Data Can Be Beautiful: Crafting a Compelling Story with SAS® Visual Analytics

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ABSTRACT

Do your reports effectively communicate your message? Are your reports aesthetically pleasing? This paper provides guidance for SAS® Visual Analytics Designer users to create compelling data stories.

The primary goal of a report is to enable readers to quickly and easily get answers to their questions. The visualizations you use for your data, the quantity and arrangement of information included, and the use of color all contribute to the reader's ability to understand your report. This paper describes how to guide your reader's movement through a report to support comprehension of the data story. It includes tips on how to express quantitative data using the most appropriate graphs, suggests ways to organize content using visual design techniques, and explains how color can be used to enhance the efficacy of a report.

A thoughtfully designed report can educate the viewer without compromising visual appeal. Included here are recommendations and examples to help you create reports that are both informative and beautiful.

INTRODUCTION

SAS® Visual Analytics is an industry leader in on-demand analytics, providing you with a powerful tool to consume, analyze, and publish data. This report building application allows you to synthesize your data and produce multi-sectioned reports with many visualization options.

With SAS Visual Analytics, you choose which chart will represent your data, and you decide how many sections to include in your report. You are provided with a blank slate upon which you can add a multitude of graphs, tables, and controls. SAS Visual Analytics also equips you with numerous styling options. You can change the direction and grouping style of your bar chart; change the background color and line thickness of your line chart; and change the font size, placement, and color of your labels and legends. SAS Visual Analytics allows you to build custom reports from your data in infinite combinations.

Given the various options, do you know how to design a compelling report? This paper provides you with simple pointers so that your reports are clear, concise, efficient, and beautiful. Before you build your next report, follow these tips to create the most appealing report possible.

PLANNING

Before you start building your report, spend some time planning. Ask yourself the following questions, and explain your answers. The answers will help guide your report design.

1. What is your main objective? Are you trying to persuade your readers on a particular topic, or are you merely sharing facts?

2. How is your data structured? Do you need to transform the data before including it in the report? How many values does each variable have? Do you need to include explanations?

3. What is your single message? Your report needs one narrative. If you compound your report with disparate facts, you will limit the effectiveness of your communication.

4. What is your report's lifespan? Will it be a static report that is disseminated once, or will it exist for a long time with regular updates and interactivity?

5. Who is your audience? Is it an individual or a group of people? Does your audience consist of executives, data scientists, business analysts, marketing personnel, or some other profession? Are your report viewers managers or line workers? How familiar is your audience with the data you are including in your story?

6. What is your audience's objective? Do they want to explore the data, or are they interested in a high-level overview? Will your readers need to make decisions based on your report, or are they accumulating knowledge? Understanding the goal of your audience will help you arrange your information in an easily consumable manner.

7. What form will your report take? Will your report be printed, viewed on screens, or projected? Printed reports are non-interactive; information available only through interactivity will get lost in print. Color and images must be optimized before printing. Will your readers want to view your report on mobile devices? Keep the report minimally cluttered if intended for mobile devices.

COGNITIVE CONSIDERATIONS

Human attention is a limited resource. Your brain receives too many sensory inputs to attend to each one of them. As you walk down the street, your senses take in the feel of the pavement on the bottom of your feet, in addition to the feel of your shoes and your clothes. Your eyes collect images of the clouds, sun, birds in the sky, houses, trees, and all the colors, textures, and brightness. You also take in scents of the grass, flowers, squirrels, and trash cans. You can hear birds chirping, children arguing, car engines humming, and your own footsteps. Your sense organs produce an enormous amount of information that is constantly changing. If you paid attention to every sensation that comes into your sense organs, you would not be able to focus on anything. For survival's sake, human beings have necessarily evolved to tune in to some inputs and tune out others.

In addition to limited attention, humans have limited memory capacity. Information processing and active learning take place in working memory, but working memory is extremely constrained. People can manage only about five to nine different items in their working memory at one time (Miller 1956). That might seem like a small number, but try to remember an unknown phone number someone tells you. Most people need to repeat the number over and over, either aloud or in their heads, until they dial it or write it down. Long-term memory has much more storage capacity, but processing new information has to happen first in working memory before learning takes place.

If you unnecessarily consume your readers' limited cognitive resources, you might not get your message across. Save your report readers' mental effort for understanding your data.

TIPS TO HELP YOUR READER

You can take advantage of some known cognitive and perceptual "tricks" in your report designs.

- **"Chunk" information.** People can remember more items if you group them together in a meaningful way. Any meaningful unit (digits, words, or images) can be grouped together, and humans will treat it as one chunk of information, allowing them to process more information.

- **Provide reminders.** Multiple choice tests are generally easier than essay tests. Fill-in-the-blank tests are much easier when there is a word bank present. Provide visual cues to remind your audience what they are seeing. If your readers need to remember what type of data they are viewing while also trying to find patterns, it will be more challenging for them to understand your data. Don't make your report viewers keep information in their heads from one section to the next. Help them by using labels and other text fields accordingly.

- **Use familiar concepts.** Build on the knowledge users have about the world. Your report is not the place for unusual creativity. If you are using a symbol to denote a concept, use a symbol that your audience understands.

- **Limit choices.** Reduce the number of choices you give to your viewer. It might seem friendly to provide many options for viewing the data, but your audience will struggle with decisions when faced with too many alternatives (Hick 1952).

- **Limit visuals.** Minimize the number of graphical objects you present to your reader in one section. When you include a large number of visualizations, you diminish the power of each individual visualization. Remove unnecessary visual elements, such as clip art or logos. Viewers need to process visual elements to determine whether they are relevant, increasing the demand on mental energy. If a visual element is not relevant to your data story, do not include it.

- **Put important information first.** The order in which you present information can affect your report viewer's experience. Humans want to maintain consistency in their minds, so what you present to them first can often establish an expectation. This affects how people perceive the subsequent information. Be sure to include the main information at the beginning of your report.

- **Hide complexity.** If your audience consists of well-informed viewers who are familiar with your data, as well as people who have only cursory knowledge, help the novices by hiding the advanced data interactions. Experts will find them, and viewers new to the concepts won't be daunted by a dense or complicated data story.

VISUAL PERCEPTION

To understand the complex visual world, the human mind simplifies it. People first see an object as a whole rather than seeing its individual parts. (Wertheimer 1938).

