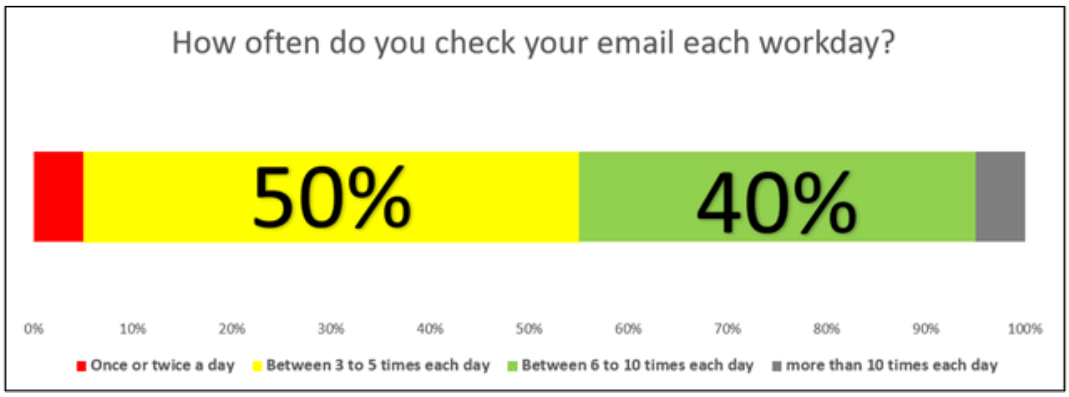


Figure 3.18—How Often Do You Check Your Email: Using a Customized Horizontal Bar Chart

6. **Add an icon array**. We could stop here, or we could change the chart to show icons. If you pick the icon from those available, they are easier to match to the colors.

a. Go to **Insert** on the main menu, then **Illustrations** and choose **Icons**.

b. Type "people" in the search bar.

c. Choose an **icon** that shows people. And then click **OK**. For this example, choose the icon that looks like male and female figures.

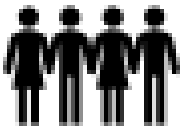


Figure 3.19—Icon Showing Male and Female

d. When it copies to Excel, you will notice that the image should be cropped. To crop the image, right-click the image and choose **Format Graphic**, then choose the icon that looks like a **mountain** as shown in Figure 3.21. Then use "crop position" to crop the height to .70″ and top to 1.1″ If these do not work for you, try adjusting them slightly. The others can remain at their default.

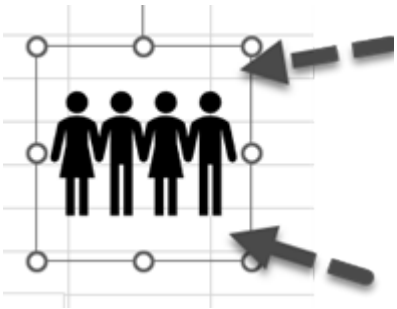


Figure 3.20—Right-Click the People Icon Image

e. Color the icon red to match. **Right-click the the icon,** choose **Format**

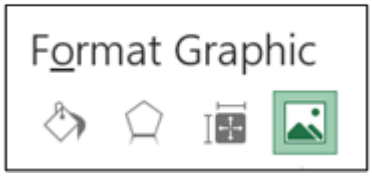


Figure 3.21—Cropping the People Icon

Graphic, and color it the same red as what you see on the stacked horizontal bar. It looks like Figure 3.22.

f. Now use a keyboard shortcut **(Ctrl + c)** to copy the people, **select the first red bar** of color, and use **(Ctrl + v)** to paste to the block.

When you do, the people will look squeezed together as shown in Figure 3.23.

g. Make sure you have the squeezed-together people **highlighted**, **right-click**, then select **Format Data Point**, then choose the **paint bucket icon**, then **Stack**. When you do, you will see the images fill it properly.

h. Just follow steps e–g for the next bars. (Note that the next bar is blue now instead of yellow. That's because the yellow icons were difficult to detect.) Your final product should look like Figure 3.24.

Figure 3.22—Choosing Color for the People Icon

Figure 3.23—Format Using Stack for People Icon

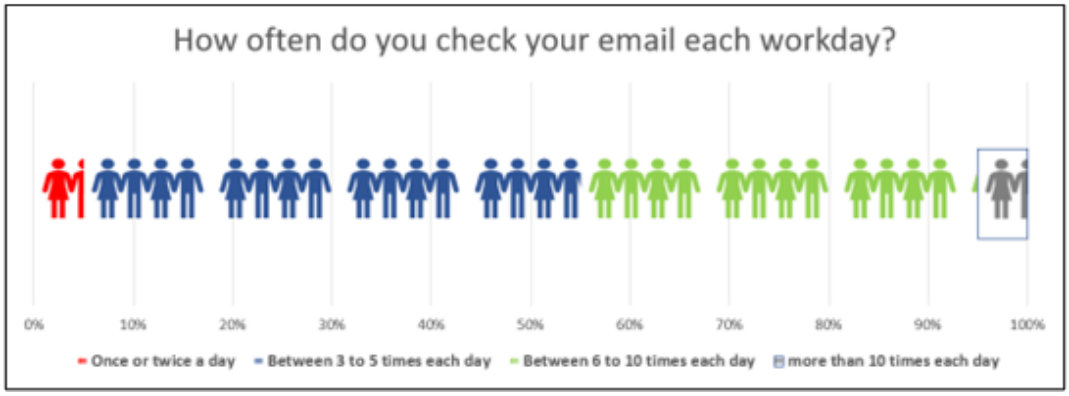


Figure 3.24—How Often Do You Check Your Email: Using Icon Array

Assessing the Effectiveness of an Icon Array

People-First Language: Be careful when you use icons to represent specific people. Use person-first and identity-first language. Instead of "a cancer patient," use "a patient with cancer." Instead of "AIDS patients," use "people with AIDS." The goal is to avoid language that dehumanizes or stigmatizes people. It is recommended to review any infographic or icon array with this perspective in mind.

Accessibility: Ensure that the icon array is accessible to individuals with disabilities like visual impairment or even audience members who are color-blind.

There are five main ways to assess the data visualization known as an icon array. These include the following:

1. *Accuracy and clarity*: Do the icons use consistent size, shape, and color? Does it accurately represent the data? Can the audience easily understand what each icon represents?
2. *Perceptions and comprehension*: For this aspect, conduct user testing with similar people who will make up the audience. Are people able to accurately interpret the data values and trends being displayed? For example, using people icons may send mixed messages when colors are introduced.
3. *Comparison and contrast*: Can viewers easily identify differences in the data values represented by the icons? Are they able to compare values across different categories or groups?
4. *Scalability and density*: Can the visualization handle a large dataset without becoming overcrowded or losing clarity?

5. *Engagement and memorability*: Does the visualization capture the audience's attention and encourage further investigation into the topic? Does the audience remember the visualization weeks after seeing it?

Working With a Horizontal Stacked Bar Chart

Before we move away from horizontal stacked bar charts, let's review a few tips and tricks. Most researchers use some type of software to create a survey like Survey Monkey, JotForm, Qualtrics, Google Forms, Lime Survey, and so on. Most survey software will allow you to export to Excel; however, moving beyond the basic charts can improve data storytelling. Horizontal stacked bar charts are useful for visualizing data that involves multiple categories as well as proportions and their relationships.

For example, a horizontal stacked bar chart can be used to

1. display the different types of expenses in a budget for various departments or display or showcase resources (time, budget, personnel).
2. display a summary of the different survey responses including a further subcategory (like demographic groups).
3. display a summary of pretest and posttest survey results. This is especially helpful to compare a before and after survey, like Figure 3.25 of students who took a precourse and postcourse survey.

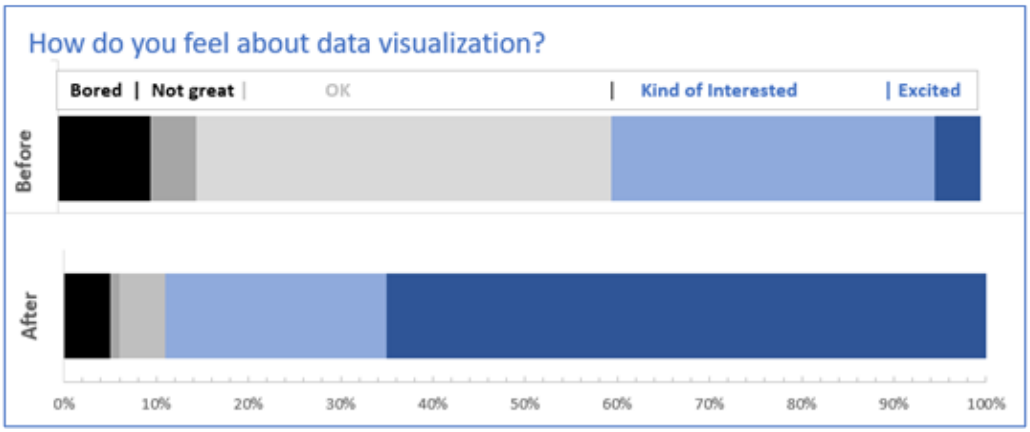


Figure 3.25—Example of a Horizontal Stacked Bar Showing Before and After Survey

4. display a project timeline by representing the progression of tasks over time.
5. display educational assessment through a distribution of grades across various categories.

In the realm of data visualization, concise and effective techniques offer invaluable insights into complex datasets. At one end of the spectrum, sparklines show powerful trends for a quick overview of data patterns over time. Icon arrays, with their adept use of symbols, deliver an intuitive representation of proportions and frequencies, making them ideal for visualizing categorical data. Horizontal stacked bar charts work great for survey questions. But as we venture deeper into the visualization landscape, the true versatility of combining these techniques comes to light with combo charts. These hybrid visualizations merge multiple graph types into a single cohesive display, presenting a wealth of information at a glance.

What Is a Combo Graph?

A **combo graph** (or **combo chart**) is a combination of two bar charts, two line graphs, or a bar chart and a line graph(s). You can work from a single dataset or two datasets as long as the datasets share a common base. You want to use combo graphs to show some kind of relationship or trend.

Example 1—Combo Chart With One Bar Chart and One Line Graph

Consider a scenario where you want to analyze the sales performance of a product over time. Using a combo chart to combine a bar chart and line graph allows the viewer to easily depict the relationship between revenue and quantity trends. It shows the audience if a lower revenue is due to quantity or lower prices (or both). Take a look at the average price in Exhibit 3.3; if you notice, the highest average price was $238 in 2020, but note that the average price for 2023 was only $22/unit. This is a huge selling price drop between 2020 and 2023.

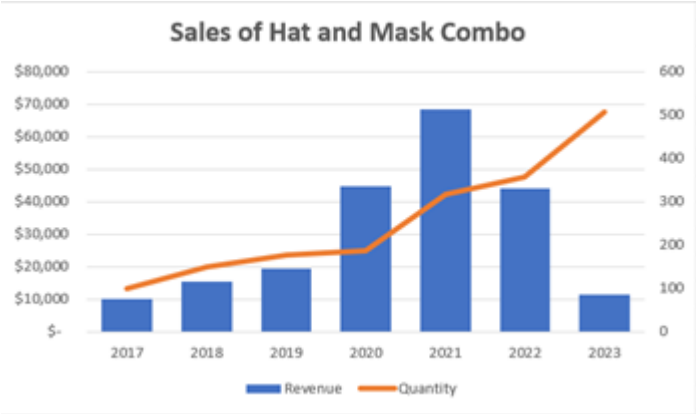
Exhibit 3.3—Scenario for Hat and Mask Combo Sales

Scenario: Sale of Hat and Mask Combo							
	YEAR						
	2017	2018	2019	2020	2021	2022	2023
Revenue	$ 10,000	$ 15,318	$ 19,470	$ 44,824	$ 68,370	$ 43,994	$ 11,315
Quantity	100	150	177	188	318	356	506
Average Selling Price	$ 100	$ 102	$ 110	$ 238	$ 215	$ 124	$ 22

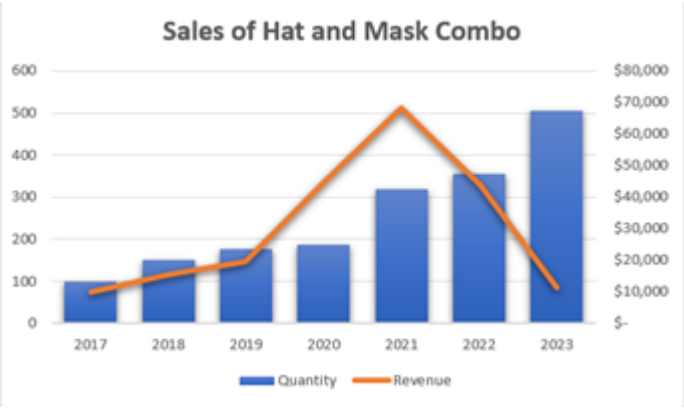
The example in Exhibit 3.4 gives two different ways to show this information. Normally, revenue is best represented by a line graph, but either of these would work. The decision on which combination to use depends on the story you want to tell with your data. Ask yourself, "Which insight is more important?" If you are unsure, show this data to two pilot groups and ask them to identify insights. Which group identified more quickly that the quantity increases because of the huge price drop? It looks like the owner will have to start giving the hat and mask combo away!

Exhibit 3.4—Combo Chart: Compare Setup

Bars = Revenue and Line = Quantity



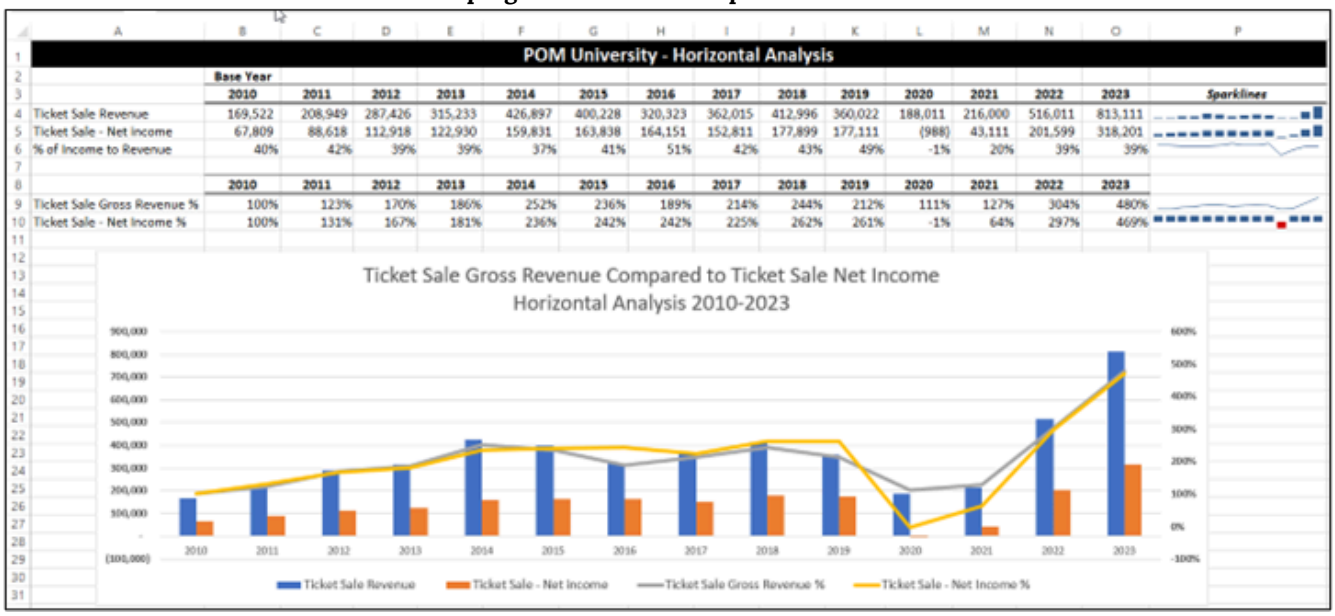
Bars = Quantity and Line = Revenue



Example 2—Combo Chart With Two Bars and Two Lines Using Horizontal Analysis

For the next example of a combo chart, let's visit the POM University exhibit that showed sparklines. You will use a new term, horizontal analysis, to see how it might be used within a combo chart setting. **Horizontal analysis** (time series analysis) is often used in analyzing financial data to identify trends, patterns and changes in data over time. In this example, shown in Exhibit 3.5, we are setting the base year at 2010. That means setting the year 2010 at 100% and measuring the increases (or decrease) of all the other years compared to the 2010 base year.

Exhibit 3.5—Combo Chart: Two Bar Grouping and Two Lines + Sparklines Revisited



POM University - Horizontal Analysis

Base Year

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Sparklines
Ticket Sale Revenue	169,522	208,949	287,426	315,233	426,897	400,228	320,323	362,015	412,996	360,022	188,011	216,000	516,011	813,111	
Ticket Sale - Net Income	67,809	88,618	112,918	122,930	159,831	163,838	164,151	152,811	177,899	177,111	(988)	43,111	201,599	318,201	
% of Income to Revenue	40%	42%	39%	39%	37%	41%	51%	42%	43%	49%	-1%	20%	39%	39%	

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Ticket Sale Gross Revenue %	100%	123%	170%	186%	252%	236%	189%	214%	244%	212%	111%	127%	304%	480%
Ticket Sale - Net Income %	100%	131%	167%	181%	236%	242%	242%	225%	262%	261%	-1%	64%	297%	469%

Look at 2010 and compare it to 2011. In 2011, the ticket sales gross revenue was 23% higher than **2010**'s ticket sales gross revenue. In 2012, the ticket sales gross revenue was 70% higher than **2010**. Note we always compare all ticket sales gross revenue for every year back to the 2010 base year.

The same is true for ticket sales net income. The year 2010 is the base year and is considered 100%. In 2011, the net income increased by 31% above the base year (2010). And in 2012, the net income increased by 67% over the base year (2010). Now the question might be, What is the purpose? The purpose is to help the audience determine historical patterns and determine the company's potential growth. The combo chart shows that net income usually tracks at the same increased level as gross revenue increases; however, COVID-19 really disrupted this trend. Starting in 2022, it appears that gross revenue and net income were once more increasing together. This is good—it means the net income is currently trending with gross income. Essentially, expenses remain on track.

If you wish to explore combo charts, please review the Excel file associated with Chapter 3. Let's turn to word clouds, a very easy visual with lots of uses.

What Is a Word Cloud?

Word clouds are just visual representations of text in graphic form where the size of each word is relevant to importance or frequency. Essentially, the more often the word is used, the larger the text.

Note: Author Illustration (2025)

These keywords are evident in the pig image. This example was created on WordArt.com using the first **100 words in a story**. I'm sure you can identify the story! Notice that even the shape tells you a little about the content.

Word clouds can be created in a multitude of ways, but one of the easiest to use is Word Art—Word Cloud Creator. This app is free to use but will add a cost to download high-quality images, though a standard download is free. This app even allows you to upload an image for the design. For example, a pig image was uploaded, and Word Art used this shape for the word cloud.

Word Art—Word Cloud Creator. Location: www.wordart.com

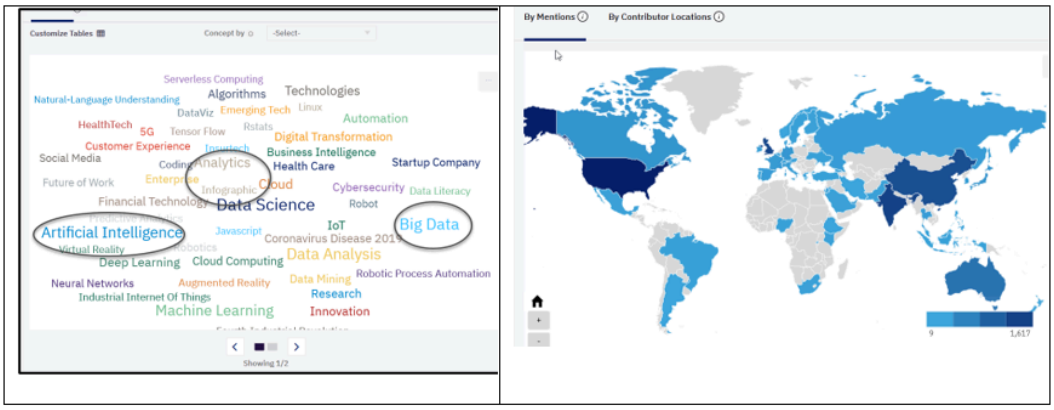
Remember, the pig example word cloud was generated from the first 100 words. There are several word cloud generators that work online without downloading any software. Most of them prompt you to copy or type text to generate the word cloud. And most, by default, start you with using the first 100 words. So how are word clouds used with large datasets?

Disruptor Intelligence Center: Global Data Uses Word Clouds

Some companies like Disruptor Intelligence Center: Global Data are using a Word Cloud to track what the top influencers in a field are talking about (and it is all live). The contributor indicates the topic based on a hashtag (e.g., #Infographic). In Exhibit 3.6 for BigData influencers, you can drill down into the resources and comments by selecting an influencer or start with the cloud and choose the topic of interest. Not everyone who reads this textbook will have access to Global Data, but if you do, read more about the features that follow.

Remember, the more a topic is discussed, the larger the word generated in the word cloud. In Global Data, choose **Databases**, and then under the **Influencer Database**, choose **BigData**. The illustration changes, since influencers use Reddit and Tweets to contribute, but you get a sense of what the influencers are talking about.

Exhibit 3.6—BigData Influencer Network With Word Clouds



Note: Author Illustrations (2025)

The word cloud is clickable, meaning if you select "Infographics," it drills into the information to share the top contributors. The map shows the location and number of contributions. The database also lists the top contributors organized by the highest score. Twitter contributors are scored using (1) average engagements received on content shared, (2) number of followers, and (3) number of times other influencers have referred to them in their shared content. If you click on a contributor's name, you will see the tweet content. One of our favorite contributors uses a lot of infographics to discuss big data, and once you find someone's work you like, you can follow them.

Just a note: Global Data contains company information including a list of peers, SWOT analysis, PESTLE analysis by country, and many others. We will dive deeper into these basic tools and how to present key information visually in a later section.

Because a word cloud can identify trends and patterns, it is often used for qualitative research in an informal way. Most word cloud apps filter out common words, which means the visual shows patterns of frequency.

Keep in mind that most word cloud creators suggest the first 100 words of a story (but not all word cloud apps set a limit). For the word cloud demonstration, please use the following key information taken from a survey about leadership.

Word Art is a little different. One way it functions is to allow the user to set up the frequency of words. Let's look at a scenario to see how this might work.

Scenario: Survey Participants Ranked Leadership Characteristics

In this survey, participants indicated the following strengths for leaders. There were 30 participants. This means that **all participants** chose "Good communicator" as one of their top 10 leadership characteristics. In a word cloud, you would expect the phrase "Good communicator" to use the **largest font**. As you review the rest of the list, note the number beside it indicates how many participants indicated that strength as one of their top 10 leadership characteristics.

Table 3.1: Survey Participant Responses

Good communicator	30	Empower others	22
Fair	22	Supportive	22
Accountable	18	Problem-solver	17
Integrity	16	Honesty	15
Open-minded	14	Creative	12

Step-by-Step Approach to Create a Word Cloud Using Word Art

Note: Screenshots of WordArt.com © WordArt.com, https://wordart.com. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. **Type** www.wordart.com in your browser and sign up.
2. **Select the Create Now** button (or the **Create** button if available). Notice that the pop-up menu has five sections: (1) words, (2) shapes, (3) fonts, (4) layout, and (5) style. In the words section, **type the top 10 characteristics** as shown in Figure 3.26.

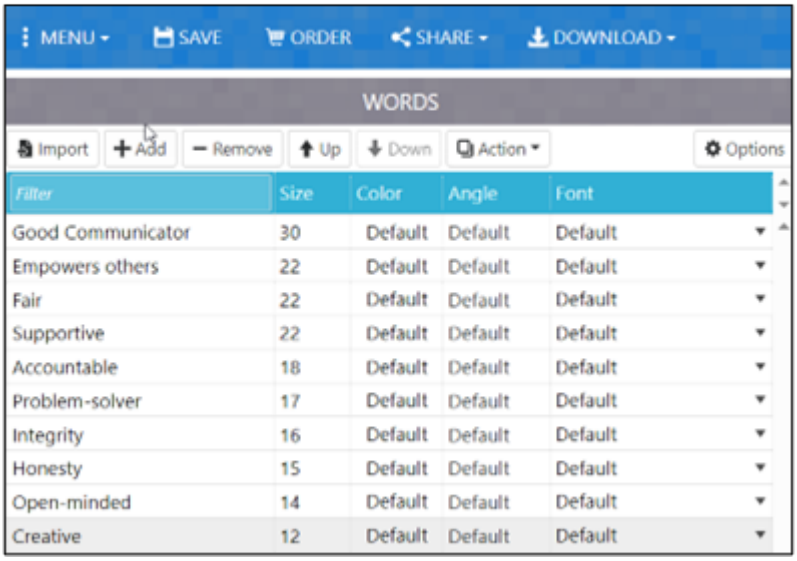


Figure 3.26—Setting up Survey Data in Word Art

This is one of the easiest ways to work with survey data. If you wish to make a word cloud from a document, use the "import" command.

3. Choose **Shapes** and for now, choose a square.
4. Choose **Fonts** and choose League Gothic.
5. Choose **Layout** and choose Horizontal/Vertical crossing.
6. Choose **Style** to see what is there, but don't change anything (you can always go back and change it later).
7. Now to see your word cloud, choose **Visualize**. Each time you make a change, you need to use this button to see the changes.

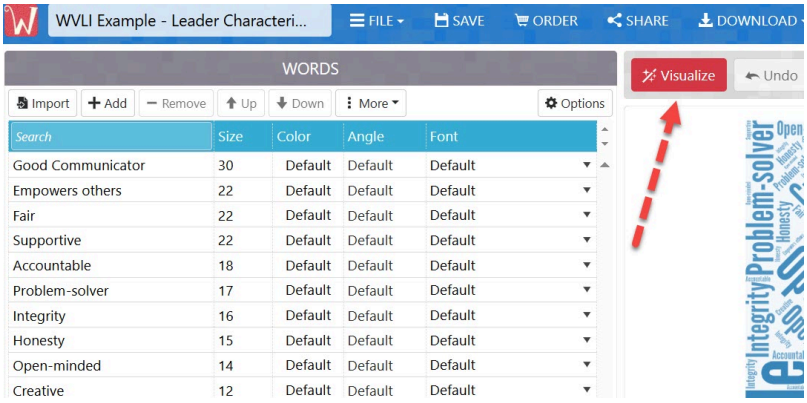


Figure 3.27 –Key Button to See Changes in Word Cloud

8. Choose **Save** in the blue menu bar.

Your image should look something like the illustration in Figure 3.28. To change any aspect and to see the changes, you will need to use the Visualize button each time you make a change to see the impact. Notice that if you hover the mouse over the words, they are animated.

Figure 3.28—Simple Word Cloud

Note: Author Illustration (2025)

Let's look at some examples of other word cloud apps.

Add Pro Word Cloud to Microsoft Word

Perhaps more interesting is the add-in availability of Pro Word Cloud into Microsoft Word. Pro Word Cloud will generate a cloud based on a word count you set in Pro Cloud along with the act of highlighting the text. This feature is a great way to introduce a presentation based on a written document (like a strategic plan, business plan, or marketing plan).

Exhibit 3.7 depicts a sample word cloud created in Microsoft Word using the add-in, Pro Word Cloud. Only part of Chapter 2 was selected to create this word cloud, but we think it captured the main points pretty well!

Exhibit 3.7—Pro Word Cloud Capturing Part of Chapter 2

This cloud was created using the default settings in Pro Word Cloud.

Font—TANK
Colors—Default
Layout—Preserve Case
Case—Intelligent Case
Max Words:—5,000
Size (px):—600 × 372
Remove common words? Checked

Pro Word Cloud is just one of many add-ins that you can use to bring impact to your presentation or your narrative. Here are the directions for adding Pro Word Cloud to Microsoft Word (for a PC). Pro Word Cloud is a *free* app created by Orpheus Technology, and sponsored by Microsoft.

Note: Author Illustration (2025)

Step-by-Step Directions to Install Pro Word Cloud Add-In

Note: Screenshots of Word © Microsoft Corporation. Used with attribution for instructional and illustrative purposes.

1. In Microsoft Word, on the ribbon, choose the **Insert** tab and **Get Add-ins**.
2. Do a **search** for the term *cloud* and look for Pro Word Cloud as shown in Figure 3.29.

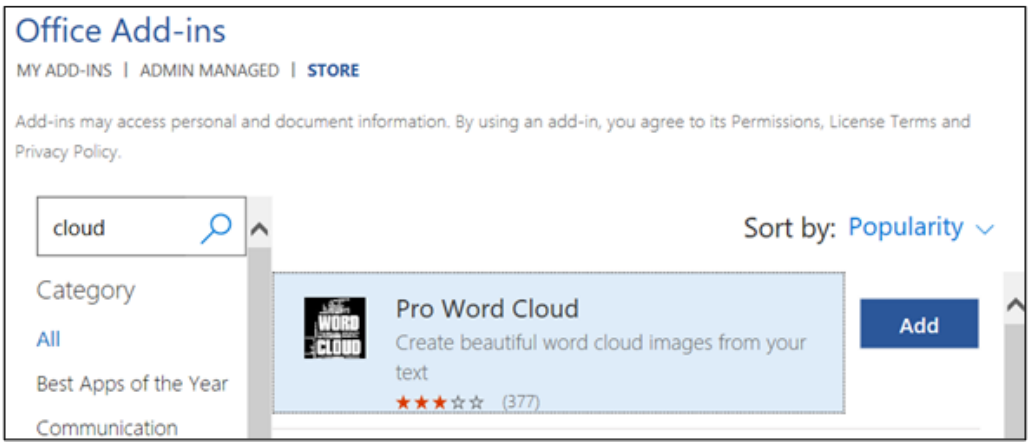


Figure 3.29—Office Add-Ins

3. Select **Add** and then **Continue**.
4. Make sure to explore the many Office add-ins available. Many of them are free! Currently, there are more than 350 apps available just for Microsoft Word.

Now that you have the Pro Word Cloud add-in, it is time to try it. (Don't be surprised if you have to add it to Microsoft Word each time you want to use it!)

1. **Open** a Word document of your choice. Note how many words are in your document (lower left-hand area of your

screen). The example used for demonstration is a draft of another chapter with 28,216 words.

2. In Microsoft Word, on the ribbon, **choose Insert**.
3. Next, **choose My Add-ins** and look for **Pro Word Cloud**.
4. Choose the **Pro Word Cloud** and then **click Add**. It should add a Pro Word Cloud box on the right side of the document (see Figure 3.30).

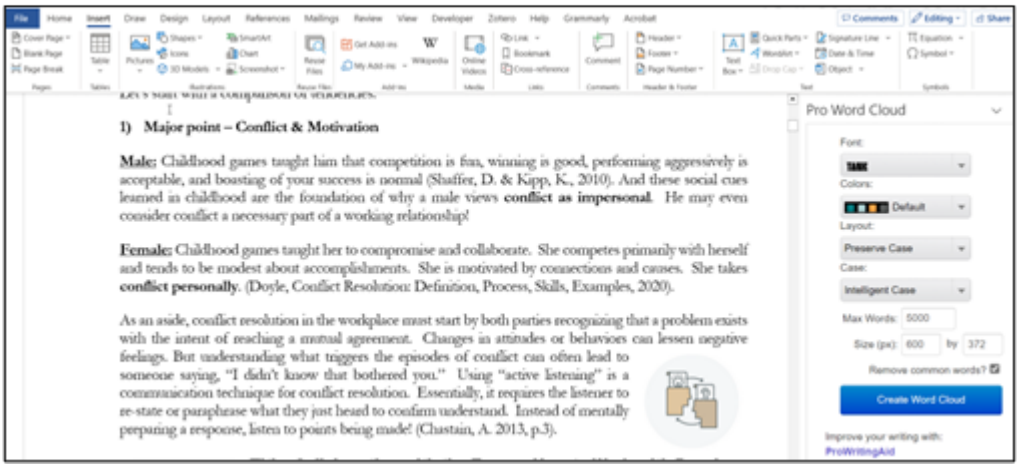


Figure 3.30—Pro Cloud Instructions

5. **Highlight** part of or the entire document (do this **with Control A on a PC**).
6. For now, just **change** the Max Words to 5,000 and keep all other default settings.
7. Click **Create Word Cloud** and wait for Pro Word Cloud to generate the image (example shown in Figure 3.31).

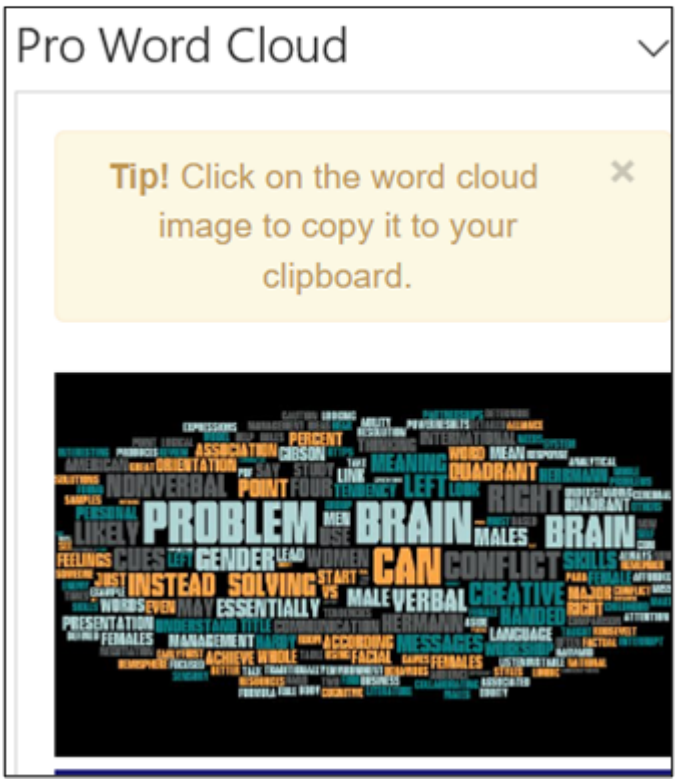


Figure 3.31—Word Cloud Example

8. **Right-click** the image **to save** as a picture.

9. Try changing a few things and regenerate the word cloud to see the changes. Save any images you like.

There are tons of add-ins for Microsoft Word, but this is a very popular feature that is easy to use. But there are many ways to increase the interest level. For example, inserting the newly created word cloud into an image of the morning news makes a bold and more dynamic image than just the word cloud image alone.

Word Clouds Are Great as an Interesting Starting Point

Word clouds are great tools for specific situations. For example, a word cloud image is used in Exhibit 3.8 in conjunction with another app, essentially combining the word cloud image within the context of a newspaper.

Exhibit 3.8—A Fun Way to Use Your Word Cloud

Note: Author Illustrations (2025) Edited with ***PhotoFunia,*** *https://photofunia.com/*

The images were created using Pro Word Cloud. Just the Word Cloud image could have been used on a PowerPoint slide or within this document; however, the word cloud image was uploaded to **PhotoFunia-Morning News** to generate the image that combines it with a newspaper setting (date, newspaper title, and section) for a compelling way to start any conference session where you are the speaker! And what if you handed out coffee mugs for your session?

How Word Clouds Can Be Used for Surveys

Customer and Employee Surveys: Word clouds quickly indicate opportunities for improvement. Most survey tools provide a way to export data in several ways (text, Excel, PDF, CSV). That data can then be used in a word cloud generator. For example, the word cloud in Figure 3.32 is from a field on an exit survey. Administrators of the survey thought that "low wages" would be the key reason employees left, but based on the keywords and their size (displayed in Figure 3.32), the top three issues are (1) unfair treatment, (2) schedule, and (3) errors on paycheck. Most survey tools have an analytics section to summarize question answers; however, none of them has a tool to summarize written comments.

Figure 3.32—Employee Survey Word Cloud

Note: Author Illustration (2025)

Just as a note—research shows that exit interviews should be conducted face-to-face (Glass Door for Employers, 2017). For example, in the previous situation, a face-to-face exit interview might shed some light on what is meant by "unfair treatment."

Customer surveys are another area where you can gain insight into customer "pain" points, which provide insight into opportunities to improve and connect with your customers. In Figure 3.33, notice that a few phrases have been circled: **slow**, **frustrating**, and **difficult**. Although these words are represented by smaller text, it demonstrates that some customers did not have a positive experience.

Figure 3.33—Customer Survey Word Cloud

Note: Author Illustration (2025)

As you create word clouds, here are a few points:

- First, avoid simply dumping text into a word cloud generator. Take time to review what you are sending (this is called optimizing the data) to gain accurate insights. Consider what is relevant and important.
- Second, always consider if another visualization method will work better. For example, survey tools often have charts and graphs available for straightforward questions that provide limited ways to answer the question. More complex data might be better represented in a dashboard where they are interactive instead of static.
- Third, always consider how a shape might emphasize the message. For example, does the shape resonate with the data, or does it cause confusion? Many cloud apps will allow you to upload an image that can be used as the shape. Would a different shape (like Figure 3.34) add context and improve interpretation?

Figure 3.34—Shape of Infographic Designs

Note: Author Illustration (2025)

- Fourth, consider ways to customize or add interactivity if it enhances the audience's insight. For example, you may notice that when your mouse hovers over a specific word, it pops up. You can record this activity with video editing software as well as add narration.

Please feel free to try some of the stand-alone word cloud apps.

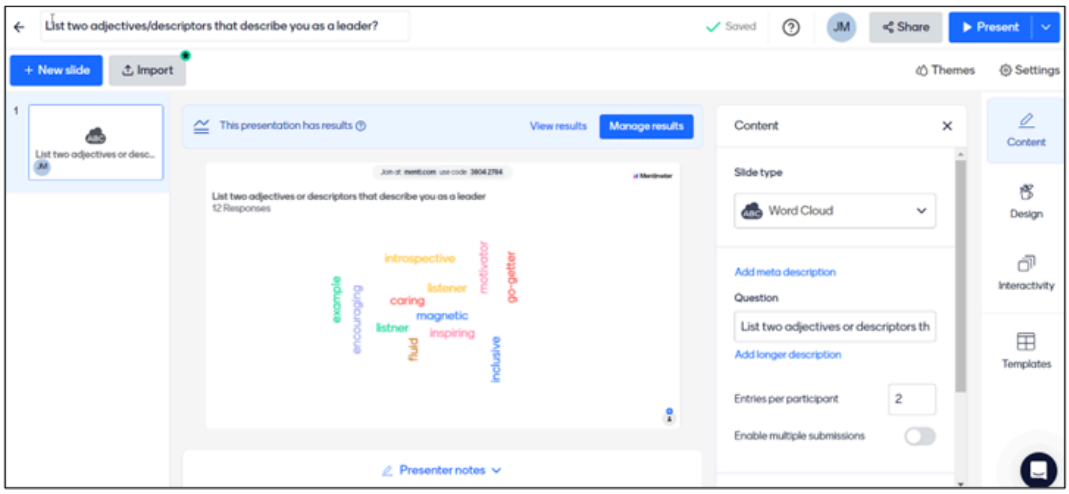
WordClouds works with typed or pasted text, uploaded Office documents (even PowerPoints), PDFs, or text data. It also has a "wizard" for step-by-step help. Location: www.wordclouds.com

WordItOut has limited shapes and fonts, but it is very intuitive and easy to use. You can use text or even pull in words from a table or spreadsheet. Location: worditout.com/word-cloud/create

Interact With Your Audience Using Word Clouds

There are several products that allow you to use word clouds to interact with your audience—Here's an example scenario: You've been asked to speak at a leadership conference, and you want to start the presentation with some audience interaction. Using an app like Mentimeter (www.mentimeter.com), you set up your slide with the prompt "*List two adjectives/descriptors that describe you as a leader.*" Your slide has a code at the top, and your audience uses their smartphones to connect to the presentation (www.menti.com) and type in the code (the code in this example is 3804 2784). The example shown in Figure 3.35 shows the setup along with a first attempt to test the interaction using my phone.

Figure 3.35—Using Mentimeter at a Conference for Interaction



Source: Screenshot of Mentimeter Interface © Mentimeter, https://www.mentimeter.com

Now it's time to set one up for your next presentation! The free plan includes unlimited audience, unlimited presentations, up to 2 question slides, and up to 5 quiz slides.

The higher the frequency of a word, like any Word Cloud, the larger the word will be. A free version is available if your only plan is to use it for inspiration, but the price for the basic plan is under $11.99/month billed annually.

Interact With Your Team Using an Add-In to Microsoft Teams

Creating an interactive word cloud in Microsoft Teams is easy, and there are several ways to create it. The following demonstration is from one of my active teams. You should be able to follow along.

Step-by-Step Directions to Install a Word Cloud in Microsoft Teams (Poll)

Note: Screenshots of Microsoft Teams interface © Microsoft Corporation, used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. **Open** a team space of your choice. Within the team space, you will see a + at the end of the menu (see Figure 3.36).

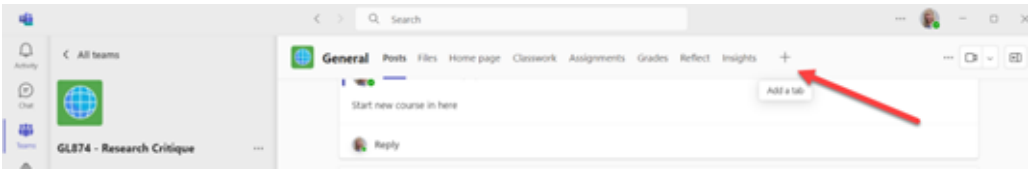


Figure 3.36—Add-In to Teams

2. When you click on the +, you should see a search bar that says **Search for apps**. If you don't see the Poll app after typing Poll in the search bar, click the box that says **Get more apps**. You may see apps like Poll Everywhere, but you should look for the Poll app created by Microsoft.

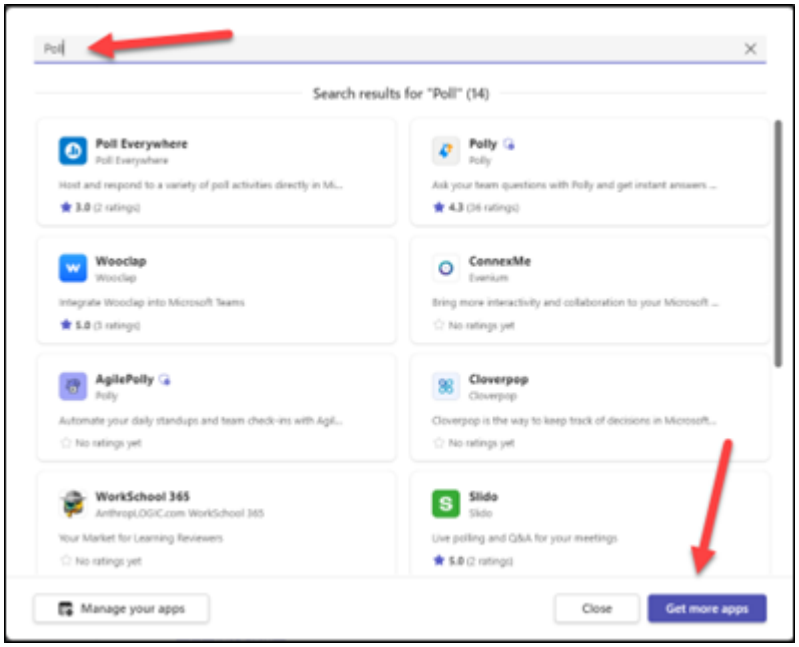


Figure 3.37—Adding Poll Everywhere to Teams

3. Once you click on **Get more apps**, Teams will open a categorized set of apps. Microsoft products have hundreds of apps available. Choose **Popular on Teams** and look for **Polls**. Figure 3.38 shows some of the more popular apps on Teams—another good one is Forms.

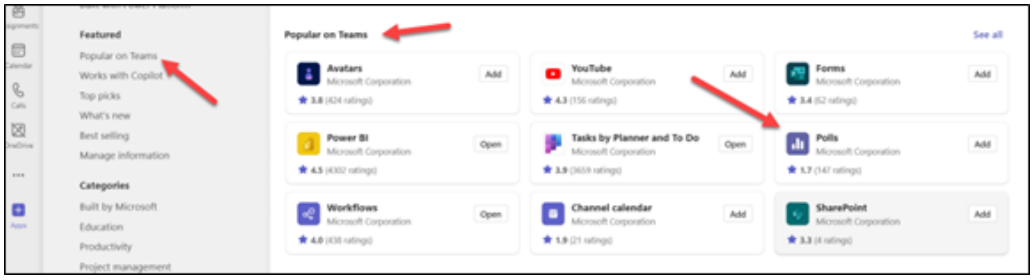


Figure 3.38—Apps Popular on Teams (Partial List)

4. Click **Add** and it will be added as a tab to your Team space. Once you add it, you will have the option to add to a team, add to a chat, or add to a meeting, as illustrated in Figure 3.39.

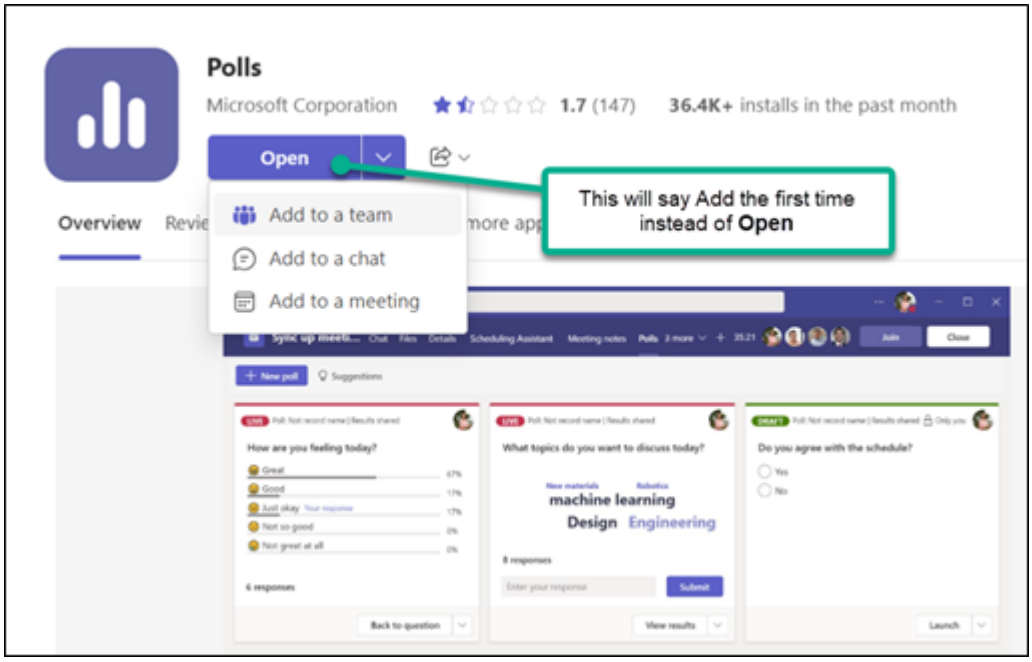


Figure 3.39—Choice of Where Polls Will Be Added

5. In Figure 3.39, the Polls app was added to a meeting, and then **New Poll** was selected. The pop-up provides choices available as of January 2024. Microsoft is continuing to update and add new features, so it is possible to see additional engagement activities. As seen in Figure 3.40, you can boost engagement with a word cloud, but other options are available.

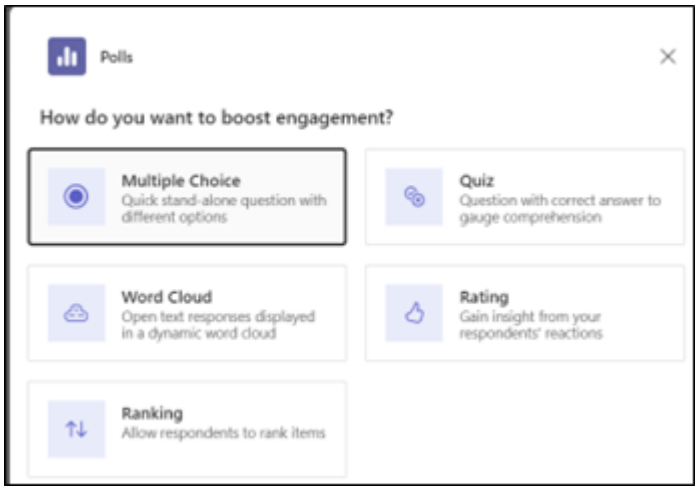


Figure 3.40—What Can You Do in Polls?

6. One of the things I like about this is the ability to **Save as draft** instead of **Launch now**. As the team members enter the meeting space, you can decide to launch when it is appropriate. If you launch the poll before the meeting starts, the team members will see the question that starts the process. It might be better to save it as a draft, as illustrated in Figure 3.41.

Figure 3.41—Setting Up Poll Question

7. If you set up the word cloud question before the meeting, the team members will see something like Figure 3.42 when they enter the team space (of course, with your question instead of mine).

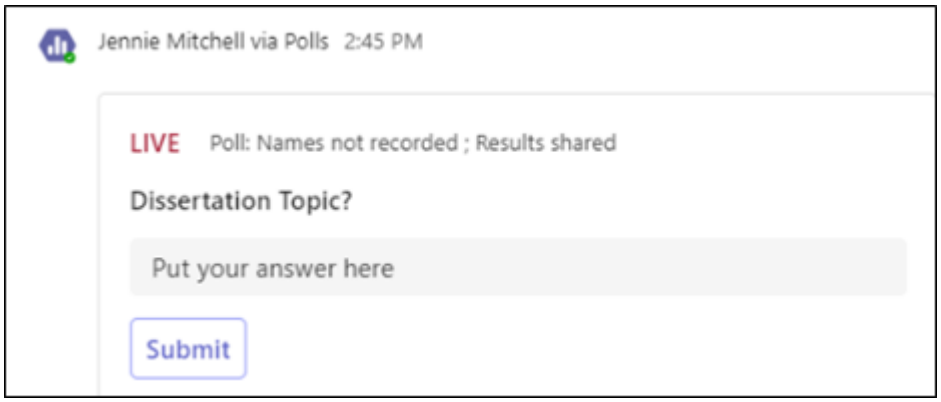


Figure 3.42—What Team Members See If Launched Before Meeting Starts

This is a great way to engage your audience without taking a lot of time. The following YouTube video shows how it was used with a live audience!

Modern Work Superheroes. (2022, Nov 9). How to Use Word Cloud in Polls for Microsoft Teams. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#oembed-2

Other Ways to Use a Word Cloud

Figure 3.43—Word Cloud Showing a Research Study

Note: Author Illustration (2025)

The uses shown in Figure 3.43 for word clouds range from a simple visual of a text document to a more intentional use of looking at survey comments, but there are many other uses for word clouds.

In a recent study, word clouds were used as "text mining" of electronic health records. Essentially, "meaningful words were extracted . . . to perform pattern matching, followed by text mining and word cloud. . . . By combining these techniques, physiotherapy treatments could be characterized by a list of constructed keywords, and the residents' health characteristics were built. Feeding defects or health outlier groups could be detected" (Delespierre et al., 2017, p. 1). If you look at the original article, this was much easier to understand than the text!

Most statistical software packages provide a way to create word clouds, but the apps shown in this chapter can help you with many word cloud projects!

3.2 Self-Assessment Recognizing Insights

Learning Objective #1—Determine insights

You have net income data for 10 years.

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https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-9

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-11

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-12

3.2 *Exercise 1: Create Horizontal Stacked Bar Charts and a Word Cloud to Provide Insight*

Learning Objective #1—Determine insights

Part 1

You work at a retail warehouse called "Just Stuff." Over the past month your team has collected feedback from customers regarding their shopping experiences. The feedback covers various aspects and is summarized in Table 3.2.

Table 3.2: Summarized Feedback From Customers and Corresponding Chart

Category	Excellent	Good	OK	Poor
Product quality	85%	10%	4%	1%
Product price	75%	5%	19%	1%
Staff interaction	50%	10%	15%	25%
Store environment	60%	11%	10%	19%
Overall satisfaction	70%	5%	9%	16%

The team chose the colors green for Excellent, yellow for Good, gray for OK, and red for Poor. The team envisions something like Figure 3.44 for each category.

Figure 3.44—Horizontal Stacked Bar Chart for Product Quality

Part 1 Assignment

- Create a horizontal stacked bar chart for each of the five components of the feedback summary (Table 3.2). The first one is completed for you.
- What insights can you share?
- What potential strategies would you recommend?

Caution—all charts should start at 0% on the x-axis!

Part 2

Besides summarizing the survey, your team members captured what customers said when asked to share

their first impression from their shopping experience. Your team recorded the first thing said by the customer during the survey.

Table 3.3: First Impression

Great prices (50 customers)	Staff disinterest (21 customers)
Quality products (50 customers)	Staff on phone (20 customers)
Best prices (30 customers)	Ignored (20 customers)
Rude staff (22 customers)	Dirty (18 customers)
Missing cashier (18 customers)	Windows need cleaned (16 customers)
Bathroom needs cleaned (15 customers)	Odd smell (14 customers)

Part 2 Assignment

- Create a word cloud for the first impression (Table 3.3).
- Develop a short report highlighting your findings and include the five charts from part 1 and the word cloud from part 2.
- What insights can you share, and what strategies would you recommend?

Post the assignments per instructor directions. Your instructor may ask you to post the assignments to a discussion board, present your charts and word cloud and discuss your findings in class, share and present in a Teams meeting, or another option.

3.3 Benchmarking, Decision-Making, and Strategic Analysis Tools

> Data visualizations must communicate answers and provide business outcomes. If the data feeding an analytics dashboard **is not trusted**, the results are meaningless. If the visualizations do not answer important business questions, the visualizations are not actionable.
>
> —Katie Horvath, CoreSignal

Today, data-driven decision-making is foundational for global business. As the quote from Katie Horvath suggests, managers and researchers must present data that is accurate and unbiased. At any point, if trust is lost, the results are meaningless. The integrity of decisions rests on the ethical handling and presentation of data. Storytellers need to ensure that biases (international or otherwise) do not distort the information conveyed.

Benchmarking is the process of comparing performance metrics (like key performance indicators [KPIs]) against established standards. Organizations rely on benchmarking to assess progress, identify areas that need improvement, and gauge the effectiveness of strategies. Metrics can help measure targets related to process, strategy, and perfor-

mance. Yet the way data are presented can profoundly influence perceptions and decisions. This section explores the intersection of benchmarking and ethical practices in data presentation. For this chapter's purpose, consider four types of benchmarking: (1) performance benchmarking, (2) practice benchmarking, (3) internal benchmarking, and (4) external benchmarking. Every industry should use benchmarking to help understand and transfer "best practices" from other organizations and improve organizational performance.

Internal and External Benchmarking

Internal benchmarking involves comparing different units, departments, or processes within the same organization. For example, a retail company with multiple store locations can survey customer satisfaction. Next, the company identifies the store location with the highest customer satisfaction. The organization would analyze this location's processes, training methods, and customer engagement strategies and share the insights gained company-wide.

External benchmarking involves comparing an organization's processes, performance, and/or practices with those of another organization, typically in the same industry. There is a plethora of tools that can be used to benchmark your organization to your competitor and your industry. For example, to understand the competitive environment of an industry, use Porter's Five Forces and Porter's Generic Strategies (both tools were developed by Michael Porter, an economist at Harvard). Let's look at these from an external benchmarking point of view.

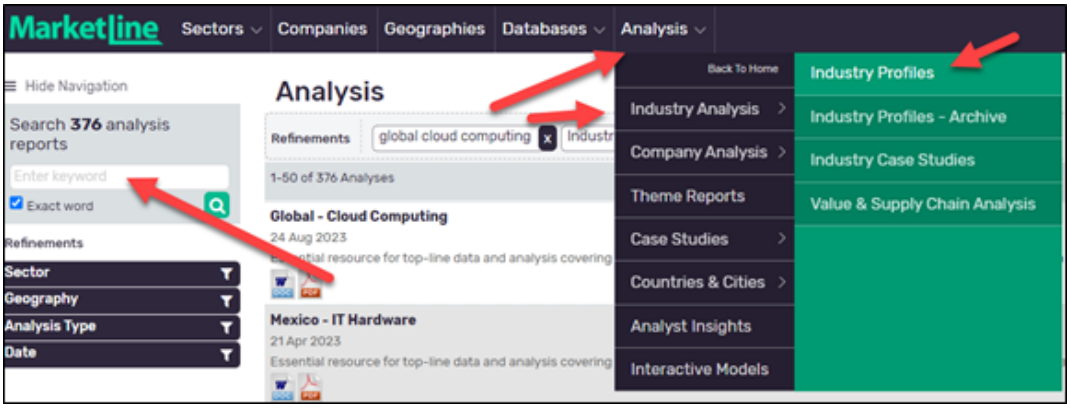
Benchmarking Tool 1: Porter's Five Forces

One of the best benchmarking tools to understand industry competitiveness is Porter's Five Forces because industry leaders recognize the components. For example, MarketLine Advantage is a world-leading provider of industry profiles that include Porter's Five Forces. MarketLine Advantage showcases over 30,000 companies, over 3,500 industry profiles, and over 110 country profiles (MarketLine Advantage Brochure, 2023). MarketLine uses Porter's Five Forces analysis framework "to evaluate the competitive pressures on 'players,' rival companies in a particular market" (MarketLine Advantage Brochure, 2023). Industry profiles include five-year forecasts, practical application of Porter's Five Forces analysis, and company financial metrics. Most college libraries have access to the MarketLine Advantage tool. Let's start by looking at an industry profile.

Industry Profile—Global Cloud Computing

The August 2023 Global Cloud Computing Industry profile is 44 pages of relevant information on the state of global cloud computing. Based on the table of contents, the industry profile includes an executive summary, market overview, market data, market segmentation, market outlook, (Porter's) **Five Forces analysis**, competitive landscape, company profiles (this includes financials in most cases), and macroeconomic indicators. Figure 3.45 shows the journey to finding the Global Computing Industry profile. From the main menu, choose **Analysis**, **Industry Analysis**, and then **Industry Profiles**. Or you can use the search feature to find it. Industry profiles are updated often.

Figure 3.45—Industry Profiles in MarketLine



Source: Screenshot of MarketLine Interface © MarketLine (Progressive Digital Media Ltd.). Author Annotations Added

If you open the global cloud computing profile, the five forces are buyer power, degree of rivalry, new entrants, substitutes, and supplier power. But what I really like is the graph, "Drivers of Buyer Power." MarketLine dives into each of the five categories. For example, in Exhibit 3.9, looking at buyer power, the following factors are measured: backward integration, buyer independence, buyer size, financial muscle, low-cost switching, oligopsony threat, price sensitivity, product dispensability, tendency to switch, and undifferentiated product. A relevant chart is supplied for each of the five forces to show the **drivers**.

Want to learn more about Porter's Five Forces?

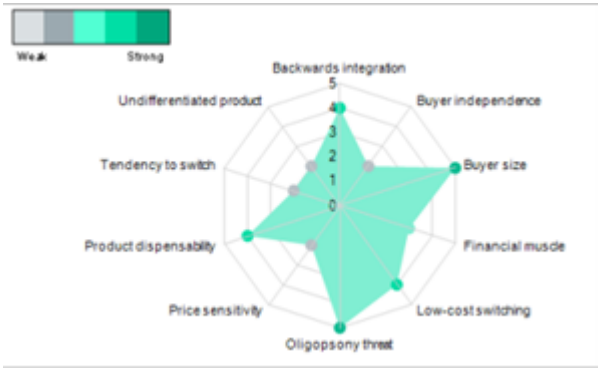
Expert Program Management (EPM). (2021, Jun 14). *Porter's Five Forces explained with example* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#oembed-3

De Bruin, L. (2016, Aug 3). Porter's Five Forces. Business-to-you. https://www.business-to-you.com/porters-five-forces/

Exhibit 3.9—Five Forces and Drill Down Into Drivers for Buyer Power

Data Source: MarketLine Industry Profile—Global Cloud Computing (August 2023)

Porter's Five Forces driving competition global cloud computing industry, 2022	**Porter's Five Forces drivers of buyer power** global cloud computing industry, 2022
	

These are radar charts (which is a chart you can prepare in Excel). Radar charts are great for visualizing how entities perform across multiple dimensions and to help identify areas of focus for improvement or further development.

Another aspect of an industry profile is the competitive landscape. This section identifies the leading players. The 2023 global cloud computing industry profile identified these top players in the cloud computing industry.

1. Amazon Web Services (AWS), a subsidiary of Amazon.com
2. Microsoft (Azure platform)
3. Google Cloud, a subsidiary of Alphabet Inc.
4. IBM Cloud, of International Business Machines Corporation
5. Alibaba Cloud, a subsidiary of Alibaba Group (and one of the fastest group cloud computing players located in China)

Because this is a textbook on leveraging data visualization, it's important to understand how to build a radar chart using the global cloud computing industry as an example and an estimate of where the two players (AWS and Alibaba) are located. The numbers assigned to AWS and Alibaba in the "Step-by-Step Approach to Build a Radar Chart in Excel" are estimated and are for learning to build a radar chart.

Step-by-Step Approach to Build a Radar Chart in Excel

1. **Open** the Excel file "3.3 Radar Chart" for this chapter.
2. Find the tab **3.3 Radar Chart**.
3. The data for this how-to section are in Figure 3.46.

	A	B	C	D	E	F
1	Global Cloud Computing Industry - Compare Industry, AWS, and Alibaba					
2		Buyer Power	Degree of Rivalry	New entrants	Substitutes	Supplier Power
3	Industry	3.2	3.9	2.8	2	3.2
4	AWS	3.2	4.3	3.3	3	3.5
5	Alibaba	3.2	4.4	3.2	2.5	3.2

Figure 3.46—Data for Radar Chart

4. **Highlight** A2:F5.
5. Choose **Insert** on the main menu.
6. Select **Recommended Charts**.
7. In the pop-up, select the tab **All Charts**.
8. Scroll down to **Radar**.
9. As shown in Figure 3.47, choose the **first radar chart**, or if you like the data points, choose the second one. Do not choose the fill one because this is a comparison.

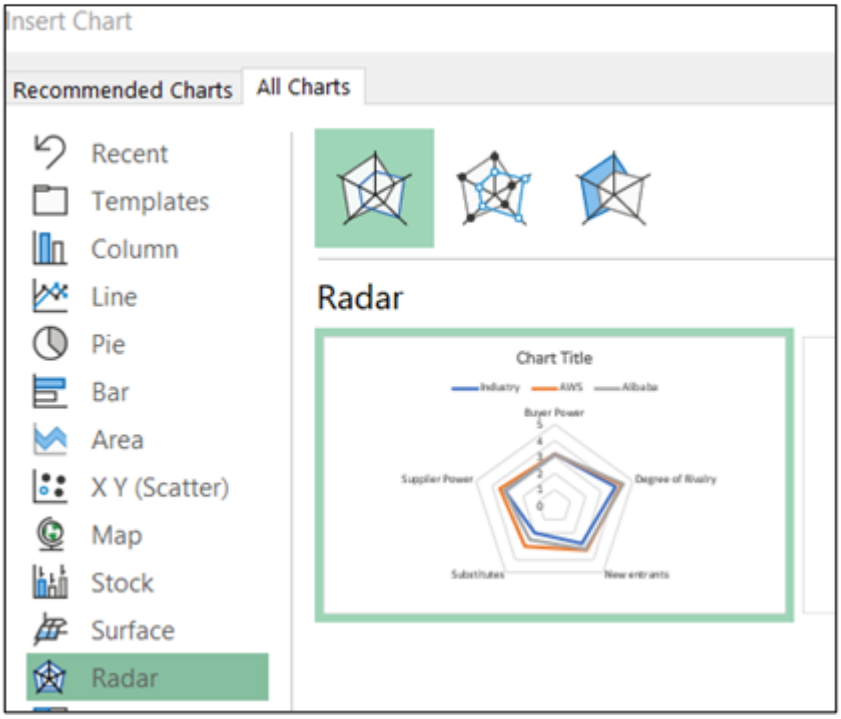
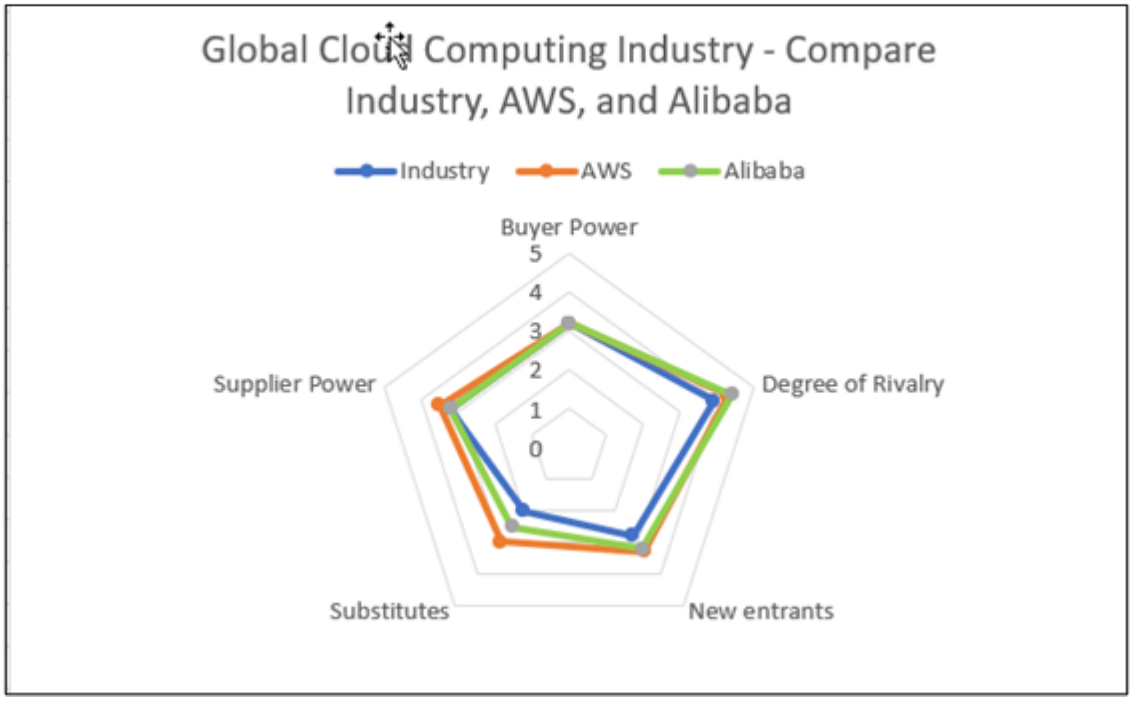


Figure 3.47—Choose First Radar Chart
Source: Screenshot of Excel Interface © Microsoft Corporation

The final comparison shown in Figure 3.48 uses the second radar chart showing the datapoints.

Figure 3.48—Radar Chart for Industry, AWS, and Alibaba



How to Interpret This Radar Chart

In this radar creation exercise, the estimate of Porter's Five Forces for each company was created for data visualization purposes. Although the industry data from the global cloud computing industry profile is accurate, the company numbers were created solely for this how-to demonstration. To interpret the results, compare the polygons of the different entities. Entities with polygons that are closer to the outer edge perform well in those corresponding variables. Entities with polygons closer to the center indicate weakness in those areas. This radar chart represents two companies ranked in the top five. Our results for a struggling company or a new entrant would yield very different results. In Figure 3.48, AWS slightly outperformed Alibaba.

Strategies That Follow Porter's Five Forces Analysis

According to Michael Porter (2008), in his article "The Five Competitive Forces That Shape Strategy," there are strategies that can be used to reshape the five forces. The strategies outlined by Porter include

- neutralize supplier power,
- counter customer power,
- temper price wars,
- scare off new entrants, and
- limit the threat of substitutes.

Let's look at them using the context of the cloud industry.

Table 3.4: Strategies to Reshape the Five Forces

Neutralize supplier power	Standardize specifications for parts so more vendors can provide them. This is a great strategy for the cloud industry since data centers rely on servers and processors, and normally have a well-established network of suppliers.
Counter customer power	Expand services so it's harder for customers to leave. This is one strategy that Amazon Web Services has done successfully and now Alibaba is practicing as well.
Temper price wars	Invest heavily in products that differ significantly from competitors. In the cloud storage industry, all competitors rely on specific computer parts, and since many of these parts come from outside the United States, Amazon Web Services has a difficult challenge. Consider collaboration—Microsoft and Oracle are usually competitors, but they are working together in the cloud industry realm.
Scare off new entrants	Elevate the fixed cost of competing by investing in R&D and artificial intelligence. Or apply for patents that support cloud service innovations.
Limit the threat of substitutes	Offer better value through wider product accessibility.

How Can Bias Creep Into Porter's Five Forces Analysis?

Bias can creep into the content development of Porter's Five Forces analysis in several ways. Bias creeps in when analysis becomes too narrow, you make untested assumptions, or your analysis is focusing on the wrong industry (this happens because companies often straddle more than one industry). Again, Michael Porter shared additional situations that can reduce profits:

Bias #1—Savvy customers

- You think you know your customers, and assume brand loyalty, but according to the State of Cloud 2023, 65% of organizations use a multicloud environment (Pluralsight, 2023). "Savvy customers can force down prices by playing you and your rivals against each other" (Porter, 2008, p. 24). An organization that uses a multicloud strategy will use two or more cloud providers to take advantage of the capabilities that best suit their purpose as well as prevent vendor lock-in.

Bias #2—Powerful suppliers

- "Powerful suppliers may constrain your profits if they charge higher prices" (Porter, 2008, p. 24).

Bias #3—Entrants

- "Aspiring entrants, armed with new capacity and hungry for market share, can ratchet up the investment required for you to stay in the game" (Porter, 2008, p. 24).

- In the case of cloud computing, the types of services are identical but when you perform the analysis, you may assume brand loyalty that is not there.

An Introduction to Porter's Generic Strategies

The term *generic strategies* was first introduced by Michael Porter and upon review, is reminiscent of Management 101. This model introduces strategies to gain a competitive advantage. It includes cost leadership, differentiation, and focus. To apply a cost leadership strategy, your organization would:

- increase profits by reducing costs (still charging industry-average prices).
- increase market share by charging lower prices (still making a reasonable profit).

Cost leadership is not for every organization. To apply this strategy, you need technology to bring costs down, efficient logistics, and a way to sustain the lower costs.

To be successful at differentiation strategy an organization needs:

- good research, development, and innovation,
- to be able to deliver high-quality products or services, and
- a marketing team that understands how to market differential products and services.

The third strategy focus is used in conjunction with cost or differentiation; Porter calls this *Cost Focus* and *Differentiation Focus*, and you should not try to do both. The process to use this model includes these steps:

1. Conduct a SWOT for each potential strategy. What strengths, weaknesses, opportunities, and threats would result in the strategy chosen?
2. Use Porter's Five Forces and PESTLE to understand the industry and the environment.
3. Compare SWOT and Porter's Five Forces and **choose one generic strategy** that gives you the best set of options.

For more information about Porter's Generic Strategies and example organizations that have applied the model, check out the following link.

De Bruin, L. (2021, Apr 14). *Porter's Generic Strategies: Differentiation, cost leadership and focus*. Strategic Planning—B2U Business-to-you. https://www.business-to-you.com/porter-generic-strategies-differentiation-cost-leadership-focus/

Benchmarking Tool 2: Comparative SWOT

Once you analyze your industry using Porter's Five Forces, the next step is to review SWOT analysis of the organization (or players) in this industry. In this same MarketLine Advantage database, each of the players shows a company summary, key statistics, research reports, deals, and a SWOT analysis. As you may recall, a SWOT will show strengths, weaknesses, opportunities, and threats. Strengths and weaknesses are considered **internal**, and opportunities and threats are considered **external**.

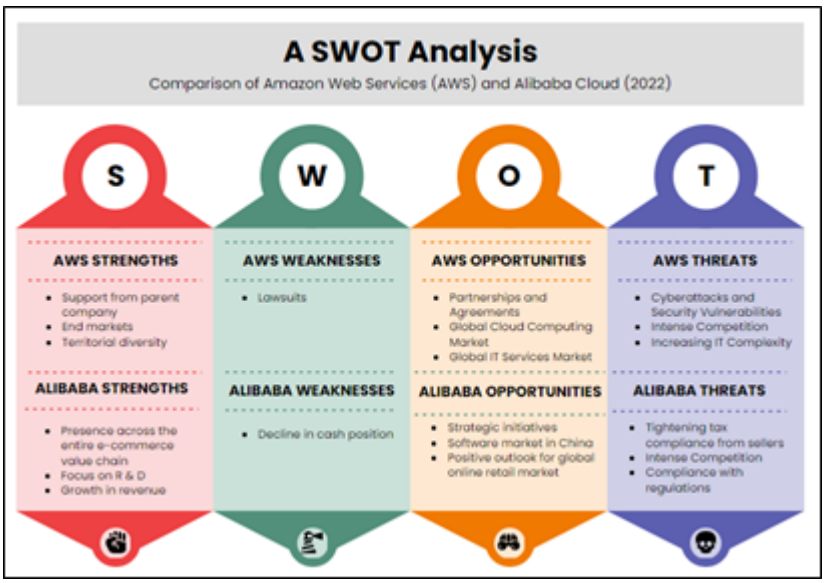
Once a company conducts a SWOT (either for their own organization or compared to a competitor), the next step is to develop strategies and action plans based on the insights gained from the analysis. These include the following:

- Capitalize on strengths: Leverage a company's strength to gain a competitive advantage.
- Address weaknesses: Work to improve identified weaknesses and develop plans to enhance capabilities, skills, processes, or resources pertaining to areas of weakness.
- Exploit opportunities: Capitalize on external opportunities that align with the company's strengths.
- Mitigate threats: Develop strategies to minimize the impact of external threats on the business by creating contingency plans, diversifying offerings, or strengthening relationships.

Remember a SWOT analysis is only valuable if it leads to meaningful action.

Figure 3.49 compares the leading player, Amazon, to the organization ranked fifth, Alibaba Cloud. The SWOTs consider the following categories: operational, financial, strategic, industry, political environment, economic situation, sociocultural environment, and technological environment.

Figure 3.49—An Example Comparison SWOT Analysis



Note: Author Illustration (2024)

One of the greatest weaknesses for growth is for an organization to be in the position of declining cash, especially if capital (interest costs for borrowing) is more difficult to raise. Let's look at another benchmarking tool that adds another layer of understanding to the situation, especially if you hope to expand your company into a new country.

A PEST/PESTLE adds another layer of understanding to your organization's situation. It is a simple and effective tool used to identify the key external forces at a *macro environment* level. A SWOT is not complete unless you conduct a PEST or PESTLE.

Benchmarking Tool 3: PESTLE (Also a Strategic Analysis Tool)

A strategic analysis tool should be used anytime your company is considering expansion into a new geographic area. PESTLE analysis incorporates: P = **p**olitical (or sometimes referred to as politics), E = **e**conomical, S = **s**ocial, T = **t**echnological, L = **l**egal, and E = **e**nvironmental. MarketLine uses PESTLE and PEST as part of the country analysis framework. So for companies considering expanding their market, this is a critical tool.

For example, one of MarketLine's PESTLE analyses is for the country Japan. The insight document (Japan In-Depth PESTLE insights) was published in January 2020 and is 96 pages long! But you can apply this analysis technique in a much smaller way. It is a pretty good model for expanding a market anywhere. Here are some considerations when conducting this analysis.

- **Political:** What is the current taxation policy and what changes are they considering? What is the political outlook?
  - What trading policies impact your business?
  - What are the specific regulations that you need to follow, and have they changed?
  - Is there current legislation that might impact your business?
- **Economical:** What is the overall economic situation? Is there a growing strength in consumer spending?
  - Does globalization affect your market share?
  - Is the economy stable? Growing? Declining?
  - Do you understand the taxes that are applicable to your product or service?
  - Is the government fighting loan deficits?
- **Social:** What lifestyle or trends are there to consider? What is the demographic of the consumer? Are there attitudes or opinions that should be considered?
  - Who is your target market?
  - Is the population growing and do they have a need for your product or service?
- **Technological:** Do they have relevant technology and innovations?
  - What technology is critical to support your operations and/or do you need vendor support? And if you need vendor support, are they in-country?
  - Does their technology infrastructure support your needs?
  - Does the country have weak intellectual property laws?
- **Legal:** Is there legislation in areas that would impact the company? For example, employment, tariffs, health, or safety. Are there labeling laws required?
  - Is the country transparent or is there evidence of corruption?
  - Are there hidden tariffs?
  - Does your organization understand the country's taxation structure (e.g., value-added tax [VAT] is often a surprise to companies when they expand into Europe).
- **Environmental:** Would a company product contribute to pollution? Are there recycling laws that would impact manufacturing the product or consumer use of the product?
  - What international treaties are signed in relation to air pollution, ozone layer damage, or disposal of hazardous waste?

Combine your analysis with a great graphic like the one illustrated in Exhibit 3.10, which helps visualize the insight analysis. You can create a PESTLE analysis in PowerPoint or one of the infographic software packages.

To illustrate how a PESTLE might be used, assume that Amazon Web Services (AWS) is investigating expanding into Greece. This potential expansion should always include a review of the PESTLE landscape. MarketLine provides a country profile for Greece. The March 2023 country profile is 82 pages long, but this small graphic (Exhibit 3.10) captures the key points.

Exhibit 3.10—Comparison of a PESTLE for Greece

Note: Author illustrations designed in PowerPoint (left) and Venngage

Created in PowerPoint	**Created in Venngage**

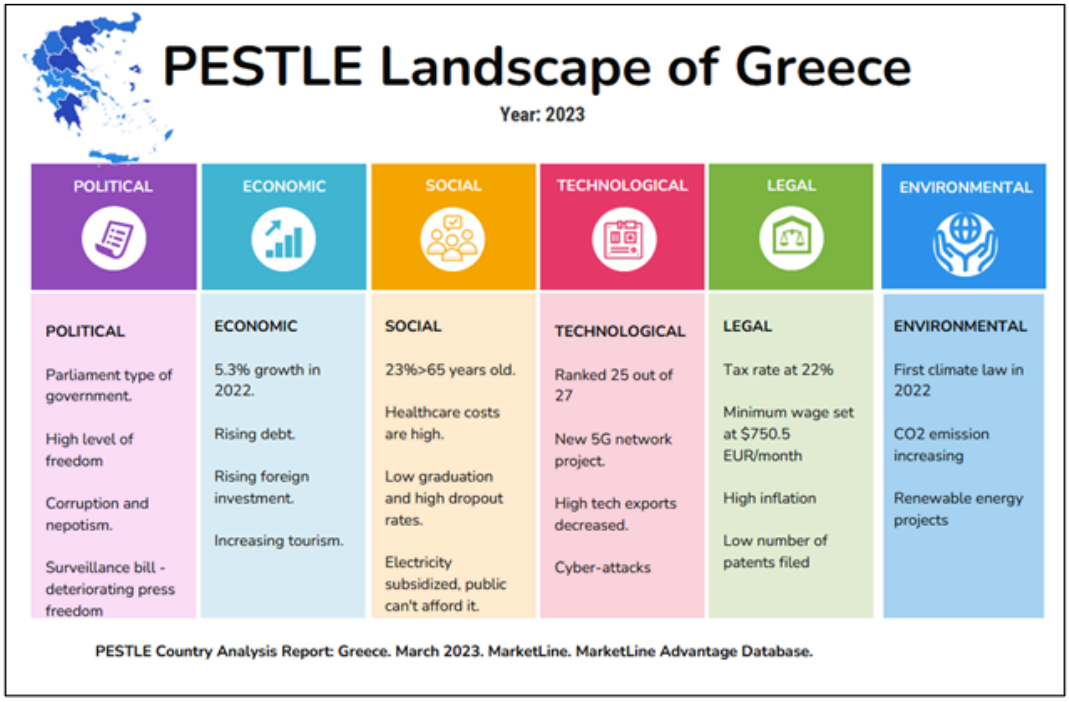
The type of background and layout is important. The Venngage example shows PESTLE all aligned, implying that each one carries the same weight; however, that is not true, and it will vary by industry.

To leverage data visualization and tell the story, begin with a brief introduction that highlights the purpose and provides context to the audience. Share an example that demonstrates the importance of understanding external factors. Next, present a clear structure. Obviously, your audience can't read all the fine print, so set up a section for each factor. Each section should include a brief overview, impacts on the organization, specific examples, and trends.

For example, Greece has just started a project to place a 5G network throughout the country. As a cloud computing company, they would want the 5G network in place, and hiring talent might be an issue because of the low graduation rate at the tertiary (college) level. Amazon Web Services would want to evaluate these factors based on their unique situation.

In Figure 3.50, notice the minimum wage of $750.50 EUR/month. Does that surprise you?

Figure 3.50—PESTLE Landscape of Greece in 2023



Note: Author Illustration (2024)

There are several variations for this strategic analysis tool, including PESTEL (just a different ordering), PEST (where companies do not consider legal and environment), and PESTELE or STEEPLE. The PESTELE or STEEPLE represents a variation that includes "ethical and industry specific factors." For example, this area would include such components as fair trade, child labor, and corporate social responsibility (CSR).

Benchmarking Tool #4—Compare With an Association Database(s)

Most industry associations provide benchmarking data specific to their sector which allows you to compare your organization's performance with industry norms. Examples include American Hotel & Lodging, National Retail Federation, Automotive Industry, Hospital Association, and National Collegiate Athletic Association (NCAA). There are hundreds more.

If your organization is required to report information, you can assume that the data collected is analyzed in some way. For example, the U.S. Department of Education sponsors the Equity in Athletics Data Analysis (EADA). The EADA is a report required by the U.S. Department of Education's Office for Civil Rights under Title IX regulations. The EADA report provides information about the participation rates, financial support, and other aspects of intercollegiate athletic programs at higher education institutions.

U.S. Department of Education. (2023). *Equity in Athletics Data Analysis*. https://ope.ed.gov/athletics/#/

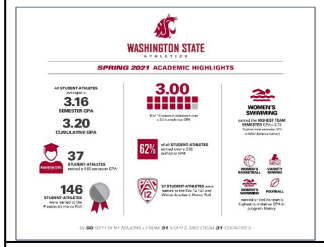
Bias in Reporting Data

The reporting of academic data, including average GPA for student athletes can vary widely from one institution to another. Although the data are collected as part of the NCAA Academic Progress Rate, it does not require a direct measure of average GPA; however, it does consider academic eligibility and retention of student athletes. Institutions that

fail to meet these thresholds can face penalties and loss of scholarships. There is no requirement to post athlete GPA for public viewing, but many institutions want to be both accountable and transparent and post some type of infographic about team GPA or sport-wide GPA. Here's the catch! Some institutions post GPA data when they are good and **fail to post anything** about student athlete GPAs when they are low.

In Exhibit 3.11, note how internal and external benchmarking might be used from an infographic perspective. Most colleges and universities track the GPAs of their athletes, and it's fairly common practice for any college or university to track their athletes' academic journeys (internal). However, some colleges have a spotty record of posting GPA information for public view (external).

Exhibit 3.11—To Post or Not to Post Average Student Athlete GPA

	
Washington State University. (2022). WSU Athletics Spring 2021 Academic Highlights. Available: https://news.wsu.edu/athletics-spring2021-academic-highlights-infographic/	Holy Cross Crusaders. (2019). Holy Cross News. Spring 2019 Holy Cross Athletics—Academic Highlights. Available: https://goholycross.com/news/2019/7/1/211806300.aspx

Now the question is, Do you see the GPA of college athletes posted for your institution?

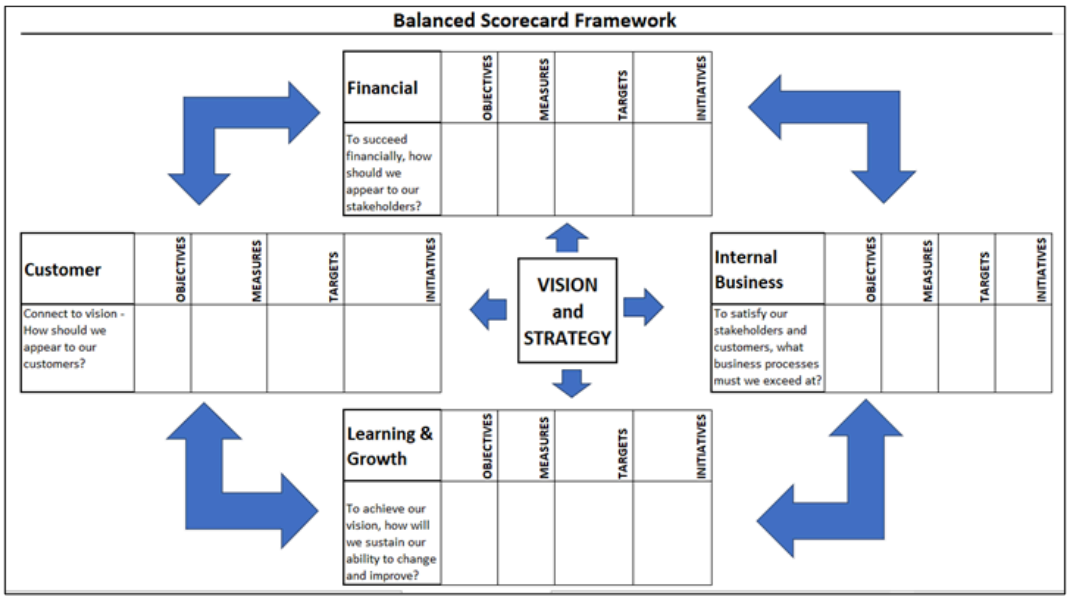
Benchmarking Tool #5—Balanced Scorecard

There are several types of performance metrics that should be considered for your organization. Organizations need performance indicators to measure performance and the organization's ability to reach their goals.

One of the first in this section is a **Balanced Scorecard (BSC)**. This benchmarking tool was first introduced by David Norton and Robert Kaplan in the late 1990s. BSC is considered to be one of the first performance metric tools to take into account nonfinancial information. The BSC measures four main aspects: learning and growth, business processes, customers, and finance (or for a nonprofit, instead of customers, it can be donors).

Figure 3.51 visually depicts what it might look like at the very early stages (this illustration was created in Excel and is included in the Excel files for this chapter).

Figure 3.51—Early Rendition of Balanced Scorecard Framework



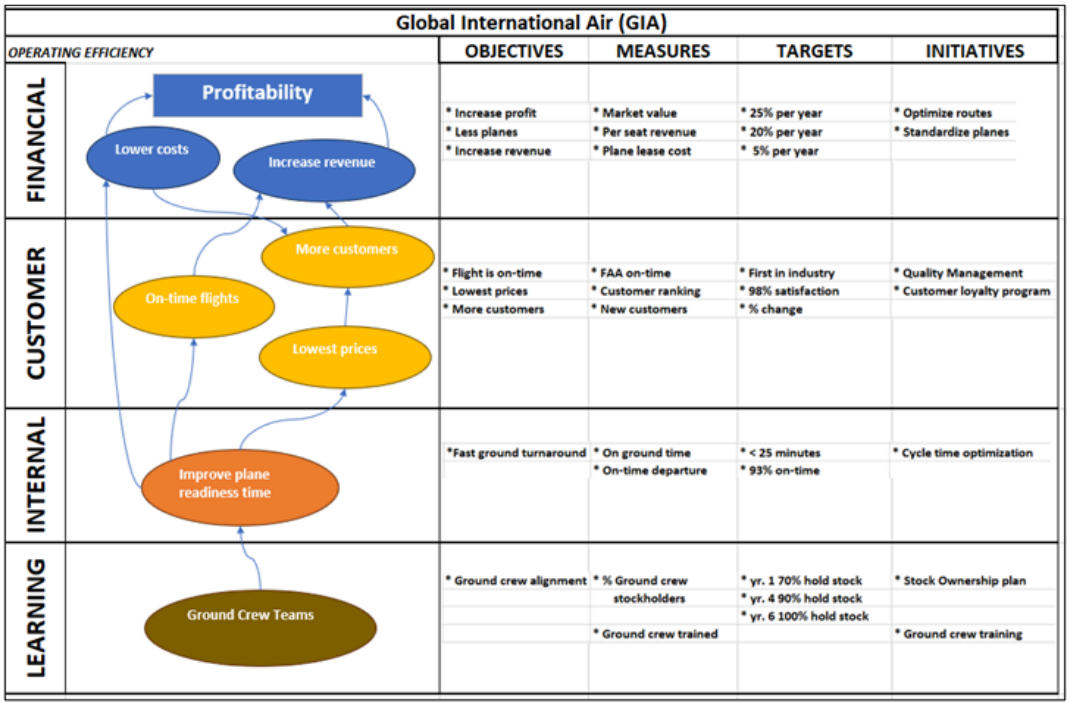
Source: Author Adaptation of Balanced Scorecard Framework in Kaplan, R. & Norton, D. (1996)

Since the late 1990s, the BSC has been used and modified by organizations. You will often see key performance indicators (KPIs) instead of measures and projects instead of initiatives. Instead of learning and growth, you might see organizational capacity. The framework for organizational capacity (financial, customer, internal processes, and the newer perspective) is often found in the form of a **strategy map**.

A **strategy map** is a visual depiction of cause-and-effect connections between strategic objectives. When used in conjunction with BSC, a strategy map is used to communicate how *value is created* by the organization. An example strategy map is shown in Exhibit 3.12. According to Kaplan & Norton (2001), "A strategy map enables an organization to describe and illustrate, in clear and general language, its objectives, initiatives, and targets; the measures used to assess its performance . . . and the linkages that are the foundation for strategic direction" (para. 14).

One of the easier industries to review is the airline industry. The cost of the flight is the same if the plane is full of passengers or if it carries only a few passengers, so it should be no surprise that standardizing planes for quick ground crew turnaround will increase customer satisfaction, since travelers hate delays for many reasons (connecting flights, losing quality time, etc.).

Exhibit 3.12—Sample Strategy Map Used With BSC

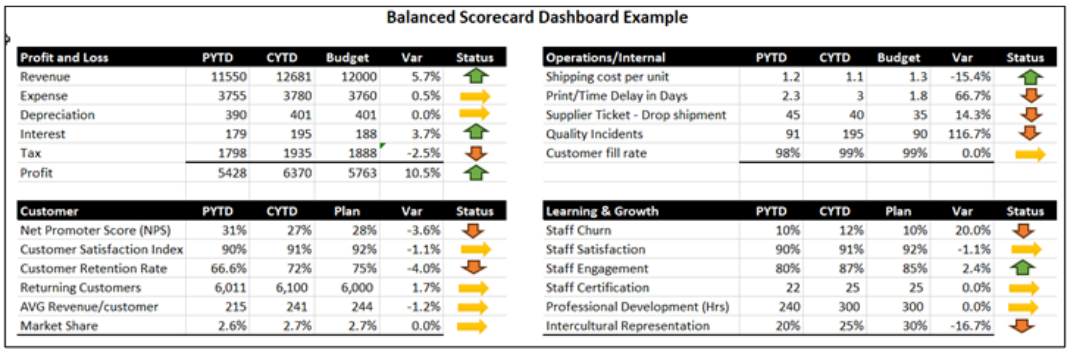


Source: Author Illustration of a Balanced Scorecard Combined with a Strategy Map (2025)

Although implementing a balanced scorecard framework can lead to substantial positive change, about 30% of BSC initiatives fail. The less-than-optimal outcomes can be caused by a lack of leadership and commitment (especially buy-in). This lack of leadership has several symptoms including unclear strategies, inadequate communication or mixed signals, incorrect metrics, or overemphasis on just the financial metrics. BSC has been around for over 30 years, and 70% of Fortune 1,000 companies have at least partially implemented a BSC (BSC Designer: Balanced Scorecard Fact Sheet, 2023). According to the "Management Tools & Trends," the BSC tool is one of the top three most popular business tools (Bain & Company, 2023).

Incorporating a dashboard in conjunction with a BSC framework can bridge the gap between strategy and execution by providing real-time insights. It's effective because it makes it easier for organizational stakeholders to monitor, analyze, and take action based on performance data. Let's look at the illustration in Exhibit 3.13 to learn more.

Exhibit 3.13—Simple (Partial) Example Dashboard to Support BSC



Note: Author Illustration (2025)

This example dashboard can support a BSC in several ways:

- centralized performance

- visual representation (the arrows) where stakeholders can see patterns and trends
- real-time monitoring, possible with built-in performance alerts
- customization (this is a very simple dashboard—many have lots more visuals)
- reinforced alignment between strategic objectives and the metrics being tracked (by organizing metrics along BSC)
- communication and decision support
- comparative analysis with historical data

To learn more about BSC, feel free to watch the following YouTube videos. The first provides the basics, and the second video is an interview with Professor Kaplan (one of the creators of the Balanced Scorecard).

Business School 101. (2022, Oct 31). *Balanced Scorecard (with a step-by-step example) from a business professor* [Video]. YouTube.

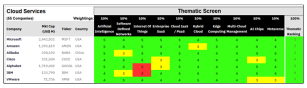
One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#oembed-4

CPA Strategic Management Accounting. (2023). *CPA R. Kaplan explains the Balanced Scorecard. knowledge equity* [Video]. YouTube. https://www.youtube.com/watch?v=4xXwFwQmRIM [Embedding disabled for this video.]

Sector Scorecard by Global Data (Disruptor)

Global Data uses a scorecard approach "to predict tomorrow's leading companies within each sector" using thematic, valuation, risk, and company screen (2023). The thematic screening ranks companies based on overall leadership by 10 themes most valued by their industry. The 10 themes are different depending on the sector. So for cloud computing services, you will see artificial intelligence, software-defined networks, internet of things, enterprise SaaS, cloud IaaS, hybrid cloud, edge computing, multicloud management, AI chips, and Metaverse. The legend indicates that green will impact earnings positively, yellow is neutral, and red will have a negative impact on earnings. The use of red, yellow, and green is symbolic in the United States, similar to a traffic light.

Exhibit 3.14—Thematic Scorecard of Cloud Service Sector (Partial)



Source: Global Data (2023). Sectors—Scorecard for Cloud Services. Global Data—Disruptor Database.

Although Exhibit 3.14 shows an overall positive impact on earnings, this is only a partial view of this scorecard. As you move down to companies ranked 25–65, expect to see a lot of red and yellow with very little green.

Personal Individual Strategy Map

The BSC can be translated into your own *personal, individual strategy map*. The example illustrated in the strategy mapping article shows a faculty strategy map from an academic perspective. The strategy map for an academic in higher education can guide personal development and define objectives in teaching, research, and service. Even more appealing is that the strategy map can help faculty members focus on strategies and should be created at the beginning of the academic year.

Novice educators should determine how setting one objective can contribute to the success of another. For example, successful research publication could enhance teaching effectiveness. The key performance indicators (KPIs) track progress toward each objective (like course evaluations, number of publications, grants, service committees, etc.).

The takeaway from this section is that strategy maps aligned with BSC perspectives provide a dynamic evaluation of your company with multiple views.

Adamson, K. (2019, Jan 23). Strategy mapping: An essential tool for new academic faculty. *Faculty Focus*. https://www.facultyfocus.com/articles/faculty-development/strategy-mapping-an-essential-tool-for-new-academic-faculty/

3.3 Self-Assessment Benchmarks

Learning Objective #4—Create and use benchmarking frameworks to provide context for problem, support decisions, and measure performance

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An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-18

3.3 *Exercise 1: Analysis of Industry Profile, Leading Players, and* SWOT

Learning Objective #2—Use benchmarking, decision-making, and strategic analysis tools

(This exercise assumes you have access to MarketLine in your university's library.)

Create a professional report that has three main components: (1) information about the industry, (2) two-company comparison of SWOTs from top players from the industry, and (3) a discussion of Porter's Five Forces.

Step 1: Start at MarketLine Advantage and find an industry profile.

Step 2: Go to the industry profile section, which lists the top players.

Step 3: Go to the company section in MarketLine and make sure that at least two of the companies from your industry profiles have SWOTs listed. If not, choose a different industry.

Step 4: From the industry profile, review Porter's Five Forces. Discuss trends and challenges for the industry. Summarize the important aspects of the industry.

Step 5: Pick two of the top players (that have SWOTs) and do a comparative SWOT. Compare and contrast the two players. What challenges do they share? Why are these two companies outperforming other companies from the same industry? Which company is stronger externally (opportunities and threats)?

What should the report contain?

- A discussion of Porter's Five Forces and the supporting factors. Feel free to capture the radar chart as a screen capture—just make sure to cite it.
- A discussion of the industry and the two players (that you chose)
    - Summarize important information about the industry.
- An infographic comparing the SWOTs
- A discussion comparing the two companies
    - Which company is stronger internally (strengths and weaknesses), and which company is stronger externally (opportunities and threats)?
    - What components are similar?
    - Did the industry profile analysis indicate similar internal or external factors to the SWOT analysis? Create an infographic comparing the SWOTs from the two companies.
    - Create a radar chart comparing the two companies.

Other aspects required are as follows:

- well-organized professional template with headings
- no spelling errors, typos, or grammar issues
- appropriate APA citations

Hint: You may want to look for professional report templates. Microsoft has dozens of paper and report design layout templates.

Check with your instructor to see if they prefer a PowerPoint presentation instead of a professional report.

3.3 Exercise 2: Create a SWOT for Your Organization

Learning Objective #2—Use benchmarking, decision-making, and strategic analysis tools

Complete research on your organization, the history, the industry, trends, and so on. What is your industry? Who are your competitors?

Create a SWOT infographic for your organization. Include a discussion that outlines your thought process. Remember S and W are internal, and O and T are external.

3.3 *Exercise 3: Conduct PESTLE Research*

Learning Objective #2—Use benchmarking, decision-making, and strategic analysis tools

(This exercise assumes you have access to MarketLine in your university's library.)

Step 1: Go to MarketLine and choose **Country Profiles**.

Step 2: From the country profile, create a PESTLE infographic.

Share the infographic and be prepared to discuss the company profile.

3.3 *Exercise 4: Balanced Scorecard*

Learning Objective #2—Use benchmarking, decision-making, and strategic analysis tools

Learning Objective #4—Create and use benchmarking frameworks to provide context for problems, support decisions, and measure performance

(This assumes that students have access to the ProQuest eBook Central database at their university.)

Step 1: Go to the ProQuest eBook Central database and find *Management Accounting Case Book*.

Step 2: Go to pages 71–78 within the case book and read "The Tri-Cities Community Bank: A Balanced Scorecard Case."

Step 3: Complete the following components of the case (the page numbers and exhibit names are from the case).

- Question 1 (p. 73): Create a table that categorizes each of the measures in Exhibit A2 into one of the four BSC perspectives. Exhibit A2 is in the case "The Tri-Cities Community Bank: A Balanced Scorecard Case."
- Question 2, modified (p. 73): Create a cause-and-effect chain using the one shown in Exhibit 3 as an example. Use the measures listed in Exhibit A2 or suggest other measures you feel are appropriate. Include an explanation.

- Question 3, modified (p. 75): Graph the key performance indicators on Exhibit B1 using the most appropriate graph type in a dashboard style. Discuss the implementation quality that may explain variation in performance among branches A–E. What implementation recommendations would you make to the ND managers considering the key performance indicators and your interaction with them?

Case Citation

Lawson, R. A. (Ed.). (2020). *Management accounting case book: Cases from the IMA educational case journal*. John Wiley & Sons, Incorporated. ProQuest eBook Central Database.

3.4 Visual Decision-Making Tools

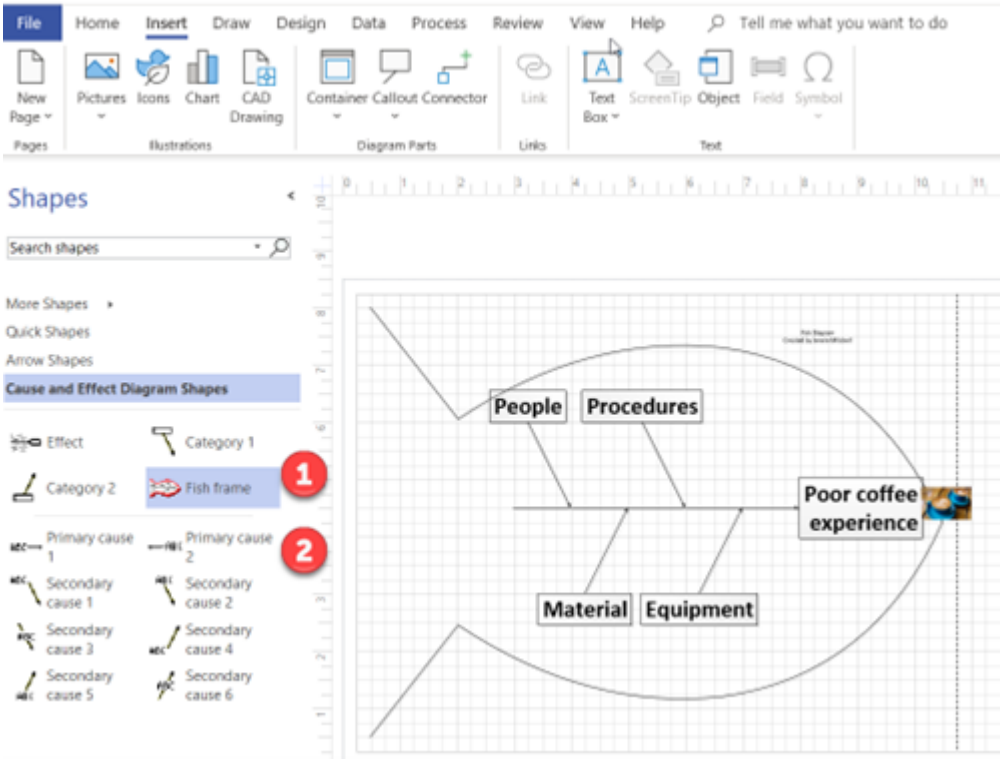
> Data visualization is the language of decision making. Good charts effectively convey information. Great charts enable, inform, and improve decision making.
> —Dante Vitagliano, CoreSignal

Visual decision-making tools can illuminate pathways to effective choices. This section delves into several decision-making tools that have visual representations. Early in this section, fill out the interconnected bones of Ishikawa diagrams to drill into the core problem instead of just treating the symptoms. Next, learn to build the structured branches of decision trees to weigh a decision using probability theory. Learn to use the discerning lenses of Pareto analysis to concentrate resources to gain the most impact. This section even includes the House of Quality used for the streamlined precision of Six Sigma methodologies. This section provides practical guidance on how to wield these tools effectively, leveraging the visualization output to communicate effectively.

Decision-Making Tool 1: What Is an Ishikawa Diagram?

An Ishikawa diagram was invented several decades ago by Kaoru Ishikawa to help a team identify and arrange the causes of a problem. It is a brainstorming tool that can help a team organize, visualize, and communicate. Often teams use sticky notes to think of all the causes that contribute to a specific problem. You can still do that! Just **start with five or six categories** and build your fins. For example, assume that you have a coffeeholic in your family. Your categories might look something like Figure 3.52 created in Visio (i.e., people, procedure, materials, and equipment). Notice that Visio provides a fish frame as well as primary and secondary cause shapes.

Figure 3.52—Ishikawa Diagram: Determine Categories.



Note: Created in Visio, Author Illustration (2022); Screenshot of Visio Interface © Microsoft Corporation. Author Annotations Added

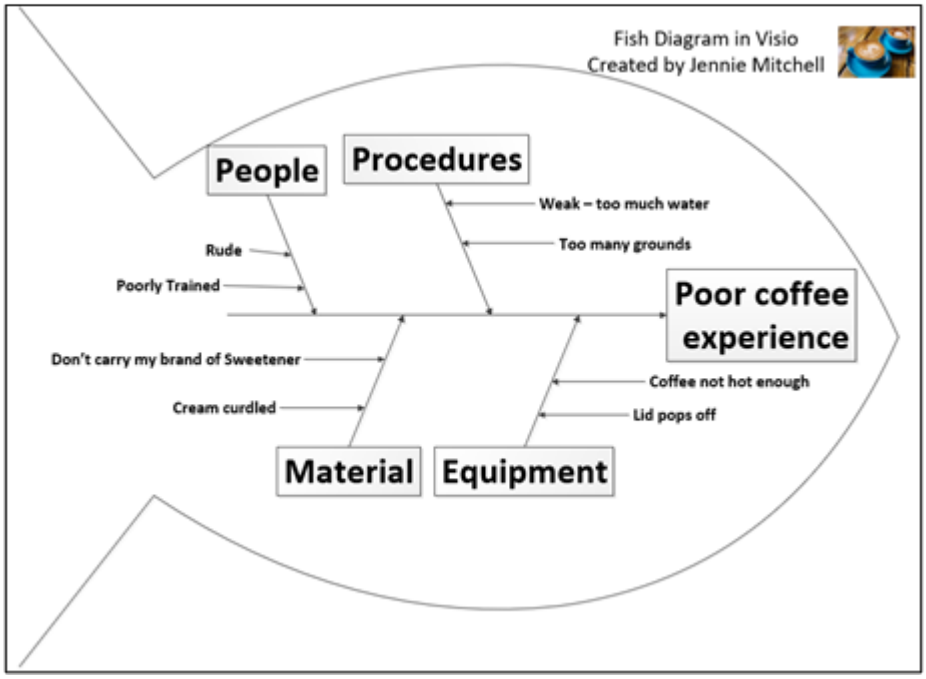
Next, have your team review each sticky note and arrange them into categories. Some example "causes" are shown in Table 3.5 for the problem "poor coffee experience" under the categories listed earlier.

Table 3.5: Brainstorming Example Causes

Procedure	Material	People	Equipment
Grounds in my coffee	Don't carry my sweetener	Rude	Cold coffee when I want hot

As you start to build out the diagram (as shown in Figure 3.53), you will probably think of other causes that lead to a "poor coffee experience," especially if you are a coffee drinker!

Figure 3.53—Partial Ishikawa Diagram



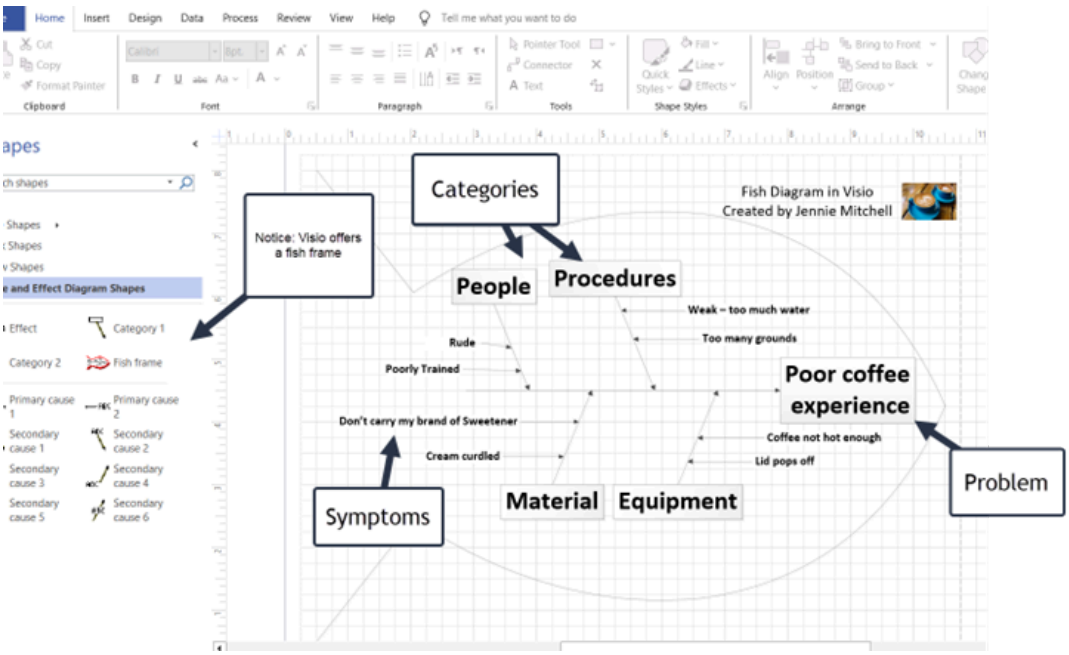
Note: Author Illustration in Visio (2022)

Categories can be customized based on the problem. If your organization is a manufacturer, you might see categories using the five **M**s of manufacturing (manpower, machines, materials, methods, and measurements). If your organization provides services, expect the six **P**s (people, processes, policies, procedures, places, and performance). But know that you can customize the categories to fit your situation.

The "problem" is situated toward the nose of the fish, and the causes (and subcauses) are pointed to the spine of the fish. Don't be surprised if you need to change your problem statement. For example, we started with "bad coffee" as the problem statement, but then saw that an employee being rude didn't really impact the *taste* of the coffee. Instead, it became clear that the real problem was a "bad coffee experience" related to visiting the local coffee shop.

Depending on the software or app that you use, the Ishikawa diagram could be called a **root cause analysis** or **fishbone diagram**. Exhibit 3.15 was created in Visio and shows the shapes and images that can be used. Note these are linked to primary causes, secondary causes, and so forth.

Exhibit 3.15—Sample Fish Diagram



Note: Visio Example—Showing Shapes and Effect Diagram Shapes (2024); Screenshot of Visio Interface © Microsoft Corporation. Author Annotations Added

Did you know that brainstorming is one of the most creative ways to solve a problem? And doing it with a team provides some additional benefits. Brainstorming can

- reduce social inhibitions among group members,
- stimulate ideas that you might never consider,
- enlighten the impact of the problem across departments, and
- capitalize on multiple perspectives.

You don't have to have a fancy fish diagram. You could even create a fish diagram in a Word document, but why create it yourself when there are templates and apps that will do it for you?

An Ishikawa diagram can be more dynamic if you use hyperlinks and the Zoom feature in PowerPoint, but there are dozens of videos on YouTube to enhance your storytelling. Watch Chad Littlefield's video "How to Make a PowerPoint Presentation Interactive" to consider ways to interact with your audience like the two-minute Google activity, contribution-not-consumption, Wikipedia Game, bringing an object in physically, a translation technique, and optical illusions.

Littlefield, C. (2021). *How to Make a PowerPoint Presentation Interactive*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#oembed-5

You can build an Ishikawa diagram in PowerPoint, but you should also consider searching Venngage or Canva for some of the diagrams. As you build the Ishikawa diagram, be prepared to dig beyond the surface-level causes and also explore the underlying currents that shape outcomes. For example, Starbucks has built an empire where they sell an experience and not just coffee. Starbucks provides a cozy atmosphere, free Wi-Fi, comfortable furniture and laptop-friendly tables, and the smell of ground coffee beans. Starbucks has even gone so far as to close all their stores early to train employees on the topic of "Racial Bias Training" on May 29, 2018. That's 8,000 stores and 175,000 employees as of 2018 (NPR, 2018)!

For more examples of fishbone (Ishikawa) diagrams, visit Venngage.

Hooper, L. (2021, Sept 10). How to Use Fishbone Diagrams to Solve Complex Problems. Venngage. https://venngage.com/blog/fishbone-diagram/

Decision-Making Tool 2: What Is a Decision Tree?

A **decision tree** offers a systematic approach to dissecting choices and their potential outcomes. It is a versatile decision-making tool that can be used in any industry to transform intricate decisions into a step-by-step journey. This section explores the foundational principles of the decision tree's creation—from understanding decision nodes and chance nodes to assigning probabilities and calculating expected values. According to Investopedia (2019),

A decision tree is a diagram or chart that people use to determine a course of action or show a statistical probability. . . . Each branch of the decision tree represents a possible decision, outcome, or reaction. The farthest branches on the tree represent the end results. (para. 1)

It derives its name from the branches and leaves of trees, which are used as part of the design along with symbols that can help your audience understand which decision is better. Exhibit 3.16 provides example symbols.

Exhibit 3.16—Symbols Used in a Decision Tree

Chance or event node	Alternative branches	Rejected alternative	Endpoint note	Decision point

A decision tree starts with a single node (the square symbol) and branches into possible outcomes. A chance node shows the probabilities of a certain event. Draw the decision tree on paper first with all the probabilities, costs, and benefits. Although the chance nodes normally show the expected value, the endpoint node shows the final payoff if the event occurred as expected.

A decision tree is best used when the decision you need to make is significant, infrequent, and strategic because it carries a lot of risks. It is a graphical representation of the alternatives and estimates value by using probability. Not all decision trees will have high, medium, and low probabilities; some decision tree models will only show two probabilities, but the probabilities should always add up to 100%.

Sample Scenario of a Decision Tree

XCaliber Systems is a small software company comprising three partners who grew up together. XCaliber is not their day job, but they love coding and making apps and have had some success selling their travel app. As they sit down to plan 2025, they have three exclusive opportunities: (a) develop a game app, (b) develop a financial app requested by a national bank, or (c) revamp their existing travel app with new features requested by their users.

Opportunity A—Develop a Game App

After some discussion, they surmise their best guess of a successful launch would be 35%, a modest launch would be 50%, and a dismal launch would be 15% for the game app. Because it is a new game, they think they can use the GoFundMe app to help boost potential revenue and estimate their best guesses for a successful launch, a modest launch, and a dismal launch. They expect the cost of creating the app will be **$80,000**. Of the three opportunities, this is the one they like the best, but they also wonder if their payoff estimates are biased based on their enthusiasm.

Table 3.6: Opportunity A: Develop Game App

Opportunity A: Develop a game app	Payoff	Probability
Successful launch	$250,000	35%
Modest launch	$150,000	50%
Dismal launch	$100,000	15%

Opportunity B—Develop a Financial App

After some discussion, they surmise their best guess of a successful launch would be 60%, a modest launch would be 30%, and a dismal launch would be 10% for the financial app. This app was requested by a national bank and could be adopted by one bank, by all the banks in one state, or by all banks in the Midwest. None of the three friends is excited about developing this app. They expect the cost of creating the app will be **$60,000**.

Table 3.7: Opportunity B: Develop a Financial App

Opportunity C: Revamp existing travel app	Payoff	Probability
Successful launch—All Midwest banks	$200,000	60%
Modest launch—All banks in one state	$120,000	30%
Dismal launch—Only one bank	$60,000	10%

Opportunity C—Revamp Existing Travel App

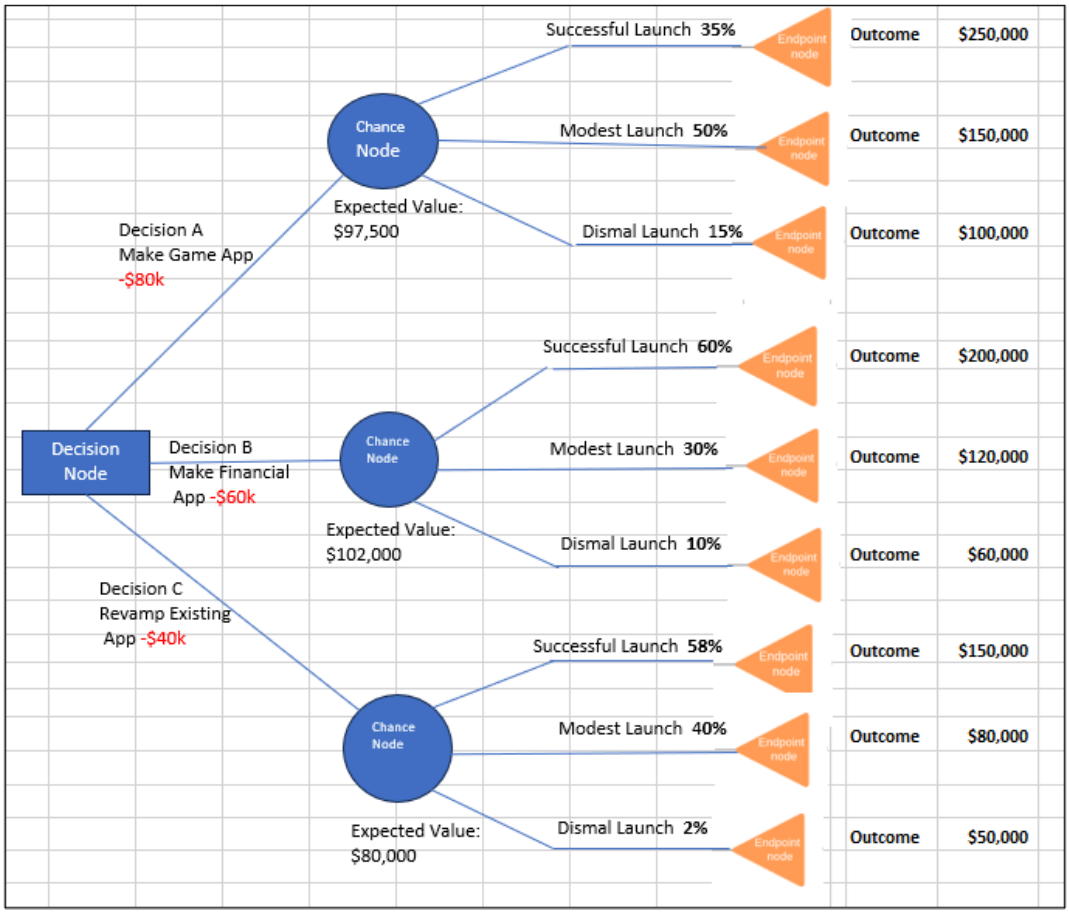
Over 50% of the customers that use the existing travel app have made some requested changes. The changes requested would not cost much (about **$40,000**) and could be done quickly. After some discussion, they surmise their best guess of a successful launch would be 58%, a modest launch would be 40%, and a dismal launch would be 2% for revamping the existing travel app.

Table 3.8: Opportunity C: Revamp Existing Travel App

Opportunity C: Revamp existing travel app	Payoff	Probability
Successful launch	$150,000	58%
Modest launch	$80,000	40%
Dismal launch	$50,000	2%

Next, they go to their digital whiteboard (as illustrated in Exhibit 3.17) and draw a decision tree in Excel.

Exhibit 3.17—Decision Tree—Three Potential Opportunities



Note: Author Illustration (2025)

The expected value is shown at each chance node. To understand how the expected value was calculated, look at Tables 3.6–3.8.

As seen in Exhibit 3.17 and Figure 3.54, the expected value for decision A (the game app) is $97,500. To calculate the expected column, take the payoff multiplied by the probability. Next, total the expected column and subtract the cost to develop the game.

Figure 3.54—Decision A: Expected Value of $97,500

Decision A			
Develop Game App	Payoff	Probability	Expected
Successful Launch	$ 250,000.00	0.35	$ 87,500.00
Modest Launch	$ 150,000.00	0.50	$ 75,000.00
Dismal Launch	$ 100,000.00	0.15	$ 15,000.00
			$ 177,500.00
Cost to develop game			$ (80,000.00)
Expected Value			$ 97,500.00

Summary for decision A: ($250,000 × 35%) + ($150,000 × 50%) + ($100,000 × 15%) = $177,500, then subtract the cost to develop the game and you have calculated the expected value for the decision. Notice that .35 + .50 + .15 = 1.00. The probability will always equal 100%.

Figure 3.55—Decision B: Expected Value of $102,000

Decision B			
Develop Financial App	Payoff	Probability	Expected
All midwest branches want App	$ 200,000.00	0.60	$ 120,000.00
The state banks wants App	$ 120,000.00	0.30	$ 36,000.00
Only one bank wants App	$ 60,000.00	0.10	$ 6,000.00
			$ 162,000.00
Cost to develop Financial App			$ (60,000.00)
Expected Value			$ 102,000.00

As seen in Figure 3.55, the summary for decision B: ($200,000 × 60%) + ($120,000 × 30%) + ($60,000 × 10%) = $162,000, then subtract the cost to develop the app and you have calculated the expected value for the decision.

Figure 3.56—Decision C: Expected Value $80,000

Decision C			
Revamp Existing Travel App	Payoff	Probability	Expected
Successful Launch	$ 150,000.00	0.58	$ 87,000.00
Modest Launch	$ 80,000.00	0.40	$ 32,000.00
Dismal Launch	$ 50,000.00	0.02	$ 1,000.00
			$ 120,000.00
Cost to revamp existing App			$ (40,000.00)
Expected Value			$ 80,000.00

As seen in Figure 3.56, the summary for decision C: ($150,000 × 58%) + ($80,000 × 40%) +($50,000 × 2%) = $120,000, then subtract the cost to revamp the existing app.

Now the three partners of XCaliber Systems sit down and compare the three opportunities. Financially, the best option is decision B, the financial app at $102,000; however, decision A, the game app, is not far behind at $97,500. It is possible that the three partners will still choose the game app, since it is only 4,500 less.

Most decision trees are used where large sums of capital are involved, especially when risk is tied to an external factor that the organization doesn't control. A good example might be the potential leasing of a venue space owned by an organization for two or more events.

Decision trees are a great way to visualize a complex problem. Risks associated with the problem explored will have

already been considered, and visualization facilitates finding the best resolution. In the case of LucidChart, the data are linked to a spreadsheet, and since it was built that way, you can add a button that shows you the best option.

The biggest thing to remember is to show all the probabilities by drawing out each component *first*. The decision tree yields a visualization comparing two or more projects.

Next, let's look at another decision-making tool that involves the Pareto Diagram.

Decision-Making Tool #3—How Can a Pareto Diagram Help?

This tool enhances your ability to make informed decisions and has been adopted by many fields, especially in the context of quality management. The Pareto Diagram prioritizes key factors through a visual representation of what industry experts call the **80/20 rule**. The typical data used to construct a Pareto Diagram is **qualitative data**.

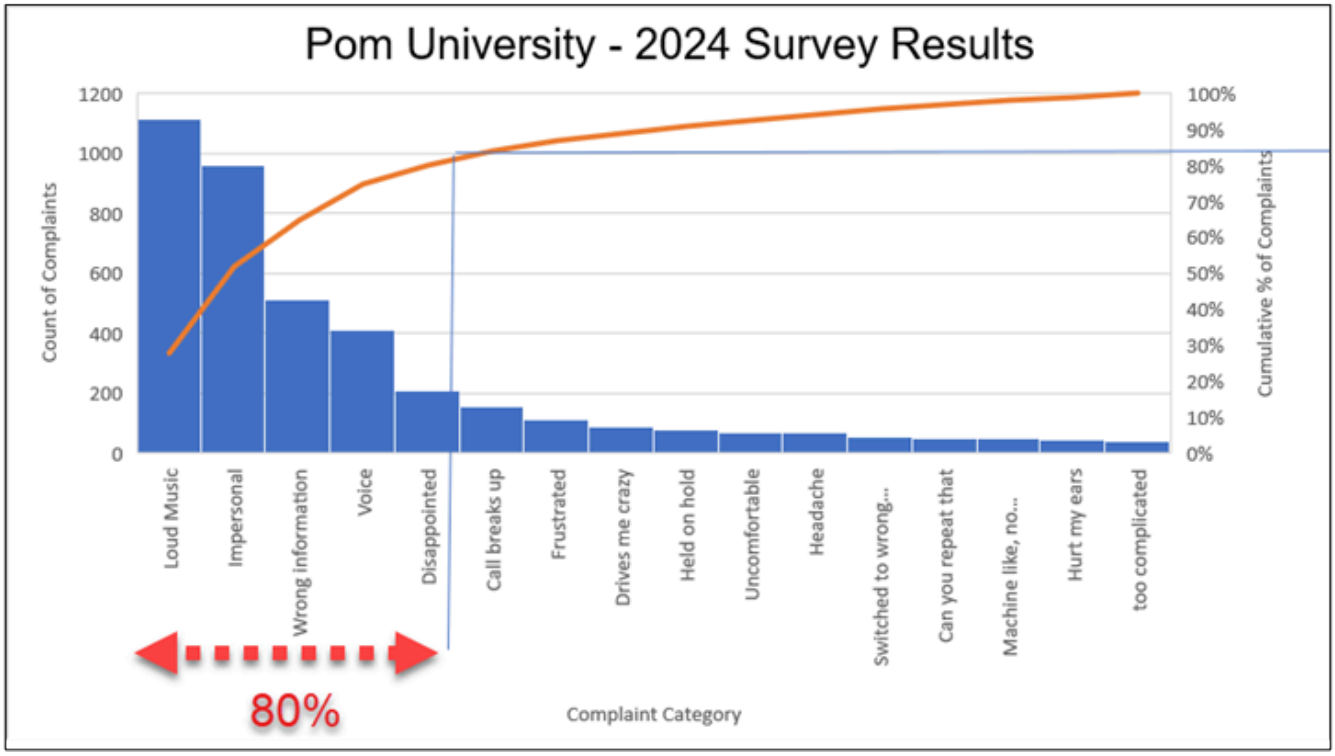
To better understand this application, let's look at an example. POM University purchased an automated system to answer fan questions. The survey had an open-ended question set, and major words were aggregated to show a word cloud. Figure 3.57 shows a summary of the data. These data are set up so we can use a Pareto Diagram. The visualization was sorted from highest to lowest frequency, while a relative frequency column and a cumulative relative frequency column were also added. Notice that some of the phrases relate to the same issue. For example, headache and loud music may relate to the same issue.

Figure 3.57—Data Setup for Pareto Diagram

Word/Phrase	Frequency	Relative Frequency	Cumulative relative frequency
Loud Music	1113	27.8%	27.8%
Impersonal	960	24.0%	51.8%
Wrong information	510	12.8%	64.6%
Voice	411	10.3%	74.9%
Disappointed	209	5.2%	80.1%
Call breaks up	155	3.9%	84.0%
Frustrated	110	2.8%	86.7%
Drives me crazy	88	2.2%	88.9%
Held on hold	75	1.9%	90.8%
Headache	66	1.7%	92.4%
Uncomfortable	67	1.7%	94.1%
Switched to wrong person	55	1.4%	95.5%
Can you repeat that	49	1.2%	96.7%
Machine like, no personality	49	1.2%	97.9%
Hurt my ears	43	1.1%	99.0%
too complicated	40	1.0%	100.0%
	4000	100.0%	

A Pareto Diagram is a bar chart plotted by order of decreasing frequency relative to other data points. In addition to the bars, the cumulative frequency is plotted as a line on the same graph. The line is called the Pareto line. You may have heard of Pareto but didn't realize it since **this graph represents the 80/20 rule**. It was named the Pareto Diagram after a well-known Italian economist, Vilfredo Pareto, and is often used in the realm of total quality management (TQM). Exhibit 3.18 shows the 80% components: loud music, impersonal, wrong information, voice, and disappointed. Pareto Diagrams help you concentrate on a few issues to serve the largest number of customers.

Exhibit 3.18—POM University Pareto Diagram



Applying the 80/20 principle to this situation means that 80% of the complaints fall into a few categories. A better way to look at it is that it helps you narrow down the list of complaints that should be prioritized. The Pareto Diagram you see here has a few extra components that we added to draw your eye to where the 80% category lies on the frequency table. Essentially, this means that 3,200 of the 4,000 complaints used these phrases.

Step-by-Step for How to Create a Pareto Diagram in Excel

First of all, a Pareto Diagram is included in the Chapter 3 Excel file "3.4 Survey Data—Pareto Diagram." You can practice with it.

1. **Highlight** the data but not the totals (B2:E18).

