# Introduction

Welcome to Week 3! During Weeks 1 and 2 we learned about the importance of tailoring our stories to our target audiences and presenting numbers in ways that are accessible and meaningful. We also considered various options for presenting our stories in verbal and written formats.

Now we will focus on presenting our stories—and particularly the data components of them—visually. Creating visual presentations of our stories, whether online, via presentation slides, or in a printed document, can be an effective method for insuring that our data is accessible and meaningful to various audiences.

This week we will learn about basic graphic design principles regarding color and fonts that we can apply to our visual presentations of our stories. Then we will turn our attention to a simple and popular data visualization method—charts—and learn how to choose the appropriate chart types for our data, as well as methods for formatting charts so that our target audience will interpret them correctly.
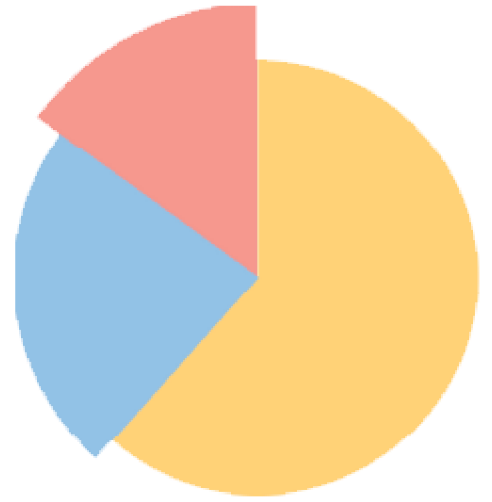
Graphic Design 101

In visual presentations of our stories, it's important to apply best practices when using design elements such as color and fonts so that they guide the viewer through the story, rather than distracting them from it. We want to take advantage of these design elements to emphasize our main points.

Color

Color is one of the first design elements that catches our attention, and people have strong associations with color, so it is important to choose colors carefully when creating a visual presentation of your story. There's a graphic on the Prezi blog (in the "Setting the Mood" section) that depicts the associations people make with various colors. Take a look at it, and think about what associations you want your audience to have when they view a visual presentation of your story.

In her book *Presenting Data Effectively*[1] Stephanie Evergreen offers the following guidelines for using color well (p. 91):

- Narrative text is gray or black
- Background has white or subdued color
- One or two emphasis colors are used
- Color reprints legibly in black and white
- Color changes denote meaning changes

These guidelines emphasize the importance of keeping things simple when it comes to using color. Including a lot of colors in a visualization, or colors that clash, is distracting to viewers and makes it difficult for them to know where to focus their attention. These guidelines also indicate the importance of being consistent with color, by using one color for narrative text and a maximum of two additional colors for other design elements such as titles, charts, or icons. These consistencies serve as cues to help viewers accurately interpret your visualization and denote meaning.

A few years ago, Library Research Service, the organization I work for, began developing infographics. At the start of this journey, we looked at a variety of infographics created by other organizations to find sources of inspiration. One piece that informed how we use color is the infographic Branches of Opportunity from the Center for an Urban Future. We liked how the designer chose one emphasis color—blue—and then used multiple shades of it. If you are not sure how to select multiple colors that coordinate with each other, this is a good alternative for insuring that your colors don't clash. This method also abides to the guideline listed above regarding limiting yourself to one or two emphasis

colors. If you want to use more than one color but aren't sure how to select colors that complement each other, I've included some resources in the *Week 3* section of the Supplementary Material page that will help you get started with this task.

One final consideration about color is that it is important to consider accessibility guidelines when creating visualizations in order to accommodate people with color blindness. Typically, people with color blindness have difficulties distinguishing between certain colors; in rare instances they only see black and white.[2] The most common color combination people struggle with is red and green; the combination of yellow and blue is also problematic for some people. You can learn about creating visualizations that accommodate people with color blindness.

Fonts

Your selection of fonts is also important when designing visualizations because it will impact the legibility of your presentation, as well as the associations your audience make when viewing your content.

What makes a font legible? Studies examining this issue have found that "the most legible [fonts] are transparent to the reader—that is, they don't call undue attention to themselves." [3] Legible fonts have high levels of openness. This refers to the amount of white space in letters such as o, p, and c, as well as the proportion of lowercase to uppercase letters. More white space and/or higher proportions of lowercase to uppercase letters equal greater legibility.
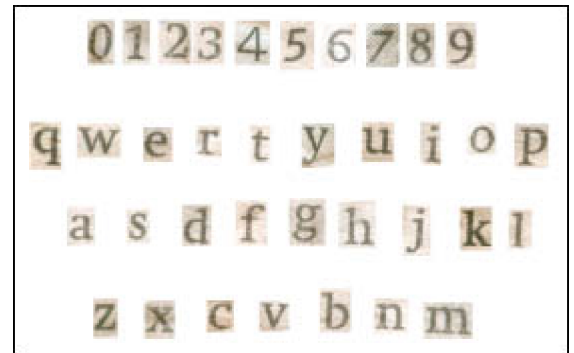
What about the legibility of serif vs. sans serif fonts? While the design community continues to debate this issue, many experts recommend using serif fonts for longer presentations of printed text, such as an article or book, and sans serif fonts online or for short printed documents.

Some examples of fonts with high levels of legibility include Arial, Garamond, and Verdana.