People perceive items to be related to each other when: (a) they are located near each other, (b) they have the same shape, (c) they have the same size, or (d) they have the same color. These are known as Gestalt principles.

Color is one the strongest ways to communicate relationships. When you use color as a visual cue, be certain to use an additional cue such as size, shape, or proximity. Proximity strongly communicates relatedness. When you want your report readers to make a connection between visual elements, position them near each other, and, when possible, use the same shape or the same size. Avoid placing unrelated objects near each other. Your report viewers might assume an association that is not there.

ACCESSIBILITY

Accessibility refers to the practice of ensuring services and products—including software and information on the web—can be accessed by anyone, regardless of ability. Designing with accessibility in mind is not just good practice, it is encouraged and sometimes legally mandated. Protections and standards like the Americans with Disabilities Act (ADA), the United Nations Convention on the Rights of Persons with Disabilities (CRPD), and the Web Content Accessibility Guidelines (WCAG) help ensure products and services meet minimum accessibility requirements.

One billion people, or approximately 15% of the world's inhabitants, experience some form of disability (World Bank 2016). Of the 56.7 million US citizens with disabilities, 8.1 million Americans have difficulty seeing, including 2 million who are blind (US Census 2010). Many people have cognitive disabilities, including dyslexia, learning disabilities, or dyscalculia, which makes reading and understanding numbers difficult. If you think you can ignore accessibility, remember that the normal aging process leads to presbyopia for most adults over the age of 40, causing blurry vision for close objects, requiring the use of reading glasses. The aging process can also lead to macular degeneration or cataracts. In addition to diagnosed conditions such as those listed above, situational accessibility issues are common, such as trying to distinguish colors on a screen in bright sunlight.

Reports that can be accessed by anyone should be straight-forward and uncomplicated. Use the simplest representation of the data. If a bar chart can display your data as effectively as a dual-axis line chart, stick to the former. Not only will a larger percentage of the population be able to understand and interpret your data, it lightens the cognitive effort for all your readers.

Provide context or conclusions adjacent to your graphs. Provide a concise description of the visualization along with any relevant information, such as outliers, skewness, clusters, or slope. To better tell your story, consider including your conclusions or patterns found, and perhaps recommend next steps. Tell your audience about the interactions available in each visualization, such as drilling in, filtering, or linking. Your report will be more accessible and more digestible.

Finally, color blindness affects many individuals. You might want to use color to denote a dimension of your data, but readers with color vision deficiencies might not be able see the differences. You must use signals in addition to color to identify dimensions of data (for example, displaying data labels).

See the following SAS Global Forum Papers for a more in-depth look at designing for accessibility: SAS6321-2016 (Sookne 2016) and SAS655-2017 (Sookne 2017).

DATA

UNDERSTANDING YOUR DATA

As a report designer, you might not be responsible for data preparation. However, when tasked with communicating the information you receive, you need to become intimately familiar with its context and inconsistencies. Regardless of your contribution to data preparation, it is important to thoroughly review each variable. This is especially true if your primary task is to explore the data and mine it for insights, with little clarity or direction from the start. If you plan to combine multiple data sources to create a more complete data set, make sure each source uses the same general methodology for data collection, cleansing, and preparation.

As you review the categories and measures in your data set, you might notice some categorical data items form a natural hierarchy. Geographical data items are a common example, but products, styles, and measurements of time can also make for convenient hierarchies. Setting up hierarchies can help reduce the number of categories shown at once, which will help your report consumers. By creating hierarchies, you can also reveal multiple, even opposing, patterns in one visualization. Hierarchies are an excellent way to combat Simpson's paradox, the concept that stratified data in smaller groups can reveal the opposite trend of the same data when in aggregate (Blyth 1972). However, if you notice that different levels of analysis communicate different parts of your data story, it might be worth pulling out each level of your hierarchy separately. This way, your readers will not miss key information.

SAS Visual Analytics selects a default aggregation for most measures. You might want to adjust the aggregations, depending on your data items and the message you want to convey. You should use the mean when your visualization reveals the impact of the whole data set, because it encompasses all values, and use the median when ranking outcomes, or when downplaying outliers in the data set (Wong 2010). In a normal distribution, the mean and median will be the same, or very similar. Use medians when expressing a central summary value in skewed distributions, but avoid using them in "M" or "U"-shaped distributions (like in 5-star ranking systems). Using a measure of dispersion, like standard deviation or variance, will communicate more about the spread of data, and less about the explicit values themselves.

MISSING DATA

In a perfect world, data collection would always be methodologically sound and without holes. Unfortunately, missing data is quite common. In some cases, you can still create an effective visualization with incomplete data. Most common graph types will showcase information meaningfully if no more than twenty percent of the data is missing (Wong 2010). You should account for the missing values by including a description of the possible effects of the missing data, or make a note that you are using a sample of the data. If the missing data point is crucial to your message, or if you have a small data pool overall, avoid plotting the data.

SELECTING THE BEST VISUALIZATION

SAS Visual Analytics offers a wide variety of graph types. Though exploring multiple variations of data can be fun, simple and familiar data visualizations are often more powerful than complex ones. When possible, limit the number of data dimensions you show in each graph. A data dimension conveys a single level of measurement or categorization. For example, a time-series plot shows two dimensions of data: one along the Y axis, and another (representing time) across the X axis. An animated bubble plot can show up to five dimensions of data: the X axis, the Y axis, the size of each bubble, the colors of grouped bubbles, and the animated dimension of time. Using an animated bubble plot is certainly a viable and robust way to communicate change over time, but be aware that your readers must do extra work to

comprehend patterns in each individual data dimension. You could use multiple time series plots to communicate the same information, allowing for comparison of a trend line or path.

SAS Visual Analytics provides several interactions to show commonalities between objects. You can use brushing or linking to point out connections or trends between graphs. Report viewers will often compare graphs even without a set interaction, especially when the graphs have a shared data item. Comparing data can be tricky, however. This becomes especially true in attempting to give equal weight to two differently sized elements using the same color mapping. Geographical maps highlight this danger best. You should avoid using maps to compare quantities or volume, unless the geography itself contributes significantly to the message (Wong 2010). Figure 1 is an example of the number of clients served in several states with vastly different areas, with a gradient showing higher sales in states with darker color. Though the number of clients in Vermont is significantly higher than in Texas, the large surface area of Texas draws the eye. The larger amount of light orange from Texas, compared to the dark brown of Vermont, emphasizes the wrong information (Wong 2010).