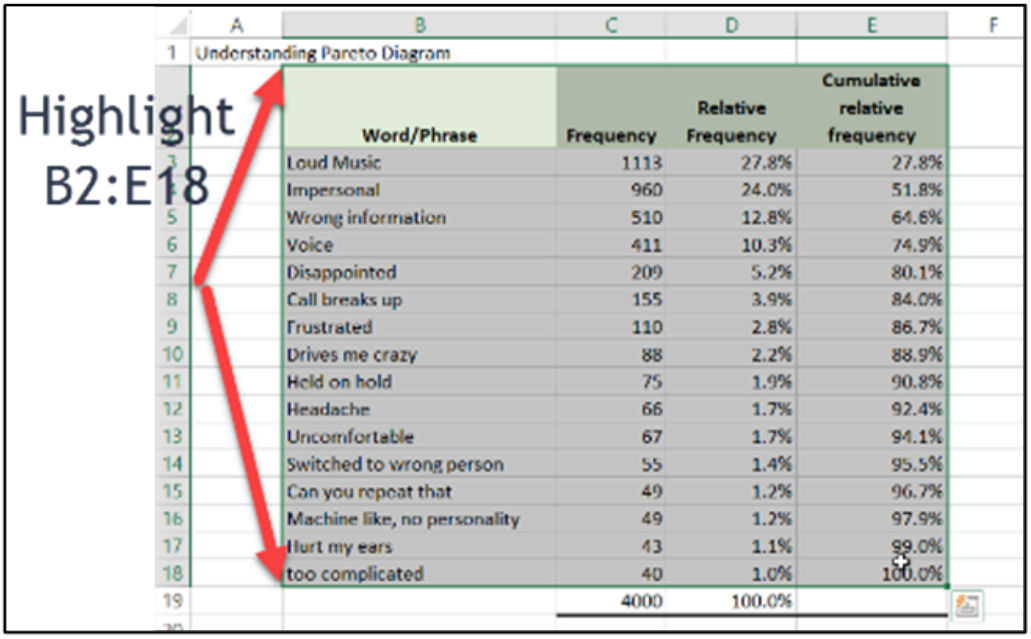


Figure 3.58—Highlighting Area for Pareto Diagram

2. Choose **Insert** on the ribbon.
3. Look for a small chart icon that when you hover over it is a statistics chart, and then choose the **Pareto chart**.

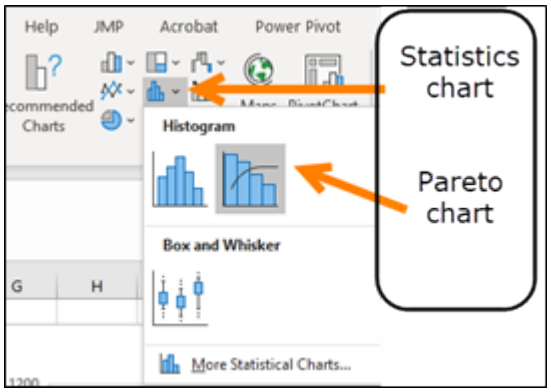


Figure 3.59—Chosing Pareto Chart

4. Then **add** some axis titles and a heading.
5. Depending on your audience, you can add lines to emphasize the 80% data points as shown in Exhibit 3.18.
6. If you plan to use this in a PowerPoint, you may want to highlight the 80% or show an animated arrow.

3.4 Self-Assessment: Use Decision-Making Tools

Learning Objective #5—Create and use decision-making tools to provide context for problems, support decisions, and assess risk

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https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-19

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https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-20

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-21

3.5 *Self-Assessment: Decision Tree Problem*

Learning Objective #5—Create and use decision-making tools to provide context for problems, support decisions, and assess risk

Suppose you have an opportunity to rent out your facility at POM University, but two different organizations want to rent the facility during the same week. As you can tell from reviewing the fact table (Table 3.9), the cost of the bid is nonrefundable.

Table 3.9: Fact Table for POM University Hosting an Event

Payoff Table	Event A	Event B
Cost of bid (nonrefundable)	$50,000	$15,000
Probability of Organizer choosing your bid	.30	.90
Costs associated with event in your facility	$100,000	$ 25,000
Successful hosting	.60	.90
Not as successful hosting (poor weather)	.40	.10
Financial benefit if Excellent	$500,000	$150,000
Financial benefit if weather issues or mediocre competitions	$400,000	$100,000

Use LucidChart, Venngage, Canva, Excel, or paper to build the decision tree for POM University. Calculate the *expected value* to fill in the blank.

Table 3.10: Event A Expected Value

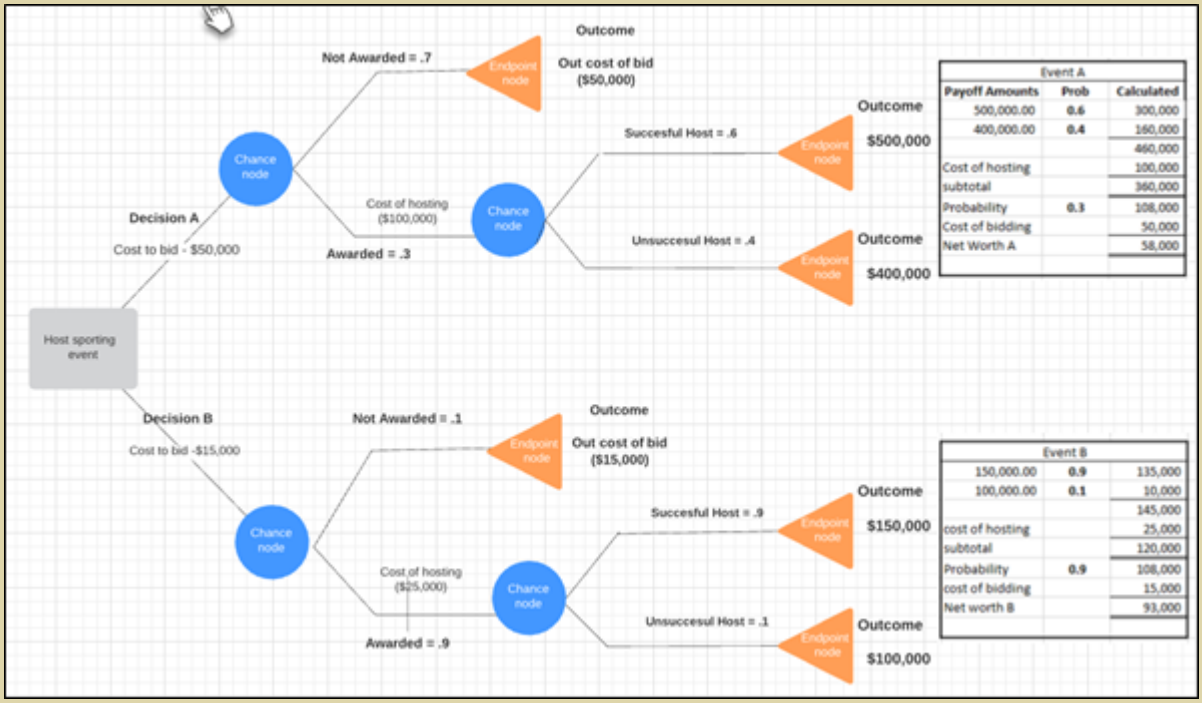
Payoff Amounts	Probability	Expected Value
$		
$		
Subtotal		
Cost of Hosting		
Subtotal		
Probability event chosen		
Cost of bidding		
Expected Value and net worth		

Table 3.11: Event B Expected Value

Payoff Amounts	Probability	Expected Value
$		
$		
Subtotal		
Cost of Hosting		
Subtotal		
Probability event chosen		
Cost of bidding		
Expected Value and net worth		

Now check your answers against the solution in Exhibit 3.19.

Exhibit 3.19—Solution for POM University Decision Tree



3.4 *Exercise 1: Which Event Should Be Contracted for the Convention Center?*

Learning Objective #5—Create and use decision-making tools to provide context for problems, support decisions, and assess risk

The exercise assignment is based on the renting of a convention center venue for two potential events: Event A—Girls Volleyball Junior National Championship; or Event B—State High School Coaches Association Convention.

This exercise (case) was written by Ceyda Mumcu and Kimberly Mahoney and is available in the digital commons (Sports Management Commons) at this URL: https://digitalcommons.newhaven.edu/sportmanagement-facpubs/14/

Reference: Mumcu, C., & Mahoney, K. (2018). Use of decision tree model in sport management. *Case Studies in Sport Management*, 7(1), 1–3.

Instructions

Take the role of a sports marketing manager. However, please note that the application learned here can be used in any field. The questions for the case have been modified to the following. Complete only these three questions and post your recommendation and support.

1. Question 1, modified: Construct a decision tree (using LucidChart, Excel, or Visio). The decision tree can be saved as an image file or screen captured into a Word document or a PowerPoint.
2. Question 2: Compare the three alternatives (Event A, Event B, or not bidding for any event) for their expected values and net gains.
3. Question 3, modified: Prepare the recommendations—include a five-minute video maintaining your role as the sports marketing manager. Tell the story. Use the decision tree and any other information to make the recommendation.

Make sure to read through the case to consider the context so you can tell the story.

Table 3.12: Payoff Table for Bidding and Hosting Sporting Events

Payoff Table	Event A	Event B
Cost of Bidding	$200,000	$10,000
Probability of Being Awarded	.1	.9
Cost of Hosting	$1,000,000	$60,000
Probability of Hosting Successfully	.7	.9
Financial Benefit Expected by an Excellent Event (including revenue for the convention center and economic impact for the city)	$50,000,000	$3,750,000
Financial Benefit Expected by a Mediocre Event (including revenue for the convention center and economic impact for the city)	$38,000,000	$1,600,000

3.5 Visualize and Persuade

> An editorial approach to visualization design requires us to take responsibility to filter out the noise from the signals, identifying the most valuable, most striking or most relevant dimensions of the subject matter in question.
>
> —Andy Kirk

Presenting your ideas, research, or insights is a complex endeavor that demands adaptability, empathy, and precision. Whether you are standing before a poster show audience, addressing a small or large gathering, connecting remotely, or speaking to individuals of varying cultural backgrounds or genders, the art of effective communication is a key component that we refer to as "visualize and persuade."

In an interconnected world where communication bridges gaps and supports understanding, refining these presentation techniques will empower you to deliver compelling messages that resonate, captivate, and inspire, regardless of the context or audience you encounter. Start with something simple, a poster show.

What Is a Poster Show?

A poster show is an event where posters are on exhibition and contain a researcher's findings, projects, or ideas using a poster as a visual aid. Posters contain visually appealing representations of the subject matter. Posters are often created in PowerPoint, and the sizes include 24″ × 24″ templates to 48″ × 96″ templates and every size in between. (Warning: PowerPoint is limited to 56″ × 56″ in size.) The size depends on the guidelines of the event organizer and whether the presenter wants a vertical or horizontal poster. Attendees can browse through the posters and ask questions to the pre-

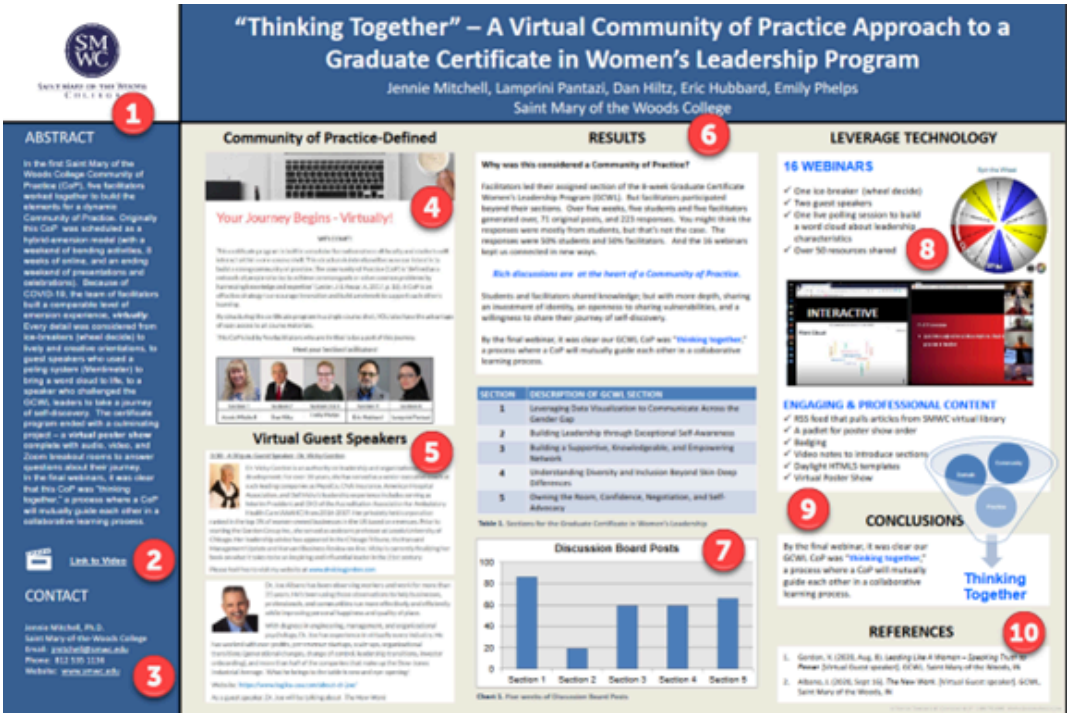
senters, and many remote poster sessions include “live” sessions where the presenters put on a short presentation and take questions from the virtual audience. The size shown for Exhibit 3.20 is 24″ × 36″.

The example (Exhibit 3.20) includes the expected components of a virtual poster:

1. abstract and title,
2. link to presentation video/audio file,
3. contact information,
4. introduction and hypothesis (if a research poster),
5. background,
6. methods/results,
7. charts or information supporting results,
8. more examples to support hypotheses,
9. conclusion, and
10. references.

Keep in mind to adjust your virtual poster to meet the requirements of the conference or journal.

Exhibit 3.20—Example Virtual Poster.



Note: *Author Illustration* (2021)

Poster Checklist

To see if the poster is following best practices, let’s start with a poster checklist (Table 3.13). Use the poster in Exhibit 3.20 and work through the Generic Poster Checklist. Always make sure to review the journal’s submission guidelines in addition to the Generic Poster Checklist.

Table 3.13: Generic Poster Checklist

Checklist Questions	Response	Explanation as required
1. Does the poster meet guidelines or organizer requirements?		
2. Is the message clear and focused?		
3. Does the poster have high-quality images and charts that are engaging without being overwhelming?		
4. Is the poster organized logically, with subheadings, guiding the viewer through the information?		
5. Is the data clear and understandable with good data visualization(s)?		
6. Does the presentation or video (if applicable) engage the viewer?		
7. If questions are asked by viewers, does the presenter add meaningful discussion?		
8. Are there visual cues, with effective use of color, white space, and cohesion?		
9. Is the poster accessible to all viewers, including those with disabilities (like closed captioning for a video)?		
10. Does it contain appropriate branding with contact information if viewers wish to reach out for further discussion?		
11. Does the presenter craft a compelling narrative that takes the viewer on a journey?		
12. Does the poster contain appropriate citations and references?		
13. Does the poster use person-first language and show a sensitivity to potential viewers?		

Poster Presentation Guidelines

The following guidelines were taken from a graduate certificate in women's leadership (GCWL) program and modified to include some of the innovative ways to participate in poster shows. Most conferences offer a poster show opportunity, and requirements will vary from one conference to another. Therefore, the requirements listed here are just shown as an example.

Using Posters in a Virtual or Hybrid Setting

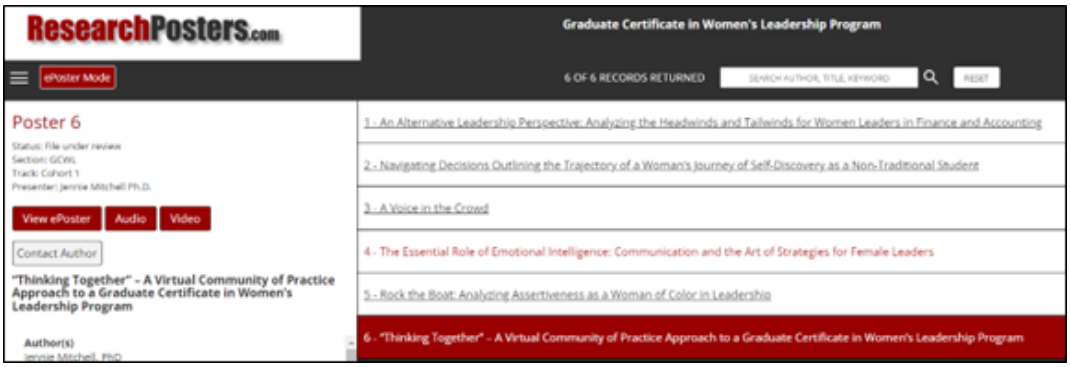
Poster sessions can be face-to-face or offered virtually. In this example, Saint Mary-of-the-Woods College (SMWC) partnered with Genigraphics Research Posters to provide a virtual experience. Partnering allowed students to receive feedback in the form of discussion or virtually (through Zoom in breakout rooms). Most often, the conference will provide PowerPoint poster templates and suggest several layouts but with a specific size. In this example, SMWC used Genigraphics Research Posters to provide a rich experience for the poster participants. As shown in Exhibit 3.21, Gen-

igraphics offered a portal for GCWL students to upload their posters in time for a virtual poster show. The audience logged into the Research Posters session to view the poster, leave feedback, or talk to the researcher through Zoom (as shown in Exhibit 3.21).

Exhibit 3.21—Setting Up a Poster Event

Source: Genigraphics.com—Used with permission

Exhibit 3.22—Virtual Poster Show (2021) Through ResearchPosters.com



Source: ResearchPosters.com—Used with permission

To understand how this project came together, here are the *actual* requirements given to students who participated in the poster show.

Exhibit 3.23—Sample Poster Requirements

Poster Format Requirements

- Your poster must meet these guidelines, so please use one of the templates at the link provided through email.
- This is a **culminating** activity. If you, as the presenting author, cited a disclosure on your disclosure form, please also add this to your poster.
- A section at the top of the poster must contain the Title, Author, and Affiliation.
- Files must be in PowerPoint (.ppt or .pptx) or Adobe Acrobat (.pdf) file format.
- Fonts other than standard Windows TrueType must be embedded in the file.

Poster Templates

- The poster needs to be 24″ × 36″. There are several different template styles and layouts to pick from.
- To see how ePoster files look on www.ResearchPosters.com, review the demo: https://www.researchposters.com/display_posters.aspx?code=DEMO1
- All files will receive a complimentary design review.

Audio File Attachments

- All posters must include a 5-minute audio in addition to the video.
- Audio is limited to 5 minutes. Audio files should be uploaded in .mp3, .wav, or .m4a file formats.
- To record audio on your computer, one option is https://online-voice-recorder.com/, which records in .mp3 and saves to your downloads folder. Another option is to use Windows Voice Recorder.

Video

- Posters are required to have a video URL link on the poster.
- Your video should not exceed 7 minutes.
- To include a recorded video, place a hyperlink to the video site within the poster. Directions for video recording (using ScreenPal) will be provided.

To see some of these, feel free to browse the variety of templates available for you to use at Genigraphics (genigraphics.com) and check out other potential poster guidelines.

Other poster guidelines are available.

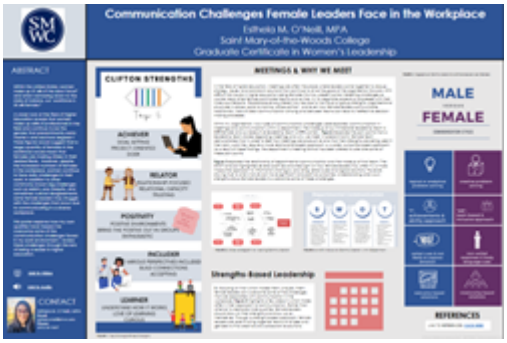
Virtual Poster Presentation Guidelines. (2021/22). A Celebration of Scholarship. John Carroll University. https://jcu.edu/sites/default/files/2021-02/Virtual%20Poster%20Presentation%20Guidelines_0.pdf

Poster Presentation Guidelines: Create A Successful Post for Presentation At the Conference. (2023). SPIE. www.spie.org

Center for Teaching Excellence & Innovation. (2022). Effective Poster Presentation. Johns Hopkins University. https://ctei.jhu.edu/wp-content/uploads/sites/61/EffectivePosterPresentations-Handout.pdf

A *surprising outcome*: For the GCWL poster show, the PowerPoint template requirement was 24″ × 36″, and students were given four different layouts. Surprisingly, students chose only two types of templates: (1) abstract sidebar design with large title space or (2) title-left design. Exhibit 3.24 shows an example for each.

Exhibit 3.24—Template Layouts



Abstract Side Bar Design with Large Title Space—GCWL Poster

Title-Left Design—GCWL Poster

3.5 Exercise 1: Create a Poster

First of all, you are not required to "create" a poster. However, you are required to discuss components and consider how you would modify an existing template.

- Look at research poster designs in Canva and Venngage and compare them to those that you see in Genigraphics (https://www.genigraphics.com/templates).
- Download a template and open it in PowerPoint. Conduct some preliminary research on a topic of your choice. This could be organization specific. For example, your topic might be based on a challenge at work (poor communication, multigenerational communication issues, a need for conflict resolution techniques, Zoom burnout, employee retention, and so on). Discuss what headings you would use. What are the key components that would support your topic, and how would you show them?{~?~IM: insert pln-mitchelldeckard-discussionicon here. ALT: TK}
- What data visualizations would you expect for your topic?

Based on your instructor, either post to a discussion board or be prepared to discuss in class.

3.6 Visualization Tools Animated Through Time

> Without a systematic way to start and keep data clean, bad data will happen.
> —Donato Diorio

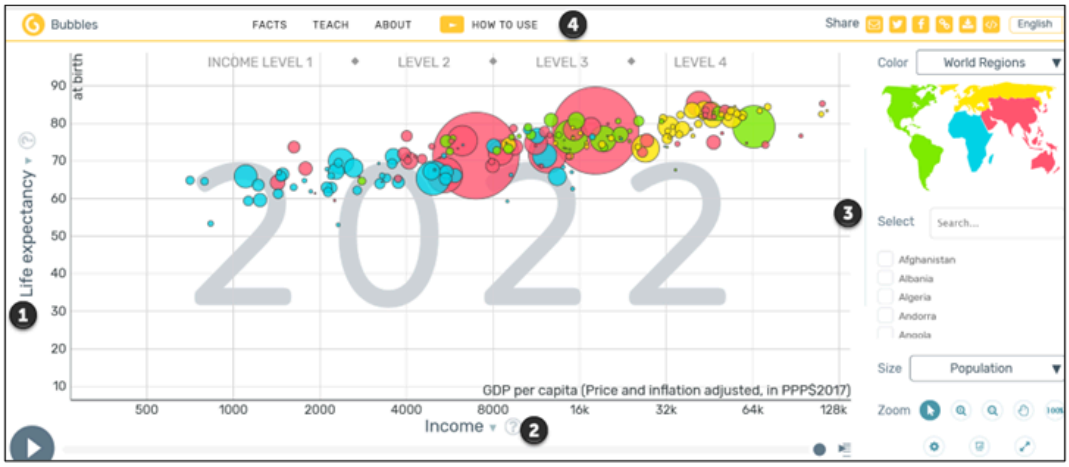
We have unprecedented access to data and tools available that will empower us to explore, analyze, and understand the intricate web of global trends with clarity. Hans Rosling once said that people are not "rocks" and that we are transforming. The rapid transformation in economics, demographics, health, and education shows distinct patterns through time. Tools like Gapminder and Flourish empower users to breathe life into static datasets. Both tools engage the viewer and facilitate a deeper understanding of trends and patterns. These types of tools play a pivotal role in transforming raw data into compelling narratives.

Gapminder Tool was developed by Hans Rosling and his team and is an innovative use of data visualization because it combines animated trends into a compelling narrative that reveals the true stories of our world. This tool was introduced earlier in the interactive infographic tools in Chapter 2. In this section, you will explore how to use the Gapminder Offline Tool using your own data.

Gapminder—a Visualization Tool Animated Through Time

If you have data that has years and you want to show the trend over time, this product will fill that need. But before you add your own data, explore Gapminder because the data already collected may offer further insight. Let's look at the image shown in Exhibit 3.25 and explore some of the options. Notice that this is an animated infographic (see the play button on the bottom left), which can be saved as a video that can be inserted into PowerPoint.

Exhibit 3.25—Gapminder GDP and Life Expectancy



Source: GapMinder. (2022). GDP and life expectancy chart—CC BY. Author Annotations Added

1 This is the y-axis. Besides life expectancy, there are hundreds of possible choices, by choosing the drop-down arrow and exploring the categories: communication, economy, education, energy, environment, health, infrastructure, population, society, sustainability, work, an advanced user section, and other datasets.

2 This is the x-axis. Besides income, there are hundreds of possible choices by choosing the drop-down arrow. It includes all the same categories listed for the y-axis and includes data from 1800 through 2020 (when the x-axis is time).

3 This section gives you the option of filtering the information, making it easy to compare one country to another. But it also has hundreds of options with the drop-down arrow. Note that you can share the video you make through social media options.

4 This menu includes a "How to Use" section. More importantly, it shows directions on downloading the Gapminder Tool and how to use this tool to show your own data.

There is a step-by-step tutorial for showing your own data on the Gapminder website. If you review this section, you will notice that you can choose templates that have bubble charts, bar rank charts, line charts, world maps, and mountains.

Vizabi. (2017, Apr 3). Show your own data. Gapminder Offline. https://vizabi.org/tutorials/2017/04/03/show-your-data/

Flourish—a New Data Visualization Tool for Canva

Note: Screenshots of Flourish interface © Flourish Studio, https://flourish.studio. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

According to Christine Hall (2022), "Canva acquired Flourish in mission to tell better stories with data" (para 1). Canva has a free account available to students and educators. In addition, Canva has many apps that add to its already broad range of infographic and design features. One such app is Flourish. To use Flourish in Canva, you must add it as an app in Canva, set up a new account in Flourish, and connect them. One of the key impacts of Flourish is how the animation can help inform, persuade, and inspire your audience. Before we get to the step-by-step, look at the many types of animated graphs available.

There are three categories of animated templates available in Flourish: (1) line, bar, and pie charts; (2) projection maps; and (3) scatterplots. Exhibit 3.26 shows only a partial list.

Exhibit 3.26—Types of Animated Charts Available in Flourish

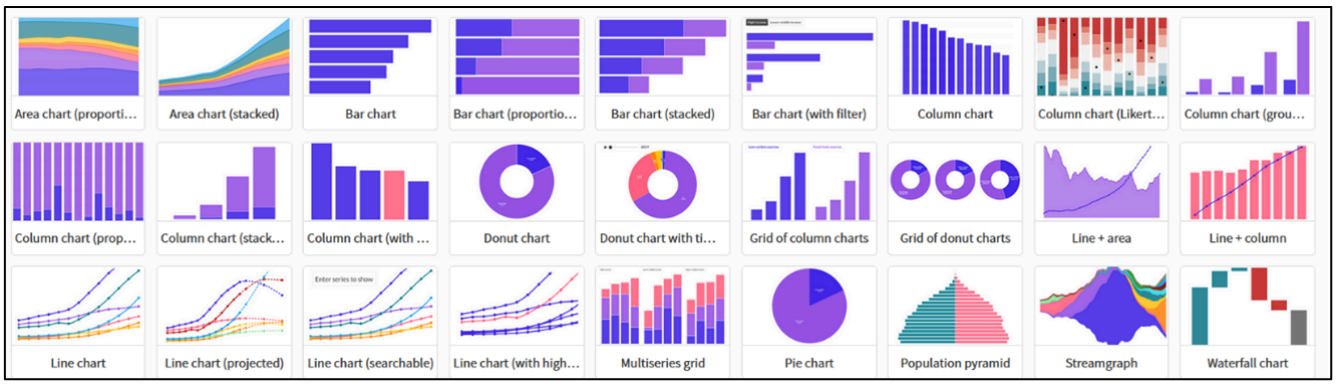


Exhibit 3.27—Types of Animated Maps Available in Flourish

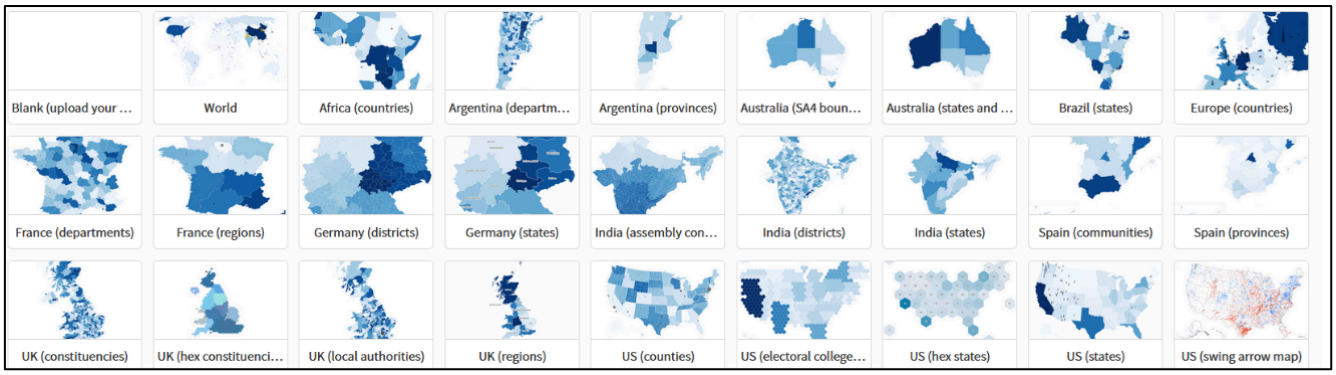
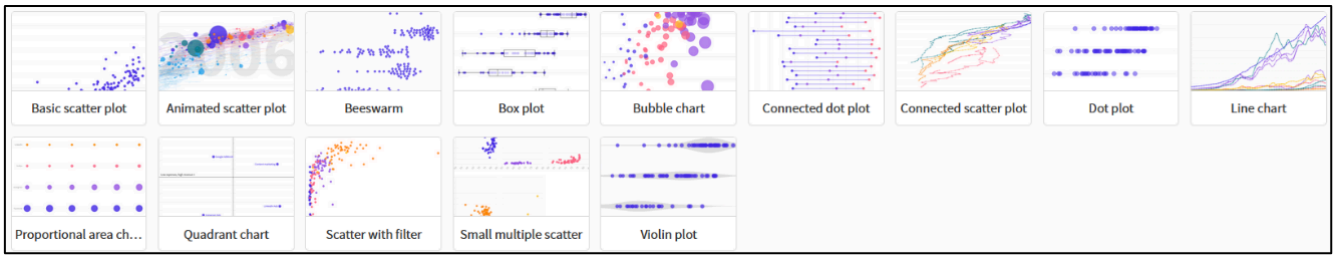


Exhibit 3.28—Types of Scatterplots, Time Sliders, and Minicharts Available in Flourish

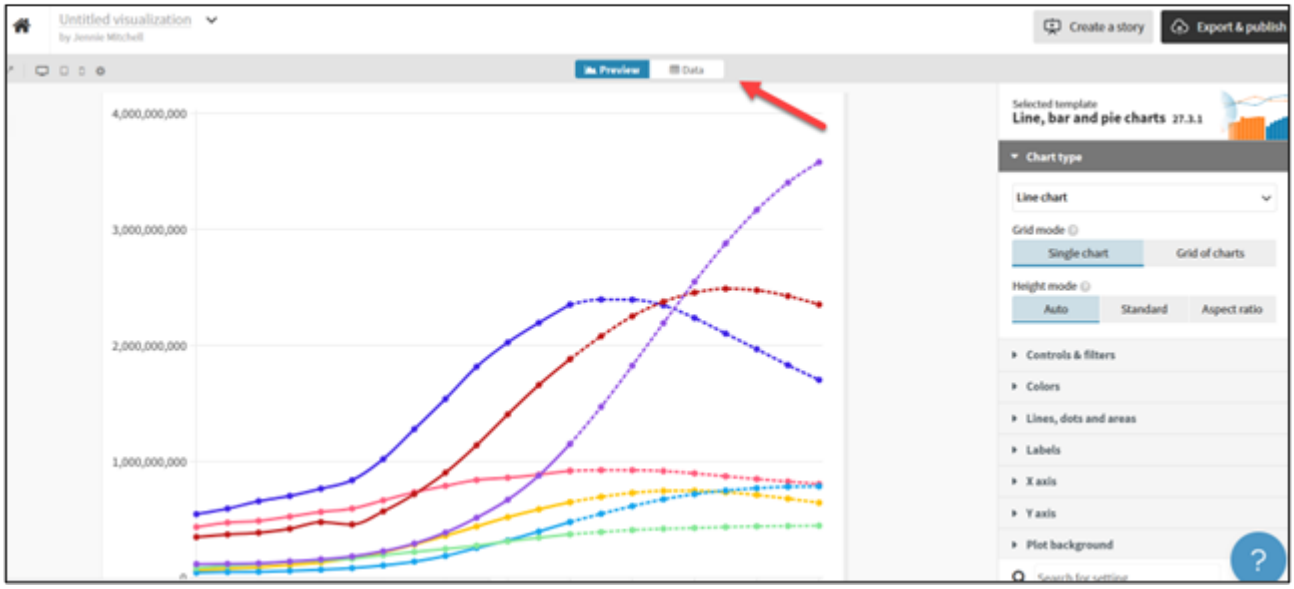


These three exhibits show the depth of available templates to use with your dataset. Now that you know all the potential templates available, get started adding Flourish to your Canva account and using Flourish to create an animated graphic.

Step-by-Step to Use Flourish in Canva

Note: Screenshots of Flourish interface © Flourish Studio, https://flourish.studio and Canva © Canva, https://www.canva.com. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

Exhibit 3.29—Flourish: Example of Setting Up Dataset



1. **Log into** your Canva account (or set up your free account).
2. In Canva, click on the **home** icon to go to your home screen, click on **Apps**, and do a **search** in the search bar for Flourish. Click the **red sunburst icon** under the search bar (refer to Figure 3.60).

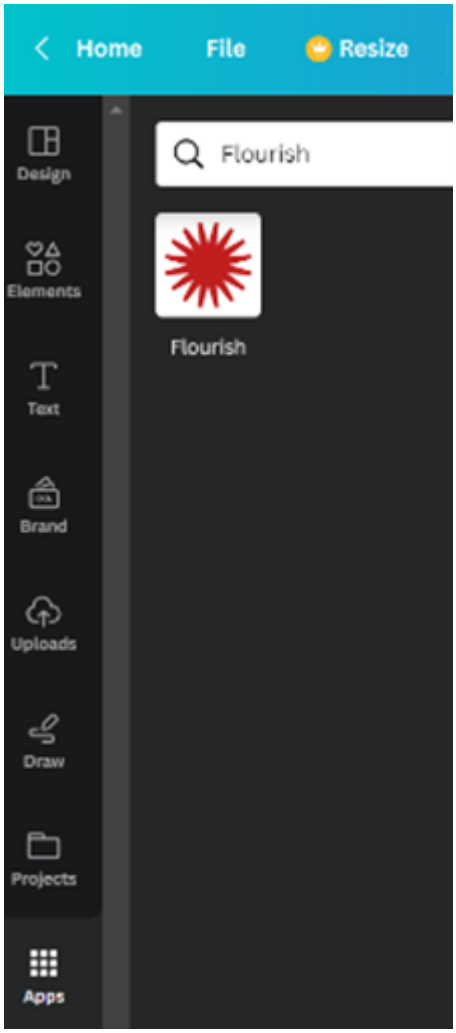


Figure 3.60—Sunburst Icon

3. This will bring up a "Welcome to Flourish!" account screen. Use the **Sign up now** button to create a Flourish account. We used the same email account that we had for our Canva account (see Figure 3.61 in step 4).
4. Connect the two accounts by choosing **Connect**.

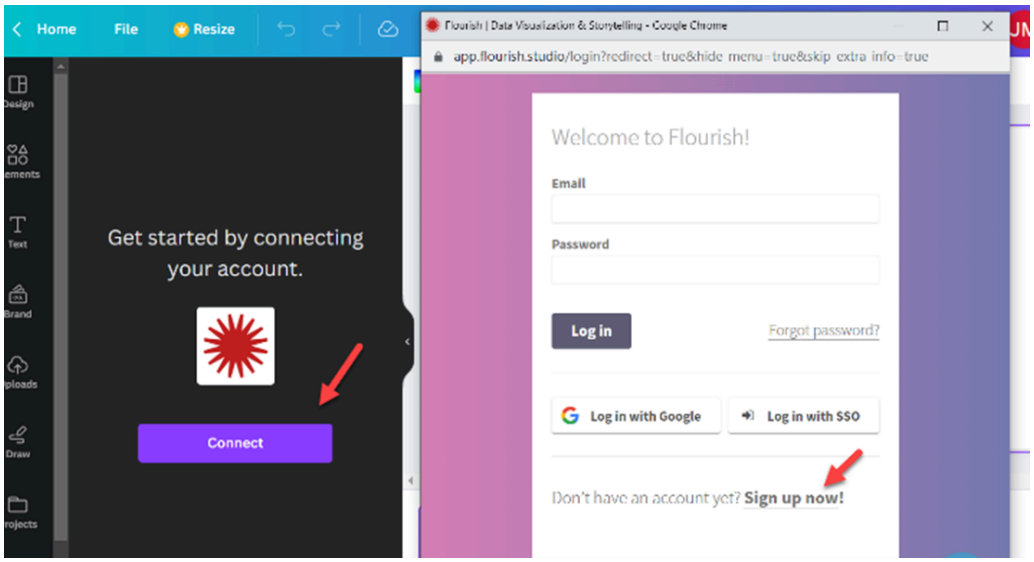


Figure 3.61—Flourish Account Screen

5. Once you have the two accounts connected, you will see a screen something like the one pictured here. We found it easier to log into our Flourish account, create our animation design, and give it a title. Afterward, the project title can be searched within Canva. If you have not created anything in Flourish, it will not show up as depicted in Figure 3.62.

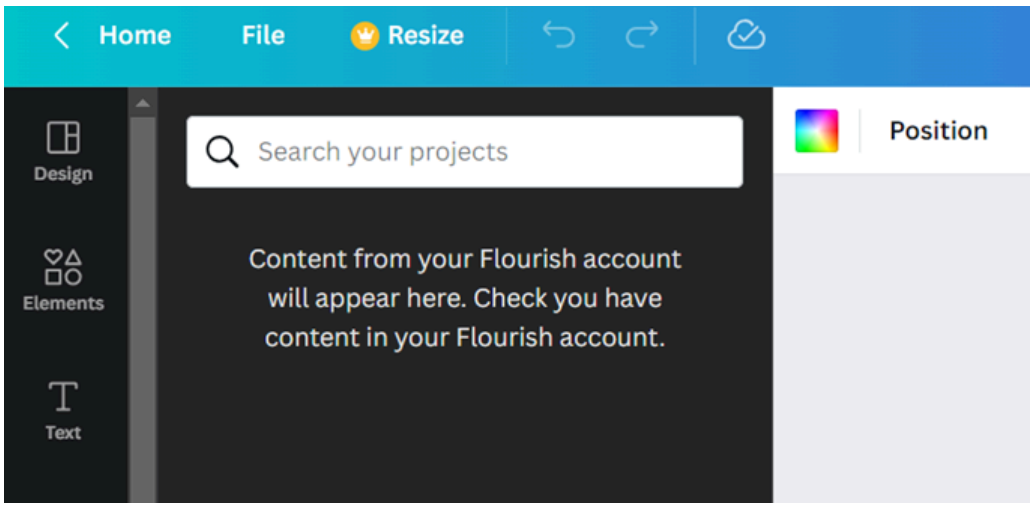


Figure 3.62—Empty Flourish Content

6. We selected a projected line chart because we wanted to use some information about women leaders in the United States and later compare it to women leaders in other countries. The template comes with example data so you can see how it works and replace it with your own.
   One thing to note: The data required some cleaning because when there was no change in leadership percentage (because of periodic elections), the Pew Center dataset skipped the year. We had to make sure there were no missing years of data. Here is the link to the data: https://www.pewresearch.org/social-trends/fact-sheet/the-data-on-women-leaders/ Also, when you first arrive at "The Data on Women Leaders," the charts are in graph form.

Notice at the bottom right of each graph a way to link to the data as shown in Figure 3.63.

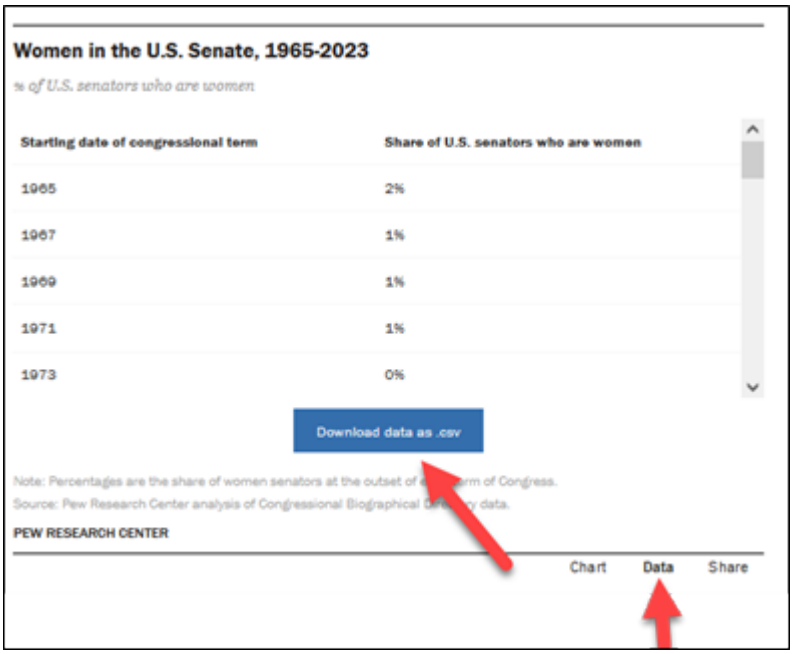


Figure 3.63—How to Find the Data
Source: Screenshot of Women in the US Senate, 1965-2003 © Pew Research Center. Author Annotations Added

- We found information about women leaders in the United States at the Pew Research Center (2021). We chose data from 1995–2019 and replaced the template data with our own data named "Women Leaders in the U.S. (1995–2019)." There is a place to upload a data file, but we just typed it into Flourish (Figure 3.64).

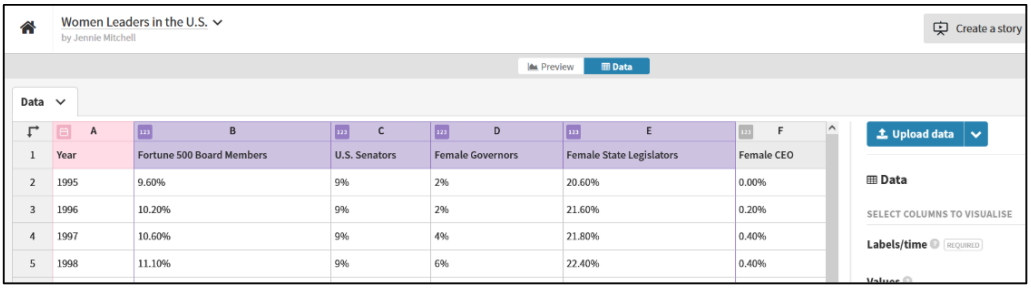


Figure 3.64—Women Leaders in the U.S. (Pew Research Center)

- Next, we **previewed** the data, which included a full preview with animation in a new window. The animation was too fast. When presenting this data and telling a story, you want the audience to be able to see the animation. On the right-hand side of the line chart, there are all kinds of controls. We selected **Animations** and changed the animation to 2,700 (the default was 900).
- Next, we **added a large title** on the graph, "Women Leaders in the U.S.," and a **subtitle**, "1995–2019."
- Next, you can select **Create a Story** and add a caption (shown in Figure 3.65). We added a quote from U.S. Senator Joni Ernst (visible in Exhibit 3.30).
- You have several options at this point. Choose **Publish to share and embed,** and a pop-up will display this message: *This project will be published to its own page where you and others can see, share and embed it.*This option works well if you have multiple ways you want to use this. (Feel free to visit the URL and see this animated line chart. You can see the URL in Figure 3.66.)

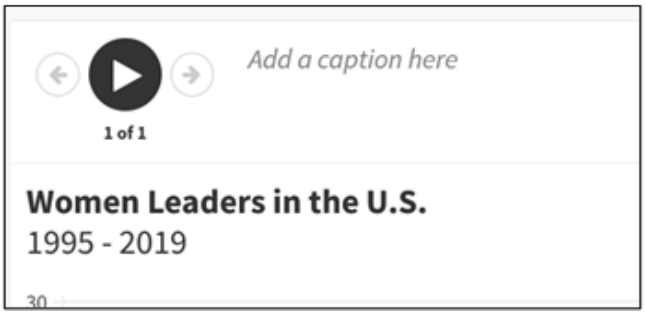


Figure 3.65—Creating a Story and Adding a Caption

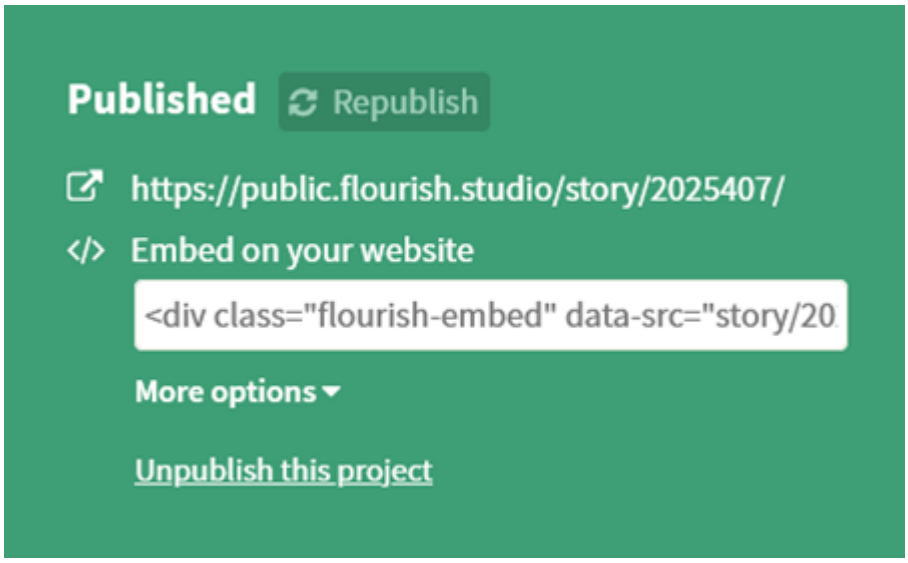
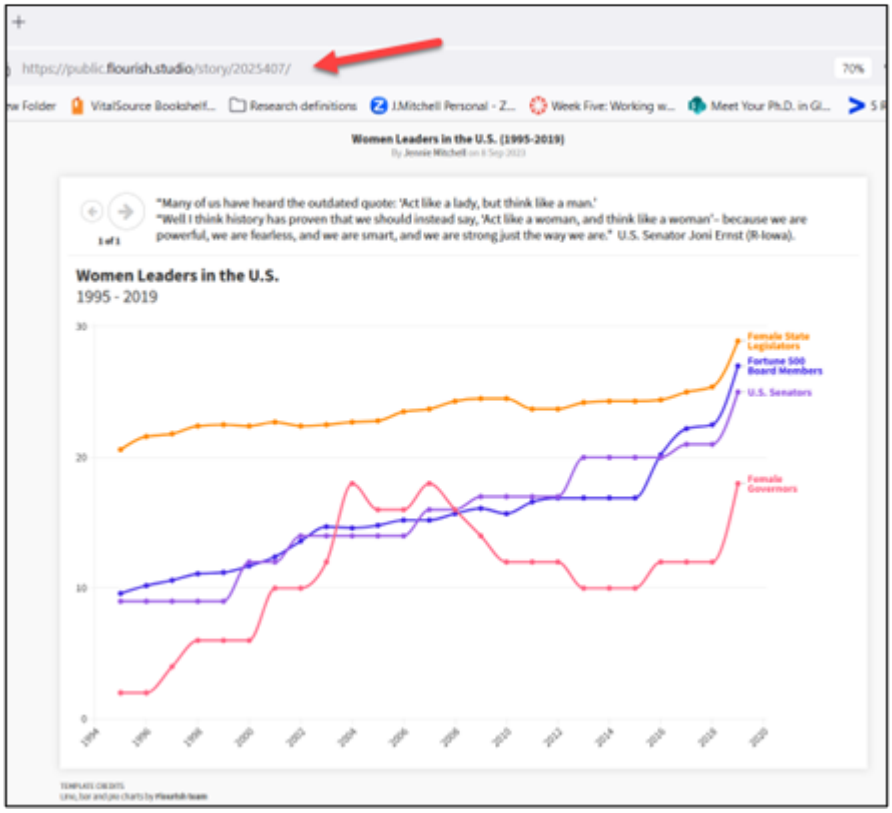


Figure 3.66—Option 1: Publish to Share and Embed

- You can choose **Add to Canva presentation**, which will bring up an untitled presentation with a place to add the animated line chart. This is the best option if you are making a presentation on this topic.
- **Do not choose** "Download HTML" because it is not available for the free account.

Exhibit 3.30 illustrates the final product. If you go to the URL, you will see the animation. Link to URL: https://public.flourish.studio/story/2025407/

Exhibit 3.30—Women Leaders in the U.S., as Shown in Flourish



You may be thinking, "I can do this in PowerPoint!" While PowerPoint's animation capabilities allow you to create dynamic and visually engaging chart series, it's important to note that Flourish offers more advanced features, interactivity, and customization options specifically designed for data visualization. The combination of Flourish and Canva will allow you to combine the interactivity of Flourish with good design presentation templates available in Canva.

3.6 Self-Assessment: Insightful Tools

Learning Objective #1—Determine insights

Learning Objective #5—Create and use decision-making tools to provide context for problems, support decisions, and assess risk

An interactive H5P element has been excluded from this version of the text. You can view it online here:

https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-22

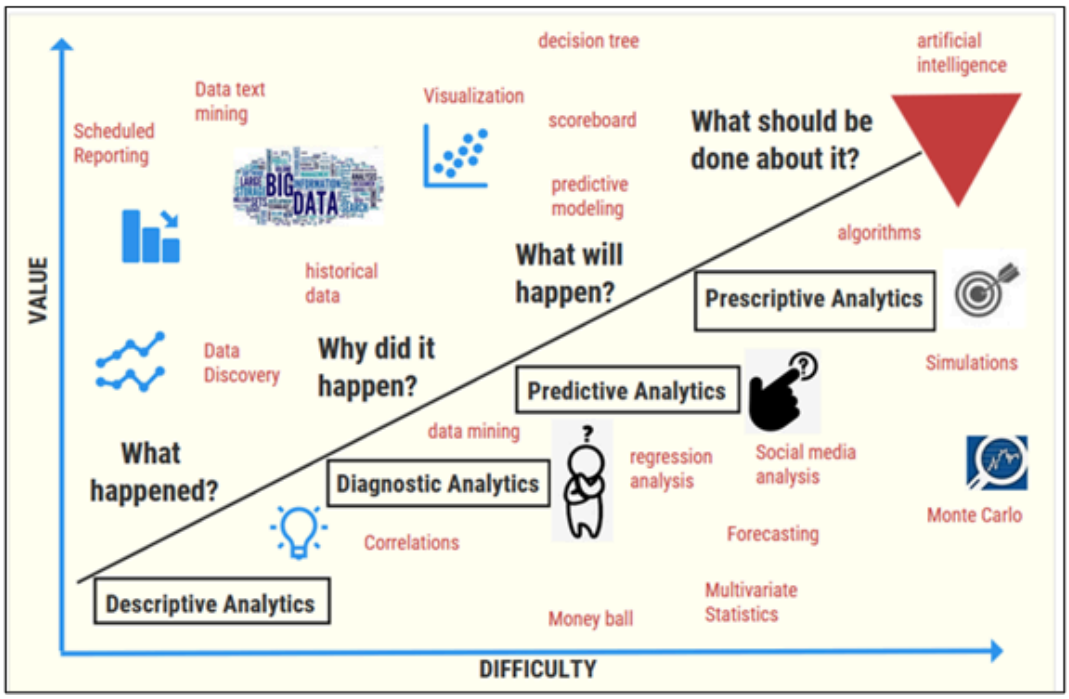
3.7 Data Visualizations Used in Statistics

> In school we learn a lot about language and math. On the language side we learn how to put words together into sentences and stories. With math, we learn to make sense of numbers. But it's rare that these two sides are paired. No one tells us how to tell stories with numbers. . . . This leaves us poorly prepared for an important task that is increasingly in demand.
>
> —Cole Nussbaumer Knaflic

In our data-driven world, the sheer volume of information at our fingertips can be overwhelming. In this era of abundant data, the ability to make sense of it all, draw meaningful conclusions, and make informed decisions has become a fundamental skill across various domains. Data visualization stands as a powerful ally in this quest for understanding, as it allows us to transform complex datasets into clear, engaging, and actionable insights. In this section, we embark on a journey through the multifaceted landscape of data visualization, exploring how it aids our comprehension of descriptive statistics, inferential statistics, Six Sigma, exploratory data analytics, causal analytics, and predictive analytics.

There are specific guidelines for how statistical data are presented, but it is the data visualizations that help the researcher grasp the central tendencies, variations, and shape of the data distribution. Whether it's a histogram depicting the frequency of values or a box plot revealing the spread of data, these visualizations breathe life into statistical summaries. An analytic journey can help answer the questions, *What happened? Why did it happen? What will happen?* and *What should be done about it?* Exhibit 3.31 of the analytic journey shows how these questions are answered.

Exhibit 3.31—Analytic Journey: How the Questions Are Answered.



Note: Author Illustration (2024)

Descriptive Statistics

Descriptive statistics should be a first step in an analytic journey. At the heart of the exploration is an initial recognition that diverse types of data lend themselves to different visual representations. Some of this has been highlighted in previous chapters, but this section takes it a step further. In the quest to understand which visualization illuminates descrip-

tive statistics, keep in mind that this text will always focus on understanding through visuals, so if the word *statistics* makes you uneasy, take a breath and be assured that you do not have to understand the math behind the statistics. Instead, the visuals will lead you to the correct decision! **So *what are descriptive statistics?***

Descriptive statistics describe and summarize the data and display characteristics of the location, spread, and shape of the data. Through visuals, you can describe a trend or specific features. Tools used to visualize descriptive statistics include bar charts, pie charts, histograms, scatter graphs, box plots, and more. Descriptive statistics address the question, "What happened?" Numerical descriptive tools allow you to summarize data for average, mean, mode, minimum, and maximum. There are two types of statistics used to describe data:

1. the measure of central tendency (mean, median, or mode)
2. the measure of spread through range, quartiles, variation, and standard deviation

So far, the explanation has used only words. Dive into an example to see what visuals can do to help you understand.

Example Scenario: Measure of Central Tendency—Finding the Mean and Median

The data in Figure 3.67 shows crime data reported on 14 college campuses. Everything listed here is **fictitious**. Notice that the crimes range from 0 to 29 and that the student population ranges from 692 to 47,993.

Figure 3.67—Fictitious Crime Data at 14 College Campuses

	A	B	C	D
1	College	Students	Crimes	Percent
2	FL U	38431	29	0.08%
3	FL A	13067	23	0.18%
4	U Cent	42465	19	0.04%
5	U South	42238	19	0.04%
6	U_M	47993	17	0.04%
7	U North	14533	6	0.12%
8	F Gulf	5955	5	0.10%
9	F Intl	34865	5	0.01%
10	Atl	25319	4	0.02%
11	Sant	13888	3	0.03%
12	Pen	10879	2	0.03%
13	Newt	692	1	0.29%
14	U West	9518	1	0.01%
15	Tenn	12775	0	0.01%
16				

You can tell it has been formatted as a table by the drop-down arrows. It has also been sorted from highest to lowest by the number of crimes. The percentage was an added calculation.

The **mean** (arithmetic mean) is the average of the values or the "center" of the data. In this case, the mean can be calculated using Excel using the =Average (B2:B15) or (22,330) for the mean of the number of students and =Average (C2:C15) or (9.6) for the mean of crimes.

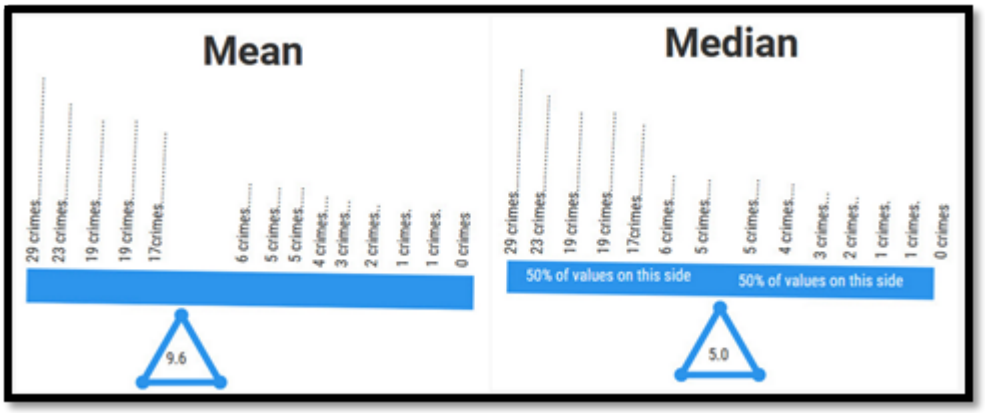
The **median** is the midpoint of a set of data values when you put them in order (either smallest to largest or largest to smallest). It always splits the data into two equal halves. Using Excel, the formula is =median (B2:B15) or (14,211) for the number of students and =median (C2:C15) or (5.0) for the crimes.

You may be asking yourself,

Why is the mean for crimes (9.6) so different from the median (5.0)?

It could be due to outliers. Outliers are values much larger or much smaller than the rest of the values. **Outliers don't have much impact on the median, but outliers can have a drastic effect on the mean.** Since the mean is the balance point, extreme values in the data will pull the mean toward it to maintain the balance (see Exhibit 3.32 to see the balance point).

Exhibit 3.32—Understanding Mean and Median



Note: Author Illustration (2024)

Example Scenario: Finding the Mode

To find the mode (or modal value), put the list in order. Then count the quantity of each number. The number that appears most often is the mode. It is possible to have more than one mode. Two modes are called *bimodal*, and more than two are called *multimodal*.

In Excel, there are several formulas for calculating mode. Look at the data again. You can see two 19s, two 5s, and two 1s. So these data are considered multimodal (see Table 3.14).

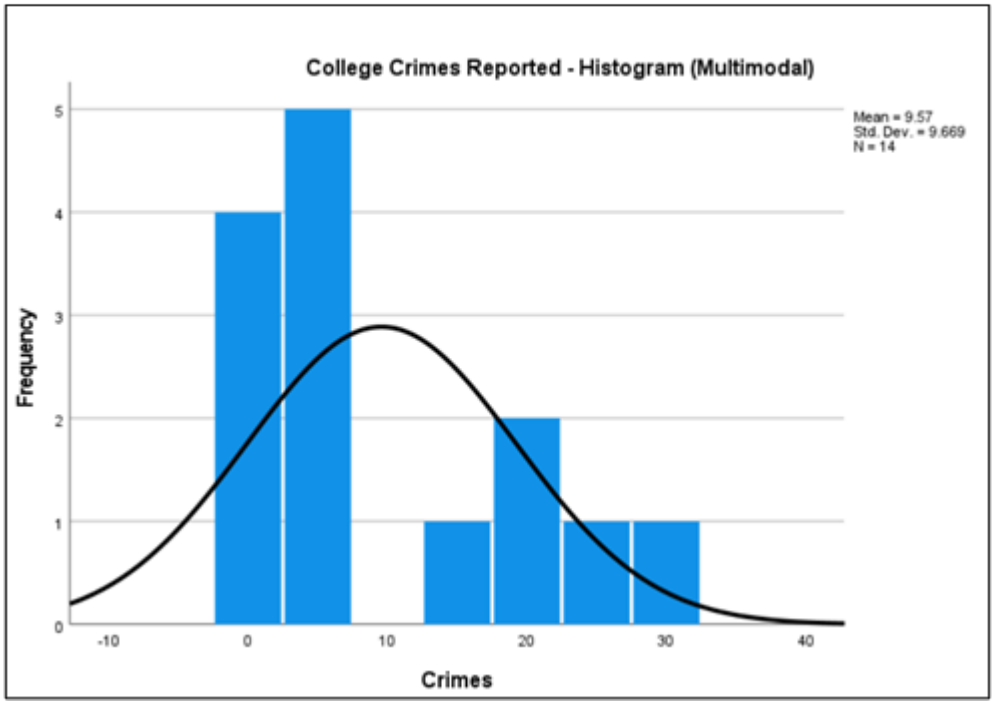
Table 3.14: Multimodal and Mode

Excel formula for multimodal	Excel formula for single mode
=MODE.MULT(C2:C15) This will show 19, 5, and 1	=MODE (C2:C15) This will show you just the value 19.

Now let's look at a visual (histogram) of this data. The taller "peaks" of the histogram indicate where more common data values cluster. These are the modes.

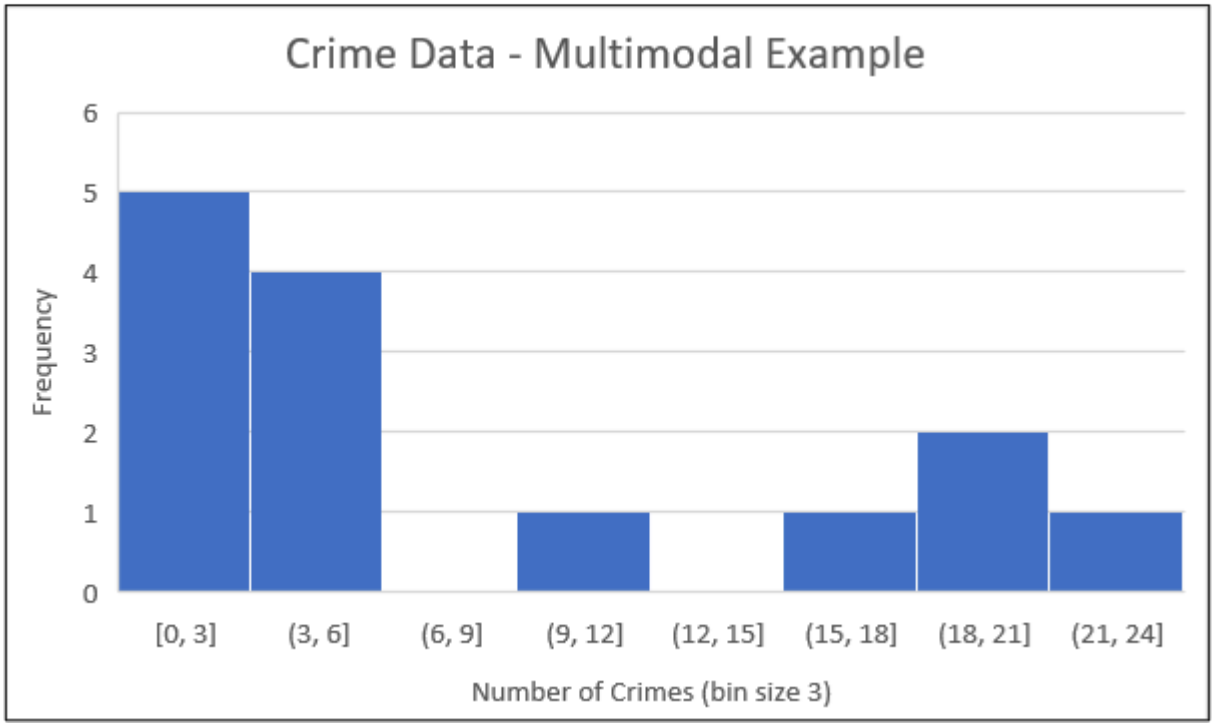
A histogram is a visual of the modes, but it can look different depending on the number of bins (or how you cluster your data). Notice in Exhibit 3.33 that a normal curve serves as a guide to measure central tendency. **Central tendency** is the statistical measure that best represents the value where all the other data gather. If you don't see that in this example (and you don't), that means these data are **not on a normal distribution**. It is skewed because one side has more data than the other. A normal distribution, called the *bell curve* or Gaussian Distribution, is a continuous probability distribution that is symmetrical. Keep in mind that the sample is only of 14 college campuses.

Exhibit 3.33—Histogram in Statistical Package for Social Sciences (SPSS)



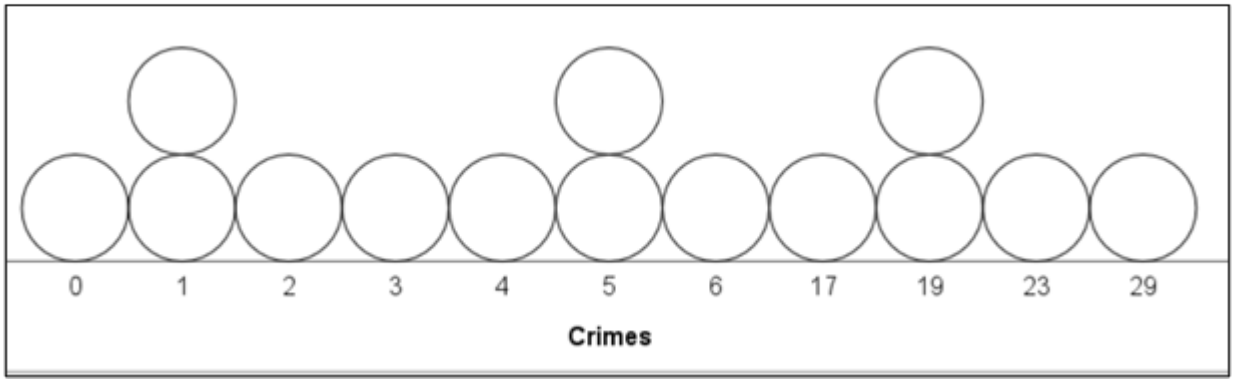
You can create a histogram in Excel as shown in Exhibit 3.34. In this example, a bin size of 3 was used. You can click on the axis and adjust the bin size. Graphing the data makes it easier to see that the data are multimodal.

Exhibit 3.34—Histogram in Excel



So the visual that might be more explanatory is a "dot plot." Note that you see the multimodal pattern of 1, 5, and 19. Make sure to compare the dot plot (in Exhibit 3.35) to the previous histogram.

Exhibit 3.35—Dot Plot of Crime Data

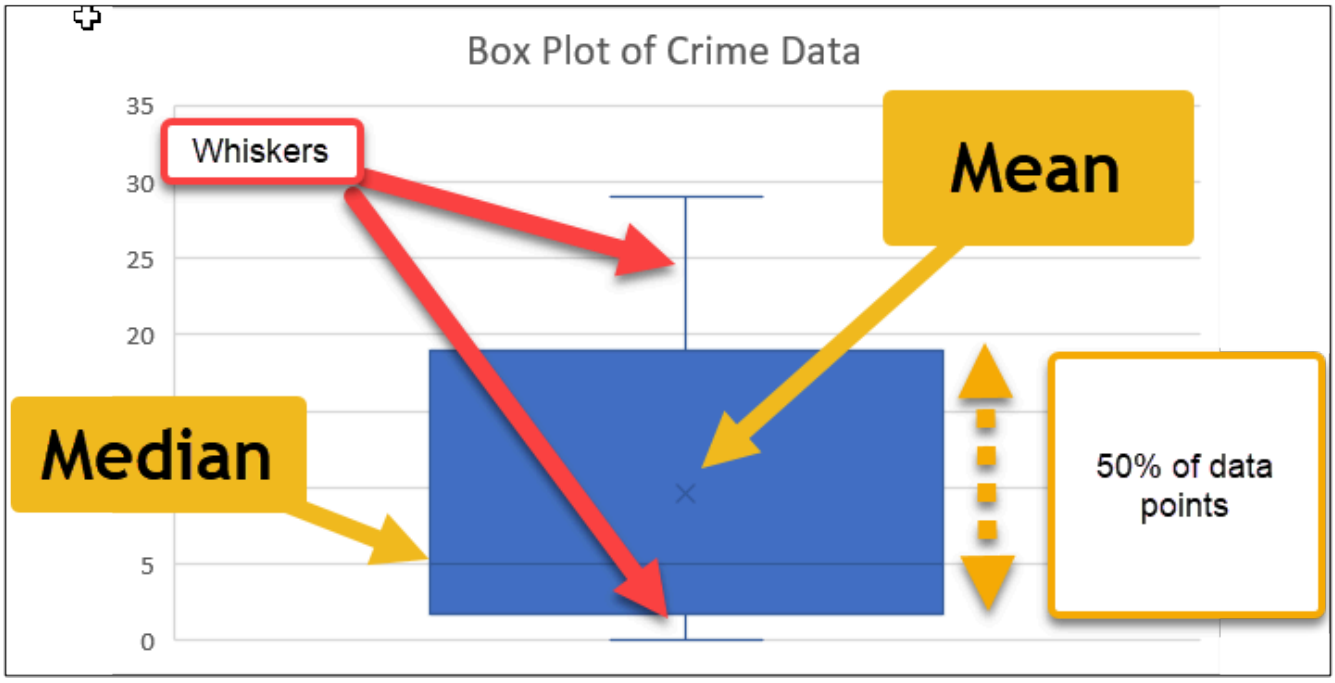


Another visual often used (especially in a business setting) is a box plot. A box plot is a visual of the variables, distribution location, spread, shape, tail length, and outliers. It is sometimes called a box and whisker plot. The box spans the interquartile range (IQR) of the data and represents the middle 50% of the dataset. The IQR includes the first quartile (Q1) and the third quartile (Q3). The whiskers extend from the box to the data points outside the IQR.

How to Interpret a Box Plot

1. Central tendency: If the median is near the center of the box (the example is not), the data are roughly symmetric; if it's closer to one end, the data may be skewed.
2. The length of the IQR illustrates the data's range. A longer box indicates greater variability, while a shorter box suggests more consistency.
3. There are no outliers in this example, but if an outlier existed, it would show as a data point beyond the whiskers.

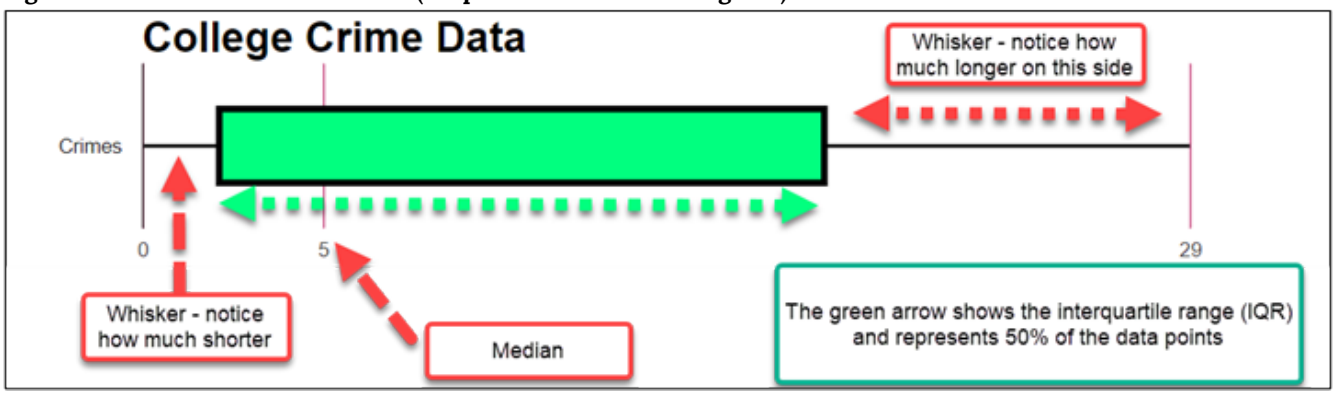
Figure 3.68—Box Plot of Crime Data (Prepared in Excel)



The example of the box plot created in Excel (Figure 3.68) shows a vertical format. It is possible to create a horizontal box plot in Excel, but it requires multiple steps. Instead, Figure 3.69 shows how to create the box plot in Statistics King-

dom (an online and free statistics helper). It is much easier to see how the data are skewed when viewing in horizontal format.

Figure 3.69—Box Plot of Crime Data (Prepared in Statistics Kingdom)



You may want to bookmark the Statistics Kingdom website. It is easy to use and models example data points, so you see how to set it up. As previously mentioned, it is possible to change the layout to a horizontal box plot instead of a vertical box plot. We find this layout easier to understand. Statistics Kingdom has several visualization choices: histogram, box plot, violin plot, cluster analysis chart, Venn diagram, stem-and-leaf plot, and more.

Statistics Kingdom. (2017, November). http://www.statskingdom.com

Analyze Data in Excel

In the more recent Microsoft 365, you will see an icon in Excel on the home screen renamed Analyze Data. According to Microsoft, "Analyze data in Excel empowers you to understand your data through natural language queries that allow you to ask questions about your data . . . [providing] high-level visual summaries, trends, and patterns" (Excel for Microsoft 365, 2023, para 2).

Here's how to use the new tool:

1. **Click** inside the data.
2. On the Home tab, select **Analyze Data**.
3. Browse through the various ways to **Discover Insights**.
4. In Figure 3.70, one of the insights found shows that there is a correlation between students and crimes, but don't start making assumptions. This is a small sample and there are likely other variables that impact the data. This is a scatterplot chart; notice the clustering of the data points (correlations will be further discussed in the inferential statistics section). But still, this new AI feature is powerful!

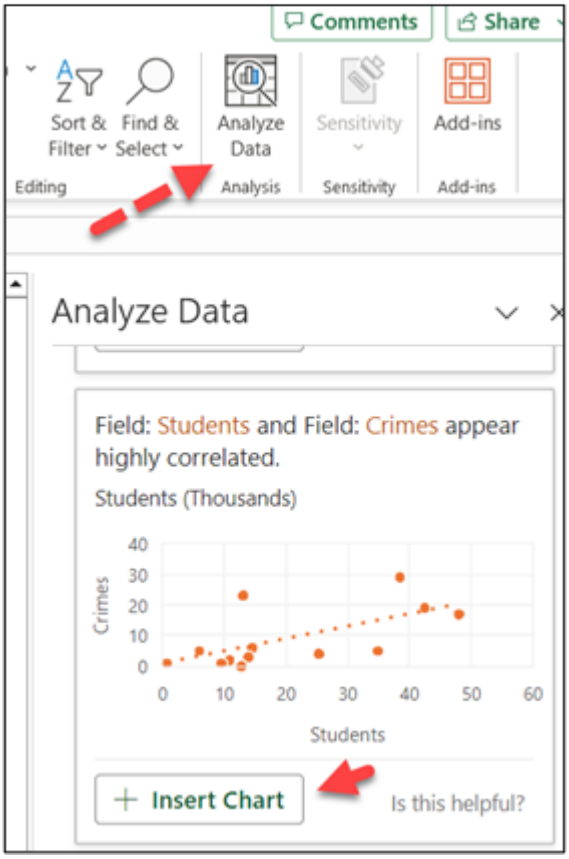


Figure 3.70—Analyze Data Feature in Excel
Source: Screenshot of Excel Interface © Microsoft Corporation. Author Annotations Added

Descriptive Statistics and Add the Analysis ToolPak in Excel

Before you can do anything with statistics in Excel, you need to add the Analysis ToolPak as an add-in to Excel. Here are the steps to add it.

Step-by-Step to Add Analysis ToolPak in Excel

Note: Screenshots of Excel interface © Microsoft Corporation, used with attribution for instructional and illustrative purposes.

You first need to make sure you add the Analysis ToolPak (and solver) in Excel. Macs have access to these tools, but the following steps are for a PC.

1. Click the **File** tab, click **Options**, and then click the **Add-ins** category.
2. In the **Manage** box, select **Excel Add-ins** and then **Go**.
3. In the **Add-ins** box, check the **Analysis ToolPak** check box, and then **OK**.
4. Select all the tools (see Figure 3.71).
5. Once you have this added, it should **appear** on your ribbon in the **Data** tab.
6. **Open** the Data Analysis tools, you will be amazed at the number of tools packed into Excel! See the partial list in Figure 3.72.

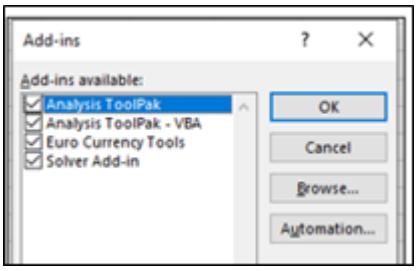


Figure 3.71—Select All Tools

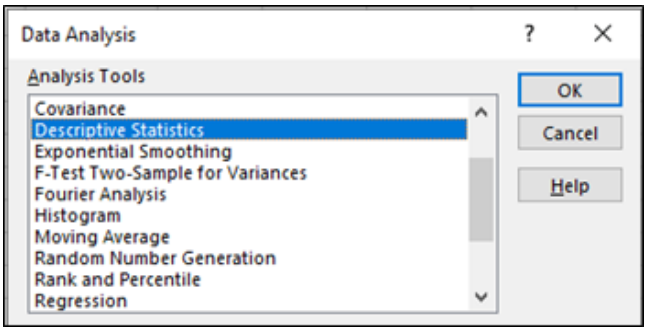


Figure 3.72—Data Analysis Tools Available in Excel

There are several reasons why a decision-maker would want to run descriptive statistics. Descriptive statistics will summarize the data. The data visualizations that accompany this step (histograms, box plots, dot plots) help decision-makers interpret the data more intuitively, identify trends, and spot outliers or unusual patterns. Descriptive statistics measure central tendency (mean and median), measure dispersion (range, standard deviation), and help decision-makers understand the variation and spread of data.

This type of understanding is crucial for assessing the consistency and predictability of outcomes. Although not discussed yet, descriptive statistics can help through metrics like mean and standard deviation for quality control. Even with the small College Crime dataset, it shows that crimes are reported more often if your student population is smaller. Although our sample is too small to make this statement with certainty, it is possible that this might be a starting point for hypothesis generation. So let's run the descriptive statistics using Excel.

Step-by-Step to Generate Descriptive Statistics in Excel

Use the Descriptive Statistics worksheet in Chapter 3, and follow these steps:

1. **Click** somewhere *inside* the College Crime dataset (see Table 3.11 for the raw dataset).
2. Select the **Data** tab and click **Data Analysis**.

3. In the pop-up window, select **Descriptive Statistics** and click **OK**.
4. A pop-up window will appear. The input range should be the students column and the crimes column (B1:C15). You can use the headings as long as you **check** the "Labels in first row" box (see Figure 3.73 showing the checkbox checked).
5. There are several places to **output** the data. If you want it on the same sheet, make sure to give it plenty of room.
6. Also **check** the "Summary statistics" box.
7. And the last step, click **OK**.

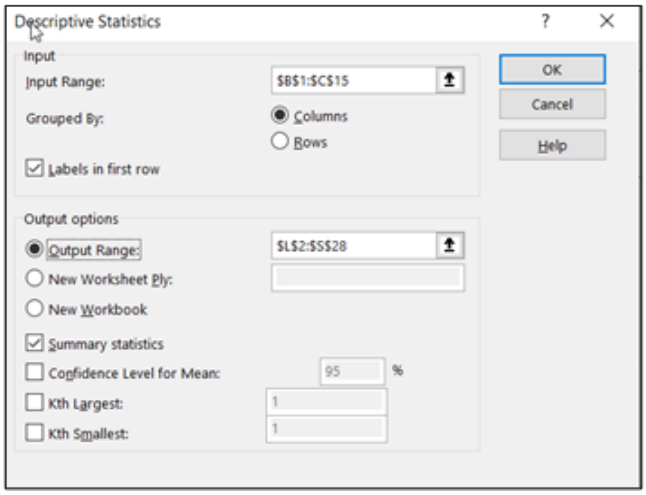


Figure 3.73—Descriptive Statistics in Excel
Source: Screenshot of Excel Interface © Microsoft Corporation.

You may want to watch this short video to see a demonstration of Descriptive Statistics in Excel.

Mitchell, J. (2021, Mar 30). Descriptive statistics in Excel [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#oembed-6

Now let's look at what Excel gave us for descriptive statistics. We'll go through each term. Some of these terms should look familiar.

Terms of Descriptive Statistics

- **Mean**—an average of the numbers
- **Standard error**—measures the accuracy with which a sample distribution represents a population by using standard deviation
- **Median**—exact middle of the set of values
- **Mode**—the most frequently occurring value. This dataset has three numbers that repeat (19, 5, and 1). Therefore, it is considered multimodal.
- **Standard deviation**—an estimate of the dispersion. Remember, an outlier can greatly exaggerate the range.
- **Kurtosis**—refers to the degree of presence of outliers in the distribution
- **Skewness**—a measure of the asymmetry of the distribution. You may have seen this drawn by a professor when they were explaining the bell curve.

Exhibit 3.36—Example Showing Descriptive Statistics in Excel

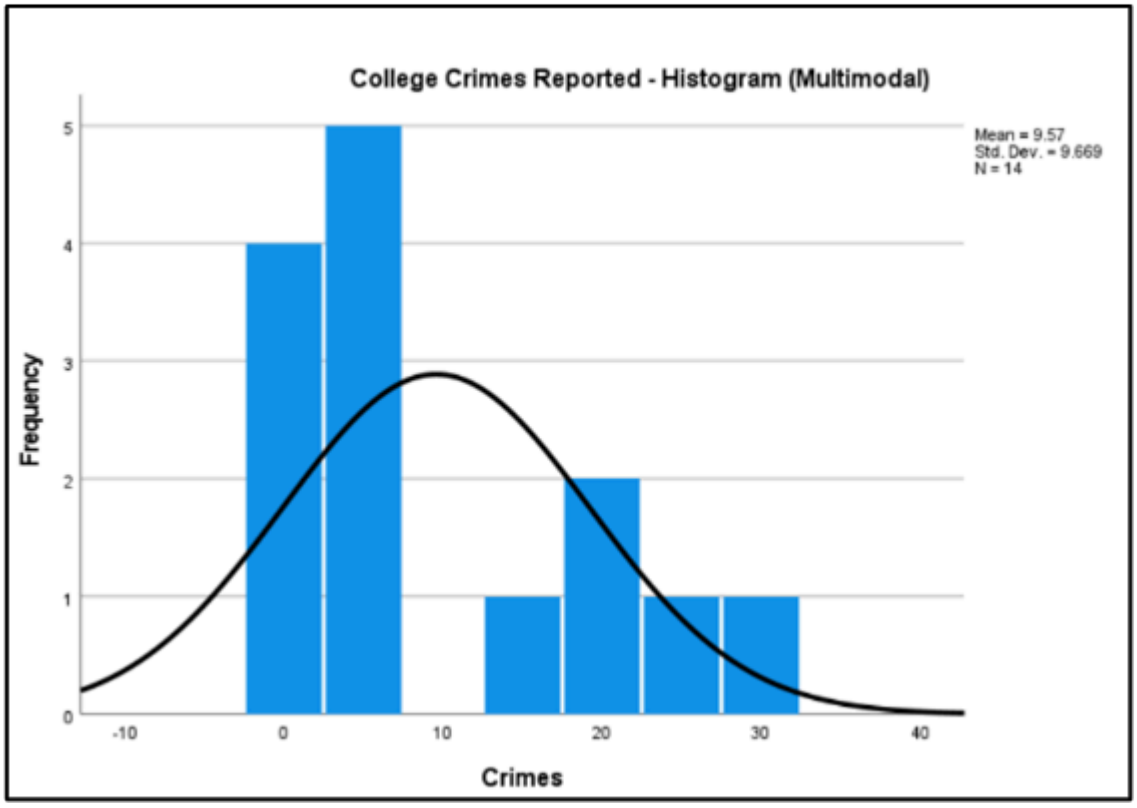
L	M	N	O
Students		*Crimes*	
Mean	22329.85714	Mean	9.571428571
Standard Error	4210.411602	Standard Error	2.584217283
Median	14210.5	Median	5
Mode	#N/A	Mode	19
Standard Deviation	15753.91767	Standard Deviation	9.669255685
Sample Variance	248185922	Sample Variance	93.49450549
Kurtosis	-1.443095718	Kurtosis	-0.758224167
Skewness	0.419055054	Skewness	0.851530118
Range	47301	Range	29
Minimum	692	Minimum	0
Maximum	47993	Maximum	29
Sum	312618	Sum	134
Count	14	Count	14

There are three types of skewness:

1. a positive skew (long right tail),
2. a symmetrical distribution (the bell curve or the normal distribution), and
3. a negative skew (long left tail).

In a normal distribution, the tails on either side of the curve are exact mirror images of each other. In Exhibit 3.37 the histogram of the College Crime dataset shows a positive skew, or long right tail.

Exhibit 3.37—Positive Skew in Histogram for College Crime



In summary, descriptive statistics serve as a critical tool for decision-makers to gain a comprehensive understanding of their data. Now we'll discuss inferential statistics and look at the difference between diagnostic analytics and inferential statistics.

Inferential Statistics Versus Diagnostic Analytics

Inferential statistics takes the boundary a large step beyond descriptive statistics. It includes hypothesis testing, confidence intervals, regression analysis, and more. It is different from **diagnostic analytics**. Diagnostic analytics' goal is to understand why something happened. It aims to identify the root causes of past events or trends. Why did sales decline? Why did enrollment drop? Diagnostic analytics works with historical data and focuses on analyzing events that have already occurred. Diagnostic analytic techniques include drill-down, data discovery, data mining, and correlations. As you might expect, the health care industry uses this analytical model every day. A sudden spike in the emergency room count could be pointing to an infectious agent that has broken out in your area (think of COVID-19!).

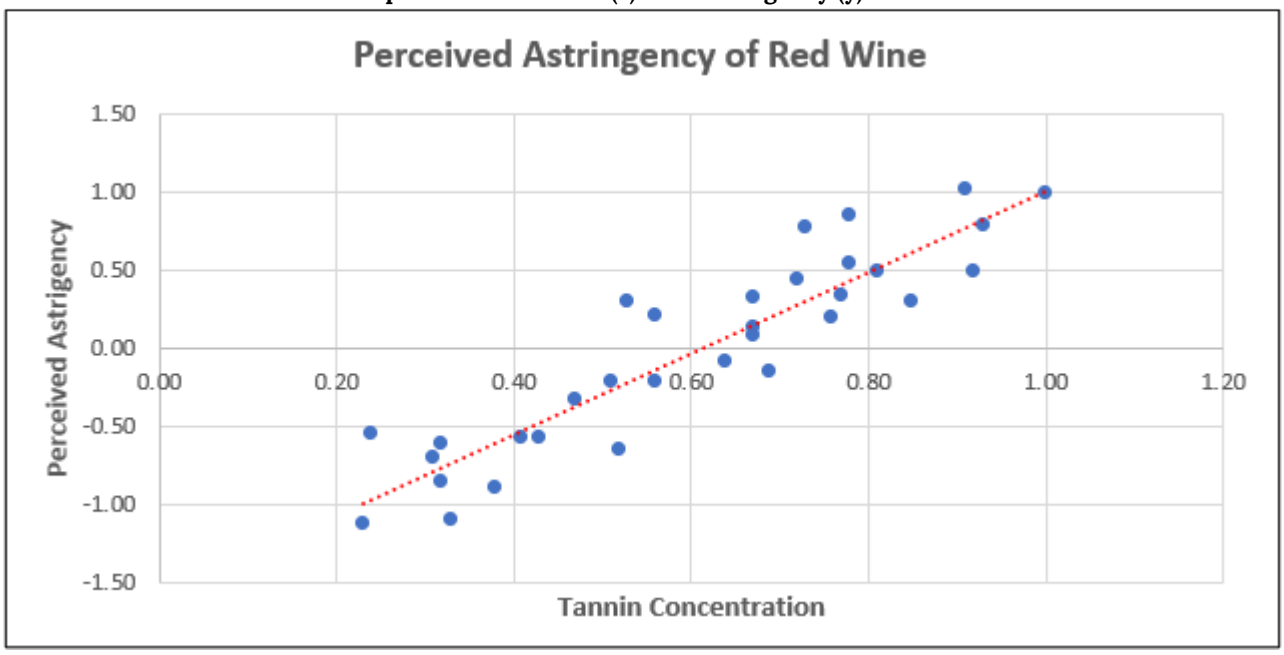
The questions often asked for **inferential statistics** might be "How likely . . . ?" or "What will happen . . . ?" Inferential statistics can be applied to both historical and future data to project estimates. Inferential statistical techniques provide insight to help the decision-maker arrive at a deduction or conclusion. Inferential statistics is a technique that allows us to draw inferences or conclusions about the population from the sample. The tools used most often include hypothesis test statistics (e.g., *t*-tests, ANOVA), though some of the concepts are beyond this text. However, not all are. So look at the type of data visualizations used in inferential statistics.

You can still expect to see histograms, box plots, and scatterplots as some of the first steps because you should always conduct descriptive statistics to understand your data. Other types of tests could be probability plots, residual plots, time series plots, and many others.

Making a Scatterplot That Tells a "Clear" Story

One of the main visuals in the inferential statistics realm is a scatterplot, which is valuable for visualizing the relationships between two continuous variables. Sometimes you expect a relationship, and the scatterplot will tell you if there is a correlation (or relationship). To understand the use of scatterplots, look at the relationship between perceived astringency and tannins in red wine as illustrated in Exhibit 3.38. Astringency is a term associated with puckering or a drying feeling in the mouth caused by the presence of tannins in wine. Tannins are primarily from grape skins, seeds, stems, or even oak barrels. In a technical brief by Kennedy et al. (2006) in a wine publication, the researchers found a correlation between tannins and astringency.

Exhibit 3.38—Positive Relationship Between Tannins (x) and Astringency (y)



Once you see a linear relationship, it's time to take the next step, and that is to run a regression to measure the amount of correlation. Regression analysis is an inferential statistical tool. At its core, regression analysis seeks to answer one fundamental question: How does change in one (or more) independent variable influence a dependent variable? In this case, we want to measure the amount of astringency that is caused by tannins. Most wine-tasting experts use their perceived taste to assess whether a wine's tannins are acceptable in its current state or whether it would benefit from further aging to soften the astringency. But what if you could predict the degree of astringency with a certain level of tannins? Here are the steps using the Tannins and Astringency dataset.

Step-by-Step to Run a Regression Analysis in Excel

Before you can do anything with statistics in Excel, you need to add the Analysis ToolPak as an add-in to Excel. This was shown earlier in this section.

1. Open "3.7 Scatterplot and Regression" in Chapter 3 Excel files.
2. Click *inside* the dataset.
3. Choose **Data** on the main menu tab.

4. Click **Data Analysis** and select **Regression** from the pop-up Data Analysis tool.
5. Click **OK**.
6. For the input Y range, choose the perceived astringency column and for the X range, choose the tannin concentration (see Figure 3.74).
7. The **output range** can be a new worksheet, but I chose to run the regression and placed it in the existing worksheet.

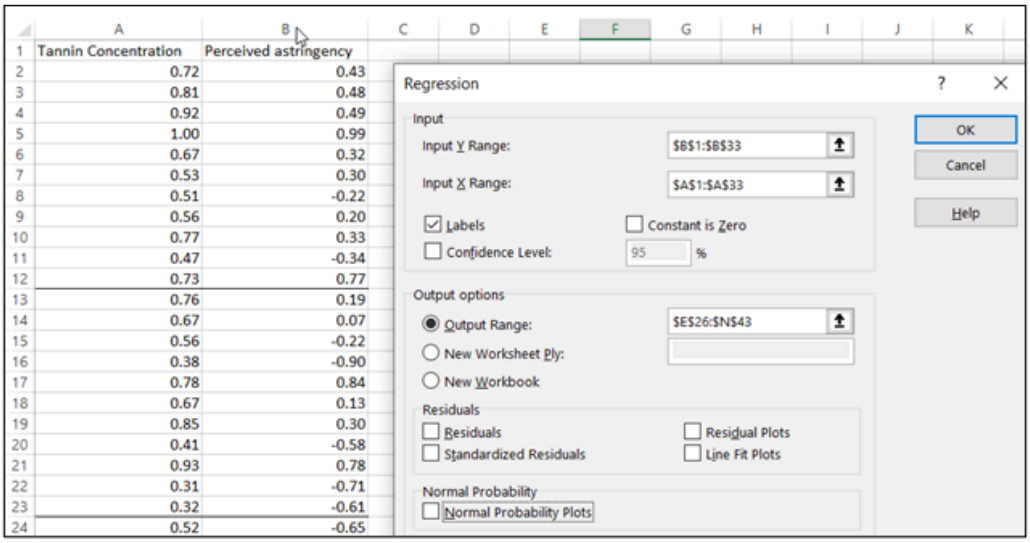


Figure 3.74—Running Regression in Excel
Source: Screenshot of Excel Interface © Microsoft Corporation

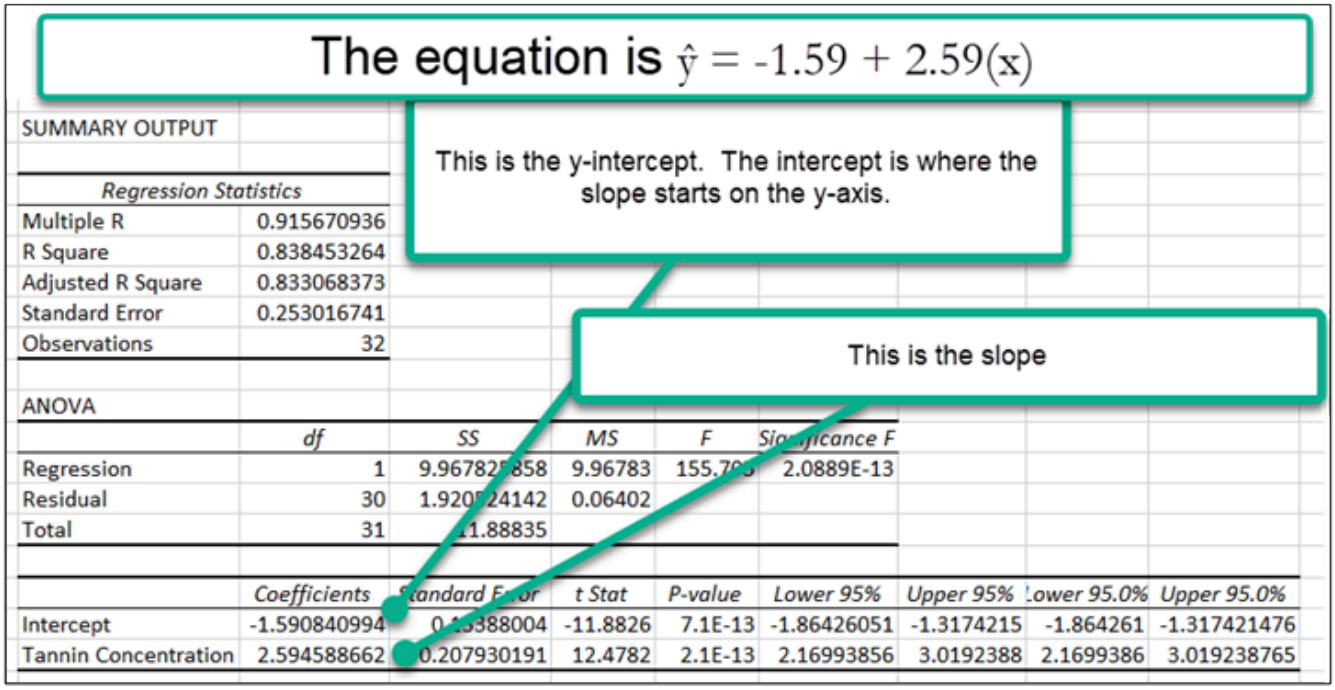
8. Then click **OK**, and you will see the output as shown in Figure 3.75.

In the illustration, you will notice that there is an equation that should be slightly familiar to you. This regression line is a fundamental component of regression analysis to help understand the relationship between two variables: One is the dependent variable, and one is the independent variable.

The formula is $Y = a + b(X)$, where

- Y represents the dependent variable, the one you're trying to predict (the perceived astringency);
- X represents the independent variable, the one you are using to make the predictions (this is the tannin concentration in this example); and
- a is the intercept, where the regression line crosses the y-axis.

Figure 3.75—Regression Output for Tannins and Astringency



SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.915670936
R Square	0.838453264
Adjusted R Square	0.833068373
Standard Error	0.253016741
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	9.967827858	9.96783	155.7[illegible]	2.0889E-13
Residual	30	1.920[illegible]24142	0.06402		
Total	31	[illegible]1.88835			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.590840994	0.13388004	-11.8826	7.1E-13	-1.86426051	-1.3174215	-1.864261	-1.317421476
Tannin Concentration	2.594588662	0.207930191	12.4782	2.1E-13	2.16993856	3.0192388	2.1699386	3.019238765

Let's start by demystifying all the terms.

Regression Terms

Multiple R: This is the correlation coefficient. A value of 1 means a perfect positive relationship. A value of 0 means no relationship, and a value of –1 means a perfect negative relationship. Correlation tells you the degree (or strength) to which two variables move in relation to each other. Correlation measures association but not causation. **In this scenario: .915670936** represents a **highly positive correlation** (which is what our scatterplot showed us).

R Square: This is called the coefficient of determination. It tells you how many points fall on the regression line. In this example, **84%** of the values fit the model.

Adjusted R Square: This adjusts for the number of terms in a model. You would use this if you had more than one *x* variable.

Standard Error: First of all, this is not the same as the standard error in our descriptive statistics! This standard error is about precision. Essentially, this model predicts a variation around the regression line of **0.253016741**.

ANOVA: If you are doing basic linear regression (and we are), this section can be skipped. But just so you know what these things are, here is the list:

The ***df*** is the degrees of freedom (the sample minus 1). The **SS** equals Sum of Squares. The **MS** is the Residual SS / Regression degrees of freedom. **F** tests for the null hypothesis. ***Significance F*** is the significance associated with the *p*-value (if you look, you will see the same value in the third section under *p*-value). When you first see this, you may not know what the "-13" means. Just know that it means that it is significant.

Regression Coefficients

We get to the most important part in the regression coefficients section. First let me talk about the linear regression equation.

Table 3.15: Regression Coefficient Formula With Coefficients

	Coefficients
Intercept	–1.590840994
Tannin Concentration	2.594588662

Equation: $\hat{y} = a + bx$

For our scenario: $\hat{y} = -1.59 + 2.59\ (x)$

Where b = slope (2.59), where x = the concentration of tannins, and where a = the intercept –1.59

The intercept is where the slope **starts** at the y-axis. So a wine with a tannin concentration of .5 would predict a perceived astringency of –0.295.

Plugging into the formula would give us the following:

$\hat{y} = -1.59 + 2.59 \times (.5) = -0.295$

Regression should not scare you! And remember, you realized there was a correlation between tannins and astringency from the visual. The regression just puts numbers to the degree of correlation and gives you an inferential statistic tool to determine astringency if the level of tannin concentration is known!

So how else are scatterplots used?

Scatterplots That Show a Pattern

There are many uses for scatterplots beyond showing a correlation. For example, some scatterplots show a pattern but not a correlation. To demonstrate such a scatterplot, a dataset was downloaded from The Human Development Center (http://hdr.undp.org/en/data), part of the United National Development Programme. Statistical reports are available with over 150 global indicators that can be analyzed in different combinations. Each tells a story. To show some specific tips regarding data with outliers, a small 2020 dataset with 40 countries (as shown in Figure 3.76) was downloaded with the following categories: Internet, GDP, CO_2, Cellular, Fertility, and Literacy. For this example, we can create a scatterplot to show the country (Column A) and fertility (Column F) of the 39 countries in 2020.

Figure 3.76—Human Development Center Data

	A	B	C	D	E	F	G
1	Country	INTERNET	GDP	CO_2	CELLULAR	FERTILITY	LITERACY
2	Algeria	0.7	6.1	3.0	0.3	2.8	58.3
3	Argentina	10.1	11.3	3.8	19.3	2.4	96.9
4	Australia	37.1	25.4	18.2	57.4	1.7	100.0
5	Austria	38.7	26.7	7.6	81.7	1.3	100.0
6	Belgium	31.0	25.5	10.2	74.7	1.7	100.0
7	Brazil	4.7	7.4	1.8	16.7	2.2	87.2
8	Canada	46.7	27.1	14.4	36.2	1.5	100.0
9	Chile	20.1	9.2	4.2	34.2	2.4	95.7
10	China	2.6	4.0	2.3	11.0	1.8	78.7
11	Denmark	43.0	29.0	9.3	74.0	1.8	100.0
30	Ru. ..a	..5	7.1	9.6	5.3	..1	99.4
31	Saudi Arabia	1.3	13.3	11.7	11.3	4.5	68.2
32	South Africa	6.5	11.3	7.9	24.2	2.6	85.0
33	Spain	18.3	20.2	6.8	73.4	1.2	96.9
34	Sweden	51.6	24.2	5.3	79.0	1.6	100.0
35	Switzerland	30.7	28.1	5.7	72.8	1.4	100.0
36	Turkey	6.0	5.9	3.1	29.5	2.4	77.2
37	United	33.0	24.2	9.2	77.0	1.6	100.0
38	United States	50.2	34.3	19.7	45.1	2.1	100.0
39	Vietnam	1.2	2.1	0.6	1.5	2.3	90.9
40	Yemen	0.1	0.8	1.1	0.8	7.0	26.9

Here are the steps to create a scatterplot:

1. **Click** *inside* the dataset located in the Chapter 3 Excel file named "Scatter Plot Pattern."
2. Select **Insert** on the main menu and choose the scatter chart (Excel will try to show you ALL the datapoints).
3. Choose **Select Data** and **uncheck** all categories except FERTILITY Source, as shown in Figure 3.77.

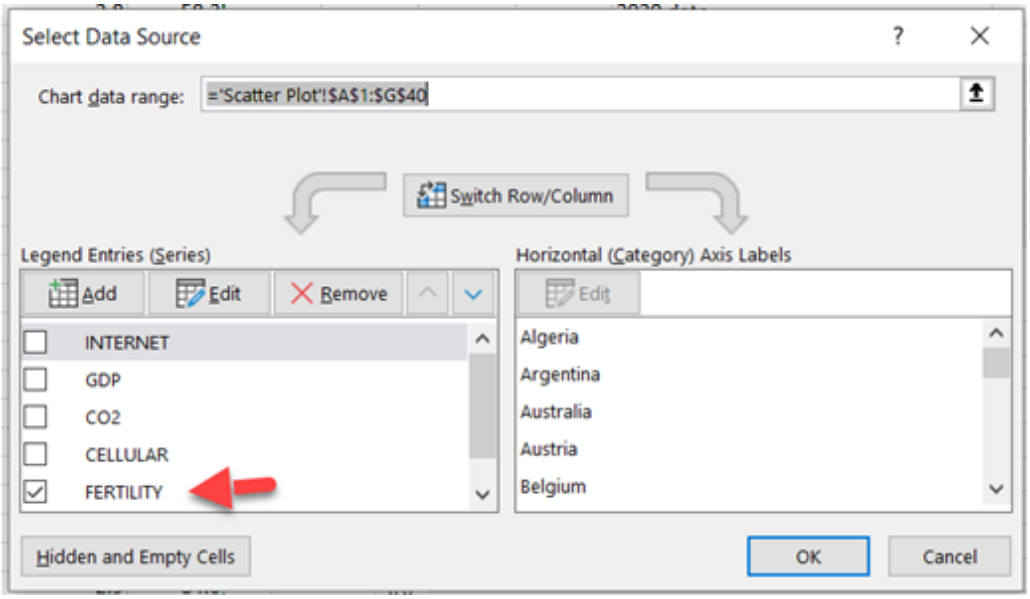
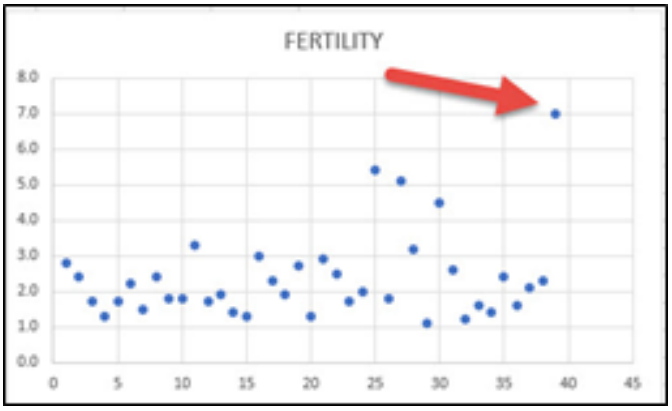
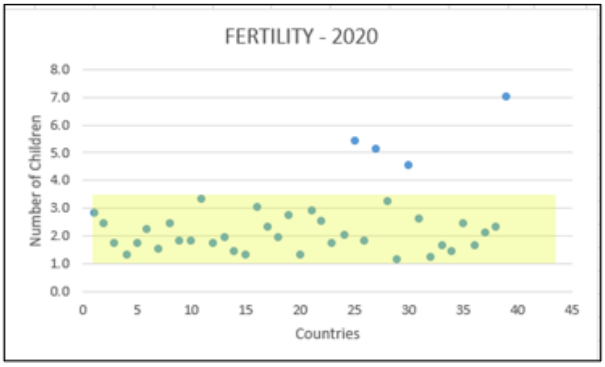


Figure 3.77—Select Fertility Only
Source: Screenshot of Excel Interface © Microsoft Corporation. Author Annotations Added

4. Click **OK**.

The default scatterplot will look like Example A in Exhibit 3.39. The red arrow (added manually) indicates an easily spotted outlier. But how could you improve the visual to tell the story better? Improve the title, add a band of color (manually), and add axis titles. Which example contributes more to your story? By using an overlay, we see the outliers more clearly. Example B is formatted so the x-axis shows the number of children, and the y-axis shows the countries.

Exhibit 3.39—Ways to Improve Scatterplot Interpretation

Example A—Simple Scatterplot	**Example B—Improved Scatterplot**
	
Default scatterplot prepared in Excel, added red arrow manually	Updated title, axis labels, and overlay (yellow highlighting) added manually in Excel

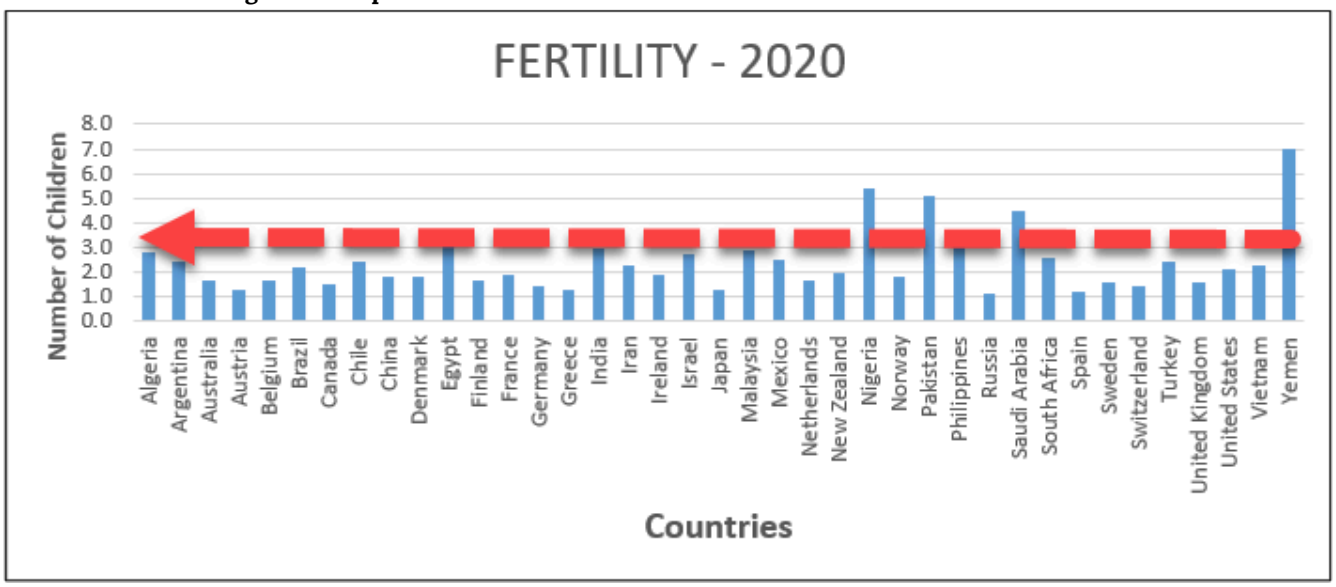
Let's assume while you are presenting, you receive a question from the audience:

"What countries are included in this Fertility scatterplot?"

Remember, we have 39 countries in the dataset, but both SPSS and Statistics Kingdom will bunch countries together

if they have the same fertility rate. Instead, you can use a bar graph in Excel. As shown in Exhibit 3.40, the red arrow was added manually to the chart image.

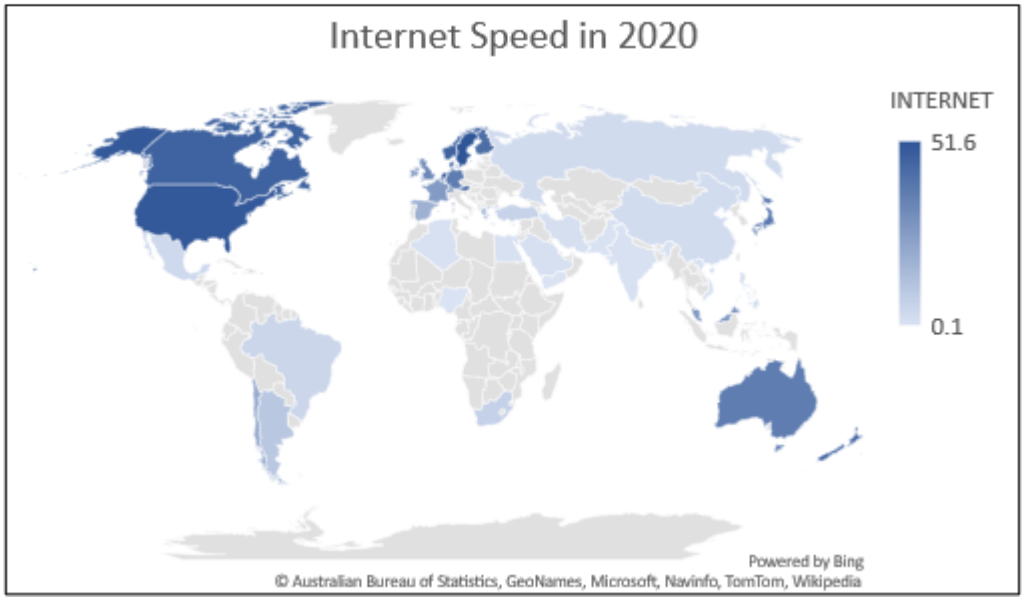
Exhibit 3.40—Showing a Bar Graph So Audience Can See All 39 Countries



Creating Maps

One of the new features in Microsoft Excel is creating a map chart across geographical regions. This is one of my favorite charts and it's always been available in Power BI. In the Chapter 3 Excel file, choose the **Scatter Plot** tab. The dataset shows 40 countries with information about the internet, GDP, CO_2, cellular, fertility, and literacy. Exhibit 3.41, shows what a "map" might look like. So the next step is to construct one.

Exhibit 3.41—Using Maps in Excel to Show Internet Speed



Note: Author Illustration (2025)

Step-by-Step Instructions to Create a Geographic Data Map in Excel

Before you can do anything with statistics in Excel, you need to add the Analysis ToolPak as an add-in to Excel. This was shown earlier in this section.

1. Go to the Scatterplot tab in the Chapter 3 Excel file.
2. Next, **click** *inside* the dataset.
3. **Highlight** the Country and the Internet columns (A1:B40).
4. Choose **Insert** from the main menu.
5. Choose **Maps** on the Insert menu. See the arrow shown in Figure 3.78.

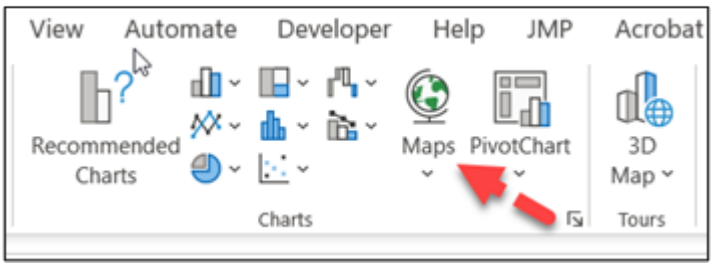


Figure 3.78—Maps in Excel Icon
Source: Screenshot of Excel Interface © Microsoft Corporation. Author Annotations Added

6. In the pop-up menu, **choose Filled Map**.
7. Now **add a title** and you're done!

Heatmaps and Correlation Matrix

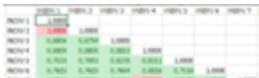
A good visual cue is a heat map. A **heatmap** is a graphical representation of data by color and it is a great tool for large datasets. For example, heatmaps are often used to show airplane delays, ranging from green for on-time landing, to bright red for delays as much as 40 minutes. Some organizations use a heat map to show website traffic by time of day.

It is also a great way to see if two different groups are on the same page (like CEOs and board members shown in Table 3.16). The images in Table 3.16 show the responses of CEOs and board members who were asked the same questions. The board members saw only a moderate correlation (.6817) for Question 1 with Question 2. The next value is .5633 when comparing Question 1 and Question 15.

But when you look at the CEOs', there is mostly very high correlation and high correlation with a majority of questions. In fact, on the CEOs' survey data, only Question 9 had no correlation with other questions.

Correlation is not causation, but it is clear that board members and CEOs are *not* on the same page. A correlation at .9 to 1 (100%) is very highly correlated, .7 to .9 is highly correlated, and .5 to .7 is moderately correlated.

Table 3.16: Heatmap Shows That Board Members and CEOs Are Not on the Same Page

Board members	CEOs
Question 1 is moderately correlated with Question 2 and Question 15.	Very high and high correl
	

A heatmap reduces mental processing because the color saturation provides visual cues. Table 3.16 shows low correlation on the left, indicated by the lack of color and strong correlation on the right indicated by color cues. For this example the numbers are not important.

A heatmap can be produced in Excel using conditional formatting. Creating a correlation matrix is available in Data Analysis (an add-in to Excel) to the Data table. Then you can set up conditional formatting. Compare the two. On the right, which reflects employees, notice how you only see one correlation between Question 1 and Question 15. But if you look at the administrators (CEOs in Table 3.16) answering the same question you see that almost all questions are correlated: Red = very high correlation, and Green = high correlation.

Without the context of the questions asked to both groups, it is difficult to tell the story. But it is clear that the board members and CEOs are not in agreement.

Heatmaps are not just a tool for business. The sports industry uses heatmaps in other ways that you might not consider. Sports team coaches use heatmaps to visualize a team's player positions, "movement, movement patterns, event occurring spots (events may include penalties, call for foul play, injuries, goals, and so on)" (Khongthaw, 2020, para. 7).

Heatmaps used for large datasets can be somewhat overwhelming. For example, the United Nations Department of Economic and Social Affairs uses a heat map to show supplementary graduation indicators and time series estimates of the least developed countries. The heatmap looks like a quilt with shades of blue, orange, and tan, but just the image provided would take over three pages in a printed textbook to show it!

United Nations: Department of Economic and Social Affairs, Economic Analysis. (2023). Supplementary graduate indicators (SGI) dataset (2002–2023). https://www.un.org/development/desa/dpad/least-developed-country-category/ldc-data-retrieval.html

Link to image of heatmap: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/Heatmap.png

Risk Matrix Heat Map

What is a risk matrix? Essentially, a **risk matrix** is a visual where the organization assesses its exposure to types of harm and plots this information on a risk matrix. The matrix is then used to develop management strategies and implement actions that manage the risk. The risk matrix should consider all the risks associated with an organization including financial risk, operation risk, workforce risk, client (customer) risk, and reputational risk, and in the case of a not-for-profit organization (NFP), programmatic risks. The example shown in Exhibit 3.42 was created in Excel and is included in the Chapter 3 files. This is only an example. If you do a search on a risk matrix, you will see slightly different theories on how the legend and colors would be assigned. Make it your own for your organization. The main point is to consider all the risks your organization faces in the next year and use this matrix to prioritize them. Next, devise strategies that will reduce or neutralize the impact of the potential risks. Remember, each organization is unique; an event that might be catastrophic for one organization might be an acceptable, easily managed risk for another.

Exhibit 3.42—Risk Matrix Heat Map—Blank

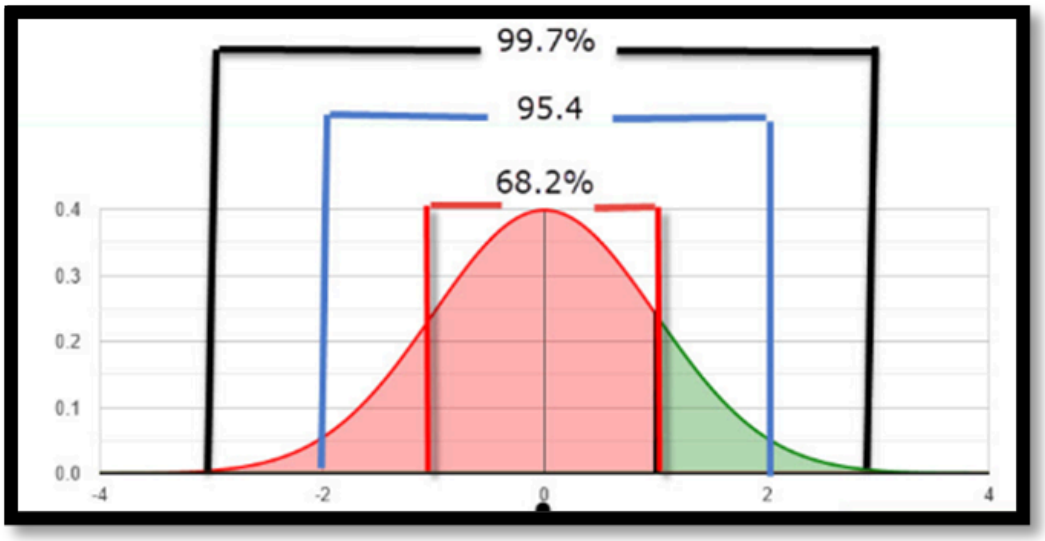
Risk Matrix						
Likelihood		Consequences				
		Minimum	Minor	Moderate	Major	Catastrophic
5	Almost certain					
4	Likely					
3	Possible					
2	Unlikely					
1	Rare					

Legend:	
Catastrophic	Stop
Unacceptable	Urgent Action
Undesirable	Action
Acceptable	Monitor
Low risk	No action

Six Sigma

Inferential statistics are a big part of Six Sigma. Shown in Exhibit 3.43, we see the empirical rule of standard deviation at one (68.2%), two (95.4%) and 3 (99.7%). Six Sigma takes it much further by working with up to 99.9999998% data points, which is ± six standard deviations from the mean.

Exhibit 3.43—Empirical Rule of Standard Deviation.



Note: Author Illustration (2022)

According to Master of Project Academy, "Six Sigma is about creating a culture that demands perfection and that gives employees the tools to enable them to pinpoint performance gaps and make the necessary improvements using data-driven problem-solving methods" (para. 10). Academic researchers are less likely to work with data that requires this level of focus on acceptable levels, but *practitioners* might be required to work with the Six Sigma model. For example, the quality of a new drug would require this model for quality control.

The DMAIC (Six Sigma) approach to solving a problem includes the following steps: define, measure, analyze, improve, and control. There are a variety of problem-solving methodologies in the corporate setting used to drive quality.

Creating a Six Sigma flowchart in Microsoft's Visio is easy since there is already a "House of Quality" template available as illustrated in Figure 3.79. The prebuilt house provides rows and column labels, and the roof is the correlation matrix. If this is something you have an interest in pursuing, the YouTube link for a Quality Function Deployment is a good place to start.

Figure 3.79—House of Quality in Visio: Six Sigma Diagram

Mister Simplify. (2023). *Quality Function Deployment & the House of Quality—Simplest Explanation Ever*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#oembed-7

Exploratory Data Analytics

In exploratory data analytics, the user gains key insights by analyzing patterns to recognize potential relationships. This is one of the first steps in understanding your data. Artificial intelligence (AI) can significantly enhance exploratory data analytics (EDA) by automating and accelerating the process of uncovering patterns, and insights.

> The greatest value of a picture is when it forces us to notice what we never expected to see.
>
> —John Tukey

One product provided by Microsoft is Power Business Intelligence (BI). In Power BI, once data are uploaded, it will review the data for insights and create graphs automatically. Power BI looks for subsets of your data. The types of insights include (1) outliers, (2) change point in a time series, (3) correlation, (4) low variance, (5) majority (attributing to a single factor), (6) overall trends in time series, (7) seasonality in time series, and (8) steady share. The insights will be covered in depth in a later chapter, or you can explore Microsoft Learn using Microsoft's (2023) resource. Part of becoming a good researcher is to be able to communicate your findings; so always use every tool you can to really understand your data. Power BI is introduced in Chapter 7.

Microsoft (2023). Types of insights supported by Power BI. Microsoft Learn. Link: https://learn.microsoft.com/en-us/power-bi/consumer/end-user-insight-types

Causal Analytics

Causal analytics focuses on the "why" something occurred. It is important to understand the difference between correlation and causation. Causation indicates that one event is the result of another event (cause = effect). Correlation tests

for a relationship between two variables. But seeing the two moving together does not necessarily mean one variable causes the other. "Distinguishing between what does or does not provide causal evidence is a key piece of data literacy" (Statistical Knowledge Portal: A Free Online Introduction to Statistics, 2020, para 2).

An example of causal analytics might involve investigating whether a marketing campaign directly leads to an increase in customer engagement and sales. By isolating and manipulating variables, we can identify and quantify causal factors that influence outcomes. Do not confuse diagnostic analytics with causal analytics. An example of diagnostic analytics could be Google Analytics to help website owners understand what has happened and why it happened. Causal analytics is like A/B testing (before and after a change of a new feature).

Predictive Analytics

Predictive analytics predicts what is most likely to happen (future), so you can expect a question, "What will happen?" Some of the techniques used include regression models, data mining, modeling, and artificial intelligence. The most common use is by insurance and financial companies but growing industries that use predictive analytics include marketing and health care (e.g., COVID-19 algorithms). The financial sector uses predictive analytics to anticipate stock price movements, while health care forecasts patient readmission rates based on historical patient data. This type of analytics enables organizations to make proactive decisions, optimize processes, and mitigate risk. Just think, you've already worked through a regression model used in the wine industry!

3.7 Self-Assessment: Data Visualizations Used in Statistics

Learning Objective #6—Conduct preliminary statistical analysis, predictive statistics, and understand Six Sigma

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An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=568#h5p-25

3.7 Exercise 1: Discuss Concepts

Learning Objective #6—Conduct preliminary statistical analysis, predictive statistics, and understand Six Sigma

Discussion Questions: Post to the discussion board and/or be prepared to answer in class.

1. Explain the concept of correlation in the context of scatterplots and provide examples of diverse types of correlations.
2. Explain the purpose of a histogram and provide an example of a real-world scenario where a histogram would be useful in data analysis.
3. Explain Six Sigma after conducting research. Does your organization use it?

3.8 Free Tools to Visualize Data

> To harness data, the world needs information: more information, better information, more complex and more nuanced understanding, and better narratives that can show ways for all to flourish. . . . **To be a data storyteller is to be a creator, a maker, a constructor**. We do not just make information, but new and enthusiastic visions of how things are and how they might be.
>
> —R. J. Andrews, *Info We Trust*

The main goal for this section is to provide a quick reference to data visualization tools available, showcasing how intuitive they are to use and their cost. Most of the ones listed in Table 3.17 have a free version that may have some limitations.

Table 3.17: Data Visualization Tools

Data Visualization Tool	Website Address	Free?
Flourish: tons of templates, great animations, intuitive to use	https://flourish.studio/	Yes
Google Data Studio: integrated with Google sheets—several templates including a Gauge, some learning curves.	https://lookerstudio.google.com/visualization	Yes
Microsoft Power BI: best product for dashboards. Some learning curves, visualizations and practice datasets are available. Faculty & Students use Microsoft 365 accounts (adding AI tools and Copilot).	Students/Faculty access through apps for Microsoft 365 Nonstudent: https://powerbi.microsoft.com/en-us/	Yes Trial
Tableau Public: full version available free for download. However, everything created is available in Tableau's visual gallery (nonfree version expensive).	https://public.tableau.com/app/discover Make sure to visit *Viz of the Day*!	Yes
Datawrapper: the tool is built for journalists. Intuitive and easy to use. *Free plan includes 10,000 charts.	https://www.datawrapper.de/	Yes*
Infogram: intuitive, drag-and-drop, some interactive visualizations. Plug-in for WordPress users. Basic account has plenty of templates.	https://infogram.com	Yes
Google Sheets or **Microsoft Excel**	https://workspace.google.com/products/sheets/	Yes

Chapter 3 Summary

In this comprehensive chapter, we demonstrated a plethora of advanced data visualization techniques and tools, exploring their applications in strategic decision-making across various situations. Anscombe's quartet was introduced to underscore the deceptive nature of statistics, emphasizing how visualizations unveil nuanced stories beyond numerical analysis. It's a great way to let the visualizations show trends and provide insights. From the simplest graphic that resides in a cell, to animated infographics created in Flourish, you were led on an enlightening journey of discovery.

Survey data visualization techniques, from horizontal stacked bar charts with icons to word clouds, were presented as effective ways to convey information. Benchmarking tools (Porter's Five Forces, SWOT, PESTLE, Benchmarks by Associations, Balanced Scorecard) were explored along with a handful of decision-making tools (Ishikawa, decision tree, and a Pareto Diagram). When working with benchmarking tools or decision-making tools, it is important to determine ways to communicate and tell your data's story even if your audience is virtual. The chapter emphasizes the significance of effective communication, especially in a virtual setting when utilizing benchmarking or decision-making tools.

To enhance practical understanding, readers explored the art of presenting at a poster show, equipping them with skills to organize graphics and data for swift comprehension by a virtual audience. This chapter also explored ways data visualizations are used in statistics, including how to interpret a box plot; how to generate descriptive statistics in Excel; best uses of scatterplots, correlations, and heatmaps; and ways to provide meaningful analysis.

This chapter has over a dozen Excel worksheets with step-by-step guidance on creating graphs and data visualizations. This comprehensive resource serves as a valuable toolkit for leveraging advanced data visualization in both strategic decision-making and statistical analysis.

Download Chapter 3 Student Files (7.5MB).

Chapter 3 Case: Empowering Women Leaders

In a conference room in the heart of Washington, D.C., a group of aspiring women leaders from diverse backgrounds gather to develop a transformative leadership seminar for the coming year. The objective? To equip the future attendees with skills and insights needed to excel in leadership roles and drive positive change in their field. One of the key ideas from the group is to introduce Flourish, a dynamic data visualization platform (and part of Canva) as a dynamic data visualization tool. Each year, they produce an annual report of gains (and losses) made in leadership in the United States with other country comparisons. Each conference planner was given a dataset to input into Flourish with an idea to model some of the statistics in their opening session.