When selecting fonts for visualizations, a good rule of thumb is to limit yourself to two or three options. One font could be used for titles and headings, and a second for all other text. If you choose to add a third font, it could be used for subheadings. And, similar to what we learned about using color, you should use fonts consistently—meaning always using the same fonts to denote headings, subheadings, and the body of the text—to provide visual cues for your audience so that they can easily interpret your visualization. This example from a Pew Research Center report uses fonts and colors consistently to help guide readers through the document.

Also similar to what we learned about color, people have associations with fonts. For example, serif fonts such as Times New Roman and Baskerville Old Face are associated with tradition, reliability, and formality, while sans serif fonts such as Calibri and Myriad Pro are associated with terms such as

"modern," "clean," and "contemporary."[4] This infographic depicts the associations people make with different fonts. What associations do you want people to make when seeing a visual presentation of your story?

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Endnotes

[1] Evergreen, S.D.H. (2014). *Presenting Data Effectively: Communicating Your Findings foMaximum Impact.* Thousand Oaks, CA: Sage.

[2] Bigman, A. (n.d.). Why All Designers Need to Understand Color Blindness.

[3] Haley, A. (n.d.) It's About Legibility.

[4] Shaikh, A.D., Chaparro, B.S., & Fox, D. (2006). Perception of Fonts: Perceived Personality Traits and Uses.

Charts

One of the simplest ways to improve your presentation of data is to display it in a chart. Numbers that might seem uninteresting or difficult to interpret if limited to a text-based presentation can become much more meaningful when presented in this visual format. In this section you will learn about how to choose the appropriate chart for your data and how to format your charts so that they will be understandable and meaningful to your audience.

> *Note:* There are two screencasts in the *Week 3* section of the Supplementary Material page that demonstrate how to create charts in Excel.

How to Choose the Correct Chart

Software programs such as Microsoft Excel and Google Sheets provide many chart options, such as pie, doughnut, bar, line, scatterplot, bubble, etc. If you plan to use a chart to display your numbers, it is important to choose the correct option so that your data will be represented accurately. Below we will learn about three common chart types—pie/doughnut, bar, and line—and consider when it is appropriate to use each one.

A. Pie/Doughnut Charts

The purpose of pie and doughnut charts is to present parts of a whole. This means that your data should sum to 100%. For example:
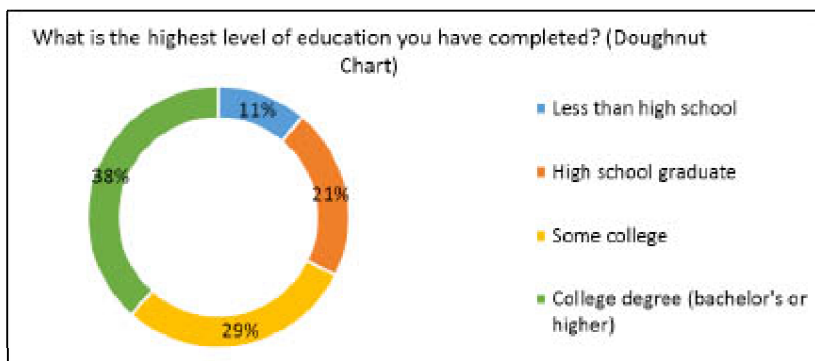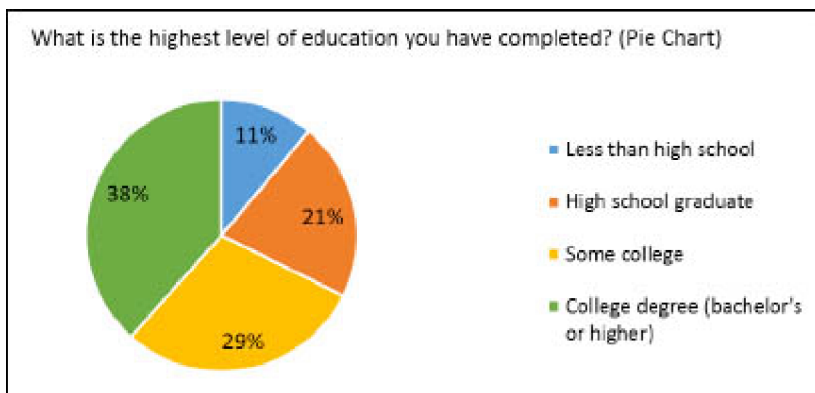
As you can see from the examples above, a viewer can look at these charts and quickly determine how the proportion of each section of the pie or doughnut contributes to the whole.

However, what if you have numbers that sum to more than 100? This might occur if you're presenting the results of a survey question where respondents could choose all answers that apply. For example:
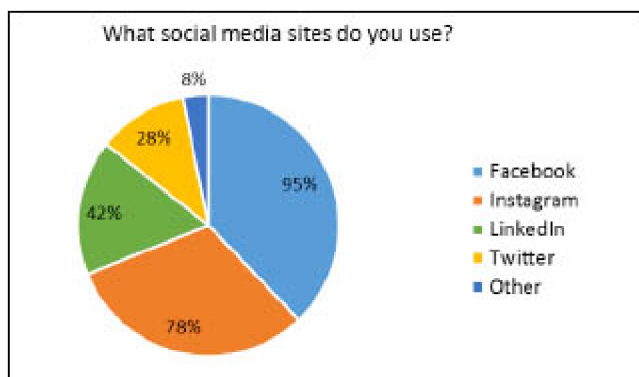
The pie chart above is misleading to viewers because the proportions are wrong. For example, Facebook's piece of the pie (95%) should occupy almost all of the pie to correctly represent its relationship to 100%, but instead it occupies less than half of it. We will see a better option for presenting this data below in the bar/column charts section.