Figure 1. Geographical Maps Can Be Problematic for Comparison of Quantities or Volume

A general consensus exists within the data visualization community is that pie charts are problematic. Comparing categories within a pie chart relies on examining angles, which humans cannot achieve with precision. Percentage and value labels provide the comparative power, rather than the pie chart itself. For illustration of parts of a whole, a stacked bar chart is often more effective than a pie chart.

ENSURING DATA CLARITY

Limit the amount of data in your visualizations. Try not to use more than 12 bars in a single bar chart. You can use stacked bars to accomplish this goal. If you have many categories, consider adding a filter or arranging your categories into larger, more comprehensive groups to limit the number of bars drawn. Keep in mind your groupings will influence the story communicated by the visualization. You can add a hierarchy and allow your audience to drill in to each bar to reach a fuller view. Try to limit time series and other line charts to four or fewer lines, and when showing multiple trend lines, place each on its own axis in a horizontal or vertical lattice (Wong 2016). Choose this option when the benefits of showing many trend lines side by side outweighs the cost of increased difficulty in comparing more specific points in time between certain lines.

Be wary of using dual-axis charts. Showing two single-Y axis graphs serves the same purpose more efficiently. If you use a dual-axis chart, do not plot two uncorrelated series with different axes. Only use dual-axis visualizations when the Y axes are directly related to, or derived from, each other.

Make your visualizations as simple as possible. Use a zero baseline. This is especially important with bar charts and butterfly charts. You can plot time-series plots, scatter plots, and other "floating" data on a nonzero baseline, but your audience might miss that detail (Few 2017).

Displaying multiple currency types in visualizations can get tricky. When plotting currency, always convert all values to a single currency. Because exchange rates vary over time, include the exchange rate of the currencies you display in a footnote, along with the day (or month, depending on the level of granularity available) the data was collected.

Labels should provide detailed information, not tell the data story itself. Labels can distract your audience and leave your chart looking cluttered. Leave off labels if you want your audience to examine general trends, rather than specific data points. Leave off labels if your readers will compare one data element to another, unless the data points are close to one another. Consider omitting labels in general unless your readers need to print the report. Report viewers can access label information via the data tip.

Use labels when you have segmented data, or a wide data range, as shown in Figure 2. If the Y axis accommodates a large number, and you do not want to de-emphasize the smaller values, turn on labels.
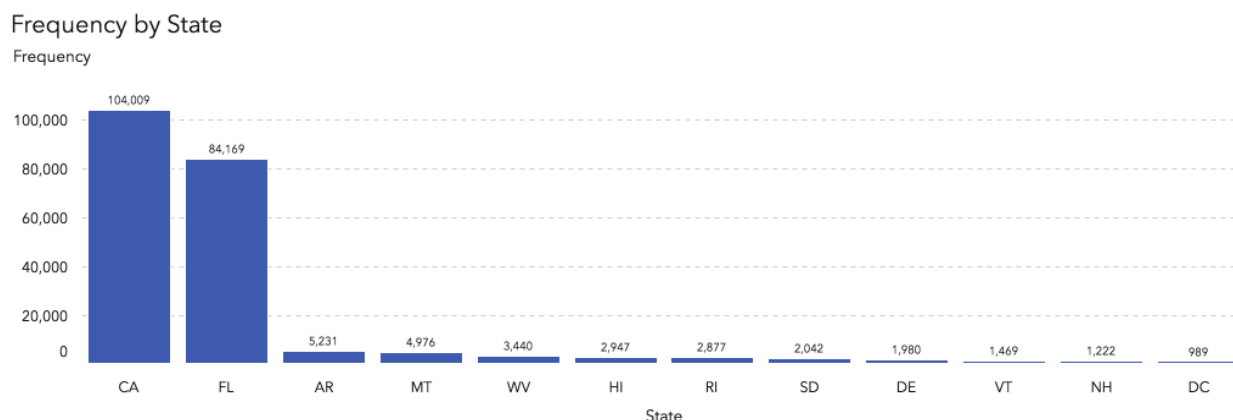
Frequency by State

Frequency

Figure 2. Add Labels When Data Has a Wide Range in Values

Depending on your goal, you can plot the smaller values in another visualization, if you prefer not to use labels. If you show two different Y axes, point out the differences in the scales. Readers often ignore the Y axis and look at the overall trend of the data. You can use precision layout to inset the scaled or "zoomed" visualization onto the more comprehensive visualization.

VISUAL DESIGN

TYPOGRAPHY

Typography, the art of arranging text, can play a critical role in your report. An understanding of basic typography will help you to choose the best font and place it appropriately. Good typography is "invisible"; it does not distract your audience from your message (Watzman 2002). The wrong font can prevent your audience from fully understanding your message and even disrupt their experience. Applying typographic principles can enhance the effectiveness and beauty of your report.

Font Choice

SAS Visual Analytics allows you to choose among a collection of fonts, featuring a mix of serif and sans-serif fonts. Courier New, Georgia, and Times New Roman are serif fonts, while Arial, Avenir Next, Trebuchet MS, and Verdana are sans-serif. As shown in Figure 3, serif fonts have additional small strokes, or serifs, at the end of the main strokes of its characters. Sans-serif fonts do not have these small strokes.

Aa Aa

Figure 3. Font Differences between a Serif Font (on left) and a Sans-Serif Font (on right)

Traditionally, print documents used serif fonts to move the reader's eye (Mackiewicz 2004). Sans-serif fonts were used in advertising signs, which were often read at a distance (Bryan 1996). Sans-serif fonts are widely used for digital content, as they have better screen readability than serif fonts (Peck 2003). Due to the lack of strokes, sans-serif fonts are thought to be easier to read at smaller sizes (Ali et al. 2013). When designing your report, keep the end format in mind. If the report will be printed, consider using Times New Roman. If the report will remain digital, Arial will facilitate legibility.