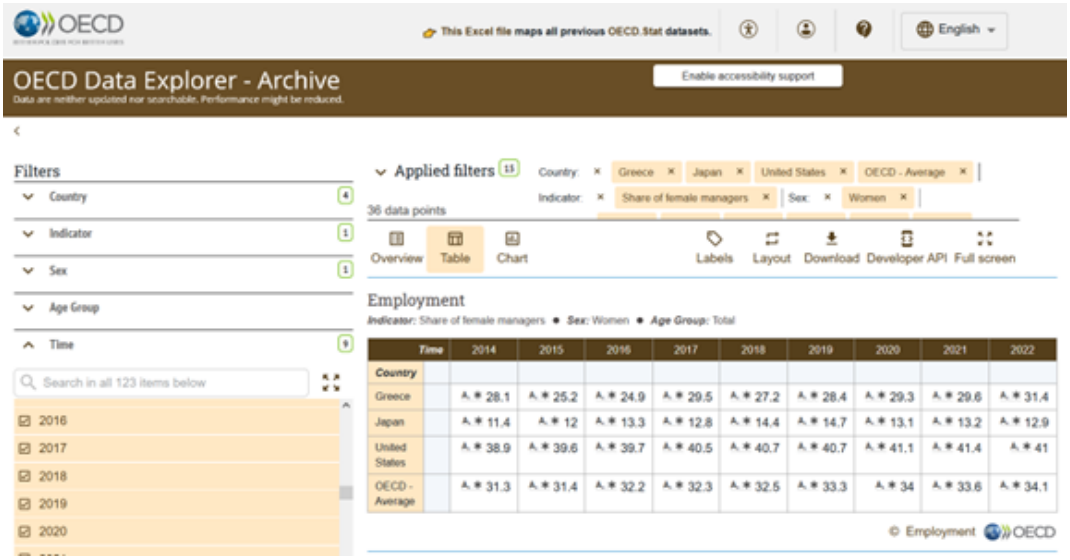
Case Objectives

1. Create and use decision-making tools to provide context for problems, support decisions, and assess risk.
2. Interpret research industry trends and recognize bias.

Case Guidelines

The conference planners divided up different datasets related to women in leadership. Your dataset is from the Organisation for Economic Co-operation and Development (OECD), and you've been asked to compare the United States, Greece, Japan, and the OECD average for the period 2014–2022. (See Exhibit 3.44 for a clearer picture of the data you need to use.)

Exhibit 3.44—OECD Employment: Share of Female Managers



Source: Screenshot of OECD Data Explorer Archive, © OECD.

Link to this site: https://stats.oecd.org/index.aspx?queryid=96330

The dataset needed to create the animated line graph is repeated here for you.

Table 3.18: OECD—Percentage of Female Managers

Country	2014	2015	2016	2017	2018	2019	2020	2021	2022
United States	38.9	39.6	39.7	40.5	40.7	40.7	41.1	41.4	41.0
Greece	28.1	25.2	24.9	29.5	27.2	28.4	29.3	29.6	31.4
Japan	11.4	12.0	13.3	12.8	14.4	14.7	13.1	13.2	12.9
OECD Average	31.3	31.4	32.2	32.3	32.5	33.3	34.0	33.6	34.1

If you want to see all the data captured by the OECD for women managers, please feel free to visit the Excel file: "Case Chapter 3—Share of female managers."

Case Instructions

1. Use Flourish to create an animated line chart from the data listed in Table 3.18.
2. Make sure the lines are identified by country.
3. Add a title, and add a quote from a woman leader.
4. Use the option **Publish to share and embed** and share the animated graphic URL with the class in the discussion board.
5. Be prepared to discuss insights (this will require additional research).

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4. Interactive Dashboards

Numbers have an important story to tell. They rely on you to give them a clear and convincing voice.
—Stephen Few

What Do You Think?

Matthew (Matt) mentioned he was competent using Excel to his boss. Matt works at XCaliber Food Distribution in the Midwest and has just been asked to provide data analytics to the owner. XCaliber Food Distribution celebrated its first year in 2024 with mixed results. Today, Matt received an exported file from the accounting software and wants to do a full analysis of last year's sales. The email from the owner indicated that the files were CSV files and represented a data dump of revenue information for the last year. Matt knew that CSV meant comma-separated values file and that he could open the file in Excel. Matt considers his Excel skills to be fairly good, but the owner asked several questions in an email that showed he wanted to move beyond a report. Instead, the owner wanted to *interact* with the information in a dashboard.

Matt reviewed the email and made notes. Here is the list:

1. I want to know how well my salespeople are doing. Which salespeople are selling the most; in what city, state, and region; and what are they selling? Are there two or three salespeople who could conduct the training (with pay)?
2. Are there products that should be dropped?
3. I want to know if using the summer intern in June and July was worth the cost (about $4,000).
4. Is every salesperson collecting from their customer by check, cash, or credit?
5. What is the range of invoices by customer, and who are our best customers? Are there opportunities for upselling?
6. Are we shipping out within the same day on a consistent basis?
7. Do we have regional overlap? Are two salespeople selling to the same customer?
8. I want to increase revenue to $60,000/month in 2025. Can you do some sort of analysis to see the best way to reach this goal—perhaps using a gap analysis or something like that?
9. I want to be able to ask a question and get the answer instantaneously. I heard it is called a dashboard. Can you set up a dashboard that allows me to analyze the data right along with you?
10. What do you think a survey of our customers will tell us?

Based on this list of questions, where would you start?

Introduction

This chapter delves into the intricacies of constructing informative and engaging dashboards, designed to communicate insights effectively to diverse audiences. We cover a spectrum of topics that includes the art of storytelling with slicers, the nuances of reports versus dashboards, techniques for creating impactful visualization, and foundational rules of

dashboard design across various fields. Data no longer resides in static spreadsheets; it breathes and evolves as users explore, analyze, and draw conclusions, *effortlessly*.

We plan to illustrate the application of these concepts along with ways to tell the story better. By the time you conclude this chapter, you will possess the knowledge and expertise to construct interactive dashboards that transcend mere data presentations. You will have the tools you need to weave compelling stories with data, unlock the insights within your datasets, and be well versed in the art of data-driven communications.

Chapter 4 addresses the following learning objectives.

Learning Objectives

At the end of this chapter, students should be able to:

1. LO 1: Review various dashboards and evaluate best practices.
2. LO 2: Understand how to clean data.
3. LO 3: Apply the appropriate data visualization: report versus dashboard.
4. LO 4: Build visuals and dashboard to structure storytelling.
5. LO 5: Use a dashboard for gap analysis to support decision-making.

Key Terms: cortex activity, dashboard, data cleaning, data model, dopamine, gap analysis, mirroring, neural coupling, PivotCharts, PivotTables, slicer, storytelling

Download Chapter 4 PowerPoint (14 MB)

Download Chapter 4 Student Files (<1 MB).

4.1 Report Versus Dashboard

> Data visualization must communicate answers and provide business outcomes. If the data feeding an analytics dashboard is not trusted, the results are meaningless. If the visualizations do not answer important business questions, the visualizations are not actionable.
>
> —Katie Horvath, CoreSignal

What is a dashboard? A dashboard is NOT a report. Reports are the most common way to communicate business intelligence: "The key attribute of a report is that it doesn't lead a reader to a predefined conclusion. Although a report can include analysis, aggregations, calculations, and event charts, reports often require the reader to apply his own judgment and analysis to the data" (Alexander & Walkenbach, 2013, p. 12). A **dashboard** displays data visually and draws focus to key trends, comparisons, and exceptions. Focus is the keyword here—having only relevant data is the goal. Most dashboards have a technique for the user to interact with the data. In the simplest Excel dashboard, adding a slicer can allow the user to answer additional questions, show new trends, and drill down into the data. A **slicer** in a dashboard is a user interface element that provides an interactive way to filter and analyze data displayed in various visuals or charts. Before we go much further, look at the difference between a dashboard and a report. Dashboards and reports are quite different in Microsoft's Power BI. For the purposes of this chapter, a dashboard provides quick insights and a consolidated view of key metrics to answer questions from the user. Users will often request a way to interact with the dashboard

(i.e., a slicer). Dashboards can provide real-time monitoring whereas reports are more historical. We will start with a very simple example scenario.

Campus Travel Scenario: Report Versus Dashboard

The college just started a Campus Travel program run by interns majoring in travel and event management. The program started in January 2024 and ran through April 25, 2024. All interns worked approximately the same number of hours per week but on different days. Occasionally, there was some overlap with other interns. Campus Travel was open 4 hours a day, every day of the week except for normal campus holidays or breaks. Scheduling the interns to work around their classes was particularly difficult. At the end of the semester, the interns worked collaboratively to create a report for their advisor.

The data had the following categories: (1) date tickets were sold, (2) salesperson (intern), (3) travel destination, and (4) number of tickets sold. The dataset consisted of 35 ticket sale transactions. For the report, the interns used the following calculations: (a) total tickets sold (81), (b) most tickets sold by intern (6), (c) least tickets sold by intern (1), and (d) average number of tickets sold (2.31). You see these calculations in D37:D40.

The interns used formulas in Excel (sum, max, min, and average) as part of the report. However, the static report was not what the advisor expected. The advisor wanted visuals, and he wanted to be able to interact with the data. The interns were stuck in a basic **report mode**, assuming that a few calculations and an ability to sort and count the data manually would work; however, the advisor **expected an interactive dashboard**!

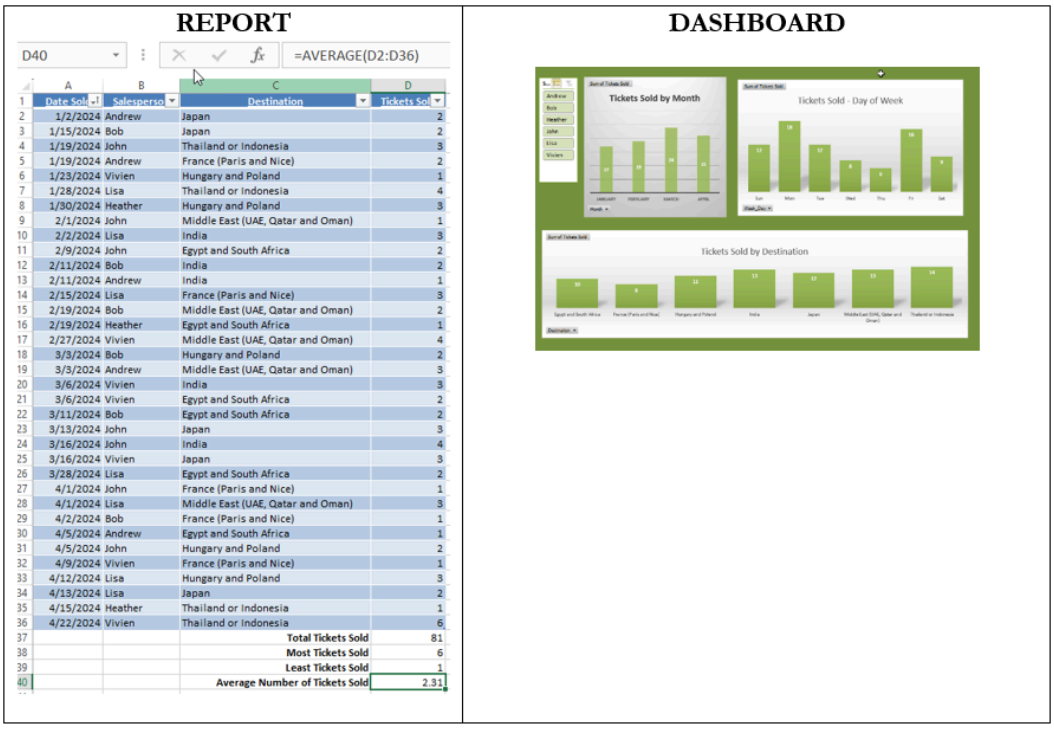
The advisor wanted to see the number of tickets for each destination and the number of tickets sold by month and by day both as a group and for each intern. Why? Because he wanted to assess the success of the program and determine what standards should be set for the repeat of the program in 2025. So the advisor might be asking these kinds of questions:

1. Did all interns sell tickets to each destination? If not, why? Was it just a chance of scheduling, or were interns unfamiliar with the destination process?
2. Is there a day of the week that Campus Travel could be closed? Scheduling is a nightmare for the advisor and interns, and both deserve one day off each week.
3. Are there interns who sell more tickets and/or travel destinations and could help train new interns?
4. Should interns be required to sell a minimum number of tickets?

According to Alexander & Walkenbach (2013), "When gathering the measures required for the dashboard . . . write out a sentence to describe the measures needed" and determine the types of techniques that will allow the user to interact with the data (p. 15).

There was a gap in communication. Let's compare the report and dashboard. Notice the dashboard in Figure 4.1 is driven by a "slicer." A slicer allows the user to manipulate all the graphs. The slicer provides the interaction and allows the advisor to look at each intern's progress by selecting their name on the slicer.

Figure 4.1—Report Versus Dashboard for Campus Travel.



Date Sold	Salesperson	Destination	Tickets Sold
1/2/2024	Andrew	Japan	2
1/15/2024	Bob	Japan	2
1/19/2024	John	Thailand or Indonesia	3
1/19/2024	Andrew	France (Paris and Nice)	2
1/23/2024	Vivien	Hungary and Poland	1
1/28/2024	Lisa	Thailand or Indonesia	4
1/30/2024	Heather	Hungary and Poland	3
2/1/2024	John	Middle East (UAE, Qatar and Oman)	1
2/2/2024	Lisa	India	3
2/9/2024	John	Egypt and South Africa	2
2/11/2024	Bob	India	2
2/11/2024	Andrew	India	1
2/15/2024	Lisa	France (Paris and Nice)	3
2/19/2024	Bob	Middle East (UAE, Qatar and Oman)	2
2/19/2024	Heather	Egypt and South Africa	1
2/27/2024	Vivien	Middle East (UAE, Qatar and Oman)	4
3/3/2024	Bob	Hungary and Poland	2
3/3/2024	Andrew	Middle East (UAE, Qatar and Oman)	3
3/6/2024	Vivien	India	3
3/6/2024	Vivien	Egypt and South Africa	2
3/11/2024	Bob	Egypt and South Africa	2
3/13/2024	John	Japan	3
3/16/2024	John	India	4
3/16/2024	Vivien	Japan	3
3/28/2024	Lisa	Egypt and South Africa	2
4/1/2024	John	France (Paris and Nice)	1
4/1/2024	Lisa	Middle East (UAE, Qatar and Oman)	3
4/2/2024	Bob	France (Paris and Nice)	1
4/5/2024	Andrew	Egypt and South Africa	1
4/5/2024	John	Hungary and Poland	2
4/9/2024	Vivien	France (Paris and Nice)	1
4/12/2024	Lisa	Hungary and Poland	3
4/13/2024	Lisa	Japan	2
4/15/2024	Heather	Thailand or Indonesia	1
4/22/2024	Vivien	Thailand or Indonesia	6
		Total Tickets Sold	81
		Most Tickets Sold	6
		Least Tickets Sold	1
		Average Number of Tickets Sold	2.31

Note: Author Illustrations (2025)

Campus Travel also conducts a posttrip survey that asks three questions. Although the information is easy to read in the table, what technique would make it easier to see insights and trends?

What Is a Data Model?

Let's work through the step-by-step process of creating a Microsoft Excel dashboard and the use of a data model. A **data model** allows you to integrate data from multiple tables and multiple sources! This is a good skill to know since most situations require you to pull data in from different sources. For example, in Campus Travel, the interns keep track of their schedules and about how long it takes to sell a destination package. The advisor might want to consider this use of time—especially if the intern doesn't actually make the sale but has spent hours of time working with the potential customer.

Step-by-Step to Create a Simple Dashboard in Microsoft Excel

Note: Screenshots of Excel interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

The first step is to explore an existing dashboard that uses two table ranges. The "4.1 Campus Travel Ticket Sales Student File" is in the Chapter 4 Excel files.

1. Open Microsoft Excel and open the file "Campus Travel Ticket Sales with dashboards."

2. **Explore** the data.
   Look at the Raw Data file. Notice that it is a table. You can tell it is a table because it allows you to sort using the drop-down arrows shown in the header row. Notice the total number of tickets sold and the other calculations used at the bottom of the table. The table extends from A1 to D36 with a header row that shows Date Sold, Salesperson, Destination, and Tickets Sold. Do not include the calculations.

   Click inside the table, and you will notice a new tab on the ribbon called Table Design. Select the **Table Design**. You should also notice that the table name shows as "Data."

Click the **Home** tab on the ribbon and locate the "Format as Table" within the Styles group. Look through the data and notice that you see the date sold but not the day of the week.

Select the **Calendar tab**. The calendar tab was created so that the date the tickets were sold could be attached to the day of the week. The day of the week formula (shown in Figure 4.2) is =TEXT(A2,"ddd"). If you add an extra "d" into the formula, the entire day will be the result. The **month** formula is =TEXT(A2, "mmmm") to show the entire month spelled out with no abbreviation.

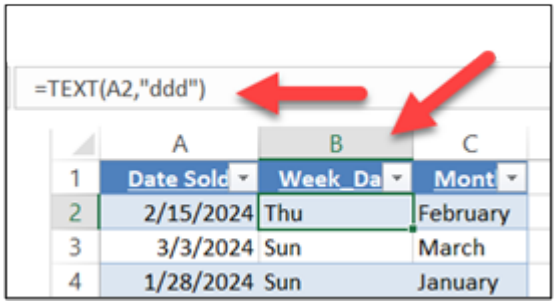


Figure 4.2—Day of the Week Formula

Next, select the dashboard tab. This is a completed dashboard for you to explore. If you click on any of the chart areas, you will see the PivotChart Fields pop-up. Try interacting with the chart by selecting the name Andrew in the slicer. You should see all three charts change.

In addition, click on one of the PivotTables and notice the PivotChart Fields that pop up. It shows both Calendar and Data tables. Note that the Calendar table has "Date Sold" and the Data table has "Date Sold." There must be a common point between the two tables you want to use. In this case, "Date Sold" is that connection (see Figure 4.3).

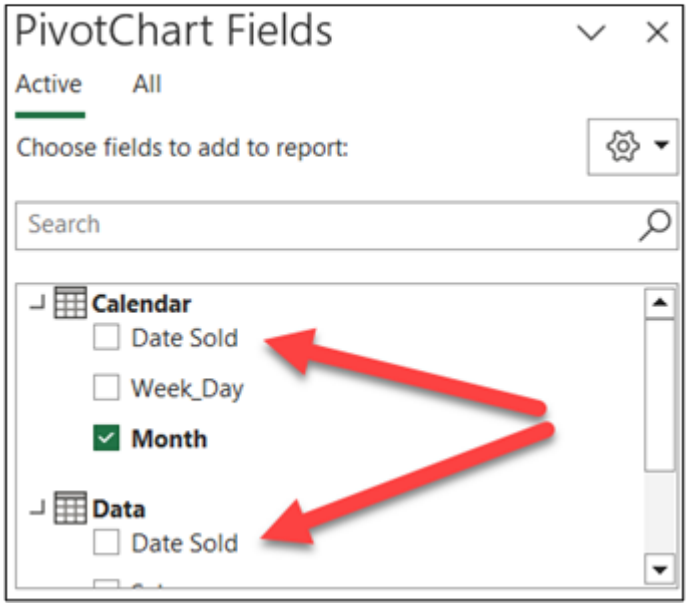


Figure 4.3—Both Tables Show in the PivotChart Field

A **data model** allows the user to integrate multiple tables.

Next, we will take you through the steps to build the data model.

- **Select the raw data file** and **click** one of the cells **within** the data table. It can be any cell within A2 to D36.
- Click **Insert** and look for **PivotChart & PivotTable** (like Figure 4.4).

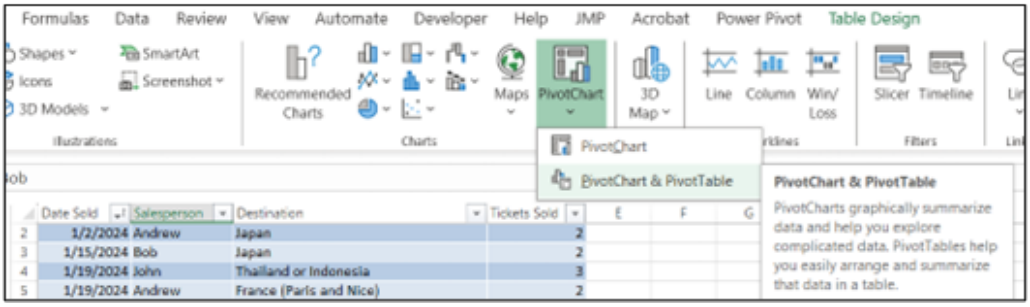


Figure 4.4—PivotChart Icon

- A pop-up screen should show a table range for the data and a new worksheet. Notice that the data itself will be surrounded by a moving dotted line. Always verify that you have selected the correct data range. In this case, you should make sure it has selected A1 through D36. You do NOT want any row after 36 even though it has calculations.

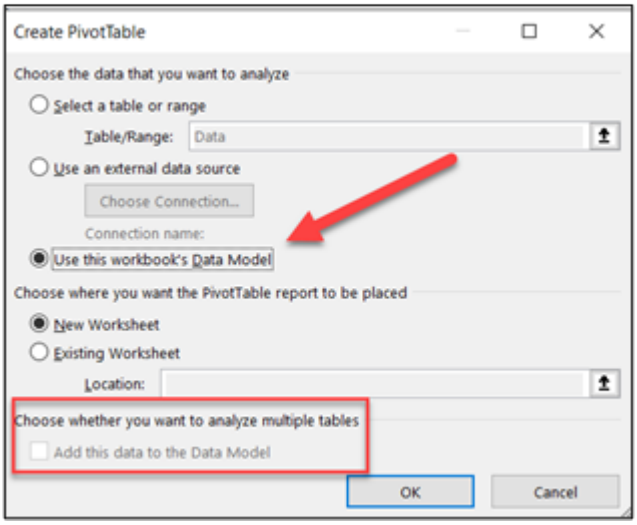


Figure 4.5—Use the Data Model

- Notice the pop-up has a checkbox for analyzing multiple tables. One of the powerful features of Excel is to bring together multiple related tables to analyze data. Since we have already done this step earlier, choose "**Use this workbook's Data Model**" as in Figure 4.5. (Note that if we had not set this up already, you would choose the checkbox shown in the red square to "Add this data to the data model.").Once you have verified the correct data, choose **OK**. You will know it worked if you see both Calendar and Data in the PivotChart Fields.If we had not already set up the data model, you would be prompted to connect the relationship between the two tables (as shown in Figure 4.6).You will know if you are working with data that do not have this relationship because your graphs will show the same data for each person.

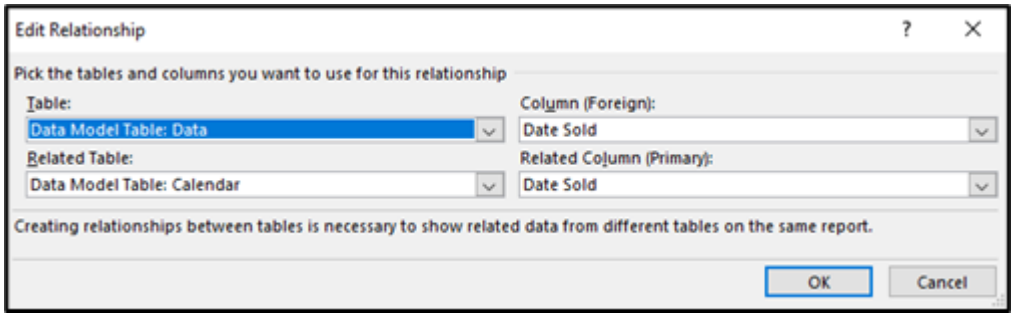


Figure 4.6—Set Up Relationship Between Tables

- In the PivotTable fields, **choose All**. This will show you both Calendar and Data.
- Now the fun part! **Drag** the **Week_day to the rows section** and the **tickets sold to the values section**. You will notice both a PivotChart and a PivotTable show on the worksheet. By default, it shows blue columns and total for both a title and a legend. Additionally, the days of the week are not in order. At this point, we have some work to do on this chart and the PivotTable. For example, in Figure 4.7, you see a "Total" legend that is not needed because it doesn't add any value.

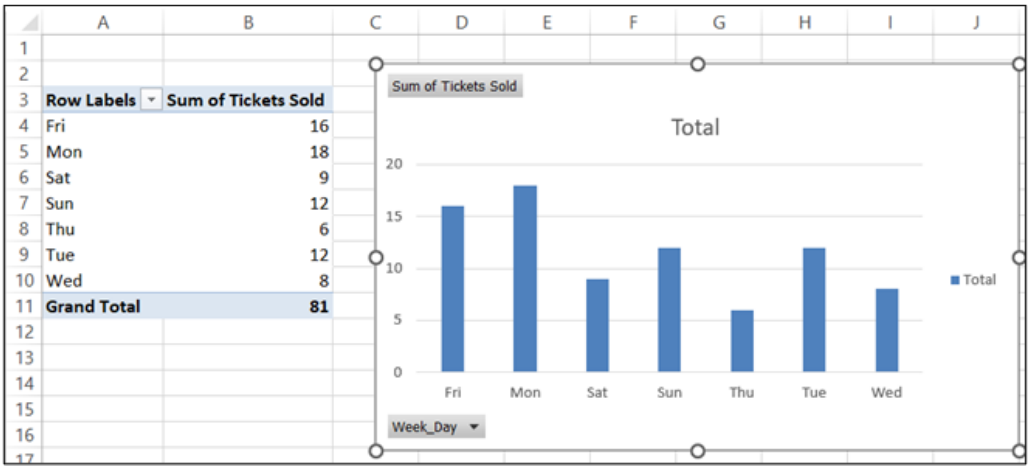


Figure 4.7—Default PivotChart

- Start by **changing the title** to "Tickets Sold—Day of Week" and delete the legend (we don't need it). This design still needs work. Notice that the days of the week are not in order, and we have field buttons. To remove the field buttons, choose **PivotChart Analyze**, click the **Field** button, and choose **Hide All**. Now follow the next four steps to clean up the chart.

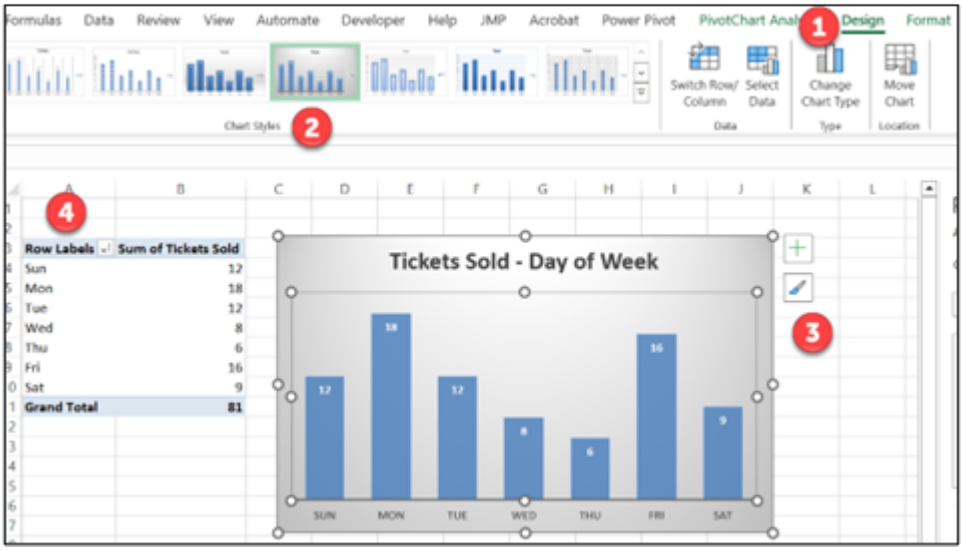


Figure 4.8—Customizing the Default PivotChart

Use the numbers in Figure 4.8 for the explanation and process.

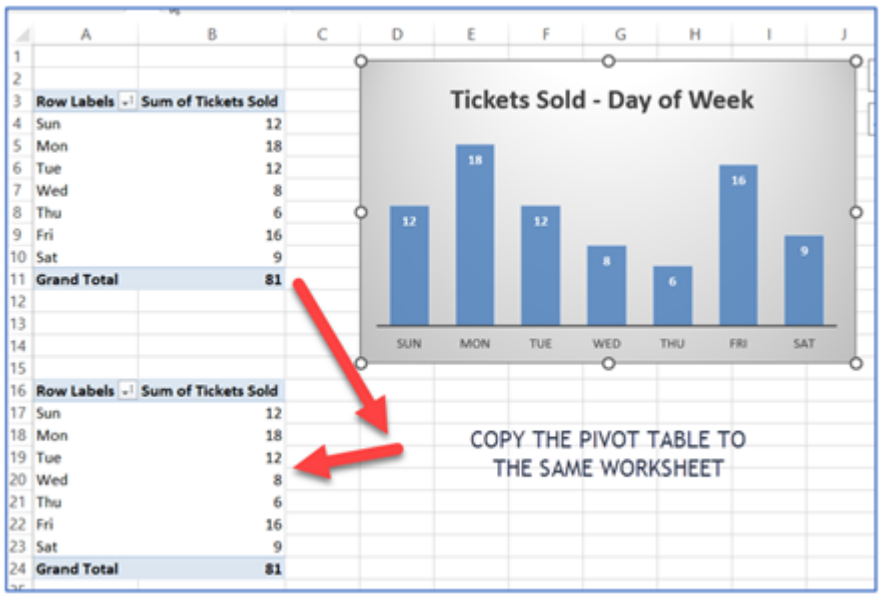
Part 1—Click on **Design**.

Part 2—**Choose** the design with blue columns and gray background.

Part 3—**Remove** the grid lines (by clicking on just the lines and delete). If you delete something you didn't intend to delete, use Control + z or Undo.

Part 4—**Click** on the Row Labels above the days of the week and sort A to Z to arrange the days of the week in order.

- Next, **name** the tab "Charts step-by-step." You may choose a different chart design, but just make sure all charts have the same color palette. Add branding if applicable. The PivotChart tools (analyze, design, and format) will show above the menu ribbon. Select Design and choose a design you like. I chose a design that removed the grid lines and featured the number of tickets in each column, as shown in Figure 4.9. Choose any color that matches your brand colors. The one thing I may still change is the text indicating the number of tickets for each day of the week. Notice how difficult it is to read "Wednesday." But for now, move on.
- Next, **highlight** the PivotTable only to copy. Copy it within the same worksheet that you named "Charts step-by-step." It looks like Figure 4.9.



Row Labels	Sum of Tickets Sold
Sun	12
Mon	18
Tue	12
Wed	8
Thu	6
Fri	16
Sat	9
Grand Total	81

Row Labels	Sum of Tickets Sold
Sun	12
Mon	18
Tue	12
Wed	8
Thu	6
Fri	16
Sat	9
Grand Total	81

Figure 4.9—Copying the PivotTable

- Make sure you have only **selected** a single cell within the second PivotTable, which starts on cell A16 in the illustration. The PivotTable fields pane will pop-up. You may need to use the drop-down to see all the fields under each table. **Uncheck the Week_Day and check the Month**. See Figure 4.10 for both a Month PivotTable and a Destination PivotTable.

Row Labels	Sum of Tickets Sold
April	21
February	19
January	17
March	24
Grand Total	**81**

Row Labels	Sum of Tickets Sold
Egypt and South Africa	10
France (Paris and Nice)	8
Hungary and Poland	11
India	13
Japan	12
Middle East (UAE, Qatar and Oman)	13
Thailand or Indonesia	14
Grand Total	**81**

Figure 4.10—Copied PivotTables

- Make sure you have selected **a cell within** the third PivotTable (that starts on cell A25 in the illustration). In the PivotTables Fields pane, **uncheck the Week_Day** and **check the Destinations** (or you can use drag and drop). We don't have charts yet for PivotTables 2 and 3.
- **Select** a cell within the second PivotTable (the month one) and notice the PivotTable Tools above the ribbon. It

shows Analyze and Design. **Choose Analyze** in the expanded ribbon and choose **PivotChart**. Choose the first column chart. As you can see, the default will need a title change, removal of the legend, removal of field buttons, and a new design to match the first one. Don't forget to sort the months!

- Next, **select a cell within** the third PivotTable (the destination one) and notice the PivotTable Tools above the ribbon. Once again, choose the PivotChart **Analyze** and choose **PivotChart**. **Choose** the first column chart and change the design to match the two previous charts. You may want to sort the destinations by selecting the Sum of Tickets Sold and sorting from highest to lowest.
  This is a screenshot (Figure 4.11) of the results of steps 11–15. Notice all the charts have a similar look.

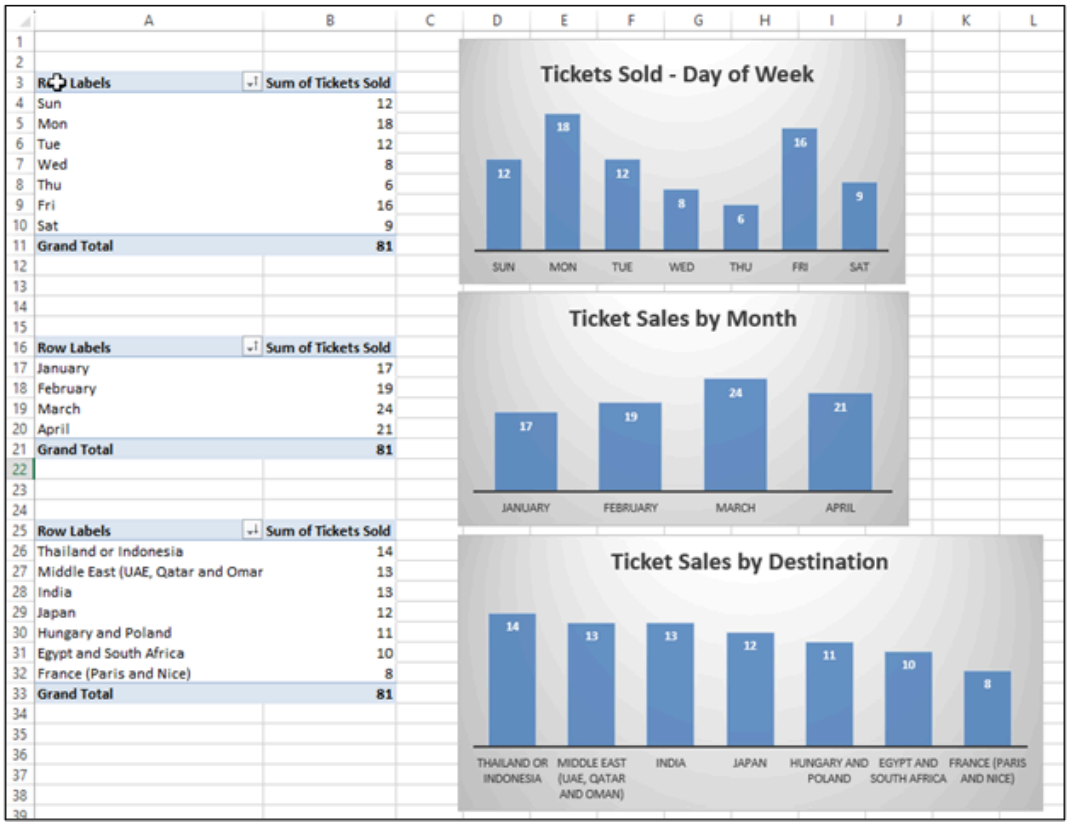


Figure 4.11—PivotTable Data and PivotCharts Before Setting Up Dashboard

- Next, add a sheet and name it **Dashboard**. You may want to organize the tabs.
  a. Put in a light gray background by **clicking** on the triangle between Column A and Row 1 and choosing a color for the background from the paint bucket (this is in the font group).
  b.**Copy** the three charts and arrange it like the following, leaving a spot for the slicer.

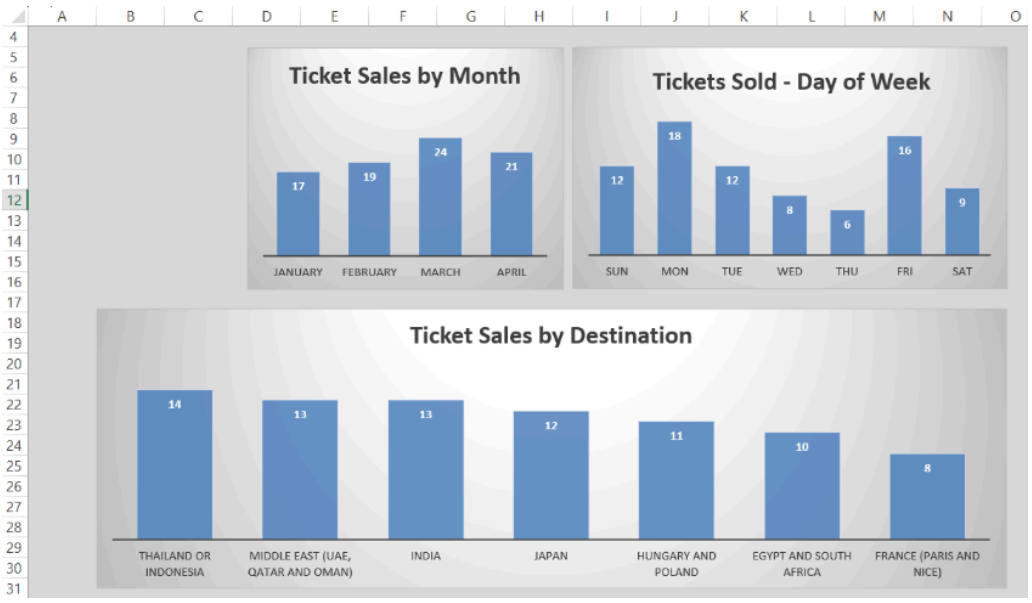


Figure 4.12—Partially Completed Dashboard

- Next, we are going **to insert a slicer**. Remember a slicer will provide interaction and allow the user to see ticket sales by day, month, and destination for each salesperson. First select the first chart. At the **insert** tab on the ribbon, select Slicer. A pop-up menu will show your table data. **Select Salesperson** (see Figure 4.13).

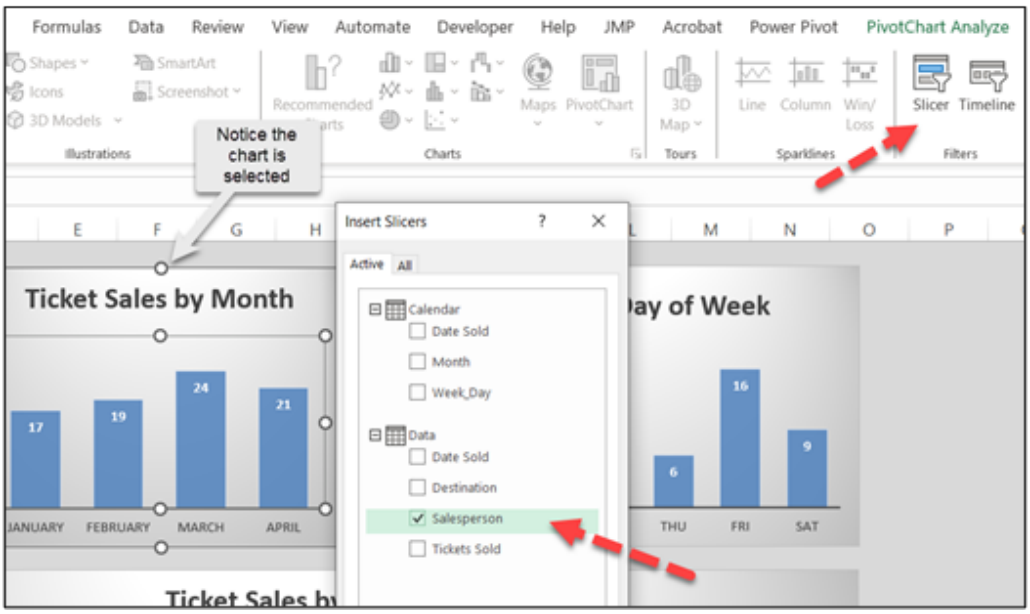


Figure 4.13—Insert a Slicer

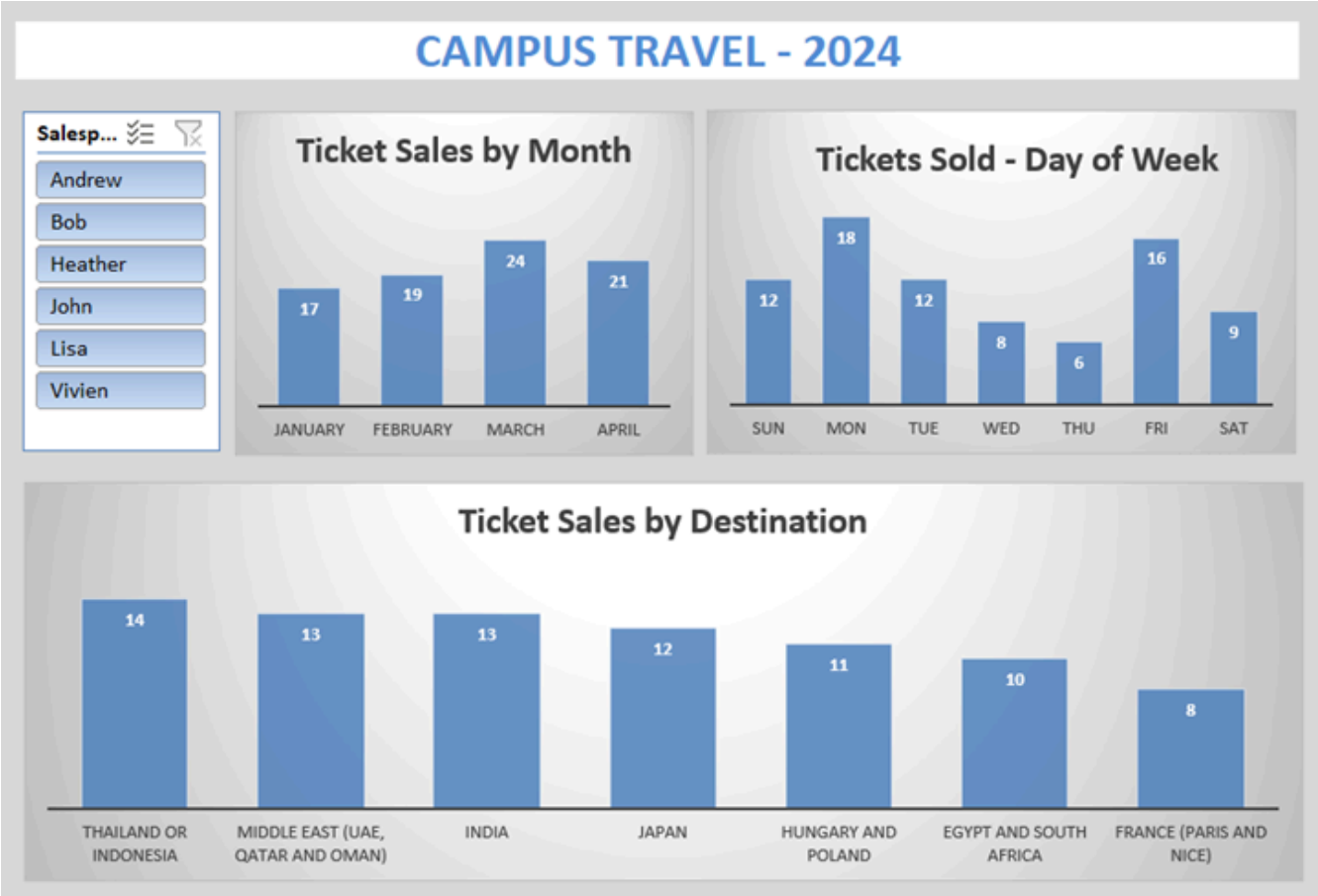
A slicer tool will appear so that you can format the slicer to match the chart colors. Since the default is blue, it matches the PivotCharts. If you chose a different color for PivotCharts, change the slicer color to match. You may want to narrow the size of the slicer.

You will notice that if you try the slicer, you will see only the first chart change. Slicers should drive or connect to all the PivotCharts.

- With the slicer selected, you will see Slicer above the ribbon and only one choice—Options. **Look** through the Options menu for Report Connections. Select Report Connections. Choose this and a pop-up will show all the

existing connections. Just make sure they are all checked **in your Dashboard**. Now try your slicer. All charts and PivotTables should change when you select a name. If anything looks off, check the tab called just "Dashboard" to make sure that the slicer is not filtering; otherwise, you can have some strange results.

Exhibit 4.1—Completed Dashboard



Using the dashboard, see if you can answer the questions considered by the advisor by using the slicer. The last question, "Should interns be required to sell a minimum number of tickets?" will take more research to determine if this requirement would help meet the learning outcomes of the program. Dashboards can't answer every question!

Are you more of a visual learner? Try watching the following 20-minute video.

Mitchell, J. & Deckard, T. (2024, Jan 18). *Campus Travel Video-Case Study*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-1

Need to see the finished dashboard? See "4.1 Campus Travel Ticket Sales Completed" in the Chapter 4 files.

Now that you have created your first interactive dashboard, let's move to how you can use the slicer and the interactive feature in PowerPoint using Slide Zoom to tell the story and answer the questions.

4.1 Self-Assessment: Dashboards Versus Reports

Learning Objective #3—Apply the appropriate data visualization: report versus dashboard

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#h5p-26

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#h5p-27

4.1 Exercise 1: Interacting With Slicers

Learning Objective #3—Apply the appropriate visualization: report versus dashboard

In the dashboard for this section, use the slicer that you built (or the one provided) to answer the following questions. Be ready to discuss this in class or on the online discussion board (check with instructor).

1. Interns earn college credit for their internship through the Career Development Office (CDO). Interns are expected to do journalling and write papers about their experience. As a teacher in the CDO, you've noticed that several mention the difficulty in selling the France (Paris and Nice) destination since it has so few interactions with locals. Did all interns sell tickets to all destinations?
2. Scheduling is a nightmare for the advisor and interns, and both deserve one day off each week. Is there a day of the week that Campus Travel could be closed?
3. Are there interns who sold more tickets and/or travel destinations and could help train new interns?
4. Should interns be required to sell a minimum number of tickets?
5. Discuss the data model process. Are there other file types you can use besides tables? Why do you

need a common field?

4.2 Simple Techniques to Visualize and Tell a Story

> We're born problem solvers. We're compelled to deduce and to deduct because that's what we do in real life. It's this well-organized absence of information that draws us in. . . . Make the audience put things together. Don't give them four, give them two plus two. The elements you provide and the order you place them in is crucial to whether you succeed or fail at engaging the audience.
>
> —Andrew Stanton, writer and director

Congratulations! You've taken raw data and created your first simple dashboard with a slicer. Now it's time to look at some simple visualizations and focus on a few indispensable tools: databars and icon sets. These unassuming techniques wield remarkable power when harnessed by skilled presenters. By delving into real-world scenarios, we uncover how storytellers can paint vivid narratives that captivate our audience.

What Are Databars?

Databars are miniature bar charts that provide an intuitive way to represent data within the confines of a single cell but are different from sparklines. The easiest way to understand how databars can be used is to look at a scenario. In the previous section, you were introduced to a dashboard created for Campus Travel. Campus Travel interns do follow-up calls with the advisor to find out if customers were satisfied with three potential areas of their trip. This is especially important since Campus Travel tries to package these trips with special amenities. The after-trip surveys ask three questions. "Reflecting on your trip, which would you want more of: (1) eat a meal with locals, (2) tour with locals, or (3) stay with locals?" Exhibit 4.2 shows the data collected from the 2024 trips.

Exhibit 4.2—Survey Data Collected (No Visualization)

Survey Data Collected from Customers After Trip				
	Want to....			
	Eat a meal with locals?	Tour with locals?	Stay with locals?	Total Customers
Japan	6	8	1	12
Thailand or Indonesia	11	10	1	14
France (Paris and Nice)	4	2	2	8
Hungary and Poland	5	8	2	11
Middle East (UAE, Qatar and Oman)	2	11	2	13
India	12	13	10	13
Egypt and South Africa	3	4	1	10
				81

We've talked about conditional formatting in an earlier chapter, but let's look at a conditional format feature known as **databars** for the survey data.

Conditional formatting is used to visualize data through databars, color scales, and icon sets. Introduced originally in Excel 2007, it was extended to integrate with PivotTables a few years later.

The survey with databars is shown in Exhibit 4.3. Clearly, customers who purchased tickets with India as their destination wanted much more interaction with the locals! But are there other insights we should notice? Or is there a different way we should show the data?

Exhibit 4.3—Survey Data With Databars: Count of Tickets

Survey Data Collected from Customers After Trip				
	Want to....			
	Eat a meal with locals?	Tour with locals?	Stay with locals?	Total Tickets Sold
Japan	6	8	1	12
Thailand or Indonesia	11	10	1	14
France (Paris and Nice)	4	2	2	8
Hungary and Poland	5	8	2	11
Middle East (UAE, Qatar and Oman)	2	11	2	13
India	12	13	10	13
Egypt and South Africa	3	4	1	10
Total	43	56	19	81

Caution! Does this really represent the whole picture? **No.** To explain, let's look at an example. Six ticket holders from Japan want to eat a meal with locals. However, six ticket holders only represent 50% of those who traveled to Japan. Now look at India. In this case, 12 ticket holders out of a total of 13 want to eat a meal with locals. Twelve ticket holders represent 92% of those who traveled to India. The "Total Tickets Sold" is a great column to have, but what might work better would be turning the data into percentages.

Exhibit 4.4—Survey Data With Databars: Percentage of Tickets

Survey Data Collected from Customers After Trip				
	Want to....			
	Eat a meal with locals?	Tour with locals?	Stay with locals?	Total Tickets Sold
Japan	50%	67%	8%	15%
Thailand or Indonesia	79%	71%	7%	17%
France (Paris and Nice)	50%	25%	25%	10%
Hungary and Poland	45%	73%	18%	14%
Middle East (UAE, Qatar and Oman)	15%	85%	15%	16%
India	92%	100%	77%	16%
Egypt and South Africa	30%	40%	10%	12%
Total	53%	69%	23%	100%

As you review the data, note the following:

- 53% of all ticket holders want to eat a meal with the locals,
- 69% want to tour with locals, and
- only 23% want to stay with locals.

But this data does bring up some questions. Why do only 25% of France ticket holders want to tour with locals? And notice that the number of tickets for France is only 10% and represents the smallest number of ticket sales. The advisor needs to add some open-ended questions about France's travel arrangements!

Another aspect of conditional formatting includes specific criteria (greater than, equal to, and less than) and icon sets.

Icon sets, like those in Figure 4.14, often use color associations like a stoplight with red for warning, yellow for caution, and green for normal, but there are many shapes beyond using a stoplight design.

Figure 4.14—Icon Sets Available in Excel

Source: Screenshot of Excel Interface © Microsoft Corporation

Revisit Icon Sets

Icon sets are specifically helpful when you are comparing lots of data and need a visual to quickly see issues. In Figure 4.15, you only see information for five landmarks, but what if you had over a thousand landmarks to review? The 2019 and 2020 years show a loss of visitors, but this is probably because of COVID-19. There was a pattern of concern for landmark #4 before the COVID-19 years, but it appears to have improved.

Figure 4.15—Icon Set Used for Conditional Format (Applied by Row)

Number of Visitors (thousands)												
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Grand Total
Landmark #1	9,198	9,316	9,367	8,767	9,192	9,289	9,372	8,050	9,189	9,178	9,166	100,084
Landmark #2	4,105	4,002	4,125	4,326	4,402	4,279	4,414	3,802	4,519	4,577	4,634	47,184
Landmark #3	3,369	3,362	3,379	3,281	3,304	3,243	3,503	2,632	3,737	3,901	3,951	37,662
Landmark #4	3,123	3,218	2,880	3,306	2,834	3,469	2,487	2,828	3,589	2,993	3,761	34,488
Landmark #5	3,218	3,593	3,459	3,677	3,587	3,567	2,657	2,690	3,735	3,666	3,826	37,675

Along with icon sets, don't forget to consider sparklines! As a reminder, sparklines are best used for trends, seasonal increases or decreases, cyclical data, and highlighting minimum and maximum values.

Now assume that the advisor has asked all the interns to work together to present their insights and findings. Let's start with the storytelling basics.

The Art of Storytelling When the Room Is Overwhelming

FEAR: Something that happens between the time you are planning for a presentation and the actual presentation. If you have a fear of public speaking (glossophobia), it may be something that you have fought since childhood. Sweaty palms, faster heart rate, and memories of prior poor performances or presentations may get in the way of connecting with the audience. About the only thing that will help with prepresentation fear is **practice, practice, practice**. Try out your storytelling with a pilot audience (family, friends, and coworkers are supportive and good critics). **Get organized** and make sure the technology works, internet is available, and the space works. There is nothing worse than presenting when the display unit is too small for the room. If you know this ahead of time, you can request a second display, encourage the audience to move forward, or even rearrange the chairs.

Source: Large venue image generated by Copilot—Public Domain

Imagine you will be presenting in the room pictured here and need to keep your audience engaged even though there are potential distractions. Do you need a wireless microphone? Do you have a wireless presentation clicker to advance the slides? Oh, wait! Where do the slides show? If someone asks a question, will you hear them? Or do you need to set up a way for the audience to send questions through a phone app? Are you being asked to present both physically and virtually? If so, that brings another set of challenges.

Be prepared—know your presenting territory, and have water available, take deep breaths, and focus on the material.

CRUTCH: Most presenters use PowerPoint, but when you use it like a crutch, it breaks the connection with your audience. Symptoms of a PowerPoint crutch include reading the slides, presenting with your back to the audience to see where you are in your slides, fumbling to remember what is next even with the slide up, and excessive "ums" and other filler words. And please, if you notice a spelling error or typo, don't point it out to the audience! Another thing we use as a crutch is index cards. Most audience members cringe at the sight of index cards, especially when the presenter is flipping them and shuffling them.

Basic Rules of Presenting With PowerPoint

So, storytellers, let's look at some basic rules and guidelines for presentations.

Example Case 1: Report, Inform, Explain, Announce

This type of PowerPoint has lots of facts that you need your audience to understand. Facts can be dry. So here are some tips to help with this type of presentation.

1. **Determine ways to add visuals.** Don't use clip art or cheesy stock imagery. Choose pictures that directly illustrate or match the tone of the slide. Use pictures of your organization if you can.
2. **Start with a story** or an activity that makes your point. Even if you are delivering several slides of facts, use a story to give the audience a way to understand the underlying meaning.
3. **Connect story to summary.** If you can't summarize your presentation topic in 10–15 words, then your audience will not "get" what you are trying to convey.
4. **Avoid too much text.** If you need to show financials and they don't fit well on a slide there are a couple of options: (a) Use a handout on the key concept or fact that you want the audience to understand, or (b) learn to use the Zoom function in PowerPoint to zoom into a magnified section.
5. **Follow the 10-20-30 rule:** 10 slides for 20 minutes with a font size of at least 30. Stay on time.
6. If you want to show charts to represent data, make sure it is **the right type of chart** and easily understandable. If you want to show a dashboard, switch to that app instead of trying to use a dashboard app in PowerPoint.
7. Look for **customized templates** instead of starting with a blank PowerPoint, but don't overuse animations. Use animations if they further your story. For example, the app Flourish is great to analyze key components that have changed over time.
8. Review the slides and **use the slide sorter** to see if it fits the overall story. Remember, most audiences want a sim-

ple structure: frame the issue, present the challenge, and explain how to solve the problem.

Example Case 2: Collaborative Presentation

Collaborating can happen in either a virtual meeting or a physical meeting, and sometimes it involves both. There are some simple guidelines and etiquette. When you are a single presenter, it is possible to start with the story and only introduce yourself after connecting to the audience with your story—but teams are different. Introduce everyone on the stage.

1. **Introduction:** Consider a team leader introducing or facilitating the team, giving them a section of the story. It can even be the 5 Ws. For example, "Let me introduce Jim Smith. Jim will share the first of the 5 Ws." Jim might hold up a small sign with the word *WHO*. When Jim shares his section, he can prop up the sign—and everything he presents should fall under the WHO. Using something like the 5 Ws does not mean you have to go in a certain order. You could start with WHY. The crucial point is that you speak with one voice and have a unified message. Consistent language, tone, and style are key.
2. **Handoff:** Consider how you will hand off the PowerPoint to the next presenter. Use a phrase like "The next presenter, Jim Smith, will share the WHO—in this case, who we consider our competitors. Jim?" And Jim may say something like, "Thank you, Sharon" and proceed with his section. It is also possible to have some mixed interaction where two people are prompting each other, but this takes lots of practice. The point is that the transitions should be seamless.
3. **Audience engagement:** One of the advantages of a team is that you can use them to field questions and leverage team dynamics to facilitate discussions or breakout sessions. Every team member should maintain **eye contact** or, if not presenting, **listen** to the presenter. As a team, scope out the room and make sure you know the audience. The audience will give you cues; don't ignore them.
4. **Schedule:** When a team presents collaboratively, it is a nightmare if one of the members doesn't keep to the schedule. So keep to a schedule, and have one person who is comfortable interrupting the presentation to keep it moving. Assume you will have technical issues, and have a backup plan.
5. **Good ending:** You need a strong conclusion that summarizes key points. End the presentation with a memorable and compelling closing quote, statement, or fact. Don't read your slides, but if you need notes, use the Notes feature in PowerPoint so you see the notes, but the audience sees the main slide content.
6. **Annoying habits:** Try to avoid annoying habits like clearing your throat, saying OK and using Ums. Body language should be natural. Project your voice so it is heard at the back of the room. If you are required to use a microphone, hold it a few centimeters away from your mouth and speak across the top of the microphone and not directly into it.
7. **Q&A:** Always leave time for a Q&A. This is harder when you have made a collaborative presentation because you may not be sure if you should answer a question if you didn't cover that section in the slide. You may want to consider the kind of questions you anticipate during your practice session and determine who will answer the questions.
8. **Gather feedback, debrief/reflect:** You should solicit feedback through a short survey. In addition, hold a postpresentation debriefing session to determine areas for improvement. Reflect on both individual and team performance.

Example Case 3: Persuade, Inspire, Sell

This type of PowerPoint needs to raise the energy in the room. And the most inspirational presentations are needed when you have a disengaged audience, one that you need to sway, or one whose support you need to gain for a tough decision. This type of presentation requires exceptional storytellers, empathy, and a deep understanding of your audience's motivation. And it is certainly not easy to do unless you practice a lot. Here are some tips to help with this kind of presentation.

1. **Know the arguments:** Spend some time researching. Know both sides of an argument and consider the audience's perspective. The main goal is to convince the audience that you know what you are talking about and that you can be trusted to tell the truth. Acknowledge potential objections or skepticism, and address them proactively. Great speakers tap into one or more of three approaches: ethos (ethical appeal), logos (logical appeal), or pathos (emotional appeal).Conduct thorough audience research. Know the audience's demographics, interests, and pain points. An example of a pain point: If you are speaking to a group of employees about a merger between two hospitals, acknowledge the challenges they've faced and how the change will impact them.
2. **Start with an attention-grabbing opening:** Begin the presentation with a powerful and dynamic opening. It could be an anecdote, a surprising statistic or fact, or a compelling question. Another way to interact with an audience is simple—ask your audience a great question at the beginning. An example here might be, "Did you know that by the end of the presentation, you'll discover how a change in perspective can lead to unprecedented success in your career?"One of the best attention-grabbing openings I've seen was done by Steve Jobs. Steve only had a few slides, but I still recall the text running across the screen behind him, how it changed to a bouncing ball, and how it looked like he caught it. Perhaps, you didn't realize this, but his average text size on slides was 190-point text, and he practiced for weeks (Gallo, 2019). It seemed as if the slide was alive and interacting with him!
3. **Tell a compelling story:** Craft a narrative that draws and resonates on a deeper level.—Connect with them emotionally. Use visuals that support your message. If the message is complex, provide timeline or milestone visuals. The story is the cue to set the hook. Instead of presenting data about declining sales, tell the story of a struggling entrepreneur who turned their business around using the strategies you are about to share.Out of all the tips listed here, this may be the most important. Tell a story that gives the audience an "aha" moment. Stories can add spice and provide your audience a chance to relate to a point you are trying to make. In a TED Talk by Elizabeth Lyle, she starts by talking about her bad habit of leaving a sink full of dirty dishes. At face value, you might not expect it to tie into her talk, *How to Break Bad Management Habits Before They Reach the Next Generation of Leaders*, but you would be surprised at how she used the story of a bad habit to stress her point.Share an inspiring example and use persuasive language such as rhetorical questions, powerful metaphors, and compelling language.
4. **Get the audience involved:** There are tons of apps that work with the user's phone. To get the audience involved, consider polling apps, word cloud apps, and Q&A. Polling apps like Poll for All, Poll Everywhere, Mentimeter, Slido, and others allow the presenter to add interactive polling. The audience can respond to the poll using their phone by visiting the voting page. The voting page (tied to your PowerPoint) collects the votes and shows the results. This is not difficult, but most presenters avoid it unless they have a budget to cover the cost (the basic free package is generous and should be researched). If done correctly it can engage a large audience!
5. **Credibility:** Credibility is on two levels: credibility of the presenter and credibility of the data. Without it, the audience doesn't connect, because they don't have trust in the narrative. It is important to choose the chart type that tells the story in a context the audience understands. Don't present charts they can't see, remove clutter, and keep your branding colors. Remember, your color choice and labels should be sensitive. Cite your sources. As a presenter, establish your expertise. Your experience, relevant qualifications, and achievements are foundational to credibility.
6. **Maintain engaging delivery:** Use varied vocal tones, gestures, props, and movement to keep the audience's attention. Physically move around the stage (another Steve Jobs characteristic). Use props. If presenting a new product,

give a hands-on demonstration. Use "trigger words" as landmarks in your demonstration to stay on track.

7. **Create a vision and a call to action:** Paint a vivid picture of the future. Help the audience see the value of their contribution. Conclude with a clear and actionable message to encourage your audience to take the next step. Inspiring an audience requires authenticity, passion, and a genuine desire to connect with your listeners.
8. **Practice, practice, practice:** Practice until you are comfortable in your own skin! A presenter should practice one hour for every minute of a presentation. A 15-minute presentation should be practiced for at least 15 hours. Record yourself and watch your presentation. According to Janice Tomich (2023), a presentation coach, "Issac Lidsky practiced his speech . . . over 1000 times. That's roughly 191 hours of practice for this 11.5-minute speech" (para. 3).

Lidsky, I. (2016). What reality are you creating for yourself? [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-2

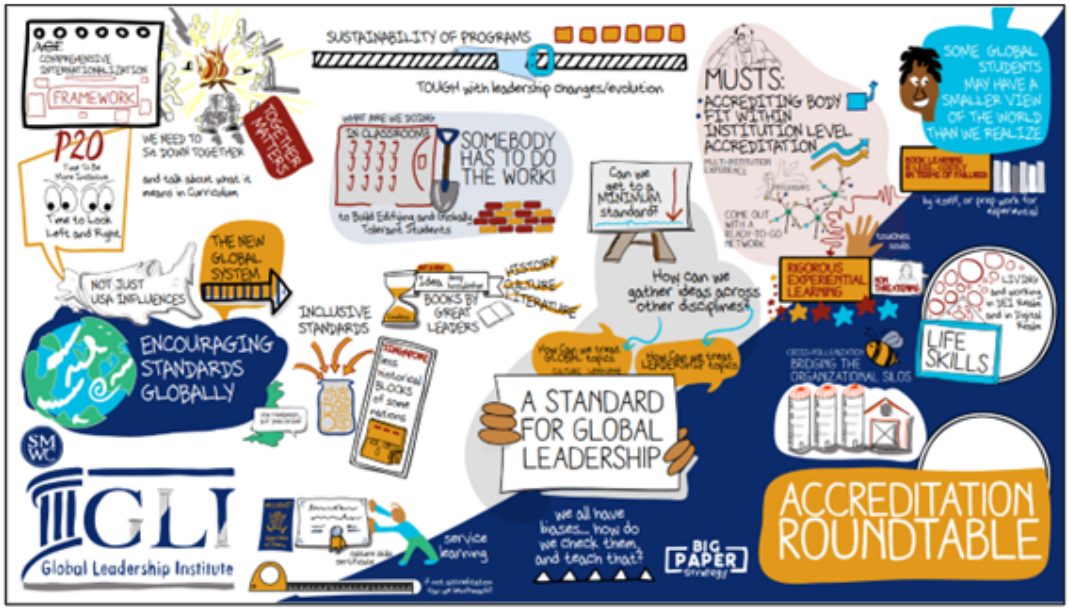
Littlefield, C. (2022). 7 *Ways to Interact With Audience in an In-Person Presentation*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-3

Example Case 4: Entertain, Divert, Relax, Set a Mood

This type of PowerPoint will not require presenters. For example, this could be a self-running slide show of audience pictures, cartoons, quotes, news, conference pictures, and even speed painting to music. Another interesting aspect of a virtual meeting can be the use of a sketch artist who draws and takes notes during a presentation. The example shown in Exhibit 4.5 is from a Global Leadership Institute conference in 2023, and the speakers discussed standards for global leadership.

Exhibit 4.5—Example of a Sketch Artist Taking Notes Live During a Conference Speaker



Source: Mendenhall, M., Walker, J., & Cassell, D. (2023, April 21). Standards in Global Leadership Education. 2023 Conference—Leading Global Innovation During Crisis. [Roundtable Discussion-Captured Live by Big Paper Strategy]. Global Leadership Institute. Saint Mary-of-the Woods, IN, United States. Used with permission

4.2 Exercise 1: Databars and Icon Sets

Learning Objective #4—Build visuals and dashboards to structure storytelling

The following information is available for your top 10 salespeople. Please use your skills with databars and icons to show this information. Post your result to the discussion board. Be prepared to demonstrate your skills or, if at the direction of the instructor, record a screencast demonstration. What are some key insights you would share from the Table 4.1 information?

Table 4.1: Top Sales by Rank

Top 10 Sales People	Sales	Rank this month	Rank last month
FULLER, NANCY	$137,707	1	1
CLABBER, JIM	$111,682	2	3
MCDONALD, DAN	$106,299	3	5
KNOTT, RITA	$102,240	4	9
BREMS, NOBLE	$83,526	5	2
WELLMAN, BUTLER	$78,824	6	11
PANITE, JANE	$77,452	7	6
STANLEY, PATTY	$76,790	8	7
SHEUM, CJ	$76,685	9	8
TANG, TERESA	$76,532	10	4

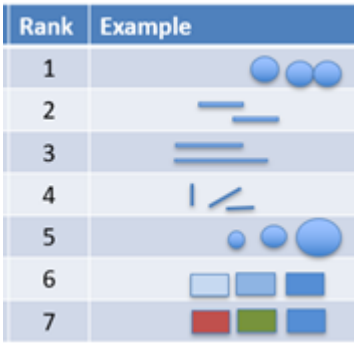
Please see Chapter 4 files, "4.2 Exercise 1—Databars and Icons" to get started.

4.3 How Storytelling Connects to the Brain

> The act of sharing a story is powerful. So much so that it synchronizes the brain activity of the teller and listener.
> —Calli McMurray, *Why the Brain Loves Stories*

Visually, our eyes can see trends, gaps, outliers, alignment, and/or position. In 1985, Cleveland & McGill ranked the visual attributes by measuring which visualizations are seen best. It is easier to show you. (Yes, visualize it!) As you can see in Figure 4.16, ranked first is position along a common scale; ranked second is position along nonaligned scales; ranked third is length; ranked fourth are angle and slope; ranked fifth is area; ranked sixth are volume, density, and color saturation; and ranked seventh is color hue. Perhaps you are surprised by the ranking. But there's more . . . !

Figure 4.16—How Your Brain Measures Visuals



Note: Author Illustration (2025) of Cleveland & McGill (1985) Concept

Nonverbal Cues

Stories impact people differently, and nonverbal cues can influence your audience. In most "two-person conversations, nonverbal messages convey more than 65% of meaning" (National Alliance for Partnerships in Equity, 2020, p. 2). That's no surprise when you realize our faces have 43 different muscles that can be activated around the eyes, nose, mouth, jaw, chin, and brow (Anwar, 2020, para 16).

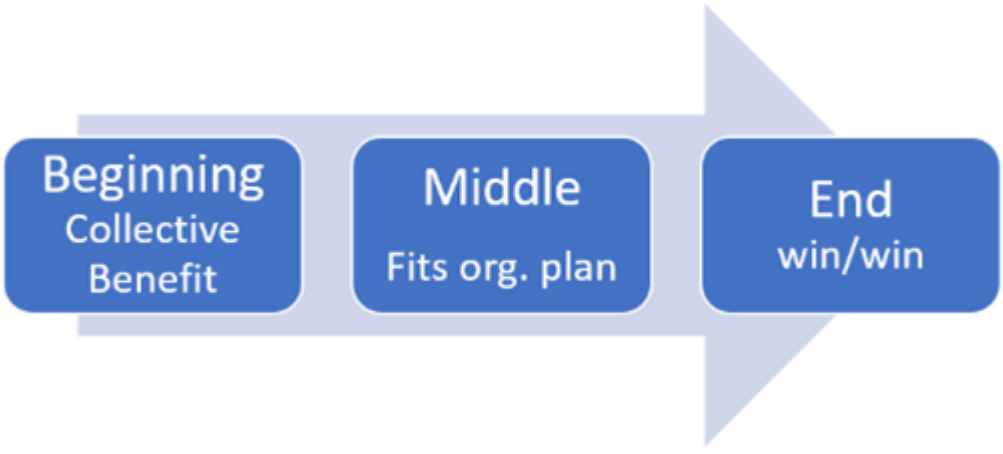
Even more interesting is the 7-38-55 rule by Mehrabian, Wiener, & Ferris (1967), who shared this formula with some caution. The rule states that 7% of meaning is communicated through spoken word, 38% through tone of voice, and 55% through body language. The authors urge caution because the formula does not apply to every situation. For example, because someone crosses their arms over their chest doesn't always mean they are closed off to your presentation; it may just mean they are cold!

Just remember, nonverbal cues can contradict or negate verbal messages. An interaction where words say one thing and nonverbal cues say another is called a double message, and everyone finds this confusing.

Planning a Beginning, Middle, and End in 7 Minutes

Figure 4.17—Plan a Beginning, Middle, and End

Note: Author Illustration (2025)



The main components of a story are the beginning, middle, and end. A strategy for storytelling practice is to use

PechaKucha. **PechaKucha** is a Japanese management style where you have **20 slides timed at 20 seconds each**. The slides automatically advance, giving you less than seven minutes to tell your story, and most slides should complement the speaker when vocalized. The PechaKucha website offers a free online and offline global storytelling platform in over 140 countries. We searched big data and data visualization and found 100s of presentations from all over the country (many in other languages). You can set up a presentation on the PechaKucha website, in Google Slides, or in PowerPoint. When you sign up for PechaKucha, you choose areas of interest, but don't be surprised if you get pulled into something different. We watched the "Presentation of the Day," and it was on Frank Lloyd Wright, which had nothing to do with data visuals.

Title: PechaKucha: Visual Storytelling That Celebrates Humanity. You will find lots of sample presentations to give you ideas. Link: https://www.pechakucha.com/

Lasseter's Lab. (2021, Jan 29). *How to make a PechaKucha presentation for class (for all students).* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-4

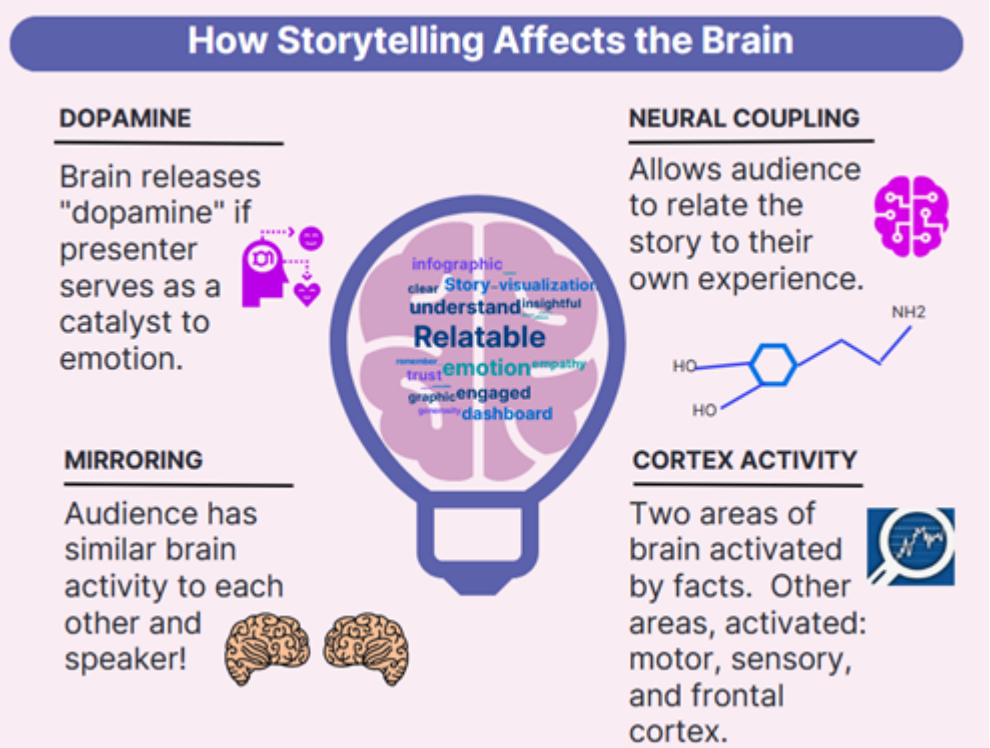
As we embark on a journey through the realms of psychology, neurobiology, and cognitive science we discover the profound ways in which stories captivate, influence, and shape our minds. The key question is "*What is it about storytelling that strikes a chord enabling narratives to connect with our brains in a manner that few other forms of communication can?*"

Our Brain When Listening to a Good Story

If we add context to the mix, our stories affect the brain, and this is a good thing! In general, good storytelling can do the following (as seen in Figure 4.18 and listed here).

- dopamine: enhances memory
- mirroring: experience similar brain experience as the speaker (we synchronize!)
- neural coupling: listener turns the story into their own ideas
- cortex activity: Lights up more of the brain
- narrative transport: engage emotionally—and if you engage emotionally, you increase trust, empathy, and generosity

Figure 4.18—How Storytelling Affects the Brain



Note: Author Illustration (2024)

In this chapter, you are learning some amazing things. It's easy to get all wrapped up in the technology. Just remember, if you start with technology, you can lose the connection to the audience. Start with the purpose and check off the why, who, and what your audience needs to understand. What actions do you want to support? What is the most important takeaway message? How will it be consumed? The more specifically we drill down for our *purpose*, the better.

Then make sure you accompany the visualization with *context*. In this case, "context" means making the topic easier to understand by giving extra information about the time, place, situation, history, background, and so on. That's part of the storytelling process!

4.3 Exercise 1: Storytelling Impacts Your Brain

Learning Objective #4—Build visuals and dashboards to structure storytelling

Watch the TED^{x} Talk video, *Why storytelling is more trustworthy than presenting data*

Eber, K. (2020, Apr 13). *Why storytelling is more trustworthy than presenting data.* TED^{x} Talks (TEDxPurdueU). [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them

online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-5

Then watch the video, Steve Jobs Introduces the iPhone

Schroter, J. (2011, Oct 8). *Steve Jobs Introduces iPhone in 2007*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-6

After watching the video, explain how your brain was impacted by storytelling. Write 10 characteristics of telling a dynamic story that Steve Jobs used. What data visualization did he use? Post these on the discussion board or be ready to discuss them in class.

4.3 Exercise 2: Chart Practice

Learning Objective #4—Build visuals and dashboards to structure storytelling

IFS Telecom Services shared their 2025 forecast for sales in all four regions. They have asked you to build several charts so they can see which ones work best for their budget presentation. They have asked for a combo chart, databars, two pie graphs—one for revenue and one for orders—and a clustered bar chart. The budget manager has asked you to demonstrate in a video how these were made (mostly so he understands how you created them). Table 4.2 has the information.

Table 4.2: Information About IFS Telecom Services 2025

Region	Total Sales	Percent	No. of Orders	Percent	Revenue divided by Orders
North	$ 8,819,623	19%	3,981	20%	$ 2,215.43
South	$ 11,008,539	24%	2,532	13%	$ 4,347.76
East	$ 9,414,701	21%	6,484	33%	$ 1,451.99
West	$ 16,428,769	36%	6,596	34%	$ 2,490.72
Total	$ 45,671,632	100%	19,593	100%	$ 2,331.02

Post your video to the discussion board and provide feedback to your classmates.

Refer to Chapter 4 files, "4.3 Exercise 2—Create and Interpret Charts" to get started.

4.4 Dashboard Cleaning and Presentation Advice

> Hammers and nails. If you are good with a tool, you may want to use it too often. If you have analyzed a problem in depth, you can end up exaggerating the importance of that problem or your solution. Remember that no one tool is good for everything. If your favorite idea is a hammer, look for colleagues with screwdrivers, wrenches, and tape measures. Be open to ideas from other fields.
>
> —Hans Rosling

Cleaning data is an essential first step in the journey toward creating a data dashboard. Just as an artist meticulously prepares their canvas before creating a work of art, data cleaning serves as a foundational step before building a dashboard. Raw data often contain duplicates, inconsistencies, errors, unexpected blanks, and unneeded data (noise). By removing noise, correcting inaccuracies, standardizing formats, and fixing format issues, we start with a "clean" dataset ready to provide an accurate and reliable dashboard.

When cleaning data, it is important to keep in mind that a combination of data may still have importance. Seemingly inconsequential data that seem unimportant to the story may become important when paired with other information. Power BI, which is discussed later in the textbook, is very adept at combining data in different ways to tell multiple stories easily. So let's review all the things that you need to clean up (with examples).

Step one is always to make a backup copy of the raw data file so you can always revert to the original data file if needed.

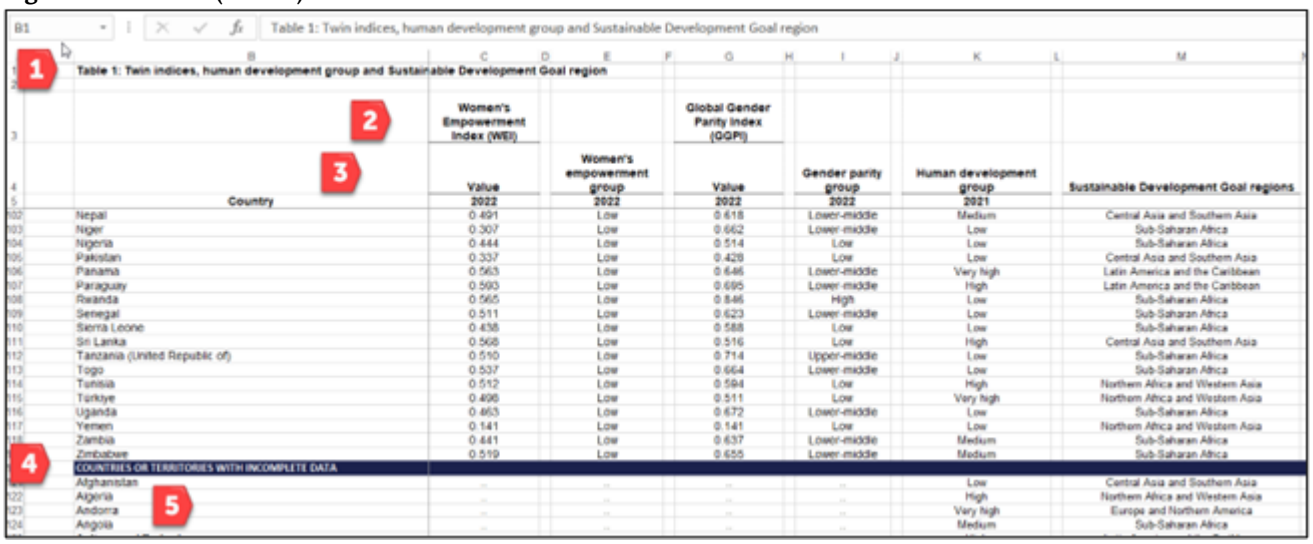
Cleaning Sample #1—Noise (Before)

The United Nations Human Development Report provides an Excel file with twin indices on women's empowerment and

gender equality. However, there is "cleaning" work to do if we want to use this file in any way. Remember, our data needs to be turned into a table before we can start analyzing it. However, we have lots of extra rows of reference materials that would need to be deleted. Follow the notations 1–5 in Figure 4.19 to clean up the "noise."

For notation 1 and notation 2, note rows that need to be removed. The notation for Row 3 indicates a suggestion to revise the heading. For example, you can only have one row of headings. Then in Row 5, we would need to rename the header row. For example, C5 is "2022," but it should really be "Women's Empowerment Index—2022." Notations 4 and 5 show that columns have missing data, so be aware that some countries had incomplete data. As an analyzer, you would want to remove the row with the text pointing this out as well as the countries with incomplete data. Also, please note that there are empty columns like A, D, H, J, and L that need to be removed.

Figure 4.19—Noise (Before)



Look at Figure 4.20 to see the same data after some cleaning was done: columns removed, blank data (countries without data) removed, extra rows removed, and header rows renamed.

Figure 4.20—After Noise Is Cleaned (Only Partial Table Shown)

A82 | Honduras

	Country	WEI-2022	Women's Empowerment Group - 2022	Global Gender Parity Index (GGPI) 2022	Gender Parity group - 202	Human Development group 2022	Sustainable Development Goal regions
81	Guinea	0.400	Low	0.546	Low	Low	Sub-Saharan Africa
82	Honduras	0.544	Low	0.716	Upper-middle	Medium	Latin America and the Caribbean
83	India	0.520	Low	0.560	Low	Medium	Central Asia and Southern Asia
84	Indonesia	0.568	Low	0.652	Lower-middle	High	Eastern Asia and South-Eastern Asia
85	Iran (Islamic Republic of)	0.454	Low	0.393	Low	High	Central Asia and Southern Asia
86	Iraq	0.363	Low	0.486	Low	Medium	Northern Africa and Western Asia
87	Jordan	0.488	Low	0.562	Low	High	Northern Africa and Western Asia
88	Kenya	0.591	Low	0.769	Upper-middle	Medium	Sub-Saharan Africa
89	Lao People's Democratic R	0.582	Low	0.839	High	Medium	Eastern Asia and South-Eastern Asia

If you wish to download this Excel sheet, feel free to visit the United Nations Human Development Report at https://hdr.undp.org/content/paths-equal, or if you prefer, see it as an interactive chart in Datawrapper at https://www.datawrapper.de/_/C1aHL/. If you recall, Datawrapper is one of the top 10 visualization tools shared in the previous chapter.

Cleaning Sample #2—Unneeded Data

Lots of accounting software will provide some default information that may not add any value to the dataset. You will recognize this as an issue because you see duplicate information. In Figure 4.21, the dataset shows every customer with

the same front register, zip code, and country. Create a copy of the sheet in its original format and a copy of the data to clean. In this case, you can delete columns H, I, and J.

Figure 4.21—Remove Columns That Add No Value

H	I	J
Register	ZIP/Postal Code	Country
Front	99999	USA
Front	99999	USA
Front	99999	USA

Cleaning Sample #3—Inconsistencies and Proper Naming Conventions

Inconsistencies happen when someone uses an override on the system. For example, they might type "Beverage" when they meant "Beverages." Remember, the dashboard will see these as two different things, so you would need to standardize these values. Use the Filter option in the data that you have formatted as a table.

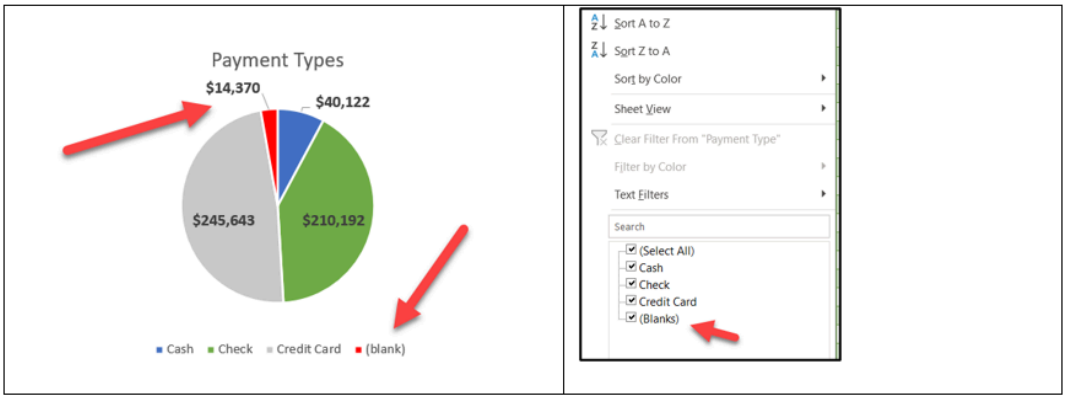
Cleaning Sample #4—Correct Data Types

Sometimes the data type is corrupted or incorrect. For example, a date for an order needs to be formatted as a number. Another example is when three decimal places are shown for sales (and currency is only acceptable at two decimal places). You will recognize it when it happens.

Cleaning Sample #5—Blanks Seen on Charts

If you notice a "blank" category showing up on your charts, that means you need to go back to the data and review that column using a filter. Using the filter for the Payment type shows blanks. It is possible that a salesperson didn't post it in the accounting system, but this would be something to investigate. Figure 4.22 shows blanks.

Figure 4.22—PivotChart Shows Blanks



Source: Screenshot of Excel Interface © Microsoft Corporation. Author Annotations Added

Note that you can sort to decipher which customers, and which salespeople, did not record a correct payment type into the system.

In summary, explore the raw data file for duplicates, inconsistencies, errors, unexpected blanks, and unneeded data (noise).

Dashboard Presentation Rules

Most of us will become so familiar with our well-designed dashboard that we assume everyone is following and understanding the presentation. In reality, our audience will be quite overwhelmed if we bring up our dashboard at the beginning of the presentation. Start with a simple presentation—presenting to your team with the goal of finding insights and helping develop a story.

Presenting and Interacting in a Virtual Team

Remote Team Scenario: Prior to COVID-19, you met your team in a great space that felt like your own. It had a coffee center, and the administrative staff always brought in fresh snacks and arranged lunch. During COVID-19, many employees worked from home—a pattern that continues, although not all employees are working from home full time. In many cases, team meetings are still held remotely. Those on site tend to go to the conference room for the meetings. So there is a mix of those on site and those attending remotely. Assume you need to meet with your team to review the dashboard, do further analysis, and look for insights. How does today's meeting compare with past face-to-face meetings?

The impact of COVID-19 created some challenges related to gender and cultural differences. According to *Mansplaining and Interruptions: Online Meetings Exacerbate Gender Inequalities in the Workplace*, women are "experiencing a unique side effect of coronavirus; their voices being drowned out" (Priore, 2020, para. 1). Mansplaining "describes a man oversimplifying common concepts to women in a degrading or condescending tone . . . as much as six times a week at work . . .' and 'Zoom conferencing' . . . make mansplaining and male conversation domination worse!" (Priore, 2020, para 6). As a team leader, you may not have noticed that men talk more or louder, but you may have noticed that those who are physically in the conference room tend to talk over teammates who are attending remotely, and they tend to have side conversations with those in the conference room.

Assume you are responsible for your virtual team's performance and how they will discuss the insights you want to present to a larger audience; you may want to try some strategies for a more productive and successful virtual team meeting. Besides the gender differences, there are cultural differences to consider. As organizations expand globally, what are the shared practices, beliefs, and expectations that will support successful business practices worldwide?

Remote meetings offer a positive aspect. Most organizations expect teams to be formed based on strength and not by geographical location. In fact, across 90 countries, "89 percent of white-collar workers 'at least occasionally' complete projects in global virtual teams (GVTs)" (Taras et al., 2021). In a study conducted by Taras et al., virtual teams had the best success when team managers considered personal diversity and contextual diversity. **Personal diversity** includes personal characteristics—age, gender, language, skills, and values. **Contextual diversity** refers to the team member's environment of economic development, types of institutions, and political systems. The study showed that personal diversity can negatively affect a team, and yet contextual diversity can positively affect a task and especially aid creativity and problem-solving at an unconventional level (2021).

According to Melissa Lamson (2018), there are three tactics for managing virtual teams. Let's look at those three tactics in light of the Taras et al. study.

Tactic 1: ***Create the right context for your team.*** Context helps teammates see commonality. Make sure they understand the who, what, and why (Lamson, 2018). Does the project require creative and unconventional thinking? If so, form

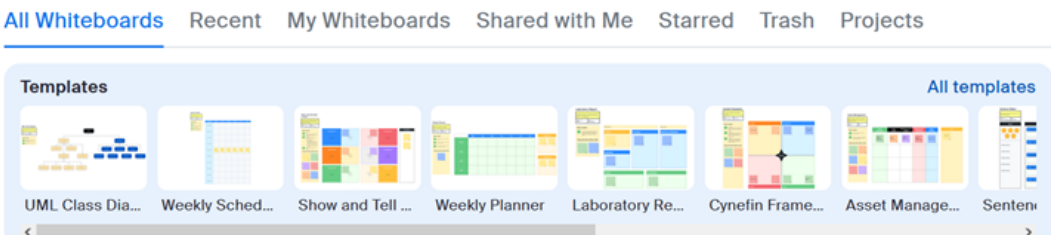
your team with contextual diversity in mind. If the project is more routine and you need efficiency, then form your team around personal diversity.

- **Strategy to create the right context:** Sending the meeting link to the dashboard before the meeting is helpful, especially if you provide some guidance by assigning an element for exploration. Setting clear goals and expectations is beneficial. To analyze and provide insights, this team should be formed with contextual diversity in mind.
- **Strategy to add clarity to context:** Most teams who moved to a virtual meeting space asked for clarity, for a plan, to be listened to, and for the freedom to innovate. A good strategy for clarity is to assign action items and follow up after the meeting. For example, use a simple summary tool like "muddiest point." The muddiest point allows each person to indicate what point is unclear. It may only take 3–5 minutes but can be quite insightful. Everyone should be asked to participate. You won't have all the verbal cues of a face-to-face meeting, but if you sense something is off with one of the team members, take the extra time to reach out and listen.

Tactic 2: ***Build a sense of community within your group.*** "Statistics show that meeting face-to-face during a project will increase productivity by 50 percent" (Lamson, 2018, para. 11). So cameras on! Introduce new members. Consider activities that provide some interaction (like posting insights or phrases to create a word cloud). Follow up after each meeting with a brief status update.

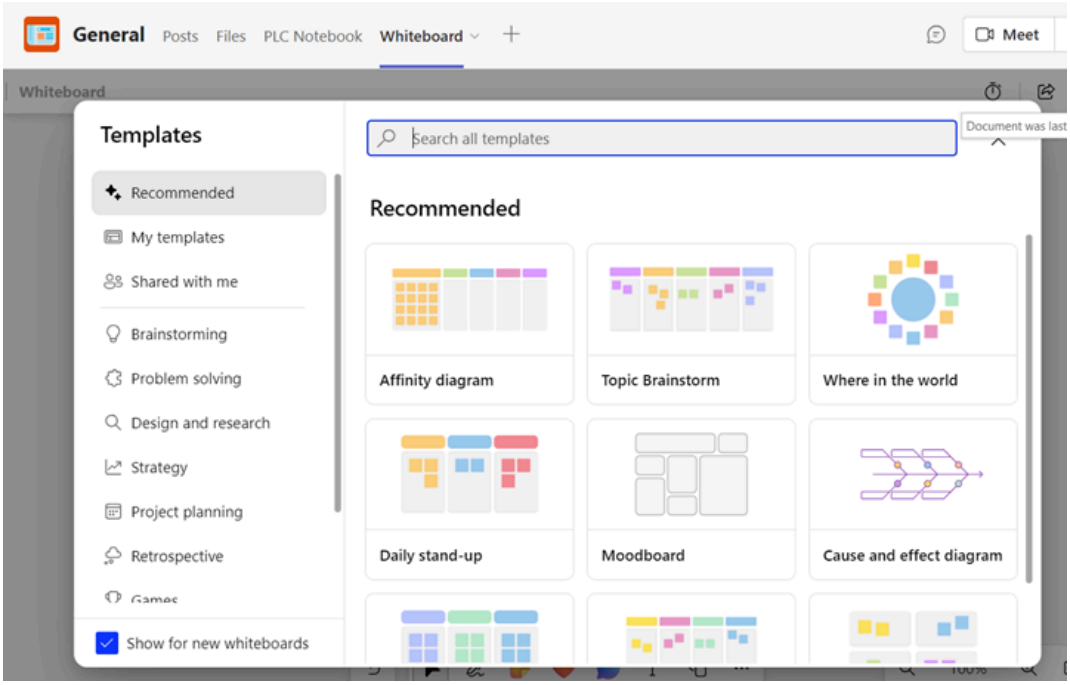
- **Strategy to build community:** Leverage technology to create interactivity and build a sense of community. If your team used a whiteboard to generate ideas, use the whiteboard available in the virtual meeting software. Virtual whiteboards are not just white squares; most of the virtual meetings have a variety of templates as illustrated in Exhibits 4.6–4.7.

Exhibit 4.6—Whiteboards Available in Zoom (2023)



Source: Screenshot of Zoom Interface © Zoom Video Communications, Inc., https://www.zoom.com

Exhibit 4.7—Whiteboards Available in Microsoft Teams



Source: Screenshot of Microsoft Teams Interface © Microsoft Corporation

Microsoft Teams has over 60 templates. You can add "Whiteboard" as a tab for easy access.

Explore additional add-ins for your virtual meeting: Grain, Slack, Miro, and others. **Grain** creates a full transcript of AI-generated notes in a shared workspace. **Slack** sets up a place to consistently communicate with the rest of the team. Although most virtual meeting apps have a whiteboard, **Miro** has very modern templates that make the experience more interesting. **Warmly** is a personalized virtual business card to provide friendly context.

Tactic 3: *Coshare leadership.* This is one of the best strategies to involve team members because it invites buy-in. When placed in a leadership role, your team member feels more responsible for outcomes and ownership of a successful project.

- **Strategy for sharing leadership:** There are various ways to share leadership including, collaborating on a meeting agenda, distributing roles to a member to conduct team rituals or social connection, or asking for a verbal round-robin on decision-making.

Virtual Meeting Space—What's It Like in the Future?

Just as "Google it" has become a verb, one has to wonder what effect the introduction of AI will have on virtual meeting spaces. Zoom and Microsoft Teams already have AI that can assist with meeting notes. But even more astonishing is the real-time translation service for up to 40 spoken languages.

Virtual meetings have been around longer than you might think. In 2005, I had an avatar that I used in my virtual meeting with three other colleagues. Our purpose was to write a conference paper, but the technology was new and quirky, and I never grew tired of telling my colleagues to quit walking into the wall. See Exhibit 4.8 and consider that this technology is over 20 years old!

Exhibit 4.8—A Virtual Meeting Room in 2005 That Used Avatars

Note: Author-created Virtual Meeting Room

This type of meeting room didn't appeal to corporate America in 2005, but *avatars* became a common word, and there always seems to be some company trying to improve avatars so they look more like their human counterparts!

Why show 3D rooms? New technology (or reuse of old technology) will emerge from the growth of telecommuting. Educators talk about the flipped classroom. Karan Mehandru (2019), a frequent contributor for *Forbes*, predicted a flipped workplace model where "physical in-person meetings take place only rarely and as needed" (para. 8). Who knew this prediction would come about so quickly—by 2025, 70% of the workforce would **work remotely five or more days per month**!

Mootup offers 3D virtual rooms. Link to www.mootup.com

How to Design a Winning Presentation to a Large Audience

Presentation content, style, theme, media, and animations should depend on the type of audience. For example, a presentation to a group of young children will have a vastly different mix of components. For a conference, we will work toward designing the best presentation using the following parameters:

1. audience—adult professionals
2. collaborative (team) presentation
3. length of time—20 to 30 minutes
4. need to persuade the audience (may include a call to action)
5. structured with **three goals**: frame the issue with a story, present the challenge, and explain **how to solve the problem**

Knowing your audience is critical for giving an effective presentation. If you don't know your audience, here are some strategies: review past events, research the group you're presenting to, engage in prepresentation conversation, ask event organizers, browse LinkedIn, review social media, and even conduct interactive polling.

Collaborative (team) presentations need to send a clear and consistent message. Every member of the team should be on the same page with the same message and contribute their strength to the storytelling. Although this is an assumption, every member should use consistent fonts, color palettes, and branding, even in the way they dress. Storytelling

should include real-world examples that connect through data visualizations. Collaborative presenters can work well with interactivity if they each know their role. As a team, make sure to use consistent terminology with appropriate data sources/references. It is essential that the team has practiced and rehearsed and can present within the time frame. And always have a backup plan. Make sure to gather feedback from the audience and provide handouts to support the data insights.

Length of time should be determined by the need to convey information clearly. It's important to provide context and key insights. Keep in mind—don't overwhelm the audience with unnecessary details. If your normal presentation is 20 minutes, use the extra time for questions and answers.

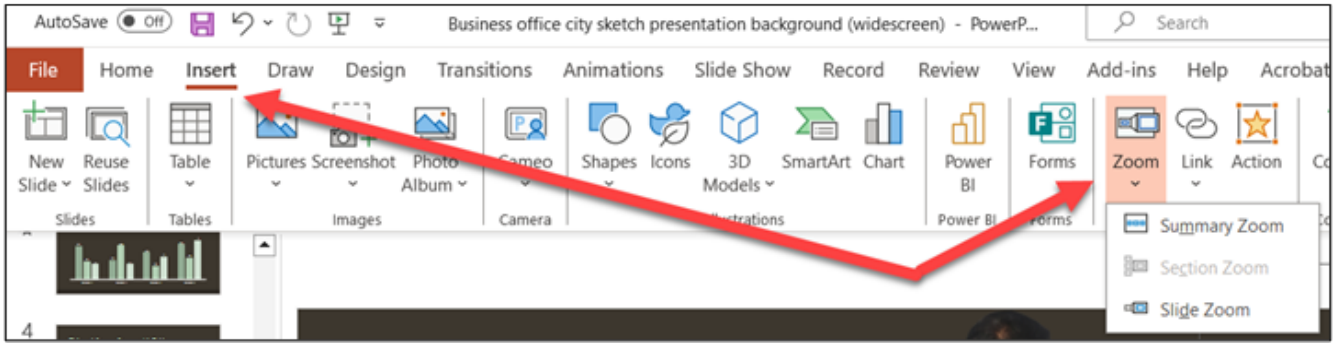
Persuading the audience and including a call to action comes after knowing your audience. In order to persuade and have them answer your call to action, your team needs to know the audience's needs, desires, concerns, and motivations. Your message needs to align with their interests. Every detail counts. Choose words that evoke emotions. Create a sense of urgency, and appeal to emotions. And stay credible by providing evidence to back up your claim. **Three primary goals** serve as cornerstones for effective communication. Begin with a story to capture the audience's attention and humanize the data, making them relatable and engaging. The story should set the stage and offer context and emotional resonance that draws the audience into the narrative. Following this, the presentation of the challenge is essential—it's the moment when data are introduced to highlight the problem or an opportunity at hand. The data become the protagonists, shedding light on the issue with clarity and precision. Finally, explain how to solve the problem to bridge the beginning to the end. The data will emerge as a powerful tool for decision-making and, even better, become the actionable insights that move the audience toward an informed solution. These three goals woven together inspire meaningful action and change. The audience should answer the call.

Some Technology to Help With Presentations

Note: Screenshots of PowerPoint interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

As early as 2016, the Zoom feature was available in PowerPoint. Essentially, Zoom allows flexibility in the order you present slides and ways to anchor to a summary slide. If you don't see this feature and you present a lot, you might invest in a newer version of the software. You can determine if you have this Zoom feature by going to **Insert** in the main menu, as illustrated in Figure 4.23.

Figure 4.23—The Zoom Feature in PowerPoint



Zoom features are a way to organize your PowerPoint. Have you ever been in the audience and asked a question and the presenter spent several minutes finding the slide you had a question about? Well, this feature will help with that and a lot more.

Currently, there are three Zoom options:

1. **Summary Zoom:** Summary Zoom populates a new slide with thumbnails. This works well when you have several topics with a few slides that relate to a topic. This option will add a thumbnail for the first slide in each section.

Perhaps you have not used sections. Sections are found in the Home tab. For both Summary Zoom and Section Zoom, you need sections *first*.

2. **Section Zoom:** Section Zoom adds links to sections on the current slide. You just click the thumbnail to jump to that section. This option will not work if your presentation does not have sections.
3. **Slide Zoom:** Slide Zoom creates a link to any slide on the current slide. This is a feature that is better understood when you see it happen, but the following scenario might help you understand how this works. If you have ever used Prezi, you might see some similarities.

When might you use Slide Zoom? Look at a scenario that fits Slide Zoom and see if you can relate!

Slide Zoom Scenario

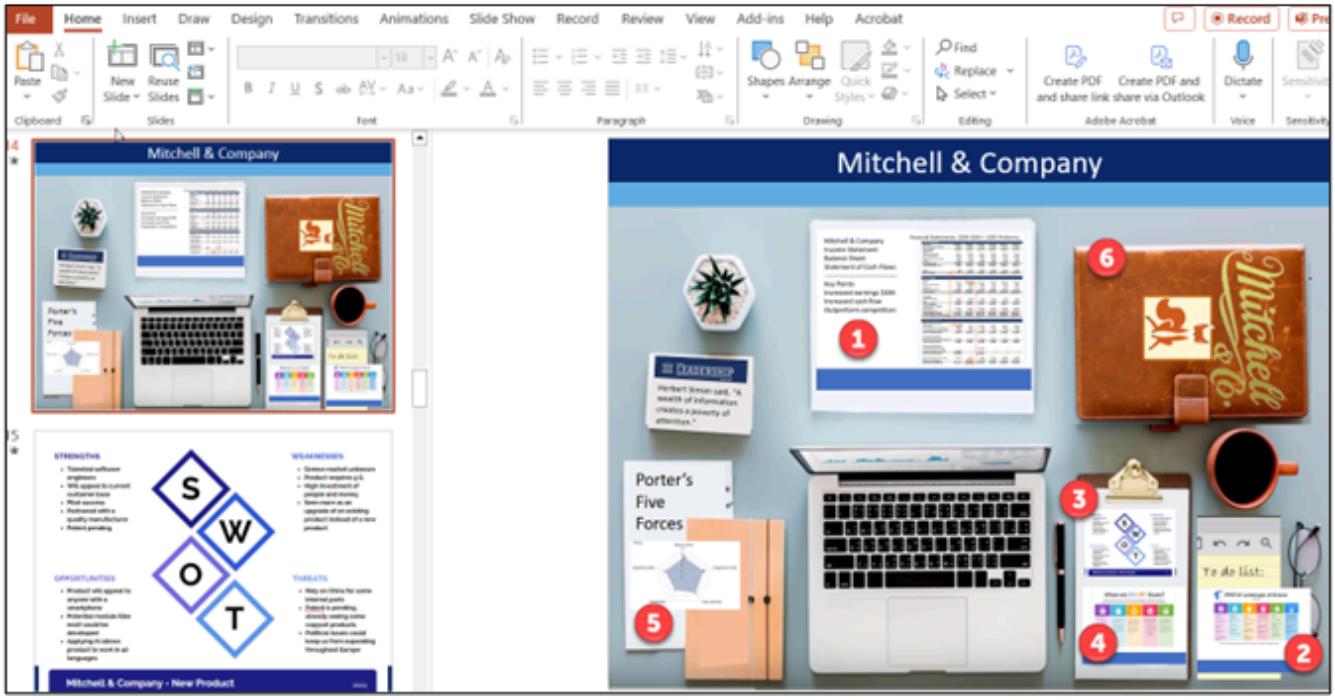
The product development team at Mitchell & Company has been asked by their director to present the estimated revenue stream for a new software product. The product works in conjunction with smartphones and requires 5G networks. They are working with several countries in Europe and have hired engineers from Greece to test the pilot launch, which was highly successful. The first preorder sales came from Greece and Germany. The team has previous experience with this director, and they know she will ask additional questions beyond the revenue stream predictions, so they always prepare every aspect they can.

The team has produced five components to present if needed. Each of these components shows up on an image of a desk. Think of the desk as a **landing page** for all the information. From the landing page, clicking on an image will zoom to a new slide, and clicking again takes you back to the landing page. The following key corresponds to images within the landing page, which can be explored visually in Figure 4.24.

1. Estimated financial section (which includes the revenue stream predictions). This is the only section requested by the director; but you know other questions will arise if past meetings are any indication. Once you click the financials, it includes charts of pro-forma revenue, animated pilot testing charts.
2. PESTLE for Greece with key financial points (this is on the clipboard image).
3. SWOT to show strengths, weaknesses, opportunities, and threats.
4. Example social media marketing materials using the SMART model.
5. Porter's Five Forces analysis.
6. A complete business plan (the leather case).

The team created one slide with images that resemble what you might see on a desk. Consider this the "landing page" for navigation. As the team assembled the information for the PowerPoint, they considered what they wanted to link from this navigation page. (Figure 4.24 is an edit section; the directions show navigation when presenting.)

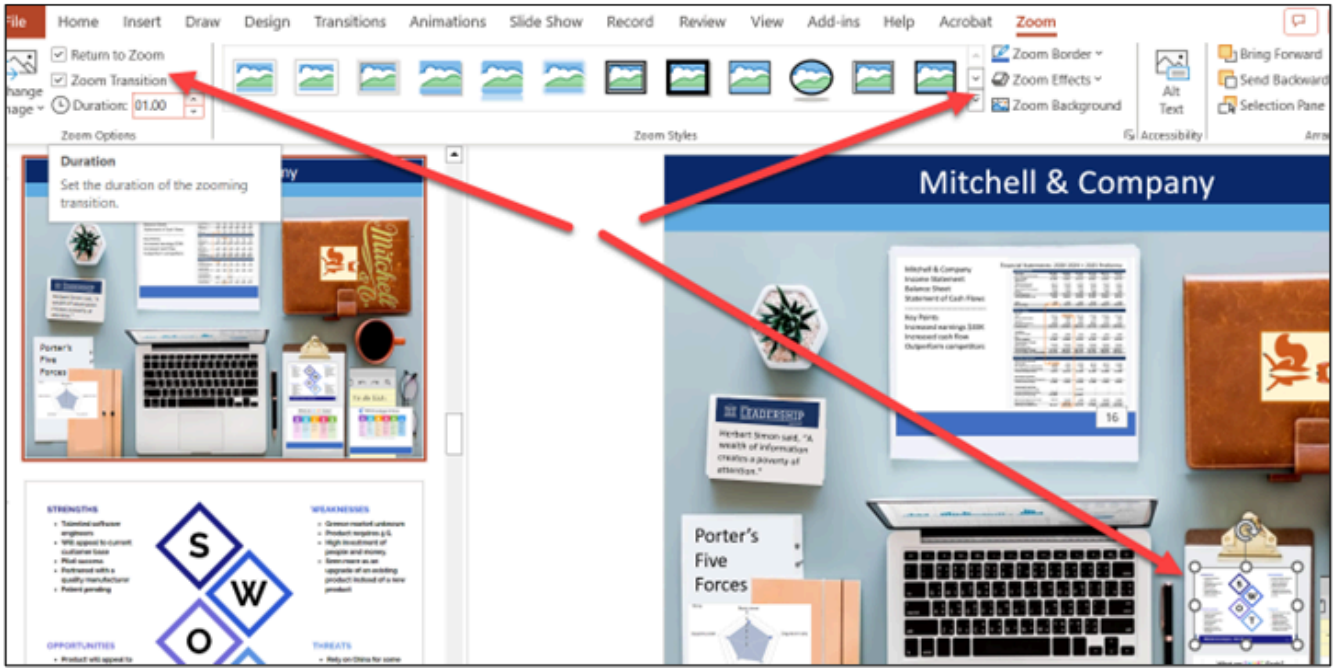
Figure 4.24—Using Zoom in PowerPoint to Communicate More Effectively



So if the director wanted to only look at the revenue stream predictions, that would be fine. But if the director asked to see their business plan, PESTLE, SWOT, or Porter's Five Forces analysis, it would be easy to navigate from the main page. The director sees a zoomed-in section by clicking on the financial image, and a second click takes the team back to the landing page.

The arrow shown from the edit mode of Zoom is setting up the Zoom effect. Therefore, if the presenter clicks on the SWOT on the landing page, the presentation will zoom to the actual SWOT slide that shows full size to the director. As shown in Figure 4.25, check the box **return to Zoom**, and the presenter will be taken back to the landing page (the desk).

Figure 4.25—Showing How to Return to the Zoom Landing Page



I think the more you work with sections and zooming, the more you will like it.

The video shows some very practical techniques to animate and show charts in the best light for data storytelling.

Tracy, S. (2023, Feb 27). *Animating Charts in PowerPoint for Better Data Storytelling.* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-7

The Report That Accompanies the Presentation

Before we get into the details, revisit a critical thinking model, Elements of Thought. This model contains eight components that lend well to designing a report to accompany your presentation:

1. question at issue
2. information
3. interpretation and inference
4. concepts
5. assumptions
6. implications and consequences
7. point of view
8. purpose

Foundation for Critical Thinking. (2007). Online Model for learning the Elements and Standards of Critical Thinking. Interactive Model Location: https://www.criticalthinking.org/ctmodel/logic-model1.htm

Report Templates in Venngage and Canva

If you are unsure of what a report might look like, make sure to visit Venngage. Venngage has over 300 report templates, and Canva lists over 2,200 report templates.

4.4 Exercise 1: Understand Clean Data

Learning Objective #2—Understand how to clean data

Cloudingo is a company that was founded on providing a service to clean data. On their home page, they state, "Find out how customers leverage Cloudingo to clean their Salesforce data and reach their goals." There are nine companies that share their story with the public. The link to this website is https://cloudingo.com/case-studies/#

Use these instructions, and answer the questions that follow:

- Read two of the public stories.
- Discuss the two stories.
- What type of issues did the companies face? Exactly what led to the need to hire a company to help them clean their data?
- What software generated the "unclean" data?
- Which other companies clean data? (This may be listed under data quality solutions.)
- What is the ultimate outcome for the two companies?
- How can AI be used to help with data quality solutions? (Hint: Ask ChatGPT!)
- Share your experiences with poor-quality data at your own organization.

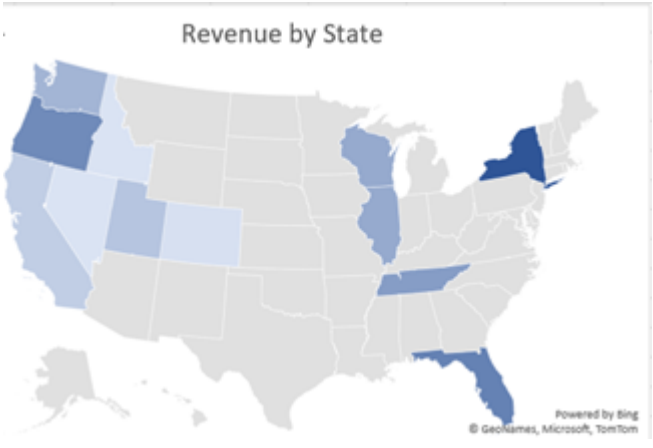
4.5 Advanced Excel Dashboard and Analyzing Insights

> A wealth of information creates a poverty of attention.
> —Herbert A. Simon, economist and political scientist

This chapter has already introduced you to creating a simple dashboard with a slicer. This section will introduce more of the basic building blocks of a dashboard with some advanced techniques in PivotTables, PivotCharts, and simple formulas to add value to the data and provide deeper insights. This dataset is provided to you with the Chapter 4 Excel files, and you will use the same dataset when you learn Power BI in a later chapter. This scenario may be familiar since it was introduced in the "What Do You Think?" section of this chapter!

XCaliber Food Distribution Company

Figure 4.26—XCaliber Sales by State



Note: Author Illustration (2025)

XCaliber Food Distribution was established late in 2023, although the business started in 2024. The company distributes

food items to 12 states. It has nine salespeople, though Naomi Shopker was an intern and only worked in June and July. In 2024, the company sold $510,326 worth of products.

XCaliber Food Distribution Company is located in Indianapolis, Indiana. The location is inconsequential since no product is housed at their location. XCaliber Foods fills a niche of distributing excess products to small grocery stores. All salespeople work from home and use a tech-powered distribution system. The manufacturing companies, farmers, and others post products as available, and XCaliber Foods salespeople arrange drop-shipping to their customers. One of the salespeople calls it a matchmaking game, and most agree. Salespeople work on commission, and the system logs the number of employee hours as well as sales in the system. Although the sales were good for the first year, the owner wants you to work up a dashboard and provide insights for every business aspect (people, categories of product, customer concentration, and payment). The owner of XCaliber asked for help from Matt, an employee who built the company's website and helped customize the tech-powered distribution system. The owner sent Matt an email with a list of concerns and wants Matt to provide some insight. The email list is provided in the "What Do You Think?" section at the beginning of this chapter. It's repeated here for your convenience.

Matt reviewed the email and made notes. Here is the list:

1. I want to know how well my salespeople are doing. Which salespeople are selling the most; in what city, state, and region; and what are they selling? Are there two or three salespeople who could conduct the training (with pay)?
2. Are there products that should be dropped?
3. I want to know if using the summer intern in June and July was worth the cost (about $4,000).
4. Is every salesperson collecting from their customer by check, cash, or credit?
5. What is the range of invoices by customer, and who are our best customers? Are there opportunities for upselling?
6. Are we shipping out within the same day on a consistent basis?
7. Do we have regional overlap? Are two salespeople selling to the same customer?
8. I want to increase revenue to $60,000/month in 2025. Can you do some sort of analysis to see the best way to reach this goal—perhaps using a gap analysis or something like that?
9. I want to be able to ask a question and get the answer instantaneously. I think I heard it is called a dashboard. Can you set up a dashboard that allows me to analyze the data right along with you?
10. What do you think a survey of our customers will tell us?

In addition, the owner conducted a survey of the grocers (all 15 customers) to see if they are happy with XCaliber Food Distribution's services. More about the survey results will be shared later.

Dataset: "Ch 4—Original Dataset—XCaliber Foods with delivery time."

Format: Formatted as a table. The table is named **XCaliber_Foods** and ranges from A1: W400. Use this file to complete all steps.

Dataset: "Ch 4—XCaliber Customer Satisfaction Survey Form" (this file has been updated to include green, red, and yellow icons).

Step 1: Make a Backup of the Raw Data

- This should always be your first step when working with any dataset.

Step 2: Get to Know the Data

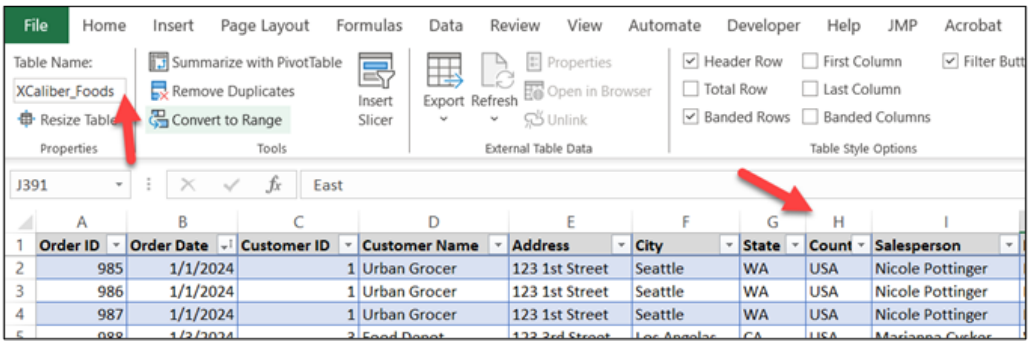
- How many customers?

- How many salespeople?
- To how many cities does XCaliber distribute food? How many states?
- How many payment types and what are they? What do you think of a blank payment type?
- How many products?
- Filter on the product called Blank. What product do you think it should be? And what do you base this on?
- What range do you see in the unit price?
- What is the range for the quantity?
- What is the range for revenue?
- What is the range for shipping fees?
- How many countries?
- How would you go about checking to see if orders are shipped the same day?

Step 3: Clean the Data

Note: Screenshots of Excel interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

- **Explore:** Are there any categories that do not add value?
- **Answer:** Yes, Column H has **USA** for all 399 entries.



	A	B	C	D	E	F	G	H	I
1	Order ID	Order Date	Customer ID	Customer Name	Address	City	State	Count	Salesperson
2	985	1/1/2024	1	Urban Grocer	123 1st Street	Seattle	WA	USA	Nicole Pottinger
3	986	1/1/2024	1	Urban Grocer	123 1st Street	Seattle	WA	USA	Nicole Pottinger
4	987	1/1/2024	1	Urban Grocer	123 1st Street	Seattle	WA	USA	Nicole Pottinger

Figure 4.27—Exploring the Table

- **Explore:** Are there blanks in the Product name?
- **Answer:** Yes, the files show blanks under the filter of Product name. Sort for blanks on product name. Then add "Green Tea" to the product name that has blanks. Check to see if the blanks are gone.
- **Explore:** Are there blanks in the payment types?
- **Answer:** Yes, however these should not be modified; the owner may want to investigate them to make sure payment was made. It is possible the customer did not pay for the delivery!

Step 4: Add a Sales Trend Graph With a Trend Line to the Dashboard

a. **Click** within the data field (I clicked on J20).
b. Click **Insert**, then **PivotChart**, then **PivotChart & PivotTable** (see Figure 4.28).

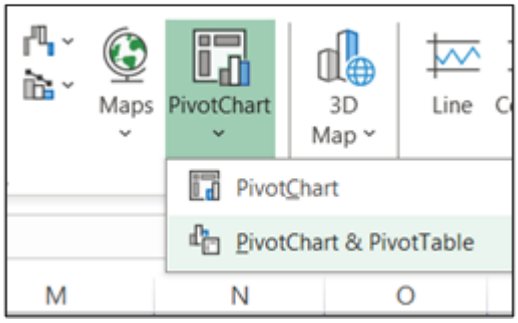


Figure 4.28—Menu: PivotChart

c. Choose a New Worksheet and select **OK**.

d. In the PivotChart Fields, **click Order Date** (it should automatically organize the order date by months).

e. **Click Revenue** (Revenue should be Sum of Revenue). The three components should look like the following. We have work to do before it is acceptable (see Figure 4.29).

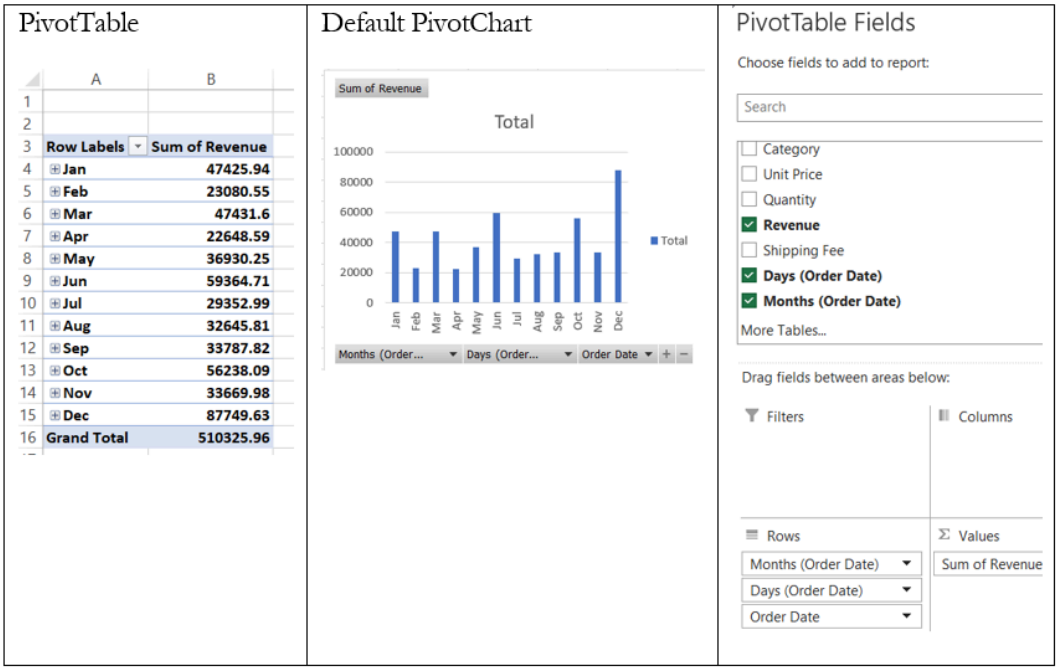


Figure 4.29—Create a PivotTable

f. **Right-click** in Grand Total in the PivotTable (B16), then choose **Value Field Settings**, then click **Number Format**, select **Custom** ($0,"k"), and click **OK** (see Figure 4.30). Now the PivotTable shows all values with the "k," so January shows $47k, February shows $23k, and so on.

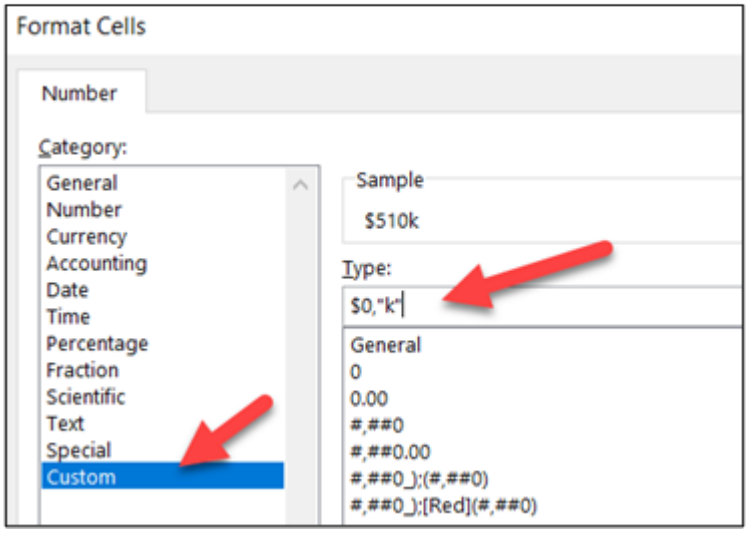


Figure 4.30—Customize Format

g. Next, select the PivotChart, then click **Design** in the top menu, **Change Chart Type**, and choose **Line**, then **OK**.

h. Click in the chart, and on the **plus**, check the **Data Labels**, **uncheck the Gridlines** and **Legend**, and add a **Trendline** by checking the box. In the chart title, type "2024 XCaliber Food Distribution Sales." Feel free to increase the font size. After adding the trendline, you may want to move the amounts that are below the trendline. Just click on them and move them and drag.

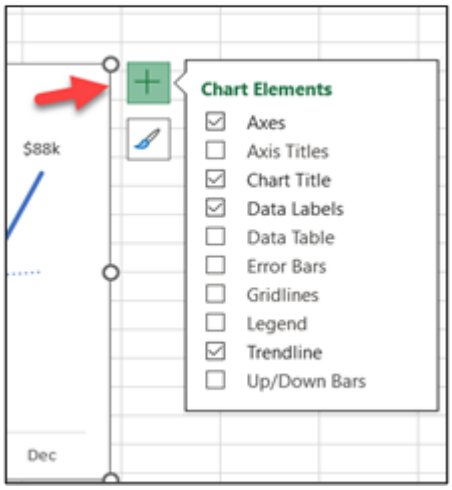


Figure 4.31—Customize the Chart

i. Next, let's get rid of all the field buttons. **Click** in the chart, and then **PivotChartAnalyze**. In the Field Buttons drop-down menu, choose **Hide All**.

j. Other items to consider: The default color is blue. When you build a dashboard, you want consistency with colors, fonts, and format of the charts. Other items include (1) change the trendline so it is more of a dash, (2) increase the font size of the data labels to 10 points, increase y-axis to 10 points, and (3) increase the x-axis to 10 points and bold. This dashboard will be in blue tones (see Figure 4.32).

k. Name the tab "Trend Line."

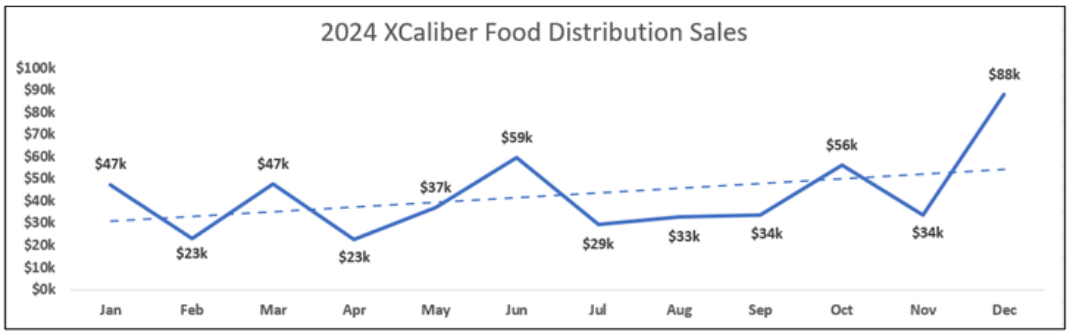


Figure 4.32—Trend Line Graph Ready for Dashboard

Now let's consider the next item that we want on the dashboard, salespeople.

Step 5: Add a Clustered Bar Chart for Salesperson, Sorted From Largest to Smallest

a. **Copy** the PivotTable to a new worksheet since the dollar amount is already formatted.

b. **Click** in the PivotTable and in the PivotChart Fields, put Salesperson in the rows and Sum of Revenue in the Values.

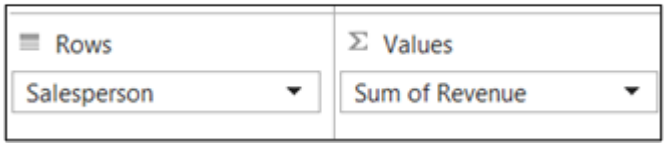


Figure 4.33—PivotChart Field

c. **Click** in the PivotTable, click Insert, **PivotChart**, and **choose** a clustered bar chart, and **OK**. The default chart needs work, but first click back in the PivotTable, make sure you are on a cell in the Sum of Revenue column, **right-click**, and sort from **largest to smallest** so the best selling salesperson is on top.

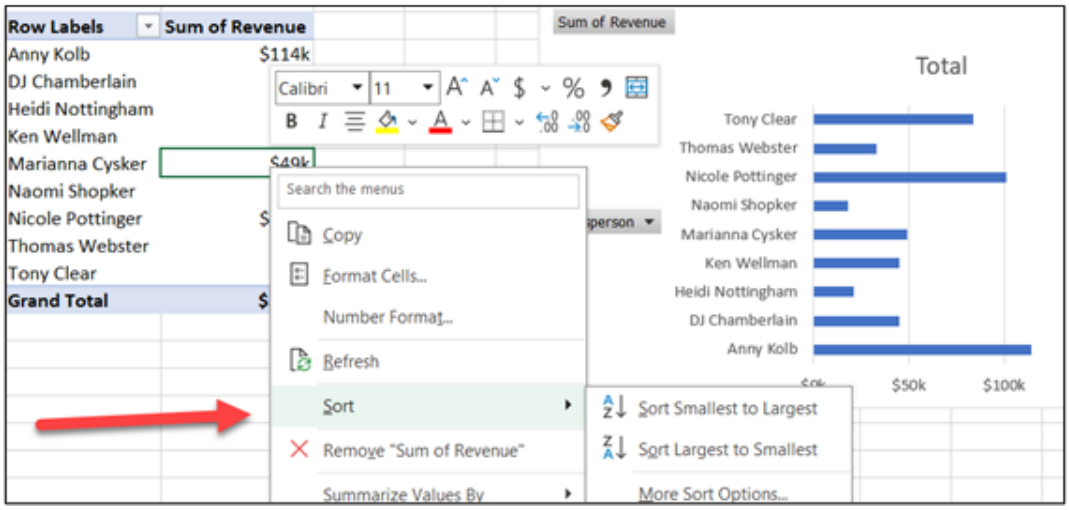


Figure 4.34—Sort From Smallest to Largest

d. The default chart has a legend we do not need. So **remove** the legend and gridlines, **widen** the columns, **check**

the box, show data labels at the end, and **remove** the field buttons. Refer to the directions for Figure 4.29 to help. Want to have wider columns? Use the gap adjustment found in the Format Chart area. **Rename** the tab of the worksheet "Salespeople."