Some examples of data that can be presented in a pie chart include demographics such as race/ethnicity or age (presented in categories such as under 18, 18-24, etc.), as well as results to survey questions that have scales for response options. For example, you could use a pie chart to display the answers to a survey question that has an agreement scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree).

If you are presenting a set of results that has a large number of categories, you should avoid using pie charts. This is because it becomes difficult to interpret pie charts if more than 5-6 categories are presented. Here is an example of a pie chart with too many categories:
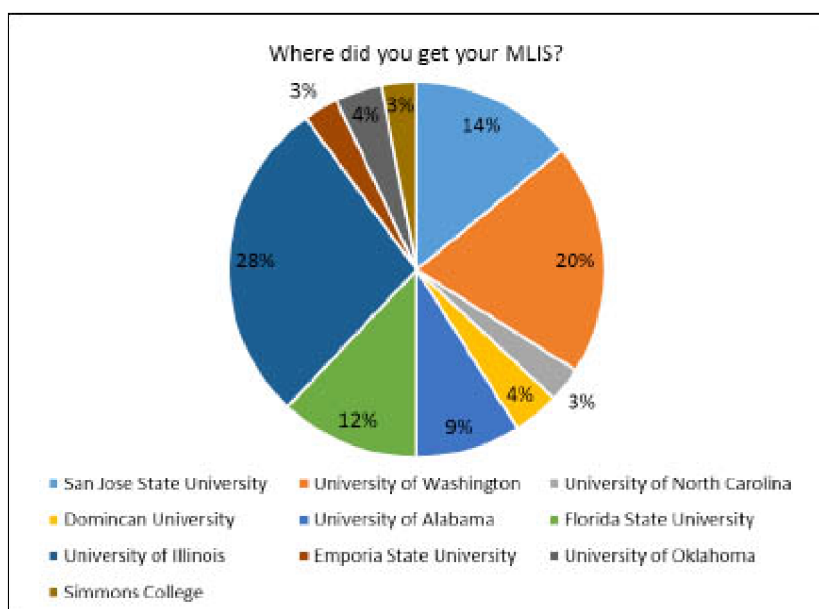
While the numbers in the example above sum to 100, it is difficult to interpret the chart because multiple shades of the same color are used for different segments of the pie. So, viewers are forced to scan back and forth between the legend and the pie to determine which shade of blue corresponds with San Jose

State University vs. the University of Alabama vs. the University of Illinois. A bar/column chart would be a better choice for displaying this data.

Here is one formatting tip for pie/doughnut charts: If the phrases for each of your categories are relatively short, you can increase the interpretability of the chart by deleting the legend and adding the response categories next to their corresponding pie segments (Don't know how to do this? Check out this screencast (also available in the *Week 3* section of the Supplementary Material page).

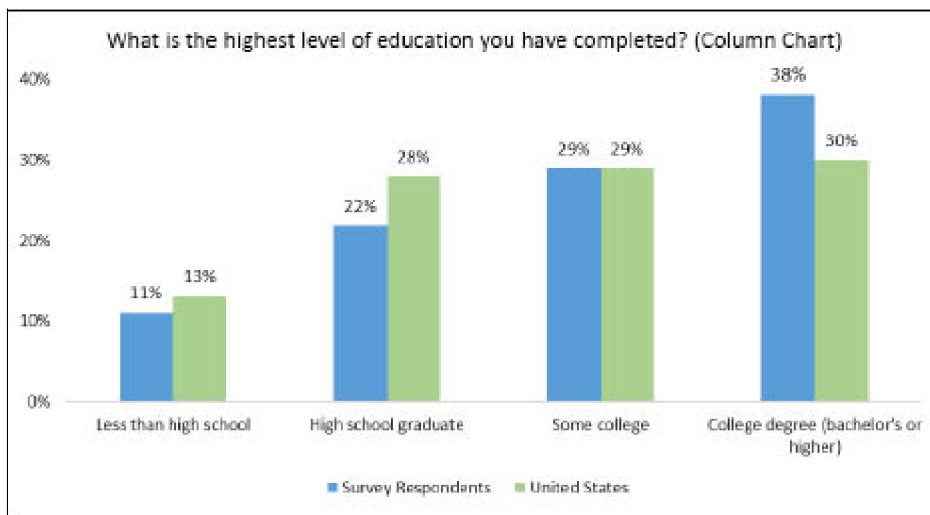What is the highest level of education you've completed?
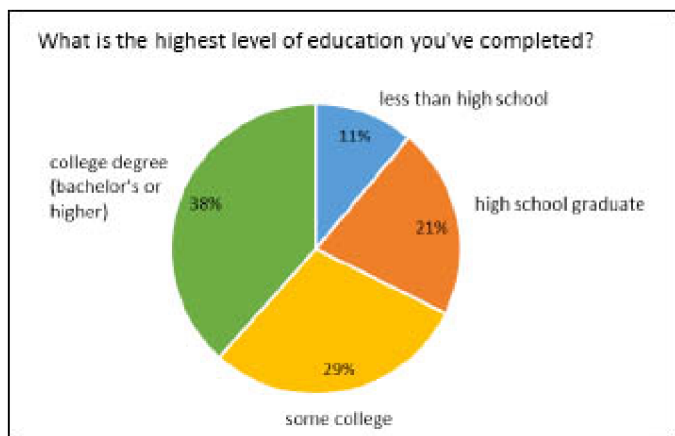
B. Bar/Column Charts