You can use both font types in combination to help create a visual hierarchy in your report. For example, use a sans-serif font for headings and a serif font for paragraph text. This creates contrast, which helps your audience navigate your report and identify which text should receive attention first. Using contrast helps to create distinct roles for each font, which makes them stand out as individual pieces of information. Use no more than two fonts throughout the report, as they can create visual intrusions that disrupt your audience's experience (Watzman 2002). You can also create contrast and hierarchy through font weight and size. Font weight refers to the thickness of the characters. For example, a bold font in a larger size can distinguish the heading text from paragraph text. This creates contrast between a thicker, larger heading font and a thinner, smaller font for the paragraph text. Using a consistent pairing of fonts throughout your report helps to convey a cohesive story with a clear hierarchy that enhances your audience's comprehension of the content. Figure 4 provides some examples you can use.

Arial as a heading in bold

Georgia as paragraph text, which pairs well with Arial.

Avenir Next as a heading

Times New Roman as paragraph text, with pairs well with Avenir Next.

Verdana as a heading

Georgia as paragraph text, which pairs well with Arial.

Trebuchet MS as a larger heading in bold

Trebuchet MS as paragraph text, which pairs well with the bold Trebuchet MS.

Figure 4. Complementary Pairings of Serif and Sans-Serif, Bold, and Regular Font Weights

Font Alignment

In addition to style and weight, placement and alignment of text can also contribute to the readability and aesthetics of your report. Report text can be left-justified, centered, or right-justified. Left and right-justified alignments provide a vertical edge suitable for reading, while centered creates jagged lines on both sides. Centered text is fine for titles or short phrases, but it can negatively impact readability. For longer text,

use left-justified alignment, as the vertical edge on the left facilitates readability for most languages. Maintaining a consistent alignment throughout the report also helps to reduce visual clutter.

As you craft your story, remember that your font choice and placement can support and enhance the effectiveness of your report.

COLORS

Color affects how you interpret information. When used well, color visually enhances a report and effectively conveys meaning. Along with typography, color helps to tell a story by creating the correct setting for the information.

Basic knowledge of color theory will help you use color better for your typography, data visualizations, and report theme. See the color wheel in Figure 5 to help you understand the relationship between colors.

Figure 5. Color Wheel

Note the primary colors in the wheel above (yellow "a", red "g", and blue "m"). Each of these is mixed with another in fixed ratios to form more colors. Colors that lie opposite to each other in a color wheel are called complementary colors. When used together, they create effective contrast between adjacent elements. For example, blue and orange are complementary colors. Using blue and orange in a bar chart that compares two categories helps viewers distinguish between them quickly.

Colors adjacent to each other on the color wheel are called analogous colors. These provide little contrast when used together, as illustrated in Figure 6. Colors k, l, and m from the color wheel are used in a pie chart. It is difficult to perceive where one category ends and another begins.
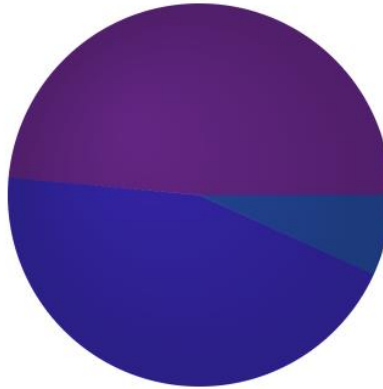
Figure 6. Pie Chart with Insufficient Difference between Adjacent Colors

A color wheel can help you create balanced graph palettes. Graph palettes can be created using SAS® Theme Designer. Most of the colors in a palette can be overridden in SAS Visual Analytics. However, allotting color to individual elements in the report should be approached with caution.

Hue, saturation, and brightness are three components of color that also affect color choices (Boulton 2014). Hue, the base color, is what you see in the wheel in Figure 5. Saturation, measured as a percentage, defines the range of color variations from the purest (100% saturation) to gray (0% saturation). As shown in Figure 7, the less saturated a color, the grayer it appears. The third component of color that affects your decision is brightness. Brightness implies the darkness/lightness of a color, which can be perceived as how much 'black' or 'white' a color contains.
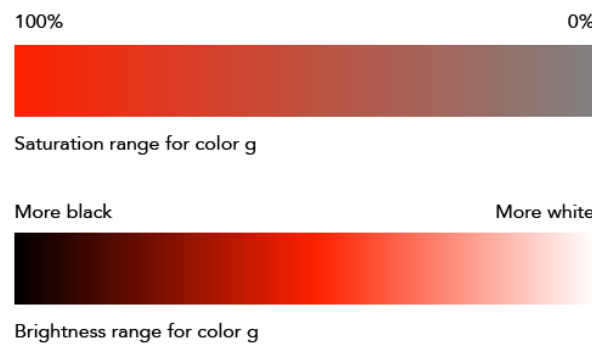
Figure 7. Saturation and Brightness Range for a Color (red)

Consider how your report will be consumed. If you expect it to be displayed through a projector, avoid colors that are light, as these will appear washed-out. If you expect it to be printed, you might want to use brighter colors. In most cases, an image on screen appears brighter than it does in print. Quick test prints are always a good idea.

Choose background colors that provide sufficient contrast against foreground elements (for example, bars and lines). Figure 8 shows how colors with similar saturation do not contrast well with each other.
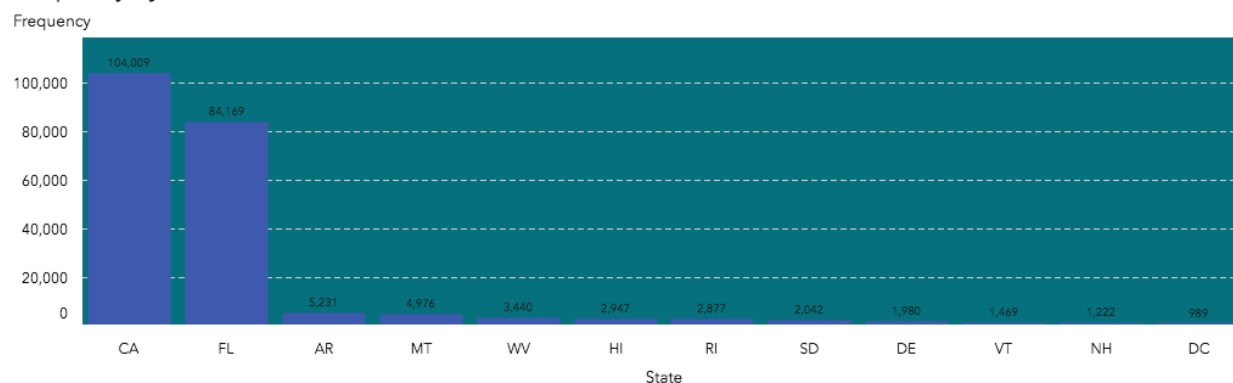
Frequency by State

Frequency

Figure 3. Graph Bars against Low-Contrast Graph Wall

Color Meaning

Color meaning plays an important role in your report. Be mindful of individual color meanings as well as meanings of color combinations. For example, depending on the culture, red can signify danger, something bad, or a state of alertness. Green can signify growth, nature, or envy. In some cultures, red and green used together could be associated with Christmas. Context matters.