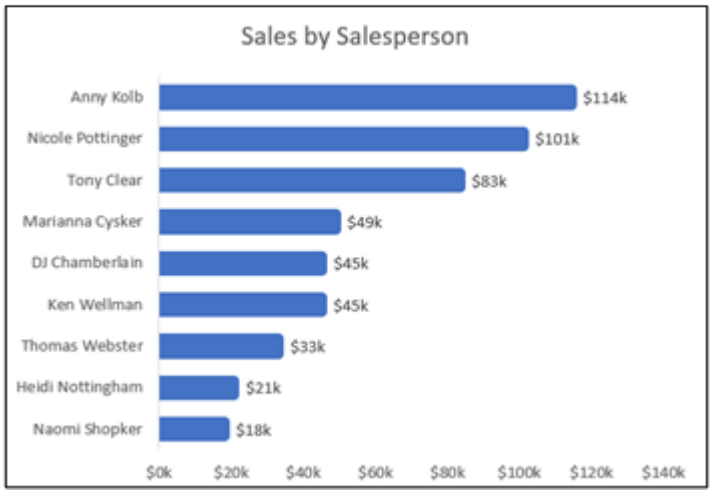


Figure 4.35—Clustered Bar Column for Sales by Salesperson

Step 6: Add Number of Days for Shipping

One of the goals mentioned by the owner was to ship out the product on the same day it was ordered. There are many ways you can approach this, but the easiest is to add to the table "XCaliber_Foods."

a. **Open** the data file and **select** an empty cell at the right of the column named "Shipping Fee." This should be Column W in Row 1.

b. **Type** "Order-to-Ship" (this represents the days it takes between order and shipping to the customer). If you cleaned the Excel sheet properly, you should be in Column W. As soon as you enter the column heading, you will see the banding that indicates you have added to the table.

c. In Column W and Row 2, type =J2-B2 and select **enter**. Essentially you are taking the shipping date minus the order date. You will see 3 show up; **copy** this formula all the way down to Row 400. One thing you will notice: XCaliber Foods is not shipping goods on the same day the order is placed!

T	U	V	W
antity	Revenue	Shipping Fee	Order to Ship
42	$756.00	$75.60	3
58	$2,668.00	$269.47	3
67	$267.33	$20.03	3
91	$928.20	$92.21	2

Figure 4.36—Adding a Column to Calculate Shipping Time

d. You may want to "refresh all"—to do this, go to Data on the ribbon in Excel, and select the **Refresh All** button. This is just good practice!

e. Create a PivotTable with Average of Order-to-Ship in days (you will notice the average of all salespeople is 2.8 with a range of 2.3 to 3.9). Feel free to create a clearer header. A good title is "Average Days Order-to-Ship."

3	Row Labels	Average Days Order-to-Ship
4	Tony Clear	2.3
5	Thomas Webster	2.3
6	DJ Chamberlain	2.5
7	Marianna Cysker	2.6
8	Ken Wellman	2.7
9	Anny Kolb	2.9
10	Heidi Nottingham	3.2
11	Nicole Pottinger	3.2
12	Naomi Shopker	3.9
13	**Grand Total**	**2.8**

Figure 4.37—PivotTable: Average Days Order-to-Ship

Clearly, the salespeople are not adhering to the goal of same-day shipping. You may want to create another PivotTable so you can see the depth of the problem. Copy the PivotTable you created in part d down to Row 17 on the same sheet. Set up your PivotChart Fields like the ones you see in Figure 4.38.

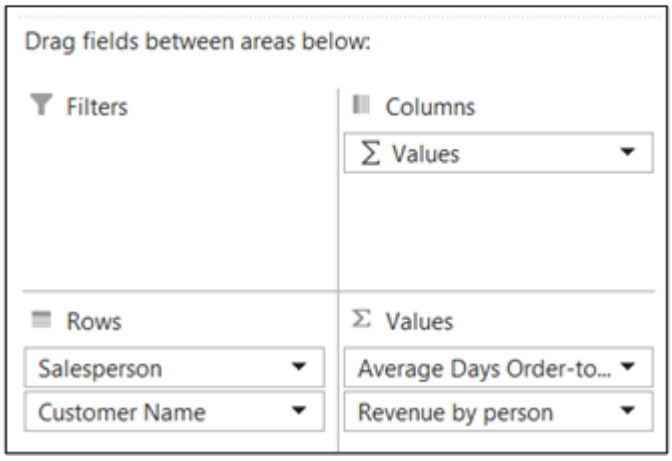


Figure 4.38—PivotChart Fields for Average Days Order-to-Ship Detail by Salesperson

17	Row Labels	Average Days Order-to-Ship	Revenue by person
18	**Tony Clear**	**2.3**	**$83,492**
19	Neighborhood Grocers	2.3	$83,492
20	**Thomas Webster**	**2.3**	**$33,167**
21	Southern Foods	2.3	$33,167
22	**DJ Chamberlain**	**2.5**	**$45,176**
23	Family Fare Supermarket	2.6	$13,521
24	Green Leaf Market	2.5	$31,655
25	**Marianna Cysker**	**2.6**	**$48,912**
26	Food Depot	2.9	$29,186
27	Fresh Choice Market	1.8	$18,403
28	Harvest Foods	2.0	$1,323
29	**Ken Wellman**	**2.7**	**$45,087**
30	Sunrise Market	2.7	$45,087
31	**Anny Kolb**	**2.9**	**$114,389**
32	Friendly Foods	2.8	$51,041
33	Quick Stop Grocery	3.5	$23,396
34	Sunny Market	2.6	$39,951
35	**Heidi Nottingham**	**3.2**	**$20,847**
36	Corner Market	3.2	$20,847
37	**Nicole Pottinger**	**3.2**	**$101,150**
38	Gourmet Grocers	3.6	$16,158
39	Savory Superstore	2.3	$49,368
40	Urban Grocer	4.3	$35,624
41	**Naomi Shopker**	**3.9**	**$18,106**
42	Gourmet Grocers	5.0	$3,550
43	Savory Superstore	2.3	$10,005
44	Urban Grocer	5.7	$4,551
45	**Grand Total**	**2.8**	**$510,326**

Exhibit 4.9—PivotTable Result of Average Days Order-to-Ship by Salesperson

f. What insights would you want to add to the story? Remember, Naomi was an intern in June and July. Also, these are averages. If you go back to the data what is the maximum number of days between the order date and the ship date?

Surprising, right? The data shown here in this exhibit would work well as a combo chart.

g. Name the tab "Order-to-Ship" We may come back to this information to create a graph for the dashboard.

Step 7: Add a Bar Chart Comparing the Size of Invoices

One of the features of selling is to upsell or persuade a customer to buy something additional. A review of the invoices will give an indication of the normal invoice amount. When you use the filter on the data, you will notice lots of transactions that show less than $500 in sales. While a customer is already purchasing from you, why not try upselling to increase the sales?

a. Click into your data file and insert a PivotTable.

b. In the PivotChart Fields, **drag Revenue** to Row and drag **Revenue** to **Values** as **Count of Revenue**.

c. In the PivotTable, **right–click** in the row label and **select grouping**. Start at **zero**, end at **3000** by **500**, then select **OK** as illustrated in Figure 4.39. You can try different groupings to see the main invoice patterns. Remember, there are 399 rows of data.

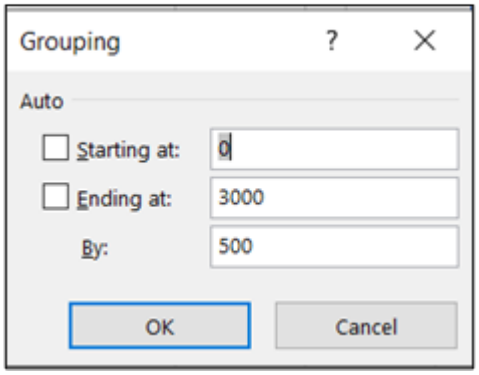


Figure 4.39—Grouping Invoices

d. Create a bar chart, remove the legend, add a chart title, add a data label, and reduce the gap between columns. When you get done it should look similar to Exhibit 4.10. As you review the chart, note that you have 117 invoices with sales less than $500.

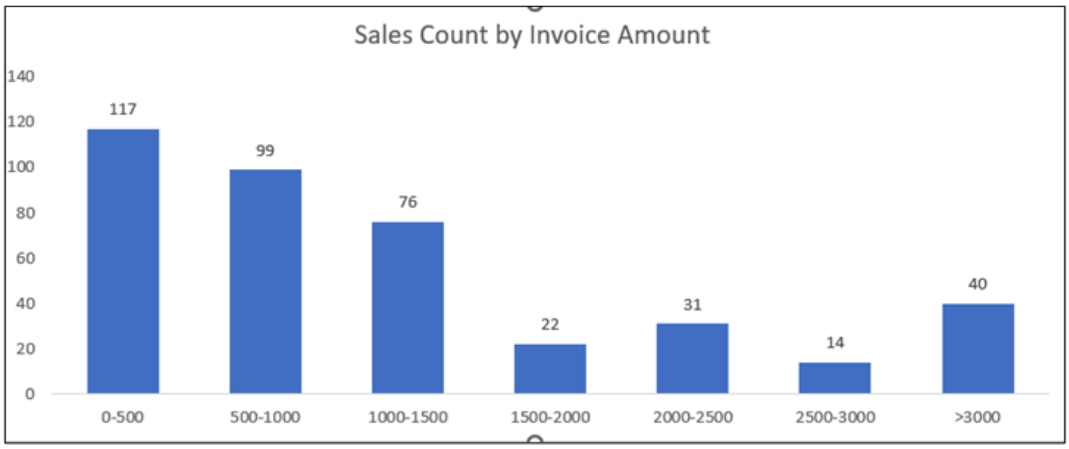


Exhibit 4.10—Bar Chart With Groupings Into Bins

e. For additional insights, add a slicer (salesperson) to see what salesperson is selling at a higher invoice amount. What products are bought in larger quantities?

f. Name the tab on the worksheet "By Invoice"

Step 8: Add a Bar Chart for Top Five Customers

In 2024, XCaliber Foods sold to 15 customers ranging from a high of $83,492 sold to Neighborhood Grocers to a low of $1,323 sold to Harvest Foods. Four of the salespeople sell to one customer (Tony Clear sells $83,492 to his only customer, Neighborhood Grocers).

a. Create a PivotTable with Customer Name in rows and Sum of Revenue in values.

b. In the PivotTable, click on the drop-down arrow in the Row Labels.

c. Look for Value Filters and choose the Top 5. It should look like Figure 4.40.

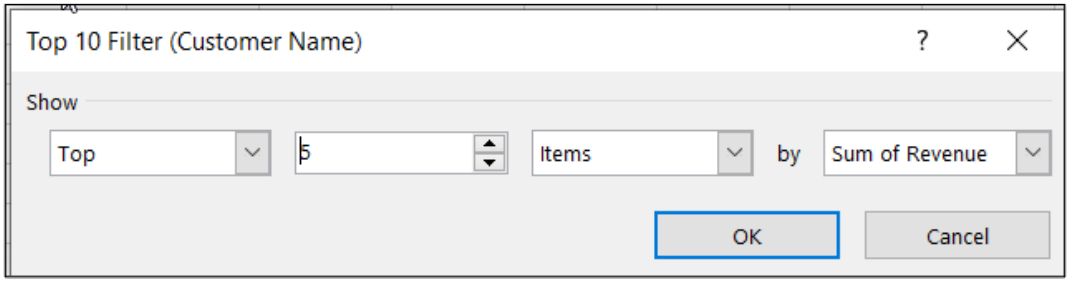


Figure 4.40—Top 5 Filter by Customer Name

d. Next, create the chart, add data labels, remove the legend, get rid of the x-axis information, add a chart title, and lessen the gap between columns. It should look like Exhibit 4.11.

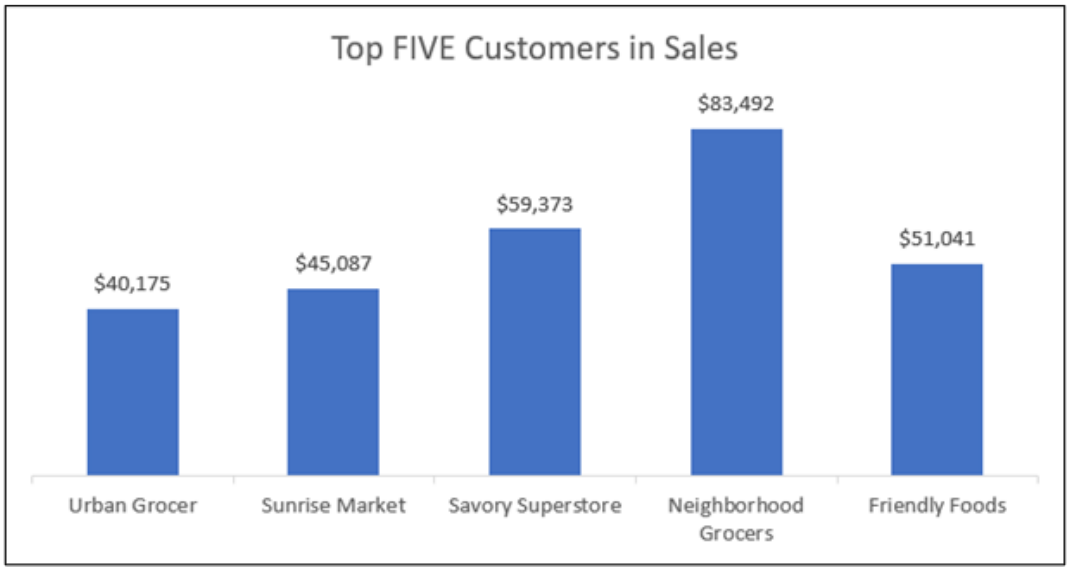


Exhibit 4.11—Clustered Column With Top 5 Customers

e. Name the worksheet tab "Top 5 Customers"

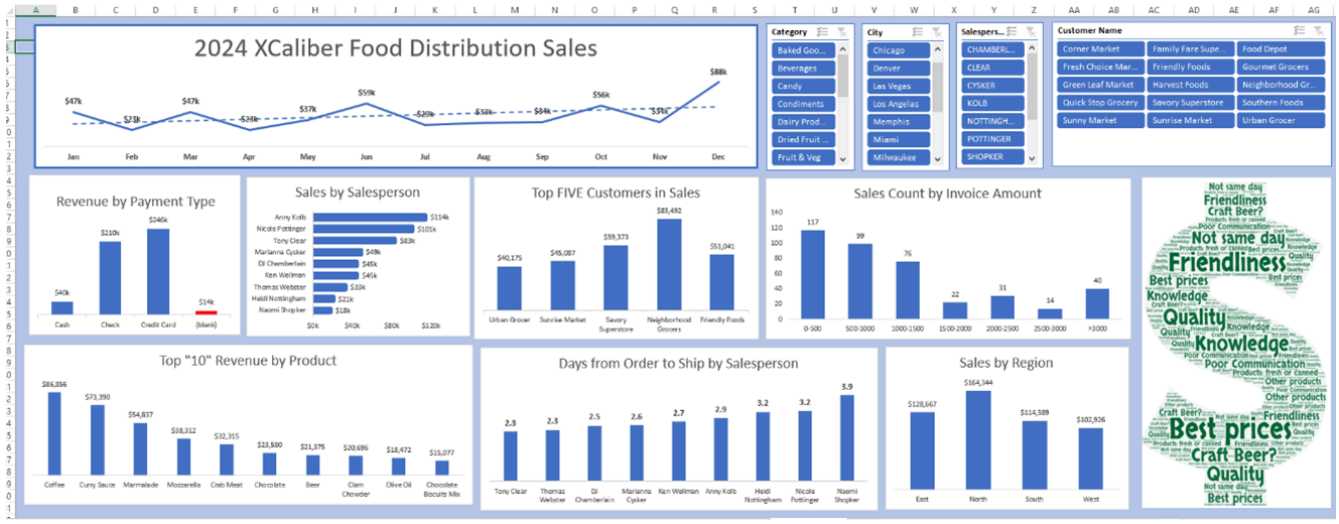
Other potential charts that you should be able to complete if you mastered the Campus Ticket Sale dashboard include Sales by Region, Revenue by Categories, Revenue by Payment Type, and Top 10 Revenue by Product. It depends on what you want to share as insight as to what you have on the dashboard. And remember as you build a dashboard, **every slicer must be connected to every PivotChart**. Exhibit 4.12 shows one example of this dashboard that is **too busy**.

There are several ways you can tell a dashboard is too busy—for example,

- if your audience would feel overwhelmed,
- if too many tool tips pop up,
- if you need to explain why you need a secondary axis, and/or
- if you include confusing labels.

The owner wanted every insight, but perhaps this owner needs to see the important causes and effects. Or perhaps the answer is two dashboards. The "too busy" dashboard includes survey data as a word cloud, but will the owner notice the "Not same day" phrase? The survey does show some interesting trends, but there may be a better way to show it (perhaps as its own dashboard).

Exhibit 4.12—Example of Dashboard That Is Too Busy



Step 9: Review and Revise the Dashboard

- The first step is to set the **purpose** for the dashboard(s).
- Organize the questions by salespeople, product, customer, process (like payment methods), and future goals. These are the questions listed in Matt's email from the owner of XCaliber Food Distribution Company:
    - salespeople: Questions 1, 3, 7, and 10—Survey
    - product: Questions 2
    - customer: Questions 5
    - process: Questions 4, 6, and 10—Survey
    - future: Question 8

Use this file to see if you have done the steps correctly. Remember, the Dashboard provided here is too busy. How would you revise it? (See "Ch 4—XCaliber_Foods_2024_Dataset_Solution.")

Step 10: Gap Analysis

Stakeholders want to know the "why" behind not reaching goals or targets. Most companies will want a full report outlining what happened. A gap analysis is the best approach to answering all the questions that bubble to the surface when goals aren't reached.

What Is a Gap Analysis?

A **gap analysis** measures actual results against expected results and answers the question "Why did we miss our expected estimate?" There are several reasons a company misses its target, including missing strategies, poor processes, inconsistent or out-of-date technologies, absent employee skills, poor management/leadership, and faulty risk assessment.

When the owner was setting up XCaliber Food Distribution Company in 2023, he estimated that the company would

have $50,000 in sales per month. XCaliber Foods sold $510k in products, almost $90k short of his estimate. Was his analysis of the market share incorrect? How would you explain this shortfall? A gap analysis can be market driven.

Here are some approaches to a market gap analysis:

- Investigate geographic sales. For example, XCaliber sells products in only 12 states but could ultimately sell to anyone in the lower 48 states.
- Investigate product base. For example, the survey indicates that several grocers would purchase beer, but salespeople didn't offer it.
- Investigate customer needs. For example, the customer survey indicates that several grocers want the merchandise as promised, and not several days after the order date.
- Investigate customer satisfaction. A question on the XCaliber Foods customer survey asked if they would be willing to recommend them to another grocer. Why not capitalize on that?

The owner of XCaliber Foods provided a list of questions that can be organized by salespeople, product, customer, process (like payment methods), and future goals.

In general, performing a gap analysis at the business level has these basic steps:

Step 1—Identify the Goals to Be Accomplished and the Areas to Be Analyzed

The owner may want you to figure out why the targets have not been met, and more importantly, a recommendation on how to meet the target.

Step 2—Analyze the Current State

Include the market gap analysis here because XCaliber Food Distribution Company is new to this market. What causes contributed to missing the target? Were workers trained well? Did the late delivery of products contribute to poor produce and loss of sales? Did salespeople sell products consistently?

Step 3—Establish the Goal and Future Goal

The owner had expected $50,000 sales revenue each month in 2024. Now in 2025, he expects $60,000 per month in revenue.

Step 4—Compare the Current State to the Goal (or Ideal State)

What is the difference? Do you see any patterns? What processes contributed to the gap? XCaliber Foods expected to hire nine salespeople, but they didn't have nine hired as of January 1, 2024.

Step 5—Describe the Gap and Show the Differences in Percentages

What recommendations do you have to make sure the target is met?

Step 6—Organize the Recommendations and Create a Plan to Bridge the Gaps

Summarize recommendations, strategies, and ideas. A great framework for goal setting is called SMART: S = goal is **s**pecific, M = goal is **m**easurable, A = goal is **a**chievable, R = goal is **r**elevant, and T = goal fits the **t**ime (time-bound). For XCaliber, show support with graphs from your dashboard.

Other frameworks for gap analysis include Ishikawa (fish diagram), SWOT, PESTLE, McKinsey 7S Framework, Balanced Scorecard, and the Nadler-Tushman Model. For this textbook, concentrate on using SWOT, PESTLE, and the Balanced Scorecard framework.

Expert Program Management (EPM). (2017, Oct 17). *How to Do a Gap Analysis*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-8

4.6 Example Dashboards and Reports

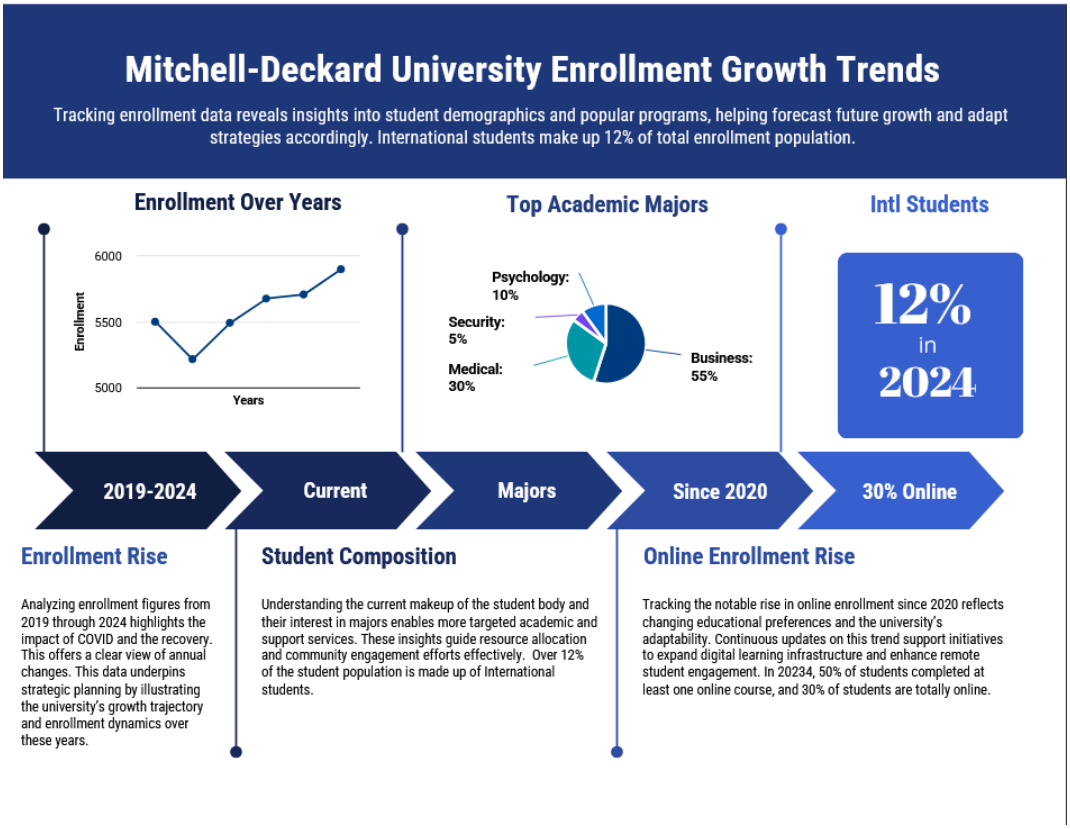
> In my view, one of the primary functions of a data story is to drive action. Without action, we can't generate value with our insights.
>
> —Brent Dykes, author of *Effective Data Storytelling*

One way to grow your skills is to review dashboards and reports. Dashboards serve as a vital interface through which organizations, institutions, health care facilities and even sport franchises make sense of the vast landscape of data. One thing to remember: There are external (public) dashboards and reports, and there are internal dashboards (behind a company login). This section of the chapter shows dashboards and reports from nonprofits, corporations, education, health care and sports. By examining the application of these data visualization tools in various contexts, we gain a comprehensive understanding of their versatility and impact. As you explore, look for common threads that connect these fields. In this age of information overload, the ability to transform data into actionable intelligence is a competitive advantage. Note how these interactive dashboards (and reports) support better decision-making, more efficient operation, and especially for not-for-profits, greater transparency.

Example of a Report in Education

An example report can be found at many educational institutions under the heading of "Enrollment Summary." For example, in Exhibit 4.13, Indiana State University provides an enrollment report branded with their sycamore leaf and using the shades of blue color palette.

Exhibit 4.13—Example of a Static Report in Education

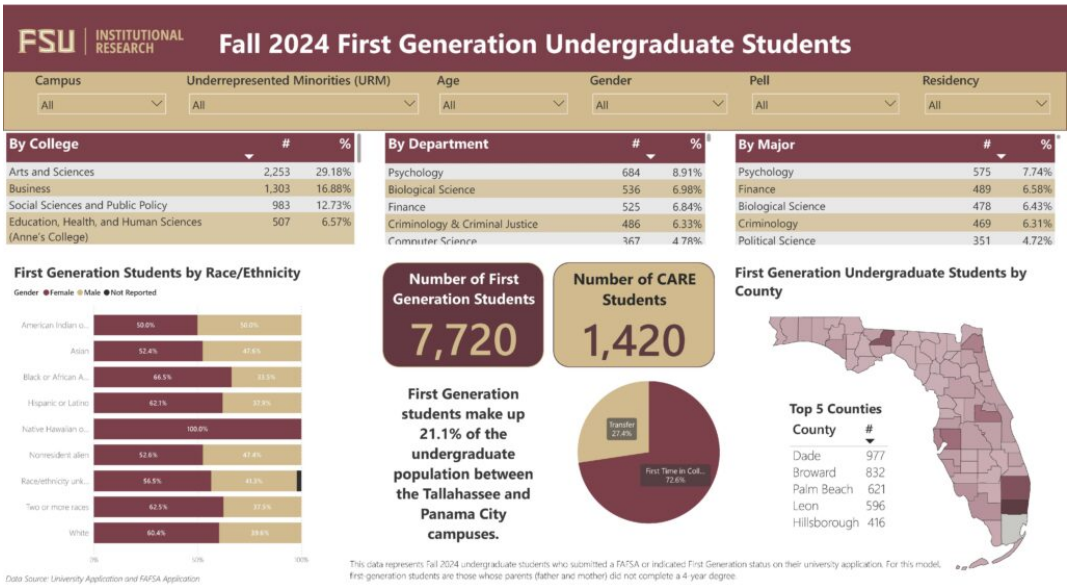


Note: Author Illustration (2025)

Example of an Interactive Dashboard in Education

Many institutional research departments develop a public interactive dashboard experience. For example, Florida State University provides an interactive report. You can tell it is interactive because of the drop-down arrows shown in the illustration (which should remind you of slicers!). Similar reports will have a "Read Me" section to support user interaction. Most include a video that introduces you to the dashboard as well. The reports in Exhibit 4.14 were created using Power BI.

Exhibit 4.14—Interactive Dashboard



Source: FSU Office of Institutional Research. https://www.ir.fsu.edu/infographics/infofirstgen_2024.aspx. Designed by student interns Patrick Martin, Martyna Smart, Gabi Mastando, and Zhan Peebles. Used with permission.

Florida State University Institutional Research Fall 2024 First Generation Undergraduate Students. https://www.ir.fsu.edu/infographics/infofirstgen_2024.aspx.

Enrollment Trends (2023, September 14) Indiana University—Enrollment Summary Tool. Link: https://iuia.iu.edu/finding-data/enrollment/index.html. NOTE: Choose the *public* report images to activate the enrollment information reports for the public.

Purdue University. (2024). International Enrollment and Statistical Report, Office of International Students and Scholars. https://www.purdue.edu/gpp/iss/_documents/EnrollmentReport/iss_statisticalreportfall24.pdf

Dashboards in Health Care

It is interesting to see the dozens of companies who wish to support dashboards in health care settings. In Helminski et al.'s (2022) article "Dashboards in Health Care Settings: Protocol for a Scoping Review," a team of researchers searched through peer-reviewed literature to discover "the development, implementation, or evaluation of a dashboard that was successfully used in routine workflow" (para. 3). The researchers discovered that there is a need for the development of a taxonomy that identifies relevant design elements that each type of dashboard should include. These authors did not think dashboards were part of the accepted routine workflow and believed they should be.

The pandemic generated lots of data and some of the datasets ended up in dashboards. Tableau Public has hundreds of public dashboards ranging from COVID-19 vaccinations to health care data breaches. Health care needs to leverage the analysis of their data to address challenges like staffing shortages, retention, effectively planning for the future, and managing patient care. Most of the software available to the health care industry has built-in dashboard capability. Instead of featuring one dashboard, feel free to use the following links to explore.

Tableau Public. (2023). Welcome to Tableau Public. https://public.tableau.com

AHRQ. (2023) Agency for Healthcare Research and Quality—NPSD Dashboards.https://www.ahrq.gov/npsd/data/dashboard/index.html

Practical Data Solutions (2023, Jan 30). *Healthcare Analytics Trends for* 2023. [Video]. YouTube. Available:

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=570#oembed-9

Interactive Dashboards in Nonprofits

Nonprofit dashboards are built around mission and desired outcomes. Nonprofits' focus will often be on funders and other stakeholders to show transparency in reaching desired goals. Transparency is a key issue raised by charity watchdogs. There are lots of organizations that provide help to smaller nonprofits in this area.

Polanco, H & Walker, S. (2019, Dec 18). Models and Components of a Great Nonprofit Dashboard. Nonprofit Quarterly (NPQ). https://nonprofitquarterly.org/financial-management-models-of-a-great-nonprofit-dashboard/

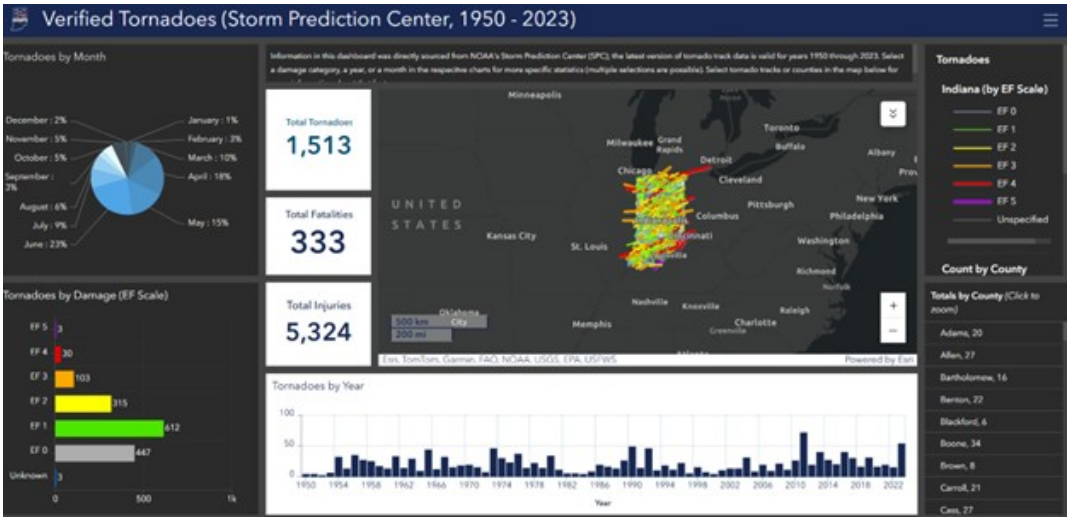
Nonprofit Dashboards—Resources List. (2023). Nonprofit Financial Commons. https://nonprofitfinancials.org/resources/nonprofit-dashboards-resources-list/

Interactive Dashboards in Government

Interactive dashboards in a government setting have revolutionized the way data are managed, analyzed, and communicated. In state government, interactive dashboards are commonly employed to share data related to public health statistics, economic indicators, education outcomes and many other areas. The ability to interact with the data enhances the feeling of transparency and accountability.

From the Office of the Chief Equity, Inclusion, and Opportunity Officer in Indiana, you can find interactive dashboards on five broad categories (health, public safety, social services, education, and workforce). For example, in the health category, a user can interact with data from COVID-19, infant mortality, births, preterm births, and prenatal care.

Exhibit 4.15—Example of an Interactive Dashboard in Indiana



Source: Indiana Department of Homeland Security (2023). DHS: Data and Dashboards—Public Domain

Another trend in the United States is for each state to build a health value dashboard for their state. The Health Policy Institute of Ohio built a dashboard-like report (which is in PDF format).

Ohio Health Policy Institute: https://www.healthpolicyohio.org/wp-content/uploads/2023/04/2023HealthValueDashboard_Final.pdf

Chapter 4 Summary

In this chapter, readers are guided through the intricacies of data modeling and visualization, exploring the creation of impactful dashboards. The chapter unfolds with a dashboard that brings in two worksheets using a data model, laying the foundation for effective information representation.

Step-by-step instructions are provided for building both simple and complex dashboards, ensuring that readers can navigate the process seamlessly. It also includes techniques on ways to incorporate databars, and icon sets to enhance visual clarity. The art of storytelling is weaved throughout the various visualizations with an emphasis on the importance of crafting compelling narratives. Insights are given into how storytelling connects to the brain, illuminating the cognitive aspects that make data more relatable and memorable.

This chapter concludes with a comprehensive gap analysis, offering a strategic perspective on identifying and addressing gaps in data representations. Readers are equipped with the tools to not only present data effectively but also act collaboratively in virtual teams, leveraging data storytelling as a powerful communication tool in the dynamic world of information.

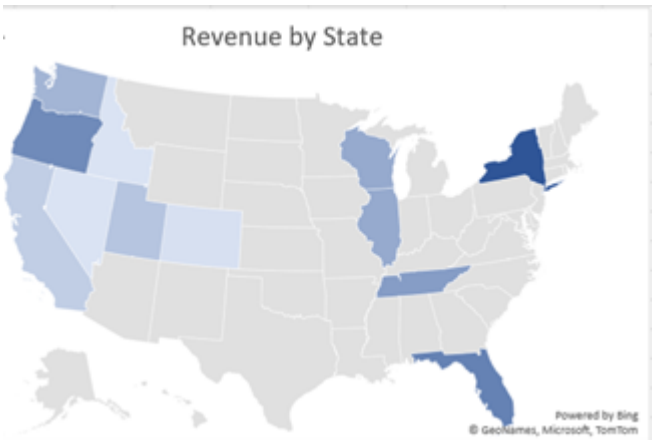
This chapter has over a dozen Excel worksheets, providing step-by-step guidance on creating graphs and data visualizations. This comprehensive resource serves as a valuable toolkit for leveraging advanced data visualization in both strategic decision-making and statistical analysis.

Download Chapter 4 Student Files (<1 MB).

Chapter 4 Case: The Power of Dashboards and Gap Analysis

XCaliber Foods was established late in 2023, although the business started in 2024. The company distributes food items to 12 states. It has nine salespeople, though Naomi Shopker was an intern and only worked in June and July. In 2024, the company sold $510,326 worth of products.

XCaliber Food Distribution company is located in Indianapolis, Indiana. The location is inconsequential since no product is housed at their location. XCaliber Foods fills a niche of distributing excess products to small grocery stores. All salespeople work from home and use a tech-powered distribution system. The manufacturing companies, farmers, and others post products as available, and XCaliber Foods salespeople arrange drop-shipping to their customers. One of the salespeople calls it a matchmaking game, and most agree. Salespeople work on commission and the system logs the number of employee hours as well as sales in the system.



Note: Author Illustration (2025)

Although the sales were considered good for the first year, the owner wants you to work up a dashboard and pro-

vide insights for every business aspect (people, categories of product, customer concentration, and payment). The owner of XCaliber asked for help from Matt, an employee who built the company's website and helped customize the tech-powered distribution system. The owner sent Matt an email with a list of concerns and wants Matt to provide some insight.

In this culminating project, apply the knowledge and skills acquired in this chapter and Chapter 3. Combine your understanding of design principles, data analysis, and storytelling techniques to showcase your understanding of leveraging data visualizations to effectively convey complex information in a visually compelling way. Review the presentation guidelines.

Case Objectives

1. Understand how to clean data by removing irrelevant columns, being aware of blanks, and so on.
2. Build visuals and dashboards to structure storytelling.
3. Able to analyze and interpret data to extract key insights and develop a narrative.
4. Use a dashboard for gap analysis, to support decision-making (specifically, make recommendations using SMART to assess goals).
5. Ables to use decision-making and benchmarking tools (see Chapter 3, LO 6).

Case Guidelines

This case may be completed by an individual or a team of students as directed by your instructor.

- Complete the XCaliber Foods Distribution Company Dashboard(s). Multiple dashboards are suggested.
- Incorporate a word cloud from survey comments and incorporate the survey into the dashboard.
- Develop a gap analysis report and a professional presentation (with webcam).
- Upload Excel files: dashboard(s) and gap analysis report.
- Record a presentation that incorporates techniques to visualize and tell a story. Your recording could include presenting the report and showing the dashboard(s). Include the link to the recording.

Goals

These are the goals set by the owner for 2024 and 2025. Are there other goals that should be considered?

- Goal 1: revenue in 2024—$50,000/month. Revenue in 2025—$60,000/month
- Goal 2: reach six more cities in 2025; use benchmarking and decision-making tools (see Chapter 3)
- Goal 3: set a minimum sales "target" for salespeople in 2025

Questions From the Owner

The owner expects answers to the questions he sent to Matt, but you may form additional questions that he *should have asked*.

1. I want to know how well my salespeople are doing. Which salespeople are selling the most; in what city, state, and region; and what are they selling? Are there two or three salespeople who could conduct the training (with pay)?
2. Are there products that should be dropped?
3. I want to know if using the summer intern in June and July was worth the cost (about $4,000).
4. Is every salesperson collecting from their customer by check, cash, or credit?
5. What is the range of invoices by customer, and who are our best customers? Are there opportunities for upselling?
6. Are we shipping out within the same day on a consistent basis?
7. Do we have regional overlap? Are two salespeople selling to the same customer?
8. I want to increase revenue to $60,000/month in 2025. Can you do some sort of analysis to see the best way to reach this goal—perhaps using a gap analysis or something like that?
9. I want to be able to ask a question and get the answer instantaneously. I think I heard it is called a dashboard. Can you set up a dashboard that allows me to analyze the data right along with you?
10. What do you think a survey of our customers will tell us?

SMART, Benchmarks, and Decision-Making Tools

1. What specific actions and strategies do you suggest (*remember to use the tools you've learned* [e.g., SWOT, Ishikawa])?
2. Use benchmarking tools (like PESTLE) to explore and expand into **four new areas**.

General Guidelines

- Write a professional report (between 3,500 and 5,000 words) that addresses potential solutions for the gap between goals for 2024, and goals for 2025. Use a professional report template from Canva or Venngage.
- Assume you are presenting to the owner of the company, *virtually*.
- Feel free to include research to support strategies. Make sure that you use APA and cite everything.
- Graphs from your dashboard **should** be included in the report—because that's the way the owner likes it (he is a little old school).
- Infographics like SWOT, PESTLE, and so on are expected.
- Accompany the gap report with a recording that demonstrates your findings as if you were presenting it to management (the owner); please use your webcam.
- Feel free to use your dashboard(s), your report, and/or a PowerPoint to help your presentation.
- If you are completing this as a team assignment, follow the guidelines discussed in Chapter 4 for presenting as a team.
- Recording is limited to 20 minutes.
- The gap report should include in-text citations, correctly labeled figures, and a reference list of your research.

Data files available:

"Chapter 4—Original Dataset—XCaliber with delivery time"

"Chapter 4—Customer Satisfaction Survey Form"

Feel free to also use the "Ch 4—XCaliber_Foods_2024_Dataset Solutions" (although remember the dashboard was "too busy" to be used).

Download Chapter 4 Student Files (<1 MB).

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5. More Than Charts!

The whole is something else than the sum of its parts.
—Kurt Koffkea, German Gestalt psychologist

What Do You Think?

Kristen found the perfect position (data visualization software specialist) listed on LinkedIn but was surprised to see several tests for applicants who passed the first phone round. The tests were both virtual and face-to-face. After reading through some comments, she realized that the virtual test was based on Gestalt Principles. The face-to-face test included putting together a jigsaw puzzle and one was called the coffee cup challenge.

Kristen called her friend in Zoom and immediately asked, "Diana, I am considering applying for a job posted on LinkedIn, but I will be required to take a few tests—one virtually and two on their campus. Do you know what the Gestalt principal test might include?"

Diana quickly performs a search and finds an article (also on LinkedIn), by Vikas Joshi called, *Gestalt Principles in Software Testing*. Diana responds excitedly, "I found something. I'm texting the link to an article about Gestalt Principles. It looks like you need to apply Gestalt Principles to recognize patterns and organize visual information."

Kristen reviews the article, and says to Diana, "It makes sense based on some of the job duties for this position. It even makes sense for completing a jigsaw puzzle. I think they want to see if I can recognize patterns. But I have no idea what the coffee cup challenge is for."

Diana leans in on their Zoom call, "I know that one, or at least I think I do. I saw it in someone's post. The company will offer you a drink like coffee from their conference kitchen and when you are done with the interview, they hope you will wash and put away your coffee cup (or glass)!"

Kristen starts laughing, "Glad you told me this. I might have asked if I could keep the cup as a souvenir!"

Diana joins Kristen in laughing and holds up her coffee cup. "Well, I'm keeping an eye on my coffee cups next time you are at my house! But seriously Kristen, you better get busy and do more research on Gestalt Principles!"

———

Question to the readers: Do you know any Gestalt Principles?

Introduction

To harness the full potential of data visualization, it is crucial to understand not only the technical aspects of chart selection and design but also the fundamental cognitive principles that underpin human perception and memory retention.

This chapter delves deep into the world of data visualization, exploring the Gestalt Principles that underlie our perceptual processes, reviewing the best charts suited for specific data types, and dissecting the mechanisms of

attentive and preattentive attribute processing. The pivotal roles of color, text, chunking, and images can enhance short-term memory retention. But the journey doesn't end there. Strategies that optimize long-term memory encoding and retrieval will help make your data-driven insights stand the test of time.

In the pages that follow, you continue your journey on a comprehensive exploration of the interplay between human cognition and data visualization by unlocking the strategies for effective communication and memory preservation. Whether you are a data analyst, a designer, or a decision-maker seeking to extract meaningful and insightful knowledge from a plethora of data, this chapter will equip you with the tools and knowledge to create a visualization that leaves a lasting imprint on the minds of your audience.

Chapter 5 addresses the following learning objectives.

Learning Objectives

At the end of this chapter, students should be able to:

1. LO 1: Apply Gestalt Principles to convey meaningful information.
2. LO 2: Discern how the brain remembers information (iconic memory, strategies for short-term and long-term memory).
3. LO 3: Analyze and develop annual reports by leveraging tools like the CASS template, Gestalt Principles, and best practices.

Key Terms: annual reports, attentive processing and preattentive attribute processing, flipbook annual reports, iconic memory, living annual reports, snapshot or impact annual reports

Gestalt principles of proximity, similarity, enclosure, connection, enclosure, symmetry, and figure/ground

Download Chapter 5 PowerPoint (9 MB)
Download Chapter 5 Student Files (<1 MB).

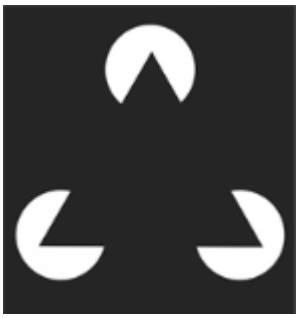
5.1 Gestalt Principles

> The storyteller doesn't decide which chart type to use. The data decides.
> —Sejal Vora

Before you continue designing data visualizations, you need to learn about Gestalt Principles. The authors are not designers of art, but visualizing data will require you to consider some artistic principles of **how the brain processes visual clues**. Gestalt is German and stands for a pattern, figure, form, or structure that is unified. You may have heard marketing or web developers talk about the Gestalt Principles when they were designing logos or social media components. You may have experienced them when you've looked at a design or visualization and said, "Something doesn't look right but I can't tell you exactly why I don't like it." Or maybe you were frustrated because there was a blue line under some text, but it was not a link like you expected. Understanding Gestalt Principles helps you understand why certain data visualization techniques work better than others. Understanding pattern perceptions helps you understand how the brain functions to support memory.

Puzzle this: What do you see when you look at the image in Exhibit 5.1? Do you see a triangle? Or do you see three Pac-Men?

Exhibit 5.1—Triangle or Pac-Men?



Note: Author Illustration (2025)

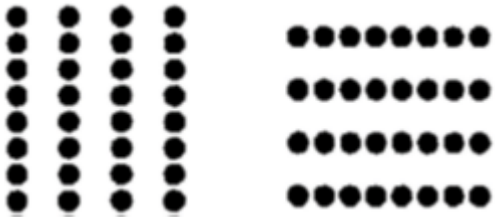
This is because our brains take ambiguous visual information and organize it into something that makes sense—"something familiar, orderly, symmetrical and that we understand" (User Testing, 2020, para. 12).

Gestalt principles will help you understand how our brains process data visualizations. The principles include proximity, similarity, enclosure, connection, continuation, closure, symmetry, and figure/ground. Look at the principles and see how we can apply these to data visualization and communication.

Gestalt Principle of Proximity

We can leverage the way people see table design **simply by using careful spacing**. Notice in the first arrangement of Exhibit 5.2, your eyes are drawn down the columns and across the rows in the second case. We see column groups and row groups (Chang, Nesbitt, & Wilkins, 2007). In dashboards, placing the visuals together helps the user group them together. You just need the white space to do it.

Exhibit 5.2—Example of Gestalt Principle of Proximity



Note: Author Illustration (2025)

Your dashboard may pull from multiple datasets, so for example, you might group customer demographics, and the nearer the objects are to each other, the more logically these objects belong in the same group.

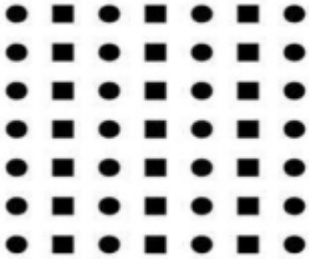
In the realm of data dashboard design, it's crucial to acknowledge that a common region is a more robust organizing principle than simple proximity. This concept is powerfully exemplified by Venn-Euler diagrams because they intuitively convey the interrelation or intersection. In a sales dashboard, using Venn diagrams to illustrate customer demographics overlapping product categories instantly shows which products are popular among specific customer segments. If you have used a Venn-Euler diagram, you will see that it is a good visualization for displaying associations among datasets.

Gestalt Principle of Similarity

Objects similar in color, shape, size, or orientation are perceived as related or belonging to the same group. Your eye is drawn vertically in Exhibit 5.3 because you see two groups—circles and squares. Color is the strongest way to suggest relationships, but even in this black-and-white illustration, you see the groups.

By leveraging this principle, data visualization can effectively convey relationships or categories. For instance, in a scatterplot displaying customer data, you can use the similarity principle to group customers who share common characteristics, such as high-value customers marked with circles and low-value customers marked with squares. The visual grouping aids in identifying clusters and patterns and makes it easier for the audience to understand the significance of these distinctions. When you think about this principle and the use of color, note that some assumptions already exist in the business world—red for loss, green for profit, yellow for caution. Remember, this principle can manifest itself using color or shape, and that brings us to some recent literature on how dissimilarity can be used.

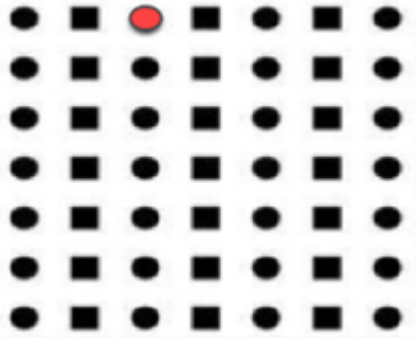
Exhibit 5.3—Gestalt Principle of Similarity



Note: Author Illustration (2025)

If one circle is shown as dissimilar (as shown in Exhibit 5.4), what does it mean? Is this customer the lowest of all high-end values? According to Pinna et al. (2022), "Limits and incompleteness of the similarity principle have suggested the basic, more general and stronger role of dissimilarity in perceptual grouping under a large variety of conditions" (p. 39). Although these authors used the basis of dissimilarity, make sure to review the Gestalt Principle of figure/ground (which seems to format the same thing).

Exhibit 5.4—Gestalt Principle of Dissimilarity



Note: Author Illustration (2025)

Gestalt Principle of Enclosure

When we see objects that are physically enclosed together, we see them as belonging to the same group. This principle shows that objects within boundaries are perceived as a unified whole and can significantly enhance data visualization

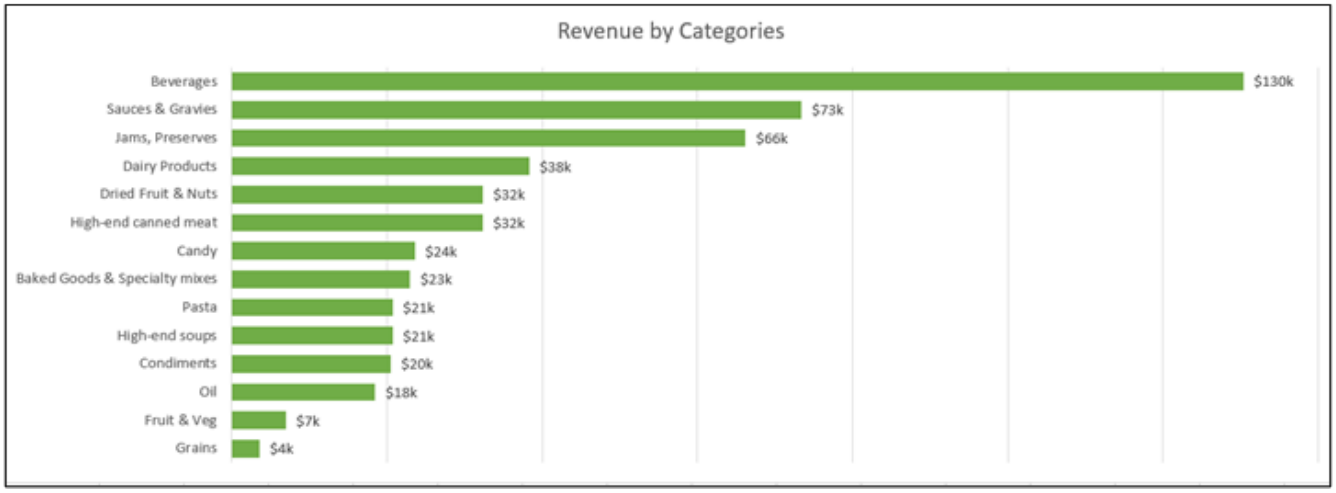
and data storytelling. Enclosure can be employed through framing within boxes, and within shading (as shown in Exhibit 5.5). This aids in highlighting relationships and patterns so the viewer grasps the message and contributes to a more intuitive and compelling data storytelling experience. A key component of a dashboard is to be consistent in color representation of a category, with the approach that green represents revenue across various graphs that are related (order count, invoice size, etc.)

Exhibit 5.5—Example of Gestalt Principle of Enclosure

Note: Author Illustration (2025)

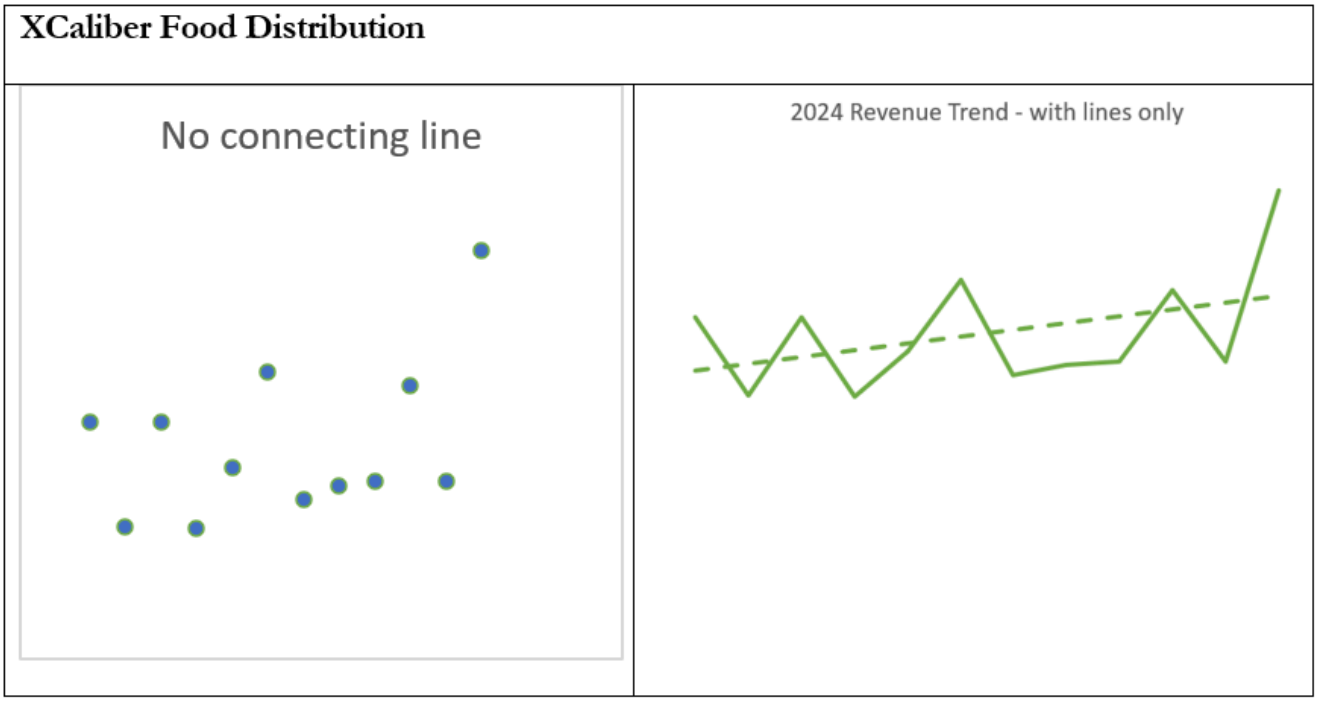
Imagine you are tasked with visualizing the performance of a company's various product lines over the past year. Think of the circles as data points. To apply the Gestalt Principle of enclosure, you could create a bar chart with each product category that is visually enclosed within a distinct rectangular boundary. Separate enclosures visually separate the data and emphasize the individual performance of each product line. The audience will immediately discern how different product categories are performing in relation to one another and will simplify the interpretation as well as enhance the data storytelling impact.

Exhibit 5.6—Revenue by Categories—XCaliber Foods 2024



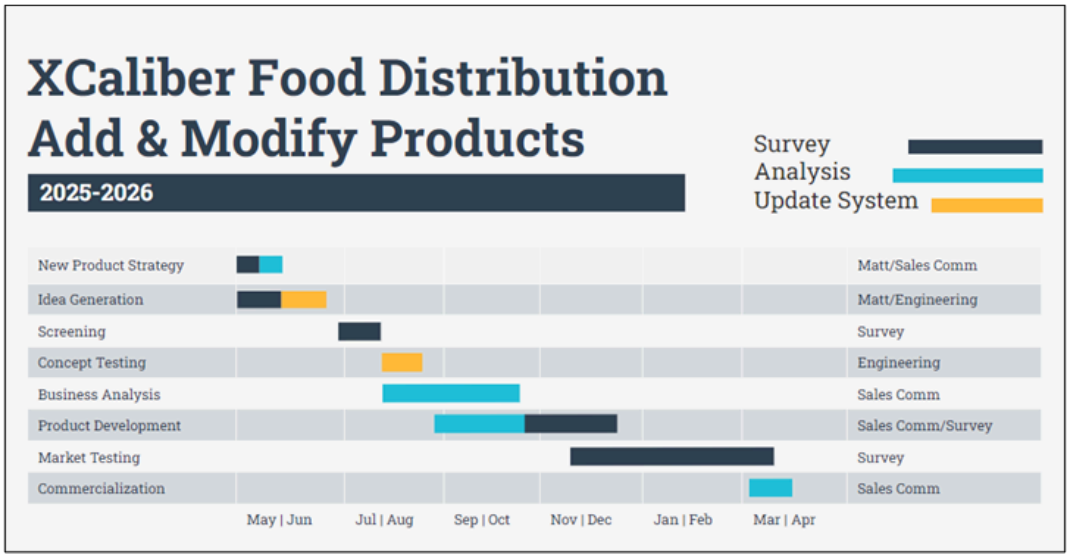
The Gestalt Principle of connection is an asset in the realm of data visualization and data storytelling. Elements connected by lines, parts, or other visual links are perceived as related or forming a coherent whole. Adding lines to data points is a great way to understand this principle (as illustrated in Exhibit 5.7). Without the lines to help us, we would not realize that we should see these data points in a trend line.

Exhibit 5.7—Example of Gestalt Principle of Connection



Besides representing revenue data points, this same principle supports flowcharts, network diagrams, and sequential timelines that visually link data points or events. An example of this would be a project connecting tasks in a Gantt chart as seen in Exhibit 5.8. This approach helps the audience understand the logical progression of the project and how each task relates to the overall project timeline. This adds clarity to the data storytelling.

Exhibit 5.8—Example Gantt Chart



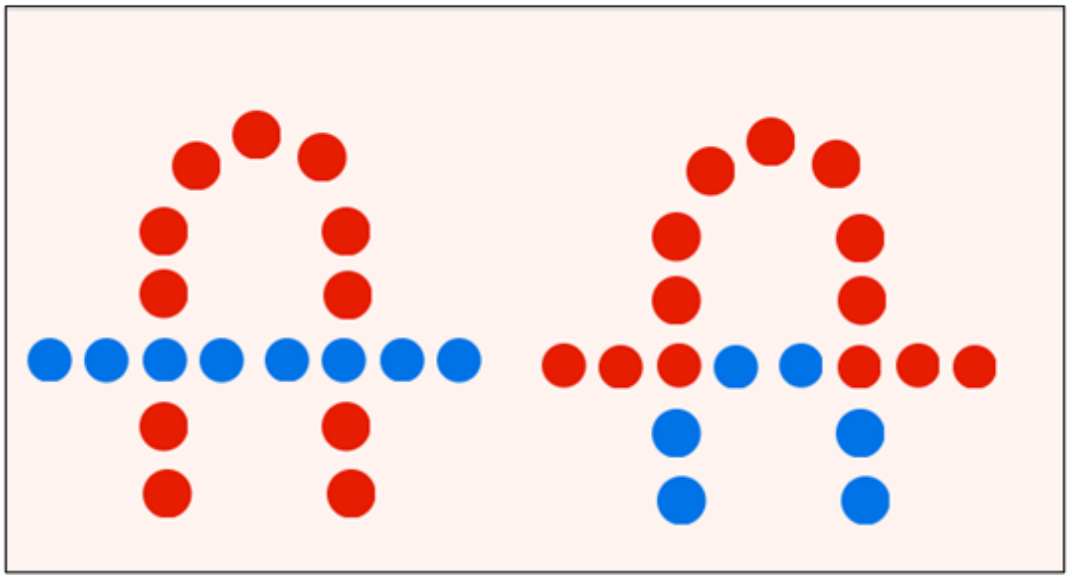
Note: Author Illustration (2024)

The example Gantt chart shows the use of color representing tasks associated with specific categories, under assigned teams. It shows connection, and this is nonquantitative data!

Gestalt Principle of Continuation

The Gestalt Principle of continuation shows an intersection between two or more objects where a viewer tends to perceive a continuous flow or connection. We tend to perceive each line as a single uninterrupted line (or object) so in Exhibit 5.9, our eyes on the left illustration would follow the blue circles and on the right illustration, our eyes will follow the red circles. Our eyes will instinctively follow the path of least resistance.

Exhibit 5.9—Gestalt Principle of Continuation



Note: Author Illustration (2024)

Gestalt Principle of Closure

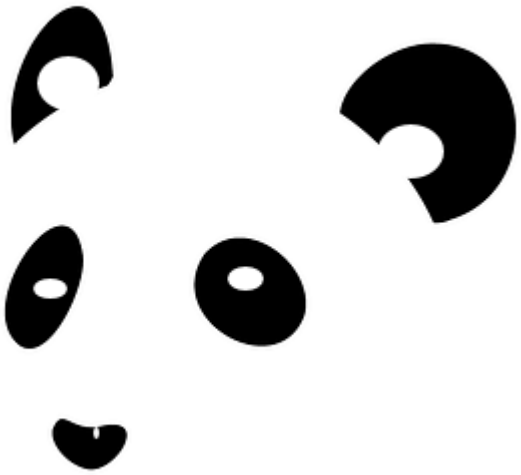
In Microsoft Excel, we can produce a line graph complete with background, data points, and chart borders. But a viewer only needs an idea that this is a graph, and they will still clearly see the trend. The Gestalt Principle of closure suggests that when viewers are presented with fragmented elements, they tend to mentally complete the missing parts to perceive a recognizable shape. In Exhibit 5.10, we might need to add the context, but the viewer can clearly see an increase! You could strip everything away, except the line, and the viewer would understand. Exhibit 11 shows a bear head, but one of the most famous examples of Gestalt's principle of closure is the World Wildlife Fund Logo (the Panda).

Exhibit 5.10—Gestalt Principle of Closure—Just a Trend

Note: Author Illustration (2025)

Exhibit 5.11—Example of Gestalt Principle of Closure

Note: Author Illustration (2025)



In data visualization, closure can be employed to engage the audience's problem-solving abilities and create a more memorable impact. For instance, a word cloud that visualizes the most frequently mentioned words in customer feedback might use the principle of closure to transform disconnected text fragments into a cohesive representation. Keep in mind, the viewer's mind naturally connects the fragments to form complete words or concepts, supporting quick comprehension and making the data's storytelling experience more interactive and engaging. Even more compelling is when you see an animated gif that uses the Gestalt Principle of closure. Exhibit 5.12 is a simple design with no outline, but everyone would know what it is.

Exhibit 5.12—Example of Gestalt Principle of Closure

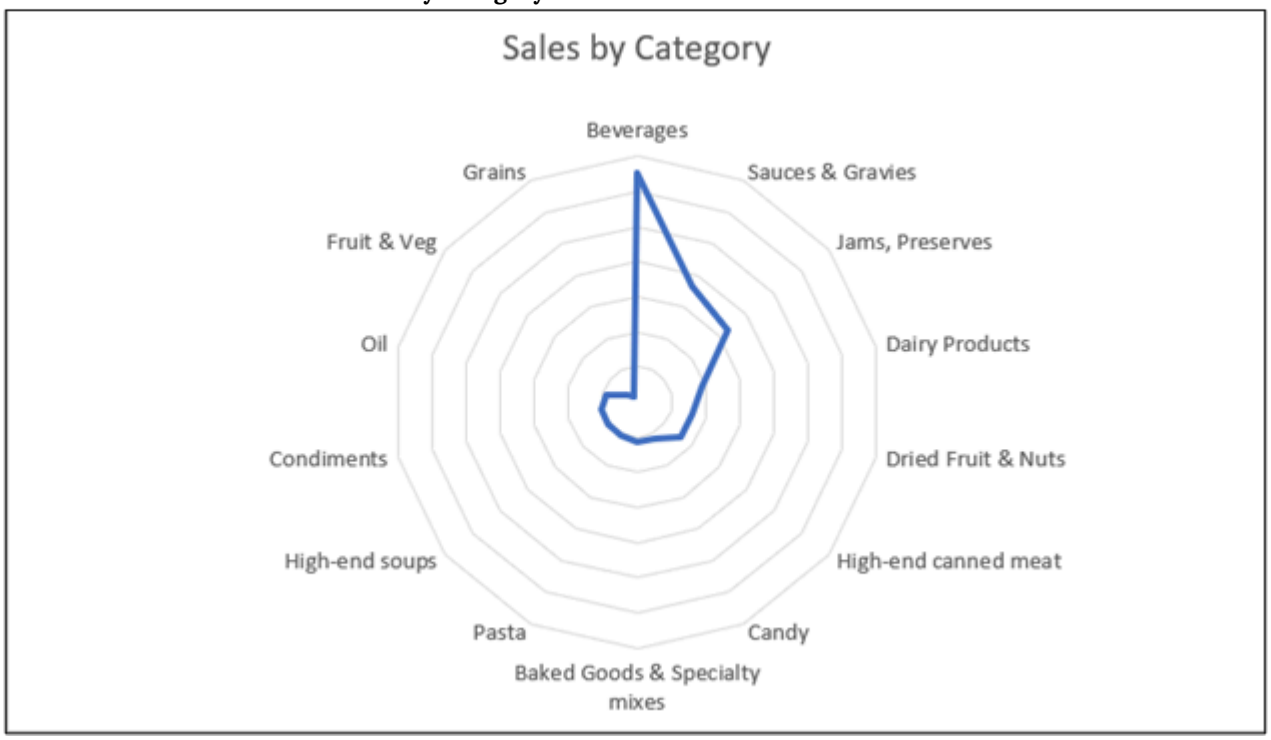
Note: Author Illustration (2025)

The walking dog image is from an article published by Gizmodo, Why Your Brain Thinks These Dots are a Dog. It is very compelling. The dog's ears are flapping, and the tail is wagging as the dalmatian quickly walks along. This animated gif uses the Gestalt Principle of closure. https://par.nellruby.agnesscott.org/teaching/gestalt/

Gestalt Principle of Symmetry

In this case, the object appears symmetrical and forms around the center. The Gestalt Principle of symmetry plays a valuable role because it fosters balance and order. You have seen examples of symmetry everywhere. It's in the golden arches of McDonald's logo. It's interesting that we associate symmetric objects with stability, consistency, and harmony while asymmetric objects are associated with negative feelings or impressions (Califf et al., 2012). In data visualization, symmetry can be utilized to emphasize the relationship between two or more components or datasets. For example, using XCaliber Foods, create a radar chart to compare the performance of different departments in an organization, using symmetrical axes and lines to draw the viewer's attention to the equanimity of performance across various aspects. Or create a radar chart to show which categories have the best performance (beverages, sauces, jams, dairy products, high-end canned meat, candy, baked goods, pasta, high-end soups, condiments, oil, fruit and vegetables, and grains). As seen in Exhibit 5.13, beverages are a clear winner!

Exhibit 5.13—XCaliber Foods—Sales by Category

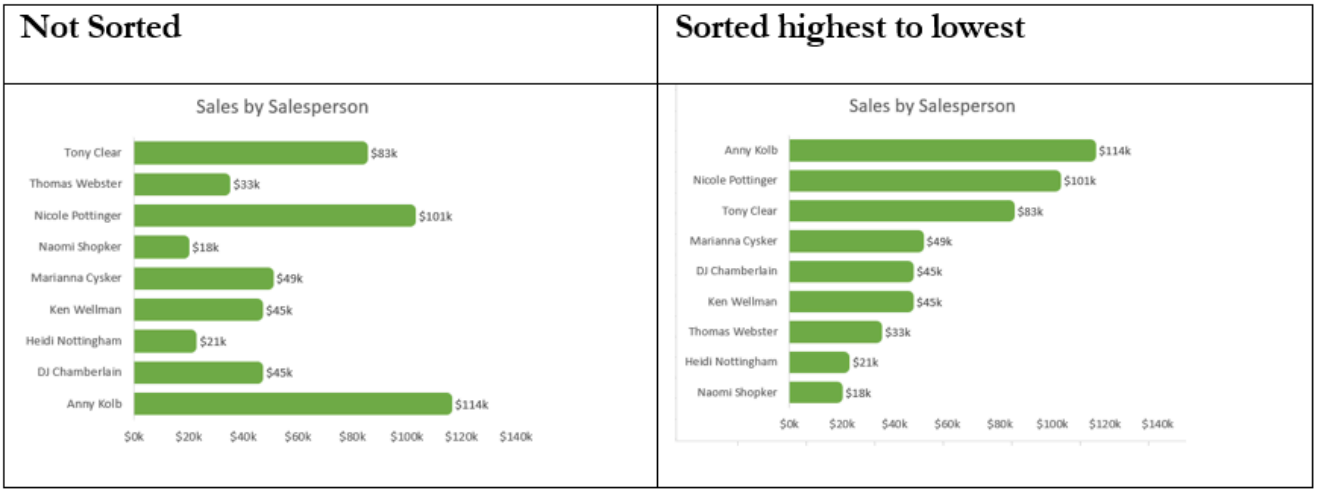


Gestalt Law of Prägnanz

Prägnanz is a German word that means "pithiness." When we combine this concept with the idea of data visualization, your brain loves simplicity and tends to process simple patterns. As an example, in the previous chapter, we learned how important it is to sort the graph's information from highest to lowest sales (see Exhibit 5.14).

As an aside, Western culture looks for the most important piece of information in the top left corner or centered in the middle of the dashboard. That is because Western cultures read from left to right and top to bottom. But what is important to one audience might not be as important to a different audience—so make sure to take that into account.

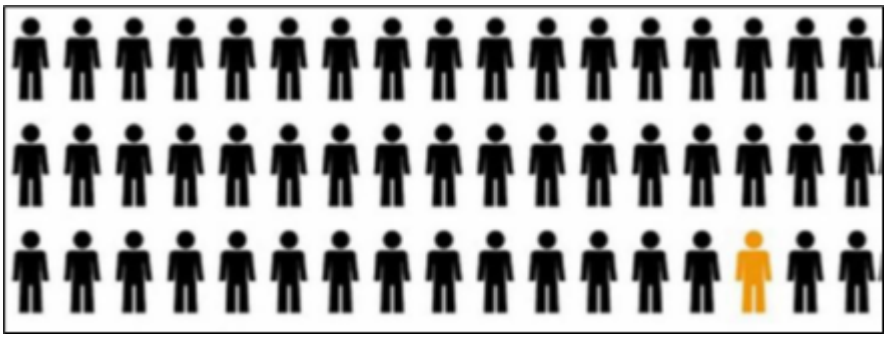
Exhibit 5.14—Example of Gestalt Law of Prägnanz



Gestalt Principle of Figure/Ground (and Other Principles)

This illustration (Exhibit 5.15) uses similarity, continuation, closure, proximity, and **figure/ground**. The orange figure represents the figure/ground because our eye differentiates this object from the surrounding area. The mind must decide which elements to focus on. As you can see, color in the design in Exhibit 5.15 was used well.

Exhibit 5.15—Example of Gestalt Principle of Figure/Ground (and Others)



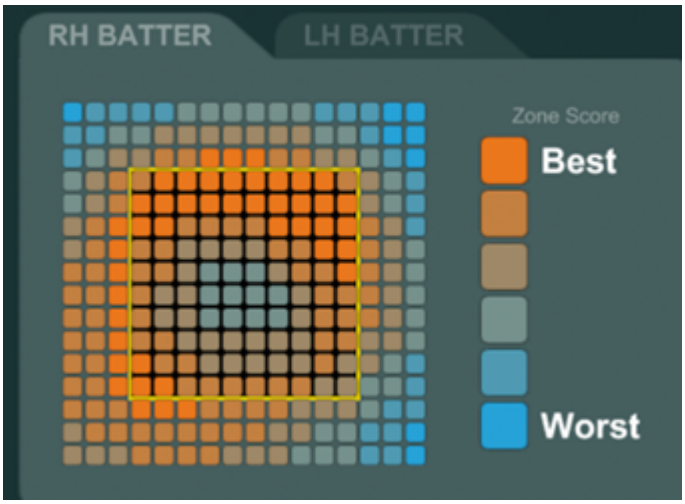
Note: Author Illustration (2024)

Another example of how the Gestalt Principle of figure-ground can enhance data visualization is in the context of heatmaps (Wagemans, 2012). In a heatmap representing website traffic patterns, the data points indicating high user engagement can be considered the "figures," while the less active ones are the "ground." By utilizing color gradients, these figures can be made to stand out prominently. Heatmaps were discussed earlier to show a correlation between CEOs (administrators) and staff on where they align in answering the survey questions. Heatmaps are more powerful if you can display the information within context. Assume you are a pitcher for your college baseball team, and you want to improve your throw. Several companies now offer a special system with membership. Once you set up a membership, you receive a baseball wired internally with Bluetooth, download the app, pair the ball with the app, and start throwing. As you throw the ball, the app will map out a heat map of your throws.

"Although pitchLogic can provide many numerical metrics, our users tell us they get a big benefit from visual feedback. A graphic like the Heat Map gives a coach or a pitcher an immediate intuitive feel for the data, which allows them to take action without spending as much time on analysis" (S. Cukiemik, personal communication, June 10, 2025).

Exhibit 5.16 shows an example of a right-handed batter.

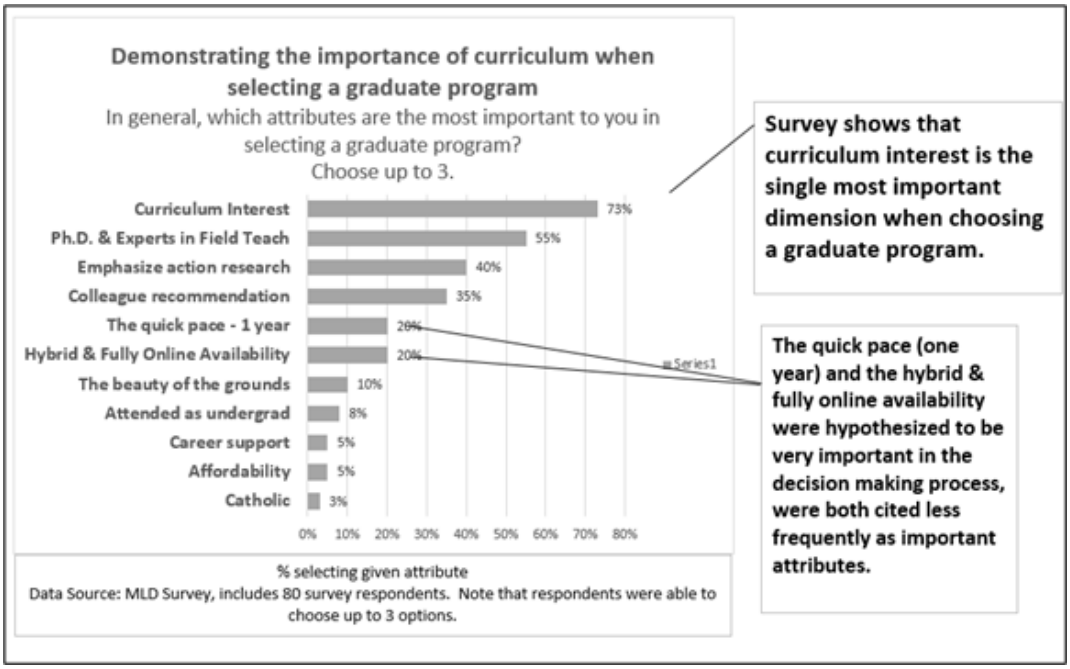
Exhibit 5.16—Heat Maps—from pitchLogic, a product of F5 Sports, Inc.



Source: Heat Maps: About, https://pitchlogic.com/stuffpl/heat-maps . Used with permission

Now let's look at two designs to see how well you can identify elements that have the appropriate visual signals (the information we want to communicate), which are noise (clutter), and which items violate Gestalt Principles. The survey data in Figure 5.1 is fictional.

Figure 5.1—Poor Design: What Needs to Be Changed?



Note: Author Illustration (2024)

This design is NOT horrible—the graph is ordered from largest to smallest. The two key observations are tied visually (through a line) to what you are meant to observe (the hypothesis). But that's where the good stuff ends.

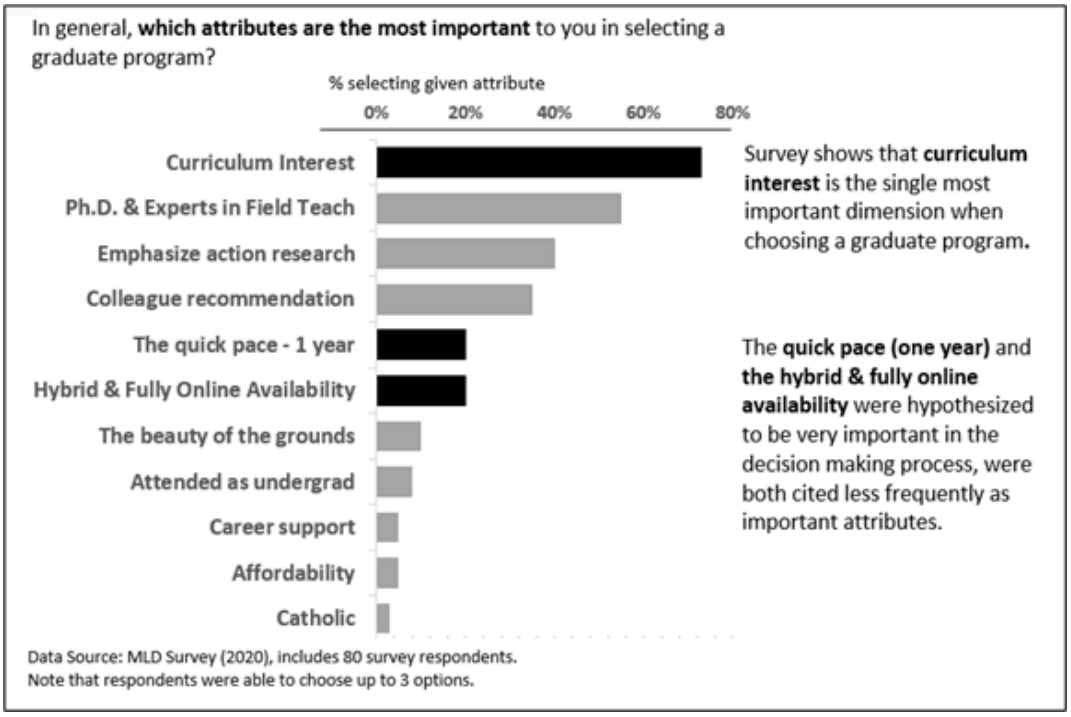
Here are the issues:

1. The title is too large—some of the information could be included in the introduction to the graph.
2. Several things are repeated—the percentage at the end of the bar and in the axis, the choice of three options.
3. Lines go through the percentages or lines don't connect.
4. Grid lines are used and are not needed.
5. The legend isn't informative, it's not needed.
6. No date found—when was this survey completed?
7. Clutter and key observations overwhelm the graph.
8. The format with borders is somewhat distracting.

These eight items don't even consider the Gestalt Principles!

How could we revise this visual? Let's look at the revised illustration in Figure 5.2 while taking into consideration the Gestalt Principles included in the new design.

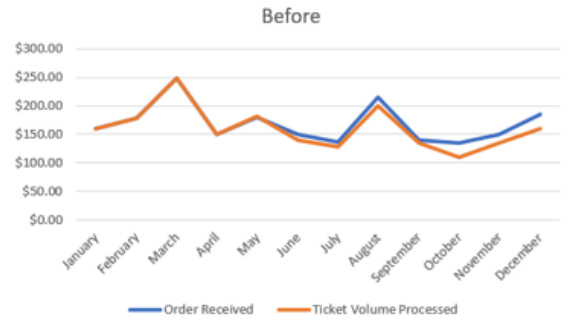
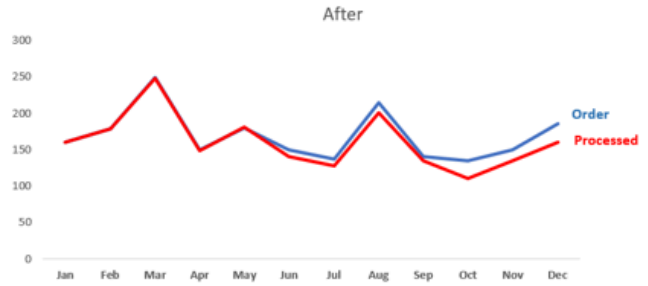
Figure 5.2—Revised Visual Curriculum Interest Is the Most Important Consideration When Selecting a College



Note: Author Illustration (2024)

Compared to the original visualization, this illustration follows a cleaner design, better alignment, conscious use of white space, and removal of repetitive or unnecessary items. It uses some of the Gestalt Principles too. Even if you aren't quite sure about your comfort level with the Gestalt Principles, you should find the second illustration more appealing. In retrospect, the second paragraph could be written, "Administrators thought students would pick quick pace and hybrid/online program availability as most important." Adding this sentence would clarify that administrators had predicted a different outcome. Now compare the two images in Figure 5.3 and see if you can name all the changes and the corresponding Gestalt Principles.

Figure 5.3—Example Before and After

Before Applying Gestalt Principles	After Applying Gestalt Principles
	

As mentioned in previous chapters, understanding the data types will help you choose a suitable graphical display. This will be discussed in a later chapter in greater detail, but let's consider the charts we've used.

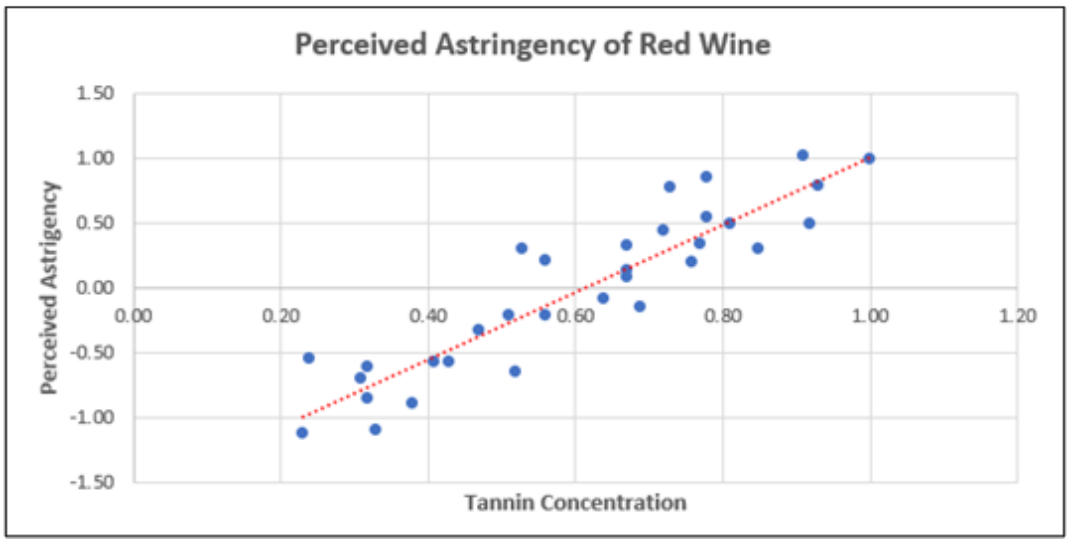
Show Relationship

If you want to show a relationship between two variables—choose a scatterplot chart or review Exhibit 5.17 where there is a positive relationship between tannin and perceived astringency. By adding a **trendline**, we enhance the ability for a user to see a better sense of relationship.

This is called the Gestalt Principles of **Common Fate**. This principle is normally explained using a flock of birds as an example. If a viewer sees the birds flying in the same direction, we assume they belong to the same group. Exhibit 5.18 shows a positive relationship.

When elements are commonly seen together (flags and countries, capitals and states), the audience will expect these to be included in one group. This is referred to as the **Gestalt Law of Past Experience**. In Exhibit 5.17, a wine connoisseur or sommelier would expect tannin and astringency to go together; however, to those of us less-refined wine experts, not so much! Keep this in mind when using this principle.

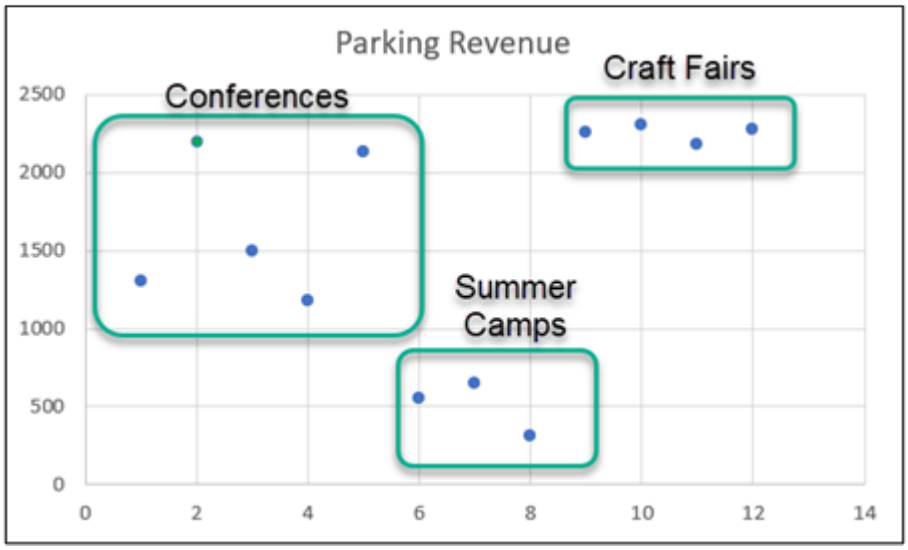
Exhibit 5.17—Positive Relationship Between Tannin (x) and Astringency (y)



Note: Author Illustration (2024)

Exhibit 5.18 shows two variables (events and revenue) in a scatterplot, but it is when you add closure (using Gestalt Principles) that you start to make sense of the data. Each type of event clusters together, so the relationship is conveyed more clearly using the Gestalt Principle of **closure**. This requires setting up the scatterplot in Microsoft Excel but then using a graphing program to add the closures. We used scatterplots to show the visuals of Ashcombe's quartet, and several other situations. The main point is you may need to do additional refinement to clarify the story.

Exhibit 5.18—Charts to Show Relationships



Note: Author Illustration (2024)

5.1 *Self-Assessment: Gestalt Principles*

Learning Objective #1—Apply Gestalt Principles to convey meaningful information

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=572#h5p-28

5.1 *Exercise 1: The Gestalt Principle*

Learning Objective #1—Apply Gestalt Principles to convey meaningful information

Watch: *DataTalks #21—Effective Data Visualization—with Valentina D'Efilippo*.

Watch: D'Efilippo, V. (2021, Apr 29). *Effective data visualization—with Valentina D'Efilippo*. The Royal Institution. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=572#oembed-1

Please be prepared to answer the following questions:

1. Name three types of graphs and infographics used in this presentation and how Gestalt principles were used.
2. Name 10 key points from this video that you can apply to your past visualizations.

5.2 The Brain and How It Remembers Information

> We see with our brains, not with our eyes.
> —Norman Doidge, *The Brain That Changes Itself*

During a thesis presentation, a graduate student provided a complete introduction to memory theory. In her career, she has trained thousands of trainers. Essentially, her point was "If you understand how memory theory works, you can leverage this understanding to make training more effective" (Emily Phelps, MLD'18).

So let's start with the basics of memory. There are three types of memory we need to understand before designing visualizations.

Iconic Memory

Source: Presenter with Thought Bubble image generated by Copilot and adapted by the author

Iconic memory is fast and deeply rooted in survival mechanisms. Think of a near-miss car accident where quick thinking on your part prevented a catastrophe! Your quick response to the situation seemed to happen almost without thought. That's why iconic memory is often tied to **preattentive attributes**. Preattentive attributes are visual properties that we notice without using conscious effort to do so. "It takes less than 500 milliseconds for the eye and the brain to process a preattentive property of any image" (Interaction Design Foundation, 2019, para. 4). Four of the preattentive visual properties include: color, form, movement, and spatial positioning.

Let's look at attentive processing versus preattentive processing. Cover up the preattentive processing in Figure 5.5. Now look at Figure 5.4—How many 5s do you see? Then look at Exhibit 5.5. Notice how quickly your eyes were drawn to the 5s almost without thought. See how this connects to the Gestalt Principles?

Figure 5.4—Attentive Processing: How Many 5s?

99633111031074567970283671098344489712346891287123698741112289663317748967544789712623489648971
23788778123448996227412511789741863941823794613227478961178946231414799642359873497902712313296361487910300708091412511 00

Figure 5.5—Preattentive Attribute Processing: How Many 5s?

99633111031074567970283671098344489712346891287123698741112289663317748967544789712623489648971
23788778123448996227412511789741863941823794613227478961178946231414799642359873497902712313296361487910300708091412511 00

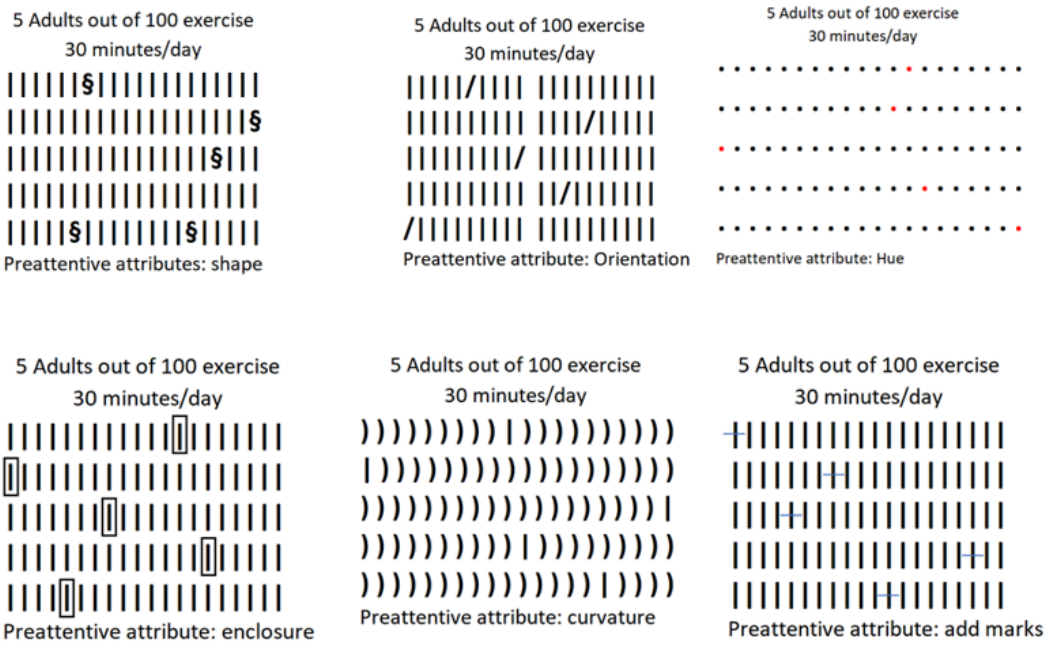
Knaflic says it best: "If we use preattentive attributes strategically, they can help us enable our audience to see what we want them to see before they even know they're seeing it" (Knaflic, 2015, p. 99).

Demonstration of Preattentive Attributes

Let's assume that you want to show a very small graph for the statistic: Less than 5% of adults exercise 30 minutes a day (HHS: President's Council on Sports, Fitness & Nutrition, 2020). BTW, this statistic is sad but true!

Let's look at some of the examples and how you might use preattentive attributes in Figure 5.6.

Figure 5.6—Six Visuals With Preattentive Attributes



Note: Author Illustration (2024)

There are several other preattentive attributes but they didn't work for this information. They include (1) line length, (2) line width, (3) intensity (we could have done this one but felt hue was better), (4) spatial position, and (5) motion. Of the six shown, it appears "enclosure" is the easiest to see, because it appears to "pop out," but all illustrations show 5 adults out of 100.

Text Preattentive Attributes

You can also use the concept of preattentive attributes in text. We used them in this book:

- **bold**, *italics*, color, size
- separate spatially (like extra space around one sentence)
- underlines

> - **outline or enclosure** (like textboxes)

Understanding preattentive attributes is very important if we want to create visual hierarchy. If you violate the rules (like typing an entire text in bold), you could easily lose your audience's attention because nothing stands out.

Members of the Audience Who Are Color-Blind

One other point should be made: Design with color-blindness in mind. About 8% of males are color-blind versus less than 0.5% of females (Colour Blind Awareness, 2020). The general rule is to avoid using shades of red and shades of green. (That's scary when you think about the traffic light metaphor, right?)

Some strategies to ensure inclusivity in your visualizations include the following:

1. Use high contrast.
2. Clearly label data points, lines, or sections (like bars).
3. Rely on other strategies—in addition to color, use patterns or textures.
4. Use color-blind friendly colors.
5. Use a tool that will simulate what a color-blind individual will see BEFORE you present. (This is discussed in Chapter 8, including several resources.)

If you are presenting to an international audience, you may want to review a book written by David McCandless where he considers the importance of colors in other cultures. For example, western cultures associate white with purity, cleanliness, and innocence (e.g., at a wedding, where brides commonly wear white dresses). In contrast, eastern cultures often associate white with death and funerals. Understanding these nuances is important when creating content that resonates appropriately with a diverse audience.

Title: Colours in Culture—at the Information Is Beautiful site. Make sure to review if you are presenting to an international audience! By: David McCandless. Link: https://informationisbeautiful.net/visualizations/colours-in-cultures/

Something to think about: According to Knaflic, "We have about 3–8 seconds with our audience, during which they decide to continue to look at what we've put in front of them or direct their attention to something else" (2015, p. 102).

At least if we've leveraged preattentive attributes well, we've given a signal of what is most important. In order to make the leap from theory to practice, we first need to look at other memory types.

Short-Term Memory

This one is important for graph visualizers! People can only keep about **four chunks** of visual information in their short-term memory at a time. So in Figure 5.7, we're making our audience go from legend, to component, to comparison of the different bands of color. In doing so, we are straining our audience by giving them a cognitive burden and we risk them giving up.

Figure 5.7—Too Many Chunks for an Audience to Process

Note: Author Illustration (2024)

In this particular situation, the solution was to add two slicers, which limited the information to one salesperson and one category. That made the graph more manageable—but *using slicers is not the answer for large room presentations*. It's more useful for small team meetings where you are **investigating** by using a multiple number of slicers to "slice and dice" the data.

Power BI lets you slice everything. Click on a chart of any kind and it filters data for all other visuals! And the great thing about Power BI is that most corporations with a subscription to Office 365 already have Power BI. "Power BI is a cloud-based suite of business analytics tools that lets everyone connect to visualize, and analyze data with greater speed, efficiency, and understanding" (Microsoft, 2020). Power BI is covered in chapter seven. It is worth discussing it in this section, especially if you face questions in a meeting that require you to go back to the data to find answers.

The point here is that we should show limited chunks of visual information. As a presenter, if your presentation only contains four chunks of visual information, you have to provide "triggers" to connect them. And this works both ways. Triggers help the presenter remember too.

Train Your Brain—Move From Short-Term to Long-Term Memory

As a presenter, the transformative potential of repetition in converting short-term memories into lasting impressions is found in the words of Squire et al. (2015), who posit, "Short-term memory can become a long-term memory through repetition" (para 14). This simple yet powerful concept not only holds relevance for the audience but also serves as a strategic tool for presenters aiming to enhance memory retention. The triggers work for both you and the audience. As a presenter, repeat the "trigger phrase" several different ways to increase memory retention (Squire et al., 2015). Write notes when you practice and work from your outline (even add trigger phrases to your PowerPoint outline).

Example of a Trigger and Repetition

Sunshine, Inc. has experienced some difficulty launching a new line of acrylics due to limited creation idea development for the users of acrylics. This has undermined a potential healthy profit. Additionally, since the line has limited products, production line issues in combination with slow delivery issues have plagued the product. The CEO announced in frustration, "The profit of our new acrylic product line hinges on a team approach during its creation, production, and delivery." What can the CEO do to get his company back on track? Let's explore a potential presentation.

Example trigger phrase: "Synergizing for Success"

How can we seamlessly integrate and emphasize this trigger throughout a presentation?

- **Emphasizing for repetition:** "Profitability isn't just about the product; it's about how we synergize as a team for success."
- **Analogical variation:** "Think of it as a winning sports team. Each player contributes uniquely, but it's the synergy, the 'Synergizing for Success' that leads to victory."
- **Illustration:** "Consider our recent product launch. The numbers speak for themselves, highlighting the direct impact of Synergizing for Success on our profit margins."
- **Audience engagement:** "Pause and reflect on your own experiences. When have you witnessed the power of teamwork contributing to success? That is the essence of 'Synergizing for Success.'"

By weaving the trigger phrase into various aspects of the presentation, the CEO reinforces the importance of teamwork in product profitability, and engages the audience in a way that enhances comprehension and retention. These repetitions would be paired with specific data visualizations for a cohesive and impactful delivery.

How Long Should You Practice an Important Presentation?

One of the most effective ways to rehearse is by recording yourself. Watch the video to judge your memory and improve your presentation. And by the way, ***practicing the night before you present doesn't work***. You need time to develop your tone and body language.

Although Dr. Jill Bolte-Taylor practiced her TED Talk 200 times, the normal rule of thumb is to practice 10 times. Other presentation gurus suggest that a 15-minute presentation should be practiced for 15 hours. According to Gallo's (2019) article, *Why You Should Practice Your Presentation 10 Times Before Taking the Stage*, you need time to develop your tone and body language. And that means, you need to have your presentation memorized, so you can concentrate on good body language. Different venues will require different skills. A virtual presentation is different from a face-to-face presentation.

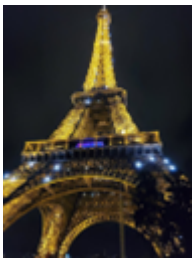
If you are presenting, you should practice recording your presentation using a tool like ScreenPal. This allows you to record yourself using your webcam and see the slides within the presentation. As long as your presentation is less than 15 minutes, it is free—both to record and to store in the cloud. Although this type of practice allows you to critique yourself quickly, remember that with ScreenPal, you are sitting before a computer and without a crowd.

ScreenPal: Formerly Screencast-o-matic. Link: https://screenpal.com. This app records both your webcam and your screen (you can have your PowerPoint on the screen). The free version allows 15 minutes of recording and a place to store it in the cloud.

Long-Term Memory

Does our audience leave with our main points lodged in long-term memory, or does our presentation get dumped out of short-term memory to oblivion? According to Vora (2019), "Information processed through visuals and images is believed to enter the brain's long-term memory . . . thus increasing the brain's power to recall and retain information that was absorbed through visuals" (p. 150).

According to Knaflic (2015), "Long-term memory is the aggregate of visual and verbal memory, which act differently. Verbal memory is accessed by a neural net, where the path becomes important for being able to recognize recall. Visual memory, on the other hand, functions with specialized structures" (p. 97). It's all about the triggers.



Note: Author Photograph

For example, one of the authors took a wonderful trip to France and Italy in 2019. If you were presenting and you included a picture of the Eiffel Tower, author Mitchell would be flooded with feelings, and get the concept of how the lighting of the tower at night makes it magical. So as a presenter, you've combined visual and verbal cues, and this combination will trigger the formation of long-term memories.

At this point, you may be struggling and asking—which visual should I use? Vora (2019) states, "The storyteller doesn't decide which chart type to use . . . the data decides" (p. 152). And this doesn't just apply to charts. It applies to any type of visual we use. Which visual tells the story the best?

Visme. (2019, May 7). *Five Data Storytelling Tips to Improve Your Charts and Graphs*. [Video]. YouTube

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=572#oembed-2

Chibana, N. (2018, Aug 13). *Data Storytelling: 5 Tips for Creating Effective Charts and Graphs*. Visme. https://visme.co/blog/data-storytelling-tips/

5.2 *Self-Assessment: Memory*

Learning Objective #2—Discern how the brain remembers information (iconic memory, strategies for short-term and long-term memory)

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=572#h5p-29

5.2 *Exercise 1: Memory*

Learning Objective #2—Discern how the brain remembers information (iconic memory, strategies for short-term and long-term memory)

Instructions:

1. Create a rubric that considers iconic memory when creating a presentation using good data visualizations.
2. Find a recent PowerPoint and use the rubric to assess it.
3. Share the rubric's assessment and the PowerPoint on the discussion board.
4. Be prepared to discuss in class.

5.3 Infographics Used in Annual Reports

> The stronger your annual report, the more you can increase your visibility with the community who supports you.
>
> —Katy French, *Column Five*

In the contemporary landscape of corporate communication and stakeholder engagement, the role of annual reports extends beyond traditional financial disclosure to embrace dynamic visual storytelling. The utilization of infographics has emerged as a powerful tool for conveying key messages with clarity and impact. This is true for both for-profit and not-for-profit entities, where the annual report serves as a crucial vehicle for transparent communication, fostering investor confidence, and demonstrating accountability.

In this section, we review annual reports, dissecting their effectiveness in enhancing comprehension and engagement across different organizational sectors. Students will learn to recognize the nuances and unique considerations that shape the use of infographics within diverse industries.

For-profit organizations use the annual report to articulate the company's value proposition and market positioning, and they lay a strategic direction. These organizations integrate infographics to distill complex financial data into visually digestible formats, providing stakeholders with a comprehensive understanding of the company's performance. In addition, infographics can be tailored to highlight key performance indicators, market trends, and competitive advantages.

Conversely, not-for-profit organizations face a unique set of challenges in annual reporting since their objectives center on social impact and community engagement rather than profit margins. In this context, infographics can illustrate the organization's mission, showcase tangible outcomes, and convey the value generated for the community. Visual representation of impact metrics, program outcomes, and success stories (video infographics) can effectively communicate the not-for-profit's achievements and foster donor trust. Charity Watchdog (charitywatch.org) goes so far as to tell charities to rebrand their annual report as "Impact" reports (Styron, 2022).

Annual Report for For-Profit Organizations

All public U.S. companies must file regular financial reports to the Securities Exchange Commission (SEC). These reports include the annual report (i.e., the 10-K), quarterly reports (10-Q), and several other reports. The data are filed in the

SEC's Electronic Data Gathering, Analysis, and Retrieval system, affectionately known as EDGAR. Other countries have similar processes. In the past few years, stakeholders have wanted more than just the annual report with financial information and performance. Specifically, investors want a report that encompasses environmental, social, and governance reporting. The expanse of stakeholders includes investors, creditors, regulators, government (compliance), customers, suppliers, and so on. The components of corporate reporting have grown because the technology is available to support it.

Let's look at some of the components in a for-profit annual report as filed through a 10-K:

- **Letter from chief executive:** Expect to see a letter from the President or Chief Executive Officer (CEO). This letter provides insight from upper management on major issues and directions of the company.
- **Investor relations section:** Expect to see forward-looking information in the investor relations section. (Sometimes the environmental, social, and governance impacts [ESG reports] are included in the investor relations section.)
- **Financial information:** This section is driven as a requirement for public companies (public companies just means that they are listed on the stock exchange). This includes interim financial reports (usually quarterly) but also the annual financial statements. Note that with the support of technology, interim reporting takes less time and is more up to date.
- **Performance measures:** Useful measures like earnings per share but note that an increasing number of companies are listing earnings before interest and taxes (EBIT) and other measures that do not meet generally accepted accounting principles (GAAP).
- **Management discussion and analysis reports (MD&A):** This section includes an extensive narrative of the management's analysis of the company's performance. It normally includes a discussion of core businesses, objectives and strategies, capability, compliance, performance, risks, and outlook.
- **ESG reports:** These reports include a discussion of the environmental footprint, but can also include talent management, product safety, data security, and even matters like board diversity, executive pay, and business ethics.

This next fact may surprise you. Reports are voluminous, and reports like the 10-K and 10-Q are not user-friendly. They lack graphics, pictures, and do not easily tell a story. For example, Amazon.com, Inc's Form 10-K for the fiscal year that ended on December 31, 2022, is 88 pages long. It includes a table of contents (partial image shown in Exhibit 5.19).

Exhibit 5.19—Amazon.com, Inc., Form 10-K

AMAZON.COM, INC.
FORM 10-K
For the Fiscal Year Ended December 31, 2022

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Source: U.S. Securities and Exchange Commission, https://www.sec.gov/Archives/edgar/data/1018724/000101872424000008/amzn-20231231.htm—Public Domain

In the 10-K report, the Amazon shareholder letter from Andy Jassy, President and Chief Executive Officer of Amazon is seven pages long and what is interesting is that the 2020 Annual report includes a shareholder letter reprinted from the 1997 annual report; intentionally telling shareholders what was true in 1997 is still true in 2022.

As you can imagine, companies have faced regulatory overload and duplication until XBRL (Extensible Business Reporting Language) was required by the SEC and other major regulators around the world. This is because XBRL can be read by any recipient regardless of the system they are using. XBRL did not reduce the size of annual reports. So while XBRL reduced regulatory overload, the increased size of reports has led to **information overload**.

If you look at the investor relations (IR) section of the Amazon website, you will find the same 10-K report, but many more items, including innovation, job creation and investment, our communities, supporting small business, and working at Amazon.

Amazon's IR website has more of a barebones approach but look at some examples of top-rated IR websites. One such example is Zurich Insurance Group. Zurich's 2022 annual report is **392 pages long** and full of images. **Use Exhibit 5.20 -Example of Table of Contents for an Annual Report.**

Exhibit 5.20—Example of Table of Contents for an Annual Report

Note: Author Illustration (2025). Inset images from Copilot and Venngage.

Even the half-year report for Zurich is full of images, charts, and good use of color. Overall, the Zurich Insurance Group site provides a vast array of useful information for shareholders and investors.

Zurich Insurance Group Investor Relations Website. Scroll to Annual Report, and choose 2022. Link: https://www.zurich.com/investor-relations

Let's look at another investor relation website for a different insurance company named AXA (this is not an acronym). At the investor section of the website, you will find an Annual Report, an Integrated Report, an Impact Report, and a Climate and Biodiversity Report.

AXA Investor Relations Website. Scroll to Annual Report, Integrated Report, Impact Report or Climate and Biodiversity Report. Link: https://www.axa.com/en/investor

The 2022 annual report has 530 pages full of images, infographics, and charts. The 2022 integrated report is 31 pages long and includes images, infographics, with lots of narrative about their actions throughout the world. The 2022 impact report is 10 pages long and includes the Bloomberg Gender Equality Index, the ESG Risk rating, and the highest level of AXA's strategic plan. The climate and biodiversity report is 85 pages long and includes images, infographics, performance metrics, organizational structure, and a variety of context boxes.

AXA 2022 Annual Report. Link: https://www.axa.com/en/press/publications/2022-annual-report

AXA 2022 Impact Report. Link: https://www.axa.com/en/press/publications/2022-impact-report

AXA 2022 Integrated Report. Link: https://www.axa.com/en/press/publications/2022-integrated-report

AXA 2022 Climate and Biodiversity Report. Link: https://www.axa.com/en/press/publications/2022-climate-report

A New Trend in Virtual Conferences for Investors

Besides the use of digital reports, a growing trend is the hosting of a virtual conference for analysts and investors. For example, BASF (a German company with a portfolio of chemicals, plastics, to oil and gas) has an annual report that is **296 pages long** and is full of images, infographics, graphs, and key performance indicators (KPIs) in relation to the UN's Sustainable Development Goals (SDGs). But BASF also held a virtual conference on February 24, 2023, to explain the impact of rising uncertainties, rising energy prices, and inflation with widespread economic distortions. BASF is the second largest chemical producer in the world, so it is strongly impacted by world events like the Russian invasion of Ukraine. No wonder that BASF wanted to use a virtual conference in addition to a PDF report to explain the impact.

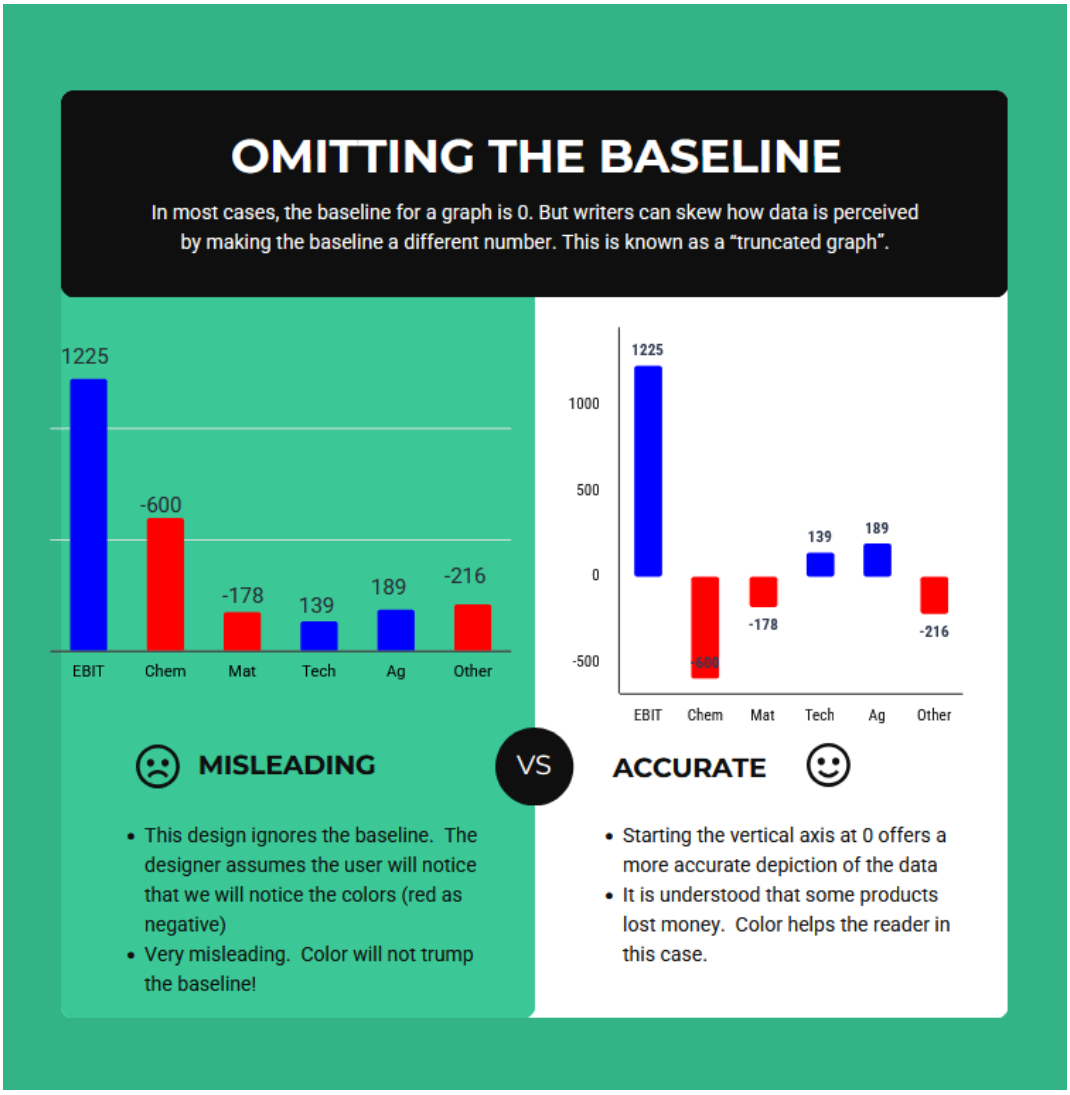
BASF used a graph during the virtual conference to explain that five of the nine divisions had a loss in 2022. However, it did not show a common axis—you must notice the negative numbers to realize there was a loss. At least least they were shown in red!

Make sure to investigate the different aspects of the virtual conference presentation!

BASF Global Investors. Scroll to FY 2022 Reporting and Investor Update. Includes presentation, but choose more information. Link: https://www.basf.com/global/en/investors.html

Figure 5.8 illustrates how omitting the baseline is misleading. What Gestalt Principle is violated?

Figure 5.8—Example of Misuse of Baseline



Note: Author Illustration (2025)

Drilling Down Into the Data

One of the newer trends is the interaction available for users to drill down into data. One such example (shown in Exhibit 5.21) is by Repligen, a company involved in the bioprocessing and production of biologic drugs.

Exhibit 5.21—Repligen Interactive Analyst Center

Source: Repligen Interactive Analyst Center

What is interesting is that it includes images, infographics, and charts in front of the standard 10-K structure, so you might not realize how much Repligen has done in other areas. In addition to the interactive analyst center, there are other interactive components available to the investor.

Repligen—Interactive Analyst Center. Link to Investor Relations for Repligen: https://www.repligen.com/company/Investors/investors-overview

Repligen—Link to Interactive Analyst Center: https://apps.indigotools.com/IR/IAC/?Ticker=RGEN&Exchange=NASDAQGS

The Use of Social Media to Push Annual Report Information

According to Jung et al. (2018) in the article "Do Firms Strategically Disseminate?—Evidence from Corporate Use of Social Media," the most frequently adopted social media platforms by S&P 1500 companies was Twitter and then Facebook (p. 229). The types of announcements include everything from earnings, executive turnover, to new customers.

In a separate article, "Corporate Use of Social Media," the authors found "companies are less likely to disseminate earnings news through Twitter when the earnings miss the consensus forecast and the magnitude of the miss is larger" (Tonello, 2016, para 13). This same bias might be a potential issue for annual reports in general.

What Are Investor Relations (IR)?

Investor relations is the effective two-way communication to provide relevant and necessary information between the issuer and the financial markets. The IR team aims to provide information that is sufficient and timely. It is not public relations, but they do share similar aspects.

Shareholders do not take an active part in the day-to-day management of the company; however, they want to know the issues, objectives, strategies, operating environment, and financial information to ensure that their investment is healthy and growing. A growing number of investors are expressing interest in nonfinancial factors like ESG, diversity, equity, and inclusion (DEI), sustainability, and other nonfinancial factors, but may still impact the bottom line.

Nonprofit Annual Reports

Annual reports for nonprofits highlight the mission and vision statement, the community impact, financial statements, and most importantly, a "thank you" to donors. They can contain more depending on the size and goals of the nonprofit. Nonprofit annual reports are typically smaller than their for-profit counterparts (average of 15–30 pages, but larger non-profits can be 200 pages). It really depends on the audience, the stakeholders, and the story you need to tell.

An overall guide to the number of pages for a full annual report and the broader work include:

1. letter from executive/leader: 1 page
2. mission and metrics: 2–4 pages
3. program overview: 4 + pages
4. impact story: 2 pages
5. financials: 2 pages
6. testimonial: 1+ pages
7. leadership: 1–2 pages
8. recognition of donors: 1–6 pages
9. looking forward to: 1 page

Keep in mind that the purpose should drive the report—some nonprofits do a full annual report but use a one-page "snapshot" for social media sharing, while some nonprofits build their annual report on their website.

Many nonprofit organizations publish their annual reports, which includes financials, at the same time they file their Form 990, since a Form 990 contains the financial information of the nonprofit. Nonprofits do not have an oversight regulator like the SEC requiring that specific items be included in an annual report.

There is no corresponding 10-K for nonprofits, but many nonprofits consider an annual report as part of the transparency requirement for charity watchdog organizations. Nonprofit annual reports are full of infographics, images, and stories that relate to community impact. Let's look at some of the best practices for nonprofit annual reports.

Best Practices to Communicate to Donors and Stakeholders

There are several fundraising and donor management tools that can be used to discover information about a nonprofit's donors. The annual report gives an organization an opportunity to understand their own organization better. What questions do you need answered about your donors, about your programs, and what questions come from your community? Understanding donors is crucial to the success of a nonprofit organization and foundational to how you should build your annual report.

By gathering information about your donors, you can significantly enhance the nonprofit organization's annual report. With this insight the annual report becomes more than a "report."

The Annual Report From a Donor's Perspective

- **Personalization of messaging**—*How do your donors prefer to be recognized?*
  Incorporate personalized recognition in the annual report based on donors' preferences (i.e., acknowledgment of their preferred causes or programs).
  - Draft a letter from a board member or leadership to set the tone and introduce the annual report.
  - Share strategic goals for the future of the nonprofit.
- **Tailoring content**—*What do your donors want to see about your programs?*
  Highlight specific initiatives or projects within the annual report that align with donors' interest, demonstrating the direct impact of their contributions.
  - **Clearly articulate the organization's mission** and show how activities align with core values.
  - Emphasize the impact.
  - If the report is built for donors, determine if they would prefer printed, infographic, living report, animated, snapshot, PDF, or flipbook. (This will be discussed in the next section.)
  - Thank you can be said in multiple ways. For example, "This was only possible. . . ."
  - If your annual report is large, include a table of contents.
- **Highlighting impact**—*What motivates your donors to give? What are your accomplishments?*
  Share compelling stories and testimonials that highlight your accomplishments and resonate with donor's motivations for supporting the organization. Make their donation tangible.
  - Weave a compelling narrative that combines quantitative data with qualitative stories.
  - Utilize visualizations to illustrate the nonprofit's achievements, measurable outcomes, and program effectiveness.
  - Incorporate infographics, charts, and graphs in people-first language.
  - Consider a separate summarized page with infographics that you can send to board members only (not all of

them will read a full report).
    - Use social media to announce the annual report. Divide up some content to spread out announcements.
    - It is easier to tell a story about one person than a group. Choose a beneficiary whose life has changed because of your work (or a story of an inspired volunteer).
    - Consider video or use quotes and first-person narratives.
    - Use the CASS template (Context, Audience, Story, and Situation) to assess the storytelling. This framework combines several of the models and is a great template to evaluate existing data storytelling or build your own storytelling with data when you have a large dataset with several insights to share. This template was introduced in Chapter 2. Use the 10 key criteria to assess this section.
- **Encourage engagement**—*What influences your donors to volunteer or take part in events?*
  Showcase future opportunities for involvement and events and encourage donors to engage with the organization beyond their financial contribution. Showcase past successful events and activities and emphasize the types of events that resonate with donors.
    - Weave compelling images of the events and show how the activities impact the program(s).
    - Include a call to action.
- **Recognition and gratitude**—*How do donors wish to be recognized?*
  Express gratitude in the annual report in a manner that aligns with donors' preferences for recognition. Donors need to feel sincerely appreciated. Invite feedback from your donors.
    - The annual report is only in one place. Make sure to incorporate your annual report into a larger strategy. Donors, corporate partners, and volunteers should be thanked more than once per year. However, make sure you have permission to post your donor's names!
    - Think of your board members—how do you recognize them in your annual report?
- **Building relationships**—*Will your donors help you expand your network? Does your organization support matching donations or sponsor volunteers for the nonprofit organization?*
  Leverage donor networks by strategically highlighting connections and donor testimonials and/or joint testimonials with a recipient and donor/volunteer. Leverage information about donors' affiliations and networks.
    - Request permission to share logos of corporate sponsors and ask for quotes that can be highlighted.
    - Build a virtual donor recognition wall.
    - Use well-designed, compelling videos.
- **Stewardship strategies**—*What do donors wish to see about financials?*
  Donors wish to see how their contribution impacted the programs and that nonprofit financials show good stewardship practices. Many donors want to see how much of a dollar contributed goes directly to support programs. If there are concerns, demonstrate the organization's commitment to transparency and responsiveness. If the nonprofit has long-range planning (bequests, estates, etc.), share the plan.
    - Your annual report can include traditional financial statements, or you can use infographics and charts to **tell your financial story**. If you choose the latter option, make sure to include the traditional financials on your website and indicate they are available.
    - Use data visualization and data storytelling techniques to meet the needs of your annual report reader.
    - Consider charity watchdog ratings and consider posting your Form 990 at the same time you post your annual report.
    - Consider creating a dashboard for project-based fundraisers and share the link in the report (and your website), so donors can track your progress and feel included.
- **Grants**—*How will donors want to see grant income?*
  Many nonprofits rely heavily on grants for program services. Grants should not drive your programming; instead, they should support your mission. Donors do not appreciate mission creep.
    - Use infographics to show how grant income supports the mission.

Use design principles (remember Gestalt!) that keep it simple and design with a theme (like colored circles that tie the entire report together). Emphasize people using rich images or videos that focus on people. All design apps that aid in creating infographics will have annual report templates. This following video is a great common-sensical video especially if this is your first time developing a nonprofit annual report.

Miller, N. & Miller, E. (2023, Jan 10). Your Giving Story, Told Better: A Nonprofit's Guide to Compelling Annual Reports.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=572#oembed-3

5.3 *Self-Assessment: Infographics Used in Annual Reports*

Learning Objective # 3—Analyze and develop annual reports by leveraging the CASS template, Gestalt Principles, and best practices

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5.3 *Exercise 1: Compare and Contrast Annual Reports*

Learning Objective # 3—Analyze and develop annual reports by leveraging the CASS template, Gestalt Principles, and best practices

Instructions:

1. Find a 2023 annual report for a for-profit company and a 2023 annual report for a nonprofit annual report. Compare and contrast the two reports. Share at least two similarities and five differences.

2. Post this to the discussion board making sure to include the links to the reports. Write in third person and use proper APA for citations and references.

5.4 Technology Available for Annual Reports

> The biggest mistake nonprofits make is that they don't see their report as an opportunity for engagement.
> —Jitasa: *Numbers for Good* (2023)

In the realm of nonprofit communication, the annual report serves as a vital tool for showcasing achievements, impact, and transparency. As organizations strive to present their stories in innovative and engaging ways, the traditional static format of printed annual reports has been replaced by digital reports in a variety of formats. Anything from creating a living annual report, an animated annual report, a flipbook annual report, an impact snapshot annual report, or an infographic annual report is possible. There are various technologies and tools that support this change. Here's an overview for each type.

Living Annual Report

A living annual report is where the organization shares an up-to-date report. Tableau Foundation has created such a report where data are updated weekly. Tableau Public allows an organization to use the **Tableau Public** software for free. This is not a scaled-down version of the software, but the catch is that anything you create is public. Make sure to visit the Tableau Living Annual Report to see how you can interact with the data.

Tableau Foundation Living Annual Report. Link: https://www.tableau.com/foundation#content-210555

Exhibit 5.22—Tableau Foundation—A Living Annual Report

Source: Tableau Foundation

To learn more about a **living annual report**, please watch this video.

Tableau Foundation. (2019, Jan 14). *Moving beyond the annual report*. Tableau Conference. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=572#oembed-4

This video is 57 minutes long, but it is worth it. Just make sure you get past the "cheesy introduction" (their words!).

Another product that has the same capability to produce a living annual report, is Power Business Intelligence (BI) from Microsoft. Power BI's tutorials and videos mostly use examples from a for-profit organization, called Contoso. However, you can find a nonprofit dataset for Power BI using Contoso for Good (see Power BI Data Visualization for Nonprofits from Microsoft).

Microsoft—Power BI Data Visualization for Nonprofits. Link: https://www.microsoft.com/en-us/nonprofits/power-bi. Scroll down to find Nonprofit Templates for Power BI

Microsoft Power BI—Power BI 101—Learn the Basics Provided by TechSoup. Link: https://techsoup.course.tc/catalog/power-bi-101. [Four course track, BI101, BI102, BI201, and BI202]

The image shown in Figure 5.9, is an example dashboard that is built on Contoso for Good. This page is about the availability of Volunteers, but the nonprofit template has a page for Case Management, Case Management: Wellness Survey, Deployed Field Resources, and Donation Management. The image in Figure 5.9 shows Power BI in edit mode—see the visualizations and the data columns on the right. However, if your organization holds the right type of license, you could publish the data so that your users could interact with it on your website. Although this is not an example of a living annual report, it does show some of the benefits of information organized in a dashboard.

Figure 5.9—Contoso for Good Example of Power BI for Nonprofits

Source: Screenshot of Power BI Interface © Microsoft Corporation

One of the key features of a Power BI dashboard is that every chart works as a "slicer" allowing the user to drill down into the data. This dashboard would not be a public facing dashboard but would serve a great function internally to the nonprofit executive team and board members. Please review Section 3.9 to find other products that can provide data visualizations for the living annual report.

Animated Annual Report

Nonprofits are seeking innovative ways to engage their stakeholders and convey the impact of their work effectively. One such method gaining popularity is the integration of animated gifs in nonprofit annual reports. Animated gifs are visually compelling and engage the audience. The question arises—is an animated report the right mode of communication for an annual report. It all goes back to meeting the needs of your stakeholders (audience). An animated report can be built online by multiple types of hosting platforms (including Word Press). It only requires the user to scroll down, and various infographics will show animation. Here are a couple examples:

Girls Who Code. Link for 2021 Report: https://girlswhocode.com/2022report/. Link for 2022 Report: https://girlswhocode.com/2023report/

DANA: Delaware Alliance for Nonprofit Advancement. Link: https://delawarenonprofit2022.org/

Flipbook Annual Report

Nonprofit organizations strive to present their stories in innovative and engaging ways. One such trend is the adoption of digital flipbooks that offer a dynamic and interactive platform. A flipbook recreates the experience of flipping through pages, akin to a traditional printed report. However, it can go much further since some platforms allow multimedia elements and interactive features. Before your nonprofit uses this feature, you have to be prepared to pay an annual fee to gain the URL that houses your flipbook. But the good news is that this fee is reasonable.

Features Needed to Create a Flipbook

- flipbook software that supports HTML5; older tools that use Adobe Flash won't work well with iPhones and iPads, since they don't support Flash
- ability to remove advertising
- ability to offer searches on keywords
- ability to allow embedded videos

Examples of Flipbook Software

- **ISSUU**—ISSUU is easy to use, full-featured, and the purchased version allows the ability to remove ads and customize embedment. It is a hosted web service from $0 to $299/month. ISSUU has Canva and InDesign integration.

  Sample Use of ISSUU:
  2022 UNICEF: https://www.unicef.org/reports/unicef-annual-report-2022

- **Flipping Book**—Flipping Book creates HTML5 interactive documents that can be hosted on your own platform from $44 to $179/month.

  Sample Uses Flipping Book:
  Multiple examples: https://flippingbook.com/presentation-examples

- **Instant Flipbook**—Instant Flipbook works for organizations who have technical support. It offers search, videos, and is priced by book: $77 for the first book with standard features, with discounts after one book. At 20 books, the cost is $47 per flipbook.

More flipbook comparisons are available through Source Forge:

Source Forge—Nonprofit Flipbook Software. Link: https://sourceforge.net/software/flipbook/for-non-profit/

Regardless of which flipping book software you use, make sure it fits what you need and is within your budget.

An Impact Snapshot or an Infographic Snapshot Annual Report

Organizations may want to share key performance metrics as a **snapshot** in time that will highlight the impact that the nonprofit can share with donors or stakeholders. Snapshot Annual reports can be digital, print, or both. The goal is to showcase the organization's successes, challenges, and strategic adaptations. It tells a compelling story, but with more focus on the organization's journey. It can be a snapshot of infographics with images. Review the following examples to see potential snapshot designs.

MANP: Maine Association of Nonprofits. Link to Financials and Annual Reports: https://www.nonprofitmaine.org/financials-annual-reports

MANP: Look Back & Launch Forward—Impact Snapshot 2020–2022. Link to Impact Snapshot Report: MANP_2020-2022_ImpactSnapshot-64712f37.pdf

Impact Snapshot reports include lots of graphics and large font numbers, and some snapshots are videos. The nonprofit Repair the World (2022) created a video (a little over a minute long) that is a "2021–2022 Annual Report Snapshot." The report looks something like a slide show, but with music and data. For example, the first slide has a great image with the text, "95% of volunteers said serving with Repair the World made them feel a sense of purpose" (Repair the World, 2022, para 1). Take the minute and watch this short YouTube video.