Another common chart type is the bar/column chart. This is a versatile chart type that can be used for several different purposes. One purpose is to display a range of responses to a question, particularly if there are a lot of categories and/or if the results sum to more than 100, such as in the social media pie chart shown above. Here is the same data displayed as a bar chart:


What social media sites do you use? (Bar Chart)
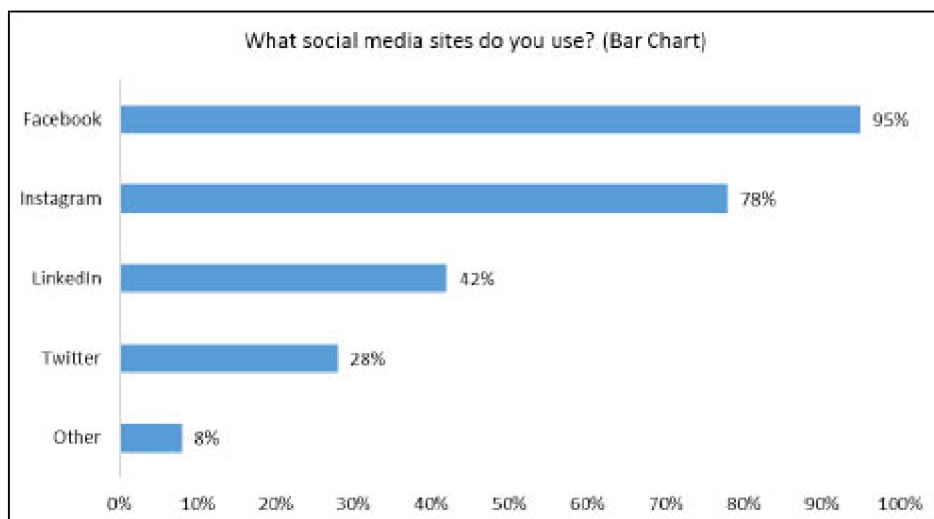
You can also use bar or column charts to show comparisons between categories:

What is the highest level of education you have completed? (Column Chart)

By clustering the columns, your audience can quickly see how the survey respondents' level of education compares to the United States population overall.

And, a third purpose for using bar or column charts is to show trends over time:

Smartphone Adoption in the United States
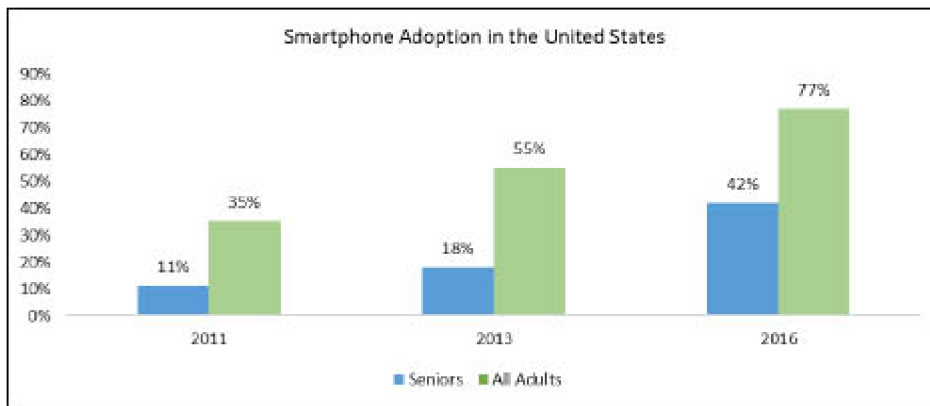
In this example, the clustered columns enable your audience to easily make comparisons between seniors and all U.S. adults over the three time points of the survey.

Here is one formatting tip for bar charts: Order the presentation of your data from greatest to least or least to greatest, such as what was done in the social media chart above. This aids your audience's ability to quickly interpret the data. One exception: If you are presenting the results to a response scale (for example, Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) your order for presenting the data should match that of the response scale.

C. Line Charts

The purpose of line charts is to demonstrate trends over time. The example below depicts the results of a biennial survey. By using a line chart, viewers can quickly comprehend the trends for smartphone adoption in the United States from 2011 to 2016.