When using brand colors in a report, ensure that the data does not change meaning. For example, avoid using too much red in a report simply because it is one of your brand colors. A data visualization or text might acquire additional meaning associated with the color red. It is essential to use colors that fit the context of the data, the intended meaning, and the overall story being told.

Color Consistency

Using clearly defined palettes helps to maintain color consistency. With SAS Theme Designer, you can build custom graph palettes, which can be accessed in SAS Visual Analytics. The preset graph palette that comes with SAS Visual Analytics is designed with the considerations discussed so far. These colors can be overridden for individual visualizations by selecting the object and editing its colors (and in some cases, its transparency). At the report level, background and font colors can be customized from within SAS Visual Analytics. At the data visualization level, colors of the graph elements (wall, background, labels, and so on) are editable. This high level of customizability might be exciting, but use it consciously based on the intent of communication, rather than for decoration or to fill up empty space.

Use a color outside your graph palette only when absolutely necessary. If you can use a color from your existing graph palette without confusing your audience, do not use a new color.

Keep colors consistent across graphs for gridlines, axis labels, and so on. Use display rules to visually highlight significant portions of data. Use the same color for similar display rules throughout your report.

Color Overuse

Overuse of color can happen in three ways: (1) if you use too many colors, (2) if you use too much of one color, or (3) if you use color in all the available white space. Compare Figures 9 and 10. Figure 10 shows how you can help your readers focus on one element at a time, leading their eyes from one point to another while bringing the important information to the foreground.
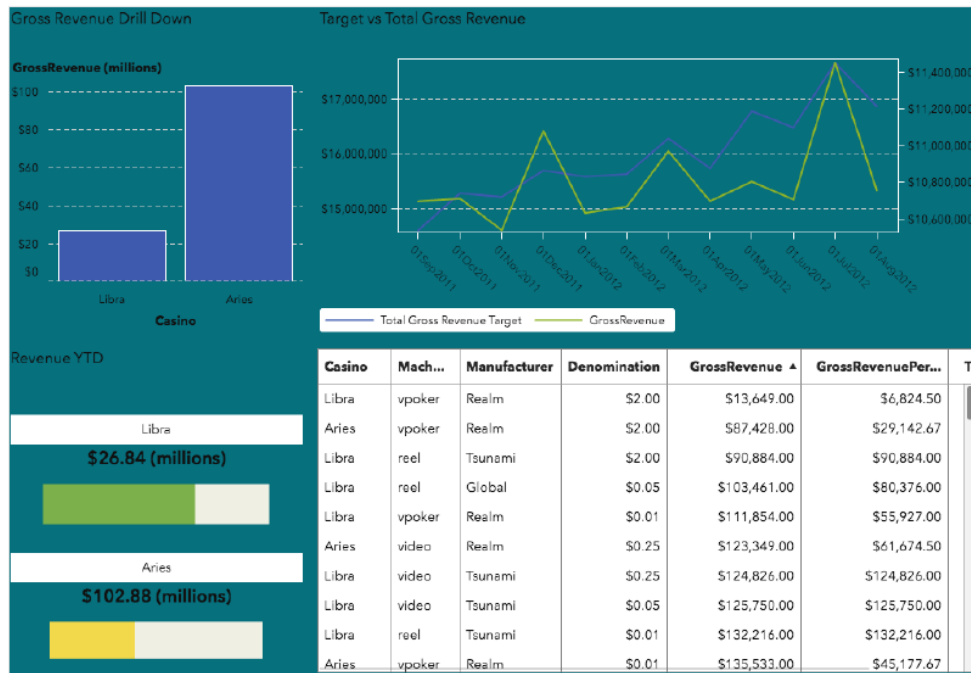
Figure 9. Report Illustrating Color Overuse in the Background
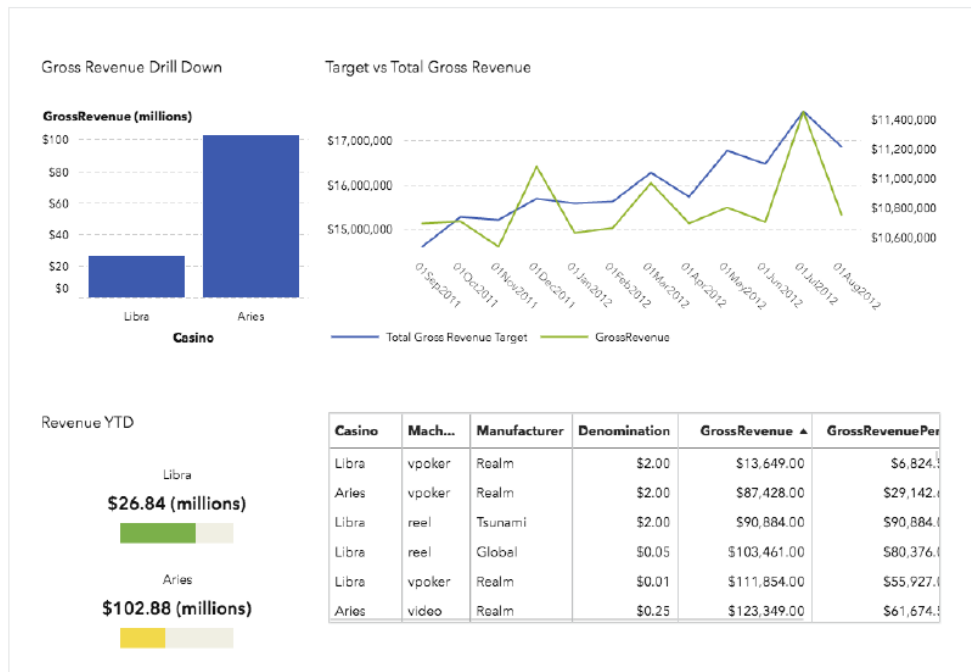

Figure 10. Report without Color Overuse

When too much color is used in the background, it can feel like a separate element competing with actual content. This results in visual clutter.