Repair the World. (2022, Nov 1). *What a year it's been! 2021–2022 Annual Report Snapshot*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=572#oembed-5

What Apps Are Available for Video Creation and Editing?

In the contemporary landscape of snapshot annual reports, the integration of multimedia elements has become a dynamic way to convey impactful narratives. Selecting the right video software becomes a critical decision in the annual report process. The good news!—there is a plethora of free video editing apps, and most phones can generate fabulous video. Let's look at a few video editing contenders that include a free version.

ScreenPal (Formerly Screencast-o-matic)

Strengths: Simple to use screen recording tool to capture screen (like PowerPoint slides) to later add music.

Weaknesses: Although ScreenPal has basic editing features, it does not have extensive transitions or effects when compared to its competitors.

Capcut (Developed by Bytedance)

Strengths: User-friendly interface. Very intuitive—drag and drop. Easy to cut, trim and add music.

Weaknesses: Lacks some advanced features. Bytedance is the creator of TikTok and banned in some countries.

Canva

Strengths: Versatile graph design platform and many users will recognize the interface. Lots of potential templates. Several add-ins can be used to tell good data stories (like Flourish).

Weaknesses: Lacks depth of video editing features. Better suited to simple edits.

DaVinci Resolve

Strengths: Multitrack editing, professional grade color correction, audio postproduction capabilities, and many advanced features. This app makes both the free lists and the purchased list. It is also used by Hollywood!

Weaknesses: May overwhelm beginners and it requires a robust computer with a good video card. Older computers won't be able to perform well.

Camtasia (Paid Version)

Strengths: Comprehensive screen recording and video editing software. Multitrack editing, animations, royalty-free assets with more available by a year subscription. Fairly intuitive.

Weaknesses: There is a cost (although educators and students get a steep price break) and the free version has limitations.

Other Resources

If you consider a narrated video for your annual report, make sure to write a script that matches your images. All video editing software has a way to add an audio track (and even edit it and change effects). However, it might be difficult to capture a board member's remarks. One way to remove this obstacle is to send your board member to Online Voice Recorder at 123Apps. Just click the button to start and follow the on-screen directions. The software saves the file as an MP3 file, and you can add it into your video editing mix.

Online Voice-Recorder at 123Apps. This is a free app! Link: https://online-voice-recorder.com/

Chapter 5 Summary

In summary, this chapter explored the Gestalt Principles and the intricacies of how the human brain remembers information. The art and science behind effective communication was taken into a new realm of annual reports for both for-profit companies and nonprofits. Different purposes drive how the data are presented but both types of organizations realize the importance of conveying complex data in a way that connects with the stakeholder.

As technology continues its rapid evolution, the landscape of annual reporting has expanded into the digital realm. The emergence of digital annual reports, nonprofit living annual reports, interactive flipbooks, and potential reports built on Tableau or Power BI represents a paradigm shift in how organizations share their narratives. Living annual reports leverage innovative technologies and give the nonprofit an ability to create a dynamic, engaging, and real-time experience that captivates stakeholders and fosters a deeper connection with their mission.

In fact, video is transforming the nonprofit sector's annual reporting endeavors and can be used to share impact with stakeholders in a way that transcends traditional storytelling. The visual and emotional depth conveyed through video has the power to immerse audiences in the mission and impact of nonprofits, providing a visceral and authentic experience and many video editing software programs have a reasonable cost. Imagine testimonials that accompany documentation of a mission project and leave a lasting impression.

In this chapter, you were introduced to the evolution of annual reports from static printed documents to dynamic immersive experiences. The fusion of Gestalt Principles, cognitive science, innovative technology, and reasonable costs for multimedia development software are all fundamental in forging lasting connections with stakeholders. Every organization should see the value in creating a dynamic annual report.

Chapter 5 Case: The Power of Annual Reports

In this culminating project, apply the knowledge and skills acquired in this chapter to compare several nonprofits that provide the same services. Assume you are a member of the board for a nonprofit and want to compare your organization to other similar-sized nonprofits. For this case, assume that you are looking at four symphony orchestras.

Case Objectives

Learning Objective #1—Apply Gestalt Principles to convey meaningful information

Learning Objective #3—Analyze and develop annual reports by leveraging the CASS template, Gestalt Principles, and best practices

Instructions: Form a Team and Create a Comparison Report

Plan to compare the Terre Haute Symphony Orchestra in Terre Haute, Indiana to the Chicago Symphony Orchestra, Detroit Symphony Orchestra and one other orchestra of your choice.

- Summarize the posted information from the charity watchdogs (both Guidestar and Charity Navigator) for all four

organizations.

  - Did the organization earn at least gold on Guidestar and 4 stars on Charity Navigator?
  - What do these rating systems mean?
  - Are there areas that need to be completed, updated, or revised?
  - Explain why charity watchdog criteria should be used for annual report best practices.
- Find the most recent Form 990 (found in Guidestar), but make sure to identify years and use the same years to compare organizations.
  - What was the total revenue from the previous year to the current year?
  - What is the executive director's salary? This is found on page 7 of Form 990—Part VII.
  - What similarities do you find in the organization's mission? (p. 2, Form 990—Part III)
  - What infographics could you use to explain the financial statements? Share some examples.
- Summarize websites for transparency.
  - Does the organization post their Form 990 on their website?
  - Does the organization have an annual report linked on the website?
  - Why is this important for donors and stakeholders?
- Review the annual reports.
  - What type of annual report is used for each organization? (PDF, flipbook, interactive, etc.)
  - Compare the similarities and differences of each annual report.
  - If an organization does not have an annual report, what strategies would you recommend to them for developing their own annual report? What key pieces of information should be included?
  - Use the CASS template to improve storytelling for one of the organizations that had an annual report.
  - Review potential templates available for annual reports in Venngage or Canva.

As a team, post this "comparison report" to the discussion board making sure to include the links to the reports. Write in the third person and use proper APA for citations and references. Be prepared to discuss this in class.

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6. Visualize Data With Purpose

Stories change people while statistics give them something to argue about.
—Bernie Siegel, author and surgeon

What Do You Think?

Michelle Goodwin was the president and CEO of a drop-shipping company, named Bridges. The name "Bridges" fit since the software bridged a connection between vendor (seller) and buyer through their manufacturing plants. The company's success hinged on her software app, but each new medium added to the catalog brought its own set of problems to the code. The company was expanding rapidly into various markets including jewelry, blankets, and acrylic and the manufacturing plants could provide any of the customized options and ship it out within 48 hours.

Michelle was at her limit. She understood coding but interpreting financial statements, financial reports, or general manufacturing reports now took up 80% of her time. She wanted to spend her time dreaming up the next medium for the catalog, not sifting through reports or asking questions that led to asking another and another. Each question left her feeling as if her executive team expected her to know the answer.

She cringed when she recalled her outburst at the last executive meeting. But could they blame her when the finance executive Thomas Perry announced a $40,000 penalty for late payments on the VAT? And what was VAT anyway?

Although the penalty was eventually waived, Michelle asked Thomas to discover how this happened. Thomas quickly answered, "I can tell you exactly why it happened. We have such a high turnover rate in my department; I've been using contract help. When we expanded our sales into Europe, none of my contractors had experience or even knew this was a 'Europe' thing. This value-added tax (VAT) is assessed at each production stage, and we just didn't know about it."

Michelle was good at reading body language and tried to keep her tone calm and friendly. She could tell that Thomas blamed himself for the problem. Michelle leaned in and placed her elbows on the table, "Thomas, I didn't know your department was so shorthanded. What can we do to fix this and more importantly, how can we develop a reporting setup that alerts me to staffing issues?"

Michelle picked up the coffeepot and topped her cup, asking, "More coffee, Thomas?" Michelle could see that Thomas was giving this some thought. "Michelle, I've been giving you mostly raw reports with some graphs on the financial information. What if we brainstorm with the other executives and find out what issues should 'hit' our weekly reports?"

Michelle smiled, "Go on—what else?"

Thomas hesitated, "I know the manufacturing reports come in daily to you. Are you aware that the shipping is delayed, and most items aren't shipped within the 24-hour guideline?"

"What? How is that possible?" Michelle squeaked and reached for the 25-page report and flipped to the last page. She knew the shipping data in hours was summarized there. As she examined it thoroughly, she realized it had the data of only one of the plants, and not all three.

Michelle could feel her face growing hot, but looked directly at Thomas, "It's clear that we are growing so fast that we need to consider how we give proper oversight and make good decisions."

"I agree, Michelle. We need to visualize the data with purpose and figure out a way to manage and not become overwhelmed. I think we almost need a retreat, but I don't think we have time!"

Michelle laughed, "Let's keep our retreats for the team-building events. How about we look through our current reports and see what has purpose and what is missing."

Thomas, showing some excitement, turned his laptop so they could both see it, "I've been looking at a KPI dashboard in my own area. What if we modified your dashboard to the key pieces of information you need?"

Michelle started laughing, "This is why you were hired, Thomas—you have a knack for anticipating what I need. I think I needed the threat of a $40k penalty to make me realize the importance of **purpose**!"

Introduction

In the realm of data analysis, the ability to transform raw data into meaningful insights is a skill that sets apart the adept from the novice. In this chapter, we look at visualizing data with **purpose**, recognizing that the manner in which information is presented can profoundly influence our understanding of complex datasets. Effective data visualization goes beyond creating aesthetically pleasing charts; it is a strategic process that aligns with the specific nature and objective of the data at hand.

We already know the power of visualizations. For example, illustrations are 83% more effective than text for long-term memory and a study by the University of Minnesota indicated that the human brain processes visual information 60,000 times faster than text (Verma, 2023, para. 5, 7). The symbiotic relationship between data types and visualization techniques emphasizes the importance of tailoring visualization to the inherent characteristics of the dataset. Essentially, a line chart may not reveal the same insight as a bar chart. Or even worse—the presenter tries to show everything, and insight is lost in the clutter.

This chapter also looks at qualitative data visualizations and the pivotal role in uncovering patterns and trends from an academic setting. In previous chapters, the authors demonstrated outliers and correlations. This chapter looks at guidelines and standards, particularly those engaged in academic pursuits such as writing theses and dissertations, and how the APA 7th edition style guide is used. The chapter will cover best practices for incorporating visualizations into scholarly works, ensuring that the clarity and integrity of the data are preserved while meeting the stringent requirements of academic standards.

Purpose should drive the use of key performance indicators (KPI) for dashboards to provide a snapshot of the way things are now. An example of an operational KPI dashboard might be tracking severe weather and accidents to help local governments assign utility vehicles and first responders. In a corporate setting, KPIs should align with the organizational objectives and can include sales targets, production output, shipping goals, and more nonfinancial data like customer satisfaction scores, or employee turnover and/or overtime hours. And KPIs that are aligned with other frameworks like a Balanced Scorecard approach can be powerful in reaching strategic objectives.

This chapter serves as a comprehensive guide for anyone seeking to visualize data with purpose. Aligning visualization techniques with data types, unraveling qualitative intricacies, aligning strategies and KPIs, or navigating academic reporting, require a presenter to use the tools necessary to extract meaningful insight.

Chapter 6 addresses the following learning objectives.

Learning Objectives

At the end of this chapter, students should be able to:

1. LO 1: Choose the appropriate infographic and chart based on data type.
2. LO 2: Design appropriate visualizations for key performance indicators (KPIs).
3. LO 3: Apply appropriate visualizations that meet academic standards and follow APA 7th edition.

Key Terms: APA 7th edition, categorical, continuous, data type, discrete, interval scales, key performance indicators (KPIs), nominal, normally distributed, ordinal, parametric test, Qlik, Qlik Sense, ratio scales, SMART goals, scale, skewed data, variables

Download Chapter 6 PowerPoint (8 MB)
Download Chapter 6 Student Files (<1 MB).

6.1 Best Graphical Visualizations Based on Data Type and Purpose

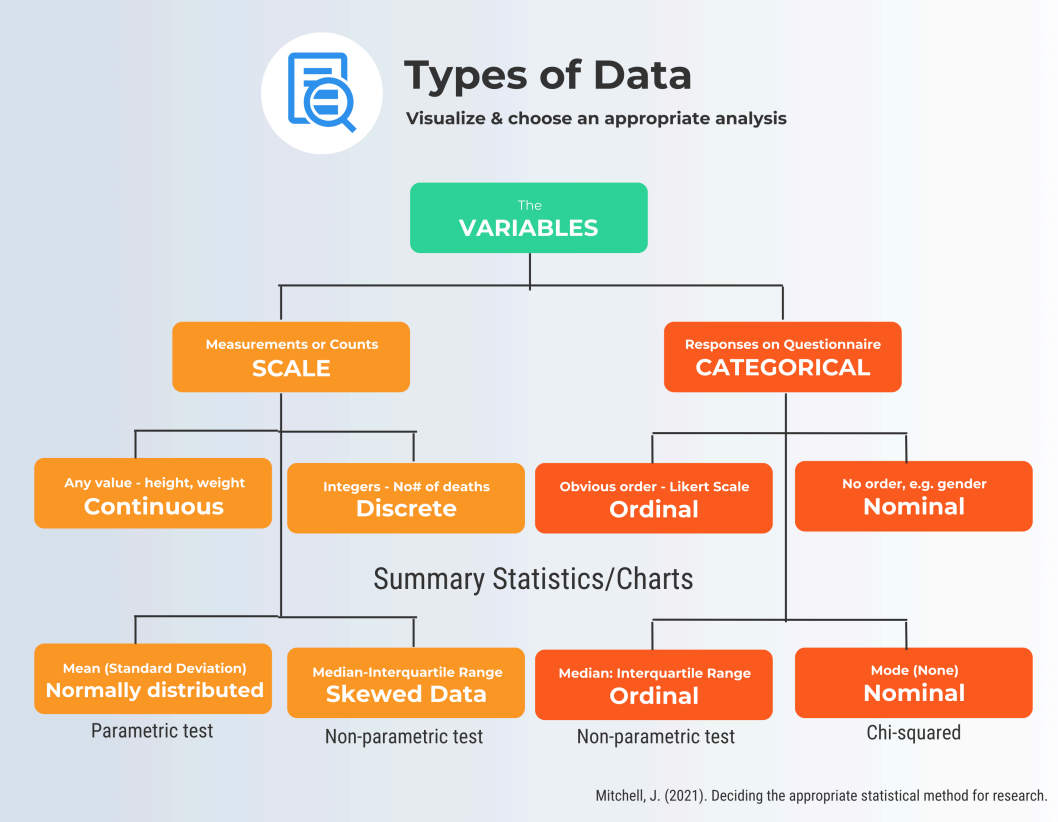
> Often the most effective way to describe, explore, and summarize a set of numbers—even a very large set—is to look at pictures of those numbers.
>
> —Edward Tufte, *The Visual Display of Quantitative Information*

Understanding your data type will help you choose a suitable graph or infographic, but understanding your purpose in conjunction with the data type helps you reach your audience and present your insights.

In any setting (but especially an academic setting), understanding your data types will help you choose a suitable summary statistic and analysis, and the best graph or data visualization. In an academic setting, students tend to leap to hypothesis testing. In a corporate setting, the typical KPIs are used, when it might be better to investigate the data with summary statistics and summary charts. Get in the habit of sorting your data with filters to determine issues like outliers, missing data, and trends. Use quick summary and aggregations like SUM, AVERAGE, and COUNT. With the growing application of artificial intelligence, upload data and ask the AI "What does this data tell me?" Remember, charts don't need to be in statistical software (although they can). You can create most of the charts in Excel or a more advanced Power BI.

Perhaps you have seen these terms in an undergraduate statistics course, but how many of these types of data can you explain as listed in Exhibit 6.1?

Exhibit 6.1—Types of Data



Note: Author Illustration (2025)

In the realm of data analysis, understanding the two primary types plays a crucial role: scale and categorical data. Scale data are also known as quantitative or numerical data whereas categorical data are often termed qualitative or nominal data representing distinct categories without inherent numerical significance. Scales can be either continuous or discrete and the types of summary statistics will depend on if the data are normally distributed or skewed. For categorical data type, you look at either ordinal or nominal. Make sure to look at the examples with each data type.

Now look at the ways to describe and visualize the data when we have nominal data, ordinal data, interval data, and ratio data.

Nominal scale describes the variable with categories. "If you were to assign a numerical value to a category; a higher score would not necessarily mean that there was more of some quality" (Adams & McGuire, 2022, p. 66)

Examples of nominal variables: zip code, eye color, political party, gender.

- **Calculations:** frequency distribution, percentages, mode, describing ranking
- **Visualizations:** bar charts, pie charts. Nominal data represents categories with no inherent order, so visual representations focus on the distribution of categories.

"**Ordinal scales** represent rankings that have magnitude, but we do not assume that the intervals between the rankings are equal. Because we do not assume equal intervals with ordinal data, we do not calculate the mean and standard deviation" (Adams & McGuire, 2022, p. 154).

Examples of ordinal variables: socioeconomic status (low, middle, and high income), survey responses like a satisfaction rating (extremely dislike, dislike, neutral, like, extremely like).

- **Calculations:** frequencies, percentages, median.
- **Visualizations:** bar charts, stacked bar charts, line charts. Since ordinal data has a meaningful order, display the

rank order of categories.

"**Interval scales** are ratings in which we assume there are equal intervals between scores . . . , do not have a true zero" (Adams & McGuire, 2022, p. 154).

Examples of interval variables: SAT score (200–800), credit score (300–850).

- **Calculations:** frequencies, percentages (*mean if normally distributed, median if not), standard deviation.
- **Visualizations:** histograms, line charts, box plots. Interval data allows for meaningful differences between values, so you can use more advanced statistics like mean and standard deviation.

"**Ratio scales** measure quantity and have both equal intervals and a true zero" (Adams & McGuire, p. 154).

Examples of ratio variables: pulse, weight, dose amount, income, age.

- **Calculations:** frequencies, percentages, mean (if normally distributed), median (if not normally distributed), standard deviation, range.
- **Visualizations:** histograms, line charts, box plots, scatterplots. Ratio data, like interval data, allow for more advanced calculations. In addition to the mean and standard deviation, you can also calculate the range. Scatterplots are useful for exploring Power BI Desktop to Power BIing relationships between two ratio variables.

A word of caution: Specific analyses and graphs (or infographics) can vary depending on your purpose (like the research question), the characteristics of the data, and the audience you are communicating with. Always consider the context and purpose. And always see if your data are normally distributed. It will impact what statistic you report (mean or median) and will impact the type of statistical test (parametric or nonparametric).

* A big difference between the mean and the median indicates skewed data or influential outliers.

Table 6.1 presents a quick view of the type of graphical display that matches the variable type and data type and what purpose it can serve.

Table 6.1: Which Graphical Display Fits the Purpose?

Graphical Display	Analysis Level	Data Type	Purpose	Summary Statistic
Bar chart	Univariate for 2 or more groups	Categorical: Nominal or Ordinal	Compare frequencies or proportions	Frequency, Percentage
Comparative Bar Chart	Univariate for 2 or more groups	Categorical: Nominal or Ordinal	Compare frequencies or values across categories	Frequency, Percentage, mean
Pie Chart	Univariate	Categorical: Nominal	Show proportions of a whole	Percentage
Box plot	Univariate for 2 or more groups	Scale: Interval, or Ratio	Show distribution and identify outliers	Median, Quartiles, and IQR, and outliers
Dot plot	Univariate	Both: Categorical or Scale	Display individual data points	Depends on the type of data
Comparative dot plot	Univariate for 2 or more groups	Categorical: Nominal or Ordinal	Compare individual data points across categories	Depends on the type of data
Stem-and-leaf display	Univariate	Interval, or Ratio	Show distribution and individual data points	Display counts
Comparative stem-and-leaf display	Univariate for 2 groups	Interval, or Ratio	Compare 2 or more groups of individual data points	Display counts to compare
Histogram	Univariate	Scale: Interval, or Ratio	Display distribution of continuous data	Mean, Median, Standard deviation
Scatterplot	Bivariate	Scale: Interval, or Ratio	Explore relationships between two variables	Correlation coefficient
Time series plot	Univariate, collected over time	Scale: Interval or Ratio	Investigate trends over time	Means by time point (if appropriate), Median, Time-related statistics
Bubble Chart	Bivariate	Both: Categorical and Scale	Display three dimensions of data with markers	Depends on the type of data
Heatmap	Univariate or Bivariate	Both: Categorical or Scale	Visualize the magnitude of a phenomenon	Mean, Median (if applicable)

The purpose of most of these graphical displays is to understand the distribution—keep that thought in mind as we move through the examples.

Let's review some of the terms. Here is a quick overview of some types of variables:

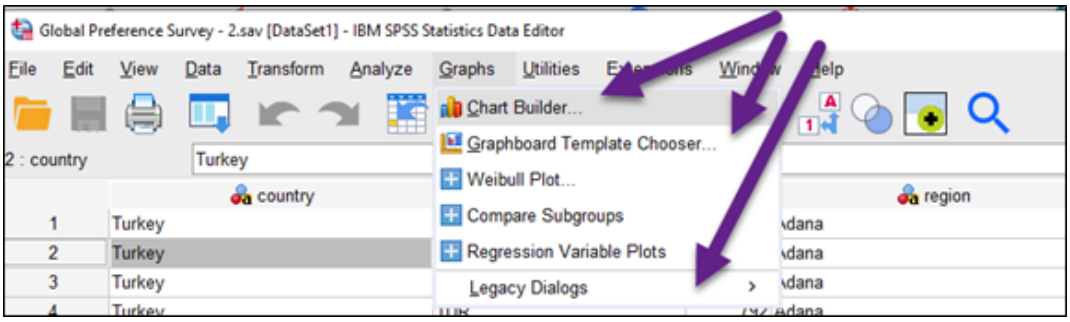
- **univariate dataset:** consists of observations on a single variable made on individuals in a sample (e.g., height).
- **bivariate dataset:** where two different characteristics are measured simultaneously (for example—swimming pool attendance and temperature). Usually, the researcher is trying to find out the relationship, causes and explanations. These variables are often plotted on x- and y-axes on various graphs. One variable is dependent, and one is independent.
- **multivariate dataset:** when the data involve three or more variables (e.g., a marketing researcher wants to compare three different social media ads using the click-through rate for both men and women).

Graphs and Charts in Statistical Package for Social Sciences (SPSS)

Most researchers underestimate the possible graphics in statistical software programs like SPSS. You aren't expected to create graphs and charts in SPSS (most of us prefer Excel); it is important to at least know what is available.

Let's look at some of the features using a public dataset. SPSS offers chart builder, Graphboard template chooser, and legacy dialogues. Figure 6.1 shows the Chart Builder in SPSS.

Figure 6.1—SPSS Graph and Chart Capability



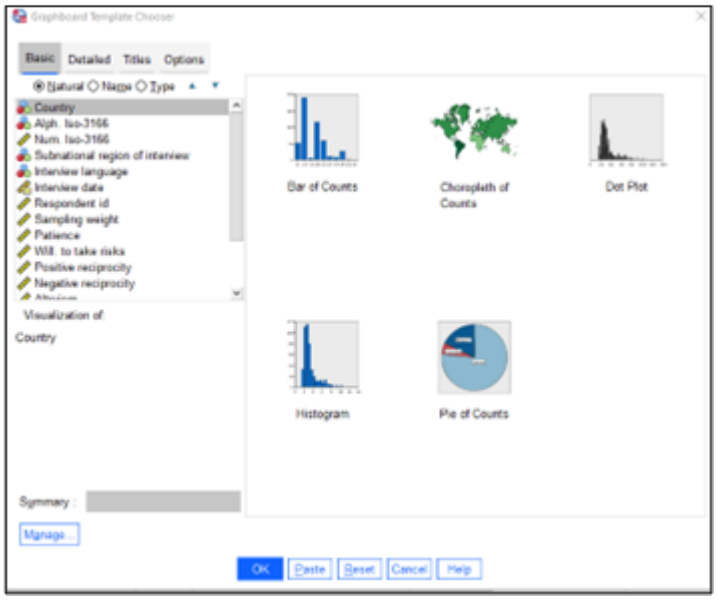
Source: Screenshot of IBM SPSS Statistics interface © IBM Corporation. Author Annotations Added

The Graphboard Template chooser (Figures 6.1 and 6.2) includes Basic, Detailed, Title, and Options. When you click on a nominal category (i.e., country), it will give you specific charts that are appropriate for the data, but a word of caution. Even if it shows an appropriate chart type for the data, make sure you think about what to expect. For example, if the dataset had 49 countries; imagine what a pie sliced 49 times would look like!

SPSS manages statistical procedures and graphical analysis in an integrated manner. But the biggest reason to use SPSS might be the preferences of the research community and the requirements of your discipline. But for most of us, we are much better working with Excel, because it is what we know. Although we don't delve into all the capabilities of SPSS in this textbook, it is still a good idea to know what you can do in it.

There are some similarities—for example in the Graphboard template chooser, you see the type of charts SPSS recommends based on the data type (Figure 6.2).

Figure 6.2—Graphboard Template Chooser



Source: Screenshot of Graphboard interface in IBM SPSS © IBM Corporation

All statistical software packages have graphing capability, and most are fairly intuitive. And Excel will meet most of your requirements. But let's look at some of the known issues in Excel as well as some tips and tricks to help you tell your data story better.

Consider Purpose

Label data point or axis: Consider your purpose when deciding on either axis label or labeling the data points directly. For big picture trends, use the axis. If specific values are important, label the data point. So if you label the data point, eliminate the axis.

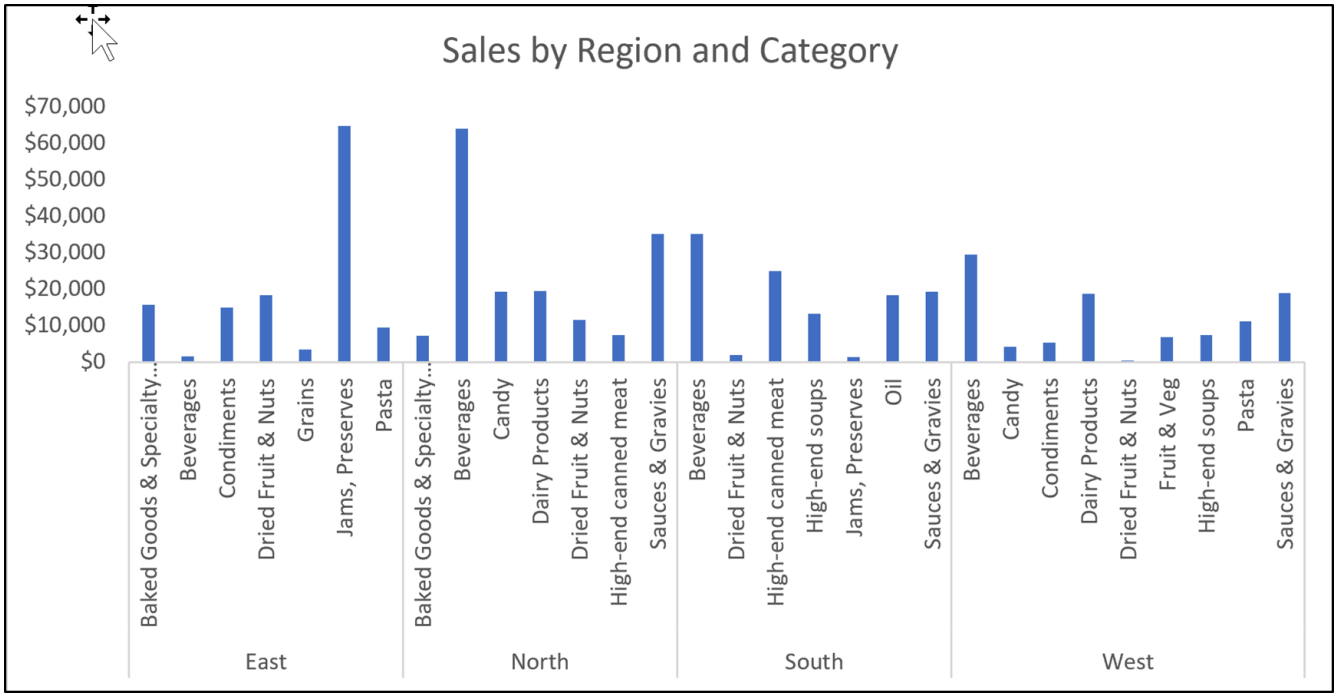
Font size and type: Another important aspect is font type and font size. Keep it simple and choose fonts that are easy to read. A study conducted by Song and Schwarz (2008) gave students instructions on exercising. Half the students were given written instructions in an easy-to-read Arial font. The other half were given instructions using a brushstroke font. The results? Students with the script font (brushstroke) expected the exercise routine to be difficult and indicated they were less likely to try it. So if your chart looks complicated, the message may get lost.

Default settings: Unfortunately, Excel's default settings for graphs will include gridlines, two decimal places, tick marks, and its own interpretation for colors. Excel will also include a legend that you might not need as well as a poor title name and field buttons. Some experts refer to these as "visual noise." If you have a specific chart style preference, the ideal step is to create a chart template, rather than customizing each chart.

Emphasize purpose: Many data storytellers use arrows to draw the audience's attention. However, you can also use images with annotations. For example, assume you are looking at the history of online users from the time your organization launched their website until today. You noticed specific surges in online users as you look at the trendline. As you dive into the data, you discover that there was an increase in online users after your organization launched Facebook, and then another surge when you launched Twitter. Adding a graph with an explanation works well, but you could also use the Facebook logo and Twitter logo along with the text, like an annotation.

Prechunk: Most people can only process four to seven pieces of information, so it makes sense to evaluate the data and think of how best to show it. Suppose your main point is to show the largest sale category for each region with a sense of the variety of products sold. In Figure 6.3, you can figure it out with some effort, but you have lots of distractions or noise.

Figure 6.3—Showing Sales by Region and Category in One Chart



Instead of one large chart for XCaliber Foods, you can use multiple charts, one for each region, highlighting the largest category with a distinct color and use an overlay or animated text to show sale *details* in the East, West, North, and South areas of the United States.

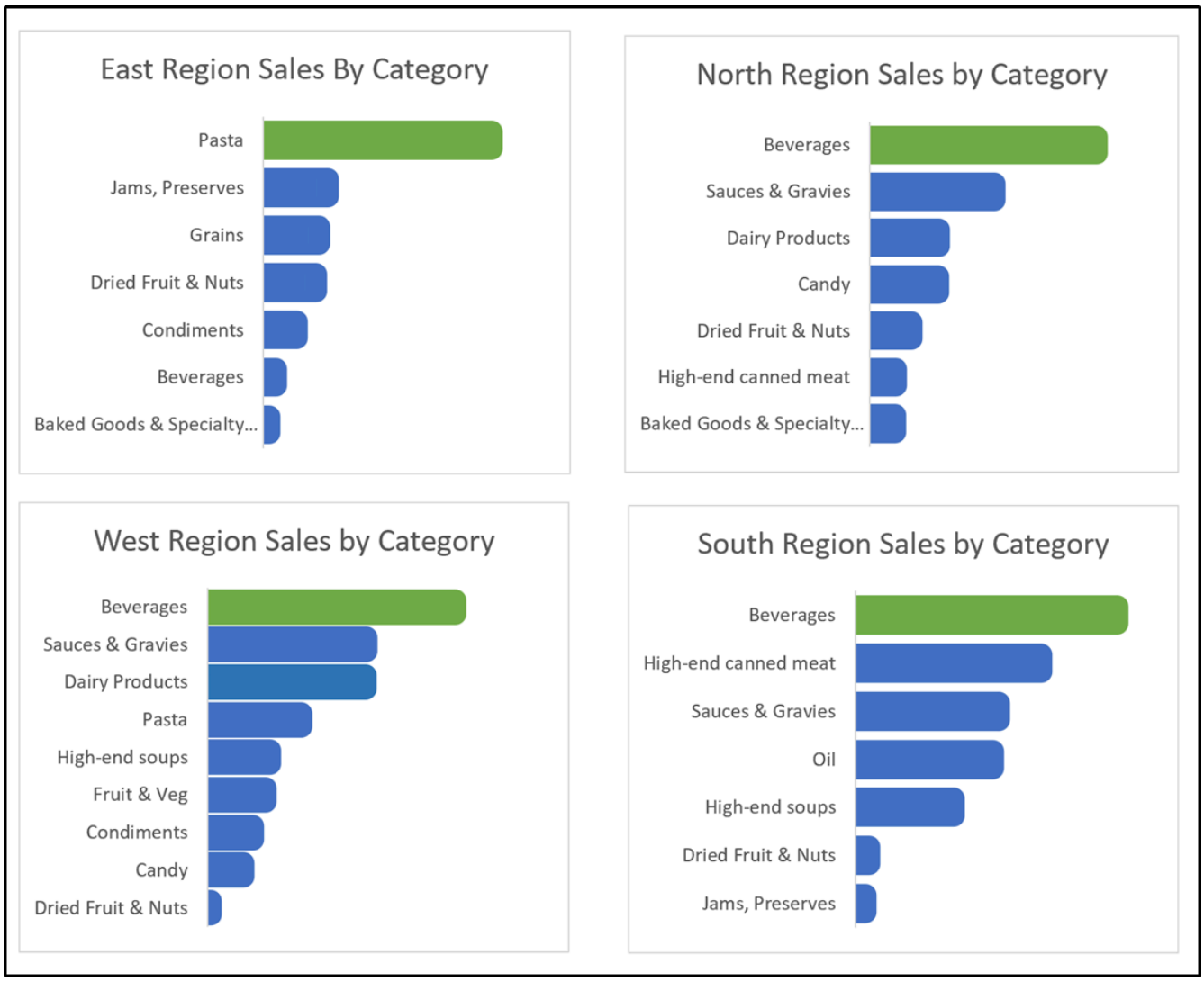
In addition, annotating with text could show the percentage of the largest category to the overall category in the region as well as the percentage of this category overall. The annotations can be brought in as an overlay (like adding animation in a PowerPoint presentation). But let's look at the insights (Figure 6.4) from this prechunk approach with no overlay.

Insight #1: In the multiple charts, it is obvious that three out of four regions have beverages as the largest sales category.

Insight #2: In multiple charts in the West region, the *variety* of products is larger than all other regions.

Insight #3: Pasta has the highest sales in the East, but pasta is barely represented in the other regions. What insight could a presenter bring for this finding?

Figure 6.4—Prechunk: Show Multiple Charts



Now let's look at the steps to create custom templates in Excel, so it makes this process easier. Also, let's work with a previous dataset, Campus Travel Ticket Sales, so the only new thing you are learning is saving a chart as a template.

Step-by-Step Approach to Creating a Custom Template in Excel

1. **Open** the Excel file, "Campus Travel Ticket Sales." (This is in Chapter 4 files.)
2. **Create** a chart using the column for salesperson and the column indicating the number of tickets sold. The default looks like the following (notice the gridlines, the axis, the large gaps, the color blue, and the visible field buttons).
3. Now **customize** the chart so it looks like the chart on the right.

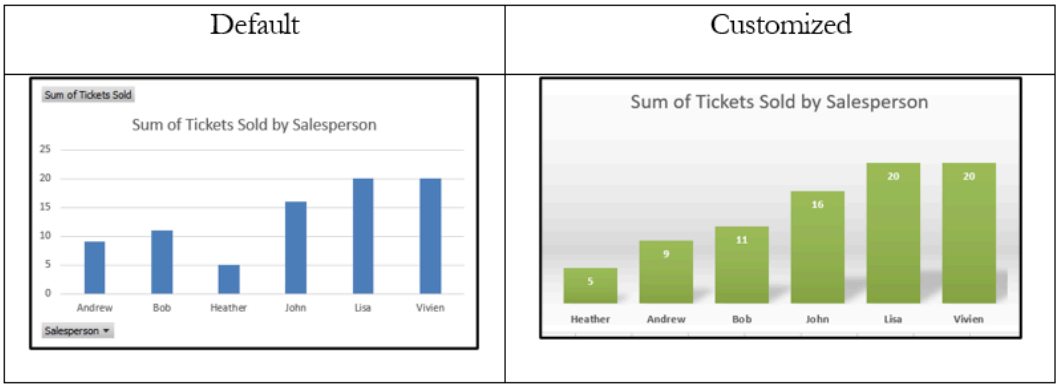


Figure 6.5—Default Versus Customized Charts

4. **Right-click** the customized chart and **Save as Template**, and for file name, use "Green_Dashboard."

5. Now click in the raw data and **insert a PivotTable**. Pull destination to rows and tickets sold to values. It should look like Figure 6.6.

	A	B	C
1			
2			
3	**Row Labels**	**Sum of Tickets Sold**	
4	Egypt and South Africa	10	
5	France (Paris and Nice)	8	
6	Hungary and Poland	11	
7	India	13	
8	Japan	12	
9	Middle East (UAE, Qatar and Oman)	13	
10	Thailand or Indonesia	14	
11	**Grand Total**	**81**	
12			

Figure 6.6—Destination Sum of Tickets Sold

6. Now select a cell in the PivotTable and **click Insert** and then **recommended charts**.

7. **Click the Templates folder** and choose the customized "Green_Dashboard chart." It should look like the following. Notice that the only thing you need to change is the title and that this format works with your other graph (see Figure 6.7).

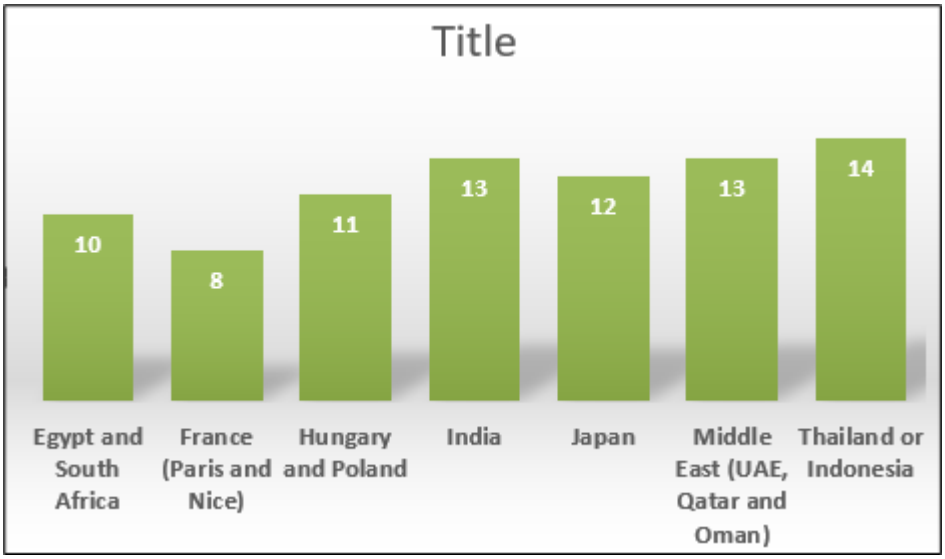


Figure 6.7—Using a Template for a Chart

What action title should we use for the graphic? That would depend on the purpose and the insight you wished to share.

6.1 Self-Assessment: Choose Appropriate Infographics and Charts

Learning Objective #1—Choose the appropriate infographic and chart based on data type

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=574#h5p-31

6.2 Visualize Key Performance Indicators

> If you can't measure it, you can't improve it.
> —Peter Drucker

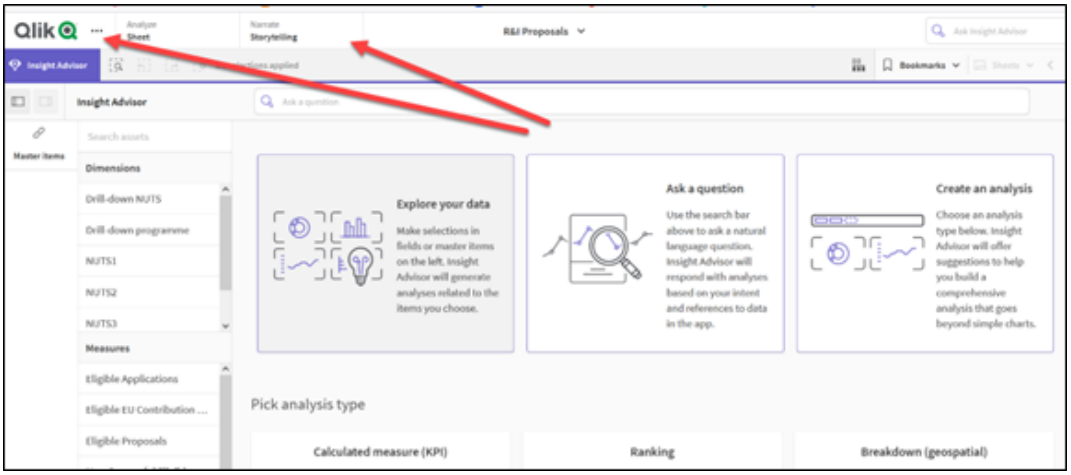
If you do a search in this textbook, you will discover that key performance indicators (KPIs) have been discussed in several chapters. This section is devoted to a unique use of KPIs. The application of KPIs in unconventional contexts reflects

a paradigm shift in how we assess progress and tackle global challenges. The visualization of KPIs in these diverse settings goes beyond data representation; it serves as a catalyst for informed decision-making, public engagement, and the pursuit of a more sustainable and equitable future. Look at some of the unique ways KPIs are visualized.

European Commission Use Qlik and Narrate Storytelling to Show Progress

The European Union is the EU's politically independent executive arm. It draws up proposals for new European legislation, helps shape the EU's overall strategy and monitors the EU budget. KPIs play a pivotal role in tracking the progress of each goal, providing a quantifiable framework for assessing impact. "Since its launch in 2015, data.europa.eu has been the main point of access at the EU level to public sector information published across Europe . . . with aims to improve access to open data, as well as foster both high-quality open data publication and the reuse of open data to create impact" (Measuring Open Data Maturity, 2023, para 3). To that end, the European Commission supports Single Electronic Data Interchange Area (SEDIA) on their Horizon Dashboard. But even more interesting is the EC's use of Qlik. The European Union uses Qlik to add a "Narrative Storytelling" feature (see Exhibit 6.2) so a user can take snapshots of current graphics and create their own story.

Exhibit 6.2—How a User Can Use Qlik With the EU SDGs



Source: Screenshot of Qlik Interface © QlikTech International AB, https://www.qlik.com. Author Annotations Added

Essentially, you add the graphs that provide insight to the Qlik library and place them in the order that supports a good story with related insights. As you can see, Qlik allows a viewer to look at the R&I Proposals in European countries to narrate a story. To better understand this process, watch "Building Your Story," which was produced in 2022 by Qlik Help.

This video is a little over six minutes long.

Qlik Help. (2022, Apr 29). *Building Your Story*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=574#oembed-1

Keep in mind that Qlik (or Qlik Sense) is one of many business intelligence tools. Here is a list of other software apps that offer a similar product. The main reason to include so many on the list is the shift to public data.

- SAP Business Objects Business Intelligence
- Statistical Analysis Systems (SAS)
- Microsoft Power BI (this is covered in our next chapter!)
- Tableau (remember Tableau public is free)
- Zoho Analytics
- Oracle Business Intelligence
- Qlik Sense

United Nations and the 17 SDGs

The United Nations Sustainable Development Goals (SDGs) represent an ambitious agenda aimed at addressing global challenges, ranging from climate action to social equality. KPIs play a pivotal role in tracking the progress of each goal, providing a quantifiable framework for assessing impact. The point to make here is the use of icons that drive every report. This short video gives a quick introduction to the SDGs.

This video is a little over one minute long.

United Nations. (2018, Apr 20). *Do you know all 17 SDGs?* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=574#oembed-2

Look at how thoroughly the United Nations carries out the icon and even the icon color. For example, Goal 1 is "No Poverty" with a bright red background. If you click on Goal 1 at https://sdgs.un.org/goals, and scroll down, the infographic is a white background with red lettering with the title "End poverty in all forms everywhere." Try visiting the website to notice how well the United Nations uses color and icons to keep a wealth of data organized. Visualization of KPIs often takes the form of interactive dashboards, heatmaps, and thematic charts.

Key Performance Indicator—What Is Important?

Organizations will have different KPI visualizations depending on the purpose, the stakeholders, and the time available to look at them, but there are some specific components to consider when you are organizing the KPIs for your organization. According to Kerzner, there are six attributes to KPIs: predictive, measurable, actionable, relevant, automated, and few in number (2017, pp. 210–211).

Think about what we mean when using the words "key," "performance," and "indicator."

- key = major contribution to success or failure
- performance = provides measurable, quantifiable, and controllable elements
- indicator = valid representation of present performance

If you start looking at KPIs for your organization type, you will find that many organizations have KPI creep. This may mean that stakeholders are asking for information that may not necessarily have a specific target. For example, University KPIs often have the location of students as part of their reporting and insights. Board of trustee members want to

know where the students are coming from (which state), the international student's location, and other interesting factors. Some organizations split up entire dashboards by an overall topic (not necessarily tied to KPIs). See the following example from the University of Tennessee. You will see several dashboards: Graduate Blueprint, Enrollment Management, Human Resource, Academic Unit Stats, Student Success, Academic Reporting Portal, Faculty Reporting Database, and others. Maine's Public Universities provides a one-page summary with a three-year trend key letting you quickly see either meeting goal, neutral, or not meeting goal. (This site uses Tableau public.)

The University of Tennessee: Data Central—Decision Support Resources for the UTK Community. (2023). https://data.utk.edu/executivedashboard/

Maine's Public Universities. (2023). Board of Trustee Accountability Data. https://www.maine.edu/databook/ums-dashboard/

6.2 *Self-Assessment: Key Performance Indicators*

Learning Objective #2—Design appropriate visualizations for key performance indicators (KPIs)

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=574#h5p-32

6.2 *Exercise 1: Key Performance Indicators*

Learning Objective #2—Design appropriate visualizations for key performance indicators (KPIs)

Outline the main KPIs for your organization. Next, determine how they follow what is called SMART goals (specific, measurable, achievable, relevant, and time-bound). Set it up as follows and show how the KPI meets the SMART goals:

a. Key performance indicator:

i. Specific

ii. Measurable

iii. Achievable

iv. Relevant

v. Time-bound

Discussion Question #1

Research your industry for common KPIs. Be ready to discuss how they contribute to the success of the organization.

Discussion Question #2

Examine the features of Qlik that make it a suitable platform for visualizing KPIs. How does Qlik (or Qlik Sense) enhance the presentation and interpretation of complex data, and what advantages does it offer compared to other data visualization tools?

6.3 Academic Reporting Standards to Accompany Visualizations

> Clear thinking becomes clear writing; one can't exist without the other.
> —William Zinsser, *Writing Well: The Classic Guide to Writing Nonfiction*

Most graduate programs require a specific style and grammar guideline for all theses and dissertations, and the style guides can vary by discipline. This text will show examples following APA 7th edition for the more common statistical tests. Don't worry if you struggle a little to understand the statistical terms. The point here is to become familiar with the type of standards required by APA 7th edition style guide.

Many students have questioned, "Why so strict?" The American Psychological Association (APA) publishes guidelines to ensure consistency and clarity in scholarly writing. They are standardized so readers can quickly locate and interpret information. The APA also wants consistency across publications, so it aligns with the formatting standards of a broader academic community. Part of the strict requirements is to ensure clarity and interpretability. While the guidelines may seem strict, they serve the broader goals of enhancing communication and maintaining a high professional standard in academic writing.

APA 7th Edition Format for Figures (Charts and Other Visuals)

The APA style guidelines consider graphs and other visuals as "figures." There are specific guidelines for sample bar graphs, line graphs, flowcharts, sample maps, and a variety of infographics that clarify the text. In order to help with this, the APA Style website offers examples as well as a downloadable Word file.

APA 7th Edition Website. Link: https://apastyle.apa.org/style-grammar-guidelines/tables-figures/sample-figures

APA 7th Edition Table Format for *t*-test

For this example, let's look at a subset from Larson & Morris's (2008) study "Sex and Salary." A survey of purchasing and supply professionals, answering the age-old question, "Are women still paid less than men for comparable work?"

The actual sample was large (over 300), but here is the subset of the data. The amounts are in the thousands, and there are 10 samples for each group:

Men: 81, 69, 81, 76, 76, 74, 69, 76, 79, 65

Women: 78, 60, 67, 61, 62, 73, 71, 58, 68, 48

Review the output illustration of the independent *t*-test. Be consistent throughout. A caution: Always review the latest APA updates. Requirements and suggestions change!

#1—Include the mean and standard deviation of both groups

#2—Include Levene's test result

#3—Include the calculated t-value

#4—Include the degrees of freedom

#5—Include the significance (report p values less than .001 as p < .001)

#6—Include the effect size

Exhibit 6.3—Sample *t*-test Information—Are Women Paid Less?

T-Test

Group Statistics 1

	Gender	N	Mean	Std. Deviation	Std. Error Mean
SALARY_	men	10	74.60	5.400	1.707
	women	10	64.60	8.618	2.725

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
			2	3	4	5			95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SALARY_	Equal variances assumed	2.004	.174	3.110	18	.006	10.000	3.216	3.244	16.756
	Equal variances not assumed			3.110	15.123	.007	10.000	3.216	3.150	16.850

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SALARY_	Cohen's d	7.191	1.391	.390	2.361
	Hedges' correction	7.509	1.332	.373	2.261
	Glass's delta	8.618	1.160	.114	2.161

6

Note: Author Illustration (2025)

Please note that the APA 7th edition manual Section 6.36 suggests that standard deviations should be one decimal, but the APA Sample Tables show several *t*-test tables with three decimal places! So please be consistent as well as discuss this with your thesis or dissertation committee. **Keep in mind that you could have a narrative or a table but not both**.

Independent *t*-test Sample Write-Up

An independent *t*-test sample was conducted to compare annual salaries for male purchasing managers and female purchasing managers. Levene's Test for equality of variance (showed no violations, $p = .174$). Results indicate that males (M = 74.60, SD = 5.40) earned significantly more than females (M = 64.40 and SD = 8.618).

$t\ (18) = 3.11$, $p < .001$, *Glass's delta* = 1.160

The effect size is high; the difference between the two means is more than one standard deviation.

Table 6.2: Independent *t*-test Sample Table

Annual Salaries Parameter	Males		Females		$t(18)$	p	Glass's delta
	M	*SD*	*M*	*SD*			
Annual Purchasing Manager Salaries	74.60	5.40	64.60	8.62	3.11	0.003	1.16

Note: Author Illustration (2025)

The APA manual has lots of help on sample tables. Bookmark the following reference.

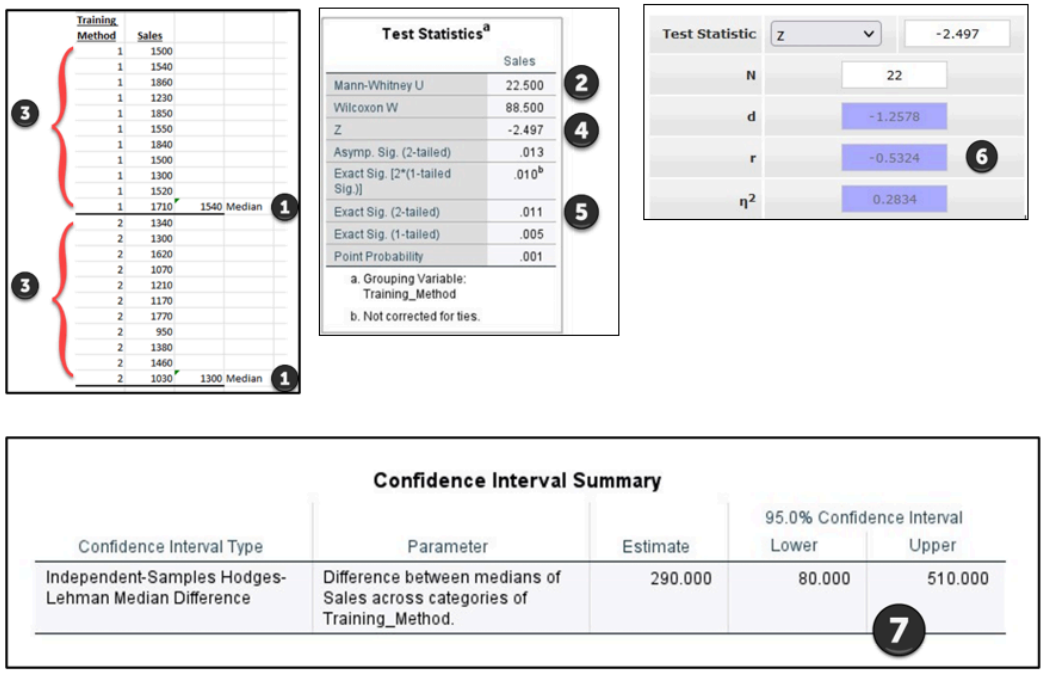
American Psychological Association. (2023). APA Style—Sample Tables. Sample tables (apa.org) https://apastyle.apa.org/style-grammar-guidelines/tables-figures/sample-tables.

APA 7th Edition Table Format for Mann-Whitney U Test

The sample dataset is for two groups, training method A and training method B. Essentially, training method A is for group 1 and training method B is for group 2. There are 11 participants in each group. After the salesman training, a month of sales data was collected. Preliminary exploration determined that the data fit a nonparametric test (the Mann-Whitney U test). Although we don't show you the SPSS results, the following requirements should be met:

#1—Include the median of both groups
#2—Include the U test results
#3—Include the sample size of each group
#4—Include the z score
#5—Include the significance (report p significance from Exact)
#6—Include the effect size
#7—Include the confidence interval

Figure 6.8—Mann-Whitney U Test: Training Methods (Excel, SPSS, and Online Z Calculator)



Note: Author Illustration (2025)

Confidence Interval Summary

Confidence Interval Type	Parameter	Estimate	95.0% Confidence Interval	
			Lower	Upper
Independent-Samples Hodges-Lehman Median Difference	Difference between medians of Sales across categories of Training_Method.	290.000	80.000	510.000

7

Mann-Whitney U Test Sample Write-Up

Training method A had sales of (Mdn = $1540, n = 11) and were higher than those in training method B (Mdn = $1300, n = 11). A Mann-Whitney test indicated that this difference was statistically significant, U = 22.5, Z = −2.497, *p* =.011, with a larger effect size, r = −.5324, 95% CI [80, 510].

Mann-Whitney U Test Sample Tables

In this section, let's look at a couple of examples. The first example is set up for one test and it does not include the confidence interval.

Table 6.3: Example Mann-Whitney U Table

	Training A		Training B		*U* (22)	*p*	*Z*	r
	Mdn	*Range*	*Mdn*	*Range*				
Sales	$1,540	$ 630	$1,300	$ 820	22.50	0.011*	-2.497	-0.532

Note: Author Illustration (2025)

The second table assumes that you will add other statements. For example, you may have conducted a survey with the training that may be relevant. Again, the confidence interval would be placed in narrative if not included in the table.

Table 6.4: Mann-Whitney U Table With Additional Statements

Statement	Training Category	*N*	Mean rank*	*U*	*Z*	Significance	r
Training method A has more impact on sales	Method A	11	14.95	22.5	-2.497	.011*	-0.532
	Method B	11	8.05				
	Total	22					

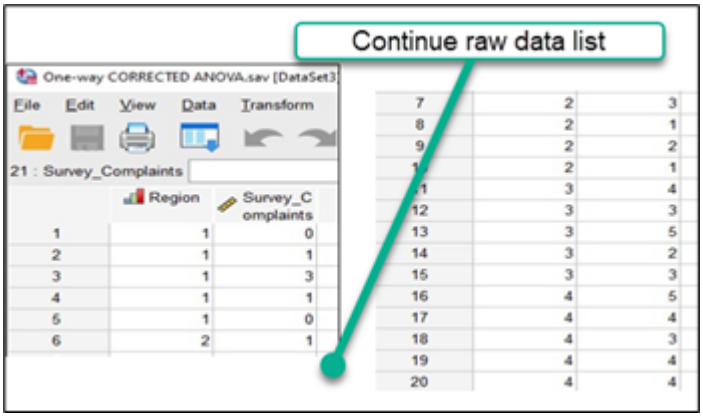
*Mean Rank difference is significant at the 0.05 level

Note: Author Illustration (2025)

APA 7th Edition Table Format for ANOVA

Sample study: Your company has timber yards in all four regions of the United States, and you've received complaints about your COVID-19 policies, but you don't know if the complaints are mostly in one region or not. You randomly choose five stores in each region to collect the number of complaints (mainly guests who do not want to wear a mask) from their store in the last month. You want to see if there is a difference between regions before you make any changes to the COVID-19 policies. The raw data are shown in Figure 6.9.

Figure 6.9—Raw Data for ANOVA



Source: Screenshot of IBM SPSS Statistics interface © IBM Corporation. Author Annotations Added

The following requirements should be considered.

#1—Include the mean and standard deviation for all groups.

#2—Include the F test results with degrees of freedom.

#3—Include the sample size of each group.

#4—Include the significance.

#5—Include the effect size (and in the narrative indicate which one was used).

#6—Include the confidence interval (probably in a further discussion).

The order of the exhibits shown is not the actual order you would complete these in SPSS; however, it helps to see where each item is found.

Figure 6.10—ANOVA Post Hoc Test in SPSS

Descriptives

Complaints about COVID-19 policies

1

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
North Region	5	1.00	1.225	.548	-.52	2.52	0	3
South Region	5	1.60	.894	.400	.49	2.71	1	3
East Region	5	3.40	1.140	.510	1.98	4.82	2	5
West Region	5	4.00	.707	.316	3.12	4.88	3	5
Total	20	2.50	1.573	.352	1.76	3.24	0	5

Figure 6.11—ANOVA Test in SPSS

ANOVA

Complaints about COVID-19 policies

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	30.600	3	10.200	9.951	<.001
Within Groups	16.400	16	1.025		
Total	47.000	19			

Figure 6.12—ANOVA Effect Size

ANOVA Effect Sizes[a]

		Point Estimate	95% Confidence Interval Lower	Upper
Complaints about COVID-19 policies	Eta-squared	.651	.221	.762
	Epsilon-squared	.586	.075	.717
	Omega-squared Fixed-effect	.573	.072	.707
	Omega-squared Random-effect	.309	.025	.445

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

Keep in mind that you can have a narrative or a table but not both.

ANOVA Test Sample Write-Up

There was significant difference among the four regions on COVID-19 mask complaints, $F(3, 16) = 9.951$, $p < .001$, $\eta^2p = .65$. Post hoc testing revealed significant differences between pairs of regions with North (M = 1.0, SD = 1.23) and South (M = 1.60, SD = .89) having fewer complaints than East (M = 3.40, SD = 1.14) and West (M = 4.00, SD = 0.71). These findings indicate that there are more complaints in the East and West regions.

Table 6.5: ANOVA Test Sample

Measure	North		South		East		West		F(3, 16)	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*		
Complaints	1.00	1.23	1.60	0.89	3.40	1.14	4.00	0.71	9.95***	0.65

***p < .001

This table shows the significance overall, but you would not know the significance between each region from reviewing this table.

APA 7th Edition Table Format for Mixed Methods

Many researchers approach a question using two different methods (qualitative and quantitative), which is then called a mixed methods study. The two methods often entail a survey that has both qualitative open-ended questions and Likert scale questions about perceptions. This helps the research gain a deeper understanding of the issue as well as more confidence in the findings. This process is triangulation. Keep in mind that data collection could include interviews, surveys, focus group interviews, and data captured that is factual and related to the project.

Let's look at the following example:

#1—The table is bold, no italics, no period ending.

#2—The title is in italics.

#3—The Mixed Methods table shows Quantitative results, Qualitative results, and Example quote. The actual APA manual shows a hanging indent, but most dissertations and theses appear to have no indents.

#4—It is possible to have notes if the table cannot be understood from the table title or the narrative.

Table 6.6: Example of a Mixed Methods Table

Note: Author Illustration (2025)

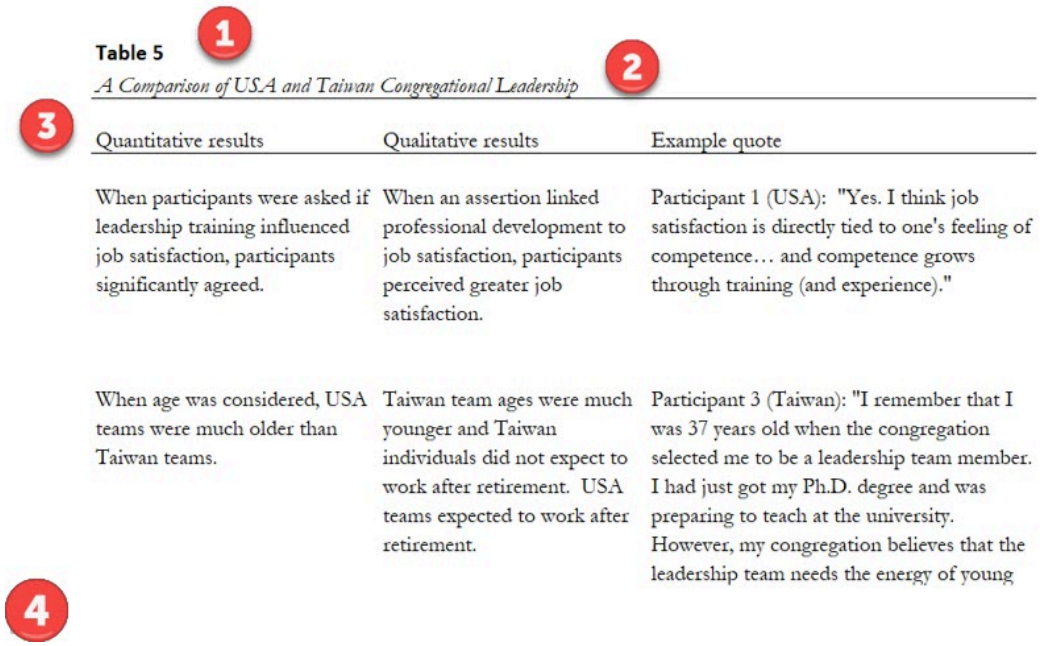


Table 5

A Comparison of USA and Taiwan Congregational Leadership

Quantitative results	Qualitative results	Example quote
When participants were asked if leadership training influenced job satisfaction, participants significantly agreed.	When an assertion linked professional development to job satisfaction, participants perceived greater job satisfaction.	Participant 1 (USA): "Yes. I think job satisfaction is directly tied to one's feeling of competence… and competence grows through training (and experience)."
When age was considered, USA teams were much older than Taiwan teams.	Taiwan team ages were much younger and Taiwan individuals did not expect to work after retirement. USA teams expected to work after retirement.	Participant 3 (Taiwan): "I remember that I was 37 years old when the congregation selected me to be a leadership team member. I had just got my Ph.D. degree and was preparing to teach at the university. However, my congregation believes that the leadership team needs the energy of young

Please make sure to review the APA guidelines online for specific examples that resonate with you!

6.3 *Self-Assessment: APA 7th Edition Format*

Learning Objective #3—Apply appropriate visualizations that meet academic standards and follow APA 7th edition

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=574#h5p-33

Chapter 6 Summary

This chapter underscores the fundamental "purpose" behind visualizing data, elucidating how specific data types align more effectively with chart formats. Data types were presented to show that certain charts fit data better than others. "Exhibit 6.1—Types of Data" organized the different types of data into nominal, categorical, ordinal, interval, and ratio scales with example calculations and visualizations. "Table 6.1: Which Graphical Display Fits the Purpose?" takes the decision-making process to a more sophisticated level by amalgamating the intended purpose with the most suitable visualization type.

This chapter imparted insights on refining visualizations, encompassing techniques such as noise reduction and the significance of appropriate labeling, including font choices. Notably, default settings in Microsoft Excel lack alerts regarding the suitability of a chart for the given data. Consequently, the recommendation is to craft a personalized set of chart templates so your organization can ensure consistency in appearance. All of this section leads to the importance of chunking. An exploration of "chunking" considers the cognitive strategy that involves grouping pieces of information to enhance user retention and facilitate a comprehensive understanding of collective insights. Chunking is a method of grouping individual pieces of information, so the user remembers the point and sees the collective insight.

Key performance indicators were discussed in a new light to show how nonprofits and governmental units are engaging the public to choose insights that fit their story. Organizations like the European Commission are using tools like Qlik and Qlik Sense to support narrate storytelling with open data and data insights. A user can choose the data insights to support the story that has meaning to them. This is a powerful trend that supports transparency.

The subsequent section delves into academic reporting standards to accompany visualizations, underscoring the significance of adhering to style guidelines specific to one's discipline. Many students in the early stages of writing a thesis or a dissertation may be unaware of guidelines dictating how data should be presented in tables or the appropriate format for charts like histograms. Statistical output was explored to determine the appropriate way to present that data according to APA 7th edition guidelines. It is not necessary to know how to use SPSS; instead, it is working with the output to recognize the patterns of how the data should be presented.

Chapter 6 Case: Create Appropriate Infographics and Charts

You currently work as a data analyst for an online retailer (Walmart) in the United States and your boss just asked you to create charts to show the revenue and growth of Walmart, as well as highlight the fastest-growing market segmentation in the sector. Your boss gave you the **sector** market segmentation data (Table 6.7) and Walmart's revenue from MarketLine (Table 6.8) to get you started. KPI Targets: Growth of 5% from 2021 to 2022 across all categories.

Table 6.7: United States Online Retail Sector Category Segmentation

Category	2017	2018	2019	2020	2021	2022	2017–22
Electrical & Electronics Retail	108,266.5	121,206.6	133,467.1	199,434.9	219,537.3	223,319.0	15.6
Home & Garden Products	49,958.0	60,511.6	71,617.8	123,624.3	159,623.4	183,783.8	29.8
Apparel Retail	69,598.4	78,565.5	87,333.5	107,835.0	125,301.6	137,103.4	14.5
Food & Grocery Retail	30,022.8	37,292.0	46,793.1	83,380.6	102,019.4	119,645.1	31.9
Furniture & Floor Coverings	22,653.4	26,281.9	29,444.9	42,514.1	47,046.2	50,835.5	17.5
Footwear	12,766.9	15,105.7	17,462.3	21,920.2	24,924.7	26,643.4	15.9
TOTAL	293,265.9	338963.3	386118.7	578709.1	678452.6	741330.2	

The last column represents the growth for that category from 2017–2022.

NOTE: Use Table 6.8 to calculate growth. Do not mix Table 6.7 with this one. Table 6.7 only shows a segment of total U.S. revenue. The tables are separate.

Table 6.8: Walmart Revenue (you will need to calculate growth)

Year	U.S. Revenue	% Growth
2018	500,343	
2019	514,405	
2020	523,964	
2021	559,151	
2022	572,754	

Case Objectives

1. Choose the appropriate infographic and chart based on data type.

2. Design appropriate visualizations for key performance indicators (KPI).

Case Instructions

1. Create graphs from both tables and embed them in two or three PowerPoint slides. Make sure to show **good action titles (connect to KPIs that make sense)**. For Table 6.7, use sparklines to show trends. For Table 6.8, use columns and calculate the percent growth year to year.
   a. **Visuals** feature revenue by year and percentage of growth.
   b. **Animation** in a two-slide process or an animation using Flourish or PowerPoint's animation. (If you recall, Flourish can be found in Canva or directly at Flourish.com.)
2. **Research:** Complete a couple of slides that provide insights about the online retail sector. This can be found in Marketline*.Be prepared to post your PowerPoint slides on the discussion board and discuss your action titles and the insights, as well as the rationale behind the charts created.

* Note to Instructor: Students need access to MarketLine in your virtual library for the research requirement.

The dataset is found in the Chapter 6 files—"Ch 6 Case 6.1 Online Retail Analysis."
Download Chapter 6 Student Files (<1 MB).

Chapter 6 References

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7. The Power of Business Intelligence

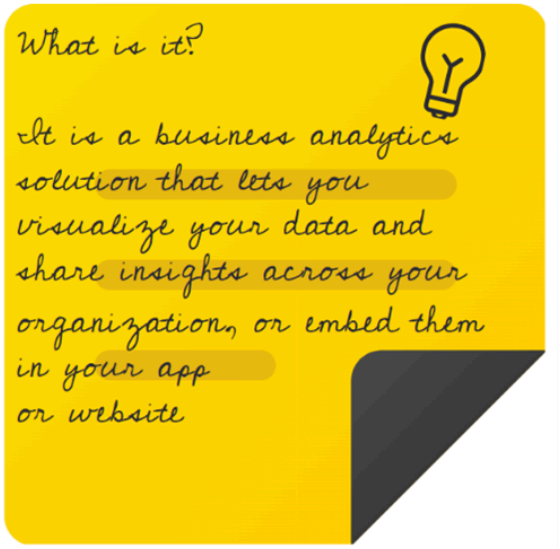
You don't need a title to be a leader!
—Mark Sanborn

What Do You Think?

John was just boarding a return flight from a conference and could not wait to share things he had learned while attending a three-hour session on Power BI storytelling. On his return plane trip, he outlined key points he had learned. As he scrutinized his session notes, he noticed his first note was "What is it?" and then he noticed that he had highlighted "your app" in his note. John was amazed that he had learned how to create a storytelling dashboard and an app.

He started pulling a list of questions from his notes.

1. What type of account do we need, and do we already have Power BI with our Microsoft 365 account?
2. How are we presenting quarterly sales now? How are we telling the story of our sales now?
3. Can we create a dashboard that is interactive and uses visuals (like maps for geographical distribution of sales) and drill-down techniques?
4. Who else in my department knows about Power BI?



Note: Author Illustration (2025)

Consider—What other questions should be part of the planning stage to launch the Power BI suite?

Introduction

In the era of data-driven decision-making, organizations are embracing robust tools to weave compelling narratives from raw data. Microsoft Power BI stands out as a game changer, offering a dynamic platform to transform raw data into actionable insights. This chapter serves as a gateway to a variety of topics ranging from when to use Power BI to applying techniques and features that support storytelling. Examples of how Power BI is used in different industries illustrate how diverse sectors leverage this tool to gain a competitive edge and drive innovation. Power BI building blocks, robust visualizations, and quick insights are some of the features covered in this chapter. When you complete this chapter, you will be able to create your own Power BI reports, and dashboards, and see how an app would benefit communication within your organization. The authors will also share the abundance of training resources available (for free!). Whether

you are a novice or an experienced storyteller, the insights and knowledge gained in this chapter will lay the groundwork for a successful journey into the world of Power BI storytelling.

Before we get started, let's determine the parts that are free. Power BI Desktop is free and users can develop dashboards, create apps, or use the "quick insight" feature. Power BI Desktop is a great place to clean data, analyze data, and create reports. However, Power BI Desktop does not work on a Mac. Power BI Services Online provides the ability to create dashboards (often from the reports created in Power BI Desktop), create apps, and share content. Power BI Services Online works on either Macs or PCs. It makes sense to learn both Power BI Desktop and Power BI Services (Online). Mac users are encouraged to follow the reading during the Power BI Desktop and apply what they learn from the Power BI Services (Online). In this chapter, both the **Power BI Desktop and Power BI Services (Online) will be demonstrated**.

> "**Power BI Desktop** unifies the former Excel Power Tools (Power Pivot, Power Query and Power View) into one vastly improved, stand-alone, data discovery desktop application built on a modernized HTML5 visualization framework."
>
> —Edward Price, *Applied Microsoft Power BI: Bring your data to life!*

Chapter 7 addresses the following learning objectives.

Learning Objectives

At the end of this chapter, students should be able to:

1. LO 1: Explain the differences between Power BI Desktop and Power BI Services Online.
2. LO 2: Upload Excel files and/or sample files to Power BI Desktop to transform (clean) data.
3. LO 3: Create a multipage report in Power BI Desktop with storytelling techniques.
4. LO 4: Publish a Power BI Desktop File (or a .pbix file) to Power BI Services Online.
5. LO 5: Generate quick insights in Power BI Services Online to analyze trends, outliers, and correlations.
6. LO 6: Download available datasets using Power BI skills.
7. LO 7: Apply appropriate visualizations for specific key performance indicators (KPIs).

Key Terms: Bookmark, business intelligence, dashboards, DAX expressions, Decomposition tree, modeling, metrics, My Workspace, One Lake Data Hub, Power BI, Power BI app, Power BI Desktop, Power BI Services Online, quick insights, reports, scorecard, semantic models, storytelling techniques, transform data, Workspace

Download Chapter 7 PowerPoint (11 MB)
Download Chapter 7 Student Files (15.6 MB).

7.1 Features of the Power BI Suite

> Storytelling is our obligation to the next generation. If all we are doing is marketing, we are doing a disservice, and not only to our profession, but to our children, and their children. Give something of meaning to your audience by inspiring, engaging, and educating them with story. Stop marketing. Start storytelling.
>
> —Laura Holloway, founder in chief of The Storyteller Agency

In the previous chapter, you created dashboards in Excel with slicers. For some of you, this may have been your first experience creating a dashboard. If so, keep in mind that old phrase from Bachman-Turner Overdrive, "*You Ain't Seen Nothing Yet*!" If you are familiar with data from your organization, you can probably list the potential uses for building interactive dashboards and reports. But you haven't encountered the "Quick Insights" available in Power BI Services (Online) or seen the ability to create an app for your organization.

Licensing:

Power BI Services (Online): There are three kinds of Power BI Services (Online) per-user licenses: Free, Pro, and Premium. Power BI in Microsoft Fabric is a free account, and no credit card is required to use it. Both PC and Mac users can use Power BI Services (Online). The online service is bundled with Microsoft 365 and is a free license. With a free license of Power BI Services Online, you can use it for personal data analysis and visualization in "My Workspace." The Power BI Service Online is a cloud-based service where users view and interact with reports and dashboards. The Power BI Services (Online) Pro license has built-in collaboration capabilities and costs $10 per user/month. The Pro license opens a way to strategically communicate within your organization.

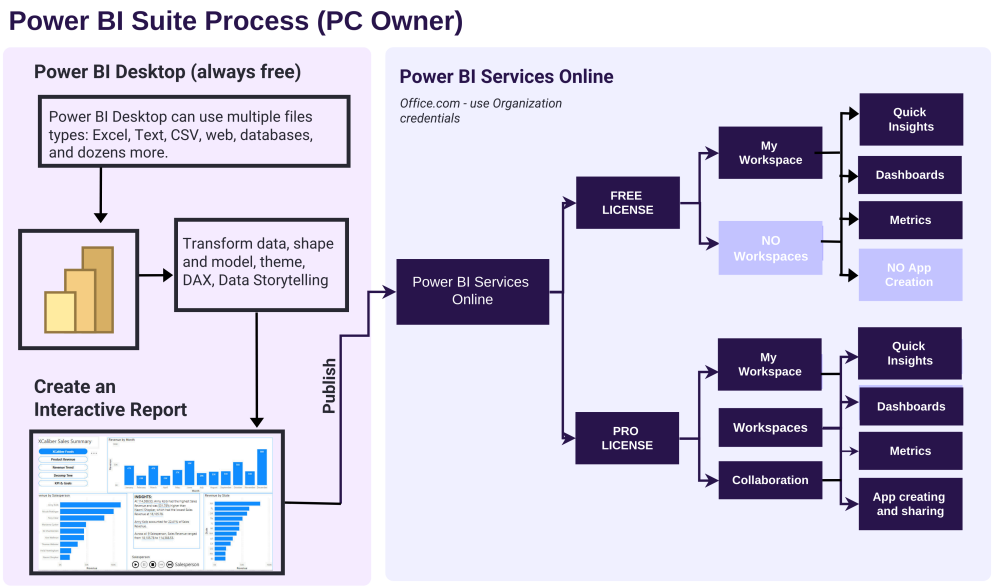
Power BI Desktop: Power BI Desktop can be downloaded from the Microsoft Store and is **always free**. Use the Microsoft store since Windows will automatically update your Power BI Desktop. You can download Power BI Desktop at Microsoft **IF you have a PC**. There is no Mac version at this time.

A Power BI Desktop license allows you to **publish** reports to **My Workspace** if you are using the free version of Power BI Online. If you have a Pro license in Power BI Services Online, you can also publish from the Power BI Desktop to **Workspaces** in Power BI Services Online. You need a Microsoft Power BI Services (Online) **Pro** to publish to the web from Workspaces. I know this sounds confusing, so please feel free to explore Publish to Web from Power BI or Power BI service per-user and capacity-based licenses from Microsoft Learn. The authors will show features of the Pro option, but any assignment expectations will use only the free license.

Please review the Power BI Suite Process shown in Exhibit 7.1, and notice the process is very similar whether you have a free license or a Pro license. The biggest difference is collaboration within the Workspace and the ability to create a Power BI app for consumer consumption. The Pro license unlocks more advanced AI capabilities as well (although we will not be working with AI in this context). The Power BI Desktop accepts hundreds of file types. Once you upload an Excel file to Power BI Desktop and save it, the new extension for the file is .pbix. Both Power BI Desktop and Power BI Services can upload and use .pbix files.

Exhibit 7.1—Power BI Suite Process

Note: *Author Illustration (2024)*



As a Student, Where Do I Find Power BI Services (Online)?

Note: Screenshots of Power BI interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

1. **Login** to your Microsoft Office account provided to you at your university. Make sure to use your college credentials.
2. In the menu (located vertically on the left side), choose **Apps**.
3. **Look** in the "Explore by category" section for Power BI (Power BI is listed under several categories). Review Figure 7.1 to see the menu and Apps area.

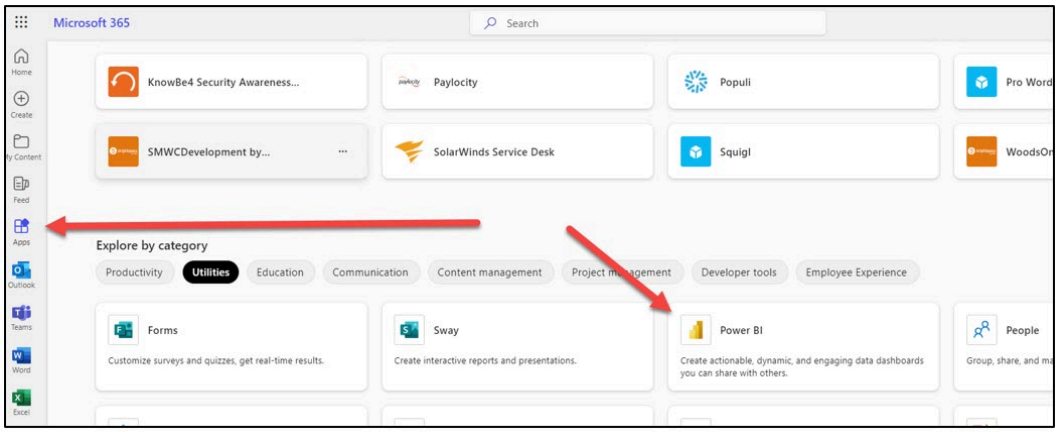


Figure 7.1—Where to Find Power BI Services Online
Note: Screenshot of Microsoft 365 Interface © Microsoft Corporation. Author Annotations Added.

4. When you open Power BI Services (Online) the first time, you should see several tiles like, Getting *Started with Power BI* (see #1 in Figure 7.2), and several *Explore this data story* (see #2). If this is your first time working with Power BI Services Online, make sure to explore these. Keep in mind, your experience will be slightly different

since the examples change. Also, you will not see anything in the **My Workspace** tile since you have not added anything to your My Workspace yet. But the most important component is **Learn** (see #3).

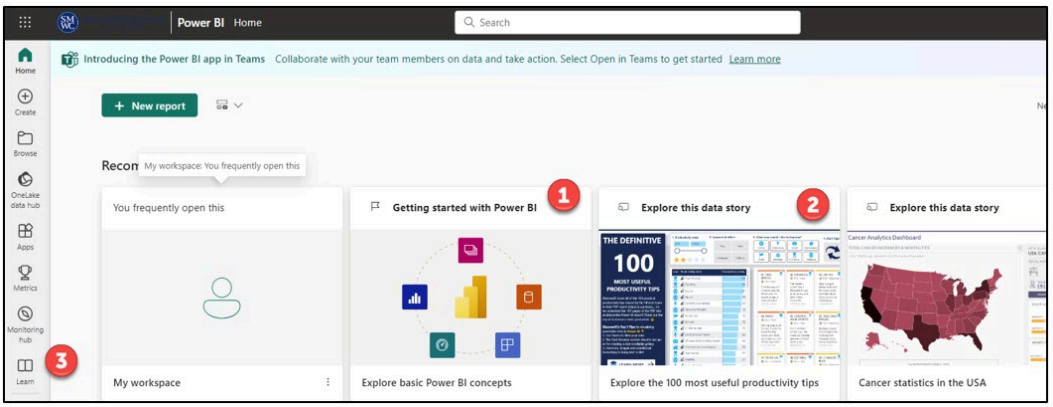


Figure 7.2—Opening Screen for Power BI Services (Online)

5. If you select **Learn** (#3), you will see the Learning Center provided by Microsoft, essentially the hub for all Power BI training. Figure 7.3 shows the variety of examples you can explore. Note the sample reports, information on the newest features, lots of potential training opportunities, and testimonials.

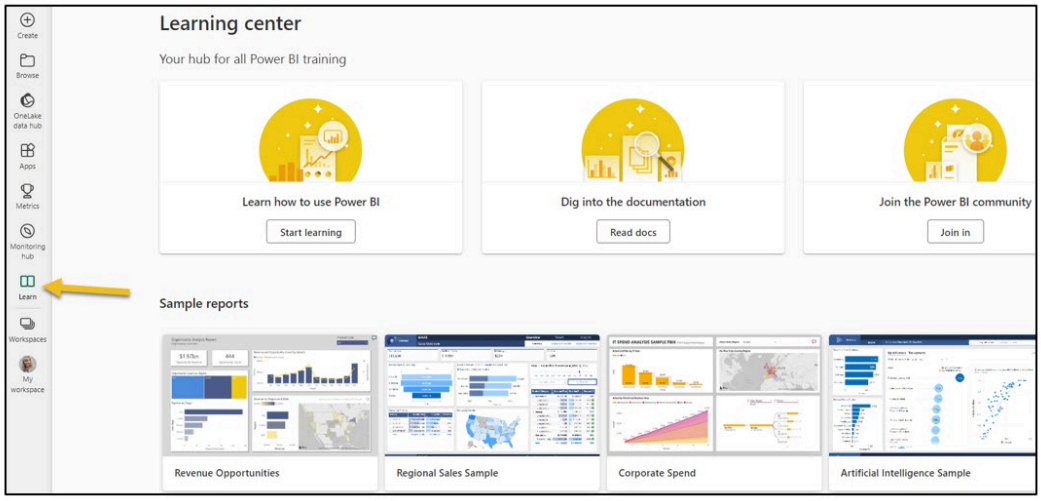


Figure 7.3—Power BI Services Online Learning Center

Before demonstrating how to upload files, let's define some of the terms used by Power BI. Don't worry; take one step at a time to understand how the suite of Power BI works together. This chapter will use Microsoft datasets and templates, public datasets, and the XCaliber Foods dataset to demonstrate many principles. So let's start with the foundational components.

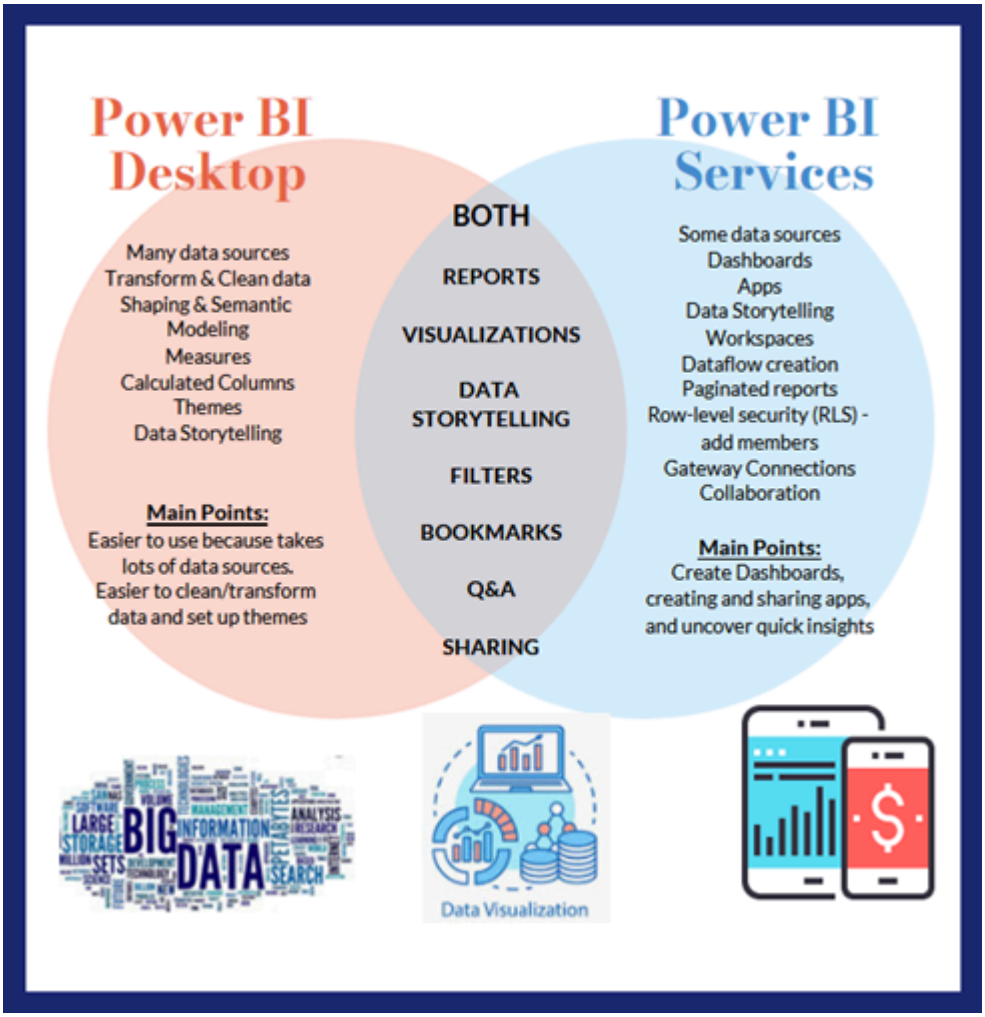
What Is Power BI?

"Power BI is a collection of software services, apps, and connectors that work together to turn unrelated sources of data into coherent, visually immersive, and interactive insights" that can be shared (Microsoft—Power BI Introduction, 2023, para 1). You can upload an Excel file, a SalesForce file, a Mailchimp file, a web page, a database, and **hundreds** of other

sources into Power BI Desktop. Multiple sources are possible. Just as a car is built of metal, fabric, glass, and rubber, a dataset potentially pulls from unrelated, even third-party sources.

The best Power BI experience is on a PC. You can only use Power BI Desktop on a PC unless the Mac is running software to simulate the Windows experience. However, it is possible to do most of the same things in Power BI Services (Online). Let's look at a comparison of Power BI Desktop and Power BI Services (Online). Make sure to notice the main points in the visual. There may be terms you don't understand yet, and that's OK. We will cover them shortly.

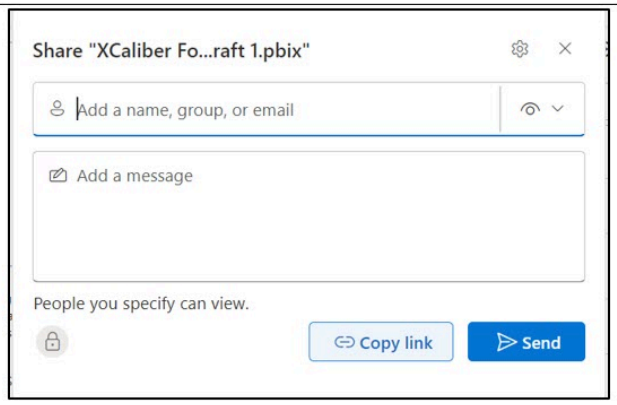
Exhibit 7.2—Comparison of Power BI Desktop and Power BI Services (Online)



Note: Author Illustration (2024)

A note on sharing in Exhibit 7.2. When you use the share button in Power BI Desktop, it is a unique experience depending on whether you use the Pro or Free version of Power BI Services Online. Evidently, Power BI Desktop knows which version you have. Sharing in a Pro environment gives you a way to directly connect with others. Sharing in the Free version means the sharing comes about because you are saving it to a shared folder. Look at Figure 7.4 for some of the differences.

Figure 7.4—Pro Versus Free Sharing Feature

Sharing with Power BI Desktop if **Pro** Power BI Services Online License	Sharing with Power Desktop if **Free** Power BI Services Online License
	

Compare Power BI Desktop to Power BI Services (Online)

The Power BI *suite* has two main components plus an App Creation Tool that work together to give your users the best experience. The first component is the Power BI Desktop.

Power BI Desktop

This is an app that you download to your computer (but it is only for PCs). You can download and install it for **free**. You can upload files from many different sources and connect them through modeling. You can design a report on the Power BI Desktop and **publish** it to Power BI Services Online. If you have the **free** version of Power BI Services Online, your only option in Power BI Desktop is to publish to My Workspace. As shown in Exhibit 7.3, when you first open the Power BI Desktop app, you see a pop-up window to get started with helpful videos to guide you.

Exhibit 7.3—Power BI Desktop App—Opening Screen

To close the pop-up window, just click the X in the upper right-hand corner. You will now see an Untitled—Power BI Desktop container. The main sections include the ribbon, the views, the filters, visualizations, and fields.

According to Devin Knight, a Microsoft Data Platform MVP and president of Pragmatic Works, there are four main

steps to reach the report process: (1) data discovery/data shaping, (2) data modeling (like creating relationships, DAX: Data Analysis eXpression), (3) data visualization (building reports, custom visuals), and (4) data sharing—publishing the reports to Power BI Services Online to share with others (2023, 14:37–15:29). Does it surprise you that data visualization is the third step?

Figure 7.5—Main Sections of Navigation in Power BI Desktop

Ribbon—The ribbon has a similar look and feel to other Microsoft products. At this early stage, one of the key components is the **Get Data** or alternatively **Excel Workbook**. One of the key differences of Power BI Desktop when compared to Power BI Services (Online) is the ability to "get data" from multiple sources. Besides Excel, some of the file types accepted by Power BI Desktop include text/CSV, XML, and PDF, as well as several databases like SQL Server database. There are hundreds of other files that can be used with Power BI Desktop. This is a significant difference since Power BI Services Online accepts very few file types and Power BI Desktop accepts over a hundred file types. Also on the ribbon is the ability to transform data (essentially clean it up).

Note that Power BI Desktop has a **Publish** button on the ribbon. You can only publish to *My Workspace* (if free version of Power BI Services Online). If you are using a Pro version of Power BI Services Online, Power BI Desktop will publish to either *My Workspace* or *Workspace*. Power BI Desktop will know which version of Power BI Services Online that you have (free or pro).

Views—These three icons provide views: Report view, data view, or model view. The **data view** shows your dataset (like opening Excel). The **report view** shows the canvas and any visualizations you have started. The **model view** is where you can create relationships, build hierarchies, or perform calculations through DAX (Data Analysis eXpression). **DAX** is a formula expression language that allows users to create more complex measures, calculated columns, and tables. It is specifically tailored for business intelligence.

Filters—This is somewhat explanatory. You can add filters to "filter the data." An example for using the filter could be if your company is dropping a service or product line and you want to filter it out from anything you create.

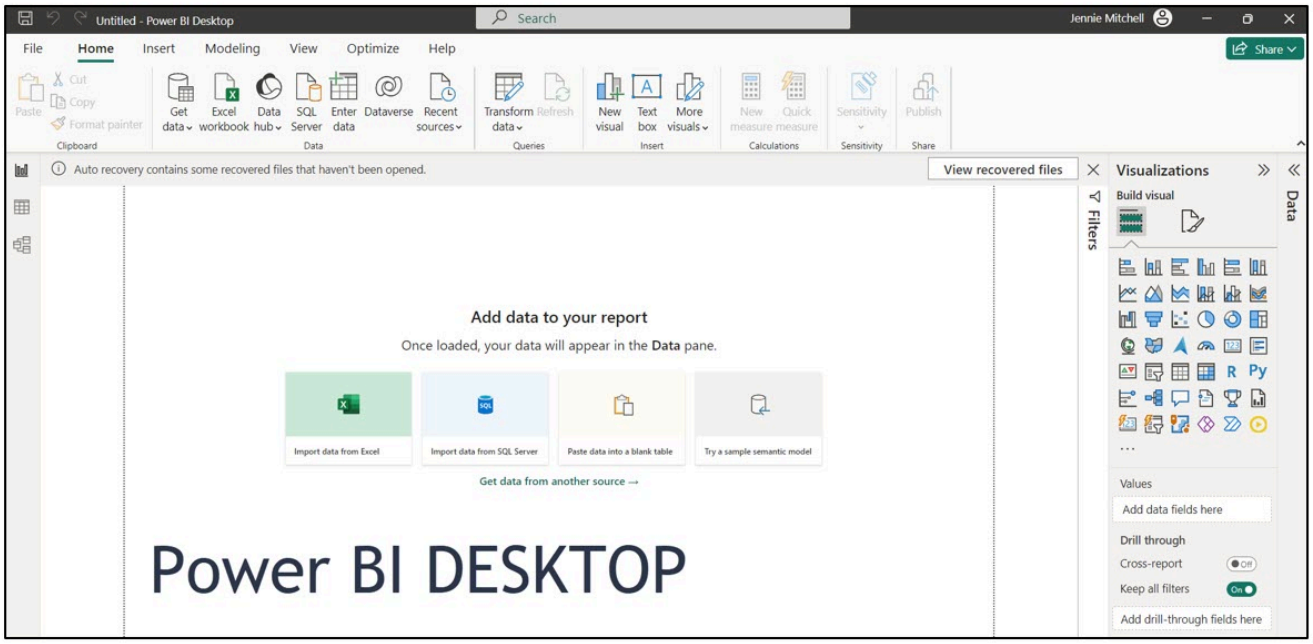
Visualizations—Although you see a robust number of visuals, if you click on the three dots (ellipsis) you can get more visuals. Exhibit 7.4 shows only the first page of visualizations. It might surprise you, but there are over **400 visuals available**! As a word of caution, download visuals that have been tested and approved by Microsoft.

Data shows the tables and fields of the dataset.

Canvas is where you build the report with visualizations and context.

Exhibit 7.4—Example of Power BI Visualizations Available

Figure 7.6—Power BI Desktop



Take a minute to explore the Power BI Desktop as shown in Figure 7.6. Try out the samples so you get a sense of what is available.

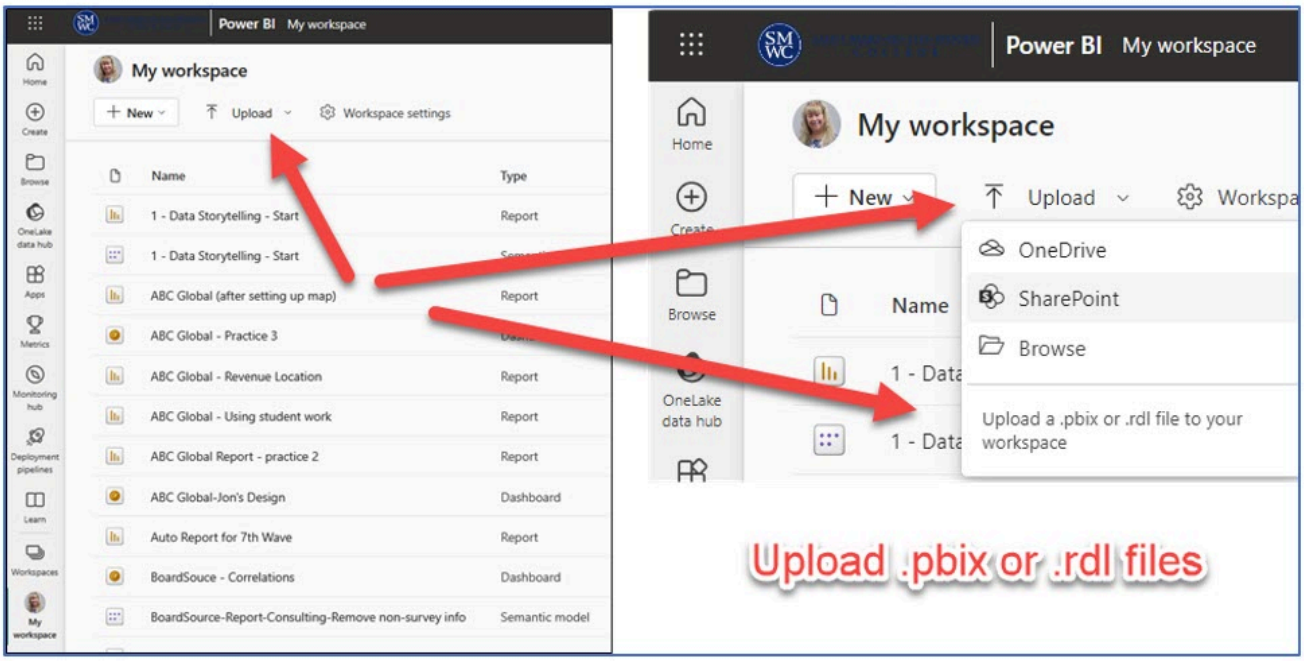
The next component of the Power BI suite is Power BI Services (Online). You can determine your license by selecting your avatar. The authors have a Power BI Services (Online) **Pro** license and a student account that has a **Free** license. We have tried to make sure to point out the differences.

Power BI Services (Online)

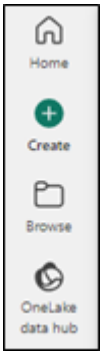
This is available by logging into Office.com using your organization's credentials (shown in the next section). This Power BI Services Online works on either Mac or PC. Power BI services can Upload ***some*** data sources including .pbix files and Power BI Services Online is used to create dashboards and analyze the data through quick insights. If you have the Pro version, you can create and share a Power BI app. There's much more, but let's take it one step at a time. The report you

build in Power BI Desktop is ***published to*** Power BI Services Online. If you have the free account, you can publish to "My Workspace," or if you have a Pro license, you can publish to "My Workspace" **and** "Workspace" assuming you have first created a Workspace! In Figure 7.7, you should note the Upload feature. You can upload a .pbix or .rdl file here, but NOT an Excel file. Read on to discover how you can upload your Excel File to Power BI Services Online.

Figure 7.7—Power BI Services Online



Home, Create, Browse, and OneLake Data Hub in Power BI Services Online



Home is what you would expect—It shows your files based on how recently accessed. It also has a "New report" button that you can use to start creating reports.

Create allows you to add data to start building a report. You have a few choices—(a) Excel (Preview), which means you link your Excel file from OneDrive; (b) link a CSV file from OneDrive; (c) paste or manually enter data (looks like a spreadsheet); or (d) select a published semantic model. If you recall, "Power BI semantic models represent a source of data that's ready for reporting and visualization" (Microsoft Learn, 2023, para 1).

Browse includes a list of files in order of the most recent use.

OneLake Data Hub is a centralized data hub for your entire organization. It allows members of the organization to use Fabric data items if they are given access. When you click on OneLake Data Hub, you will see a list of your data (My data). If you select, "Endorsed in your org," you will see a list of datasets available to you from your organization. Since you are visiting this as a student, this selection will not show any files. You can learn more about this at Microsoft Learn: Discover data items in the OneLake data hub.

A Word to Mac Users

Although you can't use Power BI Desktop to "get data," you can still get your data into Power BI Services Online. Once you have the data in Power BI Services Online, you should be able to create dashboards and reports.

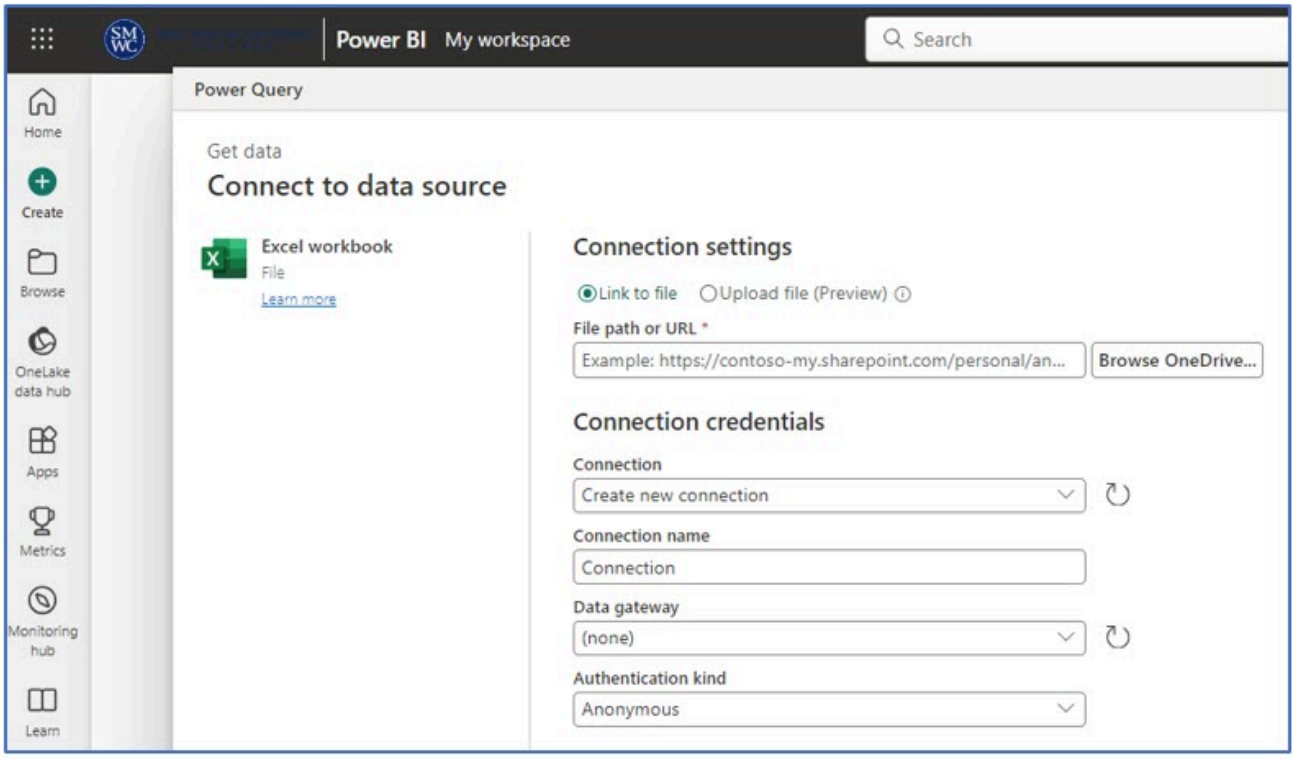
Here are two options:

Option #1—Link an Excel File to Power BI Services Online

Mac users should be able to use Excel Preview to **link** their Excel file to Power BI Services Online. Two things are important.

- First: The Excel file must live in a OneDrive space. According to Microsoft (as of Sept 29, 2023), "Upload of local workbooks to Power BI Workspaces will no longer be allowed" (Microsoft Learn, 2023, para 2).
- Second: Use the **link to file** option, not the upload option. Start with Create, then Excel (Preview), and Link to the Excel file (as shown in Figure 7.8).

Figure 7.8—Link to Excel File



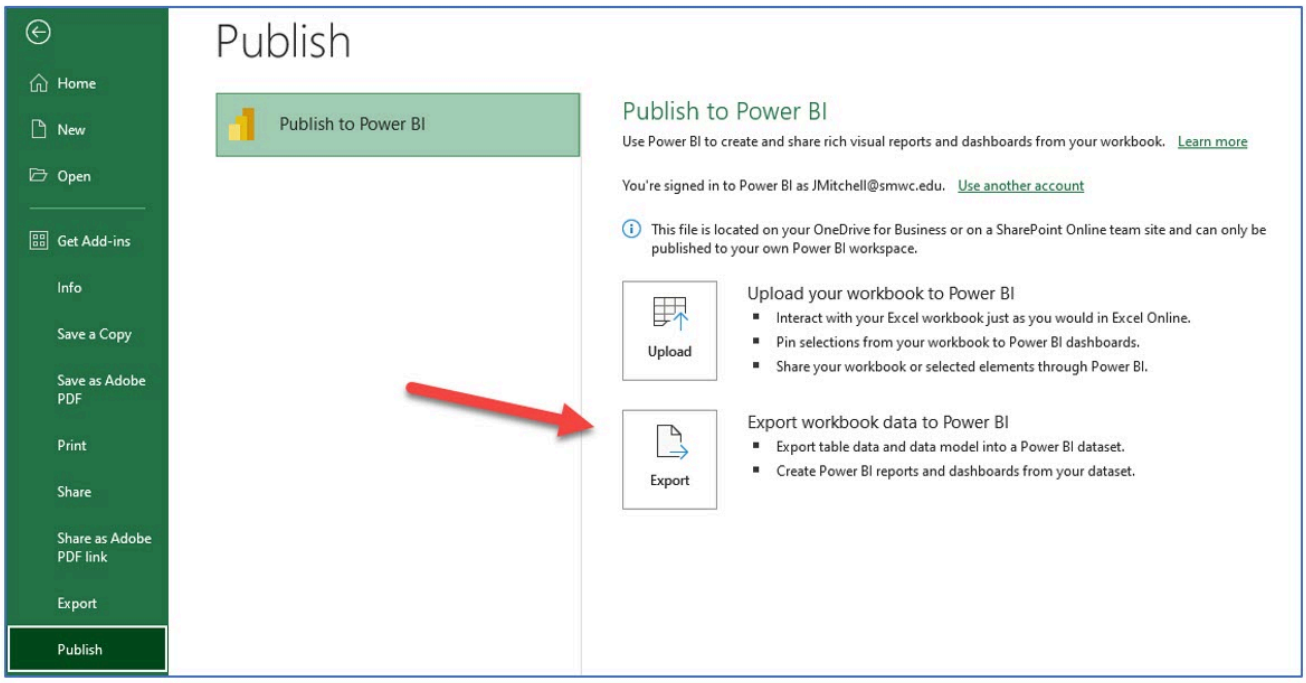
There is another way to get your Excel file to Power BI Services Online right from the Excel file itself.

Option #2—Publish Excel File Power BI Services Online

Note: Screenshots of Excel interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

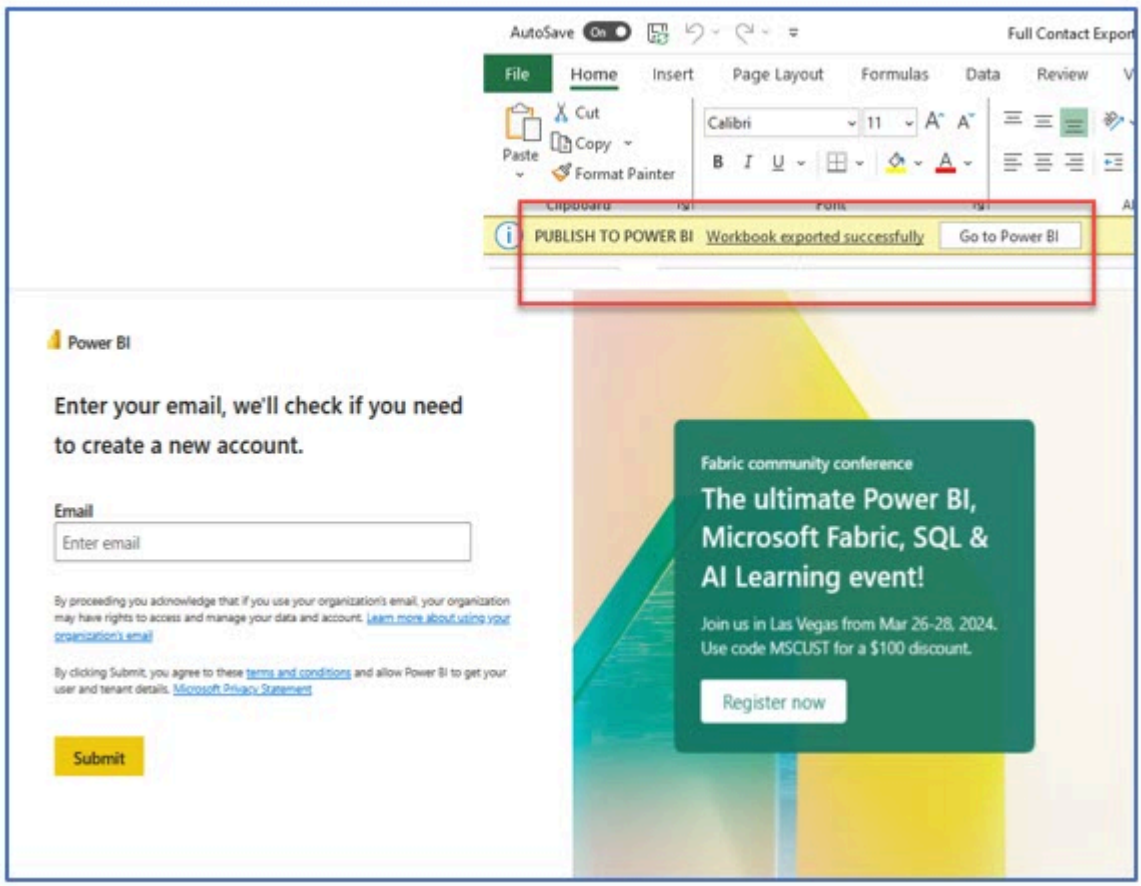
- First, go to Office.com and log in. Find the apps, search for Power BI Services Online, and have it open.
- Second, open the Excel file you want to use. Make sure it is in table format.
- Third, go to File and scroll down to Publish. Select Publish, and a pop-up screen will show up. Choose Export (as seen in Figure 7.9) so you can create reports and dashboards.

Figure 7.9—Publish Excel File Directly to Power BI Services Online



- Fourth, you will see a note that the workbook was exported successfully. Select the Go to Power BI button, and the following pop-up window will appear. Type in your email (use your college email account).

Figure 7.10—Select Button and Follow On-Screen Directions



Visit the Power BI Services Online, and the file you published should show Semantic Model as the type. This means you will be able to build reports and dashboards with this dataset!

Now that we have the Mac file issue solved, let's review more of the Power BI Services Online features.

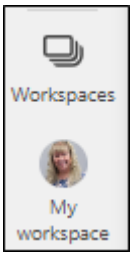
The section of interest is the Power BI components: Reports, Paginated Reports, Scorecards, and Dashboards. The other components (i.e., Data Factory, Data Science, Data Warehouse, and Real-Time Analytics) are beyond what the authors plan to cover.

In order to have a more logical understanding of how things work, let's look at Workspaces and My Workspace next and come back to Apps and Metrics.

Workspaces in Power BI Services (Online)

Note: Screenshots of Power BI interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

Power BI Services (Online) Pro version provides two workspace types (or containers) and an ability to construct an app. Everyone has "My Workspace," but only Pro accounts will be able to use Workspaces. If you have the Pro version, you can have multiple Workspaces.



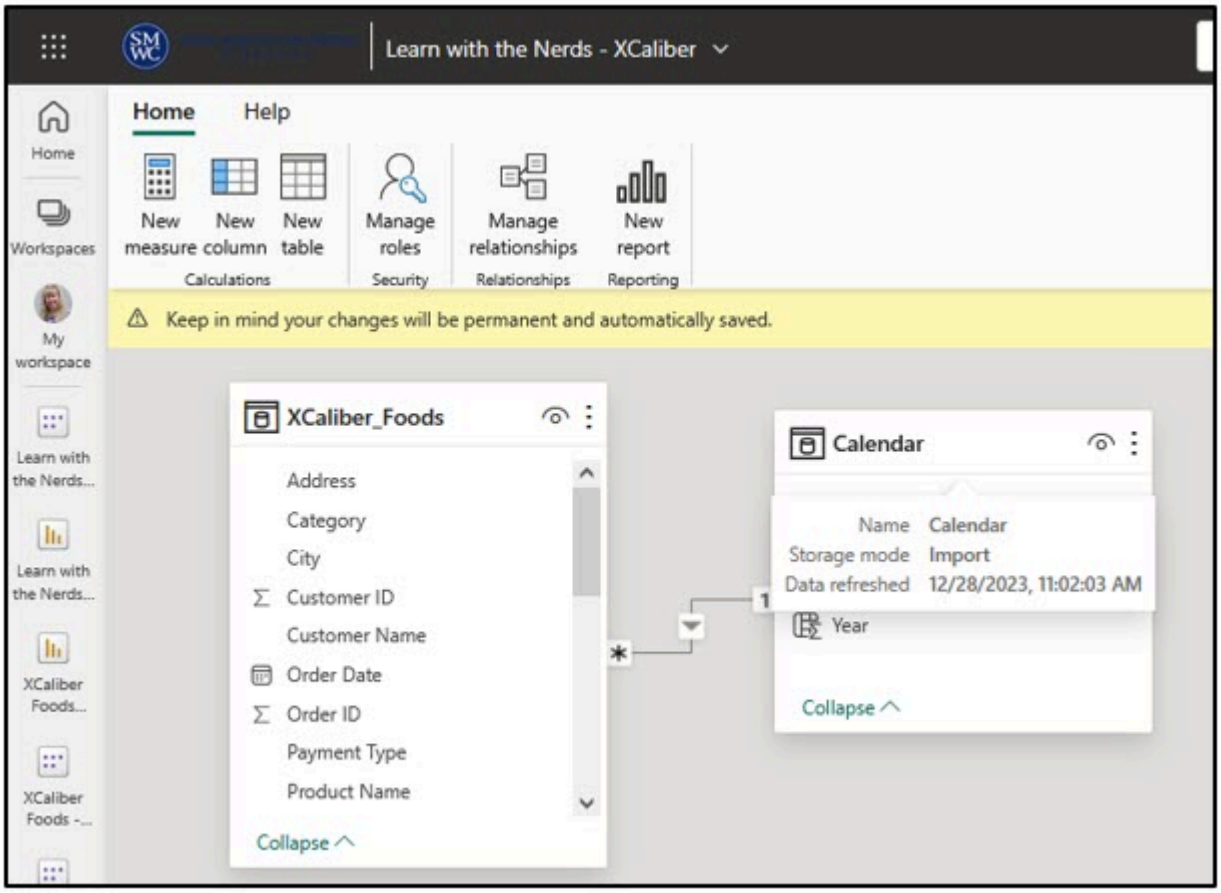
Workspaces are containers for dashboards, reports, and semantic models. Workspaces can provide a team environment to collaborate with your coworkers. You can add coworkers to your Workspace if they also have a Power BI **Pro** license and are part of your organization. If you only have a Free license, you will **not** be able to create a Workspace. And you can *only create an app* in a Workspace.

My Workspace is your personal space for content. Only you have access to your "My Workspace"; however, you can share individual dashboards and reports in the Pro version. If you have a Free license, plan to share from Power BI Desktop to a OneDrive shared folder. If you try sharing a file directly in Power BI Services Online, you will see a pop-up to upgrade your license.

What Is a Semantic Model?

- In Power BI, a semantic model is a way to organize and represent the data; it's like creating a common language for understanding. You can create semantic models to create relationships, create measures, build hierarchies, and create visualizations. For example, you might have a table on quality control and a table on product manufacturing codes. If you want to connect them, you create a relationship. For example, when creating measures, you may always want data shown a certain way (like year-to-date last year) compared to (year-to-date this year). Creating a model that has this measure can then be used by all. For now, it is enough for you to know what they are and their purpose.
- Semantic models are available in either Power BI Desktop or Power BI Services Online. Here is an example in Figure 7.11.

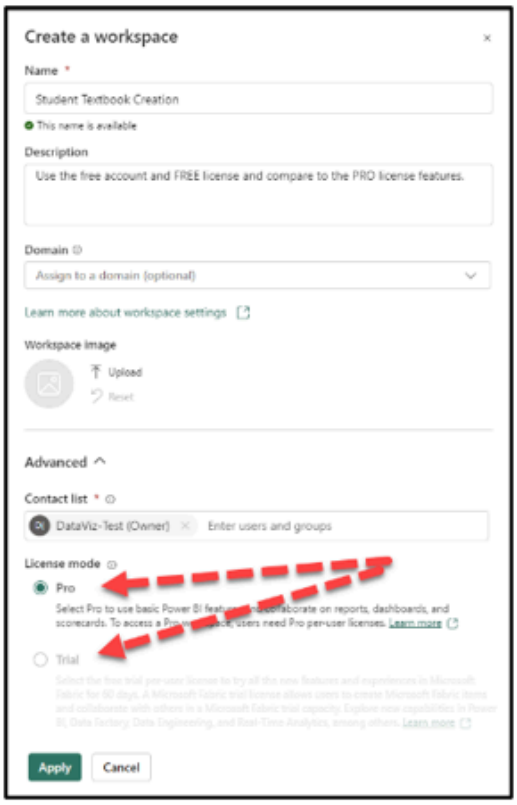
Figure 7.11—Semantic Model in Power BI Services Online

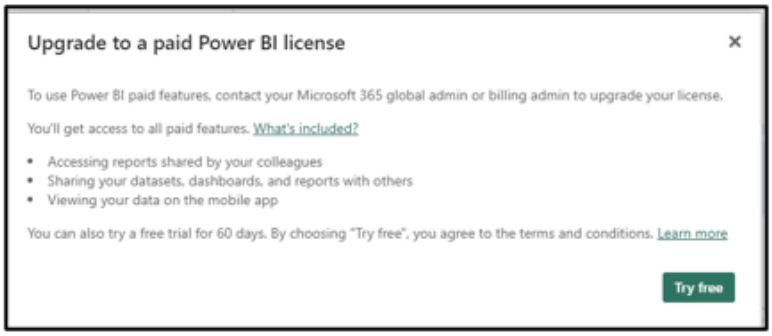


Workspace Options Seem Available

If you have a Free Power BI Services (Online) license, you will still see a button to create a Workspace. However, once you start setting up the Workspace, you won't be able to move forward unless you update your account from Free to Pro or sign up for a free trial. The arrows in Figure 7.12 show this limitation.

Figure 7.12—Limitation of Power BI Services (Online) Free Account

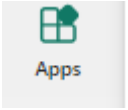




To see information about Power BI apps, let's switch to a Pro license in Figure 7.12. In this illustration, the Workspace is named "Textbook Creation" since the dashboards, reports, and the app were created for this textbook. You can **only** create a Power BI app with a **Pro license** and only **one app per Workspace**. Creating an app is one of the more powerful aspects of Power BI Services Online.

So What's a Power BI App and How Is It Used?

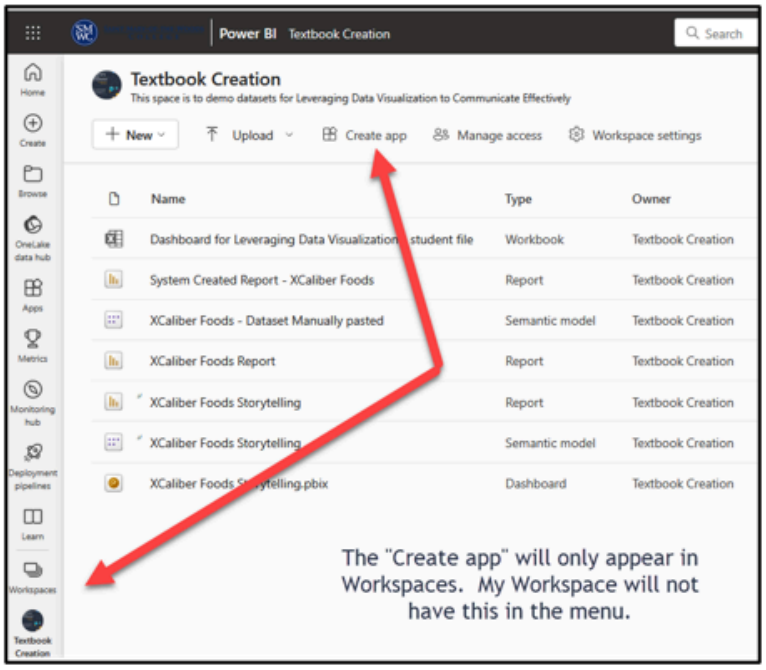
Workspaces are considered a staging area. You can create an "app" from the content. "An app is a collection of dashboards and reports built to deliver key metrics to the Power BI consumers in your organization. Apps are interactive, but consumers cannot edit them" (Microsoft, 2023, para 3).

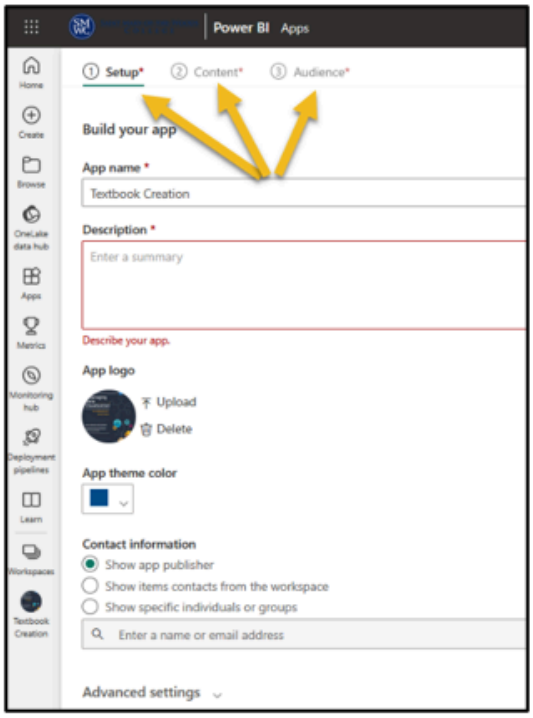


Create an App. "In Power BI, you can create 'official' packaged content, then distribute it to a broad audience as an app" (Microsoft, 2023, para 1). Apps are created in Workspaces and not "My Workspace." That might sound odd, but think of My Workspace as your personal space, whereas the intent of an app is to publish it for a large group of people. And note that free account users cannot create a Power BI app because they can't create a Workspace!

As shown in Figure 7.13, there are four parts to creating an app: (1) setup, (2) content, (3) audiences, and (4) publishing the app. This means you can develop one app that will work for more than one audience. For example, the audience might be the entire organization, and the app would limit the content they would see. Through the app, managers might see most content; whereas VPs might see all reports and dashboards contained in the app. As a consumer, you can filter, highlight, and interact with the content on the app. For example, organization-wide users can't modify the contents of the app. Licensing is important for how this works.

Figure 7.13—Power BI Services Online: Create an App in Workspace (Pro License)





See a Sample App If You Have Power BI Services Online—Pro Version

Microsoft created apps that contain Power BI content, dashboards, and reports. At the AppSource, search on Power BI to see this app and experience how it works.

Follow these steps.

1. Exhibit 7.5 shows the AppSource. This is a place to explore. You can search at the AppSource Sales & Marketing or choose any example that interests you. (keep in mind that Microsoft changes out sample files frequently). Other examples are available at Get samples for Power BI – Power BI | Microsoft Learn.

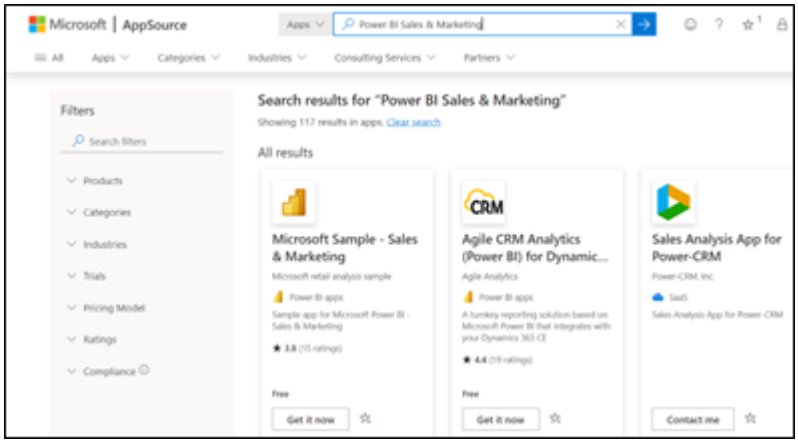


Exhibit 7.5—AppSource—Microsoft Sample—Sales & Marketing

2. The Microsoft AppSource will ask you to Sign in. If you don't have an account, sign up for a free account.
3. Complete the profile information, then select Continue.

4. Select Install as shown in Exhibit 7.6.

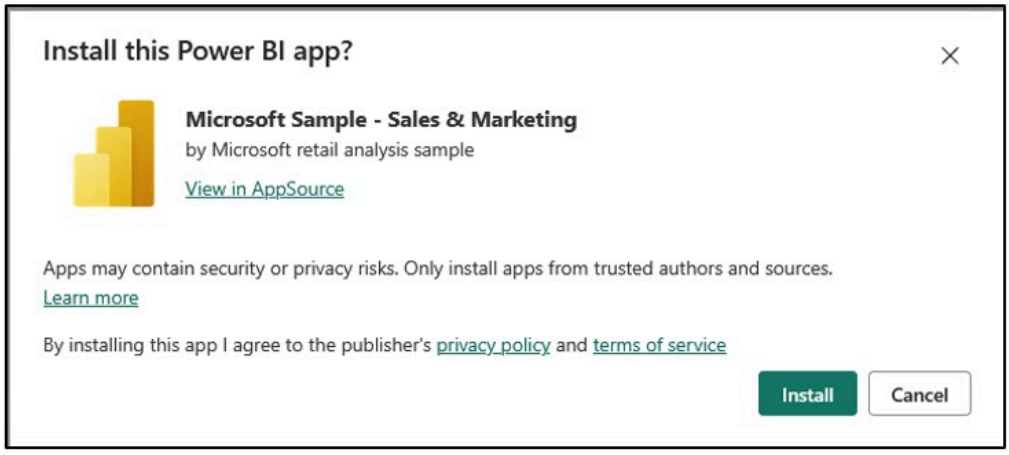


Exhibit 7.6—Install Power BI App

5. It will show up in the Apps section of your Power BI Services (Online) account.

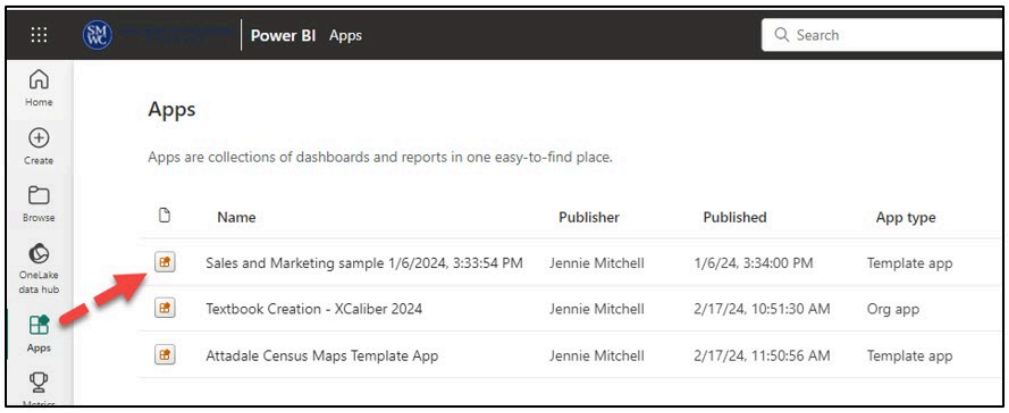
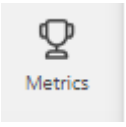


Figure 7.14—Power BI App Showing in Power BI Services (Online)

6. If you click on the Name: Sales and Marketing sample, it will open the app you can explore. You can interact with it, but you can't edit it.