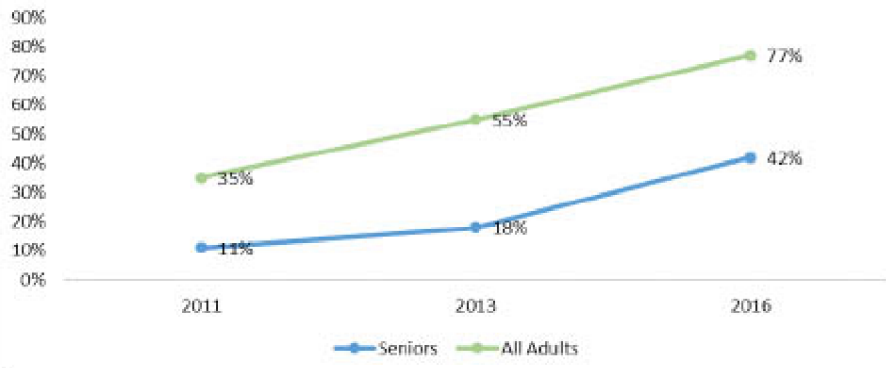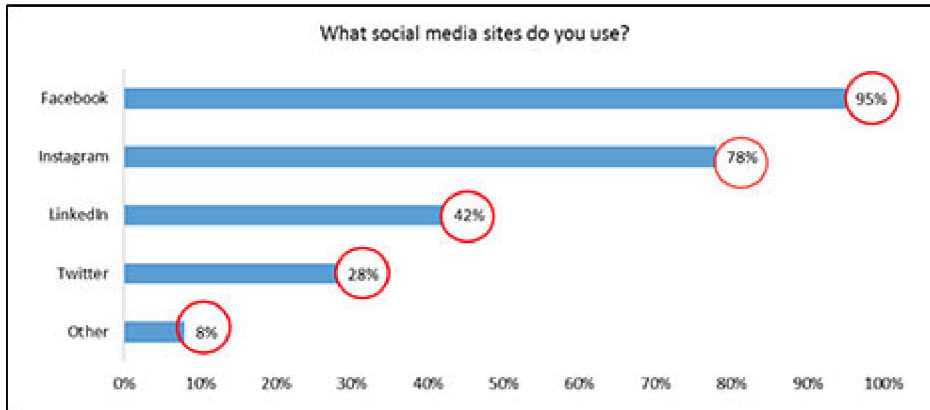Smartphone Adoption in the United States (Line Chart)

- Seniors
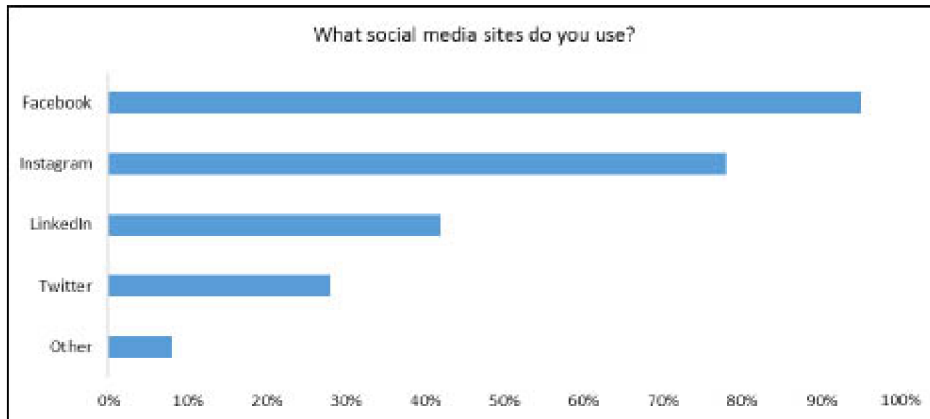- All Adults

Chart Formatting Tips

Here are three formatting tips that apply to all chart types:

Tip #1 – Data Labels

In Excel and Google Sheets, the default templates for charts do not display data labels. What are data labels? They are circled in red in the chart below:
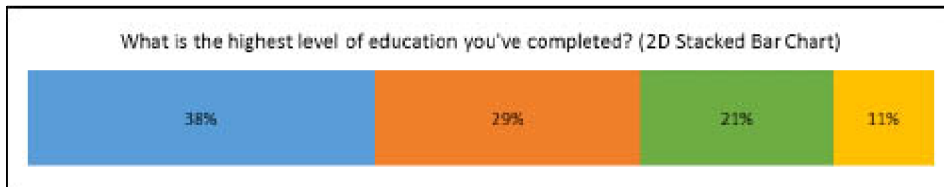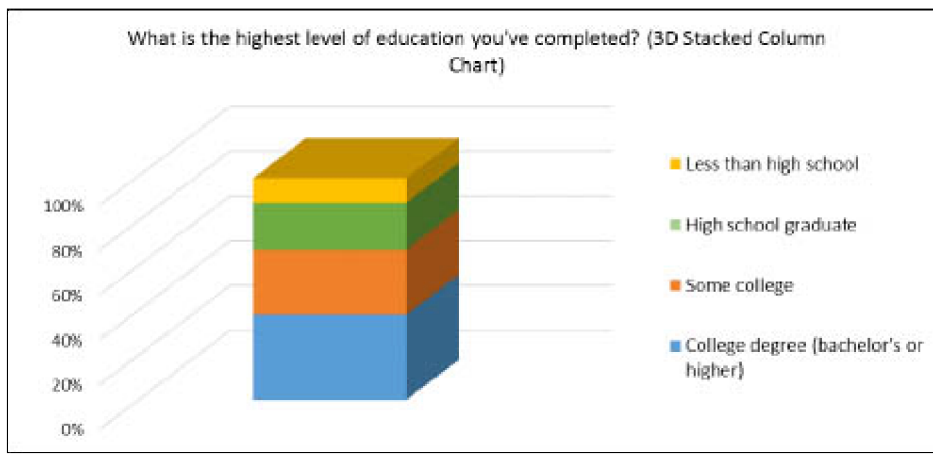

Here is the same chart, without data labels:

By adding data labels, viewers can quickly see the percentage or number each category represents, instead of having to look back and forth between the category and the axis and attempt to make estimates.

