

6.3: Accommodating Human Limitations

Humans have both perceptual and cognitive limitations that can make some visualizations very difficult to understand. It's always important to keep these in mind when building a visualization.

6.3.1 Perceptual limitations

One important perceptual limitation that many people (including myself) suffer from is color blindness. This can make it very difficult to perceive the information in a figure (like the one in Figure 6.10) where there is only color contrast between the elements but no brightness contrast. It is always helpful to use graph elements that differ substantially in brightness and/or texture, in addition to color. There are also “colorblind-friendly” palettes available for use in R, which we used in Figure ??.

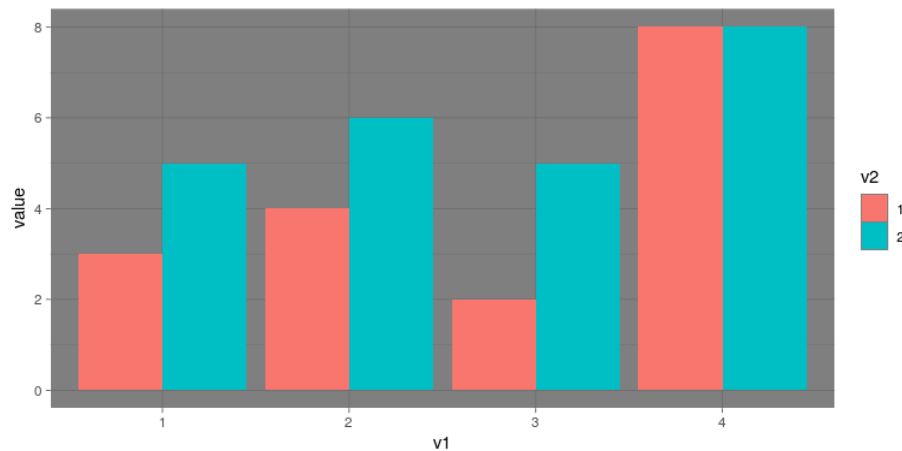


Figure 6.10: Example of a bad figure that relies solely on color contrast.

Even for people with perfect color vision, there are perceptual limitations that can make some plots ineffective. This is one reason why statisticians *never* use pie charts: It can be very difficult for humans to accurately perceive differences in the volume of shapes. The pie chart in Figure 6.11 (presenting the same data on religious affiliation that we showed above) shows how tricky this can be.

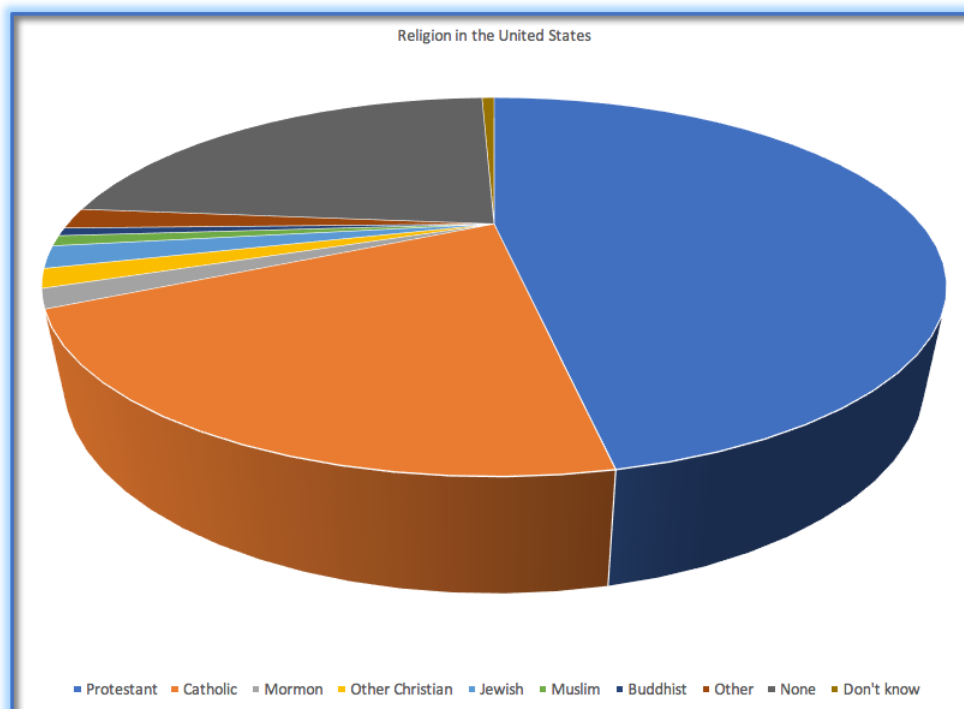


Figure 6.11: An example of a pie chart, highlighting the difficult in apprehending the relative volume of the different pie slices.

This plot is terrible for several reasons. First, it requires distinguishing a large number of colors from very small patches at the bottom of the figure. Second, the visual perspective distorts the relative numbers, such that the pie wedge for Catholic appears much larger than the pie wedge for None, when in fact the number for None is slightly larger (22.8 vs 20.8 percent), as was evident in Figure 6.6. Third, by separating the legend from the graphic, it requires the viewer to hold information in their working memory in order to map between the graphic and legend and to conduct many “table look-ups” in order to continuously match the legend labels to the visualization. And finally, it uses text that is far too small, making it impossible to read without zooming in.

Plotting the data using a more reasonable approach (Figure 6.12), we can see the pattern much more clearly. This plot may not look as flashy as the pie chart generated using Excel, but it’s a much more effective and accurate representation of the data.

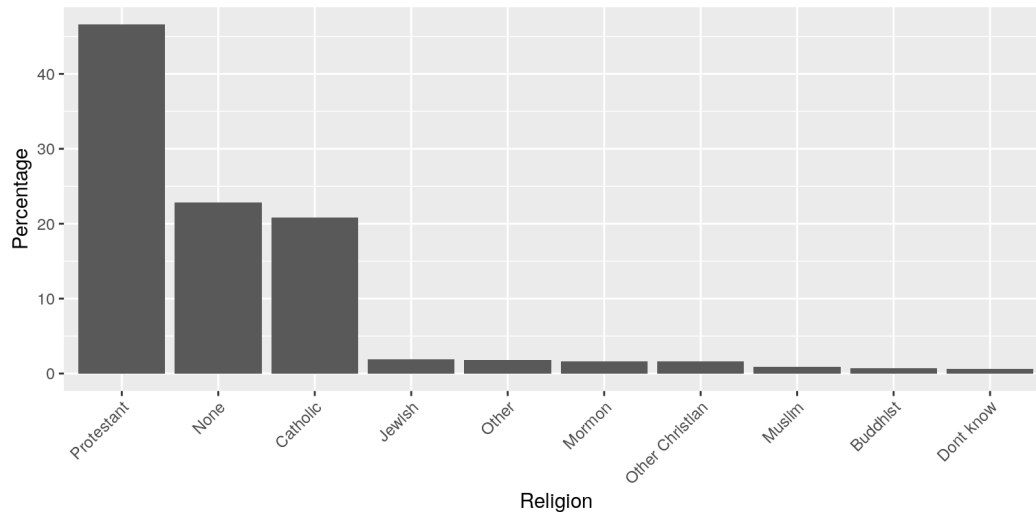


Figure 6.12: A clearer presentation of the religious affiliation data (obtained from <http://www.pewforum.org/religious-landscape-study/>).

This plot allows the viewer to make comparisons based on the the length of the bars along a common scale (the y-axis). Humans tend to be more accurate when decoding differences based on these perceptual elements than based on area or color.

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