IMAGES

Carefully chosen images can increase the visual appeal of your report, but they can also introduce visual clutter and detract from your report's effectiveness. Compare Figures 11 and 12.
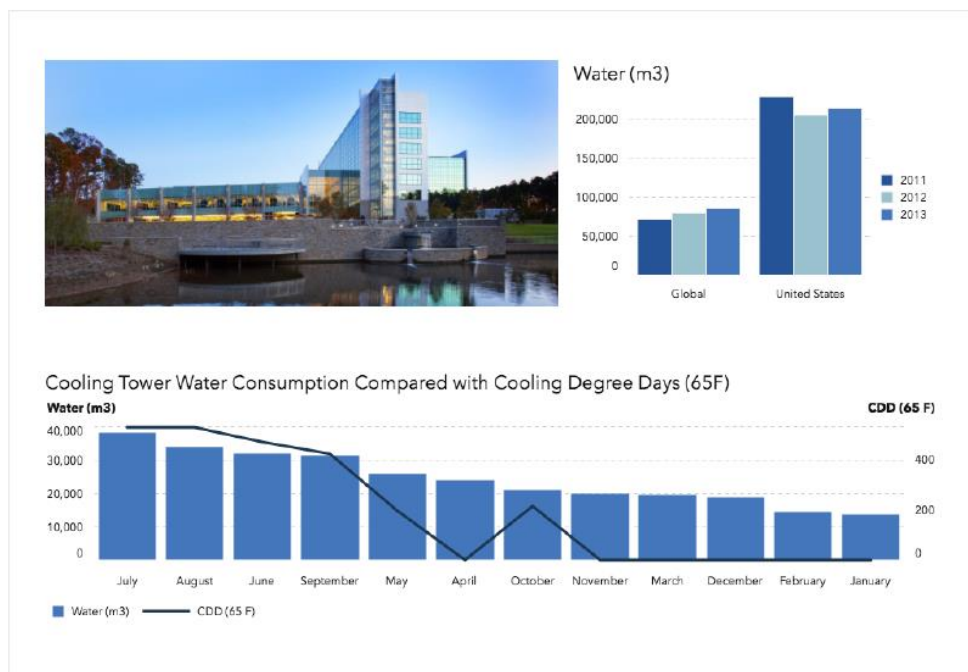

Figure 11. Reports with Competing Visuals

Figure 12. Report Using an Image as Relevant Content

Appropriately placed images facilitate the delivery of your message. Refrain from using images that cover most of the report background. As Figure 11 illustrates, a large image on the background will distract your audience and compete with the information you are trying to convey. Additionally, avoid placing text on top of your images because it reduces the legibility of the text. Reduced legibility impacts all of your readers, but particularly those with vision impairments.

Figure 12 illustrates how imagery with relevant content can improve the visual appeal and effectiveness of the report by using the image to connect the colors of the data to the colors found within the image.

Avoid using images for decoration. Choose quality over quantity. Though images serve as rich sources of visual interest, only use them to convey your story while adding to the overall beauty of your report.

VISUAL STRUCTURE

Reports often contain a substantial amount of visually complex objects, each expressing one part of the overall message. You can leverage the form of your report to guide the viewer's eye, which in turn facilitates his/her ability to gain meaningful insights from the data. Simplicity in the layout and delivery of the content are key factors in the report's function. The visual structure of your report directly contributes to your audience's perception and comprehension of your message.

If you create a report without paying attention to structure, you might disorient and confuse your viewer. An inconsistent layout with too many objects on a page negatively impacts the story you are presenting to your audience. To deliver your message effectively, keep the following key principles in mind.

Limit the Number of Objects per Section

A well-designed report will support the meaning of the data without adding unnecessary clutter and detail. As you add visual content to your report, it can quickly become noise, making it more difficult for the reader to visually interpret and understand the message. Limit your report to a maximum of five objects per section. This minimizes the visual complexity of each section and allows you to tell your story in a concise manner. An added benefit of this limit is the content is more likely to fit on a tablet or computer screen without the need to scroll. Keeping content to one screen eases interactions like filtering between objects and visual comparison between objects in the section.