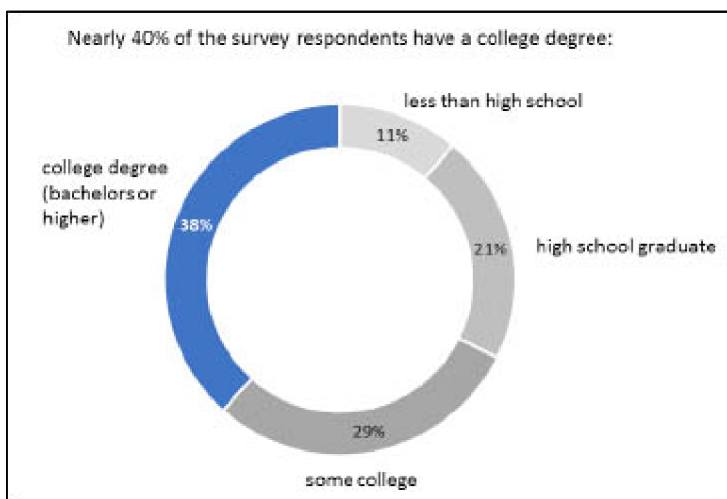## Tip #2 – Three-Dimensional (3D) Charts

Resist the urge to use the 3D feature offered in spreadsheet software. To understand why, let's look examples of a 3D chart vs. a two-dimensional (2D) chart:

What is the highest level of education you've completed? (3D Stacked Column Chart)

■ Less than high school

■ High school graduate

■ Some college

■ College degree (bachelor's or higher)

What is the highest level of education you've completed? (2D Stacked Bar Chart)

| 38% | 29% | 21% | 11% |

As you can see from these examples, adding a third dimension actually distorts our ability to interpret the numbers correctly. In the 3D chart, we can't accurately estimate the percentages for each category (particularly without data labels). It looks like the categories sum to less than 100%, when actually they do sum to 100%. Because of this distortion issue, it is not helpful to your audience to display your data with 3D charts.

Tip #3 – Selective Color

If there is a specific point you want to make that focuses on one category of the data, you can use color selectively to emphasize it:

Nearly 40% of the survey respondents have a college degree:

less than high school 11%

high school graduate 21%

some college 29%

college degree (bachelors or higher) 38%

Note also that in the example above, I changed the color of the digits for the college degree percentage (38%) to white so that it would stand out against the dark blue background.

Chart Dissection

Spreadsheet software provides many options for formatting charts including the ability to add, delete, and change the placement of chart elements such as titles, legends, and data labels and to modify colors and fonts. It's important to use these formatting options strategically so that your audience will interpret your data correctly.

Let's do a chart dissection activity so that we can learn about how to modify common chart elements in order to improve the chart.

Here's an example of a chart created in Excel:
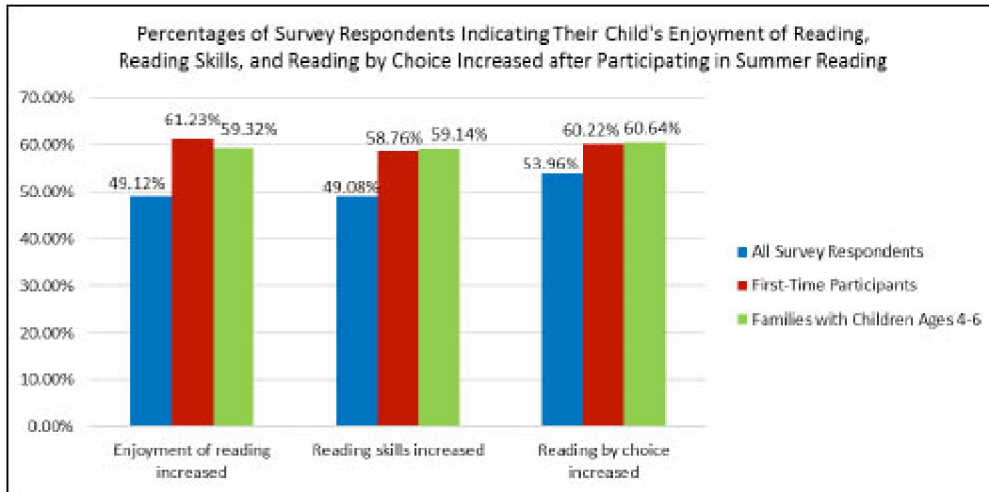
It's passable, and we've seen similar versions in countless reports and presentations. But there are a few tweaks we can make to increase its meaningfulness and readability.