Later in this chapter, the authors will show you how to create an app with a Pro account using the XCaliber Food Distribution Company report built-in Power BI Desktop and published to the Workspace "Textbook Creation" in Power BI Services Online.

What Is Metrics?



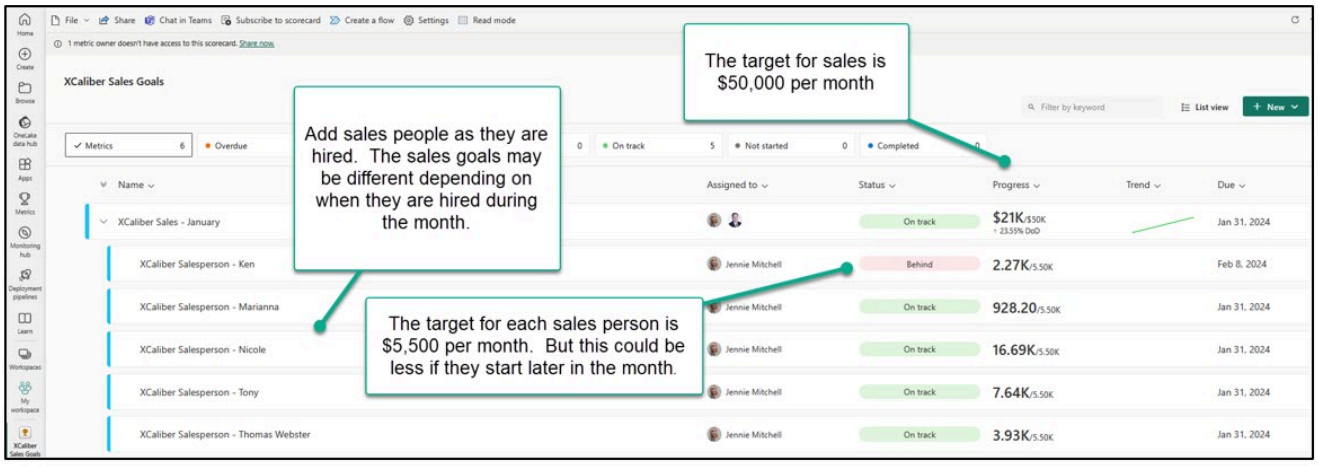
In Power BI Services (Online) you have an option to build metrics to hold your organization accountable by tracking them against key business objectives. The fundamental value of the scorecard is that others in your organization are interested in the targets set. In earlier versions of Power BI Services (Online), this was called "Goals."

Metric Example Using XCaliber Food Distribution Company

As an illustration, XCaliber Foods opened its business in 2024 intending to sell $50,000 each month. XCaliber planned to hire nine salespeople, which meant that each salesperson would sell approximately $5,500 per month. Instead of waiting until year-end to see if you are on target, you may want to set up the scorecard so that it looks at a monthly target ($600k total sales divided by 12 = $50k per month). Targets for salespeople also make sense to set up monthly. Then if you don't make a target, you can investigate why. More likely, you may want to set targets for products, targets for salespersons, and targets for cultivating new customers.

In Exhibit 7.7, the sales metric is set up for January (goal of $50,000) and individual salespeople have a monthly sales target of $5,500. Here is the preliminary metric setup.

Exhibit 7.7—Setting Up Metrics for XCaliber Foods for 2024 Goals



Metrics can be manual, use submetrics (like average and sum), or connect to data.

In a previous section, we discussed the Balanced Scorecard Framework. The following Balanced Scorecard Framework helps us see how metrics might be used to set it up. Some of the metrics would be set up manually, and some could connect to data. Metrics in Power BI Services (Online) would use both the measures (goals) and targets (like KPIs).

Balanced Scorecard Framework + Power BI Services (Online) Metrics

Financial: To succeed financially, how should we appear to our stakeholders?

Objectives: increase sales

Measures: KPIs for sales overall, KPIs for sales by salesperson,

Targets: sales = $600k or $50k per month, salesperson target = $5.5k per month, customer sales (since only 15 customers) = $40k per year

Initiatives: use drop-shipping software program

Customer: connect to vision—How should we appear to our customers?

Objectives: deliver products as promised (within 24 hours, or as we advertise, "same-day shipping")

Measures: KPIs for average delivery time = 1 day from order-to-ship date

Targets: from order-to-ship date, 24 hours or less

Initiatives: complete customer satisfaction interviews by email/phone

Internal Business: To satisfy our stakeholders and customers, what business processes must we exceed at?

Objectives: cost control (use correct pricing), introduce new products, word of mouth marketing

Measures: KPIs for new products as % of sales, KPIs for new grocers

Targets: increase number of grocers to 25, Increase new products 15% per year

Initiatives: incentive program for grocers, Expand to more neighboring states.

Learning and Growth: To achieve our vision, how will we sustain our ability to change and improve?

Objectives: able to sell to new customers

Measures: KPIs for employee development and onboarding for upselling and consistent sales, KPIs for drop-shipping software exam score, customer satisfaction survey

Targets: survey score at four out of five, drop-shipping exam score 90%

Initiatives: buddy program, online training for remote salespeople, review and investigate customer surveys

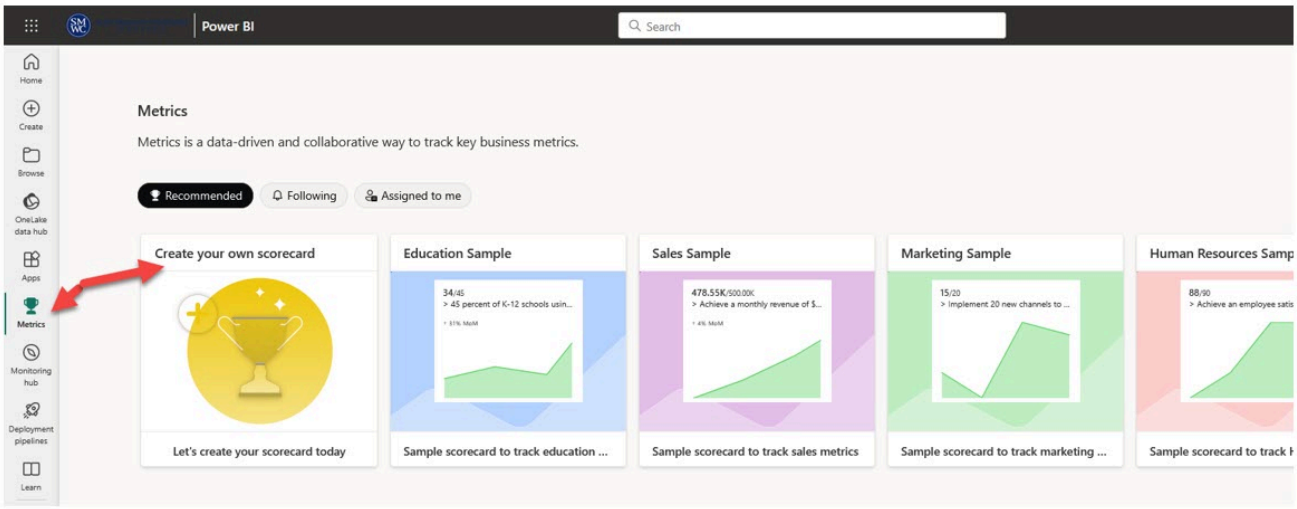
To learn more about metrics, visit the Microsoft Learn site.

Microsoft Learn: Get started with metrics in Power BI. Link: https://learn.microsoft.com/en-us/power-bi/create-reports/service-goals-introduction.

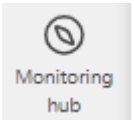
Create scorecards and manual metrics in Power BI. Link: https://learn.microsoft.com/en-us/power-bi/create-reports/service-goals-create#step-1-create-a-scorecard

To gain meaningful use for the scorecard system, users need Power BI Pro. As a student, you can still create scorecards; however, they won't mean much if you can't collaborate with a team. Still, it is worth looking at the examples provided in Figure 7.15.

Figure 7.15—Metrics in Power BI Services Online



What Is the Monitoring Hub in Power BI Services Online?



Monitoring hub won't be too important to you as a new user, but as you add datasets and create more Power BI content, you will appreciate this feature. The monitoring hub enables you to monitor your Microsoft Fabric activities. If you have reports and dashboards connected to data that is being updated, you will want to see that the status shows "completed" and not "failed." If you see "failed," it normally means that there are connectivity issues!

What Is a Deployment Pipeline?

A deployment pipeline provides "content creators with a production environment where they can collaborate to manage the lifecycle of organizational content" (Microsoft Learn, 2023, para 1). By default, there are three typical stages: Development, Test, and Production. For example, software developers could use the process to write, build, test, and deploy code. You may not see the deployment pipelines icon in the menu. In My Workspace, click New, and More Options, to see the Data Pipeline in the Data Factory section. But how would you use it?

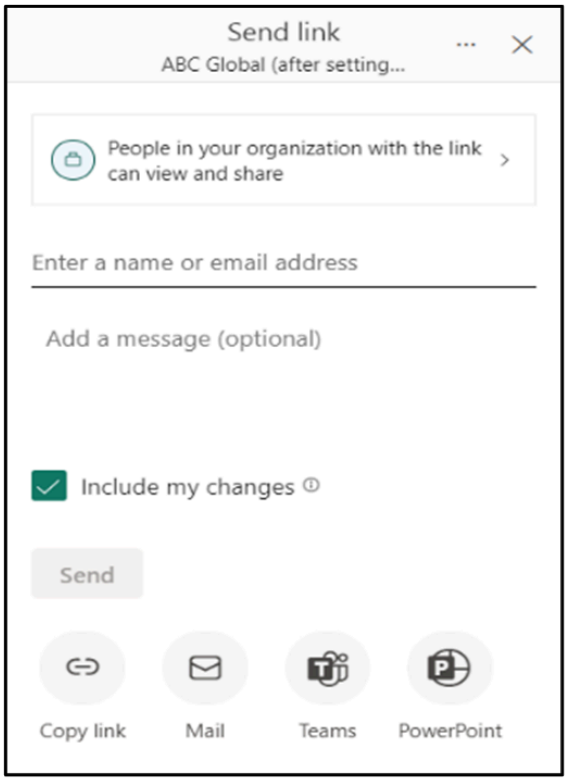
For an example that is easier to understand, let's look at XCaliber Food Distribution Company. Assume that a small team is working on creating Power BI visualizations for sales data across different states and regions. The report undergoes many changes, including new visuals and calculations, and is reorganized to improve the user experience. During this stage, the team uses the deployment pipeline to work collaboratively in a Workspace called **development-XCal**. Once the development stage is complete, the team moves the report to the test stage. In this stage, the process allows the team to validate the report against test data. This Workspace is called **test-XCal**. Once the report passes the testing and validation process, the report is moved from the test environment to the production environment. In the **production-XCal** Workspace, the report is available for consumption by end-users.

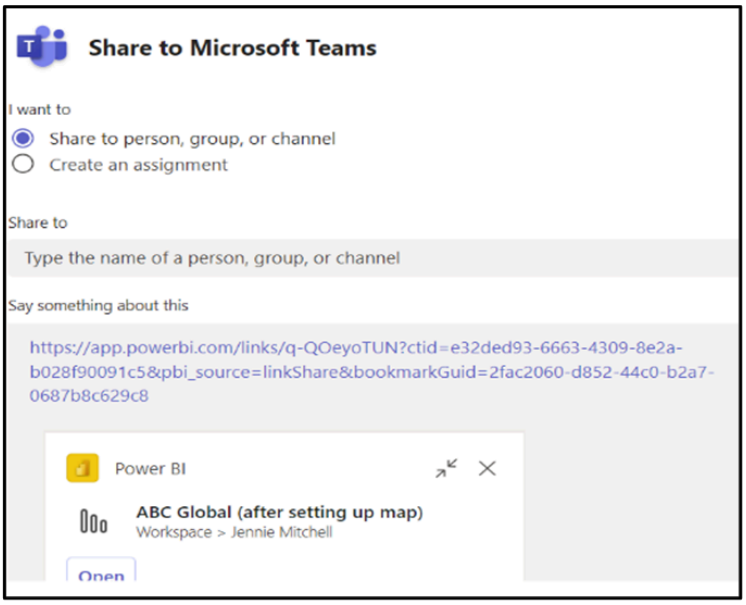
You may be saying to yourself, "We can do all of this from the first Workspace, and you would be correct, so why use it?" This pipeline deployment process reduces manual work, which can contain errors. Also, organizations can build in validation that includes consistency and maintains content quality. The bad news is that you need to be a **premium user**!

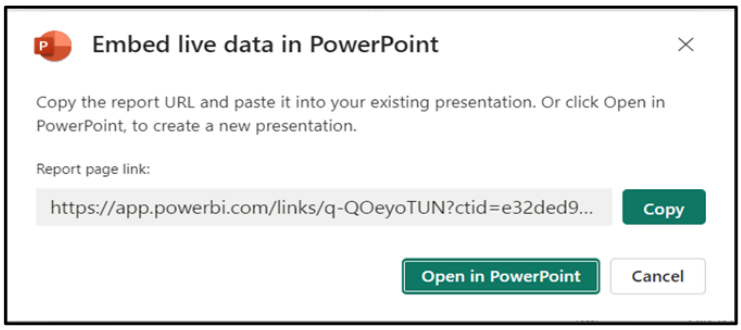
Other Sharing Differences Between the "Free" License and the "Pro" License

When teams work together in a Workspace, it helps if collaboration is easy and intuitive. Workspaces provide roles and allow co-ownership of content but there are some limitations. "You need a Power BI Pro license to share . . . and the people you share it with do too" (Microsoft Learn, 2024, para 6). One of the keyways to collaborate is to embed your Power BI report(s) in Microsoft Teams. You can use the tabs in Microsoft Teams for each Power BI report so that the chat conversation is tied to the report. Figure 7.14 shows several sharing options: share to email, Microsoft Teams, or PowerPoint. If you click the Teams file, you can share it with a person, group, or channel, or create an assignment. If you click the PowerPoint file, you will see that you can embed live data in PowerPoint.

Figure 7.16—Sharing Pro Version of Power BI Services Online

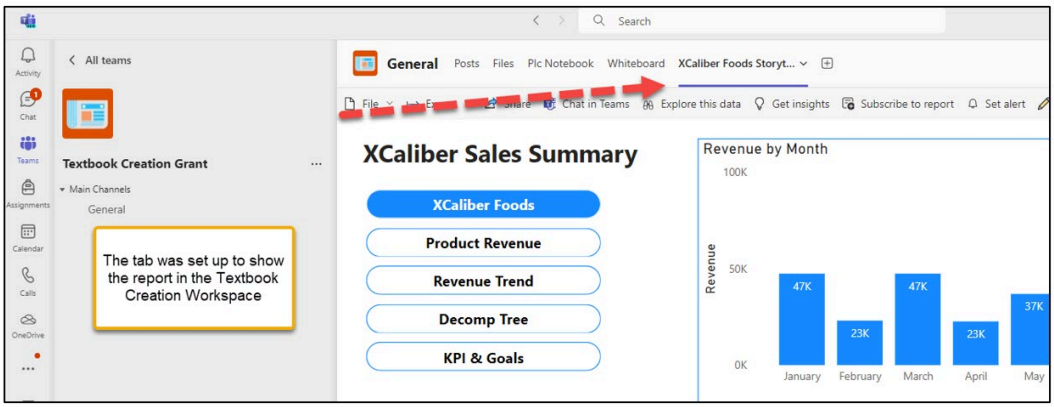






You can even add your report on a tab in your Team space as shown in Figure 7.17.

Figure 7.17—Showing Power BI Tab in Team Space



Souce: Screenshot of Microsoft Teams Interface © Microsoft Corporation. Author Annotations Added

7.1 Self-Assessment: Power BI Suite

Learning Objective #1—Explain the differences between Power BI Desktop and Power BI Services (Online)

Watch the Pragmatic Works YouTube video "Report or Dashboard in Power BI" and choose the sentences that are correct.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=576#oembed-1

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=576#h5p-34

7.1 Exercise 1: Power BI and Artificial Intelligence (Advanced)

Learning Objective #1—Explain the differences between Power BI Desktop and Power BI Services (Online)

Learning Objective #2—Upload sample files (in this case .pbix)

Visit Microsoft Ignite at *Artificial Intelligence sample for Power BI: Take a tour* located at https://learn.microsoft.com/en-us/power-bi/create-reports/sample-artificial-intelligence.

Step 1: Download Power BI Desktop and install, then follow the page to download the Artificial Intelligence Sample Report and Dashboard (this is the .pbix file).

Step 2: Create a screencast of your experience exploring the three pages Key Influences, Decomposition Tree, and Anomaly Detection. Share at least two things you learned from this experience. Post the recording to the discussion board (or as suggested by your instructor).

7.2 Transform (Clean) Data in Power BI Desktop

But when is a given data set clean enough? Like a kitchen countertop, it can always be cleaner. We hit a point of

> diminishing returns in our preparation of any data set, though, where more elbow grease and scrubbing doesn't yield sufficient incremental benefit to warrant the time and effort.
>
> —Ben Jones, *Avoiding Data Pitfalls*

Data produced by systems can be inconsistent, creating challenges for the analyst. Inconsistent naming conventions, missing data points, human error at the data collection point, and the need to correct format (like a number instead of currency) are just a few of the challenges for analysis and visualization. Power BI Desktop has the best process for data transformation because it offers a variety of functionalities to streamline the process. This section will introduce students to basic cleaning of data, creating a calculated column and transforming the format to a number. This step should always be preceded by a thorough understanding of the data in **table format**. Every column should be investigated through filtering before you "Get data" in Power BI Desktop. By mastering data transformation (cleaning) in Power BI Desktop, you unlock the full potential of the data.

Know the Data

For this section, we will use the XCaliber Foods Excel file in Power BI Desktop and show you step-by-step how we work through this.

Screenshots of Power BI interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

Step 1—Download the "XCaliber Foods 7.2" file. **Review** the XCaliber Foods Data. Don't make any changes to the Excel file; instead, plan to do all cleaning work in Power BI Desktop. When you are done reviewing, **close the Excel file**.

Did you notice the following issues in "XCaliber Foods 7.2"?

- The column for Country has USA for every line of data.
- The payment type should include check, cash, or credit card, but there are several blanks. You may want to keep these until you investigate what happened. It could be an error in entering the data, bad checks, or potential fraud.
- There is a need to calculate delivery time. This can be done by looking at the difference between the order date and the ship date. This is important since XCaliber Food Distribution Company promotes same-day shipping.

Step 2—Open Power BI Desktop and Get Data

a. From the menu, choose **Get data** then Excel workbook. Find the XCaliber Foods 7.2 and choose **Open**.

Step 3—Clean Data

a. The Navigator pane will open and show two tables, one named XCaliber_Foods and one called Data. It shows this because it was already formatted as a table. Since the table XCaliber_Foods has everything, you can just **check** this one box. Then select **Transform Data**. See Figure 7.18 to see this step.

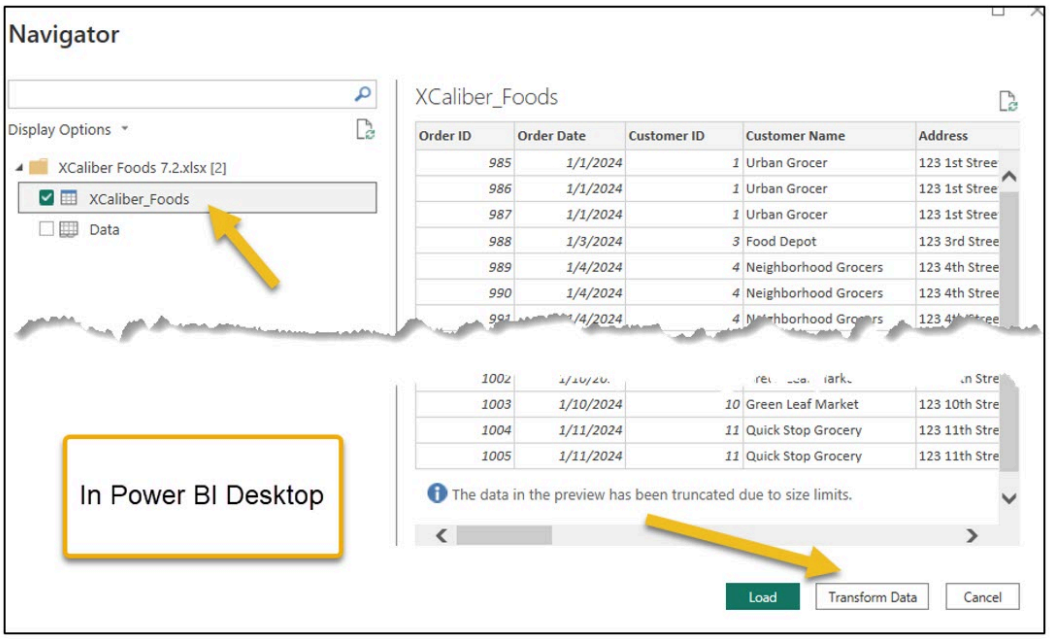


Figure 7.18—Navigator Pane in Power BI Desktop

b. The Power Query Editor will pop up on the screen. Every step we take in this setting will show up in the Applied Steps box (see Figure 7.19). The first step is to remove the Country column. When you find it, **highlight** this column, **right-click the column**, and choose **Remove**. Notice that the Applied Steps shows this action and gives you the ability to cancel it.

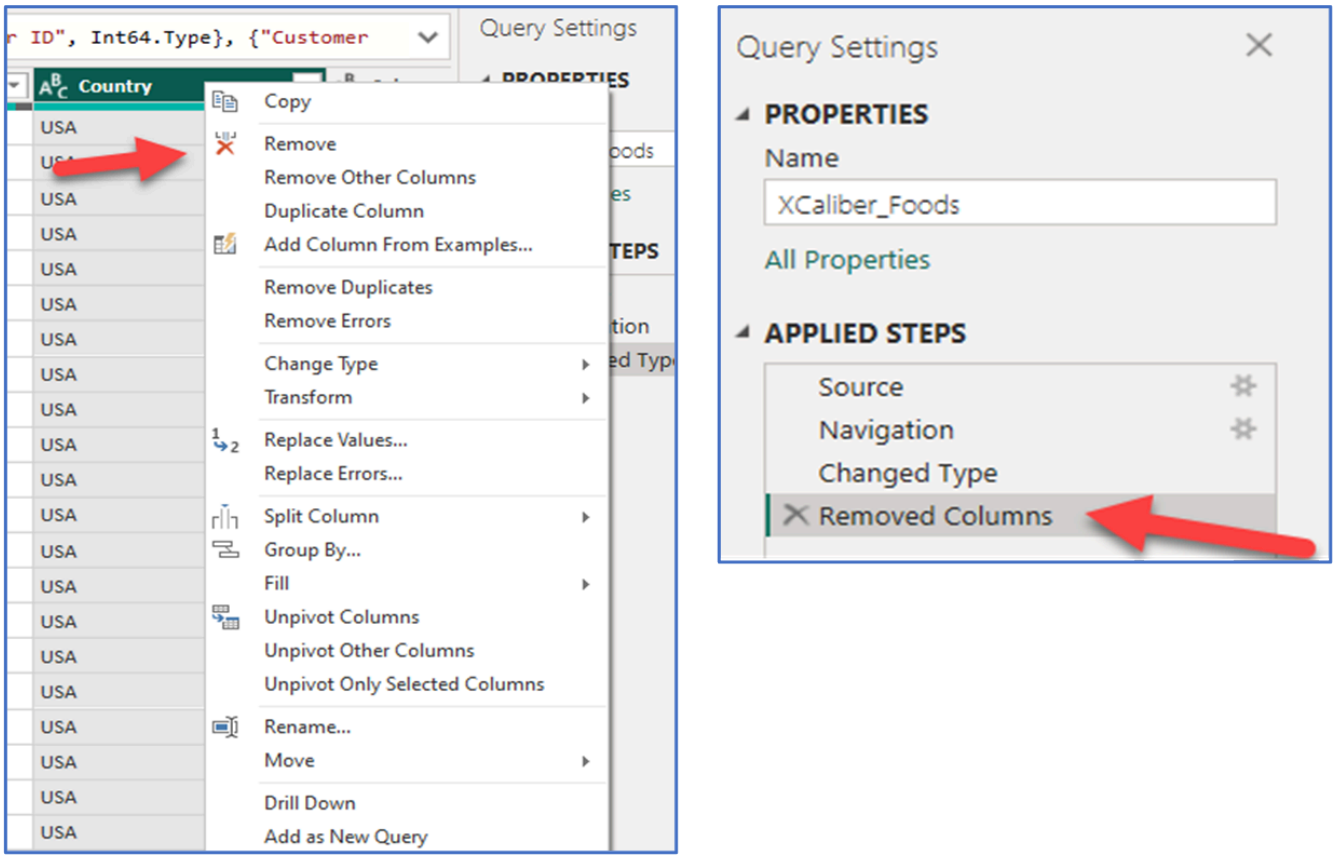


Figure 7.19—Query Editor Pop-Up Pane: Remove a Column

c. The next step is to click on the main menu to **Add Column** in the main menu and choose **Custom Column** as shown in Figure 7.20.

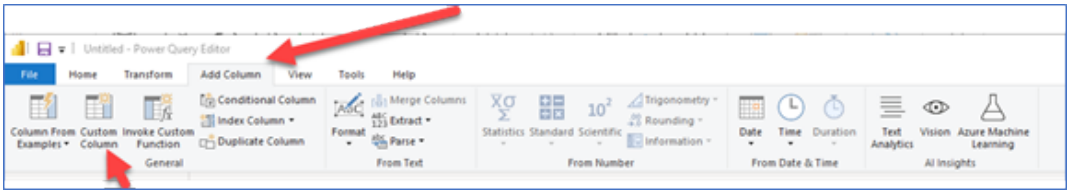


Figure 7.20—Add a Custom Column

d. Fill out the pop-up according to Figure 7.21. The formula starts with an equal sign and double-click the available columns. Essentially the formula = **Shipped Date minus the Order Date** will tell you the length of time. That's why the new column's name is **Delivery**.

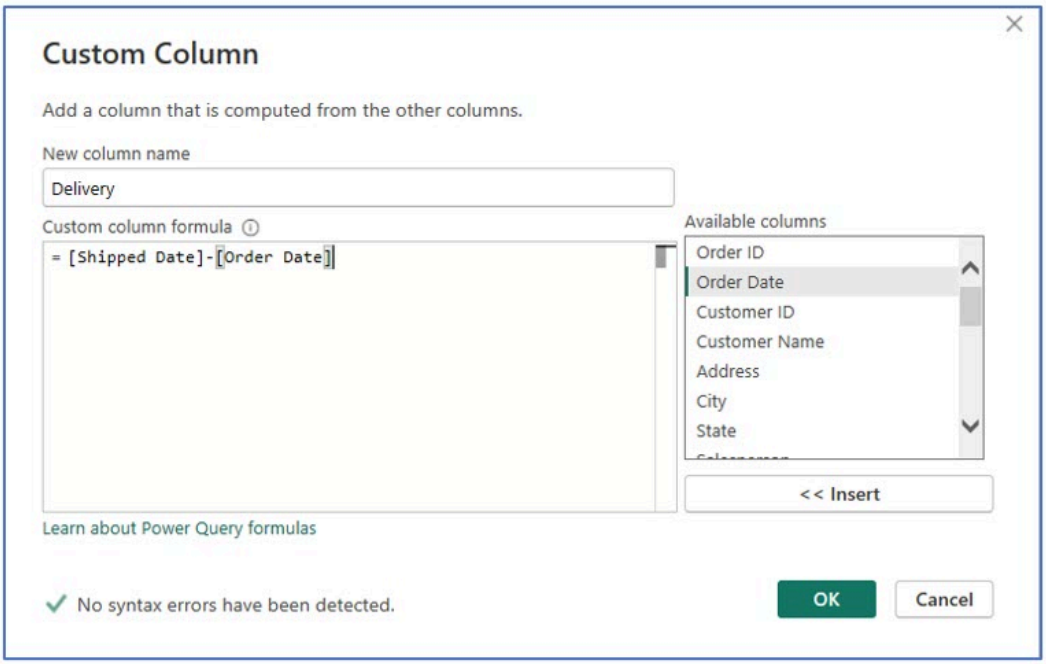


Figure 7.21—Custom Column for Delivery

e. The format for the Delivery column needs to be formatted to a whole number. On the main menu, choose **Transform**, then choose **Data Type** and then **Whole Number** to show the number of days for the Delivery column. See Figure 7.22 for choosing the data type and the second image showing the final result.

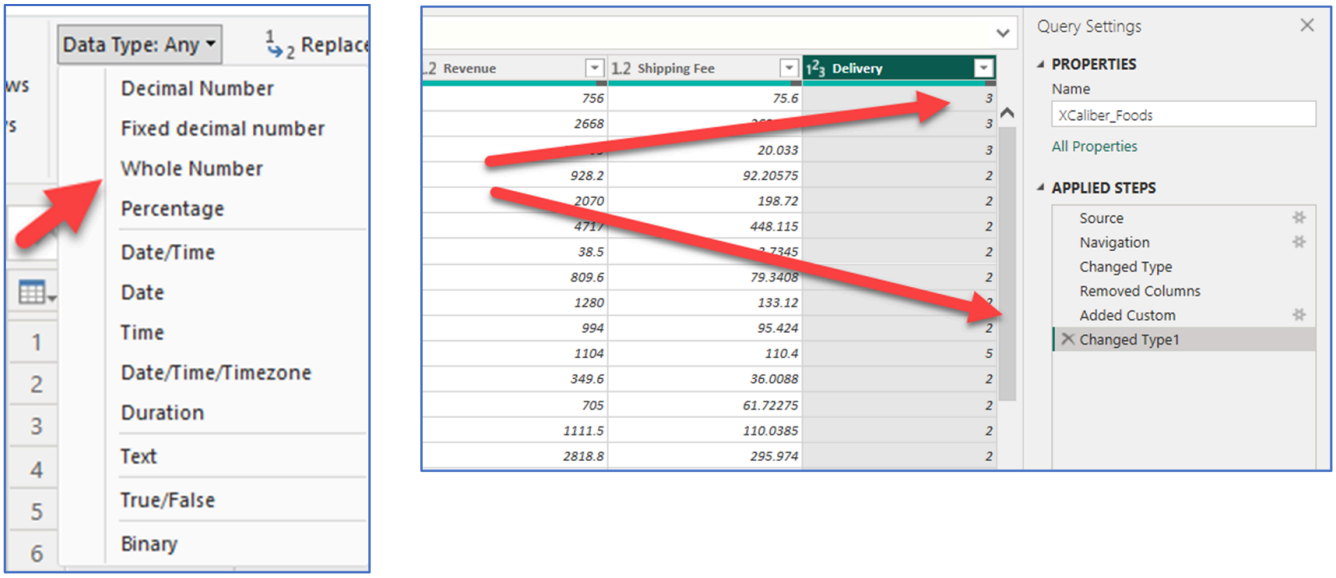


Figure 7.22—Transform Data Type to Whole Number, See Applied

f. Now on the main menu, choose **File**, then **Close & Apply**. Your changes are applied, and you have a trail of your steps. A pop-up should show that the file is applied. You should be back to the editing field in the Power BI Desktop.

g. Check to see if the Delivery column is there by choosing the table view on the left (see Figure 7.23) and then scrolling over to see the new column. Congratulations! You have just cleaned the data!

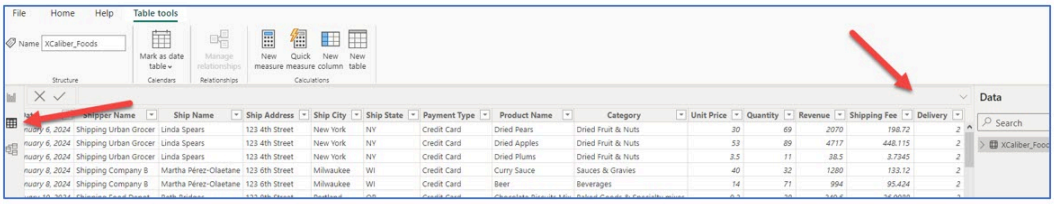


Figure 7.23—Table View of XCaliber Foods (See Delivery Column)

h. Save the file—we called ours *XCaliber Foods Storytelling—Draft 2*. But any name will work. Pay attention to where you saved it and notice that the extension is .pbix as shown in Exhibit 7.8. For best results, include the file in a OneDrive space.

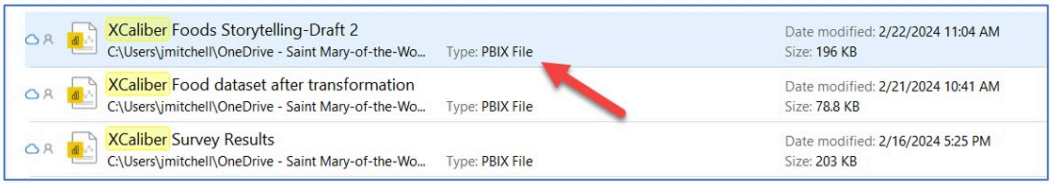


Exhibit 7.8—Note the File Extension Is .pbix

This is all the transforming and cleaning that we will do with this file but note that it is possible to use the new measure tool located in the main menu of the Power BI Desktop. Just like with all Microsoft products, several different paths can lead to the same results. Now let's move to the next important step—publish!

i. Choose **Publish** and the pop-up will show Publish to Power BI as seen in Figure 7.24. You will only have the "My Workspace" option if you have the Free license.

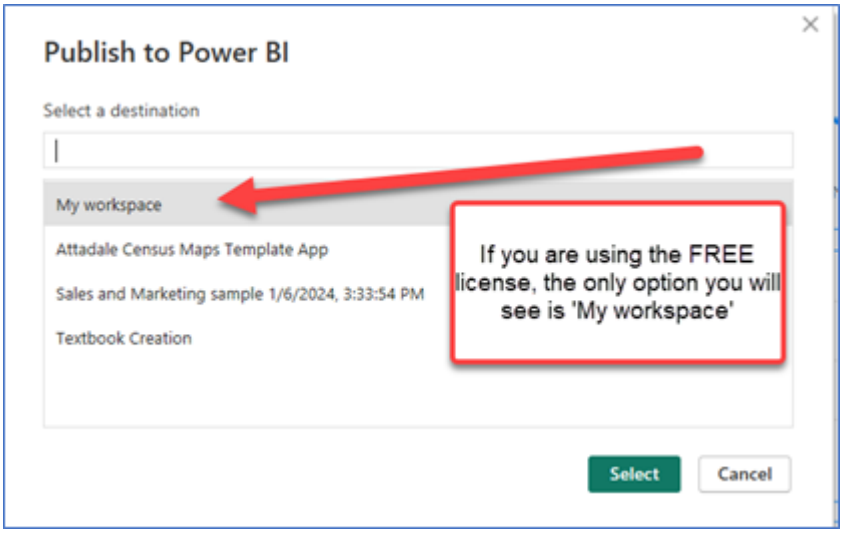


Figure 7.24—Publish to Power BI

Remember, both Power BI Desktop and Power BI Services Online will accept files with the .pbix extension. This information is important for Mac users who can't use Power BI Desktop but who can use Power BI Services Online. Please refer to the section called "A Word to Mac Users" to see two ways to use the dataset with Power BI Online Services.

If you want another example that covers not only cleaning and transforming but also shows how to merge cost information from another table into the original dataset.

Ellis, G. (2023, April 4). *PL 300 Clean, Transform, and Load Data in Power BI Power Query*. ETL. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=576#oembed-2

Let's look at some examples of where you should transform data using a maxim (rule or principle) well accepted in Power BI circles, called Roche's Maxim of Data Transformation.

What Is Roche's Maxim of Data Transformation?

Matthew Roche is a member of Power BI Customer Advisory Team (CAT) at Microsoft and a frequent speaker. He has coined the phrase, "Data should be transformed as far upstream as possible and as far downstream as necessary" (Guy in a Cube, 2022, 1:42).

Scenario #1—Small Company Expanding Local Locations

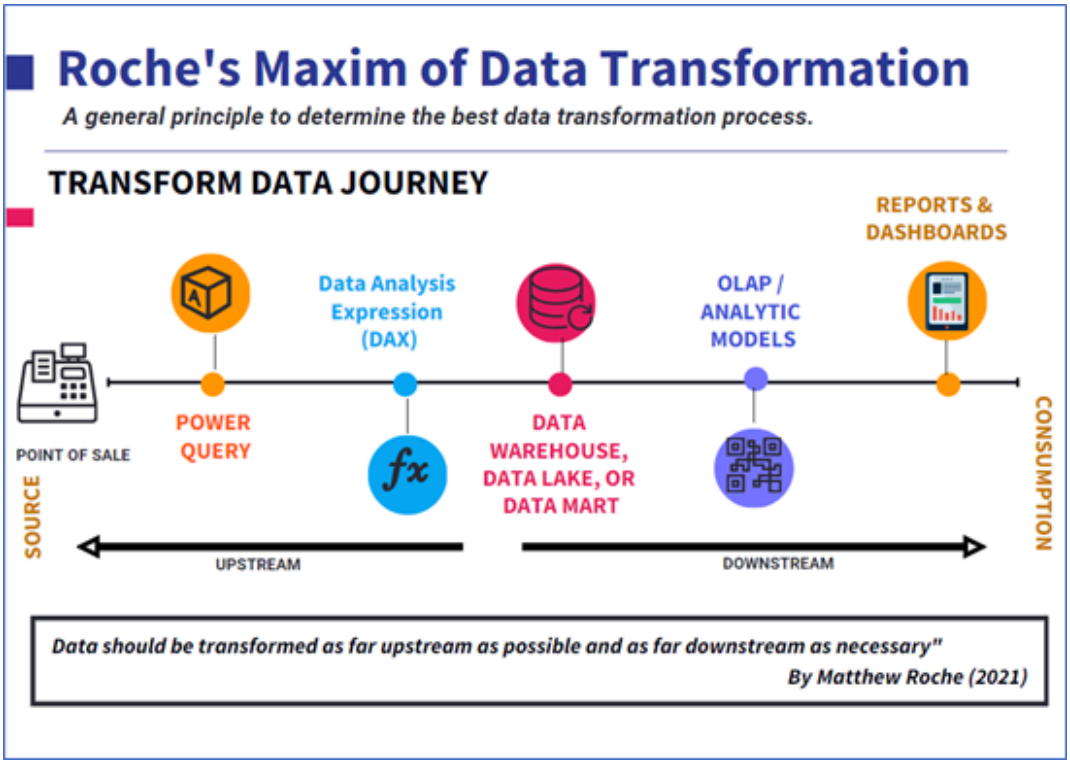
XYZ Rentals company purchased three retail locations that have a different point-of-sale (POS) system. XYZ's point of sale collects data differently from the customer. XYZ's data has a column for first name and a column for last name. The three retail locations use an older POS system that collects the entire name in one column. See Exhibit 7.9.

Exhibit 7.9—Naming Convention Between XYZ Rentals and New Locations

XYZ Retail Point of Sale System		Three Locations Point of Sale System
First Name	Last Name	Name
Trent	Deckard	Trent Deckard

To get a full report, this inconsistency should be addressed, but where and how? According to Roche's Maxim of Data Transformation, you should transform the data as close to the source as possible using Power Query (what was demonstrated in this section). According to Roche's Maxim, you should implement the transformation (or calculation) in Power Query instead of DAX. According to Matthew Roche and Patrick (Guy in a Cube), this approach means that "calculations are applied universally, transformations remain even after a refresh of the data, refresh times are reduced, and the data model gets simplified" (Guy in a Cube, 2022, 2:50).

Exhibit 7.10—Roche's Maxim of Data Transformation



Note: Author Illustration (2024)

But what happens if you have many more data components?

Scenario #2—Large Merger With up to 1,000 Locations Across the Americas

When thousands of datasets are coming in, it doesn't make sense to change them in Power Query. Instead, clean the datasets in the data warehouse. It is less costly than transforming it for every report or app.

Scenario #3—Large Number of Locations (Like 5,000)

In this scenario, you have a large number of datasets coming in but because the point-of-sale systems are different, you need a solution. Although it could be handled in the data warehouse, some corporations will decide to replace the point-of-sale system so that every location uses the same system. And some companies will decide to replace the systems in all stores, an even costlier investment.

Want to learn more about this?

Guy in a Cube. (2022, Oct 5). *Where do you add that new column in any analytics tool?* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=576#oembed-3

7.2 Self-Assessment: Transform and Clean Data

Learning Objective #2—Upload Excel files and/or sample files to Power BI Desktop to transform (clean) data

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=576#h5p-35

7.3 Create a Report in Power BI Desktop With Storytelling Techniques

> Data storytelling is about connecting the dots between data and human emotions.
> —Brent Dykes and Eric Schmidt, executive chairmen at Google

Storytelling techniques along with interactive visuals provide an environment to communicate data rather than just inform. Multipage reports allow the developer to break up content into smaller digestible insights. Although insights and change go together; not all audience members want change. Worse, if the visual is misunderstood or isn't compelling, it can't overcome resistance to change.

Some audience members may see insights as criticisms. For example, assume that the visuals include sales patterns, and managers notice a pattern they didn't expect (i.e., inconsistent sales, no new products sold, and shipping delays). Depending on how the insights are shared, salespeople may feel criticized.

For the past few decades, "data has primarily been entrusted to only two privileged groups . . . an executive who required data to manage the business; [and] a data specialist . . . who gathered, analyzed and reported the numbers for management" (Dykes, 2019, p. 5). Data savviness is no longer confined to the privileged. Small organizations are taking advantage of intense data analysis and finding ways to use data to communicate additional services.

An Example: A Competitive Edge

An Indiana-based lawn care company arms their field employees with a full truck of products and wi-fi enabled and connected iPads, allowing them to do more than service the lawns. With the iPad connected to company software, field agents give estimates with a click of a button, share new procedures for a better lawn (upsell), and bill them electronically. The field agent can connect to the square footage data for any lawn (even neighbors) and immediately send an estimate to the homeowner's email. If the neighbor wants the work completed, the field agent can immediately comply, and his schedule is adjusted automatically through the GPS on the truck. The owner receives live updates in a dashboard containing completed jobs, square footage, new estimates, new customers, and even a product usage report for all field agents. Compare this to an inefficient paper-based process where the lawn is serviced, but the field agent doesn't interact with the homeowner, can't give an immediate bill, can't upsell existing customers with an estimate, or reach new customers (neighbors) with an estimate.

"In today's dynamic, fast-paced business environment, limiting information to a narrow set of executives and data specialists no longer makes sense" (Dykes, 2022, p. 5).

So let's talk about very specific storytelling techniques that can be used in a multipage report on Power BI Desktop.

What Is the Purpose of the Report?

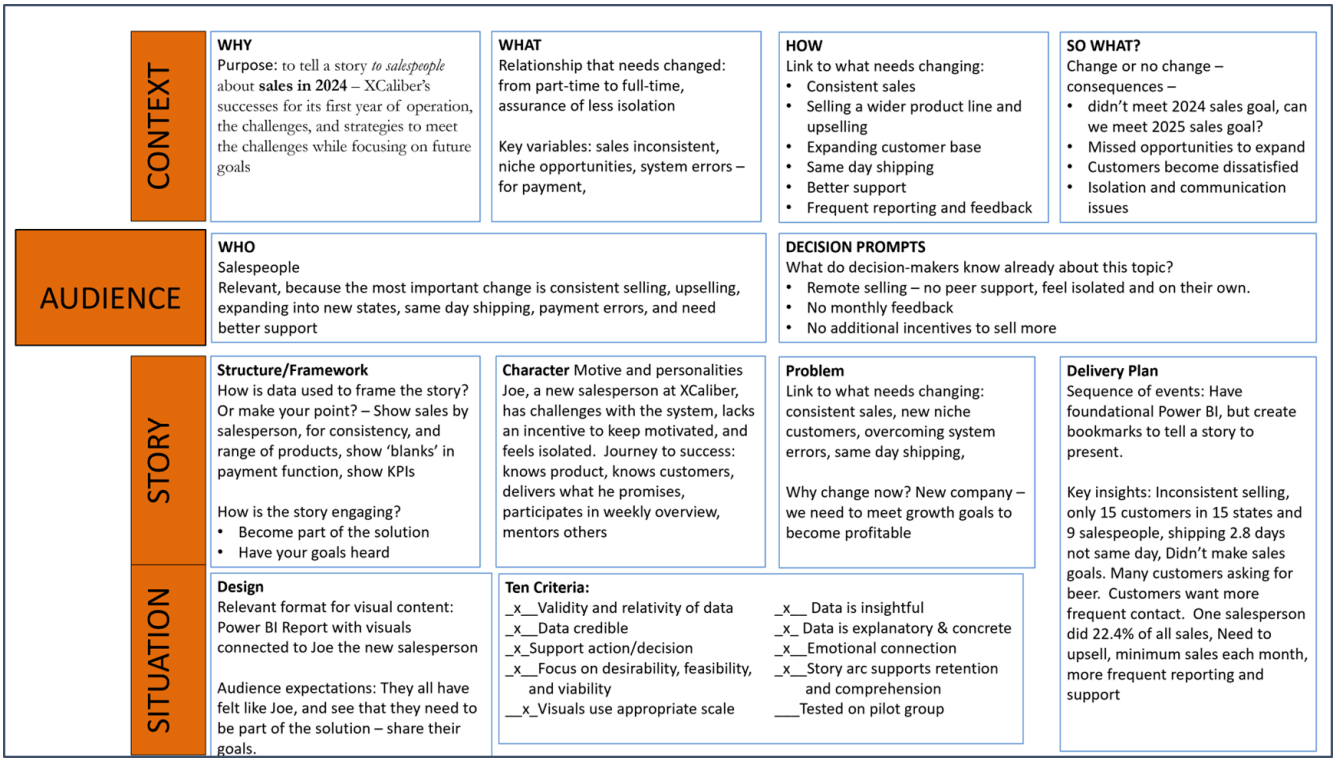
To Revisit XCaliber Foods and consider the purpose of a report and how it will be shared with the organization. XCaliber Food Distribution Company was first introduced in Chapter 4. For the initial Power BI Report, the specific **purpose** is to tell a story *to salespeople* about **sales in 2024** including XCaliber's successes and challenges for its first year of operation and strategies to meet the current challenges to focus on future goals. But how do we tell XCaliber employees (specifically the salespeople) a story to compel them to improve/change? Or should the story improve/change management communication and leadership? A compelling story connects the way we feel, the way we think, the way we act, and the way we behave (Gonzalez, 2023).

The story needs to engage the audience, and the key is to develop the story and visuals through the lens of the salespeople. Review what a good story can do to your brain. In general, good storytelling can do the following:

1. enhance memory (dopamine),
2. synchronize experience (mirroring),
3. motivate the listener to turn the story into their own ideas (neural coupling),
4. light up the brain (cortex activity), and
5. engage the listener emotionally (narrative transport).

Use the CASS template to flush out the context. See Exhibit 7.11 for more details.

Question 1: *What should the story accomplish?*
Question 2: *What do your salespeople need to know?*
Question 3: *What do you want your salespeople to do?*
Question 4: *What is the call to action?*
Exhibit 7.11—CASS Template for XCaliber Food Distribution Company

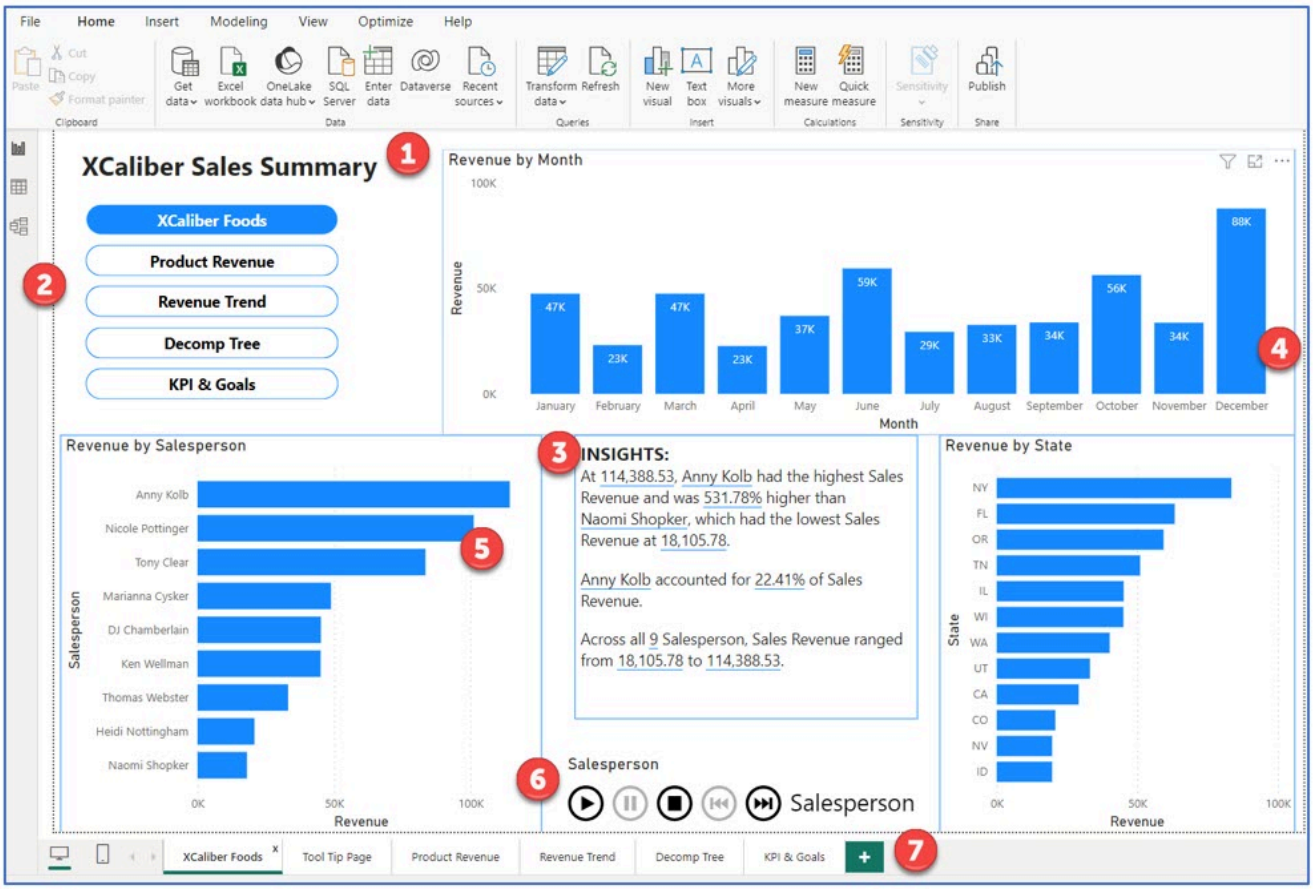


Note: Author illustration (2025)

When you have a specific purpose in mind, but the report or dashboard isn't clear to the end user, you must **add context**! You especially need to provide context for areas that require user interaction. Adding context is a key component of **data storytelling**. Here is a partial list of data storytelling techniques. Look at Figure 7.25 to see the first page of the multipage report.

Note: Screenshots of Power BI interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

Figure 7.25—Page 1 of XCaliber Food Distributions Company Report



Note: The explanations below correspond to numbered examples in Figure 7.25.

1. **A clear title** on each page that conveys the general purpose. The first page of the report is titled "XCaliber Sales Summary" since this page shows the revenue by month, revenue by salesperson, and revenue by state using a consistent theme.

2. **Navigation** can be in the form of buttons that represent page navigation or bookmark navigation. **Bookmark** navigation can show a certain view in Power BI and can be tied to images or buttons. But you can also use it like a bookmark slideshow.

3. **High-level insights** should be tied to what you want your users to focus on. In this case, the purpose is to reveal the highest sales by salesperson, so all the "insights" connect the salesperson to the level of sales. This step is completed through "smart narrative" or "narrative." It is "smart" because as you use select bars of the chart, the narrative will change to match the displayed chart.

More about smart narrative: Smart narrative creates a block of text. You can choose the visual icon from the visualization pane, or you can right-click the visual and select "Summarize." You can add static titles to this block of text. This is especially helpful to support the user's understanding.

Customize the narrative: The visual will create its own narrative, but you can customize it as well. Type a statement in the text box, click "Add Value" and Power BI Desktop will suggest values. Management may appreciate the aesthetic value of good visualization but may prefer you just "get to the point" and that is what a **smart narrative** can do (especially when using KPIs).

Updates as data changes: Although focused on Power BI Desktop, the smart narrative reminds me of quick insights available in Power BI Services (Online). Smart narrative is dynamic; as your data updates, so does the narrative.

4. **Drill through** and **analyze** are great interactive tools for the user. The user is required to right-click on the visual to drill through or analyze the data as shown in Figure 7.26 and 7.27.

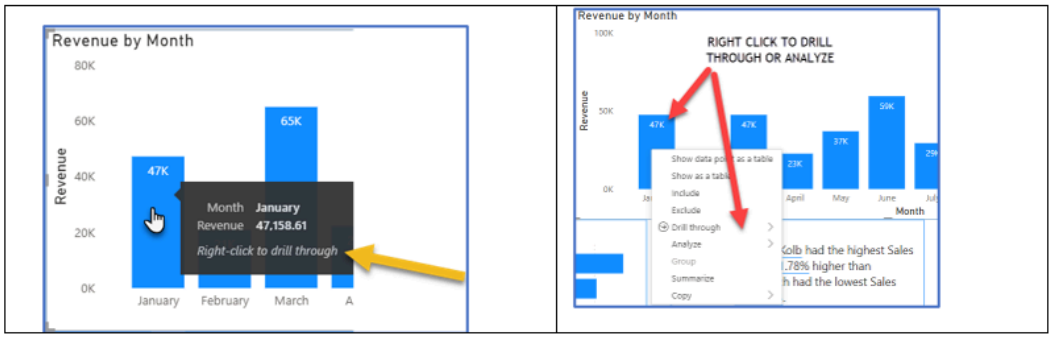


Figure 7.26—Right-Click to Drill Through and Analyze XCaliber

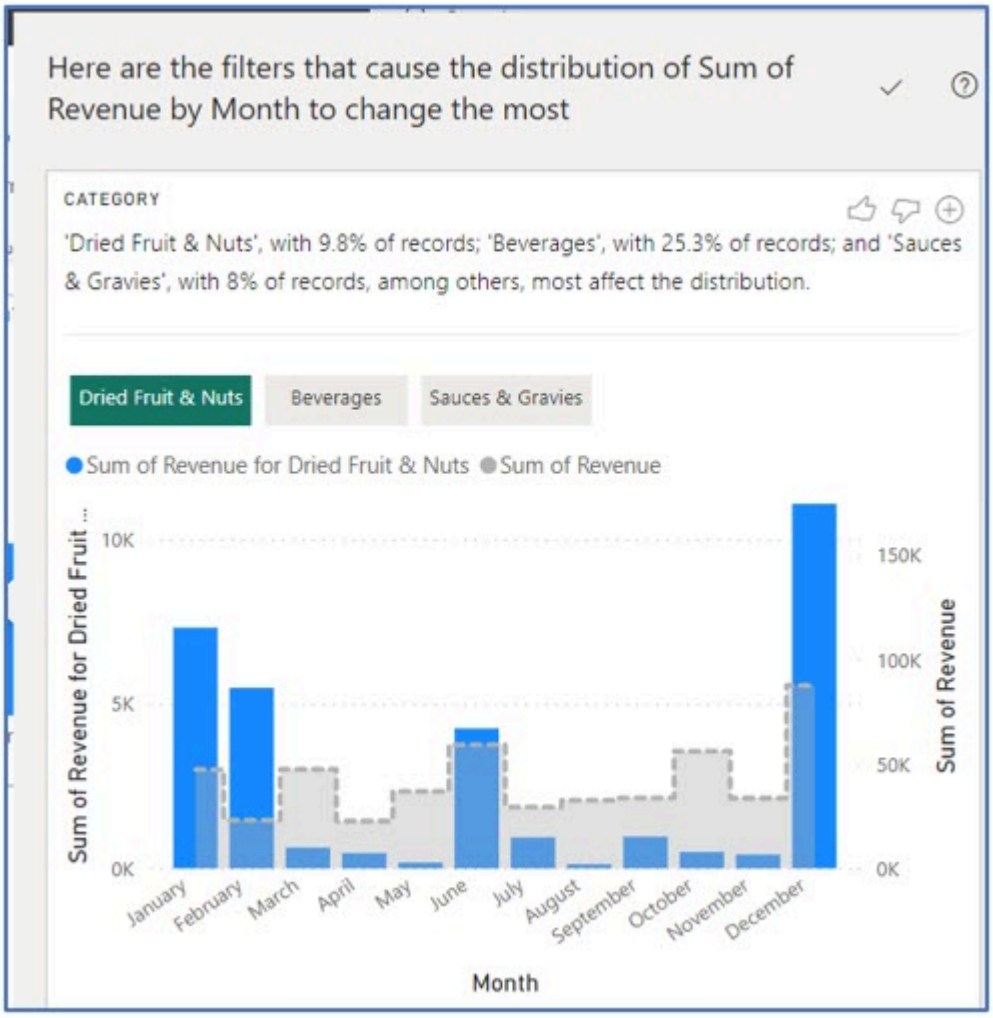


Figure 7.27—Filter by Category to Find New Smart Narrative

5. **Customize Tooltips** is a terrific way to provide additional information beyond the default tooltips. Look at a customized tooltip using XCaliber Foods. XCaliber Food's Tooltip comes up when you hover over the revenue by salesperson or revenue by state. The tooltip shows the total, but also a map (city and state) of where the salesperson sold the product. As you can see in this pop-up tooltip, the salesperson Nicole Pottinger sold in three states:

Washington, Oregon, and Idaho. Custom tooltips can even include drill-through options! Just keep in mind that you would not want a pop-up that covered the entire page!

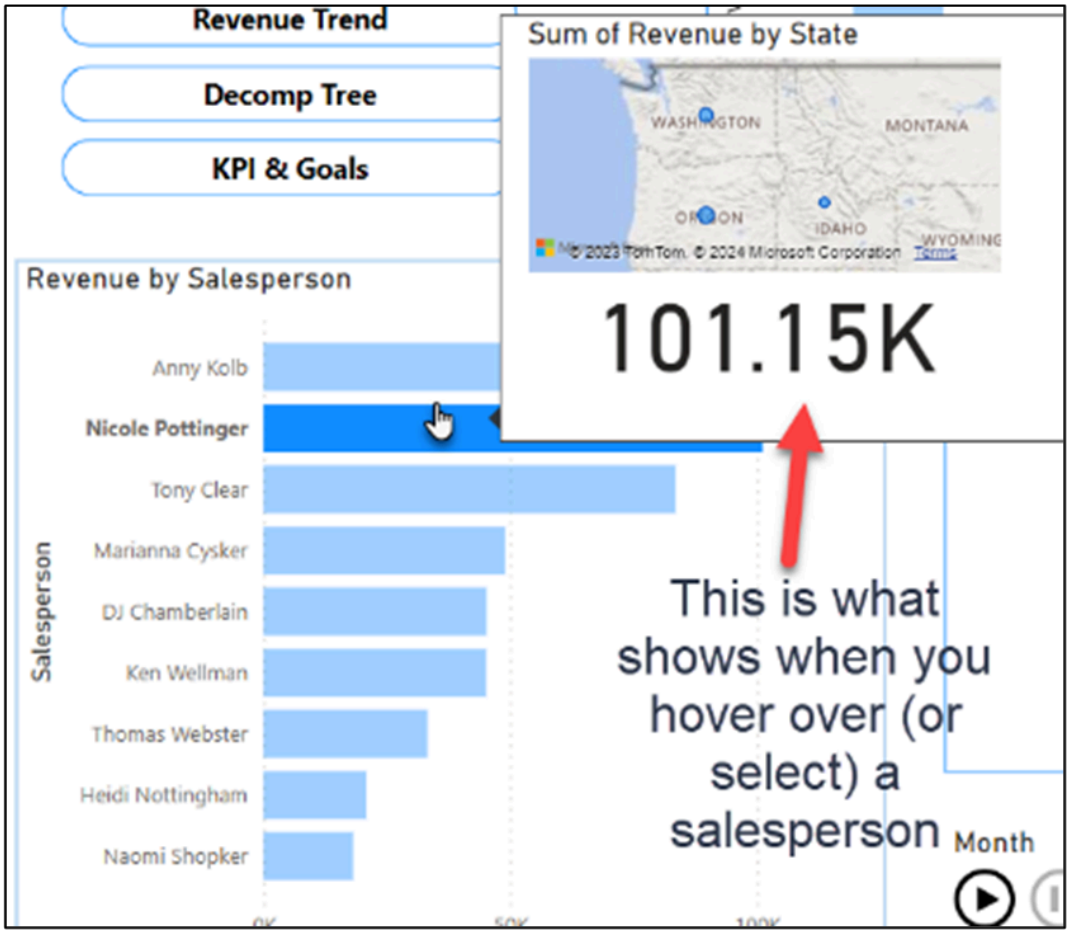


Figure 7.28—Customized Tooltip for XCaliber Foods

6. **Play axis** is a dynamic slicer, animating other Power BI Visuals to show data or categories over time. The example shown on page 1 of the XCaliber Report is based on the salesperson as the driver, but shows the revenue, insights, and revenue by state over time by just clicking the Play button.

Figure 7.29—Play Axis Button Used in XCaliber Food Report

7. **Multipage Report** is a way to organize the information to support the story. Think of it as chunking the information into sections.

Organizing a Multipage Report in Power BI Desktop

The preliminary report is organized into five pages: an overview, product revenue, revenue trend, decomp tree, and KPI and goals. The report is designed with key navigation so the storyteller can quickly move from one page to another.

Page 1—XCaliber Foods: Includes a sales summary and includes navigation, revenue by month, revenue by salespersons, revenue by state, smart narrative, and a play axis that animates all components through time dynamically. Figure 7.30 shows the tabs for each page.

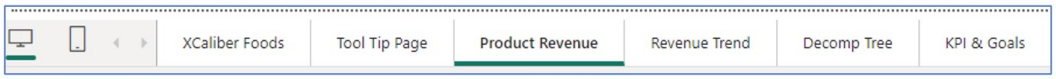


Figure 7.30—Multipage Report Tabs for XCaliber Foods

In Figure 7.30, you see the Tool Tip Page. This page is custom sized to provide a small pop-up effect. This page will only be seen in edit mode. Once an app is developed and you check the box to hide this page, the audience will not see it.

Page 2—Product Revenue: Includes navigation, revenue by product, revenue by customer, and smart narrative. As seen in Figure 7.31, the salespeople will quickly see the top products and the smart narrative will help put the information into perspective (for example, coffee accounts for 17.02% of sales revenue!). This allows the presenter to concentrate on popular products and to see what customers are purchasing.

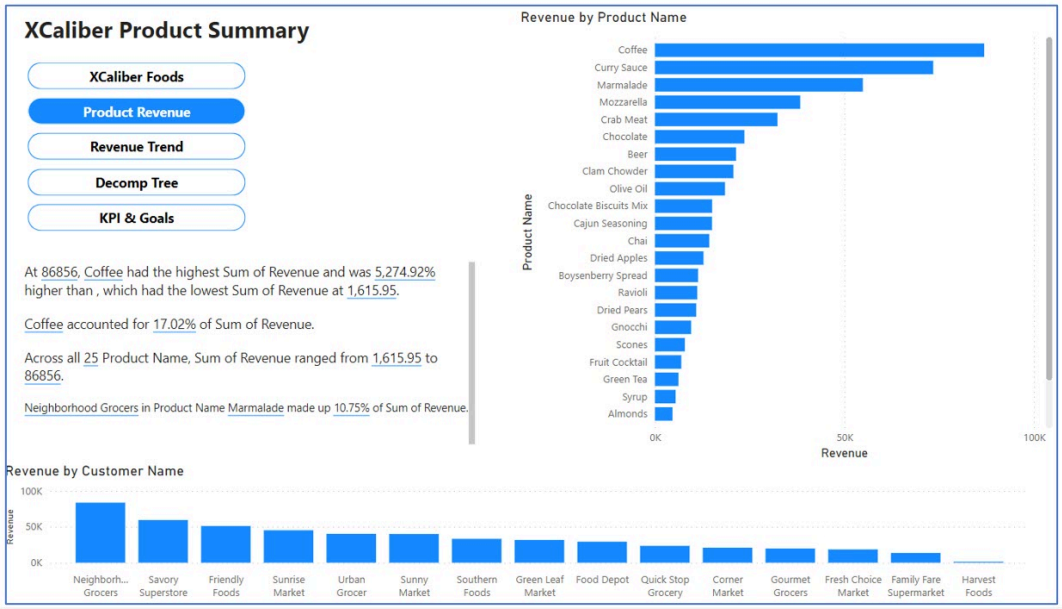


Figure 7.31—Page 2 of XCaliber Multipage Report

Page 3—Revenue Trend: Includes navigation, includes a slicer by customer name to investigate revenue by month and revenue by state, with a map showing sales by state. As shown in Figure 7.32, the user can choose the slicer to see what products are popular as well as know what months they were sold in. This will allow the user to see the inconsistencies in sales. For example, if you select Corner Market in the slicer, you quickly see that although the average sales for Corner Market are $2k, sales fluctuate a lot.

Figure 7.32—Page 3 of XCaliber Multipage Report

Page 4—Decomp tree includes navigation and a decomp example, from the North region, to the highest category (beverages), to the highest product within that category (coffee). As shown in Figure 7.33, users can investigate by changing the filters. Users can easily see the limited categories that are leading sales. The presenter can use the decomposition tree to break this into metrics. When the presenter is demonstrating the key metrics of sales, they can show dimensions through the region, product categories, product name, and even add salespeople to the mix. If the presenter wants to demonstrate supply chain data, the dimensions could be shippers, shipping methods, and delivery time (the time from order to shipped).

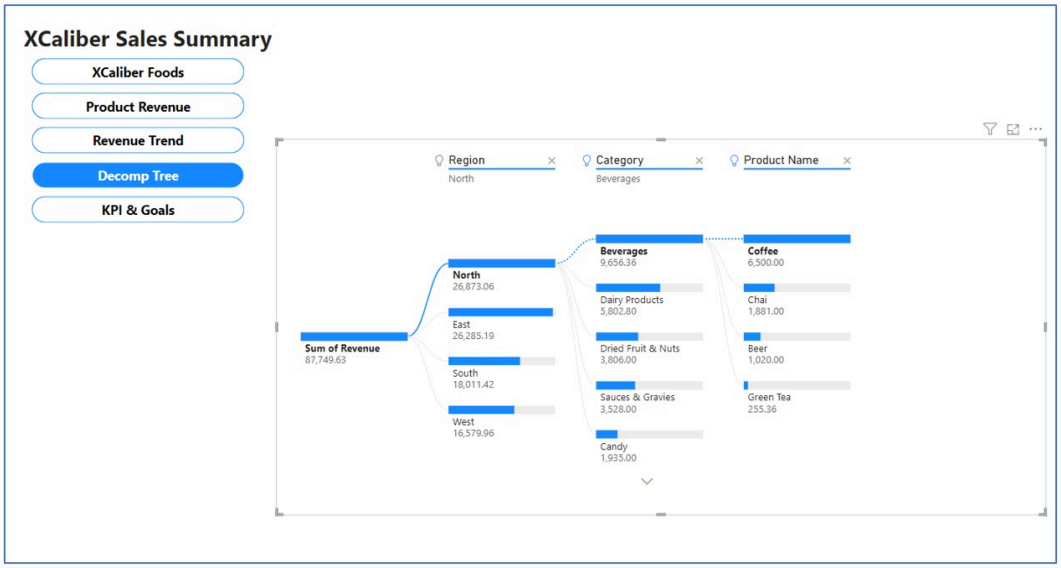


Figure 7.33—Page 4 of XCaliber Multipage Report

Page 5—KPI and goals: Includes navigation, a line chart of revenue by month, revenue by customer, KPI showing 2024 Goal per customer, 2024 revenue measured to the target ($510.33k to $600k), Revenue by payment type, and a tile card showing 2024 compared to target. In Figure 7.34, the KPIs are all from 2024 and no new goals were included. Another

page could be added for 2025 goals, or the owner may wish to gain input from the current salespeople as to what the goal should be.

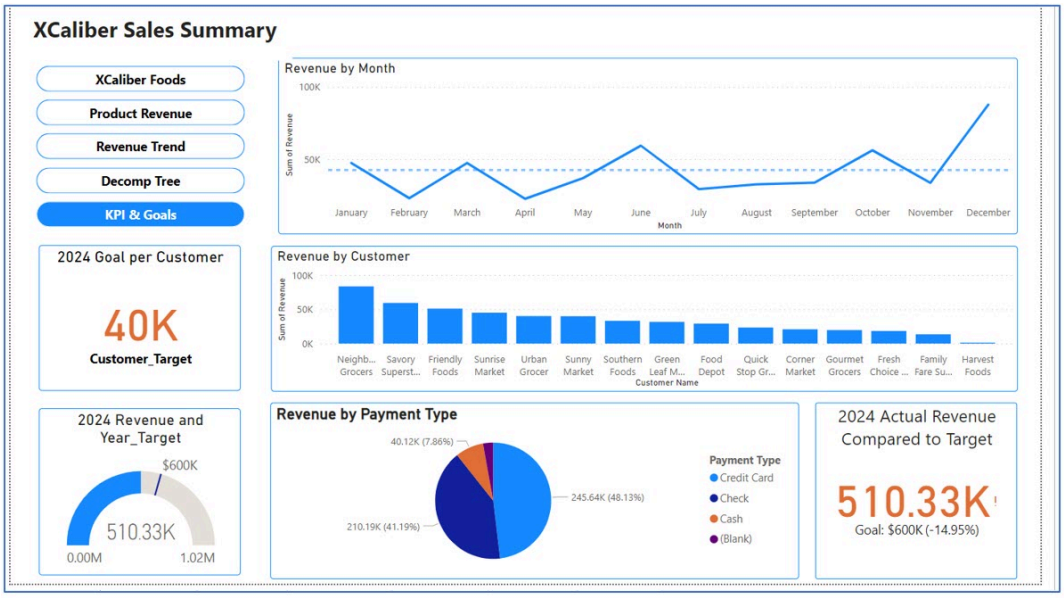


Figure 7.34—Page 5 of XCaliber Multipage Report

You may also note that no customer survey data are visualized here. Management decided to focus on 2024 and create a separate dashboard for survey data.

Connecting the Story to the Visuals and Data

If you go back to the CASS template (Exhibit 7.11), you will see that the main character in the story is Joe, a new salesperson at XCaliber. Joe's early journey shows his struggle to learn the distribution software system, experiencing a lack of motivation even though he is on commission. The less motivated he feels, the more isolated he feels. Joe's journey changes to success when he starts participating in the weekly discussions. Experienced salespeople attend the weekly meetings. Through these discussions, Joe learns how to sell products to his new customers. His confidence increases as he delivers sales orders on time. He listens to his customers, and he benefits from their growing trust. Joe bonds with his mentor and continues to participate in weekly discussions with all the salespeople. Joe feels comfortable contributing ideas to management and confident that they will be implemented. He is invested in XCaliber and wants to contribute to the overall goals of the company.

Now that we have started to see how to connect a story to the data, let's take a step-by-step approach to building the report in Power BI Desktop.

Before we show the how, let's talk about the "why" of navigation buttons in a Power BI Report (that we can ultimately publish from Power BI Desktop to Power BI Services [Online]). Navigation buttons work well for a presenter who wants to visit several pages (views) in a report and may want some flexibility in how it is presented.

Mac Users Can Create Their Report Using Power BI Services Online

If you recall, Power BI Desktop only works with PCs; however, Power BI Services Online works for either system, PC or

Mac. Recently, Microsoft has added the ability to use the Data Model, which means Mac users (or even PC users) can create their reports directly in Power BI Services Online! The trick is to set up your Excel file within your OneDrive and link that file instead of uploading the file. Instead of linking, Mac users can publish the Excel file directly from Excel to Power BI. Both steps are in Section 7.1, A Word to Mac Users.

Reminder to Open Power BI Services Online: Go to http://office.com and log in. In the main Microsoft 365 page, choose **Apps**, and look for Power BI. Open it.

Next, make sure to have your Excel file in OneDrive regardless of which method you use: the Excel Publish method or the linking method.

The Excel Publish Method

Step 1—Open the Excel file. Use the Chapter 7 file, *XCaliber Foods 7.3 Includes Delivery*.

Step 2—In Excel, choose File, Publish, and Export workbook data to Power BI.

Step 3—Excel will show an active bar publishing. It will give a message at the top of the Excel menu that says "Workbook exported successfully."

Step 4—Choose Go to Power BI.

Step 5—Type in your email address (the same one you use for your college credentials), and then click submit.

Step 6—In the My Workspace in Power BI Services Online, see if the file is there and that the type is Semantic Model. If you see this type as Semantic Model, you will be able to create reports and dashboards.

Note: If you do not see the type as Semantic Model, **try the Linking Method**.

Linking Method

Step 1—In Power BI Services Online, choose the Create button (under Home), and then select Excel (Preview). See Figure 7.35 for details.

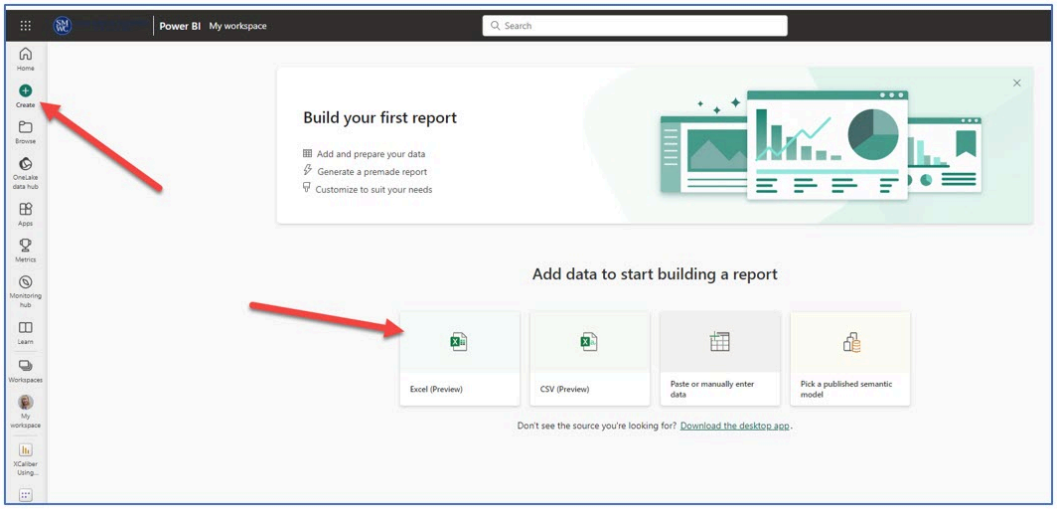


Figure 7.35—Create, Then Select Excel (Preview) in Power BI Services Online

Step 2—Choose **Link to file** and **browse** your OneDrive to find the Excel file. Use the Chapter 7 file, *XCaliber Foods 7.3 Includes Delivery*, and select **Next**.

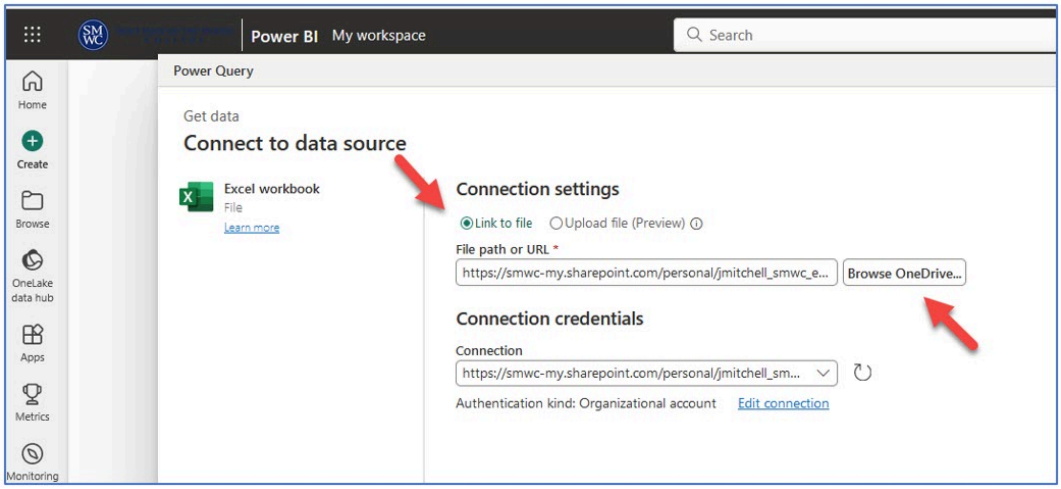


Figure 7.36—Link to File in Power BI Services Online

Don't be surprised if you are required to login (again) to Office.com.

Step 3—A pop-up Power Query window (as seen in Figure 7.37) will appear. Under the Excel Workbook folder, make sure XCaliber_Foods and Data are both collected, and then choose Create.

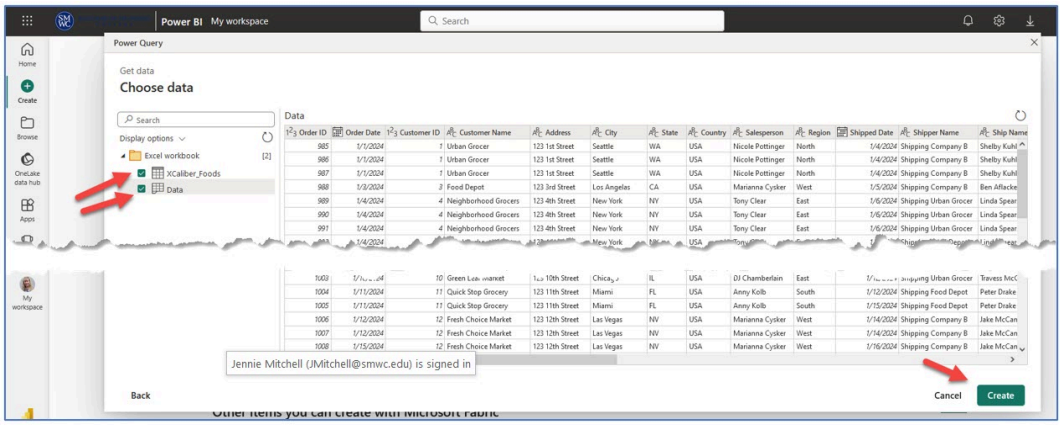


Figure 7.37—Pop-Up Power Query Window in Power BI Services Online

You will see a screen that shows your data loading.

Step 4—You will now see the canvas area (Figure 7.38) where you can build your five-page report. You should see the Visualization pane and the Data pane. Use the XCaliber Foods (they both have the same data, but the data one contains meta data).

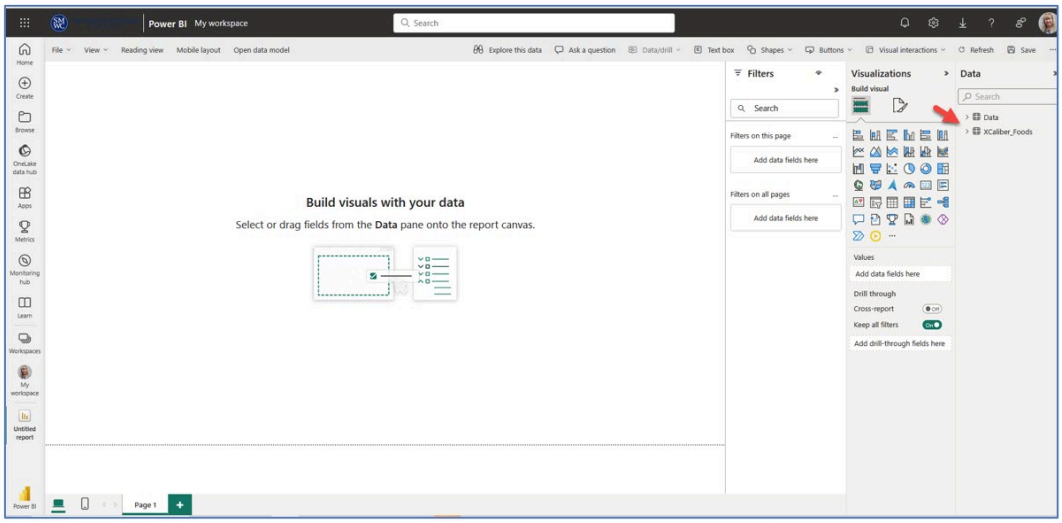


Figure 7.38—Canvas in Power BI Services Online

Now the good thing is this—the Step-by-Step instructions given next work for either the Power BI Services Online or the Desktop. Mac users should be able to create pages in the Power BI Services Online. As you work on adding information to the report. When saving the report, indicate in some way that it was created in Power BI Services Online. For example, we used *XCaliber Using BIService* as a name (see Figure 7.39).

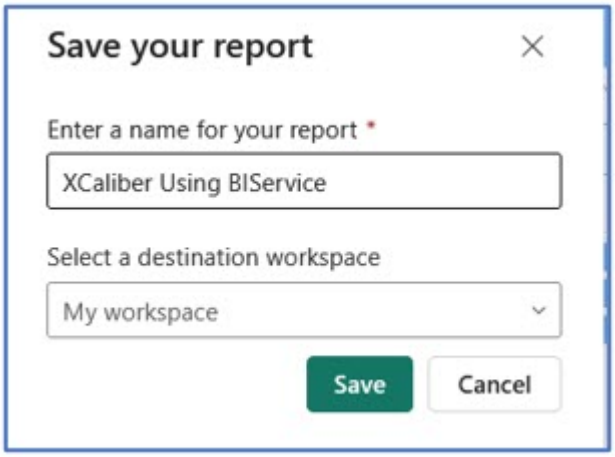


Figure 7.39—Naming the File to Show It Was Created in BI Services Online

Step-by-Step to Add Navigation to a Power BI Desktop Report

Step 1—Open Power BI Desktop and Load File (**Mac users: skip to Step 2**)

a. Open the file you cleaned in Section 7.2. My file is called "XCaliber Foods Storytelling—Draft 2" (you may have given it a different name).

b. If you didn't complete the cleaning in Section 7.2 follow these steps.

i. Choose **File** and **New**. You will see the Add data to your report as shown in Figure 7.40.

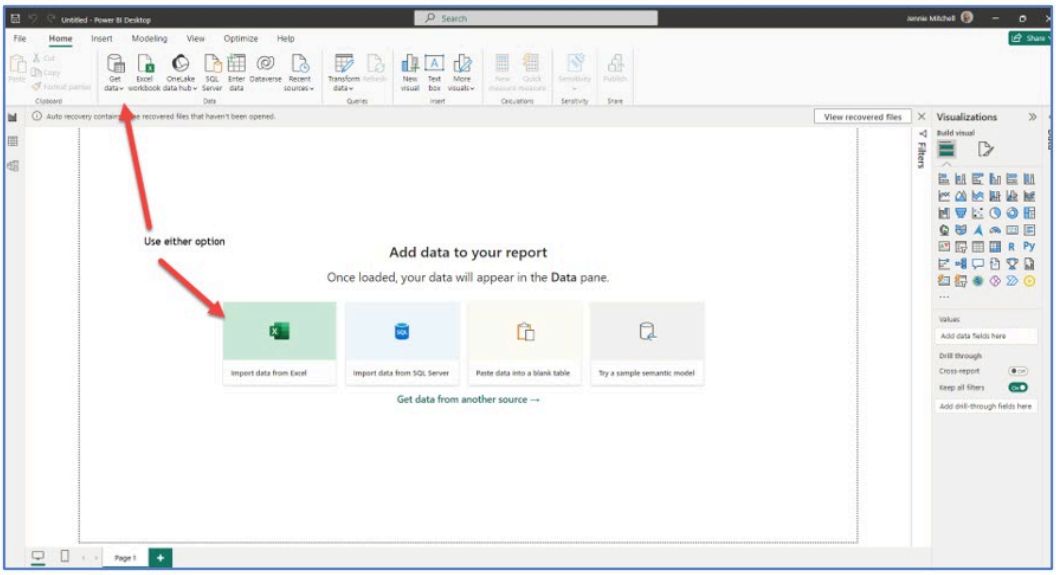


Figure 7.40—Starting New in Power BI Desktop

ii. Select **Import data from Excel**

iii. Choose the file called "XCaliber Foods 7.3 includes delivery.xlsx"

iv. Choose both tables (the red bubble number 1) as shown in Figure 7.41.

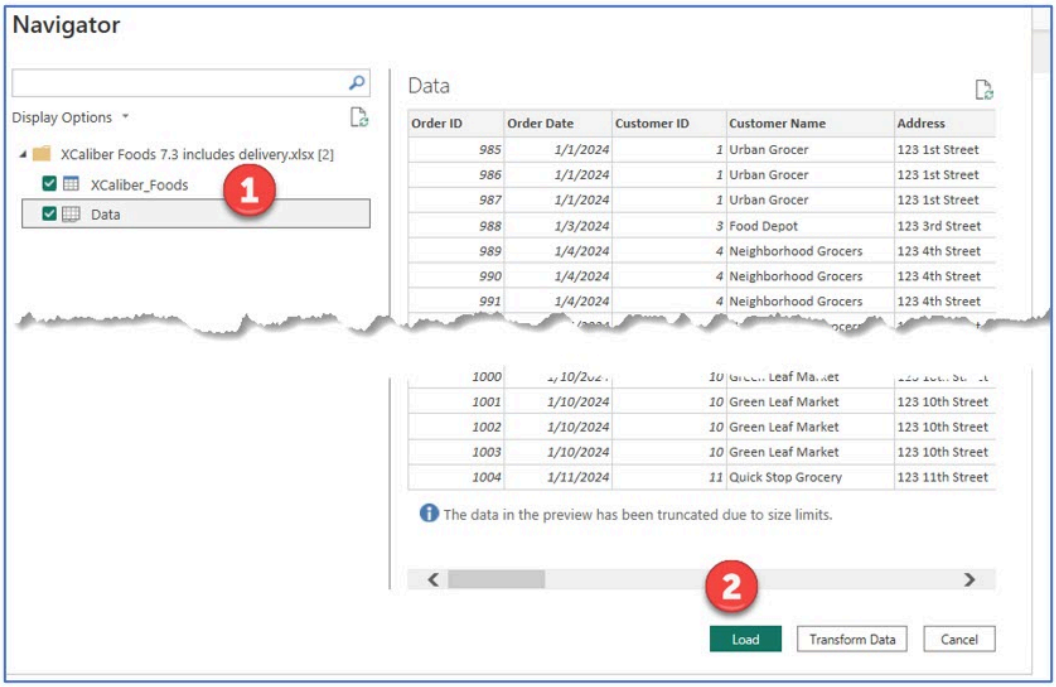


Figure 7.41—Navigator—Choose Both Tables

It may be confusing to see two tables when there is only one dataset from an Excel workbook that has one sheet. The second table is automatically generated by Power BI and represents the **metadata** associated with the Excel file.

v. Click **Load** as shown in Figure 7.42 (#2). You will now see the Data pane showing two tables. You can ignore the metadata table. The metadata table is the one called "Data" because it shows the worksheet name.

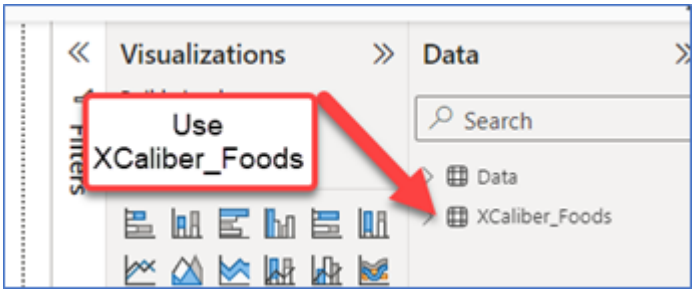


Figure 7.42—Data Shows Up in Data Pane in Power BI Desktop

Step 2—Create pages. Make tabs.

a. At the bottom of the canvas, find the Page 1 tab. **Double-click** it and rename it as shown in Figure 7.43. Then click the + key to add a new page (tab).

Figure 7.43—Name Pages (Tabs) as Shown

b. **Right-click** the Tool Tip Page and choose **Hide**. You will see a crossed-out eye symbol.

Step 3—Create Navigation Buttons

a. On the main menu, choose **Insert**, **Buttons**, **Navigator**, then **Page navigator**. Power BI Desktop by default shows all the pages, but we don't want to show the Tool Tip Page. So we need to take an extra step. See Figure 7.44.

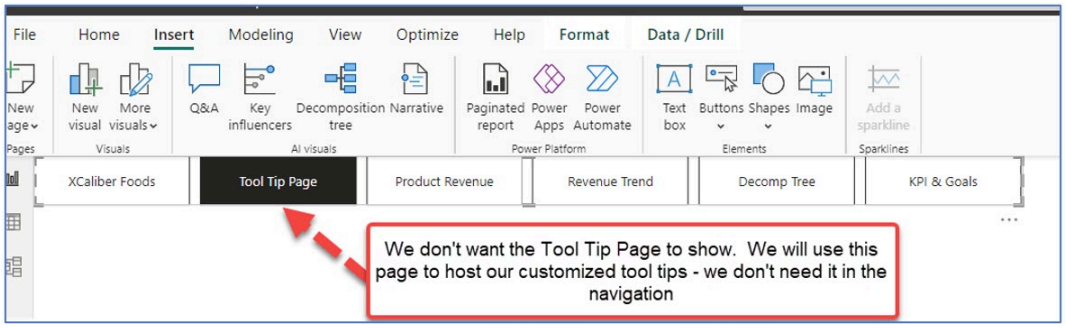


Figure 7.44—Default Navigation

b. In the Format navigator pane, go to **Pages**. Toggle "Show hidden pages" to **Off**. See Figure 7.45 to see where the Format navigator pane is located.

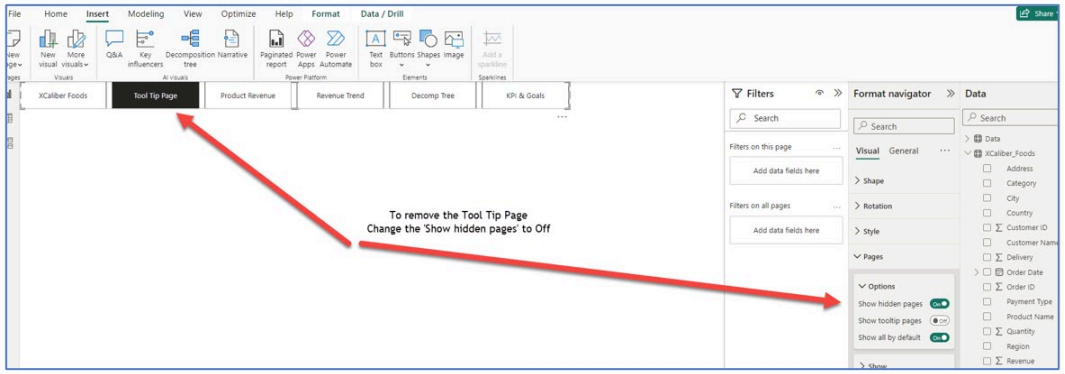


Figure 7.45—Remove a Navigation Button

c. The buttons are in a horizontal state (by default), and we want vertical buttons. In the **Format navigator**, choose **Grid layout** and change **orientation to vertical**. Don't be alarmed when you see only slim bars with no text. With your mouse, click the handler (#1) around the buttons and resize. Push the right side (of the 4 bars; #2) to the left, and then pull the bars down (#3) until you see the text (see the next two figures).

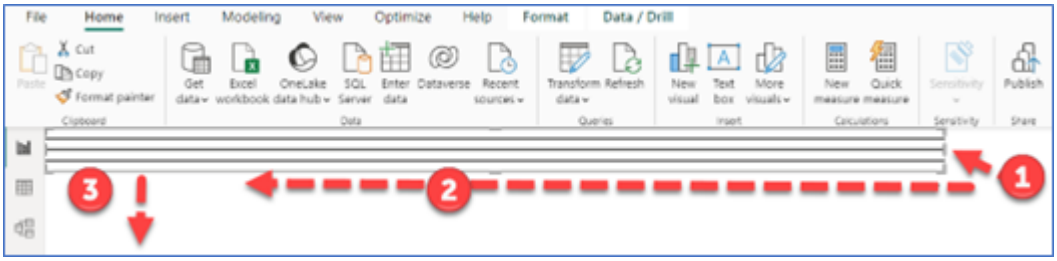


Figure 7.46—Adjust Buttons to Vertical Format

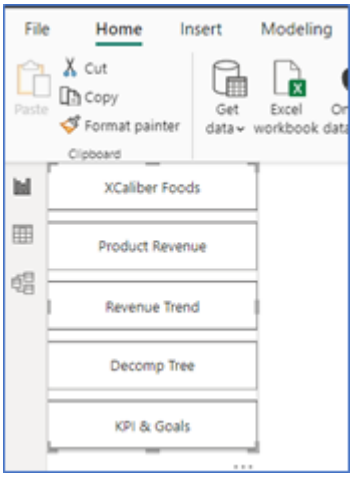


Figure 7.47—Buttons After Resizing

d. Now let's **add the title** to this page, XCaliber Sales Summary as shown in Figure 7.48. Note, the font is Segoe UI, size is 20, bold, and left aligned. The buttons look generic, so let's work on them next.

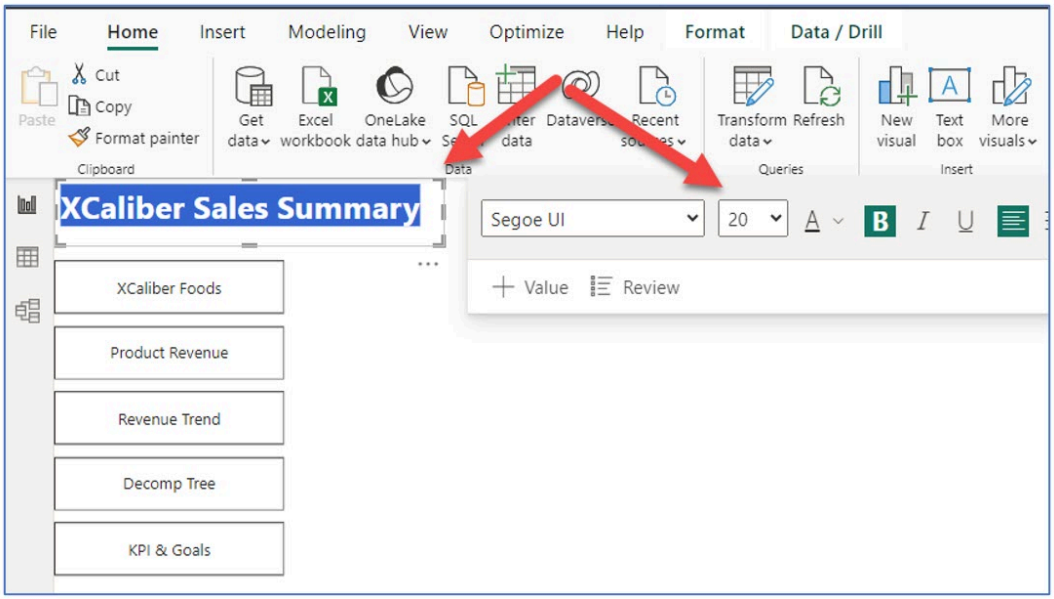


Figure 7.48—Adding the Title for Page 1 of Report

e. Users expect certain behaviors from buttons. If we get them designed on this page, we can copy them to the other pages. Buttons have four states: default, hover, press, and selected. It adds a lot to the report if the buttons work as expected by your users. There are dozens of designs that can be used for the shape of the button. For now, select the button set. The handlers will be around all five buttons. In Format Navigator, go to Shape, and change to Pill (see Figure 7.49).

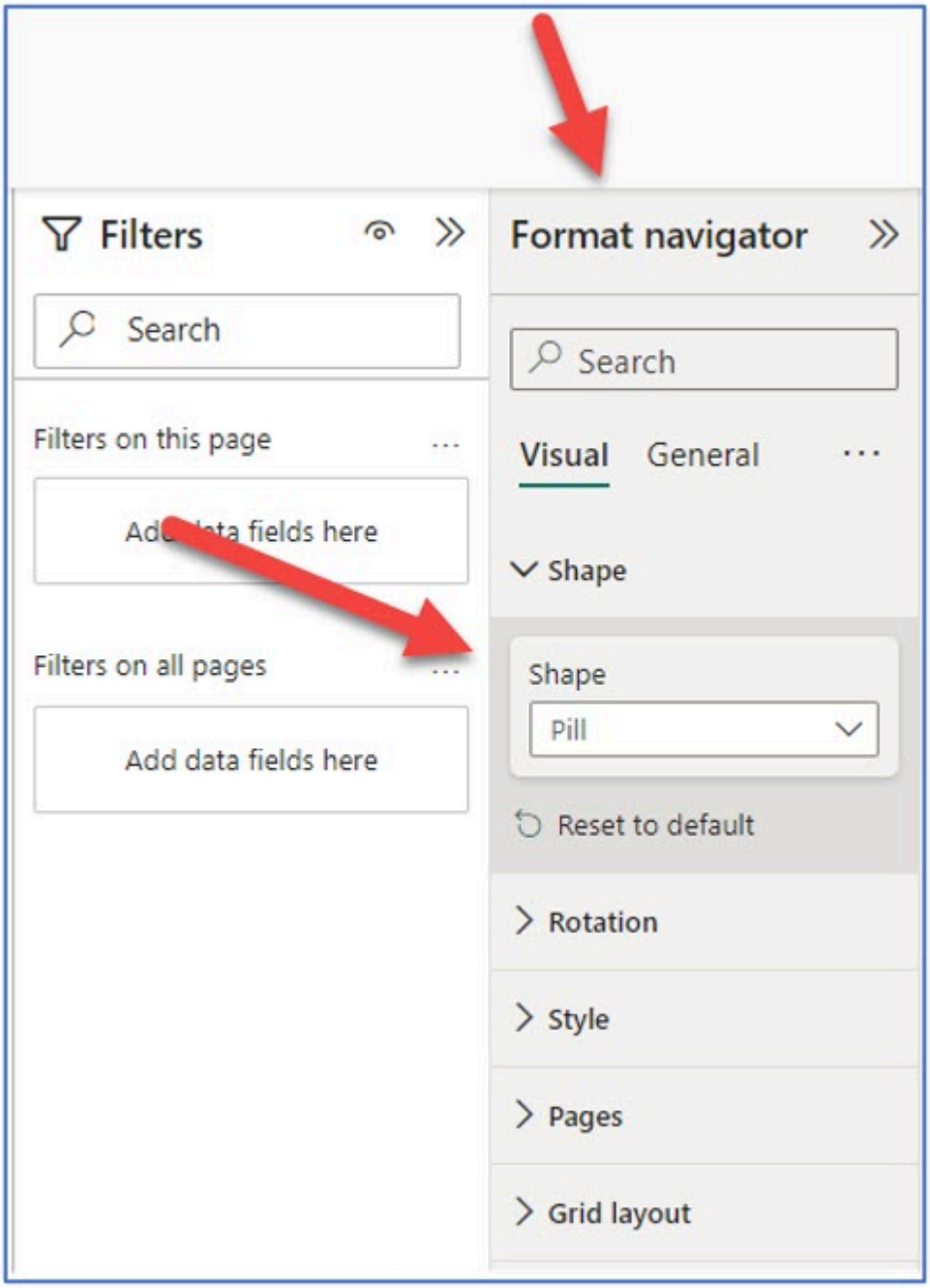


Figure 7.49—Using Format Navigator to Change Button Shape

f. To set the behavior of the buttons, we need to set the different states. Here are the states (default, hover, and selected) and what they will look like. You can change the "press" default; however, it is so quick that most users don't notice any effect. See Figure 7.50.

Figure 7.50—Showing the Button States

In the Format Navigator pane, do the Default state first. The items bolded in Table 7.1 represent subcategories under the main category Visual under the Format Navigator.

Apply all these settings to the buttons—you can do the entire button set at one time by reviewing the settings in Table 7.1.

Table 7.1: Applying Settings to the Buttons

Apply settings to the **Default State**	Apply settings to the **Hover State**	Apply settings to the **Selected State**
Format Navigator, Visual, **Style**, **Text**, Bold, font size 12 Font color—Black **Fill**—Color white **Border**—Blue	Format Navigator, Visual, **Style**, **Text**, Bold, font size 12 Font color—Blue **Fill**—Color white **Border** Blue	Format Navigator, Visual, **Style**, **Text**, Bold, font size 12 Font color—white **Fill**—Blue **Border**—White

g. Remember, Power BI shows the first button as selected as default. Now **copy the button set** to the Product Revenue page, the Revenue Trend page, the Decomp Tree page, and the KPI & Goals page. You do not want to copy it to the Tool Tip Page—we are using that page to house our pop-ups.

Don't worry though—all the states are incorporated in this full set of buttons. If you add another page, the corresponding button will use the established settings.

h. Now that we have the navigation set, let's start building the visuals and graphs for each page. It is also a suitable time to **Save** your work. Save it to your OneDrive space.

Bookmarks, Themes, and Mobile Layout Overview

Before we start the next section, review the difference between navigation buttons and bookmark navigators. A **bookmark** captures a specific state of a report page. Bookmarks save the current filters and slicers, cross-highlighted visuals, sort order, or my favorite bookmark, which clears all the filters so I'm back to my default dashboard. If you have a collection of bookmarks, you can even set up a slide show. There are all kinds of things you can do with bookmarks, including a visual table of contents, and bookmarks to turn on a color palette that works for people who are color-blind. You can even set up an overlay to add more commentary, although this is a more advanced skill. If your story needs commentary, try the overlay trick featured in the YouTube video from Sweatpants BI (2022).

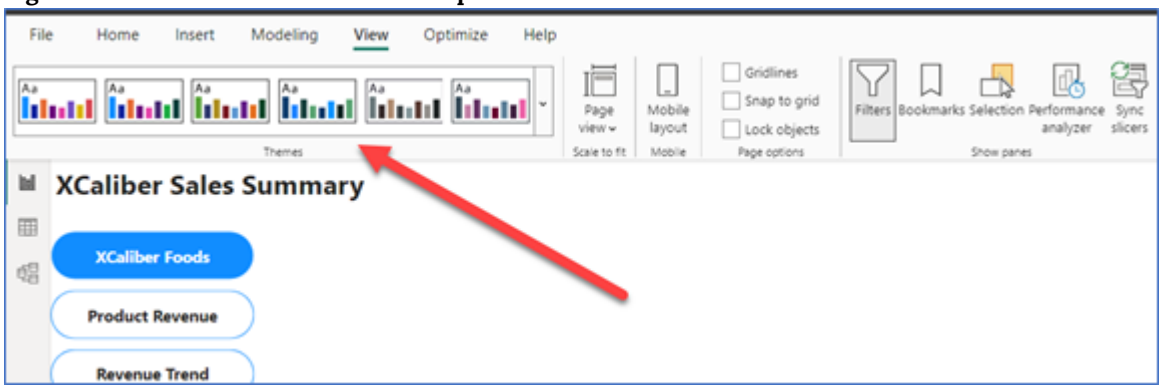
Microsoft Learn. (2023, Dec 19). Create report bookmarks in Power BI to share insights and build stories. Microsoft. https://learn.microsoft.com/en-us/power-bi/create-reports/desktop-bookmarks?tabs=powerbi-desktop

Sweatpants BI. (2022, Nov 8). *Overlaying commentary & highlights using Power BI bookmarks and Power Point*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=576#oembed-4

Please note that Power BI Desktop allows you to apply **themes**. This is not available in Power BI Services (Online), even though both products do similar things. In Figure 7.51, the default theme is the one on the far left. Note that the view shows a **mobile layout**. Essentially, in either Power BI Desktop or Power BI Services Online, you can design the report, so it works for a phone layout.

Figure 7.51—Themes in Power BI Desktop



Mac Users—Please note that you can follow the steps outlined in the Step-by-step instructions for building a report; however, the images shown here are taken from the Power BI Desktop.

Step-by-Step to Add Visuals to Page 1 of a Power BI Desktop Report

Step 1—Start with page one (see Figure 7.52 for the completed design). This page has six components: (1) Revenue by Month, (2) Revenue by Salesperson, (3) Revenue by State, (4) the pop-up that comes up when hovering over either Revenue by State or Revenue by Salesperson, (5) the Insights, and (6) the Play axis.

Figure 7.52—Visualizations on Page 1: Power BI Desktop Design

1 Revenue by Month

a. Start by clicking in the middle of the canvas, and then the **stacked column chart** in the Visualizations pane. Reposition as necessary.

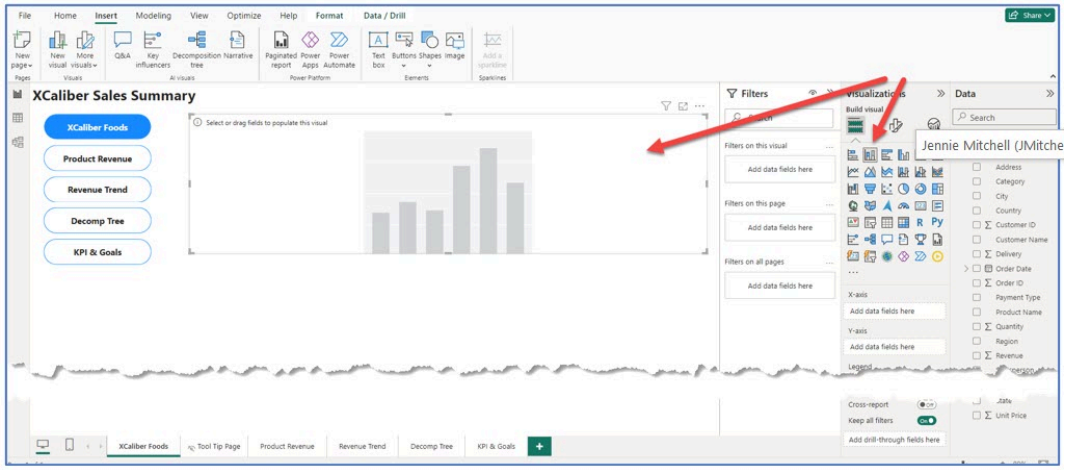


Figure 7.53—Add a Visualization Container to the Power BI Desktop Canvas

b. In the Data pane, drag the **Order Date** to the x-axis keeping only the **Month**. Then drag **Revenue** to the y-axis.

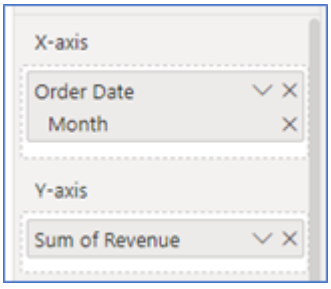


Figure 7.54—Adding Data to Create the Revenue by Month Chart

c. In the **Visualization pane**, choose **Format** (paint brush), then **General**, then **Title**. Remove "Sum of" so the title of the chart will be **Revenue by Month**.

d. Next, let's format the y-axis. In the **Visualization pane**, choose **Format** (paint brush), then **Visual**, then choose the y-**axis** and expand it. Choose **Title**, and type in **Revenue** (you just type right over the "Auto" in the text box). Now the y-axis says Revenue and not Sum of Revenue. Make any other format changes you desire (bold, font size, etc.)

e. To add a blue border, in the **Visualization pane**, choose **Format, General**, and then **Effects**. Expand effects, and in **Visual border**, select **On**, then change the **color to blue**.

Make sure to click out of the chart **before** you select the next visualization.

2 For the Revenue by Salesperson

a. Click on the blank canvas. In the **Visualization** pane, choose the **stacked bar chart**. Reposition as needed.

b. In the **Data** pane, choose **Salesperson** for the y-axis and **Revenue** for the x-axis.

c. Let's remove "Sum of Revenue" in the **X-Axis Title** by turning off the Title, or you can just choose to say **Revenue**.

d. Instead of Sum of Revenue by Salesperson, let's just use Revenue by Salesperson. In the **Visualization pane**, choose **General**, then **Title** and remove the "Sum of."

e. To add a blue border, in the **Visualization pane**, choose **Format, General**, and then **Effects**. Expand effects, and in **Visual border**, select **on**, then change the **color to blue**.

3 For the Revenue by State

a. Click on the blank canvas. In the visualization pane, choose the stacked bar chart. Reposition as needed but have it on the far right.

b. In the **Data** pane, choose **State** for the y-axis and **Revenue** for the x-axis.

c. Let's remove "Sum of Revenue" in the **X-Axis Title**, by turning off the Title or you can just choose to say **Revenue**.

d. Instead of Sum of Revenue by Salesperson, let's just use Revenue by Salesperson. In the **Visualization pane**, choose **General**, then **Title** and remove the "Sum of."

e. To add a blue border, in the **Visualization pane**, choose **Format, General**, and then **Effects**. Expand effects, and in **Visual border**, select **on**, then change the **color to blue**.

4 For the Pop-Up Custom Tool Tip

Power BI Desktop visualization has tool tips turned on by default; however, the default tool tips don't add much value since they replicate the data. Custom tool tips can add value and context as well as support better storytelling.

a. First of all, we already have a **separate page** in our report that we named *Tool Tip Page*, and we hid it from view. Go to this page. In the main menu, choose **View**, in **Page View**, choose **Actual size**.

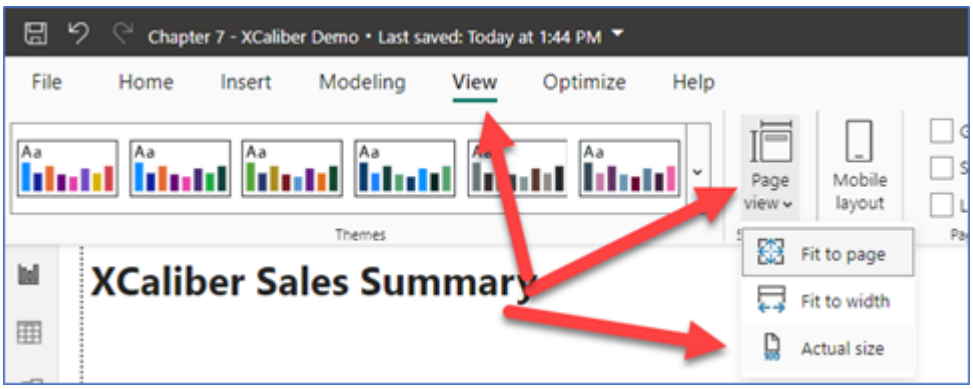
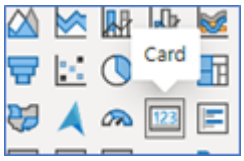


Figure 7.55—Custom Tool Tip: Set Page to Actual Size

b. Next, in the **Visualization** pane, click the **Format** (paint brush). Expand the **Page information**. You should see "Tool Tip Page" since we have already named the page. Toggle the button to **On** for **Allow use as tooltip** (see below). Next, expand **Canvas Settings**, Choose **Tooltip**, and customize the height to 240 px and width to 320 px with vertical alignment set at top. Next, in the **Visualization** pane, with the tooltip already selected, choose a **card** visualization, and in the **Data** pane, choose **Revenue**. The card might be too large, so use the Format (paint brush), choose **values**, and adjust the size. Figure 7.56 shows the results. But we still need some additional features to add context.



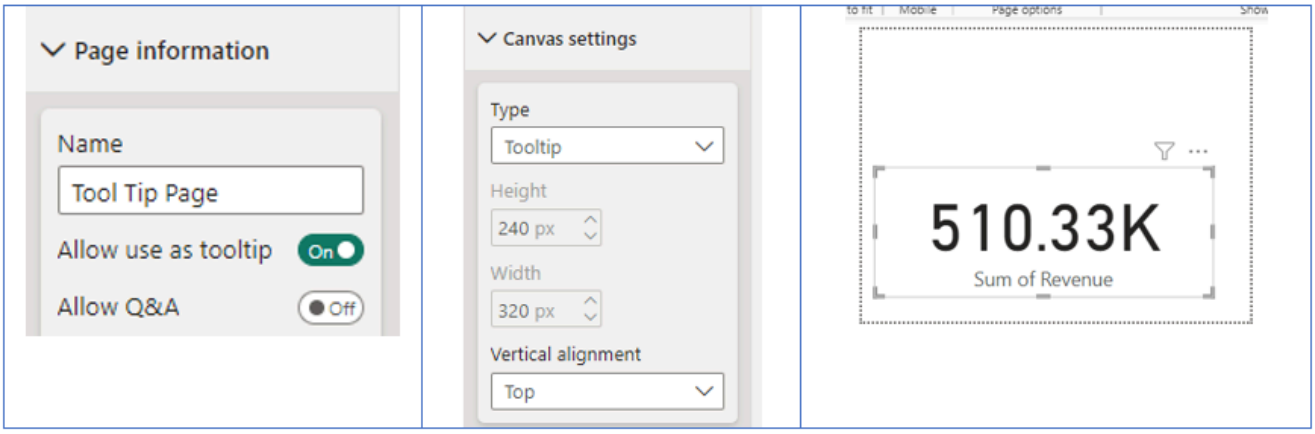


Figure 7.56—Showing Results of the Steps for a Custom Tool Tip

We have a way to go to make this worthy of being called *customized*!

c. Next, let's remove the "Sum of Revenue." Click on the handlers around the 510.33k and choose Format (paint-brush). Under Visual, turn the **Category label Off**.

d. Let's add some context by adding a map. In the **Visualization** pane, choose the **Filled Map**, then on the **Data** pane, choose **Revenue** and **State**. You may need to adjust the map, so it shows only the United States. It should look like Figure 7.57.

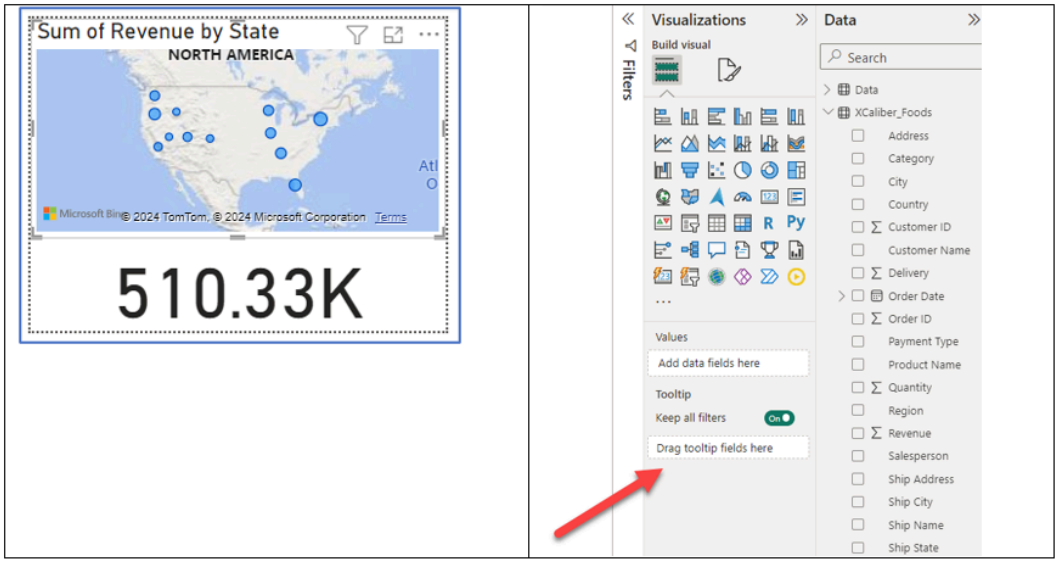
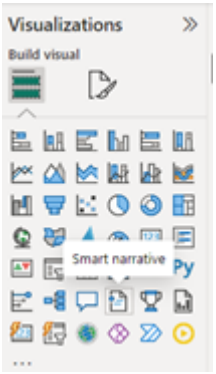


Figure 7.57—Customized Tool Tip for Any Field Chosen

e. Click on the customized tool tip and in the **Visualization** pane, you will see **Drag tooltip fields here**. You can drag more than one. So drag the fields, **State** and **Salesperson**. Now a user can see where the salesmen sold

products. And if you hover over Revenue by State bars, you will see which city and state. The dollar amount will automatically change too!

Insights



Insights can be customized but it is a great feature using the default visualization.

a. Make sure you are in a blank spot on the canvas of the XCaliber Foods page. On the **Visualization** pane, select **Smart narrative**. The component may take up more space than you expected, but you can use the handlers to resize it. Just FYI, you can set up the smart narrative as a tool tip!

Once resized, add a title to the top. I called this **INSIGHTS**. The insights shown are based on the chart showing Revenue by Month. But we can add insights to Revenue by Salesperson. Feel free to add a border and change the size of the font.

b. **Select** the **Revenue by Salesperson chart**. Then in the **Format** (paintbrush), choose **General, Header Icons**, then expand **Icons**. In Icons, **toggle** the **Smart narrative** to **On**. You will now see a Smart Narrative icon in the top right of the chart (see the red arrow in Figure 7.58).

Figure 7.58—XCaliber Foods Page Showing Two Different Insights

Add a Play Axis for Time Series Analysis

A play axis is a fairly new visualization available in Power BI (at least new to me). It reminds me of audio controls.

a. Find a blank spot in the canvas, and in the **Visualization** pane, choose the **Play Axis visualization**. It will show up in an unexpected space ready for a field (shown in Figure 7.59). Drag it down to the spot we have under Insights and resize it as needed.

b. Next, it requires a field to make this work. In this case, drag the field Salesperson. You can add a border. Format (paintbrush), **General**, and then **Effects**. Expand effects, and in **Visual border**, select **On**, and change color to blue.

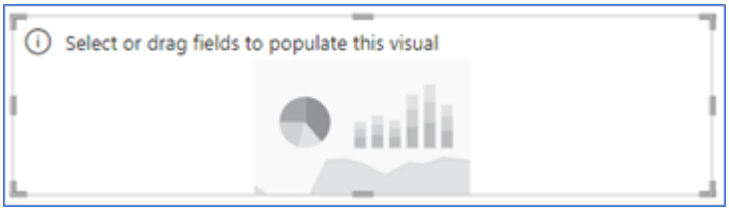
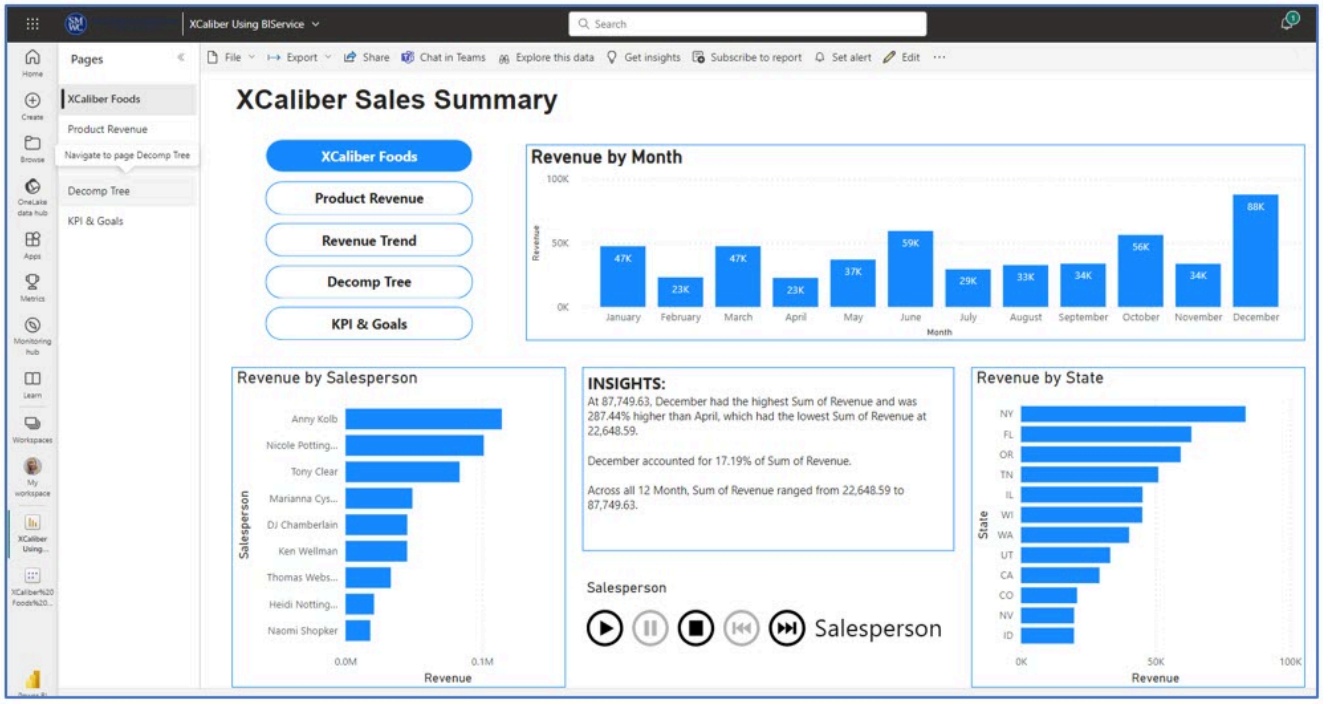


Figure 7.59—Drag Field to Populate the Play Axis

c. Try the speed—push the play button. To slow down the speed, **Format** (paintbrush), **Visual, Animation Settings**, and change the time to **2000 ms**. (As an aside, we are not convinced that this is practical for every dashboard, but it might have a place if your eyes were focused on only one component.)

d. Make sure to **Save** your file. Always make sure to save your file to a OneDrive location. Now let's move on to page 2 of the report.

Exhibit 7.12—Page One of Report Built in Power BI Services Online



Mac Users: Exhibit 7.12 shows page one of the five-page report built in Power BI Services Online.

Step-by-Step to Add Visuals to Page 2 of a Power BI Desktop Report

Mac Users: Use these instructions in Power BI Services Online.

Step 1—Start with page two tabbed Product Revenue (see Figure 7.60 for the completed design). This page has three components: (1) Revenue by Product Name, (2) Smart Narrative based on Revenue by Product Name, and (3) Revenue by Customer Name.

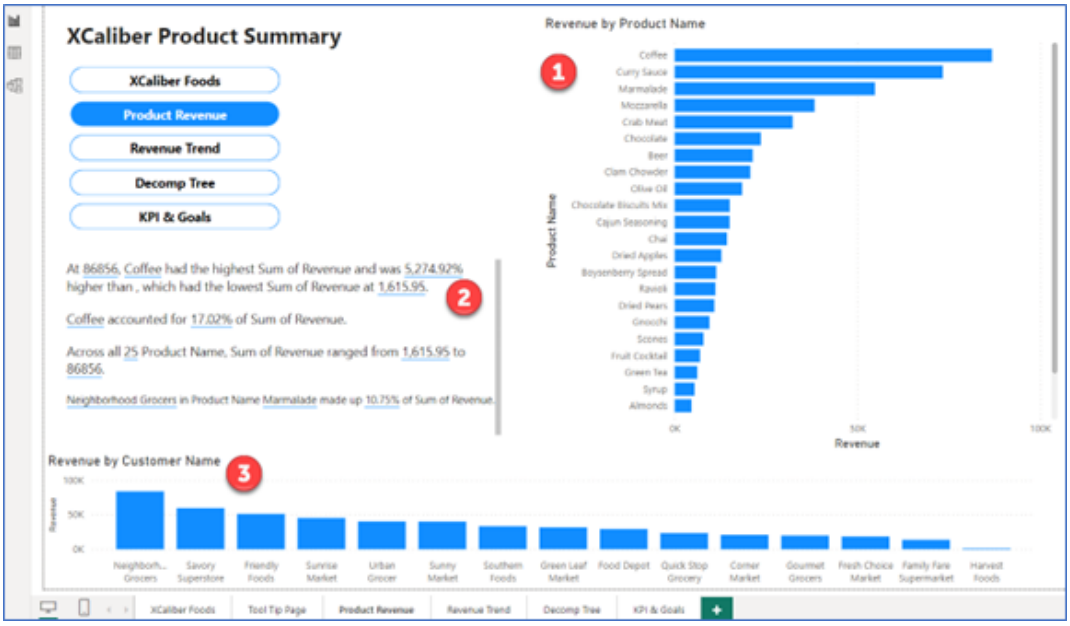


Figure 7.60—Visualizations for Page 2: Power BI Desktop Design

1 Revenue by Product Name

a. Note, you should see the navigation buttons and the Product Revenue will be in the selected state.

b. Start by clicking in the middle of the canvas, and then the **clustered bar chart** in the **Visualization** pane. Reposition as necessary.

c. In the **Data** pane, drag the **Product Name** to the y-axis and drag the **Revenue** to the x-axis.

d. In the **Visualization pane**, choose **Format** (paintbrush), then **General**, then **Title**. Remove the "Sum of" so the title of the chart will be **Revenue by Month**.

e. Next, let's format the x-axis. In the **Visualization pane**, choose **Format** (paintbrush), then **Visual**, then choose the **X-Axis** and expand it. Choose **Title**, and type in **Revenue** (you just type right over the "Auto" in the text box). Now the x-axis says Revenue and not Sum of Revenue. Make any other format changes you desire (bold, font size, etc.)

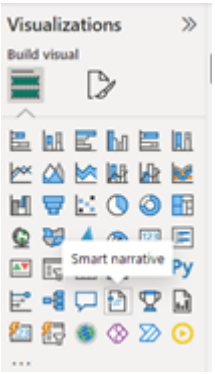
f. To add a blue border, in the **Visualization pane**, choose **Format, General**, and then **Effects**. Expand effects, and in **Visual border**, select **On**, then change the **color to blue**.

g. Add a **title** to this page, by adding a **text box**. We used the title: **XCaliber Sales Summary**, at 20-point font and **bold**. However, you might want to name this page XCaliber Product and Customers if it fits your storytelling better.

Make sure to click out of the chart **before** you select the next visualization.

2 Smart Narrative Based on Revenue by Product Name

Insights can be customized but we are demonstrating the default visualization.



a. Make sure you are in a blank spot on the canvas of Product Revenue page 2. On the **Visualization** pane, select **Smart narrative**. The component may take up more space than you expected, but you can use the handlers to resize it. Once resized, feel free to add a title to the top, like the word **INSIGHTS**. The insights shown are based on the chart showing Revenue by Product Name. Feel free to add a border and change the size of the font.

3 Revenue by Customer Name

a. Click on the blank canvas. In the **Visualization** pane, choose the **stacked column chart**. Reposition as needed.

b. In the **Data** pane, choose **Customer Name** for the x-axis and **Revenue** for the y-axis.

c. Let's remove "Sum of Revenue" in the **Y-Axis Title**; by turning off the Title (we need the room, so removing the title is the best option).

d. Instead of "Sum of Revenue by Customer Name," let's just use "Revenue by Customer Name." In the **Visualization pane**, choose **General**, then **Title** and remove the "Sum of."

e. To add a blue border, in the **Visualization pane**, choose **Format, General**, and then **Effects**. Expand effects, and in **Visual border**, select **On**, then change the **color to blue**.

f. Make sure to save your file to your OneDrive location.

Step-by-Step to Add Visuals to Page 3 of a Power BI Desktop Report

Mac Users: Use these instructions in Power BI Services Online.