Your data is what matters. Limiting the number of objects, and increasing the white space around objects, enhances the visibility of your data. Figures 13 and 14 illustrate the transformation of a visually complex report into a simplified one with a clear message. In Figure 14, several objects were placed into a stack container to improve reader comprehension, establish object alignment, and enhance readability.
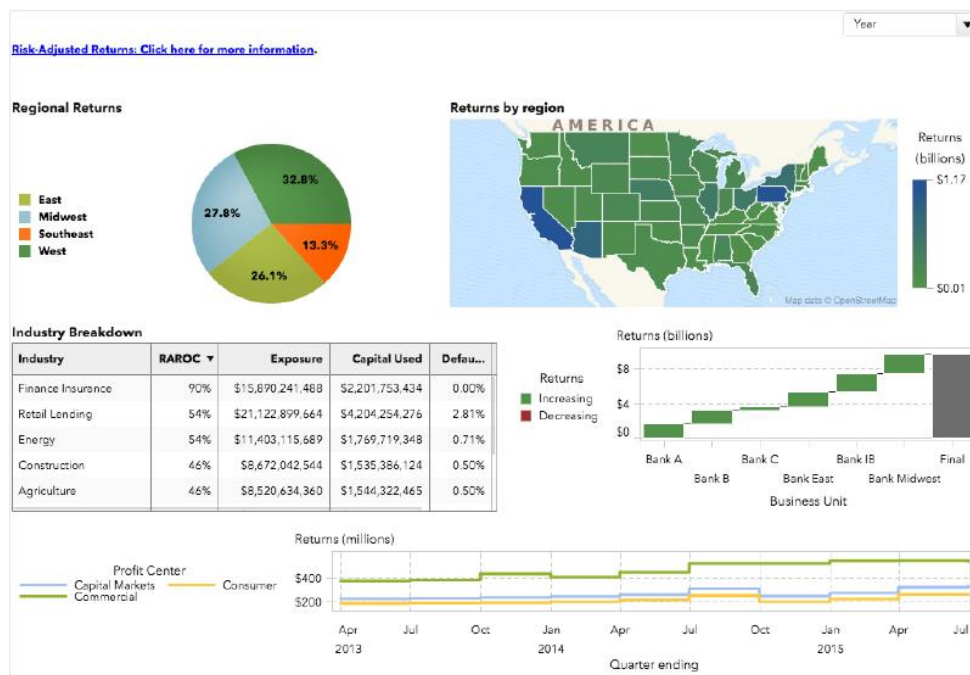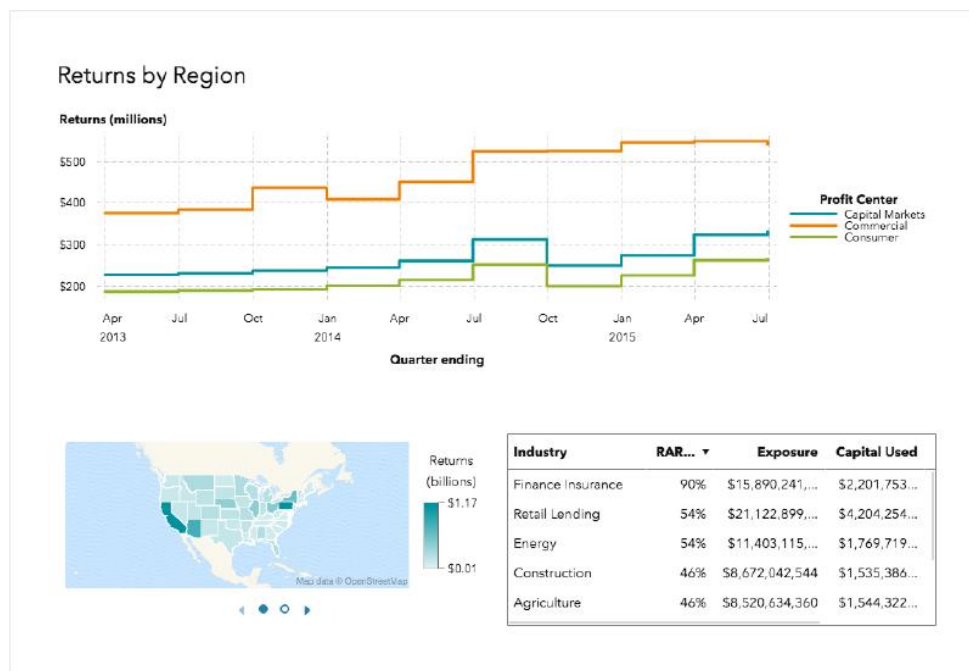
Figure 13. A Visually Complex Layout

Figure 14. A Simplified Layout

Limit the Number of Sections

In addition to limiting the number of objects per section, you should minimize the number of sections in the entire report. The number of sections can communicate that your report is a quick, easy-to-consume story, or that it is complex and will need to be broken up into several viewing sessions. In most cases, your report content should not exceed six or seven sections. Keep in mind that reports can be emailed, printed, and viewed on phones, tablets, and desktops. The information will likely be consumed in undetermined environments and across multiple platforms.

VISUAL FLOW

Designing your layout is an integral part of creating a visually successful report. Which object, or group of objects, do you want to serve as the focal point for each section? Your choice of layout should emphasize the main object, while keeping supporting objects smaller. Your goal should be to create a balanced, easily consumable report. One way to do that is to organize your information into meaningful groups. Think of your report as a visual filing cabinet: when you group similar objects together, your report consumers will find the information they need easily, creating cognitive connections (Samara 2002).

White Space

Whitespace can never be underrated. It's a very important element for both visual impact and readability. It feels quite inviting when … the organization of the page … is clearly conveyed in a split of a second." (Terror 2009.)

White space is a critical component for creating a beautiful report, equally as important as images, color, and typography. White space refers to any part of your report section that is blank: the space between your data visualizations, images, text, borders, and so on. White space, when used effectively, compels the viewer to focus on what sits inside or around it.

Use white space in your report to separate chunks of unrelated data. Separate your visualizations, and use white space to create a focal point. It's important to note that white space does not need to always be white. If you use a background color in your report, any unmarked, or blank space, can be considered white space.

Figures 15, 16, and 17 illustrate different layout options, each making effective use of white space. These layout options enhance the readability of each report object, while helping to establish associations between them.

Figure 15 shows how smaller, like-sized items, form a connection when they are scaled similarly and placed adjacent to each other. The group of objects at the top of Figure 15 divide the width of the screen equally, preserving the integrity of each individual object.

Figure 15. Report Illustrating Similar Objects Using the Same Scale

To make the best use of this layout option, ensure that similar objects have similar axis labels. Divide the white space equally between the related objects to achieve a more balanced look. The balance will help viewers connect the similarities and differences between the objects.

A different way to design your visual flow is to establish one object as a focal point. Creating a focal point helps viewers understand the main function of a section. If appropriate, your focal point can drive the interactivity between it and the supporting objects. Use the full width of the section to prevent the data labels and axis labels from truncating or wrapping. Using the full width creates some white space between the core piece of your section and the other objects. Keeping your other objects smaller, such as a supporting table or drilled-in bar chart, will help guide your viewer's eye back to the main focal point. While building your report, remember to structure the flow from top to bottom, left to right, except for audiences who read right to left.