Here are five major areas where I see opportunities for improvement:

1. **The title**
   The title is descriptive, but it's also wordy and it sounds like it should be in an academic journal. This is fine if that's its intended destination, but not if it's going to be used for other purposes.
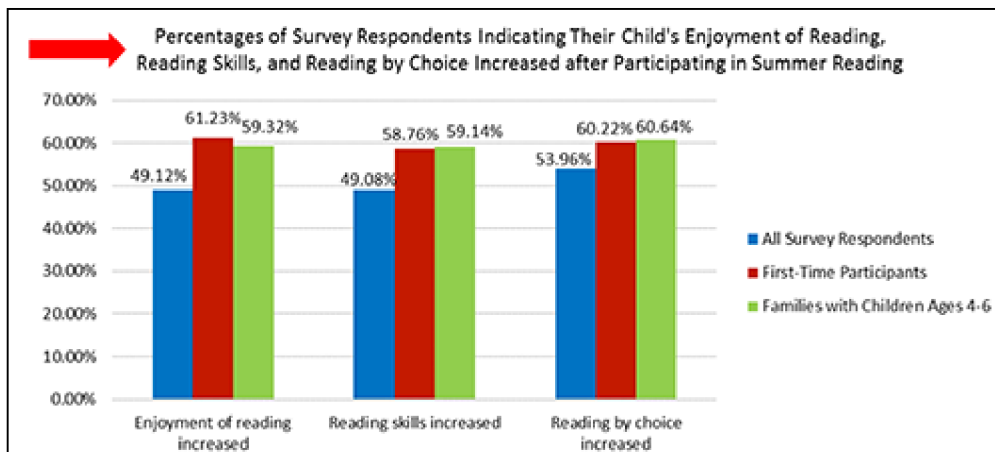

2. **Data labels and x-axis**
   The percentages go out to two decimal places on the data labels and the x-axis. However, in Week 2 we learned that unless you are comparing minimal differences between numbers (for example,

1.2% vs. 1.8%), it doesn't add to your audience's understanding of the data to use decimal places. Instead, the additional numbers create unnecessary visual clutter.
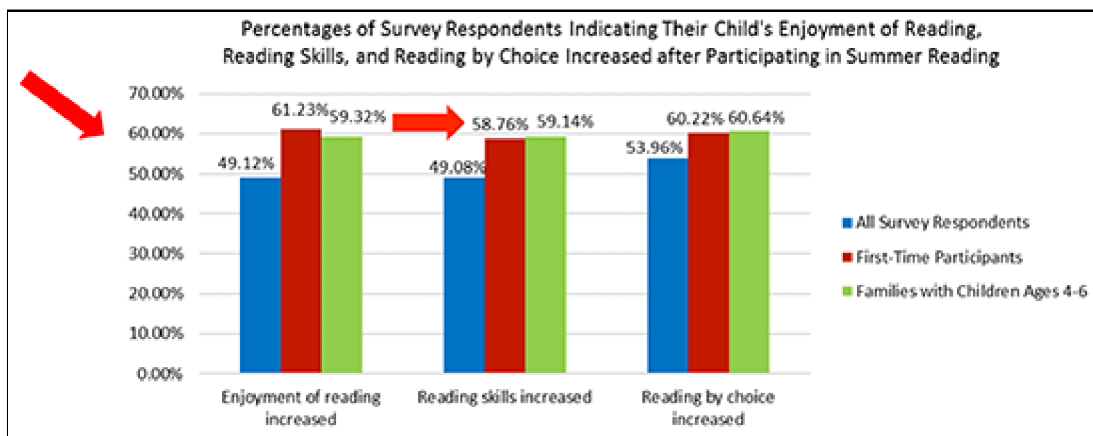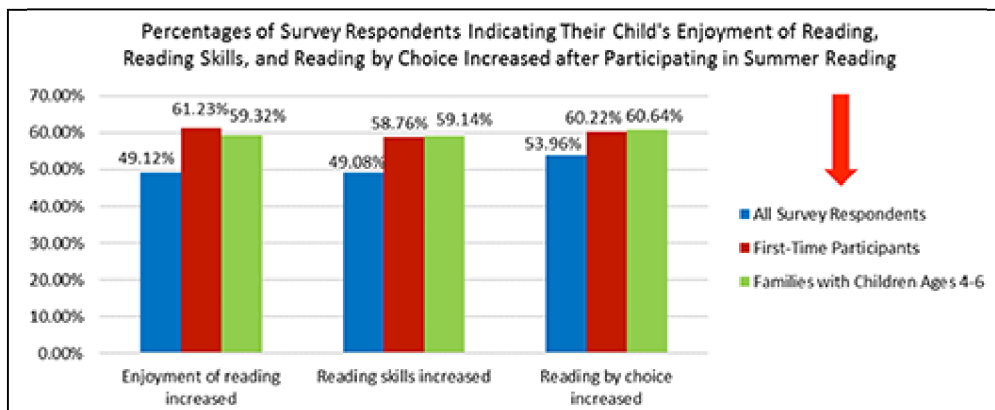