Step 1—Start with page three tabbed Revenue Trend (see Figure 7.61 for the completed design). This page has four components: (1) Revenue by Month with an average line, (2) Revenue by Product Name, (3) a slicer for XCaliber's 15 customers, and (4) Revenue by State using a map.

Figure 7.61—Visualizations for Page 3: Power BI Desktop Design

1 Revenue by Month

This same graph is used on page 1—please review the steps—they are the same until we add the average goal line, center the graph heading, and add some data labels.

a. In **the Visualization** pane, right of the Format (paintbrush), choose the **magnifying glass** as seen in Figure 7.62.

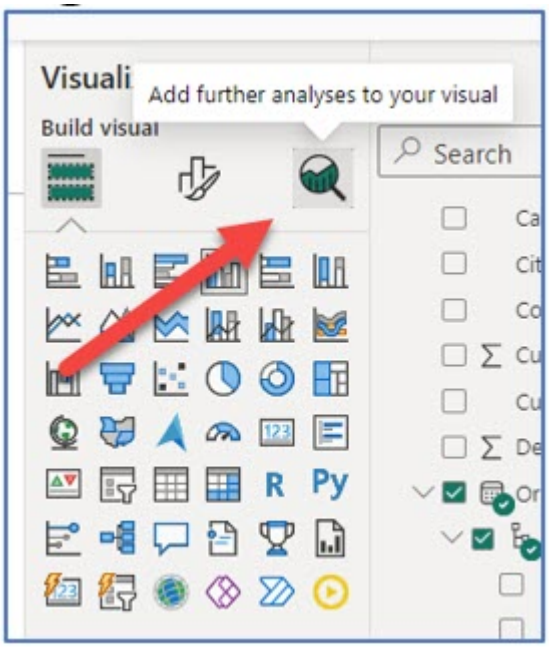


Figure 7.62—Add Further Analysis to the Cluster Column Chart

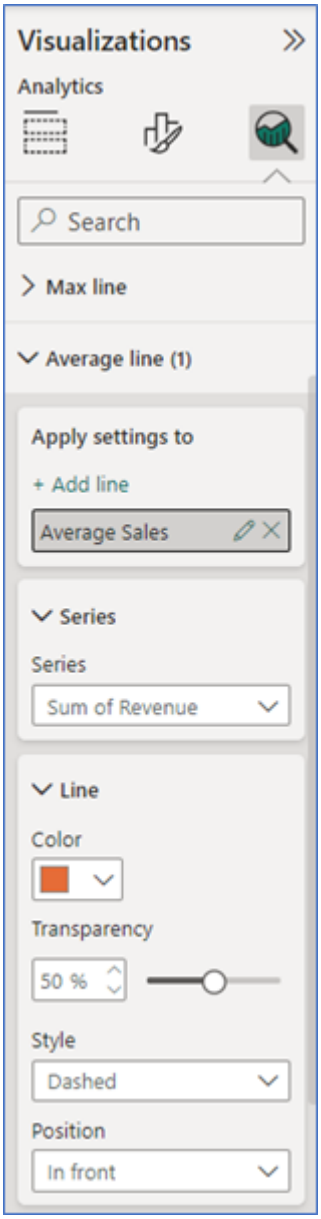


Figure 7.63—Adding an Average Line Named Average Sales

b. Once you select the magnifying glass, look for the **average line**. Note all the types of lines we could use here: constant line, min line, max line, average line, median line, percentile line, and error bars. **Expand** the **average line** and **add a line**. We named it Average Sales. Notice you can add multiple lines.

c. Next, change the color of the line. In the line feature, change the color to red.

d. Because it was somewhat crowded, we turned on data labels, turned off the y-axis title, and turned off values on the y-axis.

e. To make the data label stand out, under Value, change the font to size 10 and bold.

Just as a note: The average sales line is calculated as $42,527 ($510,326/12 months) and this line makes sense when your chart shows total sales. This line will not change even if you choose revenue by product name; however, it does reinforce the trend of inconsistent sales. It also gives the user some insight into the inconsistency of even the best sales product, coffee, as shown in Figure 7.64. Notice that it tells the user to "Right-click to drill through," adding another layer of analysis.

Figure 7.64—Slicer Shows Inconsistent Sales Patterns

2 Revenue by Product Name

This is the exact same chart as the one shown on Product Revenue but using a **stacked column chart** instead of a clustered bar chart.

Other differences: added data label and made font large and bold. Turned off values for the y-axis and removed the title, Sum of Revenue, by toggling the Title to Off.

3 Slicer Based on Customer Name

The slicer is based on the15 customers. One of the goals of the owner is to expand the number of customers and expand the number of states where the product is shipped. This slicer makes it easy to see where the customer is located and one what product they are purchasing. The slicer can work for a single customer or multiple customers. Here is an example of how well you can get to know your customers.

a. Click in a blank space on the Canvas. Then in the Visualization pane, choose the Slicer and reposition the slicer to the right of the Revenue by Month chart.

b. Drag the Customer Name to the Slicer.

c. Resize so that all the customers show in the slicer. Add a blue visual border.

In Figure 7.65, the customer, Corner Market purchased three products: beer, fruit cocktail, and chocolate. If you look at the revenue by month the revenue by month is quite inconsistent. In fact, there are no sales in February.

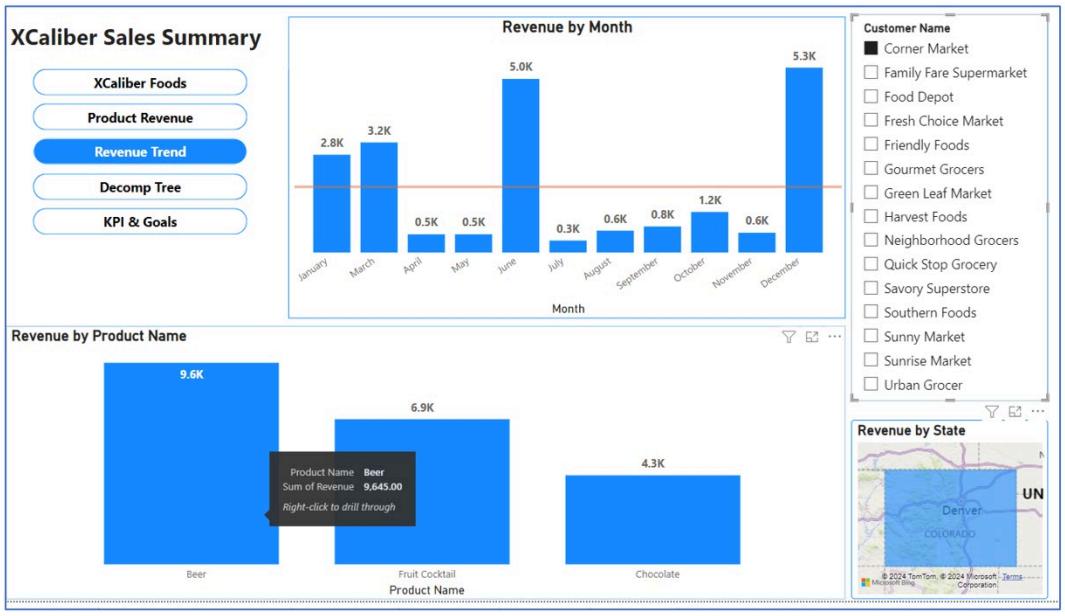


Figure 7.65—Using the Slicer for Customer, Corner Market

Revenue by State—Using a Map

a. Click in a blank space in the Canvas. In the Visualization pane, choose the Filled map. Move the map so it is mostly showing the United States.

b. Next, in the Data pane, choose State and Revenue.

c. Next, remove "Sum of" using the Format (paintbrush), General, and Title.

d. Add a visual border in Format (paintbrush), General, Effects, Visual Border toggled to On and choose a blue color.

Step-by-Step to Add Visuals to Page 4 of a Power BI Desktop Report

Mac Users: Use these instructions in Power BI Services Online.

Step 1—Start with page four tabbed Decomp Tree (see Figure 7.66 for the completed design). This page uses a Decomposition tree visual. This versatile tool adapts to your data to help uncover insights by drilling into dimensions. It's like peeling a layer of an onion to reveal hidden patterns. Look at the completed design to see what it looks like and how to drill down to see patterns.

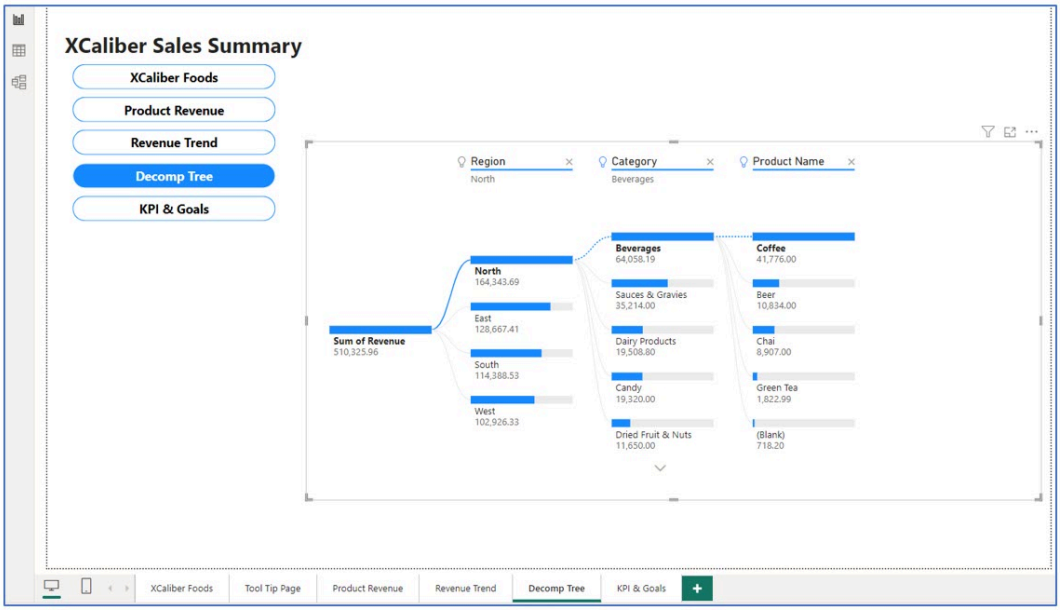


Figure 7.66—Visualizations for Page 4: Power BI Desktop Design

To interpret the Decomposition Tree, notice it shows the highest sales for the region (the North), shows the highest sales categories (beverages, sauces, dairy products, and so on), and the specific product names under the categories. If you click on the bar for the East region, you will see the highest sales categories and products.

Decomposition Tree

a. Note, you should see the navigation buttons, but you may need to add the title, XCaliber Sales Summary. If you need to add a title, click **Insert, Text Box**, and type the title with a 20 bold point font.

b. Next, click in the middle of the canvas, then choose **Decomposition Tree** in the **Visualization** pane.

c. Resize so the container takes up most of the space.

d. In the **Data** pane, select **Revenue** and **Region**. Note that a bar appears with a plus at the right side of the bar as shown in Figure 7.67. You have choices of high value, low value, category, or region.

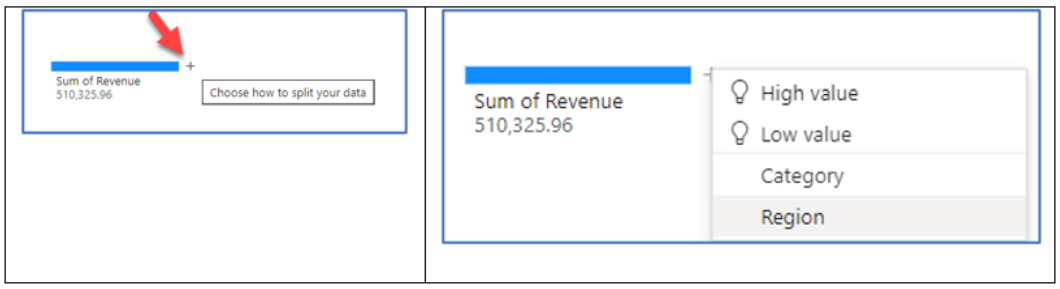


Figure 7.67—Choose How to Split Your Data in a Decomp Tree

e. Since the storyteller wants to focus on expanding and growing in regions, choose **Regions**. Your page should look like Figure 7.68.

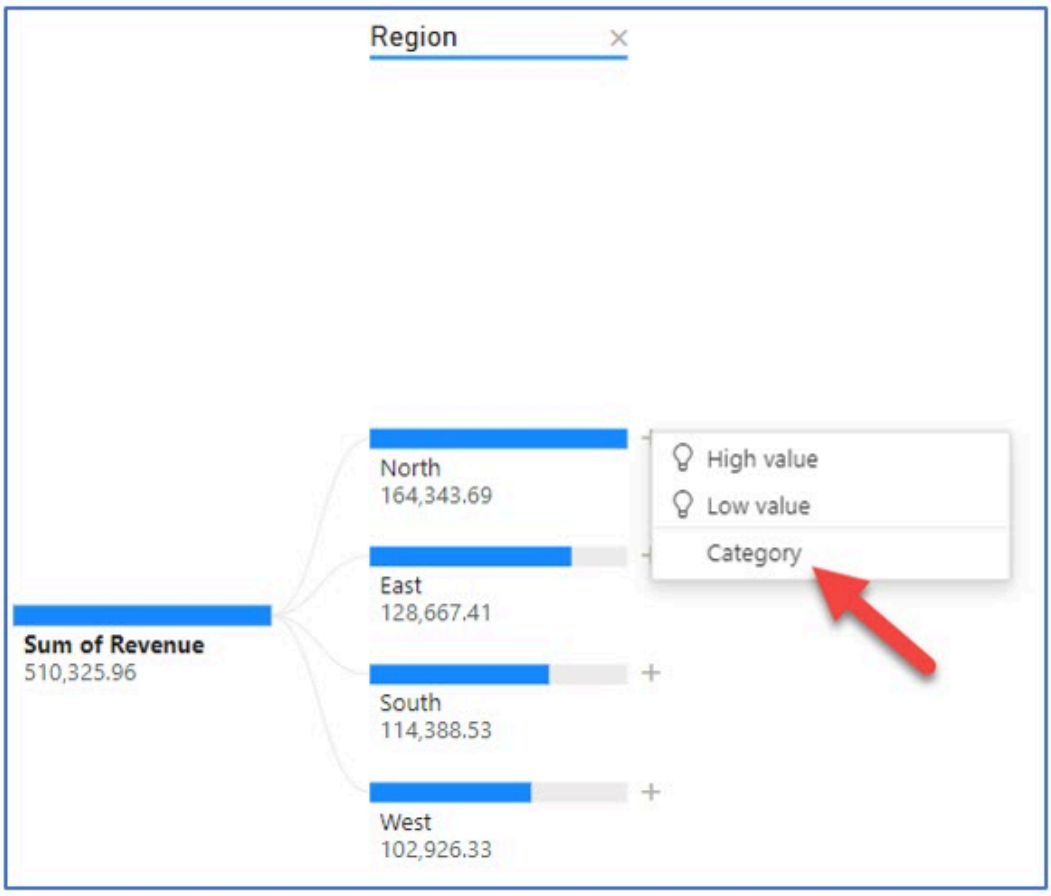


Figure 7.68—Illustrates Highest Region in Revenue

f. Click **Category**. You will see all the categories listed. To add Product names, on the **Data** pane, select **Product Name**.

g. The **plus** beside Beverages will show a choice of High value, Low value, and Product Name. Click the plus and choose **Product Name**.

Try exploring this Decomp Tree to see each region's high-selling categories and products. For example, which region has the highest sales of jams and preserves? By clicking through the Decomp Tree, you will discover the answer is the East region.

Step-by-Step to Add Visuals to Page 5 of a Power BI Desktop Report

Mac Users: Use these instructions in Power BI Services Online.

Step 1—Start with page five tabbed KPI & Goals (see Figure 7.69 for the completed design). This page includes the following components: (1) Revenue by Month—Line chart with trend line, (2) Revenue by Customer, (3) Revenue by Payment type, (4) a KPI card showing 2024 Sales total compared to goal, (5) a KPI showing 2024 customer goal, and (6) a KPI card showing year revenue to target in a gauge graph.

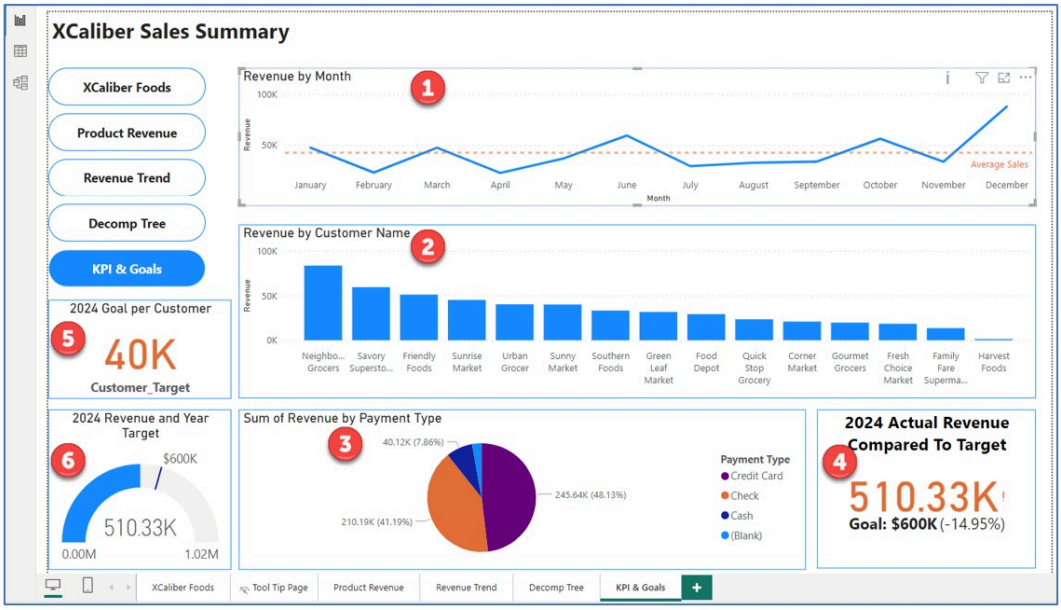


Figure 7.69—Visualizations for Page 5: Power BI Desktop Design

1 Revenue by Month

a. Start by clicking in the middle of the canvas, and then the **line chart** in the **Visualization** pane. Reposition as necessary.

b. In the Data pane, drag the **Order Date** to the x-axis keeping only the **Month**. Then drag **Revenue** to the y-axis.

c. In the **Visualization pane**, choose **Format** (paint brush), then **General**, then **Title**. Remove the "Sum of" so the title of the chart will be **Revenue by Month**. If you prefer, feel free to center the title.

d. Next, let's format the y-axis. In the **Visualization pane**, choose **Format** (paint brush), then **Visual**, then choose the **Y-Axis** and expand it. Choose **Title**, and type in **Revenue** (you just type right over the "Auto" in the text box). Now the y-axis says Revenue and not Sum of Revenue. Make any other format changes you desire (bold, font size, etc.)

e. To add an **average line**, the **Visualization** pane, then the **magnifying glass**. Go to the **Average line**, add a **line**, and name it **Average Sales**. If you desire, choose **Data label**, turn it **On**, and Choose the **name to show** (you can show both the name and the amount). We chose a different color to represent the average sales as shown in Figure 7.70.

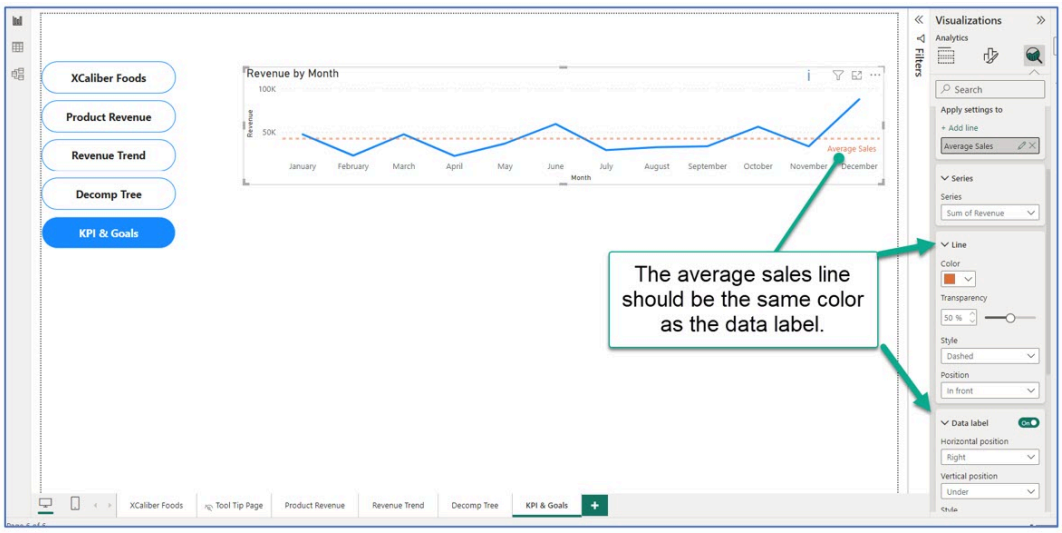


Figure 7.70—Adding an Average Sales Line to the Revenue by Month Chart

The average sales line is a good indicator for the food business. We expect revenue trends to be influenced by seasonality, economic conditions, and availability of fresh produce. An average line ($510,326/12 = $42,527) will directly show when sales are above or below average. In 2024, the sales goal was $600,000 for the year (or $50,000 per month). As you can see, XCaliber did not reach that goal in most months.

Some users will want to see a trend line, but not all charts will allow a trend line. If you don't see a Trend line selection when you select the magnifying glass, it may be because you have the wrong chart, or you have your date hierarchy set up incorrectly.

f. To add a blue border, in the **Visualization pane**, choose **Format, General**, and then **Effects**. Expand effects, and in **Visual border**, select O**n**, then change the **color to blue**.

g. While on this page, add the title, XCaliber Sales Summary. Or you may prefer a different title.

Make sure to click out of the chart **before** you select the next visualization.

2 Revenue by Customer

This same graph was used on page two, but we want to keep some of the axis titles.

a. Click on the blank canvas. In the **Visualization** pane, choose the **stacked column chart**. Reposition as needed.

b. In the **Data** pane, choose **Customer Name** for the x-axis and **Revenue** for the y-axis.

c. Let's remove "Sum of Revenue" in the **Y-Axis Title**, by typing Revenue in the Title section.

d. Instead of Sum of Revenue by Customer Name, let's just use Revenue by Customer Name. In the **Visualization pane**, choose **General**, then **Title** and remove the "Sum of."

e. To add a blue border, in the **Visualization pane**, choose **Format, General**, and then **Effects**. Expand effects, and in **Visual border**, select **On**, then change the **color to blue**.

Make sure to click out of the chart **before** you select the next visualization.

3 Revenue by Payment Type

This chart shows how customers paid for their orders. What is interesting is that we have credit cards, checks, and cash, as expected. However, we also see a small portion of sales that don't show payment of any kind—they are just blank. Are these uncollected, bad checks, or overlooked?

a. Click in a blank space on the canvas. Then in the Visualization pane, choose the pie chart. Resize as needed—this should fit nicely under the Revenue by Customer Name.

b. In the Data pane, choose Payment and Revenue.

c. The visual will show amounts and percentages. Feel free to adjust the colors.

d. To add a border, choose Format (paintbrush), General, Effects, toggle Visual Border on, and choose a blue color.

Make sure to click out of the chart **before** you select the next visualization.

KPI Card—Actual Revenue Compared to Target

a. Click on a blank space of the canvas. In the **Visualization** pane, choose the **KPI card**. Reposition so it is to the right of the Revenue by Payment Type.

b. Next, we will write a little DAX code. Don't worry—we will take it step-by-step. In the main menu ribbon, go to the **Home** tab and choose **New measure** (see Figure 7.71).

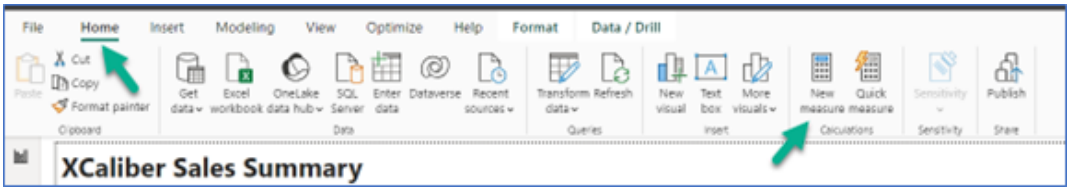


Figure 7.71—New Measure Target

c. A pop-up (see Figure 7.72) will show a place to type. You will see 1 Measure = but type over the Measure and type Year_Target = 600000 and complete the format to currency. The Name should be Year_Target. The home table is XCaliber Foods.

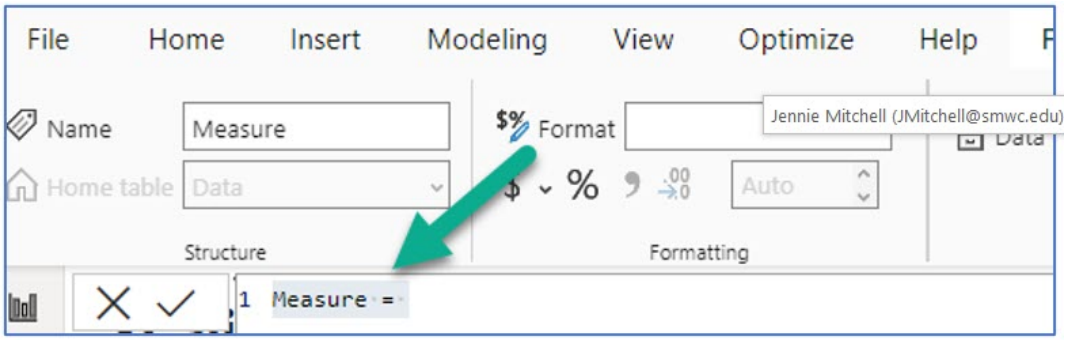


Figure 7.72—Pop-up After Selecting New Measure

You are setting up your KPI to show the target sales for 2024, which were $600,000.

Once you are done, select the checkbox to commit to this expression. It should look like Figure 7.73.

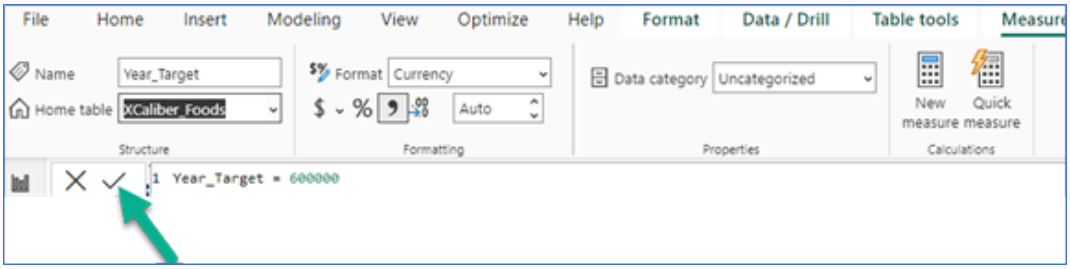


Figure 7.73—Writing a DAX Expression

You will now see the Year_Target measure in your Data pane.

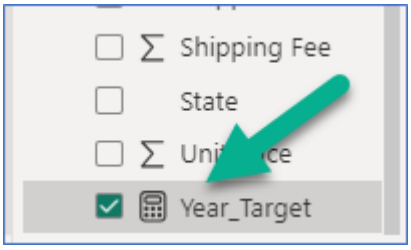


Figure 7.74—New Measure in Data Pane

d. In the Data pane, choose Year and Revenue, and Year_Target

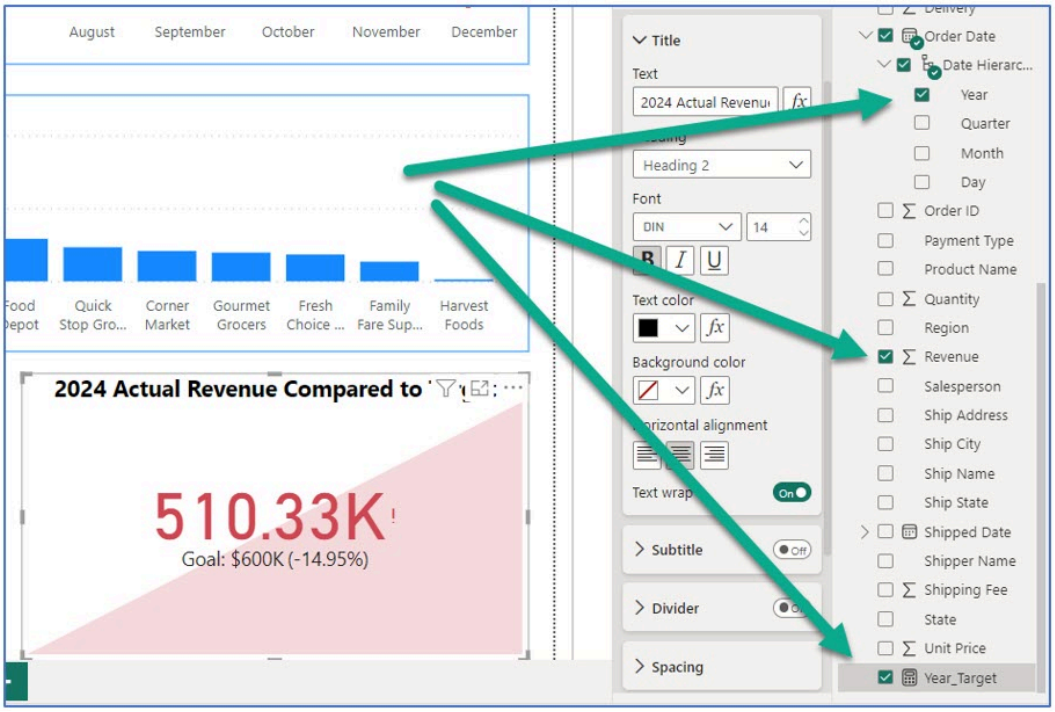


Figure 7.75—Adding a KPI Card for Total Revenue

e. Add a title: Choose **Format** (paintbrush), **General, Title**, and type this text: *2024 Actual Revenue Compared to Target*. Make it a **heading two and bold** and change the **font size** to 16. This replaces "Sum of Revenue by Year."

Figure 7.75 shows the default look. We want the title text to be on two lines, and the 510.33k to be in orange instead of red. Also, the colored block is distracting. Before we get rid of the red block, change the "bad color" to orange.

f. To do this, go to **Format** (paintbrush), **Visual**, and expand the **Trend axis**. Replace the current "bad color" of red with orange. This should change the text color to orange and even the color block has a paler color of orange.

g. Now toggle the **Trend axis** to **Off**. It will keep the orange text, but the color block is gone!

h. The Goal of $600k should be bold and larger. Go to **Format** (paintbrush), **Visual** expand **Target Label**, choose **Values**, and change the **font size** to 15, **Bold**.

i. The only thing left is to add a blue border. To do this **Format** (paintbrush), **General, Effects**, **Visual Border**, and change the **color** to blue.

Card—2024 Goal per Customer

a. Click on a blank space on the canvas. In the **Visualization** pane, choose the **card** (not the KPI card, just card). Reposition so it is under the navigation buttons.

b. Next, we will write a little DAX code. Don't worry—we will take it step-by-step. We want a KPI that shows what the goal would be for 15 customers in order to reach $600k per year: ($600,000/15) = $40k. In the main menu ribbon, go to the **Home** tab and choose **New measure**.

c. In the pop-up menu, replace Measures with **"Customer_Target = 40000"**. It will look like Figure 7.76. Make sure you have Currency in the Format and that the **Home table** is XCaliber_Foods. Once you feel you have it completed, click the **check mark** to "commit." Verify that you see it in your Data pane.

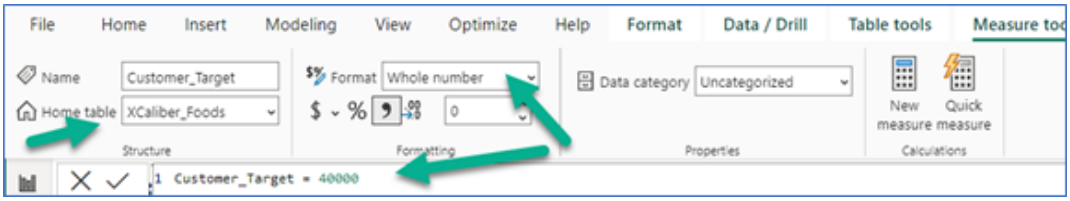


Figure 7.76—Write DAX Expression for Average Sales Goal by Customer

d. Make sure the KPI container is selected and in the Data pane, choose Customer_Target. It should look like Figure 7.77.

Figure 7.77—Using a Card to Emphasize Information

e. To turn the text color to orange, go to **Format** (paintbrush), **Visual**, and expand **Callout Value**. Change the **color** to orange. In the **Category label**, bold the text Customer_Target.

f. To add a title, **Format** (paintbrush), **General**, and **Title**. Toggle the Title to **On**. Expand the Title and type "2024 Goal per Customer." Align the title for the center.

g. The only thing left is to add a blue border. To do this **Format** (paintbrush), **General, Effects**, **Visual Border**, and change the **color** to blue.

Gauge Visual of 2024 Sales Goal

This visual is somewhat of a duplicate of the 2024 target revenue of $600,000. It does give a slightly different perspective.

a. **Click** on a blank space on the Canvas. Then in the Visualization pane, choose the gauge visual. Reposition as needed.

b. In the Data pane, select **Revenue** for the Value and Year_Target (this is the DAX expression that you wrote earlier) as the Target Value. It should look like Figure 7.78.

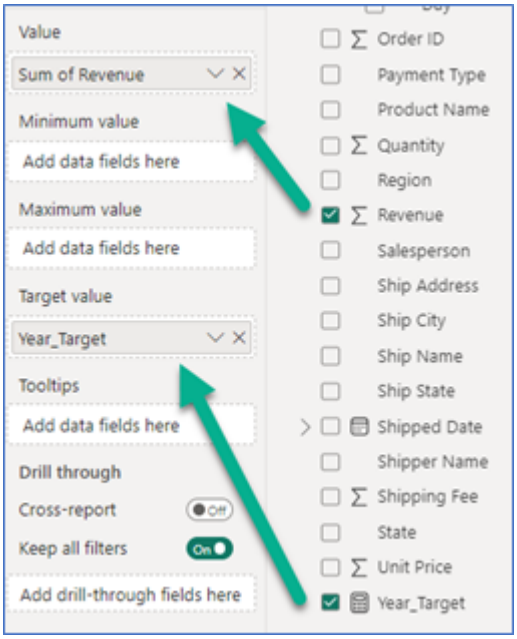


Figure 7.78—Setting Up the Gauge Visual

c. We have two things left to do on this visual. We want a title, 2024 Revenue and Year Target (remove Sum of) to be centered. Go to **Format** (paintbrush), **General**, expand **Title**. In the text box, type 2024 *Revenue and Year Target*, and **center** it.

d. We also want a blue border. To do this **Format** (paintbrush), **General, Effects**, **Visual Border**, and change the **color** to blue.

Now that you have KPI & Goals page completed, work to reposition the visuals to use the space well.

Note: If you have been working along with your Mac, you do not need to publish to Power BI Services Online (because you've been working live in it). Just make sure to save your report.

7.4 Publish to Power BI Services Online

> Data is a tool for enhancing intuition.
>
> —Hilary Mason, data scientist and founder of Fast Forward Labs

In the last section, you created a five-page report in Power BI Desktop. And it truly looks great! Mac users created their report directly in Power BI Services Online. **Mac users can skip** this part and go to the next section, Get Quick Insights. But how do PC users using Power BI Desktop get their report to Power BI Services Online? Some of what you can experience is limited if you have a *free* Power BI Services Online account and not a Pro account.

Power BI Services Online provides an array of features for data visualization, exploration, and collaboration. One particularly powerful feature is **Quick Insights**, which allows users to uncover hidden gems within their data effortlessly. By simply interacting with dashboard tiles, analysts can access automatic analyses that reveal correlations, outliers, trends, seasonality, change points, and major factors. Only Power BI Services Online has Quick Insights; Power BI Desktop does not.

Publish Your Power BI Desktop Report to Power BI Services Online

Note: Screenshots of Power BI interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

If you have not opened Power BI Services Online, here are the steps to open assuming you are a student and have access to Microsoft Office 365 as part of your college account.

Step 1—Go to http://office.com and log in.

Step 2—In the main Microsoft 365 page, choose Apps, and look for Power BI (as shown in Exhibit 7.13).

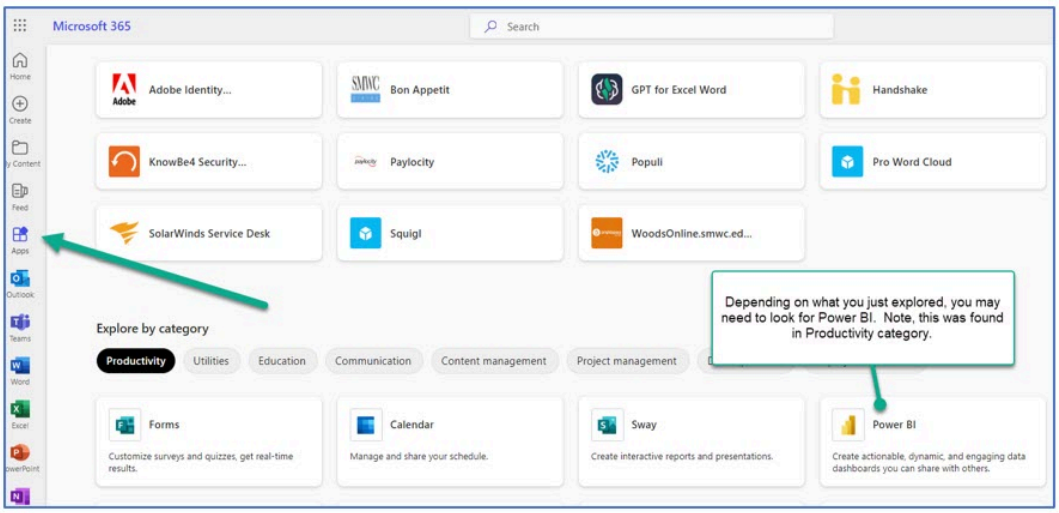


Exhibit 7.13—Finding the Power BI App
Source: Screenshot of Microsoft 365 Interface © Microsoft Corporation. Author Annotations Added

Step 3—Once logged in, click on your avatar (or picture) to determine your license. If you see "FREE," that means that some of the extraordinary features will not be available. If you see "PRO," you can create a Workspace and create an App.

Step 4—Open your Power BI Desktop to the five-page report. To publish your Power BI Desktop five-page report to Power BI Services (Online), just choose **Publish**. A pop-up screen will show My Workspace. The image shown in Figure 7.79 is different since I've been using this account and have set up Workspaces. If you don't have a Pro account, you will not be able to set up additional Workspaces; however, you can still publish to your personal "My Workspace."

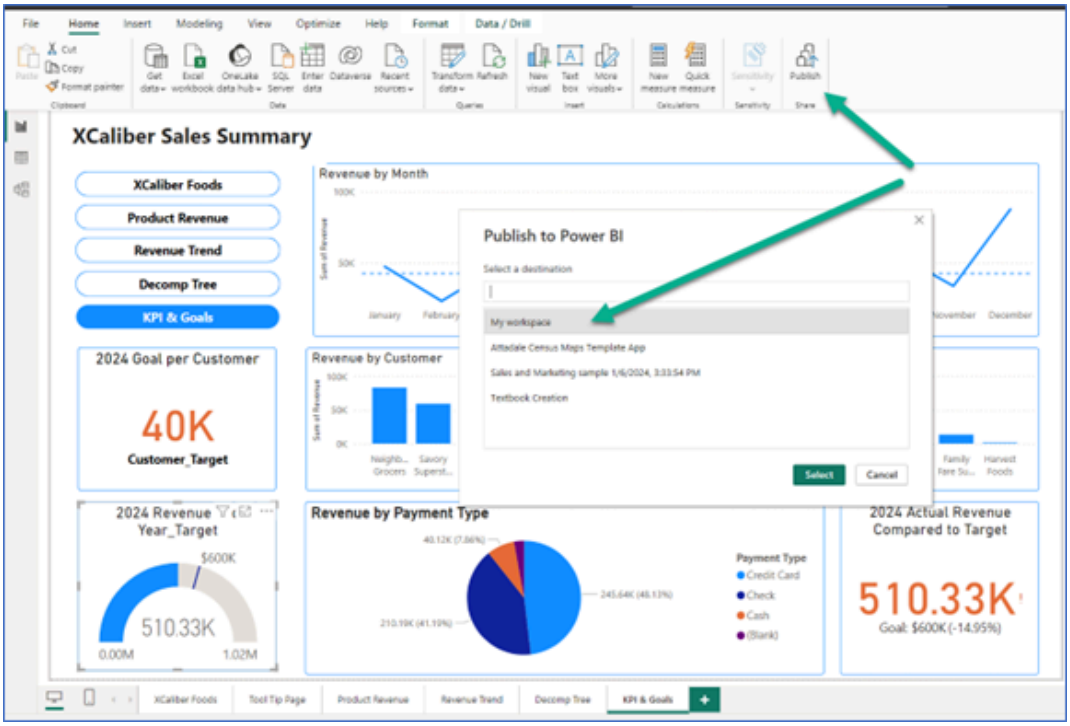


Figure 7.79—Step 4a: How to Publish

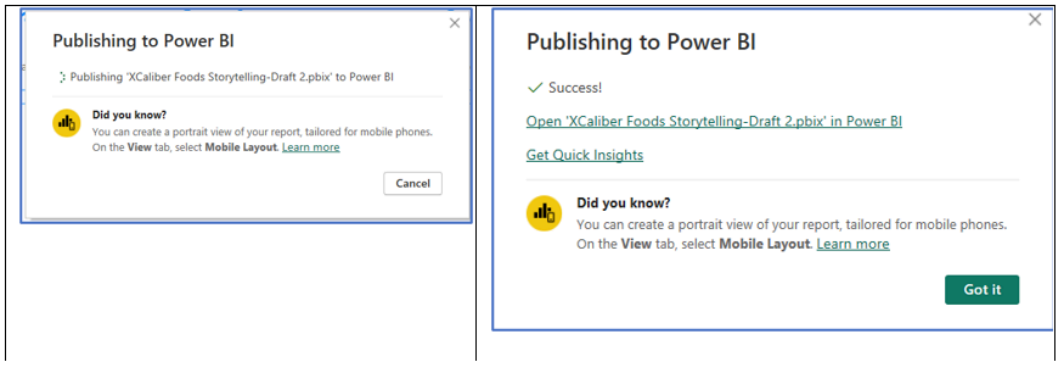


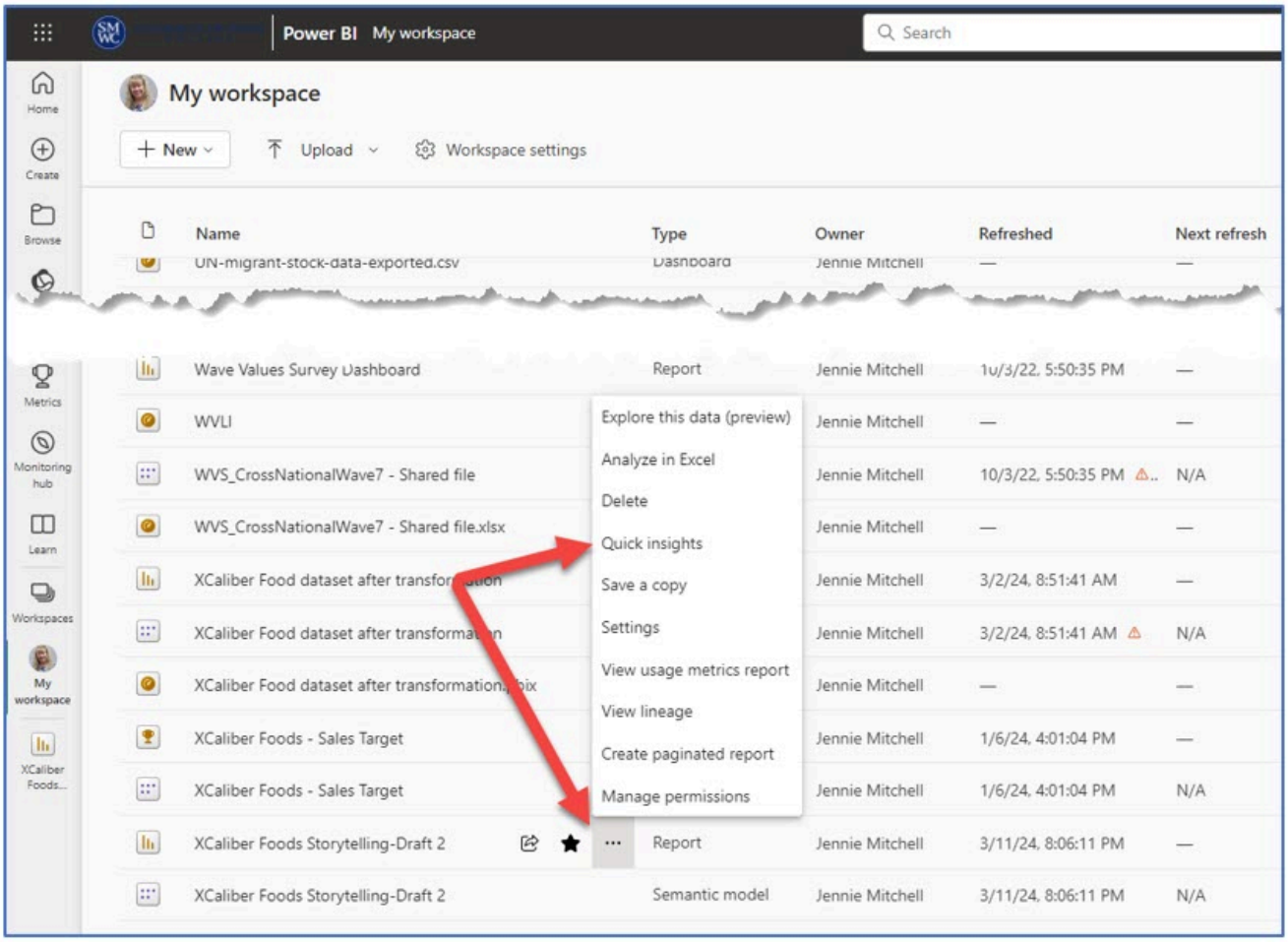
Figure 7.80—Steps 4b and 4c

Notice that Power BI Services Online is already reminding you to Get Quick Insights!

Get Quick Insights

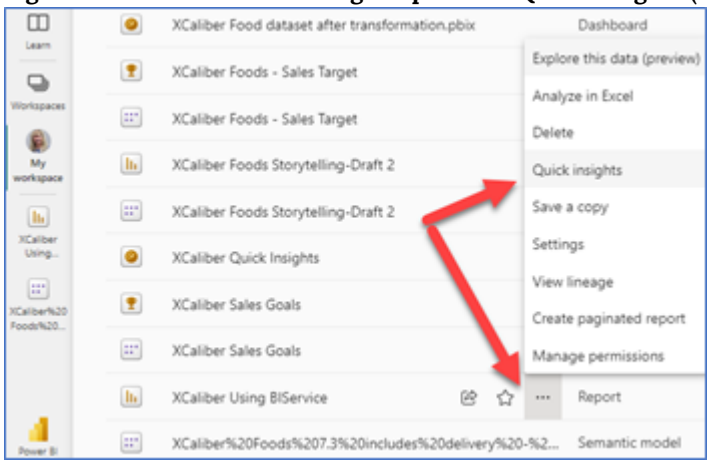
In My Workspace, two files are published from Power BI Desktop: a Report, and a Semantic model. If you click on the ellipses [the 3 dots] beside the name, lots of features are available. Note that one of the features is "Quick Insights."

Figure 7.81—Published Five-Page Report and Quick Insights (PC Version)



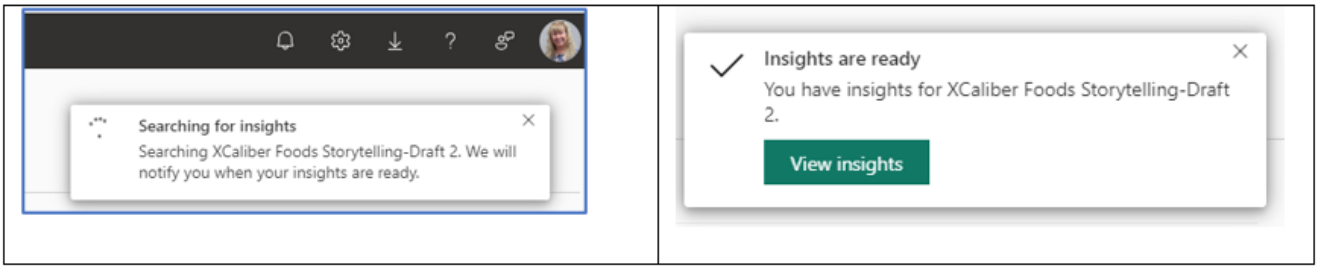
If you are a Mac user, we asked you to name the report in a way to identify it as created in Power BI Services Online. See Figure 7.82; notice the name "XCaliber Using BIService."

Figure 7.82—Published Five-Page Report and Quick Insights (Mac Version)



Once you select Quick Insights, you will see a pop-up screen as shown in Figure 7.83.

Figure 7.83—Pop-Up Screen for Choosing Quick Insights



The quick insights come in the form of charts. Just for this assignment, Power BI Services (Online) generated over 40 charts. Let's define some of the terms used, and then we will look at an example of different types of insights from the XCaliber Food Distribution Company dataset.

Some Quick Insights Categories:

Category outliers: "Highlights cases where one or two categories have larger values than other categories" (Microsoft Learn, 2024, para. 10).

Change points in a time series: "Highlights when there are significant changes in trends in a time series of data" (Microsoft Learn, 2024, para. 11).

Correlation: "Detects cases where multiple measures show a similar pattern or trend when plotted against a category or value in the semantic model" (Microsoft Learn, 2024, para. 12).

Low Variance: "Detects cases where data points for a dimension aren't far from the mean, so the variance is low" (Microsoft, 2024, para. 13).

Majority (Major factors): "Finds cases where most of a total value can be attributed to a single factor when broken down by another" (Microsoft Learn, 2024, para. 14).

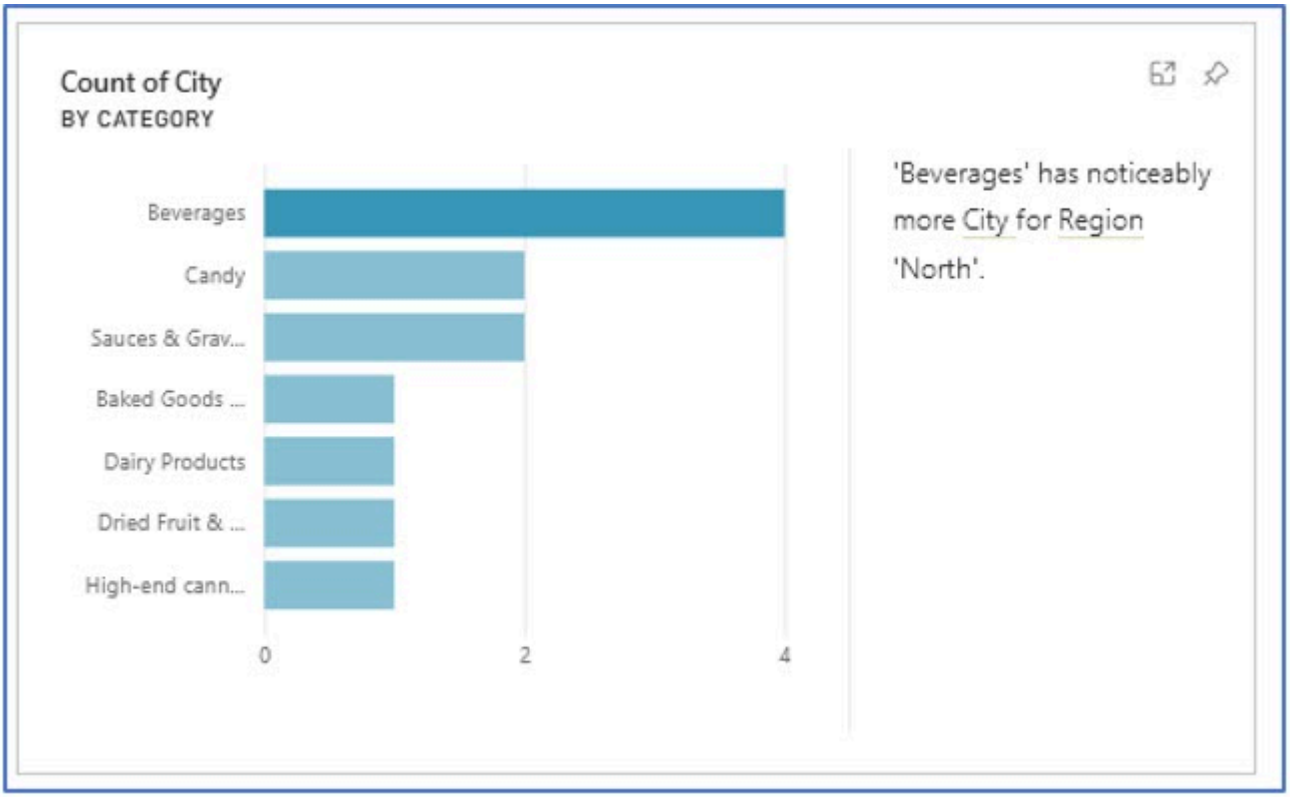
Outliers: "Outliers detect when there are specific categories with values significantly different than the other categories" (Microsoft Learn, 2024, para. 15).

Time Series (Overall trends or seasonality): These detect patterns in a time series.

We can also View insights on a single dashboard tile. But we first need to get you to create a dashboard!

Category Outlier: One of the quick insights (see Figure 7.84) shows the category "Beverages," as the highest category sold in the North. Beverages count for the top selling category in the North Region ($65k), South Region ($35k), and West Region (30k). But beverages come in last in the East Region, selling only $2k total.

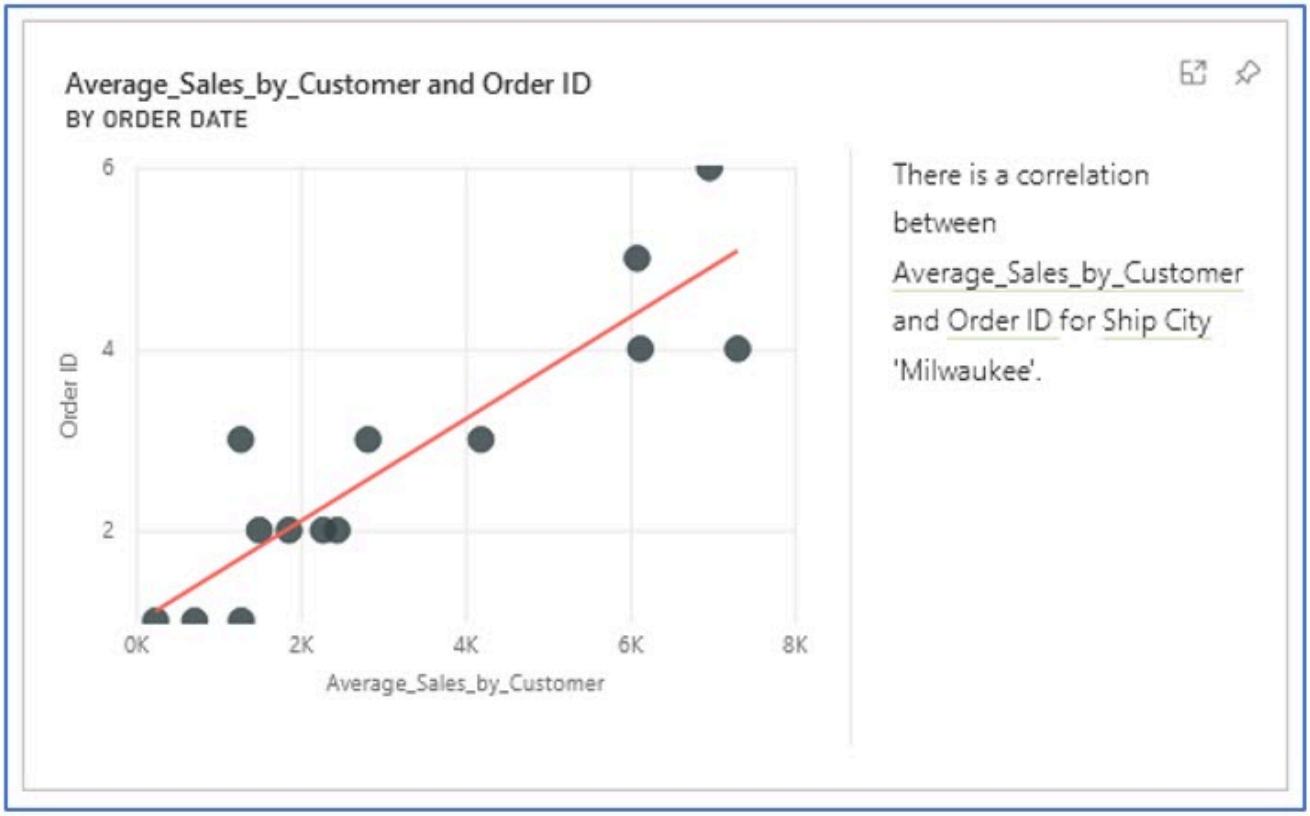
Figure 7.84—Category Outlier: From Quick Insights



Correlation: Shows a similar pattern or trend.

Figure 7.85 shows that there is a correlation between average sales by customer for the product shipped to Milwaukee. In other words, the grocers tend to place the same order over and over with little to no fluctuation in unit price charged for the product.

Figure 7.85—Correlation: From Quick Insights



Low Variance: Detects when variance is low. But what does that mean? Look at an example. In Figure 7.86, we see that salespeople Thomas Webster, Naomi Shopker, and Nicole Pottinger use the same (or nearly the same) unit price for dairy products. This is a good thing as long as the unit price for the dairy reflects what it **should be charged** to customers. If XCaliber's unit price for dairy went up, but the sales agents used an *old price*, it will impact XCaliber's profits.

Figure 7.86—Low Variance: From Quick Insights

Majority: Provides insights that we might not even be looking for.

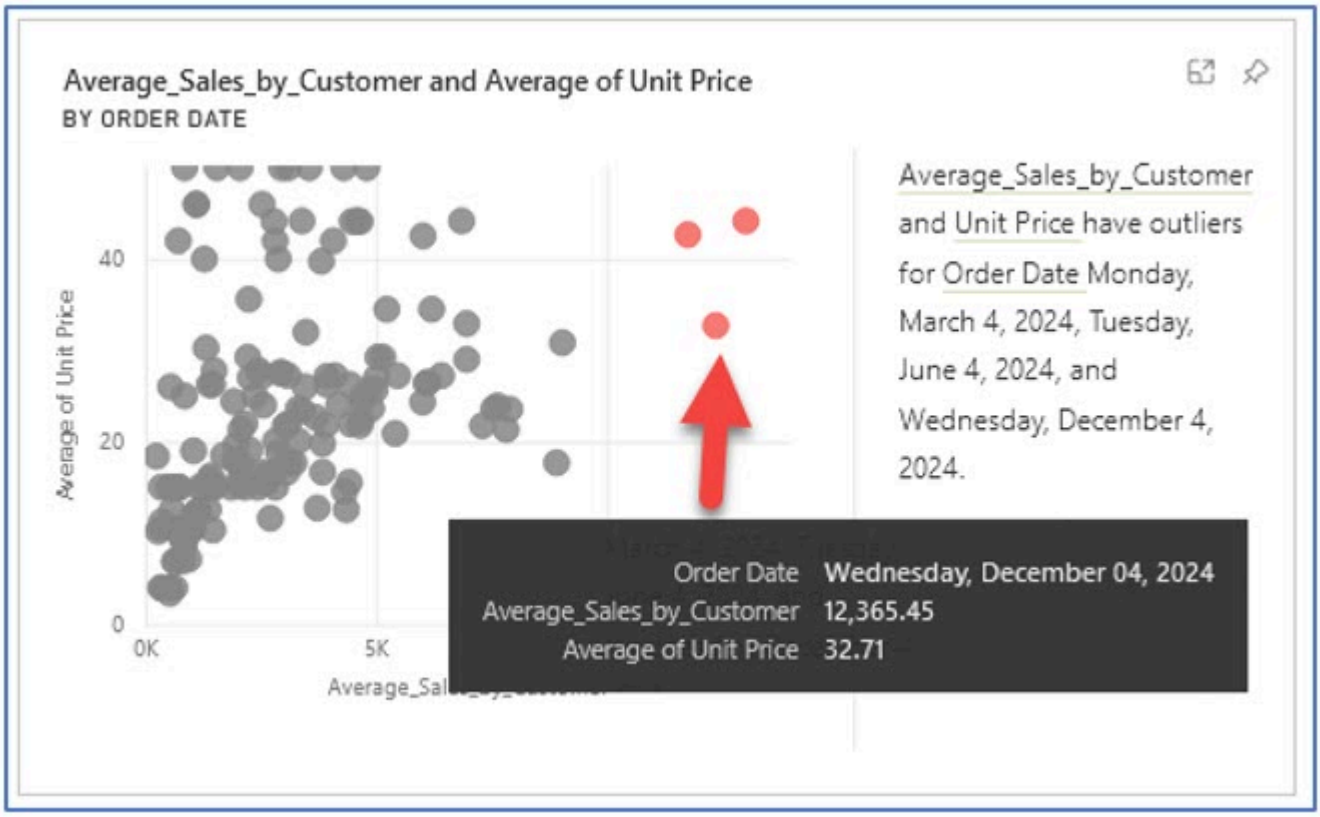
Figure 7.87 shows a majority from the XCaliber Food Distribution Company dataset. This chart tells us that the majority of shipping in the East region is done by shipper, Urban Grocer. Why is it important to know who is shipping your product? There can be several reasons to know members of your supply chain. Shipping Urban may be a consistent and reliable shipping company. They also might be a good place to see if they are delivering to other grocers to potentially recruit a new customer!

Figure 7.87—Majority: From Quick Insights

Outliers: What does it mean?

Figure 7.88 shows one of the outliers noted in quick insights. We can click on the orange dots (outliers) for more information. After digging into the orders on March 4, June 4, and December 4, we discover Tony Clear (ranked third in sales) is responsible for all three of these anomalies as seen in Figure 7.86. Tony sold some very expensive products, driving up the average unit sales for the order to his customer, Neighborhood Grocery. This is truly an example of upselling!

Figure 7.88—Outliers: From Quick Insights



Pin Quick Insights to a Dashboard

If you look at the visuals shown here, notice that each one has a pushpin image in the upper right-hand corner. This is how you pin the visual to a dashboard. Let's create a dashboard that shows only the quick insights and set up a few "tiles" to see if Power BI Services (Online) detects additional insights. So far, we have worked with a five-page report. A dashboard is a single page where we can pin items from our five-page report or pin items from the quick insights. **Tiles** refer to a single visualization snapshot of your data. Tiles can come from reports, but also the Q&A box. Dashboards can only be created in Power BI Services (Online) and not Power BI Desktop.

Step-by-Step to Pin Quick Insights to a Dashboard

Step 1—**Open** Power BI Services (Online) (as a reminder, go to Office.com and log in, choose apps, find Power BI)

Step 2—Get quick insights (go to your **My Workspace**), find the report and semantic model that you published to Power BI Services Online, click on the **three dots** (**ellipses**), and **choose Quick insights**.

Step 3—Find the category outlier shared earlier in Figure 7.86 and click the **pushpin** in the upper right-hand corner. In the pop-up, choose **New dashboard**, and name it **XCaliber Quick Insights** and then click **Pin**. The pop-up is shown in Figure 7.89.

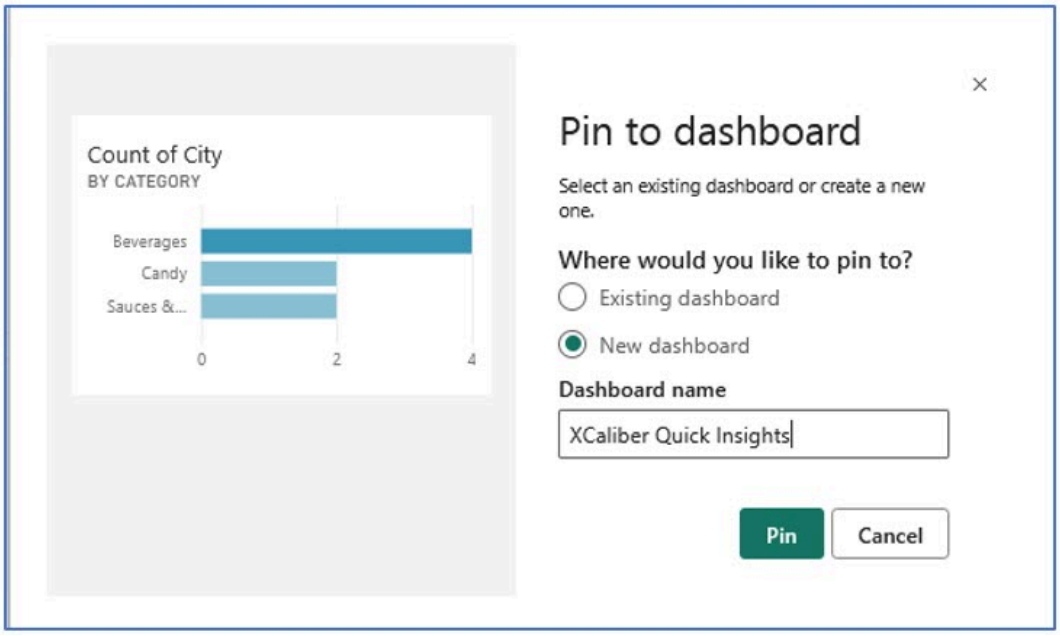


Figure 7.89—Pin to New Dashboard

Step 4—**Pin** all five of the quick insights shown in this section. Instead of a new dashboard, choose the existing dashboard, and XCaliber Quick Insights. Figure 7.90 shows how this will look once you have an existing dashboard.

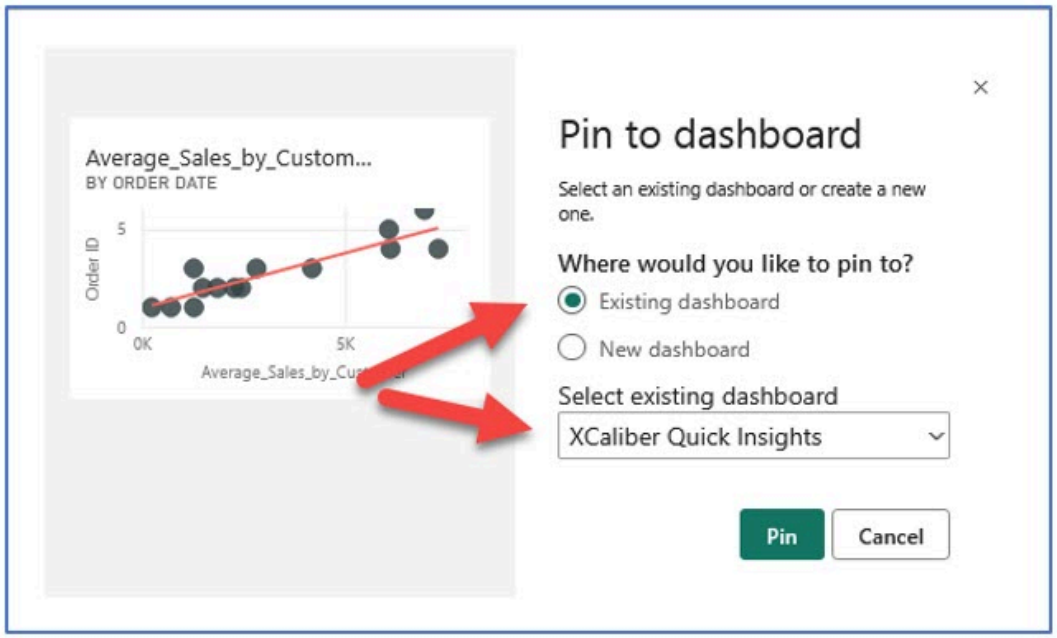


Figure 7.90—Pinning to an Existing Dashboard

Step 5—Choose **My Workspace** and look for your dashboard, and then open it by selecting the name, **XCaliber Quick Insights**. Notice in the type, it indicates a "Dashboard."

Step 6—When you open the dashboard, notice that the visuals are not organized well, with no context or title. You should also notice that by default, Power BI Services Online has added a Q&A component. This is what it should look like as shown in Figure 7.91. Note that you can edit the dashboard but let's do some exploring.

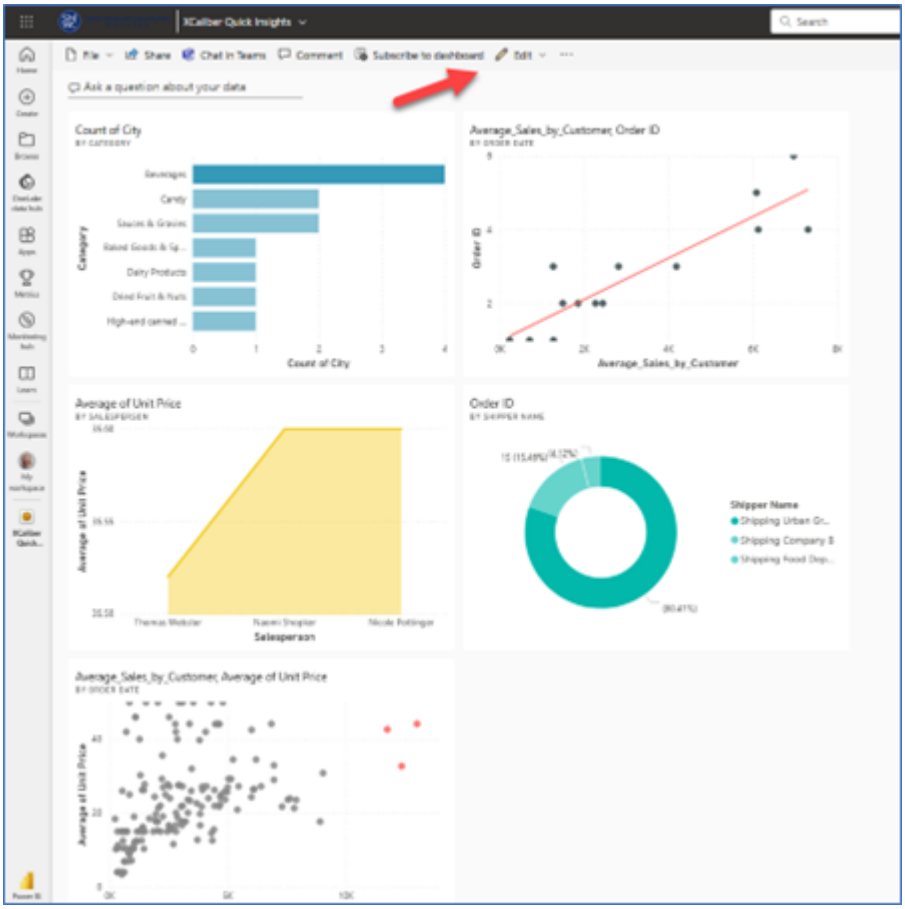


Figure 7.91—XCaliber Quick Insights Pinned to Dashboard

Step 7—Explore the Q&A by clicking "Ask a question about your data," and Power BI Services Online will provide some examples to get started, or you can choose to type your own question. Note in Exhibit 7.14 that the textbox will try to anticipate your question.

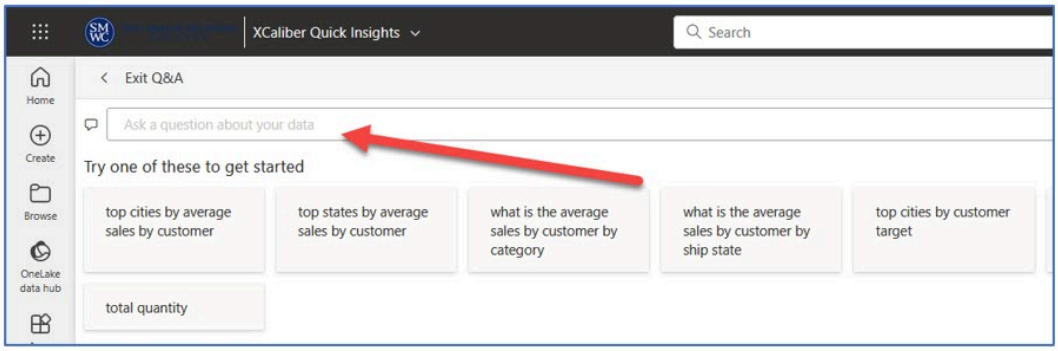


Exhibit 7.14—Q&A, Write Your Questions

Step 8—Edit the Dashboard, by clicking the edit button. You have a choice of (1) Add a tile, (2) Create a dashboard theme, or (3) Develop a mobile layout.

a. Choose Dashboard Theme and choose Dark and then save. We want to make sure when we build a dashboard from our report, that we differentiate it from the quick insights. Figure 7.92 shows the Dark theme.

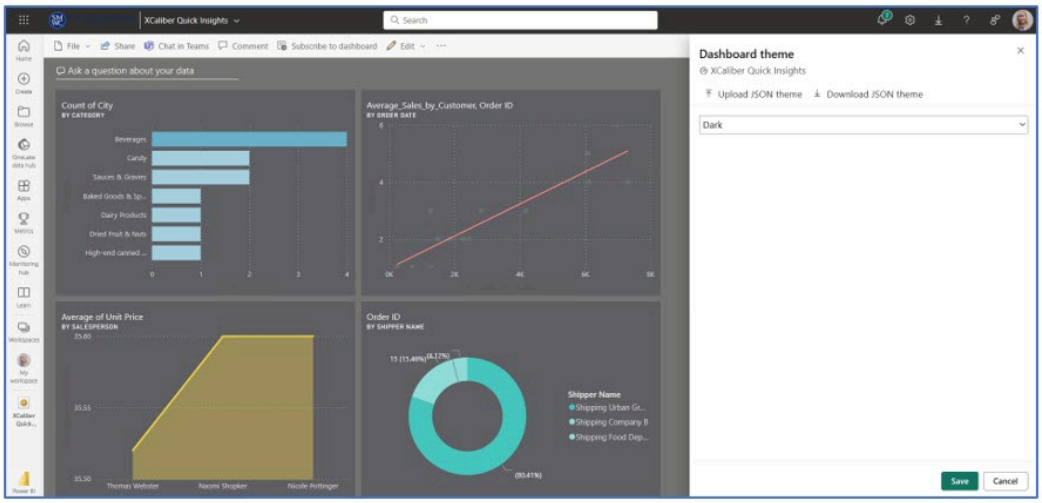


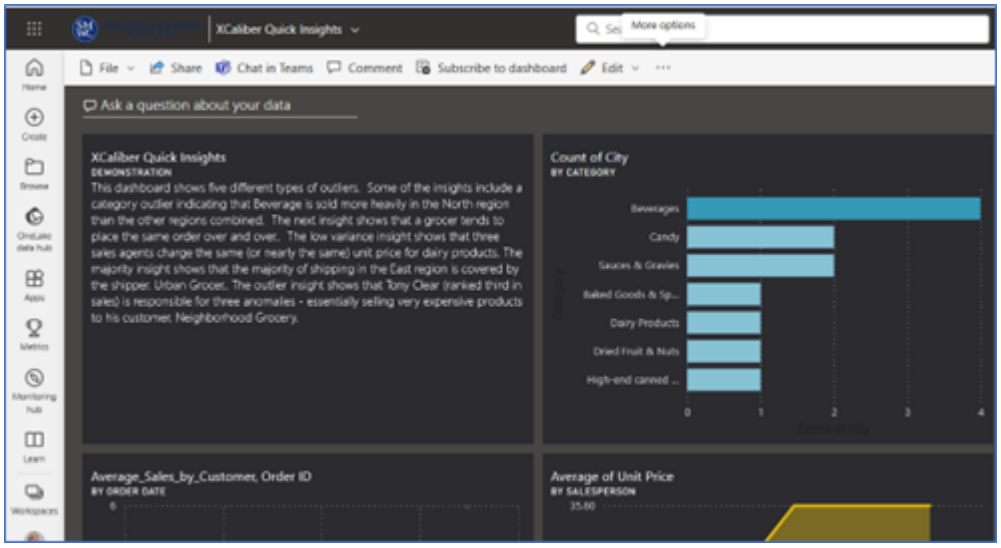
Figure 7.92—Applying the Dark Dashboard Theme

b. Next, choose **Add a tile**. You will see a choice of web content, Image, Text box, Video, or Real-time Data. Choose the **Text box** and click **Next**. A pop-up will collect Title, Subtitle, and content. **Complete** as shown, and then click **Apply**. You can **move the tile** to the top and rearrange the tiles.

Figure 7.93—Add a Textbox Tile to the Dashboard

c. View the completed dashboard. Exhibit 7.15 shows only a portion of the dashboard.

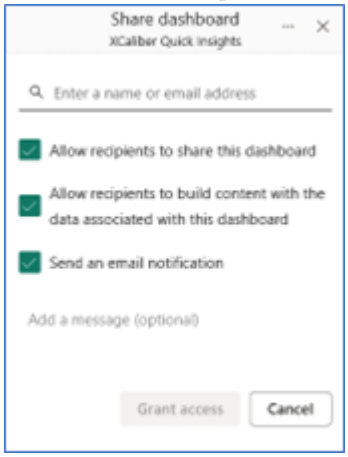
Exhibit 7.15—Dashboard (Partial) Showing Quick Insights



In Exhibit 7.16, note that there are several options available across the main menu.

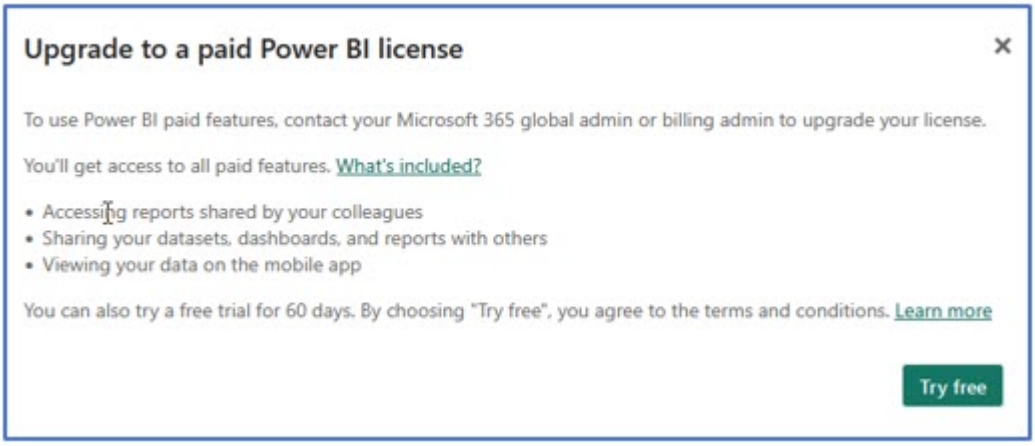
- Allow recipients to share this dashboard. (If you have a Pro account, you can share with others in your organization.)
- Allow recipients to build content with the data associated with this dashboard. (This would not be appropriate for most situations unless you are collaborating on a project.)
- Send an email notification. (The email address will reflect someone's email address from your organization.)
- In some cases, your Power BI administrator may have disabled shareable links.

Exhibit 7.16—Share Options for a Pro Account in My Workspace



Those with a free account will see a pop-up to Upgrade to a Paid Power BI Account with an option for a 60-day trial, as viewed in Exhibit 7.17.

Exhibit 7.17—No Share Options for Free Account



Next, we'll highlight the difference between reports and dashboards.

7.5 Dashboards Versus Reports in Power BI Services Online

> Dashboard: "A single page, sometimes referred to as a canvas, that tells a narrative using visuals. A well-designed dashboard simply includes the story's highlights on one page so that readers may explore related reports for further information."
>
> —Microsoft, "A Power BI Dashboard—What Is It?"

Power BI Services Online can have both dashboards and reports. Power BI Desktop can only create reports. In January 2024, Microsoft added Copilot, a smart narrative feature that is Microsoft's new Artificial Intelligence. To work, Copilot requires you to connect your Power BI Desktop to a live connection in Power BI Services and connect to a semantic model in Workspace. Those holding Free accounts or Pro accounts won't be able to use Copilot (at least at this time).

If you plan to upgrade from a Free account to Premium, you may want to check this out. If you follow the steps to be able to use Copilot within Power BI Desktop, you will see something different when you choose Smart Narrative; you will see a button for Copilot and a pane that includes a place to chat. Based on your prompts, it can create a bulleted list of insights, summarize the visuals on the page, but my favorite is an executive summary of the report. Even more fascinating is that you can ask it to suggest content for the report. Although the following video is a sales pitch, it does show the Copilot potential (this video is less than two minutes in length).

Microsoft Power BI. (2023). *Copilot in Power BI Overview*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=576#oembed-5

Difference Between Dashboards and Reports

Note: Screenshots of Power BI interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

There are fundamental differences between dashboards and reports as outlined in Table 7.2. Dashboards give an overview of key metrics for real-time (or nearly real-time) monitoring. Reports are comprehensive and support interactive analysis capabilities for exploration.

Both the story and the type of user drive whether you use a dashboard or a report. For example, the owner of XCaliber Food Distribution Company will want a report. The report will be much more effective for the owner because he is still struggling to know what questions he should ask. One analogy is this: A dashboard supplies a headline and key metrics to monitor. A report provides details with the ability to dive deeper into the data.

"The bigger the insight is, the more disruptive it will be to the status quo" (Dykes, 2020, p. 3). Apply the seven principles for better visual storytelling by asking yourself these questions.

1. Is this the right data?
2. Are these visuals the right ones?
3. Are they visuals in the right configuration?
4. Did you remove the noise or distraction?
5. Does your design focus the audience's attention?
6. Does your design make it more approachable?
7. Does your design instill trust? (Dykes, 2020)

If it helps, deconstruct your story and review the data storytelling arc. And remember to use what works well for you! So dashboard or report? Answer: It depends!

Table 7.2: Dashboard or Report?

Dashboards	Reports
Consolidated view (one single page) emphasizing key metrics and high-level insights.	Comprehensive Analysis offering in-depth analysis and insights with multiple pages (remember the tabs?)
Real-time or nearly real-time monitoring and limited interactivity	Real-time interactivity with drill-through, filtering, and highlighting (through focus)
Visuals are primarily charts, graphs, gauges, and cards.	Visuals can include charts, graphs, gauges, and cards. Also, smart narrative, focus, and customized tooltips are used to bring context.
High overview of business performance.	Structured so the user can customize visualization and peel back layers of complexity.

An XCaliber salesperson might prefer a dashboard that is focused on their sales (against goals), their products, customer trends, and delivery metrics. Let's create a dashboard for Anny Kolb. Keep in mind that you can pin to this dashboard from more than one report as long as the reports are within the same Workspace. The Kolb dashboard as shown in Figure 7.94, has five components. Let's look at what Anny Kolb, top salesperson for XCaliber Food Distribution Company will see.

The first chart is revenue by month for Anny Kolb, which includes Anny's average sales line. Fluctuation is expected since produce availability can vary; however, the owner might want to see if all sales patterns vary in the same way.

The second tile is a map showing that Anny sells in Tennessee and Florida. If Anny is considering expanding to other states, it makes sense that she should recruit new customers from adjoining states.

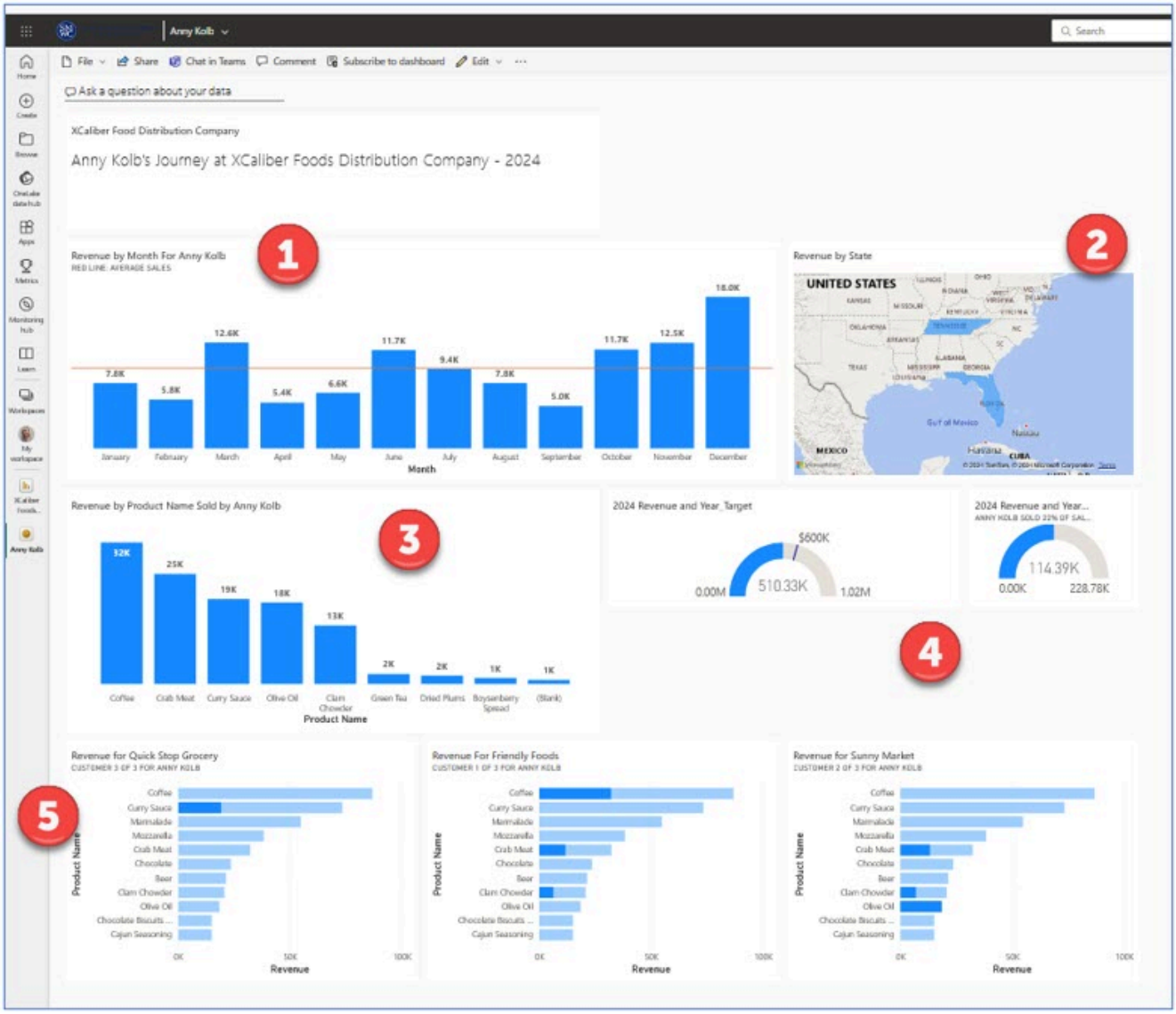
3 The next chart features the products sold by Anny. Anny's number one product is coffee, followed by crabmeat, and curry sauce. Interesting that we see a category called Blank. That might be a talking point with Anny.

4 The fourth tiles are both gauges. One tile shows the overall sales for 2024 against the $600k goal. The second one shows Anny selling $114.39k in total. What target sales should we expect from Anny?

5 The fifth set of tiles shows Anny's three customers: Quick Stop Grocery, Friendly Foods, and Sunny Market. This is interesting that Anny sells to three customers since XCaliber only sells to 15 customers in total from nine sales agents. It is also interesting that Anny does not sell coffee to Sunny Market. That might be a second talking point with Anny.

Keep in mind that there are several other key components we might want to add. For example, what is her average delivery time between the order date and shipped date?

Figure 7.94—Anny Kolb Dashboard Draft



Step-by-Step to Create a Dashboard for a Sales Representative From XCaliber Reports

Once you create your report in Power BI Desktop and publish it to Power BI Services Online, you are ready to "pin" components to a dashboard for Anny. The same is true for Mac users who created the report directly in Power BI Services Online.

Step 1—**Open the report** that you published. My most recent one is called XCaliber Foods Storytelling—Draft 2 or if on a Mac, you may have saved the report as XCaliber Using BIService. You will notice that the report in Power BI Services Online has added the tabs to the left side or you can use the buttons you created to navigate.

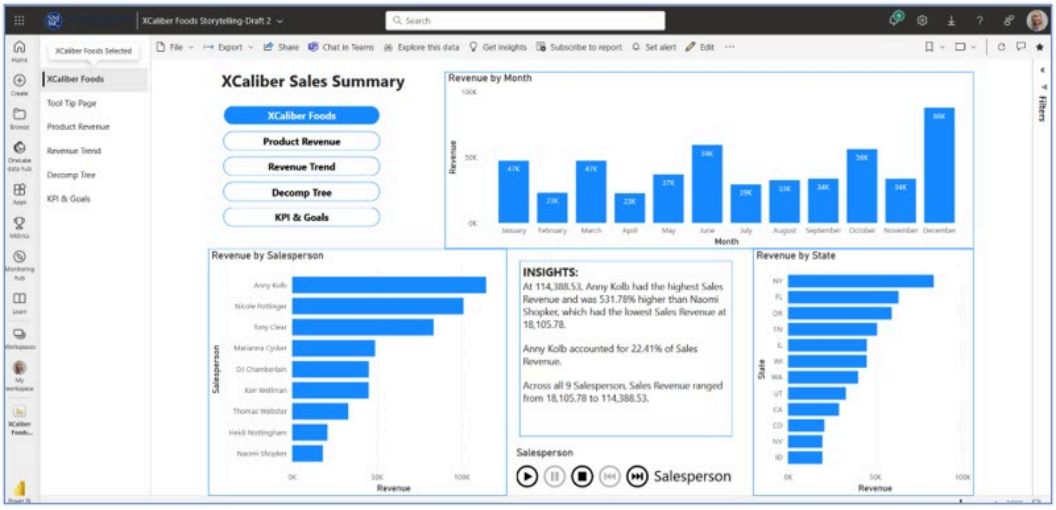


Exhibit 7.18—XCaliber Foods Storytelling—Draft 2 Report in Power BI Services Online

When you published the five-page report from Power BI Desktop to Power BI Services online, it created two files: the report and the semantic model. The XCaliber Foods Storytelling—Draft 2 was published from the Power BI Desktop. The XCaliber Using BIService was created directly in Power BI Services Online.

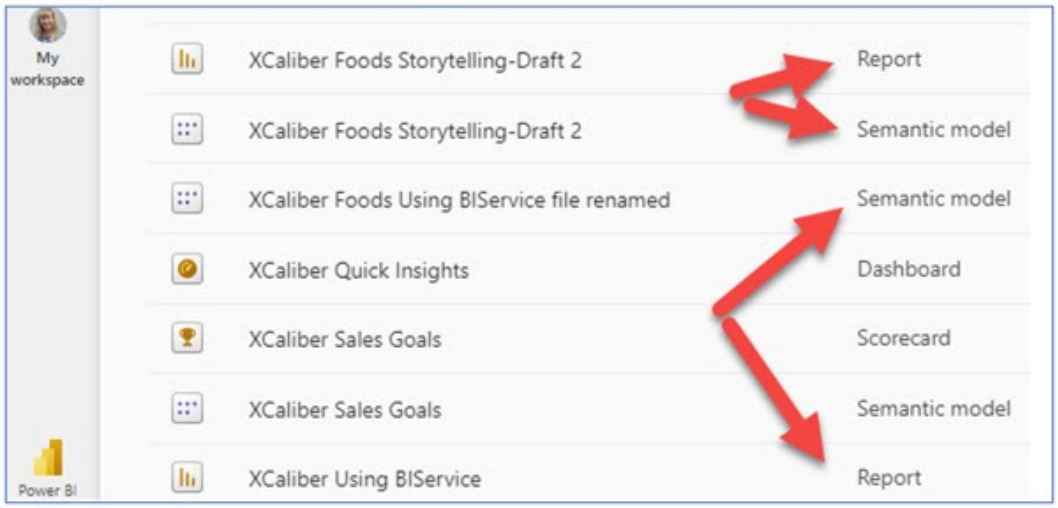


Figure 7.95—Semantic Model and Report Files

It's important to know this because you may want to add a sixth page to your report that focuses more on salespeople. If you open the Semantic model, when you go to Edit, you will have access to the Visualization pane, and the Data pane, and you will be able to create new measures writing DAX. This means you can use Power BI Services Online much like you did Power BI Desktop. You can pin items from your report.

Step 2—**Pin** Information about Anny Kolb to a New Dashboard. In page one, click **Anny Kolb in Revenue by Salesperson** to filter so her sales show up in the Revenue by Month (as shown in Figure 7.96).

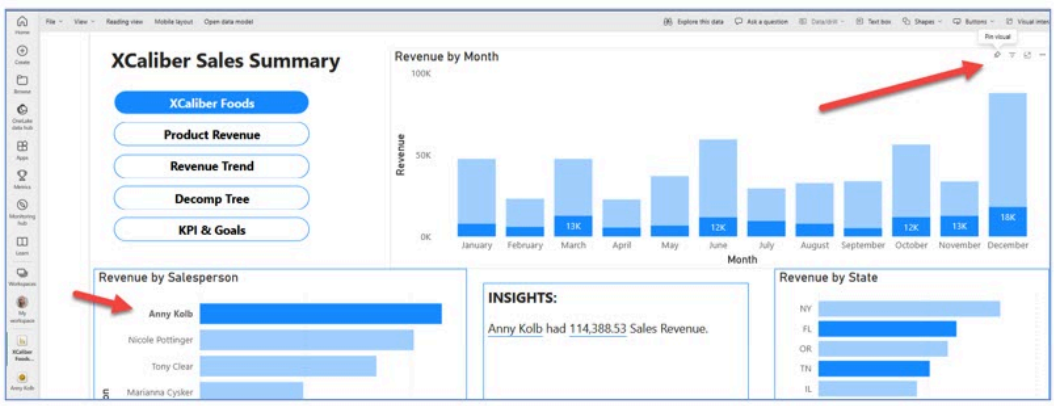


Figure 7.96—XCaliber Page One: Filtering to Anny Kolb

Step 3—In the Revenue by Month, click on the **pushpin** in the upper right-hand side of the graphic. A **pop-up** will ask you where you want to pin the visual. Create a new dashboard called Anny Kolb and choose Pin (see Figure 7.97).

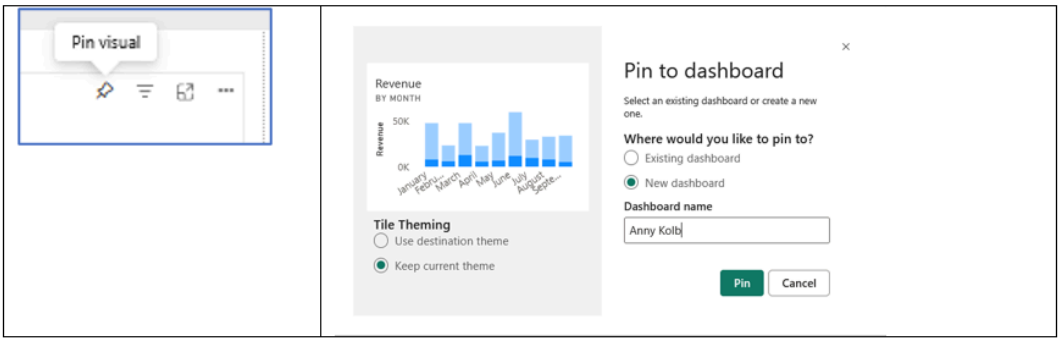


Figure 7.97—Pin the Revenue by Month (Filtered) to Anny's Dashboard

Step 4—Go to **Revenue Trend tab**, and in the **Customer Name Slicer**, choose **Friendly Foods, Quick Stop Grocery**, and **Sunny Market** (**hold the control key** down to choose multiple customers). These are Anny's customers. Notice this Revenue by Month chart with the average sales line. Pin, Revenue by Month, Revenue by Product Name and Revenue by State once they are filtered with Anny's customers. Don't worry that we have already pinned a Revenue by Month. You can delete the one you don't like.

Step 5—Go to Anny's Dashboard in your MySpace and **open** it. Notice that you can move and resize the tiles.

Step 6—If you click on **Edit**, you can add a tile (web content, image, text box, or video, and real-time data streaming). You can change the dashboard theme. And you can see and modify the mobile layout.

Exhibit 7.19 shows the Anny Kolb Dashboard in mobile layout. You can edit the mobile layout by unpinning tiles, changing the order of the tiles, and resizing images.

Exhibit 7.19—Mobile Layout for Anny Kolb Dashboard

You have conquered Power BI! You are ready to try this whole process with another dataset!

7.6 Finding Datasets to Use in Power BI Desktop

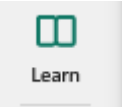
> *There were 5 exabytes of information created between the dawn of civilization through 2003, but that much information is now created every two days.*
>
> —*Eric Schmidt, executive chairman at Google*

According to a report by Markets and Markets, the "big data market will be worth $229.4 billion in 2025" (PR Newswire, 2020, Mar 13, para 1). In addition to the market of data, we expect to see governments, nonprofits, NPOs, and for-profit institutions share a greater access to data especially in the health field. In Microsoft's blog, A Cloud for Global Good, Microsoft recommends policy, noting a lack of international framework. Cross-border cooperation in the cloud is needed to protect public safety, yet a fine line exists between law enforcement and public trust. Part of the push for increased governmental public datasets is a push for transparency. As of Jan 2024, 280,601 datasets are available at Data.gov!

Download .pbix Files to Either Power BI Desktop or Power BI Services Online

Note: Screenshots of Power BI interface © Microsoft Corporation. Used with attribution for instructional and illustrative purposes. Annotations added by the author.

For learning, look at the Power BI sample datasets that are either web, .pbix files or Excel datasets. The file type (.pbix) can be used in either Power BI Desktop or Power BI Services (Online).



Microsoft offers dozens of sample files that are available through **Learn** in Power BI Services (Online). Exhibit 7.21 shows several sample reports: Revenue Operations, Regional Sales Sample, Corporate Spend, Artificial Intelligence Sample, and Employee Hiring and History. All files are .pbix, which means you can open them in either Power BI Desktop or Power BI Services (Online). Use the arrows to see more sample reports. If you open these reports, make sure to go to the corresponding "tour" (article) that corresponds to the report. The Microsoft Power BI blog is discussed in the next few paragraphs.

Exhibit 7.20—Sample Reports Available in Learn in Power BI Services (Online)

Source: Screenshot of Power BI Interface © Microsoft Corporation. Author Annotations Added

Microsoft. (2023, June 29). Get samples for Power BI. Link: https://learn.microsoft.com/en-us/power-bi/create-reports/sample-datasets#sales-returns-sample-pbix-file

The Sample files are accompanied by a tour (an article that indicates what features are used). For example, choose the Sales & Returns sample .pbix file, to show images of the file as well as demonstrating new features. The Sales & Returns report uses buttons, drill-through, conditional formatting, what-if, and customized tooltips. The tours (articles) are posted on the Microsoft Power BI Blog. By the way, the Sales & Returns sample.pbix file was created by Miguel Myers and Chris Hamill. Miguel has a design background and Chris has an accounting background. I wanted to point this out because you never know how your career path can change by knowing Power BI!

Hurr, T. (2019, Dec 16). Take a Tour of the New Sales & Returns Sample Report. Microsoft Power BI Blog. https://powerbi.microsoft.com/en-us/blog/take_a_tour_of_the_new_sales_returns_sample_report/

The APP

Remember, there are three major components: Power BI Desktop, Power BI Services (Online) and the app. To see an example app follow these steps:

Here is a partial list of public datasets:

- Amazon Web Services Public Datasets: https://registry.opendata.aws/usage-examples/
- Governmental Datasets (all incorporated in https://data.gov)
  - Bureau of Justice Statistics: https://bjs.ojp.gov/data-collections/search?ty=dca
  - Centers for Disease Control and Prevention: https://www.cdc.gov/brfss/annual_data/annual_data.htm
  - U.S. Bureau of Labor Statistics: https://www.bls.gov/cex/

    - Healthdata.gov: https://www.healthdata.gov/
    - U.S. Census Data: https://www.census.gov/
    - National Center for Education Statistics: https://nces.ed.gov/
- Gapminder.org: https://www.gapminder.org/data/
- World Health Organization: https://www.who.int/data/gho
- Google provides a separate dataset search: https://datasetsearch.research.google.com/
- Microsoft Azure Data Markets: https://learn.microsoft.com/en-us/azure/azure-sql/public-data-sets?view=azuresql
- World Bank—Open Data: https://data.worldbank.org/
- World Values Survey: https://www.worldvaluessurvey.org/wvs.jsp

7.6 Exercise 1: Downloading and Exploring a Dataset

Learning Objective #6—Download available datasets using Power BI skills

Use one of the links in the list of public datasets to find a dataset of interest, use your own dataset from your organization, or use a sample file like Store Sales Sample (https://learn.microsoft.com/en-us/power-bi/create-reports/sample-store-sales)

Step 2: Create a screencast of your experience exploring the dataset or sample file. Create at least three graphs of good quality and discuss your findings.

Chapter 7 Summary

This chapter explored the dynamic landscape of data visualizations and analysis through the lens of Power BI Suite (both Power BI Desktop and Power BI Services Online). The chapter begins by outlining the key features offered through the Power BI Suite by transforming raw data into insightful visualizations that use data storytelling techniques to support informed decision-making.

This chapter included the process of downloading Power BI Desktop for PC users, and alternative instructions for Mac users. Power BI Desktop serves as a central hub for data transformation and visualization; however, Mac users can get a similar experience working with the Power BI Services Online. Care was taken to show the examples as seen by readers who only have a free license option, with additional demonstrations for readers who have the Pro license In Power BI Services online, Workspaces and the personal workspace (My Workspace) were introduced and explained. Central to the Power BI experience is the comprehension of semantic models, which establish the framework for organizing and understanding data relationships.

The chapter demonstrated a step-by-step development of a five-page report, showcasing techniques for seamless navigation and the integration of storytelling elements. From interactive visuals to smart narratives, readers learn how to leverage a variety of tools including decomp trees, slicers, and quick insights.

In the realm of dashboard creation, the distinction between a report and a dashboard was introduced along with how key metrics can be included to support decision-making. Users are directed to pin charts and visuals to dashboards and to personalize the display tailored to specific audiences. Through comprehensive exploration and hands-on practice,

readers are equipped with the knowledge and tools needed to harness the full potential of Power BI in their data-driven endeavors.

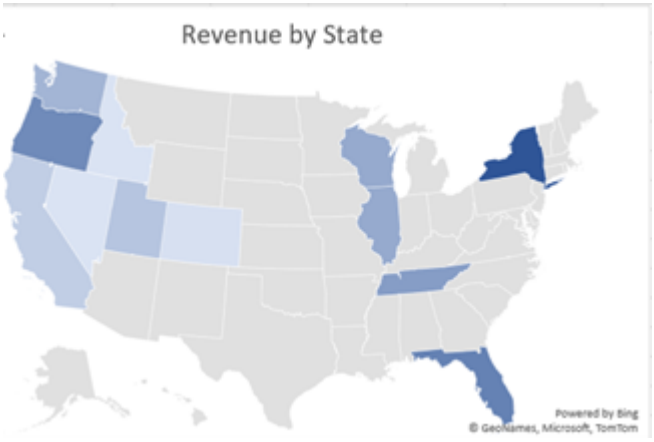
This chapter has several Excel worksheets and Power BI Desktop files (.pbix).
Download Chapter 7 Student Files (15.6 MB).

Chapter 7 Case: Power BI Report and Dashboards

XCaliber Foods was established late in 2023 although the business started in 2024. The company distributes food items to 12 states. In 2024, the company sold $510,326 worth of products (if you recall, you used XCaliber Foods in Chapter 4 working with Excel Dashboards).

Use the following Excel file: "XCaliber Foods 7.3 includes delivery.xlsx"

XCaliber Food Distribution company includes the following key points:



Note: Author illustration (2025)

- all employees are remote
- nine salespeople
- operated in 12 states
- actual sales were $510,326, and the sales goal for 2024 was $600,000
- goal for 2025 is $720,000 (or $60k per month)
- 15 customers in 2024; need more customers to succeed
- issues with delivery (should be 24 hours or less between order placed and order sent to shipping)
- 14 categories of product (24 total products)
- top five products: coffee, curry sauce, marmalade, mozzarella, and crabmeat
- top three salespeople: Anny Kolb, Nicole Pottinger, and Tony Clear
- There is a concern that not all items were paid for (review revenue by payment type and you will see products not paid—it shows blank).
- A survey was conducted that showed customers wanted more frequent contact, adherence to delivery promise of one-day order to shipping, and an expanded product line, specifically more craft beer.

Case Objectives

1. LO 3: Create a multipage report in Power BI Desktop with storytelling techniques.
2. LO 4: Publish a Power BI Desktop File (or a .pbix file) to Power BI Services Online.
3. LO 5: Generate quick insights in Power BI Services Online to analyze trends, outliers, and correlations.
4. LO 7: Apply appropriate visualizations for specific KPIs.

Case Guidelines

This case may be completed by an individual or a team of students as directed by your instructor.

Case Instructions

1. Add navigation and set the foundation for a five-page report.
2. Create a five-page report following the model in Section 7.3.

Page 1 includes (1) Revenue by Month, (2) Revenue by Salesperson, (3) Revenue by State, (4) the pop-up that comes up when hovering over either Revenue by State or Revenue by Salesperson, (5) the Insights, and (6) the play axis.

Page 2 includes (1) Revenue by Product Name, (2) Revenue by Customer Name, and (3) Smart Narrative based on Revenue by Product Name.

Page 3 includes (1) Revenue by Month with an average line, (2) Revenue by Product Name, (3) Revenue by State using a map, and (4) a slicer for XCaliber's 15 customers.

Page 4 includes a decomp tree organized by revenue: region, category, and product name.

Page 5 includes (1) Revenue by Month—Line chart with trend line, (2) Revenue by Customer, (3) Revenue by Payment type, (4) a KPI card showing 2024 Sales total compared to goal, (5) a KPI showing 2024 customer goal, and (6) a KPI card showing year revenue to target in a gauge graph.

3. Publish the report to Power BI Services Online.
4. Explore quick insights.
5. Create a dashboard that includes quick insights.
6. Create a second dashboard that highlights one salesperson's performance.
7. Create a screencast (Screenpal has a limit of 15 minutes, but you can record two screencasts if necessary). In the screencast
    i. Demonstrate one item from each page in Power BI Services Online.
    ii. Demonstrate quick insights and explain two examples.
    iii. Demonstrate the dashboards and indicate how you would unfold the story.
    iv. Make sure to demonstrate the Q&A on the dashboard.
8. Include the .pbix file as part of your submission.

Chapter 7 References

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8. Leveraging Data Visualization to Communicate Across Gaps

One of the criticisms I've faced over the years is that I'm not aggressive enough or assertive enough or maybe somehow, because I'm empathetic, it means I'm weak. I totally rebel against that. I refuse to believe that you cannot be both compassionate and strong.

—Jacinda Ardern, prime minister of New Zealand

What Do You Think?

Emilee just joined the conference session entitled *A Trio of Perspectives in Data Visualization*. She was surprised when the presenter announced that the first task was to join her assigned team based on a pre-conference survey. As Emilee found her team, the conference presenter gave them additional instructions—to share how their organizations publish information about diversity, equity, and inclusion along with other related issues.

Emilee joined her assigned teammates, Barbara and Tonya. After introducing herself, she discovered that Barbara works at a multinational corporation with a diverse workforce spanning multiple continents. Barbara, beaming with pride, said, "My organization creates visually stunning dashboards showcasing our diversity metrics to represent a comprehensive snapshot of my organization's demographics to especially highlight and promote gender and ethnic diversity." As Barbara opens her laptop to share the website, Tonya offers, "I'm not sure I'm in the right team! I'm in sports."

Tonya works for a sports consulting corporation where she works with different organizations to increase their fan base by reaching diverse cultures, generations, and gender. Tonya offered, "The world of sports faces unique challenges in conveying their commitment to diversity and inclusion. They request specific data visualizations that convey unity and empowerment. I do my best work where I can feature individual stories and collective triumphs."

Emilee looks at Barbara's laptop and compliments the aesthetics of her organization's dashboard. Emilee feels somewhat intimidated. Taking a breath, she says, "I work for a nonprofit and we operate on a shoestring budget. We rely on simple impactful visuals that convey the lived experiences of the communities we serve. We don't have a metric of our organization; in fact, we only have 12 employees. Instead, our metric is based on the number of clients we help. Most of our clients are from marginalized groups. We provide free-legal counsel."

Barbara looks perplexed and asks, "What kind of cases?"

Emilee is quick to respond, "Well things like gender pay gap, diversity issues, and inclusion issues. We use minimalist, community-centric visuals. Nothing as fancy as Barbara's organization!"

Discussion: What do you think?

Introduction

In the era of an increasingly interconnected world, diversity reigns as both a challenge and an opportunity. Effective communication bridges the gaps among diverse populations to foster collaboration, understanding, and progress. Hiring a diversity, equity, and inclusion (DEI) officer can be a significant step for any organization, but thinking about the scenario in the "What Do You Think?" section, how would a nonprofit that has 12 employees justify this action?

One topic DEI officers address is the gender wage gap. According to Elise Gould at the Economic Policy Institute, the gender wage gap in the United States still persists across all levels (low, middle, and high income) and women are paid less than men at every education level (2024). In 2023, "women were paid 21.8% less on average than men in 2023, after controlling for race and ethnicity, education, age, and geographic division" (Gouse, 2024, para. 1). It's an even bleaker picture if you dive into the data on Black and Hispanic women.

At its core, this chapter focuses on communication for diverse audiences. Topics to consider for diverse populations include gender, culture, generation, equity, and inclusion. This chapter includes DEI best practices including people-first labeling, purposeful order labels, consideration of missing groups, awareness of stereotyping, and mindful use of icons and shapes. It also includes leadership and communication strategies in relation to the relative burnout that marginalized populations are facing.

As you embark on this journey, it is imperative to recognize that effective communication is not a one-size-fits-all endeavor. It requires an understanding of audience dynamics, cultural nuances, and cognitive biases. It is hoped that this chapter will equip you to harness the power of data visualizations as a catalyst for change, driving meaningful dialogue, and fostering a more inclusive society.

Chapter 8 addresses the following learning objectives.

Learning Objectives

At the end of this chapter, students should be able to:

1. LO 1: Share strategies that address gender communication issues.
2. LO 2: Identify competing ways to influence within the global organization.
3. LO 3: Share strategies that address multigenerational communication issues.
4. LO 4: Identify data visualization techniques and strategies to address gender, cultural, and multigenerational issues.
5. LO 5: Identify how poor visualizations impact diversity, equity, and inclusion.
6. LO 6: Apply leadership strategies when your team is burned out (especially from virtual meetings).
7. LO 7: Demonstrate best practices of communication for Global Leaders.

Key Terms: Audience and audience perceptions, Brain dominance, Cognitive preference, Conflict, credibility, gender tendencies, gender motivation theory, global leader communication, interruptions, motivation, nonverbal cues, PechaKucha, PESTLE, power through character strengths, presentation designs, remote engagement, remote presenting, SWOT

Download Chapter 8 PowerPoint (9 MB)

8.1 Gender Communication Issues

> The hope is that laying out what we understand about essential differences in the minds of men and women may lead to greater acceptance and respect of differences.
>
> —Simon Baren-Cohen

Gender communication issues are a complex phenomenon that reaches various aspects of society, from workforce dynamics to decades of gender disparity and stereotyping. To begin, let's look at gender tendencies. **Gender tendencies** refer to a pattern or inclination commonly associated with a particular gender based on social norms, cultural expectations, and stereotypes. Examples of gender tendencies include (a) communication style, (b) occupational choices, (c) emotional expression, and (d) leadership style. A critical examination of gender tendencies can help challenge stereotypes and foster a greater understanding of inclusivity across diverse gender identities. It is important to note that gender tendencies are not a fixed characteristic of individuals; instead, they are socially constructed and can vary across different cultures and contexts.

So What Are Gender Tendencies?

Note: Author Photograph

Before we start, we must deal with an important caveat. The communication expectations are based on the tendencies of men and women as a group. Individuals may exhibit any combination of "male" and "female" behaviors. For example, when I am in a meeting, I tend to nest and take up a lot of room. I have my laptop and iPad, my notebook always turned to a new blank page, a few mechanical pencils, a couple of pens, and always a cup of coffee. Women normally take less room at a conference table, even pulling in their elbows. Not me. I'm crowding my neighbors and that is a typical male tendency. So let's look at these male and female tendencies to understand the environment and the audience. Remember, understanding your environment and your audience is the first step to successful communication.

Let's start with a comparison of tendencies: According to Winstok et al. (2018), "according to gender motivation theory, men are driven by a desire to enhance their status; whereas women are motivated by a desire to reduce risk" (p. 276). Leonard, Beauvais, and Scholls (1999) introduced sources of motivation from three attributes: traits ("repeated behavioral patterns"), competencies ("skills, abilities, talents, knowledge"), and values ("beliefs about desirable outcomes") (pp. 974–975). Just as one has a dominant hand (either left-handed or right-handed), individuals have a dominant source of motivation. But how did we develop these tendencies through motivation and conflict? And what does that have to do with communication?

Gender Tendency #1–Motivation and Conflict

Male: Childhood games taught him that competition is fun, winning is good, performing aggressively is acceptable, and boasting of your success is normal (Shaffer, D. & Kipp, K., 2013). And these social cues learned in childhood are the foun-

dation of why a male views **conflict as impersonal**. He may even consider conflict a necessary part of a working relationship!

Female: Childhood games taught her to compromise and collaborate. She competes primarily with herself and tends to be modest about accomplishments. She is motivated by connections and causes. She takes **conflict personally** (Doyle, 2022).

In a study by Eagly et al. (1994) the Miner Sentence Completion Scale (MSCS) showed that men scored higher than women on competitive games, competitive situations, assertive roles, imposing issues and standing out from the group. Women scored higher on authority figures and routine administrative functions. It is no surprise that male managers are often perceived as autocratic leaders. However, a newer study, using the same MSCS, discovered there was no significant difference between men and women for "competitive situations" or "standing out in a group" (Thorton et al., 1997).

The most common workforce conflicts include employment conditions, supervisor decisions, personality conflicts, and uncivil behavior. According to Van Gramberg et al. (2020), only 21% of conflicts are fully resolved. No wonder organizations are experiencing high turnover!

As an aside, conflict resolution in the workplace must start with both parties recognizing that a problem exists with the intent of reaching a mutual agreement. Changes in attitudes or behaviors can lessen negative feelings. However, understanding what triggers the episodes of conflict can often lead to someone saying, "I didn't know that bothered you." Using "active listening" is a communication technique for conflict resolution. It requires the listener to restate or paraphrase what they just heard to confirm their understanding. Instead of mentally preparing a response, listen to points being made (Chastain, 2013)!

What Data Visualization Strategies Help With Communicating?

Effective data visualization strategies that cater to different genders should aim to be inclusive, engaging, and relatable. Let's look through some of these strategies.

- **Use gender-neutral language, imagery, and color**. Create data visualizations that use language and imagery that are inclusive and gender neutral. Avoid stereotypes. If you know you have a diverse audience, opt for visuals and language that resonates with all members of the audience.
  - **Example #1:** Avoid using pink for girls and blue for boys as part of the color palette.
  - **Example #2:** In a survey, several participants did not answer the gender question (male or female). As a visualization designer, do not introduce the gender synthetically. Instead, just indicate "identity not listed" instead of "other." To most, *other* feels like a catchall category.
- **Balance visuals and textual information to tell a story:** Strive for a balance between visual elements and textual annotations in your data visualizations. Provide clear, concise explanations alongside visual representations to ensure comprehension.
  - **Example #1:** Use people-first language. So "people with disabilities" or "communities of color."

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Gender Tendency #2—"I" Versus "We"

Male: Males have traditionally been afforded *attention-getting* roles and have no trouble using the word *I*. According to Sarah Carmichael (2014) in *The Perils of Self-Promotion*, a routine use of "I did this" or "I did that" is a symptom of self-promotion. And this tendency is tied to what males typically value: power, ability, and achievement. Carmichael shares, "People do not value confidence unless it is accompanied by competence" (para 8).

Female: Females have traditionally been afforded *attention-giving* roles attached to an affiliation or the wider needs of a corporate community. She uses the word *we*. She is impressed by personal transparency and professional courage.

Teddy Roosevelt was often teased at his overuse of "I." In fact, the "New York World put a running score on its front page that year at **563,877,207** to record the number of times Roosevelt used 'I' in his public addresses" (Dalton, 2007, p. 361). TR was quite the character; we especially enjoyed his attempt to legislate a change in the spelling of 300 words. He failed then, but now we use them (check instead of cheque, or color instead of colour, etc.).

Currently, most leadership programs talk about the use of "We" instead of "me." A *Harvard Business Review* article, "If You Want to be the Boss, Say 'We' Not 'I,'" has some relevant insight. Changing to "we" language can help "shift your perspective from self-focused to others-focused, make you more aware of the needs of others . . . [and] make you a better leader" (Burkus, D., 2015, para. 8). It is worth fighting the tendency to say "I" if you wish to lead a team!

What Examples of Using "We" Can Help With Data Storytelling?

- **Use inclusive framing** through shared goals and experiences using "we/us" to emphasize common goals and a common purpose.
  - **Example #1:** Use phrases like "Together, we can address this challenge."
- **Use collaboration techniques**. Engage the audience **to contribute** problem-solving strategies.
  - **Example #1:** Use phrasing like, "Let's work together to find innovative solutions to this problem."
- **Share power techniques**. Empowerment grows exponentially when you build your narrative around shared values and aspirations.
  - **Example #1:** Use phrasing like, "Together, we have the power to make a difference in our communities."
  - **Example #2:** When you need the audience to share responsibility and accountability and to take ownership of the issue, you can use phrasing like, "It's up to all of us to ensure we . . ."

Gender Tendency #3—Cognitive Preference Instead of Brain Dominance

Male: Early literature associated males with left-brain orientation, which "produces problem-solving skills that are logical, analytical, factual, and hierarchical" (American Management Association International Presentation Skills Workshop, 2015, p. 131).

Females: Early literature associated females with right-brain orientation, which "produces problem-solving skills that are creative, sensitive, and nonhierarchical" (American Management Association International Presentation Skills Workshop, 2015, p. 132).

Females are great creative problem-solvers, but you find this same ability in males. A study conducted by Hardy & Gibson discovered that there was a gender difference in the approach to problem-solving in two of four samples, so the results are somewhat inconclusive. However, this same study indicated, "on average, females were found to **produce higher quality** creative problem solutions in all four samples" (Hardy & Gibson, 2015, p. 101). Creative problem-solving is

defined as the production of elegant solutions in response to complex, novel, and ill-defined problems (Hardy & Gibson, 2015).

The dialogue surrounding left-brain versus right-brain orientation has taken place over the last decade. It's almost like comparing left-handed and right-handed people. Over 85% of the population is right-handed. Which hand you use does not cause much of an impact (except the early stigma several decades ago where children were forced to write with their right hand). Mostly, you hear about left-handed people when you watch baseball (or bowling!). So the left-brain versus right-brain arguments sound familiar. That's why the "whole brain thinking" introduced by Herrmann is so interesting.

According to the Herrmann Brain Dominance Instrument, a four-quadrant model of cognitive preferences is more applicable. Herrmann's theory was for either gender to develop "whole brain thinking" to lead to creative problem-solving (Faust, 2019, para. 20). The quadrant reminds us of Myers-Briggs Type Indicator (MBTI), and you can find research that makes a comparison. But for now, let's look at the Herrmann model. As you review Table 8.1 keep in mind that this is a framework for understanding cognitive preferences. Each person's brain operates across these dimensions and individual strengths can exceed specific quadrants. According to LEADx, the organization that carries on the work of Herrmann, the Herrmann Brain Dominance Instrument helps you determine your dominance in how you think. But even more interesting is the ability to recognize your team's quadrants.

Table 8.1: Four Quadrants of Brain Dominance

Source: Table adapted from Left Brain, Right Brain, Whole Brain? (Morris, R., 2006)

Quadrant	Keywords to describe	Preferred Activities
Quadrant A—Left cerebral hemisphere—**analytical**	Logical, factual, critical, technical, and quantitative.	Collecting data, listening to informational lectures, reading textbooks. Judging ideas based on facts, criteria and logical reasoning.
Quadrant B—Left limbic system—**sequential**	Conservative, structured, organized, detailed, and planned	Following directions, repetitive detailed problems, time management and schedules. Known as organizers.
Quadrant C—Right limbic system—**interpersonal**	Kinesthetic, emotional, spiritual, sensory, feeling	Listening to and sharing ideas, looking for personal meaning, sensory input, and group study. Sometimes called humanitarians.
Quadrant D-Right cerebral hemisphere—**imaginative**	Visual, holistic, intuitive, innovative, and conceptual	Looking at the big picture, taking initiative, simulations (what if questions), visual aids. Appreciate the beauty of a problem, brainstorming. Innovators fall in this category.

What Examples of Leveraging Our Understanding of Brain Dominance Can Help With Data Storytelling?

- **When presenting:** Make sure you provide data visualizations or narrative that resonates with each quadrant.
  - **Example #1:** Quadrant A will want to see facts. Quadrant B will want to see an organized approach, Quadrant C will want to see the value of solving the issue, Quadrant D will want to see how the solution fits in the big picture.

A great resource for "whole brain thinking" can be found at the Herrmann website. Essentially, the free resources "help decode and harness your cognitive diversity to achieve better management results" (Herrmann, 2020). Link: https://www.thinkherrmann.com/resources. Link to Herrmann Example Report

As you can tell from Table 8.1, you don't see gender in the mix, but you may recognize the quadrant you resonate with just by **looking at the preferred activities**. Let's look at nonverbal cues next.

Gender Tendency #4—Nonverbal Cues

Male: Males are likely to hear your literal words and miss your underlying emotion or see your nonverbal cues. He is "not likely to express his feelings through facial expressions" (American Management Association International Presentation Skills Workshop, 2015, p. 131).

Female: Females are very proficient at decoding nonverbal meaning and "nonverbal messages carry over four times the weight of verbal messages" (National Alliance for Partnerships in Equity, 2020, p. 2). Additionally, females are likely to display feelings through facial expression or body language. But males are likely to miss it!

As an aside, in most "two-person conversations, nonverbal messages convey more than 65% of meaning" (National Alliance for Partnerships in Equity, 2020, p. 2). That's no surprise when you realize our "faces can demonstrate more than 10,000 facial expressions!" (Point Park University—Online, 2017).

Even more interesting is the 7-38-55 rule by Mehrabian, Wiener, & Ferris (1967) that shared this formula but with some caution. The rule states that 7% of meaning is communicated through spoken word, 38% through tone of voice, and 55% through body language. The authors urge caution because the formula does not apply to every situation. Note that 55% is nonverbal! Even the way you stand can have an influence on your audience and impact you as well.

For example, because someone crosses their arms over their chest doesn't always mean they are closed to your presentation; it may just mean they are cold!

Just remember, nonverbal cues can contradict or negate verbal messages. An interaction where words say one thing and nonverbal cues say another is called a double message, and everyone finds this confusing.

What Examples of Leveraging Our Understanding of Our Audience and Looking for Nonverbal Cues Can Help With Data Storytelling?

- **When presenting:** Make sure you pay particular attention to your nonverbal cues.
  - **Example #1:** If you stand with your hands clasped down low in front of you, it may look like you are trying to make yourself small. Audiences won't react to that as well (Weiss, 2015).
  - **Example #2:** Know your audience. In the book *Presentation Skills: Educate, Inspire, and Engage Your Audience* (2015), Michael Weiss points out four personalities that should influence how you present (pp. 46–56). These four personalities are the Driver, the Amiable, the Analytical, and the Expressive, and each type has preferences in how you present to them.
    - **Presenting to the Driver:** Use brief, short-term options, and keep things focused on the present. Let the driver take control if they request it. The best data visualization is a dashboard to provide options, which should be up to date. Nonverbal cues of the Driver include leaning forward, putting elbows on the table, and giving a firm handshake.
    - **Presenting to the Amiable:** The presentation should be traditional and inclusive of the entire team. Personal sharing is OK; the Amiable appreciates a safe, comfortable environment and doesn't like to feel rushed or confronted. They will get back to you. If Drivers are in the same room, emphasize "This is a safe environment." Nonverbal cues of the Amiable include palms open and welcoming, great eye contact, and animated hands, face, and eyes.
    - **Presenting to the Analytical:** The Analytical wants all data (past, present, and future). They are detail ori-

ented, want to see the plan, need time to verify data analysis, and have an obsession with being right. Nonverbal cues of the Analytical include the following: sits up very straight, is somewhat rigid but tends to lean back, and gives limited eye contact.

- **Presenting to the Expressive:** The Expressive wants to hear how the story will end. Painting a picture with your narrative will engage the Expressive. The Expressive wants to be asked what they think, appreciates compliments, and feels comfortable and engaged if they can contribute their ideas and tell their stories. Nonverbal cues of the Expressive include leaning forward to make eye contact and being animated in posture (restless).

If you are interested in learning more about presenting, please feel free to read this book by Michael Weiss. It is especially helpful if you struggle with getting nervous before a presentation!

Weiss, M. (2015). *Presentation Skills: Educate, Inspire, and Engage Your Audience*. Business Expert Press. ProQuest EBook Central Database.

NAPE. (2023). Gender Communication Quiz. National Alliance for Partnerships in Equity. https://napequity.org/pipe-training/r1e-gender-communications-quiz/

Gender Tendency #5—Interruptions

Male: Males are more likely to interrupt women than interrupt other men and they mean nothing personal by the interruption. "According to world-renowned gender communication expert Deborah Tannen, men speak to determine and achieve power and status. Women talk to determine and achieve connection" (Ibarra, Tannen, Williams, & Hewlett, 2019, p. 80).

Given that in American society speaking is perceived as a power position, it is no wonder that men interrupt to take the floor more often. "In using conversation to enhance connection, women are much less likely to interrupt, as it is seen as disrespectful" (Shore, 2017, p. 37)

Female: Females are less likely to interrupt men, but when females are interrupted by men, they tend to take it personally.

Figure 8.1—Interruptions and How to Handle It

Note: Meeting room image generated by Copilot and adapted by the author (2024)

What Strategies Can We Use When a Presentation Gets Interrupted?

- When your presentation is interrupted, determine the reason first.
  - **Example #1**—Is the interruption for clarity? There are strategies for deflecting interruptions (for any reason other than clarity). For example, you can ask, "There are a few more essential points I'd like to make. Can you delay a moment?"
  - **Example #2**—Is the interruption because they want to support your position? This can happen when men feel motivated to support based on your language and word choice. Instead of words like "believe," use "know" or instead of "might" use "will." (Shore, 2017, p. 37) and don't use phrases like "I just" or "I think" because these phrases limit your authority and conviction.
  - Another strategy is to notice body language. When you see men lean away or look away from you, they may be ready to interrupt, so "look them in the eye, lean in and take yourself seriously if you want to be heard" (Shore, 2017, p. 35).