In Figure 16, the scatter plot at the top filters the information in the supporting chart in the bottom left. By placing the scatter plot at full width, all the details can be seen. The table in the bottom right was chosen to supplement the other objects.
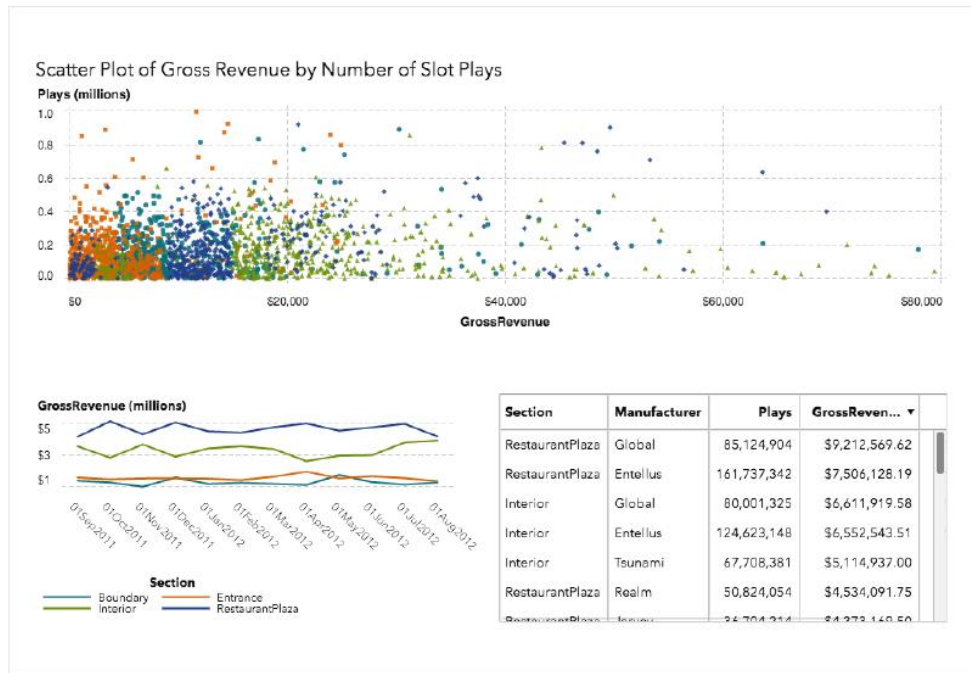
Figure 16. Report Establishing One Visualization as a Focal Point

To make the best use of this layout option, place your main content as close to the top of the page as possible to ensure your viewers will see it regardless of their viewing device. Adding a title to your focal point helps to create a sense of visual hierarchy. Align the supporting objects below the focal point, dividing the bottom part of the section in half. This creates visual balance and appeal.

Figure 17 provides a third option for creating visual flow. This report is an example of dividing the white space to lead the viewer through the objects on the page. The height of the page is divided in half. Objects and labels are aligned, allowing the reader to make associations across objects.
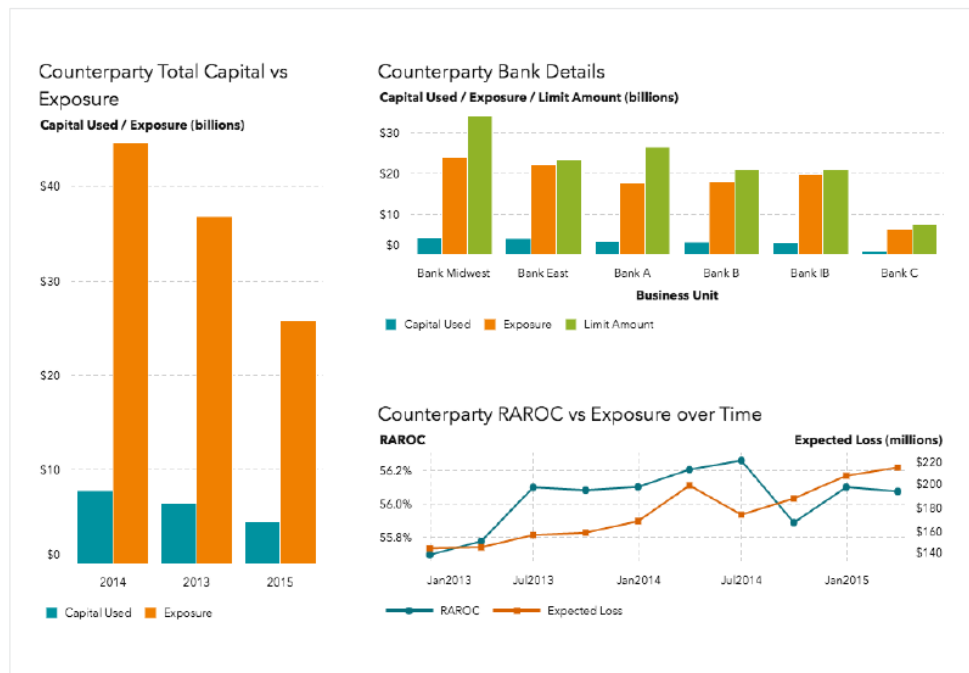
Figure 17. Report with Equally Divided White Space to Help Guide the Reader's Eye

To make the best use of this layout option, align objects to keep consistent white space between adjacent objects, establishing a visual flow for the viewers' eyes. Objects adjacent to each other can often be divided relationally based on proportions of 75:25, 50:50, or 80:20 while still maintaining optimum readability.

CONCLUSION

Focusing on the beauty of your report might seem frivolous, but beauty, readability, and ease of comprehension all work together. In addition to improving the clarity of your report, attending to design details will enhance your audience's emotional connection to your story. Humans connect to the world through emotion. "Design without beauty is void of emotion" (Van Schneider 2016). Your report viewers will benefit from your efforts to improve the form, function, flow, and beauty of your report.

TEN TIPS FOR MAKING A BETTER REPORT:

1. Know your audience, and tell them one story.
2. Help your readers by explicitly focusing on what you want them to know.
3. Design accessible reports. One billion people in the world have some form of disability.
4. Understand your data, and choose the simplest visualizations.
5. Use consistent fonts and consistent colors throughout your report.
6. Use only relevant images.
7. Limit the number of objects, and limit the number of sections in your report.
8. Keep in mind that your report might be printed, projected, or viewed on a desktop, laptop, or tablet.
9. Position your content to guide viewers through your story, using white space effectively.
10. Less is more; keep your report simple, and your data will be beautiful.

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RECOMMENDED READING

- *Don't Make Me Think: A Common Sense Approach to Web Usability* by Steve Krug

- *The Design of Everyday Things* by Donald A. Norman

- *Visualize This: The FlowingData Guide to Design, Visualization, and Statistics* by Nathan Yau

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