3. **Horizontal lines**

The horizontal lines also add unnecessary visual clutter. Viewers don't need them to refer to the x-axis since there are data labels.
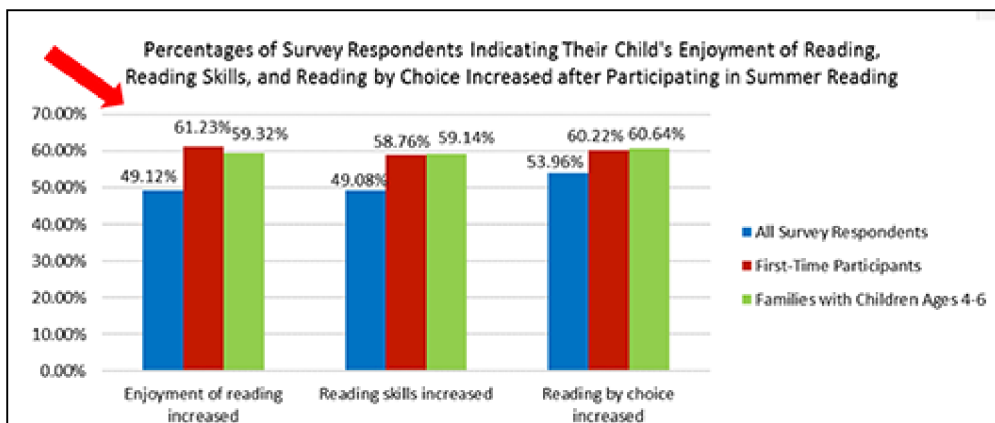
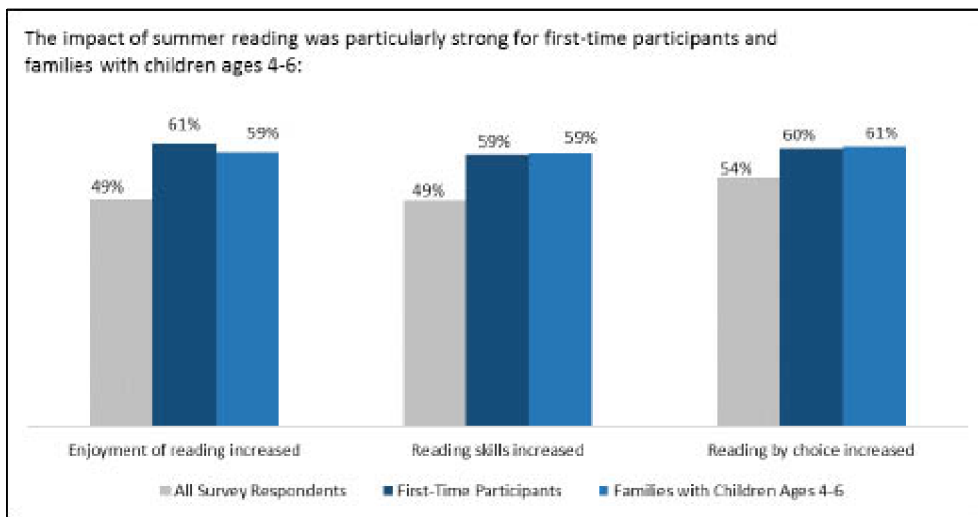4. **Legend**

This is not an optimal location for the legend, in terms of readability.

5. **Color**

Instead of being selected for a specific purpose, the chart colors are simply part of a default color scheme available in Excel. Also, the combination of red and green is a bad choice in terms of accessibility for viewers with color blindness.

Now, let's look at an "after" version of the chart:

The impact of summer reading was particularly strong for first-time participants and families with children ages 4-6:

Enjoyment of reading increased: 49%, 61%, 59%
Reading skills increased: 49%, 59%, 59%
Reading by choice increased: 54%, 60%, 61%

All Survey Respondents | First-Time Participants | Families with Children Ages 4-6

Here are the improvements I made to the chart:

- **Title**: Instead of simply describing the chart, I used the title area to make my main point—that the impact of summer reading was strongest for two subgroups: first-time participants and families of preschool age children. I didn't want to leave it up to my audience to come to this conclusion.

- **Data labels and x-axis**: I rounded each of the percentages to whole numbers, which increases readability and adds white space. Then, because viewers don't need an x-axis to help them estimate the percentages for each column, I removed it.

- **Horizontal lines**: I removed the horizontal lines, which added white space and reduced visual clutter.

- **Legend**: I reformatted the legend so that it runs horizontally across the chart. In the "after" version of the chart, each box in the legend lines up with the colors of each column as you read the chart from left to right.

- **Color**: Earlier we discussed a couple color techniques—choosing one color and using multiple shades of it and using color selectively to emphasize a point. I applied both of these techniques to highlight the results of the two subgroups.

Go back and look at the examples of pie/doughnut, bar/column, and line charts in the *Charts* section. How might you make similar improvements to them, in terms of creating a title that makes a point, reformatting the legend, and using color selectively?

Conclusion

This week we focused on visual depictions of storytelling, particularly in terms of techniques for presenting our data. We learned some basic graphic design principles for using color and fonts effectively, and then we considered some simple tips for choosing the correct charts for our data and formatting our charts so that our audiences will understand them. Next week we will focus on a popular and effective way to tell stories visually: infographics.

In this week's assignments you will have the opportunity to apply what you learned by creating and critiquing charts. Here are your assignment options:

- Select an existing chart—either something you have designed in the past or something you've found online—and redesign it, using the principles of color, fonts, and chart design we learned about this week. Share both the before and after versions in the forum, and write a post describing what was wrong with the original chart and how you improved it.

- Design a chart to display data from your library. Be sure to use the principles of color, fonts, and chart design we learned about this week in your design. Share your chart on the forum, and write a post explaining your choices for chart type and design. If you don't have any data to use from your library, I've provided some sample options in the assignment.

- Find an example of a well-designed chart online, share it in the forum, and write a post explaining why it is a good example based on the principles of color, fonts, and chart design we learned about this week. Having trouble finding an example? You can find a variety of options on the Pew Research Center site.

What to Do Next: Proceed to the Week 3 Assignment Options.