Reflective listening: If you face interruptions from your team, ask your team to practice a version of "reflective listening." "Anyone interrupting repeats or paraphrases what the speaker was saying and then explains the connection to the new thought. This prompts teams to be more aware of when and who they're interrupting. This won't work for every meeting because it slows the pace, though it is a good exercise to default to when excessive interruptions re-emerge" (Dotter, 2019, para 5).

Gender Tendency #6—Defining a Problem and Situation

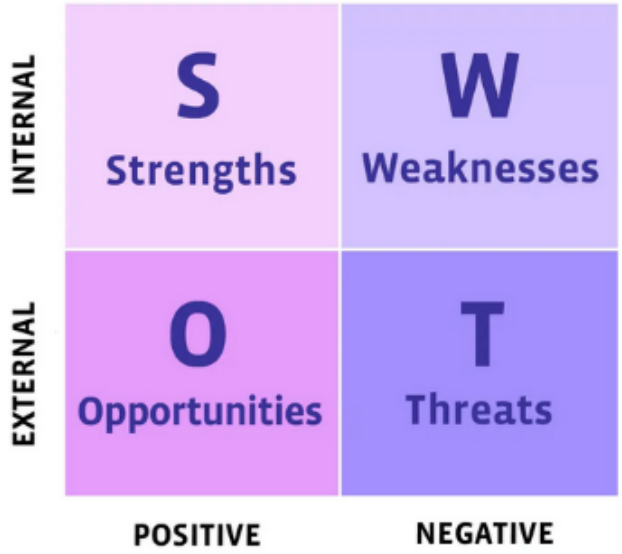
Male: Men tend to define a situation in terms of outcome. Males will assume that your presentation of a problem (even a hypothetical problem used for illustration) is a direct request for a solution.

Female: Females tend to define the same issue in terms of the people affected by it. Other females will respond to your presentation of a problem with support and reassurance with a willingness to collaborate, to share experiences, and to jointly discuss solutions. "Successful collaboration requires a cooperative spirit and mutual respect" (Doyle, Careers, 2020, para. 15). A good collaborator can analyze the problem without assigning blame and women are better at this than men.

These observations highlight the different perspectives. While men lean toward analytical solutions, women often consider the human aspect. These tendencies are generalizations and don't apply to all. Individual variations exist; expect a blend.

What Strategies Can We Use When Presenting a Problem to a Mixed Audience?

- When you present to a mixed audience, plan to appeal to both genders.
  - **Example #1**—If you are presenting to a mixed audience, what can you do? The strategy is to define the problem in a manner that appeals to both genders. Defining the problem is key—paint the picture, show the impact, the consequences, and the emotions the problem is creating for those involved (Cooper, 2014). You already consider the decision-makers in your audience; this is just considering the additional issues based on "gender."
  - **Example #2**—Use analytical tools like PESTLE (political, economic, social, technological, legal, and environmental) or SWOT (strengths, weaknesses, opportunities, and threats) so males can focus on the specific industry competition in related industries or organizations. Be direct and show results-oriented impact on the organization's bottom line. These tools were demonstrated in previous chapters.
  - **Example #3**—Share the most important information first. One of our favorite quotes made in *Storytelling With Data* is "If you only had a limited amount of time or a single sentence to tell your audience what they need to know, what would you say?" (Knaflic, 2015, p. 39).



Note: Author Illustration (2025)

Note: Author Illustration (2025)

- **Example #4**—Most presenters use PowerPoint but if you want to show an interactive report from PowerPoint, make sure to install the Power BI add-in in PowerPoint. Let's look at the step-by-step section to see how this might be used.

Step-by-Step to Bring Power BI Into PowerPoint

Screenshots of PowerPoint Interface © Microsoft Corporation. Author Annotations Added.

This application would be for fairly sophisticated audiences where your audience might be asking questions and asking for on-the-spot analysis.

Step 1—**Open** Power BI Services (Online)

Step 2—**Open** a report found in My Workspace. I opened XCaliber Foods Storytelling-Draft 2.

Step 3—**Click** the share button and choose **PowerPoint** as you see in Figure 8.2.

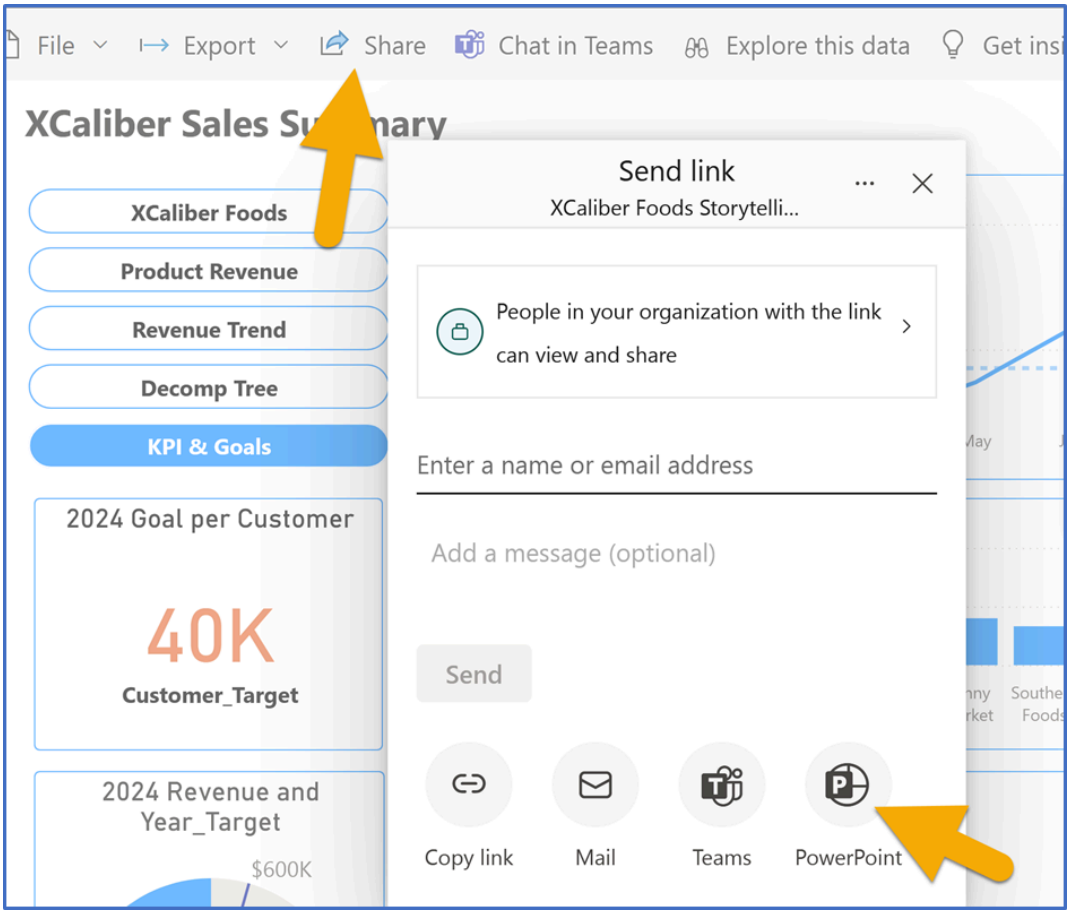


Figure 8.2—Sharing Power BI Report With PowerPoint

Step 4—When you see the pop-up (Figure 8.3), choose **Open in PowerPoint**

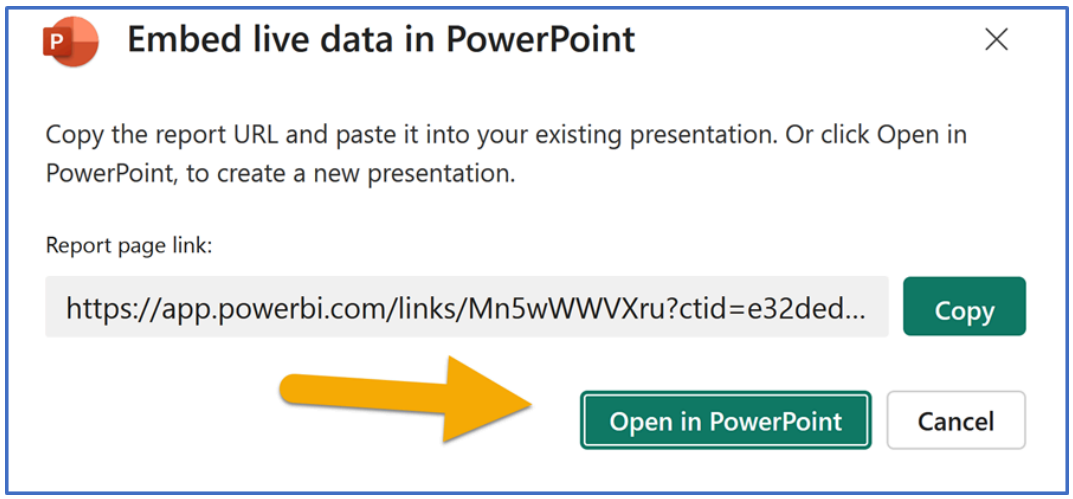


Figure 8.3—Pop-Up to Embed Live Data in PowerPoint

Step 5—In the next pop-up, choose **open the link** (Figure 8.4) so PowerPoint will connect to it.

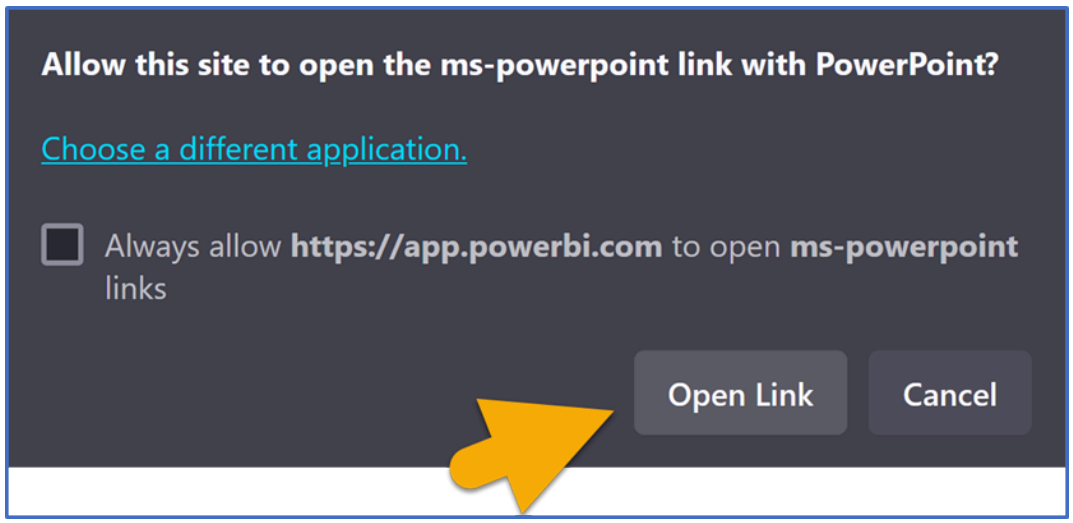


Figure 8.4—Allow PowerPoint to Open Link

Step 6—Customize the Power BI Report in PowerPoint as shown in Figure 8.5.

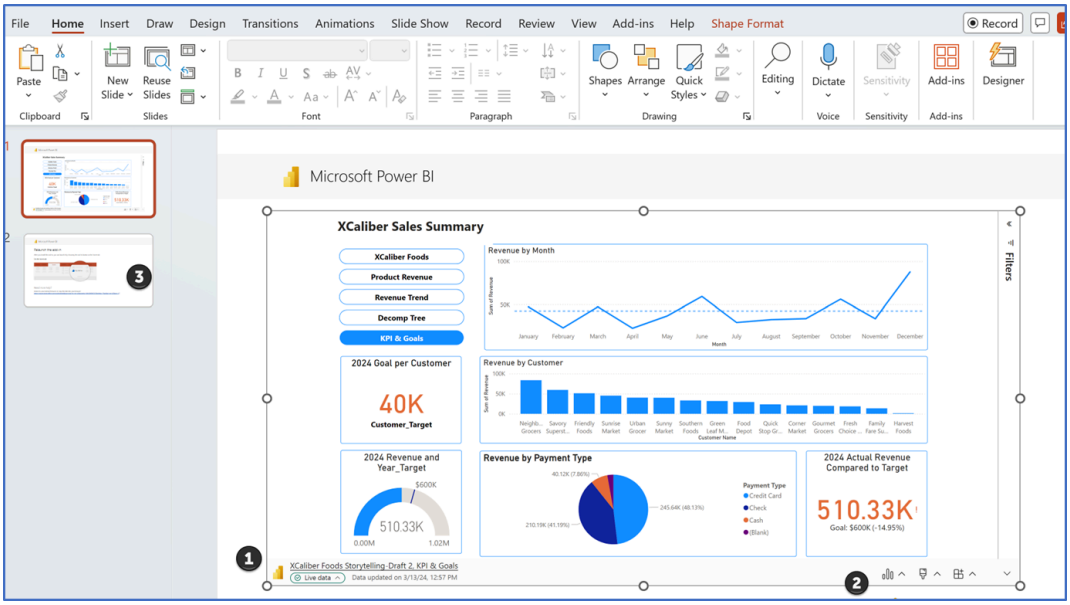


Figure 8.5—Customizing Power BI Report in PowerPoint

1 In this step, please note the information on the lower left (Live data) of the PowerPoint (see Figure 8.5). It should identify the name of the Power BI Report (in this case XCaliber Foods Storytelling—Draft 2, KPI & Goals), along with the date updated.

2 In the lower right of PowerPoint, you will notice several icons. The first icon looks like a three-column chart. When you click on it, you see the options filter, data insights, refresh, and reset, as shown in Figure 8.6[1]. Data Insights is like what you would expect from Power BI. If you have trouble loading Data Insights, troubleshoot the Power BI add-in for PowerPoint. In Figure 8.6, we demonstrate the data insight feature by using the Revenue Trend section of the report. Notice, you can paste on a slide or copy to the clipboard.

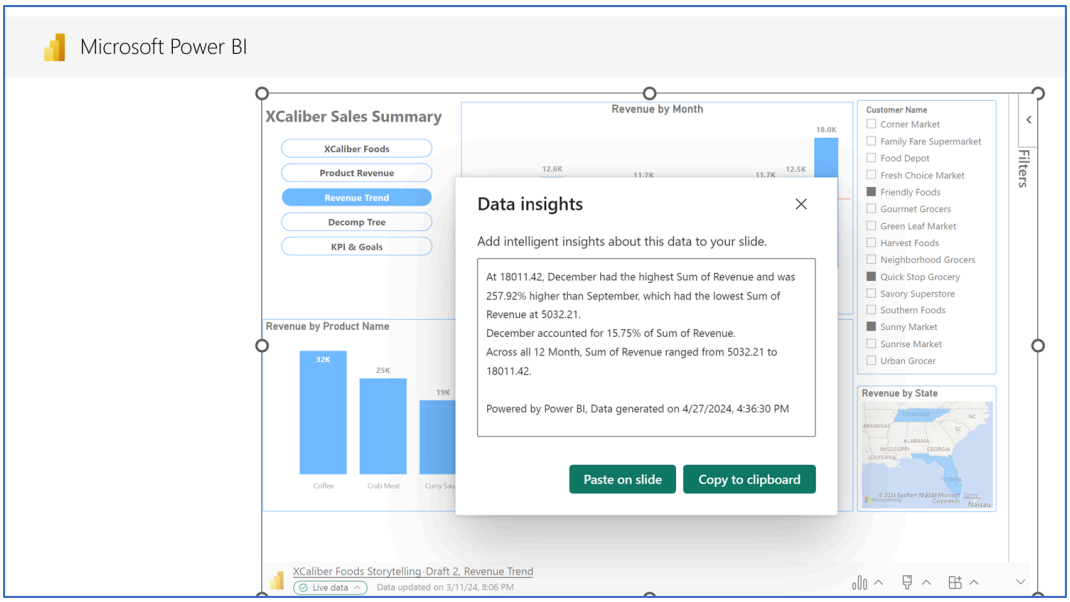


Figure 8.6—Microsoft Power BI Data Insights on Revenue Trend Section

1. Screenshots of Power BI Interface © Microsoft Corporation. Author Annotations Added.

The second icon in the lower right allows you to add style to your Power BI Report—you can add an outline. The last icon allows you to clear data, set slide show settings, and Learn.

3 When you share the report to PowerPoint, it creates two slides—one that is from XCaliber Foods, but the other is an instruction about using the add-in feature in PowerPoint to launch the report. The Power BI button shows up on the ribbon.

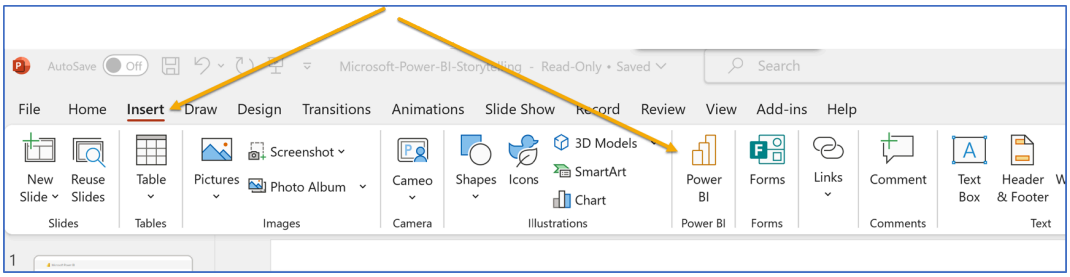


Figure 8.7—Location of Power BI Button in PowerPoint

Recall your best and your worst presentation. What strategies would you apply to your worst presentation?

8.1 Self-Assessment: Gender Communication Issues

Learning Objective #1—Share strategies that address gender communication issues

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=578#h5p-36

8.1 Exercise 1: What Do You Think?

Learning Objective #1—Share strategies that address gender communication issues

Learning Objective #5—Identify how poor visualizations impact diversity, equity, and inclusion

Instructions: Go to the "What Do You Think?" section at the beginning of the chapter and answer the following questions.

1. Compare and contrast the three organizations in leveraging data visualizations to promote diversity, inclusion, gender equity, and so on. What are the common themes that emerge and what unique insights can each organization offer?
2. How does the context of sports influence the effectiveness of data visualization in promoting diversity and inclusion? Are there unique opportunities or limitations inherent in this domain compared to the corporate and nonprofit sectors?
3. Consider the role of leadership in shaping the narrative around diversity and inclusion. How might the leadership styles be different?
4. Is one approach more effective than another?
5. Reflect on your own experiences with data visualization. Have you encountered a visualization that resonated deeply, and how did it contribute to your understanding of a particular issue?

Post to the discussion board, or be prepared to discuss in class.

8.2 Cultural Communication Issues

> Different does not mean deficient, it simply means different.
> —Tatiana Kolovou, teaching professor of management

Making Sense of Cultural Differences in a Communicative World

The rapid rise of global business, combined with the challenges brought on by the pandemic, has made cross-cultural considerations and planning an urgent priority for even the most indifferent organizational communicators. During the difficult days of the pandemic, nearly the entire world was forced to remote work, requiring immediate connection with colleagues across various parts of the globe. In Upwork's Future Workforce Survey, 1,000 U.S. hiring managers were asked, "Has responding to the pandemic forced you to make changes to the following management practice areas that will stay with you in the long-run?" (Ozimek, 2021, para. 15). The survey results indicated over 60% changed management practices for team meetings (structure and cadence) and over 55% indicated changed management practices for employee/internal communication.

At any given moment, countless individuals are connecting instantly with their organization's global offices. This shift has brought together a diverse array of cross-cultural communicators, who collaborate virtually to solve problems, present proposals, and engage in meaningful exchanges through numerous virtual platforms. Despite this reality, not all participants have received training on the nuances of cross-cultural communication.

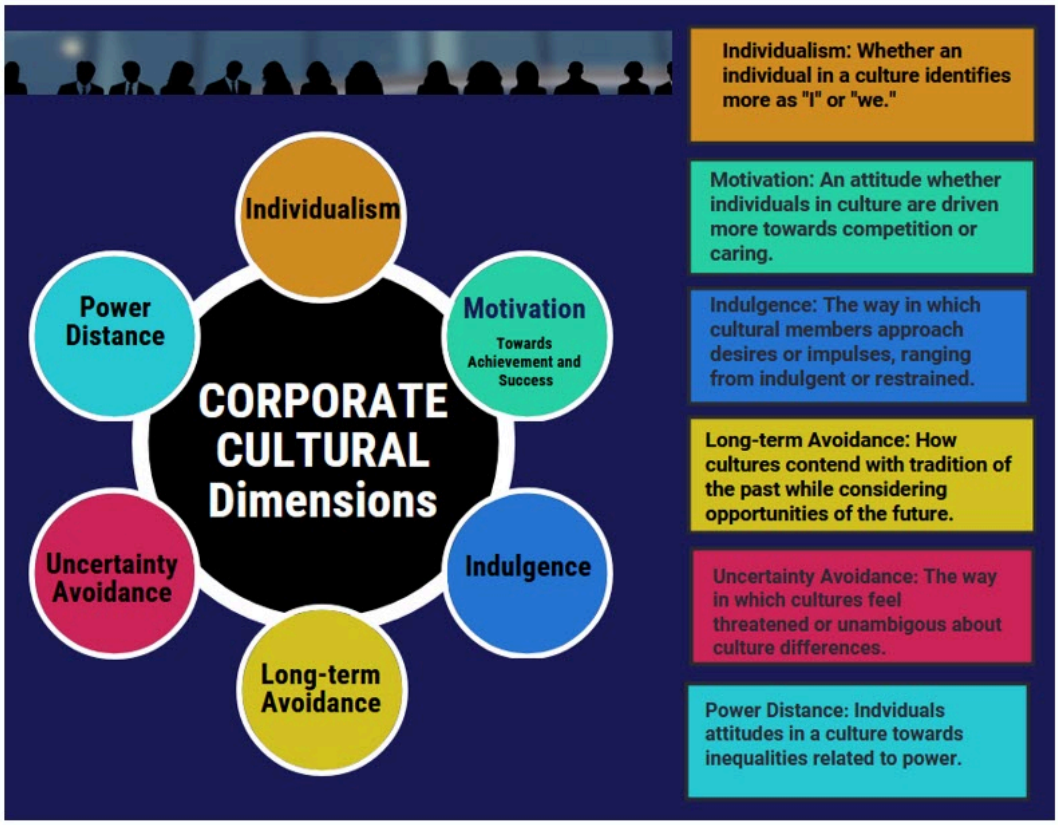
This section seeks to address that gap by discussing key considerations for effectively engaging with diverse audiences and making compelling pitches in our increasingly globalized communication landscape.

Cultural Context Matters

Each culture presents differences, and as highlighted in the quote at the start of this section, these differences should be celebrated for the diversity they bring rather than viewed as deficiencies. Culture encompasses the customs, arts, social institutions, and traditions of a particular nation, people, or other social group. Extensive research has been conducted on the differences between cultures, and while entire books could be written on this topic, this section aims to introduce a few key resources that we believe will be particularly helpful to you.

Researchers like Geert Hofstede leveraged his practical experience at IBM to develop a framework of six cultural dimensions that encapsulate common experiences across cultures. These dimensions—power distance, individualism, motivation toward achievement and success, uncertainty avoidance, long-term orientation, and indulgence continue to guide leaders and scholars. Organizations like the Culture Factor Group assist individuals seeking to understand these cultural differences by providing country comparison tools to help guide those who seek to understand and appreciate cultural diversity.

Figure 8.8—Six Cultural Dimensions



Note: Author Illustration (2024) of Geert Hofstede's Six Cultural Dimensions

Try the country comparison tool offered by The Culture Factor Group. Begin by selecting countries that you seek to compare. Once your selection has been made, visit the country comparison tool. Culture Factor Group. (2023). The Country Comparison Tool. https://www.hofstede-insights.com/country-comparison-tool

The Culture Map

Erin Meyer, author of the *Culture Map*, helped to further Hofstede's cross-cultural considerations by offering an eight-scale dimension to guide audiences. These dimensions help global audiences better identify cultural differences from a highly practical approach. The cultural dimensions of communicating, evaluating, persuading, leading, deciding, trusting, confronting, and scheduling help explain the various approaches that guide leaders as they interact with another culture. Table 8.2 explains the dimensions while the subsequent illustrations suggest how the dimensions may play out, interaction by interaction.

Table 8.2: Dimensions, Scale and Differences Explained

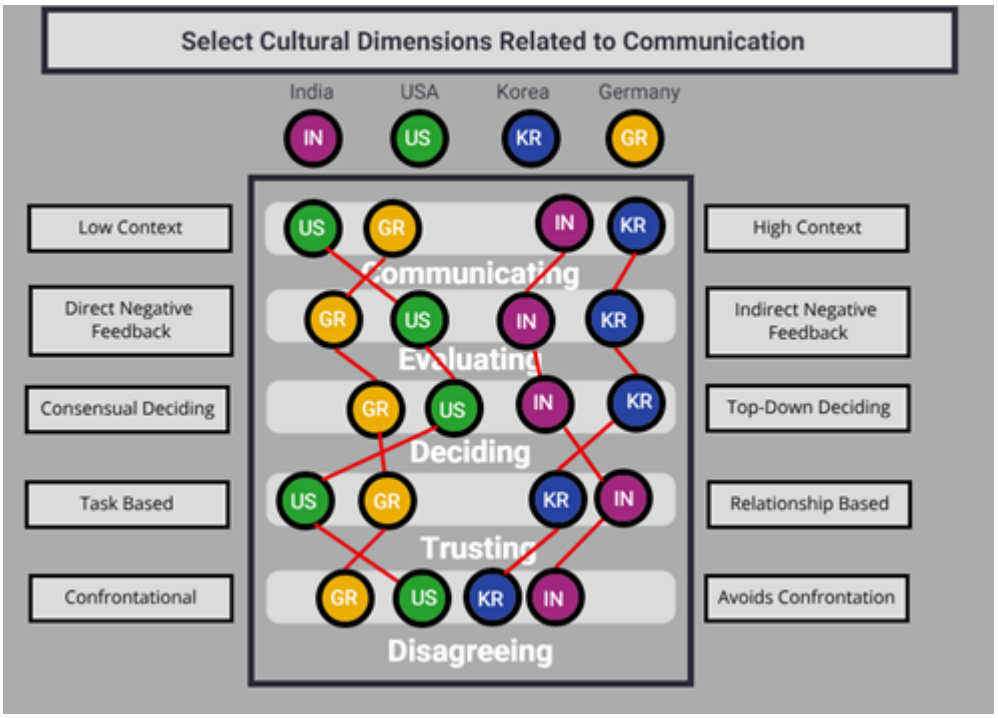
Dimension	Scale	Differences Explained
Communicating	Low to high context	Low context speakers offer all details to others, being very specific and looking for the same from others. High context speakers let audiences read between the lines to get meaning and be surprised by low context details.
Evaluating	Direct to indirect negative feedback	Those giving direct negative feedback are explicit and clear while those providing indirect negative feedback leave much unsaid or offer their reaction subtly.
Persuading	Principal-first to Application-first	Principal-first communicators offer a theory or complex concept before presenting a fact, statement, or opinion. Application-first communicators lead with a fact, statement, or opinion.
Leading	Egalitarian to hierarchical	Egalitarian leadership preferences desire group decision-making and may be comfortable with such a system or outcomes. Hierarchical preferences look to a top-down structure for such decisions.
Deciding	Consensual deciding to top-down decision-making	Similarly, consensual decision-makers look to the group to have sign-off while top-down decision-making provides such an answer for everyone to then follow.
Trusting	Task-based to relationship-based	Task-based orientations see interactions to be largely centered on getting to work around a project or goal and if it goes well, trust is established. Relationship-based preferences like to know those they are working with before getting down to pursuing projects or goals.
Disagreeing	Confrontational to avoid confrontation	Those that prefer confrontation to work through differences will be different from those communicators who avoid confrontation at all costs while not seeing it useful.
Scheduling	Linear to flexible time	Linear time schedulers see meetings, appointments, and deadlines as a precise thing to be followed. They may see arriving early as actually being on time. Those in flexible time cultures tend to be approximate on start times, not seeing the need to rush from their timelier counterparts.

Figure 8.9 illustrates how select dimensions relate to how communication may differ, culture-by-culture, in four specific countries. While audience members are never monolithic, leaders and communicators would be wise to heed these general parameters to better understand their audiences when approaching communication in such situations.

Understanding these cultural differences is just a starting point to recognize the ways in which different people connect. The next key step for any communicator is to identify specific actions to effectively communicate. First, listen to and observe your surroundings. Even when you are with a familiar work group, observe what they do daily. What are the spoken and unspoken patterns you observe? How do individuals interact and behave with each other? What is known

by the in-groups, those that regularly work and interact in these spaces versus the out-group, those who do not. These key observations can begin to help you understand and see the differences.

Figure 8.9—Select Cultural Dimensions Related to Communication



Note: Author Illustration (2024), A comparison of four countries.

Keeping in mind that differences do not mean deficiencies, a potential next step would be for a group to read resources like *the Culture Map* or take the online Cultural Profile available from Harvard Business Review in the next web resource offered in this chapter. So often, understanding diverse audiences begins by understanding ourselves and this important resource may help to illustrate key differences between you and other audience members from different cultures.

Finally, when comfortable, your working group should openly discuss and manage cultural differences. Sometimes this means acknowledging the cultural differences in daily actions. For instance, a low-context team member may acknowledge that the follow-up email they send after every meeting is simply a product of their cultural experience and not an assertion that other team members are disorganized, lazy, or not doing their work. Discussing this openly can prevent hours of unproductive soul-searching and bruised egos every time such a communication occurs. Similarly, the entire group can better understand that the manager providing very direct feedback may be operating from a cultural dimension to which they are very accustomed, rather than choosing to be critical. While that understanding alone may not help the team as they absorb the feedback, it can help everyone understand that the feedback is not personal but simply the way that manager communicates.

Considering cross-cultural communication also means examining the ways in which individuals connect routinely and a reminder of the importance of storytelling. Historical experience has taught us that individuals connect around needs, experiences, and hopes, which are often shared through story or narrative. Very often, these important discussions take place when one member connects with another via narrative and shared understanding. Storytelling is a phenomenon that exists beyond cultural dimensions and as a result, may be the precise way to connect with others via some tried and true practices depicted in Figure 8.10.

Figure 8.10—Tips for Connecting Cross Culturally

Note: Author Illustration (2024)

The Culture Map: The Future of Management. You can see the origins of the eight dimensions from Erin Meyer herself as well as hear this groundbreaking author comment on the future of management in the global organization based on her very important research.

Meyer, E. (2014). *The Culture Map: The Future of Management*. [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=578#oembed-1

What's Your Cultural Profile? This great resource from Erin Meyer and available via *Harvard Business Review* will allow you to take your own cultural profile and learn more about audience identity in your global organization. As you do, think about what surprises you. What was confirmed from your understanding of your own culture?

Meyer, E. (2014). What's Your Cultural Profile? *Harvard Business Review: Business communication.* https://hbr.org/2014/08/whats-your-cultural-profile

One additional consideration is the ways in which persuasion may be different by culture. You will recall discussion in chapter one about the need in some cultures, like the United States, to be more upfront with an argument while following a "cut to the chase" or "time is money" philosophy. This contrasts with other cultures, such as those in China, who may be more indirect with a persuasive argument. For such speakers, it may be important to pay particular attention to how they begin their argument, make their points, and reach a decision with audience members. Table 8.3 offers important considerations for such speakers to consider, depending on the audience.

Table 8.3: Persuasive Style on How Some Cultures Communicate

Persuasive Style	Key Components	Countries Practiced
Application-first	✓Individuals begin with a fact, statement, or the idea being proposed before outlining why and how it will be implemented ✓Visuals lead with little background, often getting right to the point	✓Australia ✓Canada ✓United States
Principles-first	✓Individuals begin with theoretical considerations, background, or other details before offering a possible solution or decision-point. ✓Visuals present this information for audiences to consider	✓France ✓Germany ✓Russia

8.2 *Exercise 1: Considering Culture and Persuasion*

Learning Objective #2—Identify competing ways to influence a global organization

Please read the case and identify the elements of cross-cultural communication that may assist you in developing responses to the case:

Yuri, a Russian partner in a global company, listened to his American counterpart, Michael, as he presented his idea at a pitch session. Yuri found the message from Michael a little off-putting. Michael had come in and before barely sharing his slide deck, offered that the entire East European division should be melded into Yuri's portfolio for Central Asia.

While the idea made good sense and was somewhat expected, Yuri was very surprised that Michael quickly came to this conclusion without any reasoning or evidence. Yuri would have preferred to see data, consider its merits, and then revisit after careful thought. It's not that he objected to the idea entirely. Truthfully, he would likely agree, but it was the way Michael said it. Outside of this interaction, Yuri generally liked Michael. The two connected very well after discussing their families, experiences in the workforce, and common visions they had

for the company's future. While Michael continued talking, Yuri wondered if there had not been a better way to handle all of this . . .

1. In reaching each other on this important message related to the company, what did Yuri, Michael, or both do wrong in connecting cross culturally?
2. What strategies, if any, could have been used by Michael to reach Yuri on this decision?
3. In handling this for future situations, do you have a recommendation for the company going forward?

8.3 Multigenerational Communication Issues

> If you get the culture right, most of the other stuff, like great customer service, or passionate employees and customers, will happen on its own naturally.
>
> —Tony Hsieh, former Zappos CEO

Company Culture and Multigenerational Communication Issues

Company culture plays out differently for large companies compared to small companies. In a large company, all leaders at the executive level are likely from the baby boomer generation. In fact, "roughly 80% of S&P 500 companies have baby boomer CEOs and approximately one-third of that group is 65 or older" (Potter, 2018, para. 4). As of 2016, the Pew Research Center indicated that millennials became the largest percentage of the workforce at 35%, and by 2025, 75% of the global workforce will be millennials (Fry, 2018).

In small start-up organizations, the owner influences the company culture and Millennials and Gen Z are more likely to start their own businesses. In a nonprofit, both the director and the executive board or board of trustees influence the organization's culture. On the board, expect a mix of all generations, but directors and staff are normally *not* Baby Boomers. Wong and Main (2023) explained that "company culture is about the shared norms, values, attitudes, and practices that form the collective identity of your company [shaping] how things are done within your organization" (para. 6). The return on investment (ROI) is long-term. If you've ever worked in a toxic culture where generations don't hold the same values, you can expect these symptoms: low employee engagement, high turnover, the blaming of politics, frequent use of the phrase "That's not my job," lack of trust, and high absenteeism.

Adding to the communication complexity of company culture is the multigenerational workforce. A leader's role is essential in shaping the culture that bridges a multigenerational workforce. Different generations prefer different communication styles, may have biases (negative stereotypes), and hold different expectations for their employment. Although you may be well aware of the different generations, let's review them.

The Five Generations of the Workforce

The following information is based on the Pew Research Center.

- **Traditionalists or Silent** (1925–1945)

    - Traits: Dependable, straightforward, tactful, and loyal
    - Communication style: personal, handwritten notes, not a fan of email, top-down approach
    - Pew Research Center: Less than 2% of workforce and 9.8% of the population
- **Baby Boomers** (1946–1964)
    - Traits: Optimistic, competitive, workaholic, team-oriented
    - Communication style: Prioritize personal and formal communication. They appreciate phone calls, meetings, and memos. They may print out emails.
    - Survey: Close to half (49%) of Baby Boomers are expected to or already are working past the age of 70 (Hicks, 2023).
- **Generation X** (1965–1980)
    - Traits: Flexible, informal, skeptical, independent
    - Communication style: prefer communication that is efficient, can easily adapt to digital, work hard play hard
    - As of 2021, 35% of those employed include Generation X (Kuligowski, 2021).
- **Millennials** (1981–1996*)
    - Traits: Competitive, civic and open-minded, achievement-oriented, well educated
    - Communication style: Digitally adept, which shapes their communication preference, IMs, texts, specific internal platforms like Slack, want ample feedback and recognition.
    - Less likely to remain at one organization. By 2025, 75% of the global workforce will be millennials (Fry, 2020).
- **Generation Z** (1997–2012*)
    - Traits: Global, entrepreneurial, progressive, less focused
    - Communication style: Digital natives, tech-savvy, quick learners, expect instant communication, but also IMs, social media, texts, like self-direction.
    - Seek organizations that align with their values, will self-identify as digital addicts.

* Using the new definition period for each generation from the Pew Research Center. These classifications are globally understood and recognized. More information is coming for Gen Z as they come of age.

Let's explore the number one issue of low employee engagement—knowing what is expected.

Low employee engagement: The value of engaged employees is their entrepreneurial spirit. They own their work. And as owners, they are motivated to drive change and contribute to innovation. Disengaged workers are less productive, more stressed, and less secure. Gallup's 2023 U.S. survey indicates that 33% of employees were engaged in 2023, which means that 67% of employees are *not engaged*. Actively disengaged employees, or loud quitters, are at 16%, which is down from 2022 (Harter, 2024). "The most fundamental engagement element is knowing what is expected of you," and the fallout of COVID-19 is that "70% of managers report to Gallup that they have no formal training in how to lead a hybrid team" (Harter, 2024, para 10).

If your work involves teams, consider using the CliftonStrengths Assessment from Gallop. This assessment measures your unique talents and categorizes them into 34 Clifton Strength themes. Knowing your strengths can help you leverage them, especially in a team setting. According to CliftonStrengths, it is important to discover the collective talents of your team. "To successfully manage or lead others, you must individualize your approach. You must understand what makes each of your team members unique. And you must lead meaningful conversations about performance that focus on what each person naturally does best" (Gallup, 2024). There is more about CliftonStrengths in Section 8.6. As a reminder of the 7Cs of communication, good communicators should be clear, concrete, concise, complete, courteous, and coherent.

Leaders are expected to be good communicators, so how can we leverage data visualization or communication tools to support better communication?

Key Strategies for Communicating Across Generations

Balanced Hybrid Work Model: Bridging cross-generational communication gaps can be done through a balanced hybrid work model. Everyone has experienced COVID-19, and it certainly changed how we communicated during the pandemic's rage across the globe. The lessons we learned impact communication in the present. A Forbes expert panel recommends a blend of face-to-face meetings and virtual meetings (Uzialko, 2024). Training should be delivered across all generations to make sure everyone can use the communication and collaboration tools effectively.

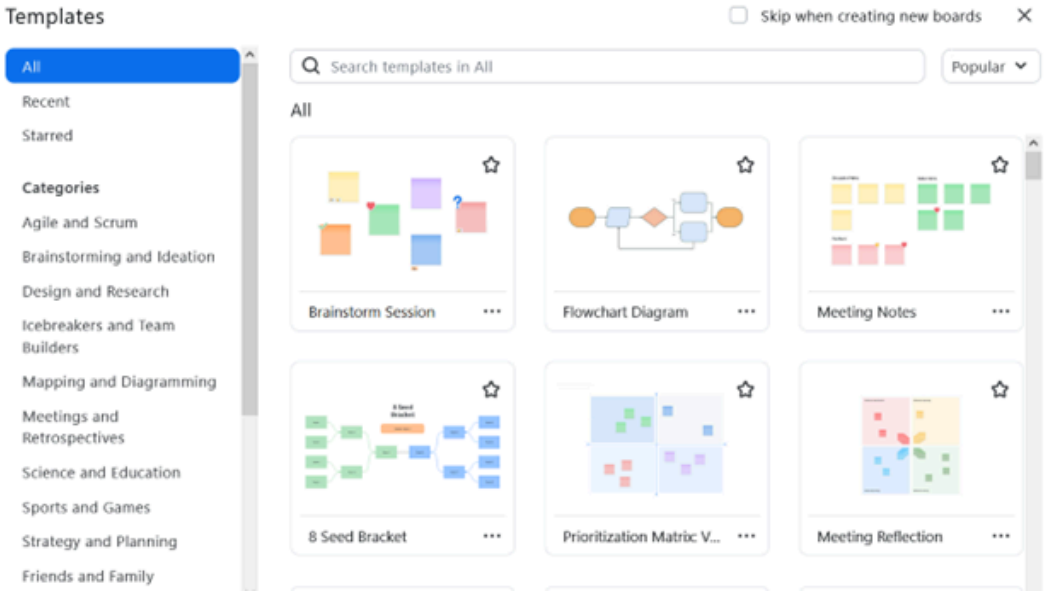
Multichannel approach: Leaders need to utilize a diverse range of communication channels. This need is why you see so many communication channels: Slack, Google Chat and Google Meet, Chanty, Microsoft Teams, Basecamp, Zoho Cliq, and dozens more. The point is that leaders need to provide a multichannel approach, perhaps an email to the Traditionalists and Boomers and an instant message (through Slack or an alternative) to other generations.

Tone, jargon-free, inclusive language: Consider the seven Cs of communication: clear, concise, concrete, correct, coherent, complete, and courteous. Tailor messages to have the right tone and free of jargon. Stay central to the topic. If your team has global members, communicate to them in their preferred language, avoid slang and colloquialisms, be conscious of time zones, and be careful of humor.

Role of AI and automation: AI-powered tools can help with internal communication (personalizing communication), predict communication patterns to help you anticipate communication needs. For example, have you ever come into a meeting late and felt like saying, "What did I miss?" Leveraging AI means that now you can ask the AI questions like this and even a question like "Did my name come up for any projects?"

Embracing remote communication methods: Use Zoom/Teams/Slack or other virtual meeting software features to their fullest by adopting interest-based conversations instead of position-based conversations. Choose the whiteboard ***before*** the meeting. Set up your polls (for feedback) ***before*** you meet. All virtual meeting software has a long list of whiteboards. In Exhibit 8.1, Zoom has templates ranging from strategy to planning, brainstorming to ideation, mapping, diagramming, meetings, and retrospectives.

Exhibit 8.1—Templates in Zoom



Source: Screenshot of Zoom Interface © Zoom Video Communications, Inc., https://www.zoom.com

Remote Meeting Strategies

Additionally, the whiteboards are visual cues to the members of your team. They will retain important facts like deadlines better when they work on it visually in collaboration with the team.

- For multigenerational teams pair partners within the team (one techy and one not) so participants who have fewer technology skills (normally Baby Boomers) can participate comfortably.
- For all team members, request a page summary to send out to the team.
- For all team members, record the meeting.
- For all team members, set up a poll using feedback questions to make sure everyone has the opportunity to contribute.
- For all meetings, identify trends across the generations and support a balance of several communication styles.
- For all meetings, adapt a policy of camera on, so you can facilitate verbal and nonverbal communication.
- For all meetings, work from an agenda, and set a time limit. The majority of employees struggle to get work done because of the sheer number of communications they receive.
- For all meetings, meet regularly and ask team members to display availability. Different organizations will have different needs, but every organization should have communication guidelines.
- For meeting follow-up, have periodic check-ins (either daily or weekly). A list of check-in questions can help you determine progress, employee focus, employee concerns, and so on. You can even do a periodic emotional check-in to see if your team members are feeling stressed.
- For all meetings, cultivate culture. Share core values and the company's mission and/or visions. Recognize employees publicly. Plan team bonding and networking—remote coffee breaks, achievements like employee-of-the-week, and use icebreakers to start a meeting. A good icebreaker for building relationships with a global team is using a map where individuals can pin their location to answer the question, "where are you from?" This template is shown in Exhibit 8.2. Just seeing where your team calls in from can help others understand the challenge of time zones, especially if you include that information as part of pinning where you are located!

Exhibit 8.2—Zoom Whiteboard: Where Are You From?

Source: Screenshot of Zoom Interface © Zoom Video Communications, Inc., https://www.zoom.com

8.3 *Exercise 1: Evaluate a Recent Meeting*

Learning Objective #3—Share strategies for multigenerational communication issues

Part 1: Investigate Zoom or Teams and discuss the potential whiteboards that you could use at your organization to help improve efficiency, brainstorming, or collaboration.

Part 2: Discuss a recent meeting (either remote or face-to-face) that had some challenges. Discuss one of the challenges. What strategies were used to resolve the communication issue or what strategy should have been used to resolve the communication issue?

Part 3: Considering the diverse communication preferences and technological proficiencies across different generations in the workplace, how can leaders effectively leverage data visualization or communication tools to support better communication in a balanced hybrid work model?

8.4 Data Visualization Techniques to Fill the Gaps

> Everybody needs data literacy, because data is everywhere. It's the new currency, it's the language of the business. We need to be able to speak it.
>
> —Piyanka Jain, speaking with MIT Sloan

It is no surprise that organizations face a rapidly changing landscape of contemporary issues. Effective communication has emerged as a cornerstone for success, partially in the realm of data-driven decision-making. "In a recent survey of analytics leaders, 67% said organizational culture is the biggest barrier to becoming a data-oriented company" (Mayor, 2021, para 8). A data-oriented organization makes strategic decisions based on data; however, "only 20% of analytics insights will deliver business outcomes through 2022 according to Gartner research" (Mayor, 2021, para 3). As organizations strive to capture the power of data to drive innovation and communicate through storytelling, the audience is becoming increasingly diverse. This section delves into the intersection of data visualization and storytelling techniques as dynamic tools for communication, with a focus on the needs of the diverse composition of modern teams.

As workplaces become increasingly diverse in terms of gender, culture, and generational backgrounds, the challenge of effectively communicating data insights to a broad spectrum of team members has become more challenging. Added to this mix is the necessary recommendation for how data are visualized from a DEI point of view. DEI is discussed more thoroughly in Section 8.5. This section explores strategies for crafting visual narratives that resonate with multiple genders, considers cultural barriers, and engages multigenerational cohorts. The point here is to cultivate a climate of technical data analysis, human-centric storytelling, and collaborative decision-making processes that harness the collective intelligence of a diverse team.

Design choice that considers the science behind visual perceptions and cognition is important to communicate effectively. Drawing upon insights from psychology, sociology, and communication theory, this section adopts a user-centric approach to data visualization and narrative construction.

Before starting this section, review some of the current population statistics:

- As of 2020, Baby Boomers are at 18.6%, Generation X is at 34.8%, Millennials are at 38.6%, Generation Z is at 6.1%, and the traditionalist or silent generation is at 2% (Purdue Global, 2020).
- "As of February 2023, women 16 years and over make up 55.4% of all U.S. employees" and "women's wages equal 83.6 percent of men's wages" (Reiners, 2024, para. 15–17).
- The 2015 census data show 56% of Millennials are white, whereas 75% of Baby Boomers are white.

- "Diverse companies have 2.5 times higher cash flow per employee" (Reiners, 2024, para 22).
- Companies that are diverse (gender, race, and culture) are more profitable (Reiners, 2024).

Design Strategies

The following strategies are based on working with a diverse team or presenting to a diverse audience.

Strategy #1—PechaKucha: Plan a Beginning, Middle, and End in 7 Minutes

Emphasize the personal benefit in the introduction concisely so you can quickly get to the major point. Plan to reestablish said personal benefit in the conclusion (McMahon, 2016). Just as important, you need to develop techniques, so the presentation does not drag. A Japanese management style called *PechaKucha* is an approach where you have 20 slides timed at 20 seconds each. The slides automatically advance giving you less than seven minutes to tell your story, and most slides should complement the speaker when vocalizing (Eckfeldt, 2019). Data Visualizations that use charts and graphs need to focus—so automatic zooming or animation might be required.

To effectively connect using the PechaKucha, use these techniques:

1. **Personalized introduction:** Begin with a brief but impactful introduction. Tailor this introduction to resonate with diverse audiences. The introduction does not mean you are introducing yourself. Introduction means sharing personal anecdotes, sharing experiences, using images that make sense to your audience, and using metaphors that fit your audience. All audiences prefer a visualization in context. Test it out before presenting.
2. **Utilize structured storytelling:** Ensure each segment flows seamlessly into the next. Use the CASS framework and keep your storytelling framework universal in design. Be careful with humor. Illustrate the main point clearly. Always show impact on the bottom line.
3. **Visual technique:** Use techniques that resonate, such as (a) simple and clear charts, (b) color considerations, (c) iconography and symbols, (d) infographics, and (e) interactive visualizations for your tech-savvy audience members.
4. **Cultural context in imagery:** Incorporate culturally relevant imagery and references—that is, if you use images, make sure they include diverse backgrounds. Avoid macho sports metaphors.
5. **Accessible design:** Alt tags, color contrast adjustments
6. **Do NOTs:** On occasion, you might be tempted to use a data visualization that makes you look like a technology wizard. Fight this! The sole purpose for data visualizations is to "help you tell stories by curating data into a form easier to understand, highlighting the trends and outliers," . . . and that means . . . "removing the noise from data and highlighting the useful information" (Tableau, 2020, para. 8).

Title: PechaKucha: Visual Storytelling That Celebrates Humanity. Link: https://www.pechakucha.com/

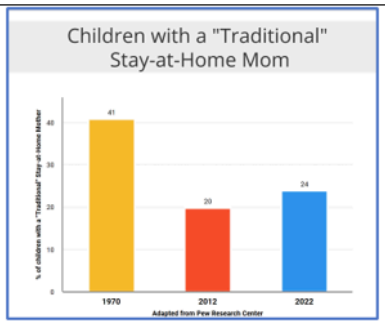
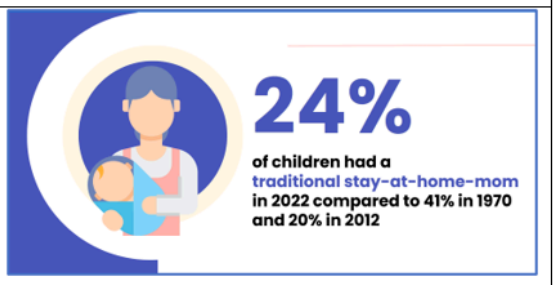
Strategy #2—Get to the Point!

One of my favorite quotes made in the *Storytelling With Data* book is "If you only had a limited amount of time or a single sentence to tell your audience what they need to know, what would you say?" (Knaflic, 2015, p. 39). Mitchell and Deckard have reviewed thesis and final projects for over a decade. Imagine a presenter receives instructions to present

for 15–20 minutes. The student has great visuals sharing the background and challenge or issue at an organization. If you are sitting in the audience still waiting on the recommendation and the presenter is already fifteen minutes into the presentation, you may be so frustrated that you stop listening. And you may be thinking, "Get to the point!" Even visuals can suffer from "getting to the point."

Which is better when you review Figure 8.11? The graphic on the right has a "get-to-the-point" component since the focus is on 24% in 2022.

Figure 8.11—Graphic Design Makes a Difference

Design – Chart Three Points	Design- Huge Point
	

Note: Author Illustrations (2024)

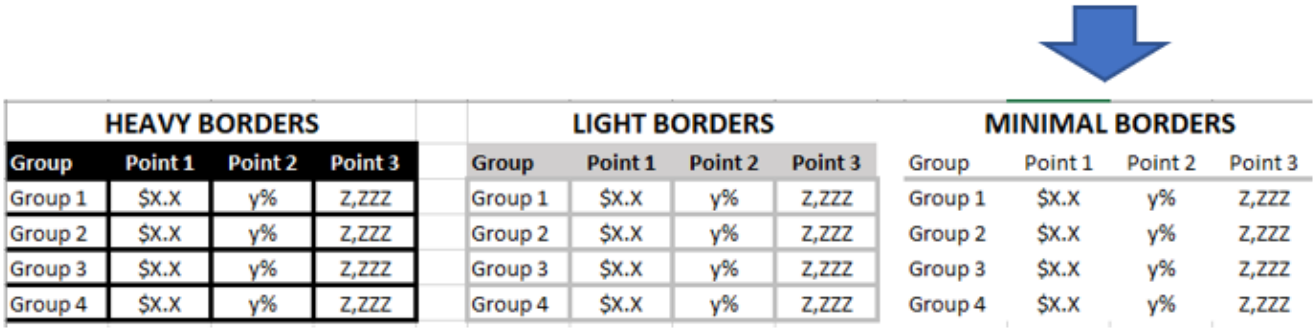
Regardless of gender, cultural, or generational preferences, everyone prefers clear and concise key points. Now look at specific data visualizations.

Strategy #3—Use the Appropriate Data Visualizations

Here are some other key points experienced by the authors. These guidelines apply to presenting to either gender. Consider this section the basics of data visualization techniques using Excel and a few references to Power BI. Keep in mind that previous chapters shared other types of data visualizations (word clouds, infographics, maps, etc.).

1. **Tables:** Do not use tables in a presentation unless you have no choice. If you must use a table, get rid of the borders and grid lines or the audience will focus on the borders and gridlines! The best visual in a large room presentation has minimal borders. See Figure 8.12.

Figure 8.12—Minimal Borders Best for Large Venue



HEAVY BORDERS

Group	Point 1	Point 2	Point 3
Group 1	$X.X	y%	Z,ZZZ
Group 2	$X.X	y%	Z,ZZZ
Group 3	$X.X	y%	Z,ZZZ
Group 4	$X.X	y%	Z,ZZZ

LIGHT BORDERS

Group	Point 1	Point 2	Point 3
Group 1	$X.X	y%	Z,ZZZ
Group 2	$X.X	y%	Z,ZZZ
Group 3	$X.X	y%	Z,ZZZ
Group 4	$X.X	y%	Z,ZZZ

MINIMAL BORDERS

Group	Point 1	Point 2	Point 3
Group 1	$X.X	y%	Z,ZZZ
Group 2	$X.X	y%	Z,ZZZ
Group 3	$X.X	y%	Z,ZZZ
Group 4	$X.X	y%	Z,ZZZ

2. **Heatmaps:** Heatmaps were discussed in earlier chapters but let's consider why this is a good choice for a diverse audience. The appeal of heat maps can vary based on individual preferences, demographics, and cultural backgrounds.

In terms of gender, research suggests that males and females may have different cognitive preferences and visual processing styles, which could impact how they perceive and interpret heat maps.

Generational differences: Baby Boomers, who grew up in a different technological era, may have different levels of familiarity and comfort with data visualization techniques like heat maps compared to millennials, who are often more digitally savvy. Again, individual preferences are most likely to drive their understanding of a heat map. A heat map can be produced in Excel using conditional formatting. Creating a correlation matrix is available in Data Analysis (an add-in to Excel) for the Data table. Then you can set up conditional formatting. Refer back to Chapter 3 (Table 3.16: Heatmap Shows That Board Members and CEOs Are Not on the Same Page) to see the benefits and how easy it is to see patterns.

3. **Scatterplots:** Scatterplots are great for showing the relationship between two things, but they aren't used as much in business, mostly because perhaps folks are not as familiar with them. Scatterplots are much easier to understand if you show the average or modify the chart with a band of color (this is shown in Section 3.7). Another way to show a relationship is with maps (see Section 3.7). Individual preferences and experiences play a significant role in determining which generations in the workforce prefer scatterplots.

Generational differences: Younger generations may be more receptive to scatterplots, but factors such as job role, industry, and personal interests, may play a part in how well younger generations understand them. You would expect the traditionalist generation to be less familiar with scatterplots, but scatterplots with average and customized bands of color can add value for all generations.

4. **Line graphs:** Line graphs are used to plot continuous data. Adding an average to a graph adds value. Line charts are great for long-term trends.

Generational differences: All generations understand a line graph, but not all line graphs are equal. For example, you can create an animated line graph using Flourish. This will appeal to the tech-savvy generations, more specifically the Gen X, Millennials and Gen Z cohort.

5. **Slope graphs:** A slope graph, introduced by Edward Tufte in 1983, is useful when you have two points of comparison, and you want to quickly show increases and decreases. An example would be an annual employee satisfaction survey, and the analyzers want to display the changes quickly between 2023 and 2024.

Generational differences: Traditionalist and Baby Boomers will like slope graphs because it is an easy way to measure change. The tech-savvy cohorts will appreciate the ease of identifying patterns but may feel just as comfortable looking for a pattern in a sparkline in Excel.

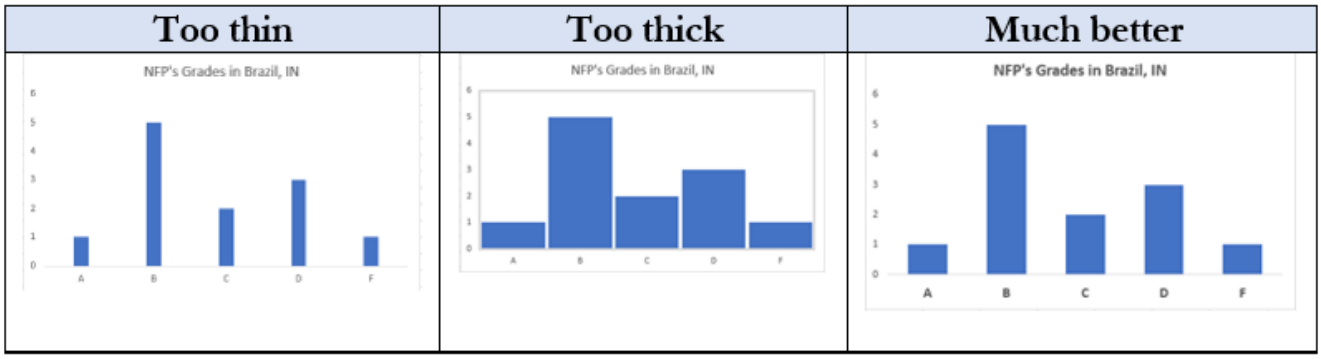
Title: Excel Slope graph. By: Online Training Hub. Template Link: https://www.myonlinetraininghub.com/excel-slopegraphs

6. **Bar Charts:** A bar chart is familiar to your audience. The audience can easily see the biggest and smallest. There is one rule you should never break. Bar charts must have a zero baseline. Although this is discussed in previous chapters, we want to emphasize the importance of using a zero baseline. If you don't use a zero baseline, you misrepresent the data by exaggerating differences and losing the trust of your audience. It violates a visualization principle. If you want to revisit this, see the figures in Chapter 2.

Generational differences: Violation of the zero-baseline principle can end up breaking the trust you work so hard to build with your audience. This is true regardless of the generation. Use a zero baseline. Otherwise, you can introduce significant issues that compromise integrity and effectiveness. Don't lose your credibility!

7. **Column Bar Charts:** The column bar (also vertical bar chart) can contain multiple columns, but consider your audience and what you want them to compare. Too many data series (columns), and it becomes difficult for your audience to visualize and connect to the "insight" you are trying to convey. Use your spacing appropriately. Figure 8.13 is a grading of nonprofits in Brazil, Indiana (this is just for illustration purposes). Besides the spacing, the gridlines were removed, and in the third illustration, the text was increased in size and made bold.

Figure 8.13—Column Bar Chart Comparison



Generational differences: Both Baby Boomers and traditionalists may have been exposed to traditional forms of data presentation (printed!) and have seen column bar charts frequently. Tech-savvy cohorts are used to the column bar charts and find them intuitive.

Is there a better chart? As you review your charts, consider changing the vertical bar chart to a horizontal bar chart because horizontal bar charts are easy to read. Baby Boomers are more accustomed to viewing information in a left-to-right format, making horizontal bar charts more intuitive. Think about how you read—starting at the top left and moving across the screen—this means the eyes can read the category names before the data in a natural process similar to reading.

8. **Horizontal Bar Charts:** As mentioned earlier, a horizontal bar chart is familiar to your audience because the data are organized from the far left corner and across—very similar to the way we read. Horizontal bar charts can have single series or multiple series. They are especially good when the **information labels are too long** to appear clearly on the x-axis of a vertical bar chart. A second thought is to consider if organizing the chart from biggest category to least category will help your audience get the big picture. The reader will see the top horizontal bar first, so this makes sense. However, **if your categories are grouped by age, or donation size, or letter grades, keep the categories in order!** Otherwise, as shown in Figure 8.14, the audience may struggle to make sense of it. So the natural order is best.

Figure 8.14—Horizontal Bar Chart: When Sorting Causes Confusion

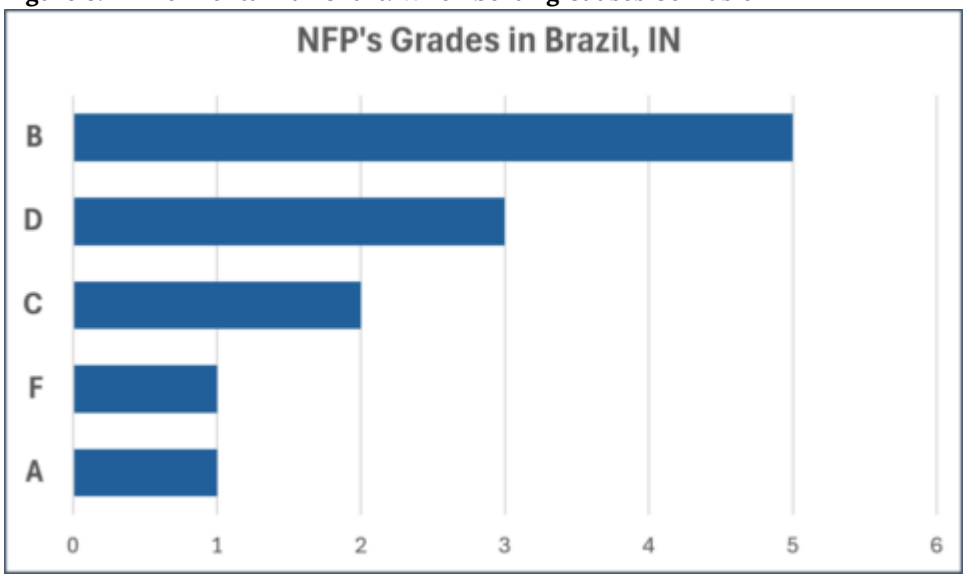
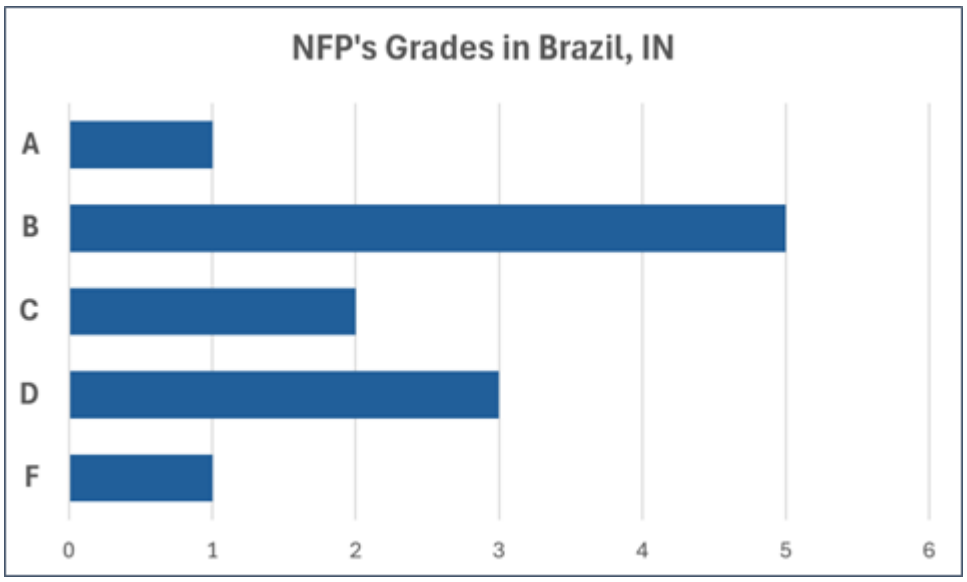


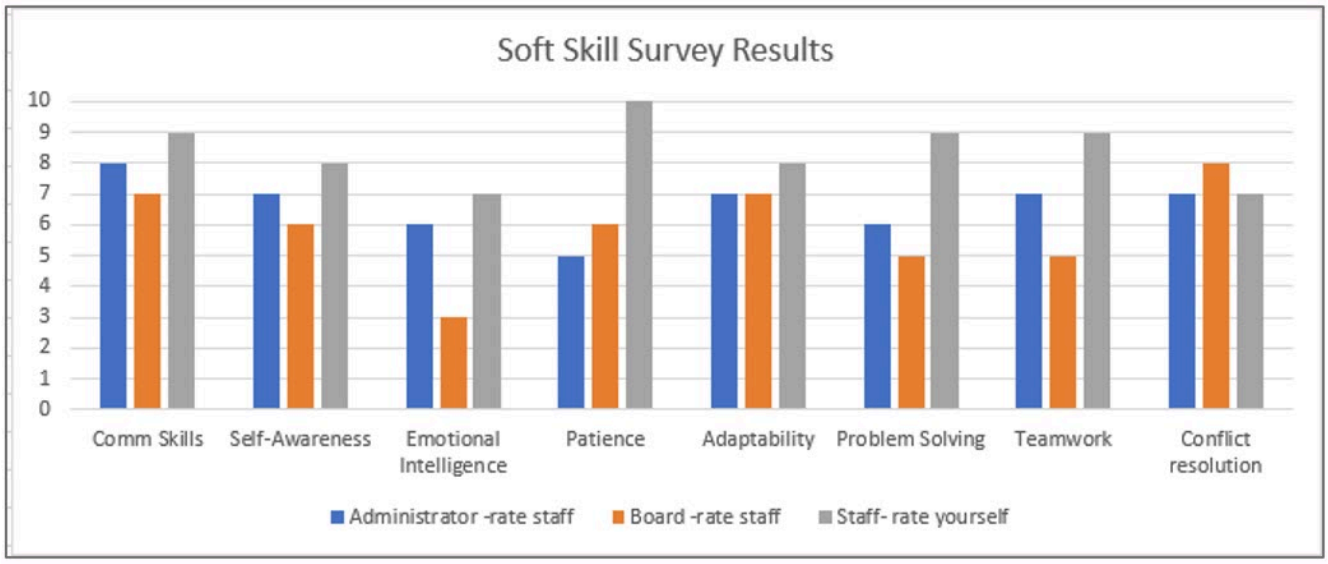
Figure 8.15—Horizontal Bar Chart: Correct Order



Generational difference: Baby Boomers and Traditionalists are accustomed to this format and find it easy to read (not Figure 8.14 though!). Individual preferences can vary within each generational cohort. What is most important is selecting the appropriate chart type for effective communication.

9. **Multiple Series—Column Bar Charts:** Bar charts with multiple series can become crowded. The chart in Figure 8.16 shows an example of a survey where administrators and board members rated the staff and the staff rated themselves. The survey has eight groupings of three variables each. The **ideal number of groupings is a total of 12 bars (or in this case four groupings) for a presentation**, so pick the groupings that are significantly different. For example, there is a big difference between how the administrators and boards saw the staff's patience compared to how the staff see themselves. There is an effective **use of colors** that is consistent across all groupings. The survey ratings are 0–10, and no distortion or exaggeration is apparent.

Figure 8.16—Multiple Series Column Bar Chart



The Soft Skills Survey Results chart could be better though. It could contain a more descriptive title and a date.

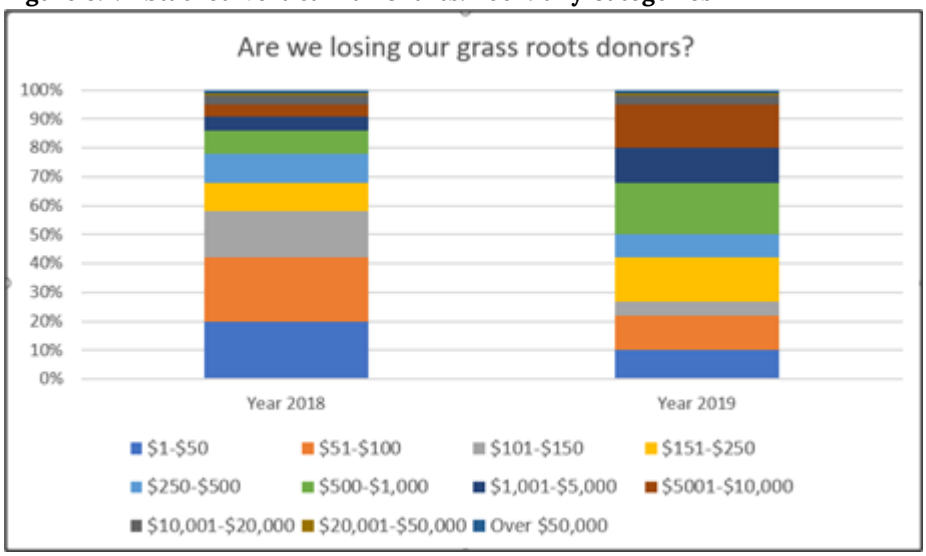
Generation difference: When you start including multiple series of data, Millennials and Generation Z often prefer interactive visualizations. For example, this could be designed so you could compare various combinations of the survey. So comparing administrators to staff might be more important than including the board. In this chart, administrators and board members rated the staff and the staff rated themselves.

10. **Stacked Vertical Bar Charts:** Stacked bar charts are used to show quantity, dollars, or a percentage that adds up to

100%. The illustration shown here is from a not-for-profit and they've grouped their donations by the size of the donations. Although they raised a similar amount of money in 2018 and 2019, the makeup of donors has changed. When you look at this chart, do you think a change in marketing is needed? And when you view Figure 8.17, do you agree with the question, "are we losing our grass roots donors?"

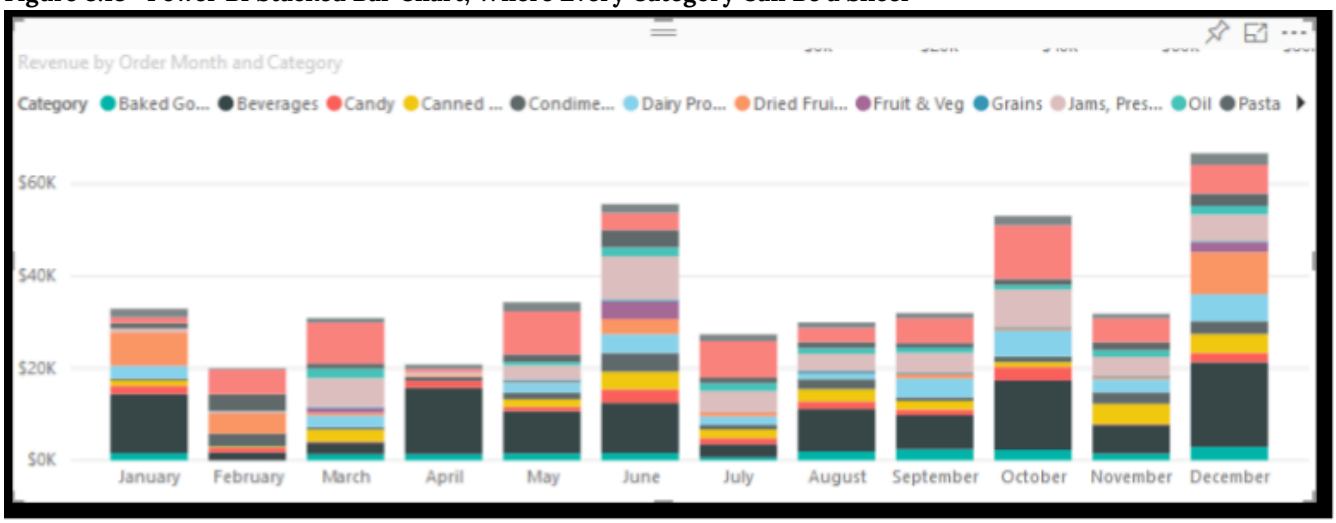
This chart has almost too many categories. According to Vora (2019), the maximum number of bars to show trends or relationships is 12 bars (12 categories). This chart has 11, but you can answer the question by reviewing the chart.

Figure 8.17—Stacked Vertical Bar Charts: Too Many Categories



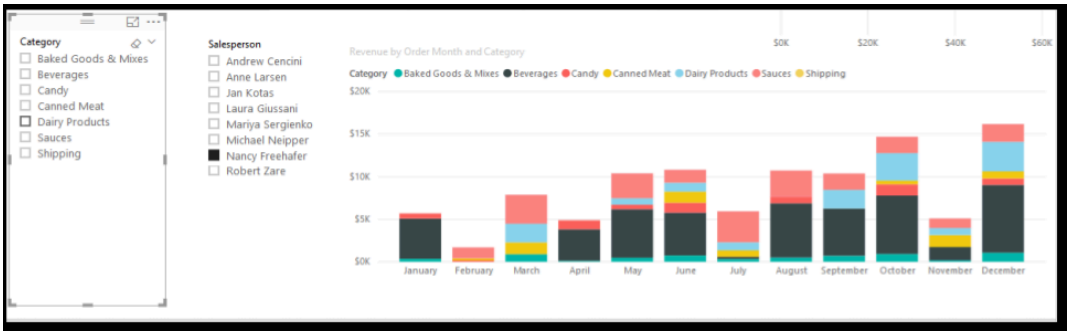
Microsoft Power Business Intelligence (BI), suggests using stacked bar charts if you use slicers. Slicers are a type of visual filter. Once you see the charts, you will understand why! Figure 8.18 does not have a slicer, and these data are very difficult to understand. But if you select an item from the legend (e.g., Candy), it will show the revenue for that item for each month. You can also select multiple products by using the control key to select two or more categories. However, this may not be intuitive to a new user of Power BI.

Figure 8.18—Power BI Stacked Bar Chart, Where Every Category Can Be a Slicer



The next two charts show how adding slicers makes it easier to understand. This is the same dataset as seen in Figure 8.18, but the slicer allows us to filter on the salesperson (in this case, Nancy), and on the category of goods. Slicers are a wonderful tool for helping understand complex data, and showing them with the charts means even novice users of Power BI will know what to do to trigger a filter.

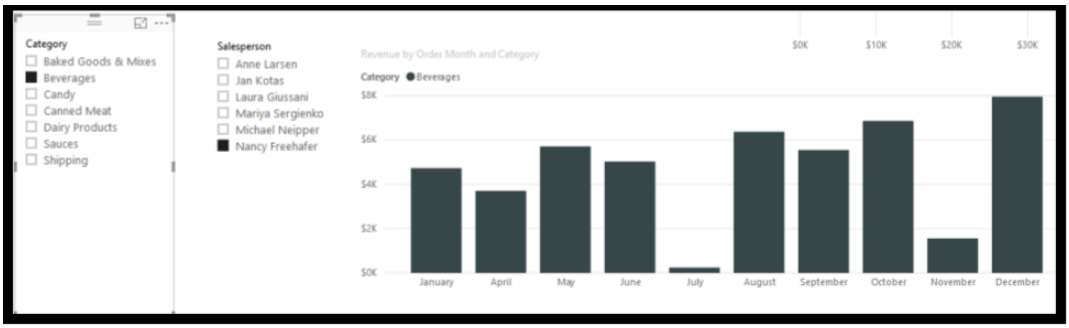
Figure 8.19—Power BI With Salesperson Slicer Selected



Source: Screenshot of Power BI Interface © Microsoft Corporation

Figure 8.20 shows two slicers in play. The slicer for the salesperson (Nancy) and the corresponding dollar in sales of beverages she has sold each month.

Figure 8.20—Power BI With Two Slicers Selected: Salesperson and Beverages



Source: Screenshot of Power BI Interface © Microsoft Corporation

Although this section has introduced several charts and the generational preferences, keep in mind that the data and the story are the key factors when choosing the correct chart. In the Infogram resource (2024), they feature a chart starter with a central question, "What Would You Like to Show?" (para 5). From this central question, are you trying to show a relationship, a comparison, a distribution, or a composition that relates to one time period or a composition that displays the changes over time?

Infogram. (2024). How to choose the right chart for your data. Infogram Blog. https://infogram.com/blog/choose-the-right-chart/

8.2 *Self-Assessment: Data Visualization Techniques*

Learning Objective #4—Identify data visualization techniques and strategies to address gender, cultural, and multigenerational issues

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=578#h5p-37

8.5 Why Is It Important to Consider DEI When Developing Data Visualizations?

> An editorial approach to visualization design requires us to take responsibility to filter out the noise from the signals, by identifying the most valuable, most striking or most relevant dimensions of the subject matter in question.
>
> —Andy Kirk, CoreSignal

In an ever-evolving landscape of data-driven decision-making, one crucial aspect often overlooked is the integration of DEI principles in data visualizations. As global companies strive to harness the power of data to drive innovation and support strategic decisions, it becomes essential to ensure that data visualizations are not only accurate and insightful but also inclusive and representative of diverse perspectives.

The significance of considering DEI can't be overstated. Data visualizations serve as powerful tools for communication. Data visualizations combined with storytelling techniques can influence perceptions, shape narratives, and drive actions. However, without careful consideration of DEI principles, data visualizations risk perpetuating biases, reinforcing stereotypes, and excluding marginalized voices.

This section will focus on best practices for diversity, equity, and inclusion in data visualizations. Although not a complete list, examples concerning DEI principles include people-first labeling, order labels purposefully, how to treat datasets that have missing groups, and care in using icons and shapes.

Best Practice #1—Know Your Biases

Preventing bias creep starts with understanding our own biases. First, critically examine where your data come from, how they were collected, and who benefits / who could potentially be harmed?

Color-Blindness: For example—audience members who are color-blind might not see the insight in the data visualizations because they can't see any difference in the two colors (red and green) you are sharing! To understand deuteranopia, try taking the Ishihara test. The test consists of 38 plates with different patterns, and your score depends on how well you detect a pattern.

Take the Free Color-Blind Test from ColorMax.org. The test is based on the Ishihara Color Plate Test. Link: Color Blind Test | Test Your Color Vision | Ishihara Test for Color Blindness (colormax.org)

If you know you have individuals in the audience who struggle with color-blindness, **avoid the following color combinations** since someone with color-blindness will see them as the same color!

- red and green
- green and brown
- green and blue
- blue and gray
- blue and purple
- green and gray
- green and black

Unconscious Biases: There are several unconscious biases that you may experience.

Unconscious Bias #1: Ageism. In this case, younger employees could consider a person's abilities related to age. An older generation can make assumptions about a younger generation's work habits.

> **How to avoid:** Ask older and younger employees to interact, mentor, and develop positive relationships. Some examples include a younger person mentoring an older employee that struggles with technology. The older employee reciprocates with global experiences related to the organization.

Unconscious Bias #2: Affinity Bias. One example is common during interviews since there is a tendency to hire candidates like you. This unconscious bias can lead to a less diverse workforce.

> **How to avoid:** Adopt clear policies of inclusion with goals for the hiring process.

Unconscious Bias #3: Weight Bias. Weight bias impacts people of all backgrounds. Fellow coworkers may think they work less or assume they are lazy.

> **How to avoid:** Stress the importance of a person's work ability and how well they contribute to the team.

Unconscious Bias #4: Name Bias. Name bias happens when a person forms a perception based on the person's name. For example, an employee in HR may be more willing to interview someone with a name like Thomas Webster than someone named Chung Jen Sheum.

> **How to avoid:** If this is something happening in the HR process, redact the name on the application.

Unconscious Bias #5: People with disabilities. According to the U.S. Bureau of Labor Statistics (2024), 22.5% of people with disabilities were employed (which means 77.5% were not employed). This is an improvement from 2022.

> **How to avoid:** Train your employees about disability bias and if you haven't hired people with disabilities, revise the HR process.

Best Practice #2—Know Your Data Demographics

If your data have marginalized populations, there are several strategies that are considered best practices for DEI data visualizations.

- Use people-first language.

  This could mean "people with disabilities" instead of "disabled people" (Schwabish & Feng, 2021, p. 41).

- Label people, not skin color.

  Use the phrase "black people" instead of "Blacks" (Schwabish & Feng, 2021, p. 41).

- Consider missing groups.

  What groups are not included? Consider adding an explanation and indicate if the data are not representative. Be careful when sorting to see if bias has a way to creep in or cause the audience to interpret a certain way. For example, a well-made infographic developed by Eleonora Nazander showed COVID-19 deaths in the United

States among African Americans. It showed that 12.9% of the population was made up of black people; however, 25% of the black people contracted COVID. Although the infographic included facts, it didn't include any language that explained why. This infographic doesn't use people-first language either. It does show that the death rate among African Americans is about two times higher compared with that of the overall population in the United States, but audience members might be asking "Why?"

Nazander, E. (2022). *Yes*. Tableau Public. http://tiny.cc/ywx2yz

- Consider colors carefully.

In the United States, red and blue represent two political parties. In another country those colors could mean something else.

You are reinforcing stereotypes when you don't consider skin tones. For example, the habit of using baby pink for "girl" and baby blue for "boy" (Schwabish & Feng, 2021, p. 41).

Avoid using incremental color palettes (light to dark) to represent different demographic groups (Schwabish & Feng, 2021, p. 14).

- Don't use "other" as a catchall category.

Recently, a thesis student conducted a survey where a substantial number of participants left a category blank. The student came up with a potential category called "preferred not to answer" as well as "identity not listed in the survey." These are both good examples to use instead of "Other" (Schwabish & Feng, 2021).

- Icons and shapes

Your audience will appreciate icons and shapes to help emphasize the data, but use them with caution. Avoid icons that are stereotypical or discriminatory.

For more information, consider reading the following 44-page report written by Schwabish & Feng (2021). The authors discuss various ways to be more equitable and inclusive with data visualizations. It also includes racial equity in data visualization checklist, and dozens of resources.

Schwabish, J. & Feng, A. (2021). Do No Harm Guide: Applying Equity Awareness in Data Visualization. *Urban Institute*. do-no-harm-guide.pdf (urban.org)

8.5 Exercise 1: Evaluate DEI Violations

Learning Objective #5—Identify how poor visualizations impact diversity, equity, and inclusion

Part 1: Evaluate a current data visualization on Tableau Public for violations of DEI. Take a screenshot of the data visualization and include it with your discussion of any issues you find. Respond to others in class or on the discussion board.

Part 2: Download the Do No Harm Guide funded by the Urban Institute. Explore one of the resources and discuss the strategies to prevent DEI violations. The link to the guide: do-no-harm-guide.pdf (urban.org)

8.6 Remote Burnout—I'm Zoomed Out!

> On a video call the only way to show we're paying attention is to look at the camera. But, in real life, how often do you stand within three feet of a colleague and stare at their face? Probably never.
>
> —L. Fosslien and M. Duffy, How to Combat Zoom Fatigue

The best way to approach this section is to look at the growing number of hours spent in virtual meetings after COVID-19 and what kind of strategies can help make the meeting more productive and engaging. While remote meetings offer flexibility and convenience, they present unique challenges that lead to burnout. The novelty wore off years ago; now, 86% of remote full-time employees report burnout. According to Dr. Gleb Tsipursky (2023), "The fundamental root cause of work from home (WFH) burnout stems from organizations adapting their existing ways of interacting in 'office culture' to remote work" (para. 1). Dr. Tsipursky lists 12 reasons for WFH burnout.

1. Deprivation of our basic human need for meaning and purpose,
2. Deprivation of our basic human need for connection,
3. Deprivation of building trust,
4. Deprivation of mentoring and informal professional development,
5. It's not simply "Zoom fatigue,"
6. Replacing office culture with activities that don't work well (Zoom happy hours, Virtual water cooler),
7. Lack of virtual technology skills,
8. Lack of skills in effective virtual communication,
9. Lack of skills in effective virtual collaboration,
10. Lack of accountability,
11. Poor work-from-home environments,
12. Poor work/life boundaries.

When organizations faced the emergency of COVID, transferring your work model made sense, but now it's time to discuss the strategies and cultural change needed to make the WFH model work long-term.

Strategy #1—Help Your Team Find Meaning, Purpose, and Connection

It is expected that by 2025, 32.6 million Americans will work from home, "which equates to about 22% of the workforce" (Haan, 2023, para. 5). Traditional workspaces must be shaped to support WFH employees. Organizations should be willing to provide the necessary equipment, WIFI support, remote helpdesk support, and organizational strategies for document sharing. As a leader of a virtual team, you should "establish a new norm for how you will work together virtually" (American Management Association, 2020, para. 7). There is no one-size-fits-all approach to motivating productive team interaction. What is (or was) successful for a face-to-face team meeting doesn't always translate well to a virtual meeting. Most organizations used the sink-or-swim model during the COVID-19 pandemic; now it's time to be intentional in your leadership.

Job Craft: According to Amy Wrzesniewski (2020), when employees lost their traditional work experience, they lost their interdependence with others and the relationships that grow as a result of working toward a common purpose. WFH employees often don't feel they belong as part of a collective. Wrzesniewski did an in-depth study of hospital custodians to uncover how the happiest staff were also the most effective custodians. She coined the term *job crafting* to describe how custodial workers would "create the work they wanted to do out of the work they'd been assigned" (Coleman, 2017, para. 6). Wrzesniewski shared several examples of job crafting. One custodian rearranged artwork for the

comatose patient's brain; another custodian researched the chemicals used to clean and figured out which chemicals caused the least irritation to the patient's condition. Neither of these things were part of the job assignment; instead, the employees job-crafted their work to find meaning.

As a virtual team leader, meet individually with your team members and help them to job-craft. Ask questions like:

- ✓What do you miss about working at the office?
- ✓Do you have a workspace at home that is only for work?
- ✓Do you have a morning ritual that you used to enjoy at work (for example, some individuals would gather at the coffeepot in an informal setting upon arrival at work). For example, did you listen to an audiobook on your commute, or listen to a podcast?
- ✓Do you have a routine that differentiates "work" and "not at work"?
- ✓What part of your work gives you joy or helps you find meaning?

Connecting: Fostering connections requires routines to support them when you move from an office that you commute to compared to an office at home. Although we laughed at some of the virtual meeting gaffs (getting caught wearing pajama bottoms, being told you're on mute, children, cats and animals stealing the camera), as leaders we need to find a new norm for the WFH employee. Employees forge connections often cultivating an informal sounding board for ideas during breaks from a face-to-face meeting. How can individuals grow that connection in a virtual meeting?

As a virtual team leader, meet individually with your team members and help them find ways to connect. Ask questions like these:

- ✓What connections do you miss in your WFH office?
- ✓What were the informal communications you enjoyed when you worked at the corporate office?
- ✓Have you kept in communication with another team member?
- ✓Do you connect better in small groups (like breakout rooms)?
- ✓Do you need social interactions before, during or after the meeting?

Strategy #2—Building Trust

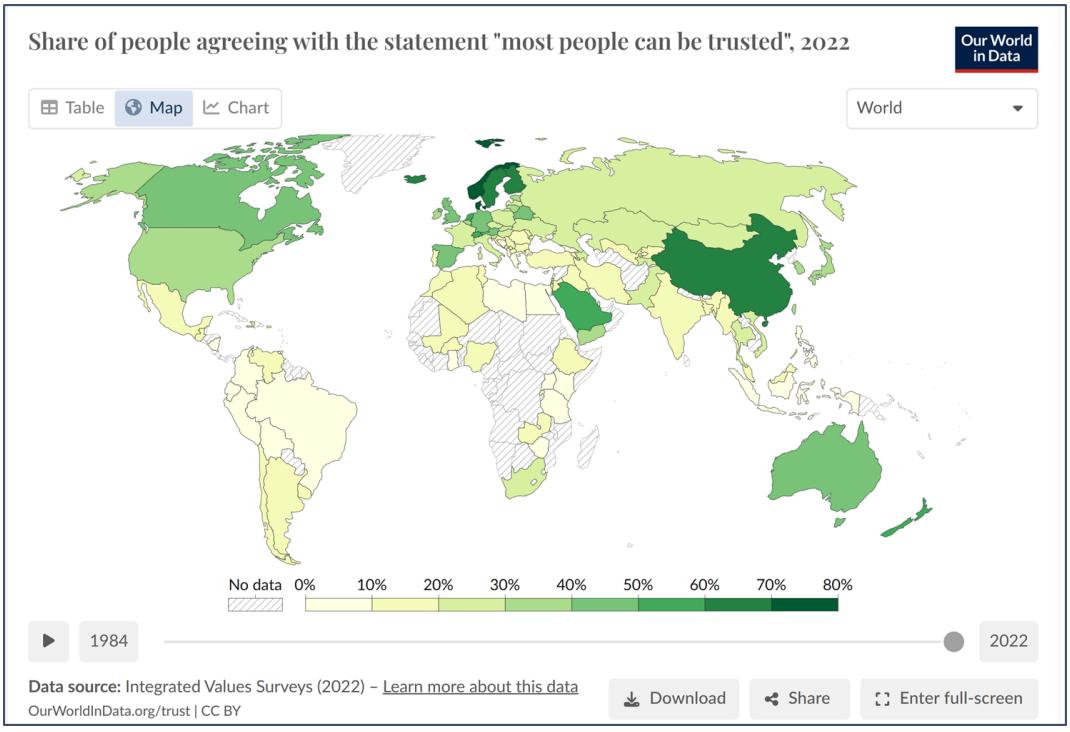
Building trust in a virtual setting is more difficult but it is worth it. According to a study in Harvard Business Review, high-trust companies report "74% less stress, 106% more energy at work, 50% higher productivity, 13% few sick days, 76% more engagement, 29% more satisfaction with their lives, and 40% less burnout" (Zak, 2017, para 2). "Studies have shown linkages between trust and positive outcomes such as employee satisfaction, performance, collaboration, knowledge sharing, successful negotiation, postmerger integration, and favorable joint venture outcomes" (Mansour & Zeheer, 2021, p. 2).

Interpersonal trust and trustworthiness are founded on three key characteristics: ability, benevolence, and integrity. For example, "Leaders who are perceived to be competent are generally viewed as trustworthy" (Mansour & Zeheer, 2021, p. 3). Trust is much more difficult to foster in virtual settings when you collaborate with people (or cultures) you don't know as well. If you are assigned to work together on a project, you assume you can "trust" your team to fully contribute.

Trust is a foundational building block to a successful team and is measured differently in different cultures. A measurement of trust is one of the outcomes of the World Values Survey. This survey is conducted in waves (the seventh wave ended in 2022) and includes 90 countries. The following map is from the seventh wave, and answers the question from the survey, "Generally speaking, would you say that most people in your country can be trusted or that you need to be very careful in dealing with people?" (Haerpfer et al., 2020, Dataset WVS Wave).

In the Our World in Data organization's website, you can find dozens of charts and maps that relate to trust. And the best part? Since this is a longitudinal study, you can see the change from 1984 to 2022 with a click of a button.

Exhibit 8.3—Most People Can Be Trusted



Source: "Share of people agreeing with the statement "most people can be trusted" from Integrated Values Surveys (2022) – with major processing by Our World in Data—CC BY

Our World in Data. (2024). Link: https://ourworldindata.org. Use this resource to see all the charts on trust that can be filtered to compare trust. All charts are open access under CC BY license.

In Exhibit 8.3, one of the examples of a change in trust was in Norway. In 1984, Norwegian citizens who participated in the study agreed 55.5% with the statement "Most people can be trusted," but by 2022, Norway agreed with this statement 72.1%. Virtual teams are becoming more global and although that brings a richer perspective, it can also create new challenges related to culture.

According to Javidan & Zaheer (2021), it is easier to trust others who share commonalities, are from similar cultural and ethnic backgrounds, and share common values and beliefs. These authors built a 3D *Trust Building Process* that has three steps:

1. Discovering the national cultural approaches to trust;
2. Discussing similarities and differences in trust building approaches, and
3. Developing a team-based protocol for trust building.

The entire 3D *Trust Building Process* takes about three hours to complete with your team. The kinds of questions (all from the 3D *Trust Building Process*) include the following:

Discovery:

- ✓How trusting is my national culture?
- ✓What criteria do managers in my culture typically use when deciding whether or not to trust a colleague?
- ✓As an individual, how close am I in my personal approach to trust versus my cultural approach to trust?

Discuss similarities and differences:

- ✓What are the major similarities and differences among members' national cultural approaches?
- ✓What are the big surprises?
- ✓What are the key learnings?

Develop a team-based protocol:

- ✓Develop a trust etiquette (protocol).

✓Consider actions that either enhance or violate trust.
✓If trust is violated, what is the path to rebuild trust (Javidan & Zaheer, 2021, p. 5)?

Strategy #3—Professional Development: Skills for Effective Communication

Set the right tone for professional development for teams and leaders. Invest in professional development training that helps the team perform better with higher levels of productivity. If the team suffers from a lack of trust, start with the 3D Trust Building Process.

How you as a leader can build trust. It starts with a safe environment where your team can express themselves and take risks. Encourage open communication with anonymous surveys. Leaders should establish clear expectations, be open, authentic, and transparent. Leaders should provide regular feedback individually. Be constructive and follow through. The purpose of building trust is for team members to develop tools to prevent premature judgment, miscommunication, and trust-damaging behaviors.

"*Honesty is paramount!*" Have you ever had a leader say "I'll send a follow-up email" but you're still waiting for the follow-up a week later? Or has your team leader promised a short meeting that goes beyond the planned time? As a leader, if you don't honor your commitments, you lose trust.

There is no such thing as overcommunicating. Choose your medium carefully. Sometimes a phone call works better than an email. Watch your tone and make sure your message matches how you say it. A psychology professor, Albert Mehrabian introduced the 7-38-55 rule where 7% of meaning comes from the spoken word, 38% from voice, and 55% through body language. In a virtual environment, set your tone to match your facial features to send a consistent message. Consider these factors to set the tone—word and sentence stress, the right pace, pauses, pitch, intonation. Additionally, foster a culture of communication with regular updates and check-ins. Remove ambiguity and outline what kind of messages should be sent through which mediums.

Don't multitask. When attending meetings, the sound of somebody's keyboard clicking can be disruptive. When you see an email pop up on your screen, fight the desire to answer it immediately. Instead turn off email pop-ups and set your phone to silent.

Know the technology. Know the technology and make sure any documents are shared appropriately. Learn tips on the technology you are using. For example, Zoom has an AI component that will gather a summary of the meeting. Always activate closed captioning. For members of your team—provide professional development to learn how to use the technology. Don't leave them struggling.

Keep it professional. Work from an agenda. Ask team members to always start with their name with each comment. Wear professional clothes and keep good posture (no slouching). Avoid the emoji and funny gifs in your instant messaging platform. Ensure accountability. What is professional for one team may be different for another team.

Use prereadings and prerecorded videos. If team members are international, what fatigue busting strategies could be used? Include prereadings or even prerecorded video sections by the team leads that can be disseminated prior to the meetings to help keep the message on track, and time spent in the meeting "familiarizing" the team with the material to keep the meetings shorter. For international team members, sharing information to review prior will help those who need more time to digest the information.

Strategy #4—Collaboration and Accountability

No one likes to work on a team where the leader does not consider time zone differences, address language barriers, or face tardy or absent team members because they were confused on the time. Policies that indicate the common language, the use of translators and closed captioning, and clear guidelines for scheduled meetings are necessary. Provide

tools like a time zone converter and use meeting reminders. Both collaboration and accountability are necessary for a productive and engaged team. And teams work better if each individual team member leverages their strengths and knows they will be held accountable.

Collaboration benefits from knowing your strengths: One of the ways to increase collaboration is to provide professional development using CliftonStrengths Assessment to discover individual team member's strengths. The assessment takes about 45 minutes and has 177 questions in English (you only have 20 seconds to answer each question). If your proficiency in English is a barrier, you can contact Gallup, and they will turn the timer off. After taking the assessment, Gallop provides a Strengths Insight Guide report. As you review the report, highlight the statements that seem to describe you.

The assessment can be followed up by watching the CliftonStrengths Theme Descriptions on YouTube to get a short (under 2 minutes) message about each strength. For example, assume your top strength is **Achiever**. What does that mean for your team? "Having someone with dominant **Achiever** on your team means you have a natural pacesetter. They derive joy in doing and can help other people accomplish more" (Clifton Strengths Theme Description—Achiever Strength, 2020, Video 1). Achievers also like visualization for keeping track of progress. Learning the strengths of your team is just as important as learning your own strengths. Leveraging your top strength(s) makes you more productive and you will feel more accomplished.

Gallop. (2020, Aug 20). *CliftonStrengths Theme Descriptions—34 Videos* (one for each strength). [Video]. YouTube. https://www.youtube.com/playlist?list=PLxDaK7wIyw950tOSJwr0LWc3MkUkBSaiA

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=578#oembed-2

Accountability: Accountability needs defined for your team. Start by identifying the specific metrics you want to track. For example, missed deadlines, project completion rates, new products launched, might be some of the areas that you develop key performance indicators (KPIs). Create SMART goals (specific, measurable, achievable, relevant, and time-bound) first for your team and then individually for the members of the team.

Examples of SMART goals for a Dev Opps team could be:

- ✓The team will develop the code to support 10 new products this quarter.
- ✓The team will clear up 50% of the work request (helpdesk) tickets this quarter.
- ✓The team will explore at least two potential partnerships (outlets) to determine if their production facility could be used for our company's order overload.

Now create clear and achievable goals for each employee. A big part of assigning tasks in this case will depend on coding skills. It will be up to the leader to regularly assess progress toward the goals to gauge individual accountability. Holding your team accountable should also include regular performance reviews to discuss achievements, challenges, and areas that need improvement.

Strategy #5—Overcome Zoom Fatigue

Zoom fatigue is a real concern. Before the COVID-19 pandemic, researchers indicated that intense computer usage was not healthy for employees. Zoom (or any virtual platform) adds a new layer to the complexity.

Plain Backgrounds: What's the correct number of virtual meetings for you and your team(s) to have each week? An excess number of virtual team meetings and expect your team to start zoning out. As you meet with a team of 10, it's like meeting in 10 rooms at once. Your eyes see the furniture, plants, collection of comic books, collection of historical

figures, and so on. The brain has to process all these cues at once. There are a couple suggestions: (a) turn off the camera unless you are speaking, and (b) ask everyone to use a plain background.

Frequent Breaks and length of meeting: Consider shorter meetings and frequent minibreaks with some scheduled blocks of time between meetings. Require teams to stand up, get a cup of coffee, or cold drink.

Social Virtual Meetings should be optional: Not all team members will want to socialize virtually after a long day of required virtual meetings. Keep social meetings optional and feature your best facilitators. A poorly run "gather around the virtual cooler" doesn't work.

If you have a budget, try one of these:

❖Send your team a s'mores kit (a tea candle, a toothpick, graham crackers, chocolate, and marshmallows) by mail and have your best facilitator organize some virtual campfire activities.

❖Do a pet event. Send a goodie bag to the pet and pet owners.

❖Participate in online games like remote work bingo, a virtual escape room, or web games.

❖Learn skills together. Do a creative writing workshop, cooking lesson, coding bootcamp, or even self-defense class. You can all become part of a class at Udemy, or find other online classes.

❖If your team appreciates music, host a virtual jam session and invite your team members to bring their instruments. If you have singers, try a karaoke song or two that everyone knows the chorus to (e.g., "I Will Survive" by Gloria Gaynor, "Respect" by Aretha Franklin, "Total Eclipse of the Heart" by Bonnie Tyler).

Strategy #6—Visualization Tips for Presenting in Zoom

Part of Zoom burnout can be the distraction of this medium. There are several visualization tips for Zoom that can reduce Zoom fatigue as well as connect with your audience. Use PowerPoint slides to articulate your insight with a headline. Use color as a technique so a specific color follows an insight throughout the presentation. Limit the number of colors so your audience can follow the visual cue. If you want to use images, select images that match your audience's expertise and set the story's tone. A more technical audience can handle complex visualizations and drilling (or filtering). A general audience will appreciate simple bar graphs. Even if you meet daily, remember that data without a story lack impact. And if you are creating the visuals for the Zoom meeting, don't try to show ALL of it.

Follow these three tips before you even start visualizing the data:

- Purpose: What am I trying to achieve with the data? Do the data I've chosen move the story forward?
- Expectations: Who is my audience, and what level of data detail will they expect?
- Takeaway: What is the key takeaway for my audience? If you had to pick one data point, what would it be?

Follow these Zoom tips to reduce distraction:

- Have you ever said, "You're muted" in a Zoom meeting? Use the space bar to mute and unmute your microphone.
- Have you struggled using breakout rooms? Use the answer to a poll question to organize the breakout rooms.
- Have you wished for an organized summary of the meeting? Try Zoom's new AI Summary feature. You can set it so that only meeting hosts receive a summary. Or if you prefer, try the note feature, which can be shared with other collaborators while in a meeting.

8.7 Leadership and Communication

Great leaders communicate and great communicators lead.

—Simon Sinek, English American author and inspirational speaker

Putting It All Together Through the Lens of Leadership

This text has thrown a lot your way in the way of data visualization and storytelling. These are powerful communication tools that help you reach your audience. Remember that reaching the audience with your information, data, pitches, and ideas remains largely our chief goal as communicators and leaders. To that pursuit, we've given you tips and techniques designed to offer everything from powerful storytelling narratives noted by Christopher Booker to instructions on Power BI, the powerful tool designed to foster better interaction with data visualization. We've given you a lot.

It would be fair to admit at this point that you may be tired and struggling a bit to determine how specifically all these things fit together for your individual or organizational needs. We've discussed information overload in Chapter 1, and you may be feeling a bit of that, just as charting next steps and pathways seems out of reach. Despite this feeling, good leadership often means a bit of fatigue as you strategically make decisions about what to include or not include in your communication, data visualization, and storytelling. It will be up to you to plot the next steps to help your group or organization. This section is designed to get you thinking about items we've discussed in the text while also helping you to plot a path forward.

Leadership in Data Visualization Projects

Leaders make complex decisions based on data. Those data can include considerations for what choices are affordable, available, efficient, or prioritized. If you ask any leader what choices are off the table, very often they will rely on both data and experience to narrow available choices. Similarly, leaders make choices about communication within data visualization based on what they know regarding their team. That said, there are expectations of the team for their leaders. What does your team expect from you, the leader? Does your team know you well enough, that they model the storytelling and data visualizations you expect to make decisions?

Below is a leadership in data visualization checklist for leaders to consider:

1. Leadership is responsible for setting the **vision and goals** for the data visualization project. This involves defining what insights the organization aims to gain from the data and how visualization can help achieve those objectives. How is your data visualization displaying your vision and goals?

    Hint: If you struggle to identify the vision and goals from your own knowledge or data visualization, it is likely an ideal time to clarify the message.

2. Leaders deal with **resource allocation**, including budget, time, and personnel, to ensure the success of the project. They make strategic decisions about which tools, technologies, and talents are needed for effective data visualization. What does your project require among resources? What is already available and what is feasible for you to manage?

    Hint: This could be a great opportunity to gather the team and think exhaustively about which resources are needed or could be used. This may expose you to resources you've overlooked or not often considered. Also, we wrote this text to be accessible for teams just like yours. Feel free to distribute and share the wealth of the resources discussed.

3. Leadership **coordinates the efforts** of a multitude of teams involved in data visualization projects including authors, data analysts, designers, and domain experts. Effective leadership ensures clear communication, collaboration, and alignment of efforts toward project goals. What strategic steps have been taken to align the team?

    Hint: Many teams consider a team or project charter for these kinds of opportunities. These charters often discuss project scope, objectives, stakeholders, roles and responsibilities by name, timelines and

milestones, budget, resources, risks and assumptions, communication plans, quality standards, and approval.

Note: Leaders determine who in the information flow will receive what information/visuals. In a heavily matrixed organization, at times, data can be micromanaged to the point where some roles are excluded from the flow of critical data.

4. Leaders **engage with audiences** across the organization, including executives, managers, and end-users, to understand their requirements, gather feedback, and ensure that the visualizations meet their needs. When necessary, leaders help adjust the content to be even more pertinent based on any feedback.

Hint: While many authors may contribute to a message, a strong leader doing quality control with their feedback can see a general picture that other contributors may ignore. Even when such duties have been delegated, leaders are responsible for the final product.

5. Leadership **identifies and mitigates risks** associated with data visualization projects, such as data quality issues, technical challenges, or resistance to change. They develop contingency plans and navigate obstacles to keep the project on track.

Hint: Does identifying and mitigating risks sound familiar? You likely noticed that the last two items in the checklist seemed quite similar. Many leadership roles are repetitive. Even with all that duplication, mistakes still happen.

6. Leaders make **informed decisions** based on data insights derived from visualizations. They use visualizations to gain actionable intelligence, drive strategic initiatives, and solve business problems effectively.

Hint: This entire book has been devoted to making choices, data, and ideas clearer in communication. As a leader considering your data visualization, consider whether you find it clear enough to decide from your perspective. If you did not have your existing knowledge about the project, would you still understand it? Not sure? Go for a second opinion and be sure to listen carefully.

7. Leadership **facilitates change management efforts** associated with adopting data-driven decision-making processes enabled by visualization. They promote a culture of data literacy, encourage adoption of visualization tools, and champion best practices across the organization.

Hint: If you are not leaning into making data-driven decisions, why should anyone else? Always remember that the culture you are creating and supporting with your decision-making will be modeled on by your team. If you utilize strong data visualization in your ideas and decision-making, so will they.

8. Leaders ensure the **quality and accuracy** of visualizations by establishing standards, conducting reviews, and providing guidance to the team. They enforce best practices in data visualization design and storytelling to enhance comprehension and usability.

Hint: A little quality and accuracy assurance can go a long way to ensure the kind of audience-centered deliverables that are key to your work.

9. Leadership fosters a culture of **continuous improvement and flexibility** by monitoring key performance indicators (KPIs), soliciting feedback, and iterating on visualizations based on user experiences and evolving business needs.

Hint: If you display an attitude that is unwilling to change, it will permeate your organizational culture and not assist you in reaching goals. Keep in mind, data visualization trends today will continue to evolve as practice is influenced by audience and market needs. How will you monitor those trends, make space for learning new best practices, and continuously evolve?

This is not a one-and-done process. Instead, key parts of the checklist for leading with data visualization may overlap, be taken out of sequence, or simply exist in whole or part while complementing one another.

Leading teams. In this video, Simon Sinek discusses the traits of successful team members. He also offers some key insight into traditional leadership positions that don't hold up in tough situations. As you evaluate, consider how these observations intersect with your own experiences.

Sinek, S. (2020). *What Makes the Highest Performing Teams in the World.* [Video]. YouTube.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://pressbooks.palni.org/leveragingdatavisualizationtocommunicateeffectively/?p=578#oembed-3

Reinforcing a Data-Driven Culture

Managing a data-driven culture involves fostering an environment where data are valued, accessible, and utilized effectively to drive decision-making and innovation. Leadership must champion the importance of data-driven decision-making, particularly as evidenced in the steps outlined in the leading with data visualization checklist. This involves not only advocating for the use of data but also demonstrating their value through actions and decisions. It also involves clearly defining the objectives of becoming data-driven to answer the "So what?" questions that often come from organizational members. What specific goals do you want to achieve? This could include improving operational efficiency, enhancing customer satisfaction, or driving innovation.

The growth in available data has certainly not been matched by our ability to consume this information. This is why it is important to create key internal policies to help govern decision-making. Establish data governance policies and procedures to ensure data quality, security, and compliance. This involves defining roles and responsibilities, data standards, and protocols for data collection, storage, and usage. It also helps to limit constant data pursuits that can sometimes replace organizational decision-making with a cycle of analysis paralysis. More than once, we've all been in a meeting that seeks to replace actual decisions with a desire to collect just a bit more data. Remember that leadership means understanding decision-making opportunities and reacting appropriately when prompted, even if not all the available data have been collected. None of these situations are top-down or embody a one-size fits all approach, but rather exist in a way that requires key decision-making as appropriate.

Additionally, to support a data-driven culture, it is important to invest in the necessary infrastructure and technologies. This may include data warehouses, analytics tools, and data visualization platforms, such as much of the software and tools we've discussed in this text. It is important to ensure that these tools are accessible and user-friendly for organizational members at all levels. It may also involve asking for expertise from among those who are knowledgeable about such things. It may also mean investing in data literacy and other forms of training. This includes teaching employees how to interpret and analyze data, as well as how to use data tools effectively in their roles. A good leader will encourage collaboration between data specialists and other teams within the organization. Data-driven decision-making is not just the responsibility of the data team; it should involve input from stakeholders across the organization.

Reinforcing a data-driven culture. This helpful article from B Eye at LinkedIn further discusses how to support data-driven cultures in organizations. It also notes some key metrics happening in the organizational marketplace that make supporting data-driven cultures so important.

B Eye: Pulse (2023, Aug 14). How to Build a Data-Driven Culture in Your Organization. *LinkedIn*. How to Build a Data-Driven Culture in Your Organization (linkedin.com)

Ethical Considerations While Leading With Data Visualization

As a leader managing data, it is very important to remember that behind every data visualization are humans receiving information or being represented in the findings. There is much to consider when it comes to managing ethics and data

visualization, including data privacy, precision, diversity, and transparency. Figure 8.21 highlights some of those key considerations that leaders should consider, and Section 8.5 can be reviewed for DEI best practices.

Figure 8.21—Ethical Considerations in Data Visualization

Note: Author Illustration (2024)

As a leader, it may be helpful to empower a team to regularly evaluate these ethical dimensions. Such teams can meet periodically and answer key questions:

1. How is data privacy being protected?
2. Are data being portrayed accurately and truthfully?
3. Are messages inclusive and appropriate for the audience?
4. Are clear explanations available on where data are sourced? Can most audience members locate this key information?

The answers to these questions may not be readily available or easy to identify. Still, the fact that you are thinking

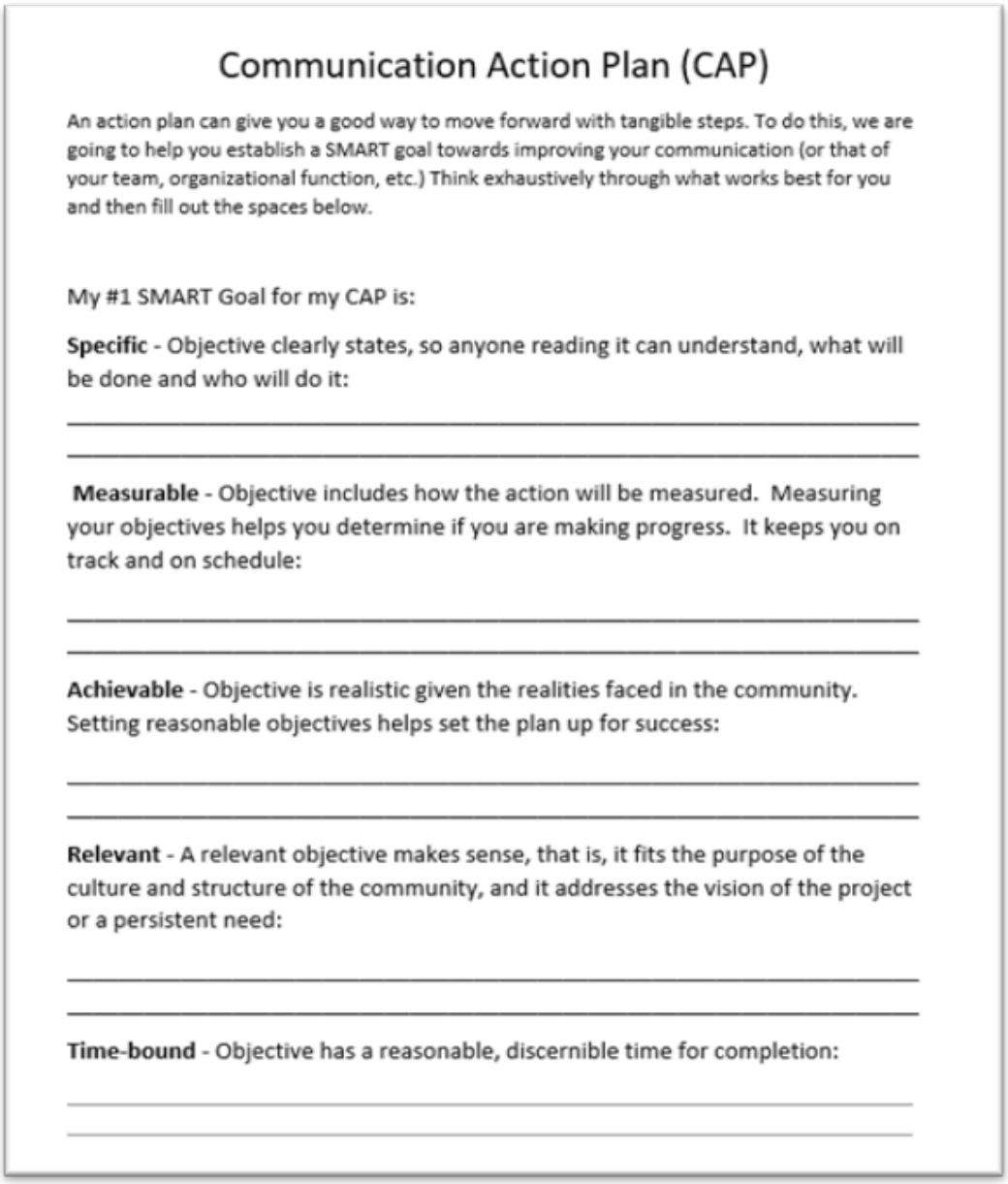
through these possibilities demonstrates ethical leadership in data visualization and that further supports your overall credibility.

Communication Action Plans as Part of Your Strategy

Now that you have thought about your leadership and communication overall, along with considering the many tools within this text, you may find it helpful to develop a strategy in which you seek to put these good ideas and tools to work. A Communication Action Plan (CAP) is an effective way to do just that. We've seen many communicators implement real change in their leadership styles by adopting this strategy to implement change.

A CAP serves as a written plan for an individual, a team, or an organization. CAPs do this by adopting SMART goals. SMART identifies goals that are **s**trategic, **m**easurable, **a**ttainable, **r**elevant, and **t**ime-bound. Using these SMART goals through such a strategy as the CAP allows the user to identify potential change, consider how best to implement, and then hold the process accountable.

Exhibit 8.4—Communication Action Plan (CAP)



Communication Action Plan (CAP)

An action plan can give you a good way to move forward with tangible steps. To do this, we are going to help you establish a SMART goal towards improving your communication (or that of your team, organizational function, etc.) Think exhaustively through what works best for you and then fill out the spaces below.

My #1 SMART Goal for my CAP is:

Specific - Objective clearly states, so anyone reading it can understand, what will be done and who will do it:

_____

_____

Measurable - Objective includes how the action will be measured. Measuring your objectives helps you determine if you are making progress. It keeps you on track and on schedule:

_____

_____

Achievable - Objective is realistic given the realities faced in the community. Setting reasonable objectives helps set the plan up for success:

_____

_____

Relevant - A relevant objective makes sense, that is, it fits the purpose of the culture and structure of the community, and it addresses the vision of the project or a persistent need:

_____

_____

Time-bound - Objective has a reasonable, discernible time for completion:

_____

_____

Note: Author Illustration (2024)

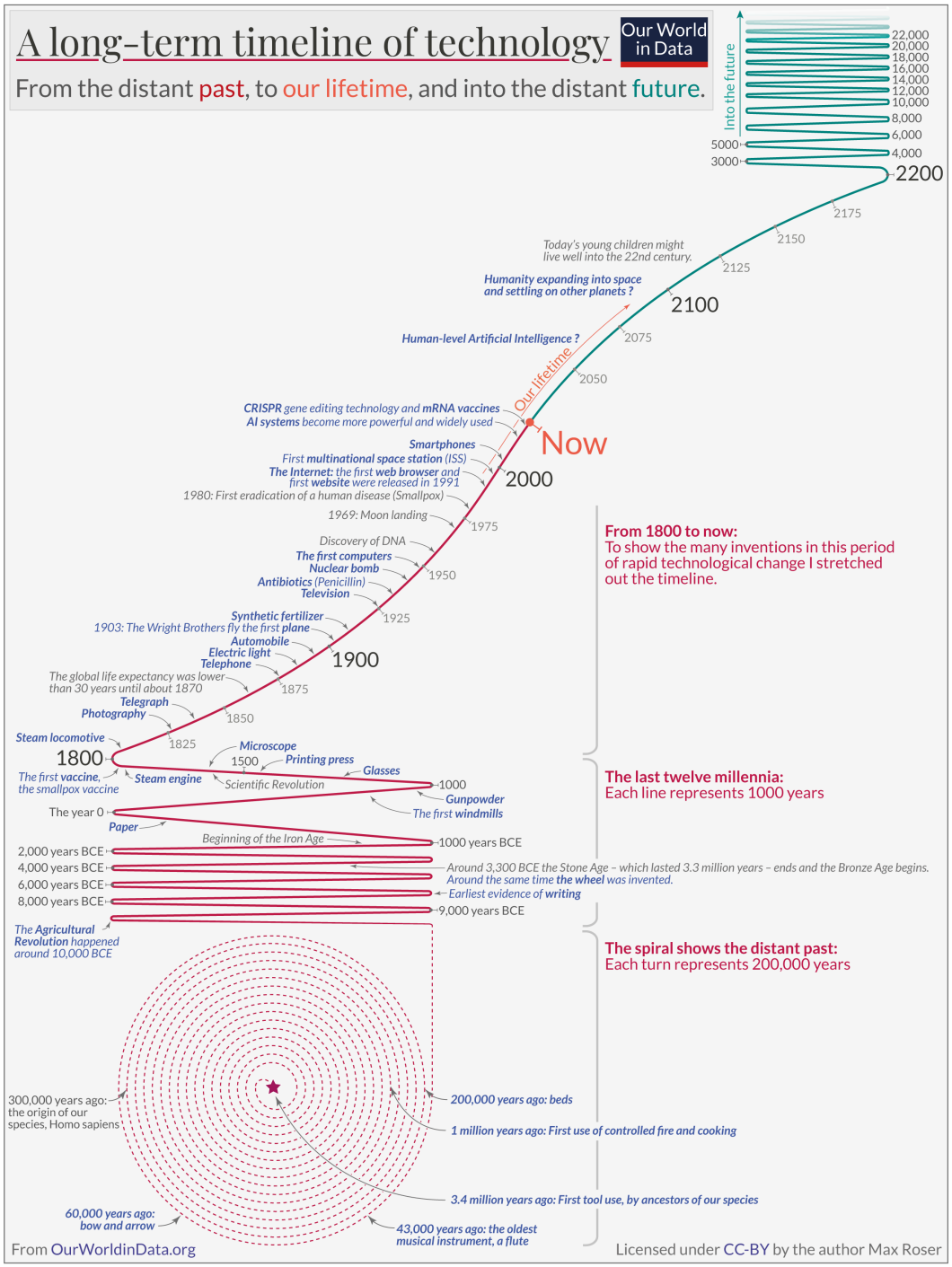
Using a CAP is not exclusive to just a one-time implementation. CAPs should be built into your schedule and allow you to regularly assess how change can be made. If you consider exhaustively the tools in this book, you could go chapter by chapter and assess what new tools or techniques are most helpful and set several CAPs to commence in the coming days and months. This regular process of deep consideration for what works well aligns with the checklist of leadership components discussed at the start of this chapter. It also demonstrates an easy way for leaders to do the heavy lifting of making change in their individual and organizational communication.

Another technique is to set aside an hour each week for your team to explore new software (or the nuances of existing software), new techniques, or research. This type of practice moves you toward a learning culture, which is given credit for increased employee engagement, setting a foundation for a growth mindset, improving creativity and motivation, and cultivating leadership and emotional intelligence. Just keeping pace with rapidly changing technology is a challenge.

Max Roser (2023) shared the change in technology, from the distant past, and into the distant future at Our World in Data. According to Roser, "In addition to this trend towards increasingly rapid innovation, . . . technology has become

increasingly powerful. While our ancestors wielded stone tools, we are building globe-spanning AI systems and technologies that can edit our genes" (para. 20). Follow the link connected to Figure 8.22 to see details of just how much has changed!

Figure 8.22—A Long-Term Timeline of Technology



Source: "A *long-term timeline of technology*" *by Max Roser (2023) at Our World in Data—CC BY*

8.7 Exercise 1: *Identifying Leadership Steps for Data Visualization*

Learning Objective #1—Identify competing ways to influence the global organization

Please read the case and identify the elements of leadership and communication that may assist you in developing responses.

Bryan leads a team, and he feels like he is not getting results. New to the organization and this particular team, he repeatedly feels disappointed; the meetings appear less than productive, even to him and his usual laid-back ways. As he often tells anyone who will listen, the previous organization he led operated very differently with productive close-knit meetings. With this current team, Bryan observes disengaged team members, decisions driven by anecdotes or opinions, and lots of directionless discussions. In the last three meetings alone, not one single person had presented any sort of evidence to support the arguments they were making, although opinions ran high.

The start of the meetings usually involves more than a few minutes trying to figure out who set up the Zoom link, who will be joining remotely, and where to position the monitor for those in the virtual room to be able to see their hybrid teammates. Several accompanying technology issues usually contribute to this process. Repeatedly team members complain that they'd like to better understand new technology and software but are not sure where to turn next. No training or development dollars have been allocated for such a purpose, and in a recent data download, it was revealed that the team had no way to analyze the information they had received in a key business quarter. After a frustrating period of outsourcing the information with key customer data, the group finally gave up hope of understanding any of it and returned to the default decision-making of anecdote and opinion, to which they were most accustomed.

1. What is Bryan and his team doing wrong, if anything?
2. What initial steps, based on this chapter or the text, do you think assist them in addressing their management of data?
3. How much responsibility does Bryan have for the present situation faced by the team? What should he be doing, specifically?

Chapter 8 Summary

This chapter delves into the multifaceted nature of communication issues, exploring them through the lenses of gender, culture, multigenerational dynamics, and DEI topics. It underscores the importance of adopting best practices such as people-first labeling, purposeful ordering of labels, considering missing groups, avoiding stereotyping, and using appropriate icons and shapes. The authors highlight strategies used by global leaders to foster effective communication across these diverse groups, emphasizing the role of leadership in mitigating burnout especially in a virtual meeting.

Effective communication requires a nuanced understanding of audience dynamics, cultural subtleties, and cognitive biases. By equipping readers with these insights, the authors aim to enable the use of data visualizations as powerful tools for driving meaningful dialogue and fostering inclusivity.

Gender communication issues are complex and deeply ingrained in societal norms, influencing aspects like commu-

nication styles, occupational choices, emotional expression, and leadership styles. Understanding and challenging these gender tendencies can dismantle stereotypes and promote inclusivity. These tendencies are not fixed, are socially constructed, and vary across cultures.

The rise of global business and the pandemic-induced shift to remote work have heightened the need for cross-cultural communication. Upwork's survey of U.S. hiring managers reveals significant changes in management practices due to the pandemic, particularly in team meetings and internal communication. This shift underscores the importance of training in cross-cultural communication to navigate the diverse and globalized work environment effectively.

Company culture varies significantly between large corporations and smaller organizations. In large established companies, leadership is held by the Baby Boomer generation, whereas Millennials and Gen Z are more prominent in startups. Nonprofits typically feature a mix of generations in their leadership. The authors note that a toxic company culture, characterized by low engagement and high turnover, often arises when generational values clash. Multigenerational workforces add another layer of complexity to organizational communication.

This chapter also explores the challenges and strategies of communicating data insights to a diverse audience. Effective data visualization and storytelling are crucial in a data-driven organization, but organizational culture often impedes the full utilization of analytics. The integration of DEI principles in data visualization is essential to avoid perpetuating biases and to ensure that all voices are represented. Key factors that contribute to burnout stemming from remote working from home (WFH) are discussed and strategies to address them are provided.

The authors conclude both the chapter and the textbook by emphasizing the importance of data visualization and storytelling as communication tools. The authors acknowledge the potential for information overload and encourage readers to strategically integrate the discussed techniques to enhance your own communication and leadership efforts.

Chapter 8 Case: Cross-Cultural Leadership and Communication in a Global Tech Firm

Introduction

You are Maria, a senior project manager at Global Tech Options (GTO), a leading technology firm with offices in North America, Europe, Asia, and Africa. GTO has recently embarked on a major initiative to develop a new AI-driven data analytics platform. This project involves collaboration across multiple departments and geographic locations, making effective communication and leadership crucial to its success. As the project leader, you must navigate gender, cultural, and generational differences while integrating principles of DEI into your communication strategies.

GTO has always prided itself on innovation and inclusivity. However, recent employee feedback highlighted several communication challenges, particularly related to cross-cultural and multigenerational interactions. These challenges include misunderstandings during virtual meetings, stereotyping, and a lack of engagement from younger employees. There is a growing concern about burnout from work-from-home (WFH) remote workers, especially those from marginalized groups. WFH workers have expressed concerns that work at the office employees don't seem to trust WFH workers to complete their work.

To address these issues, the company's executive board has tasked you with developing a comprehensive communication strategy that incorporates best practices for gender, cultural, and generational inclusivity. Your strategy should also include data visualization techniques to enhance understanding and engagement during presentations. They also want you to research Our World in Data to see if there is a difference in trust as part of a culture from the four locations. They also want you to create a table using The Culture Factor Group's Country Comparison Tool. Use the Countries tab

to select North America, Europe, Asia, and Africa. Look for Cultural Dimensions Related to Communication for the four countries.

Country Comparison Tool website. Link: https://www.theculturefactor.com/country-comparison-tool

- Step 1 – Go to link provided: https://www.theculturefactor.com/country-comparison-tool
- Step 2 – Select 'Resources' in the main menu
- Step 3 – Choose Country Comparison Tool
- Step 4 – Put in the countries at the drop down menu, following the steps online.

Personal Observations

❖You notice that male team members tend to dominate discussions, often interrupting their female colleagues.

❖All meetings are set to accommodate time zones in Indianapolis.

❖Your team includes Baby Boomers, Gen X, Millennials, and Gen Z employees. Millennials and Gen Z employees embrace Slack. Baby Boomers don't quite get how it helps, and Gen X employees feel Gen Z makes it too social.

❖The data visualizations being used at meetings are based on the premise of red=warning, yellow=monitor, and green=no issue. Several visualizations don't use people's first language.

❖The employee turnover is twice as high for WFH remote employees than for work from office employees.

❖Several employees complain about difficulty understanding their Asian and African counterparts in virtual meetings even though all meetings are conducted in English. Other issues include lack of focus, stereotyping, and lack of engagement from Asian and African counterparts.

❖Presentations seem too long, are hard to follow, and the data visualizations are static and disengaging. One Gen Z employee was overheard saying, "one of the old geezers must have created that slide deck!"

Case Objectives

1. LO 1: Share strategies that address gender communication issues.
2. LO 2: Identify competing ways to influence within the global organization.
3. LO 3: Share strategies that address multigenerational communication issues.
4. LO 4: Identify data visualization techniques and strategies to address gender, cultural, and multigenerational issues.
5. LO 5: Identify how poor visualizations impact diversity, equity, and inclusion.
6. LO 6: Apply leadership strategies when your team is burned out (especially from virtual meetings).
7. LO 7: Demonstrate best practices of communication for Global Leaders.
8. Integrate storytelling techniques into data presentations to enhance engagement and understanding using best practices for visualizations (Chapters 1–8).

Case Instructions

1. Go to Our World in Data (Our World in Data) and type "trust" in the search bar. Find the chart that shows the details of the statement—Most people can be trusted. See if the trust has changed by looking at the 1984 data and the 2022 data for the four countries. Create a line chart showing the change of the four countries.

2. Go to The Culture Factor Country Comparison Tool: Country comparison tool (hofstede-insights.com) and set up the dimensions for the four countries.
3. Conduct research on the profitability of organizations that embrace better communication and DEI principles. Include this research and especially data visualizations to support a better bottom line.
4. Analyze the information from steps one and two and conduct any other research to create a communication plan that addresses all the issues. Include specific strategies.
5. Suggest a formal policy/protocol that is based on research. Include how to best share company related virtual meeting protocols.
6. Create a presentation that incorporates great data visualizations and an engaging narrative (storytelling).

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