Which chart or graph is right for you?

Tell impactful stories with data

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You've got data and you've got questions. Creating a chart or graph links the two, but sometimes you're not sure which type of chart will get the answer you seek.

This paper answers questions about how to select the best charts for the type of data you're analyzing and the questions you want to answer. But it won't stop there.

Stranding your data in isolated, static graphs limits the number of questions you can answer. Let your data become the centerpiece of decision making by using it to tell a story. Combine related charts. Add a map. Provide filters to dig deeper. The impact? Business insight and answers to questions at the speed of thought.

Which chart is right for you?

Transforming data into an effective visualization (any kind of chart or graph) is the first step towards making your data work for you. In this paper you'll find best practice recommendations for when to create these types of visualizations:

1. **Bar**
2. **Line**
3. **Pie**
4. **Map**
5. **Scatter plot**
6. **Gantt**
7. **Bubble**
8. **Histogram**
9. **Bullet**
10. **Heat map**
11. **Highlight table**

Making one of these visualizations should be a starting point, however, not your end goal.

Interact with your data

Once you see your data in a visualization, it inherently leads to more questions. Your bar graph reveals that sales tanked in the second quarter in the Southeast. A scatter plot shows an unexpected concentration of product defects in one category. Donations from older alumni are significantly down according to a heat map. In each example, your reaction is the same: why?

Equip yourself to answer these questions by making your visualization interactive. Doing so creates the opportunity for you and others to analyze your data visually and in real-time, letting you answer questions about your data at as quickly as you ask them.

Combine for impact

Once you've made your visualization interactive, take one more step: combine visualizations onto a single dashboard. Showing related but different views in one place is one of the most effective ways to get a complete picture of your data.

So, for example, instead of settling for a line chart showing revenue trends, combine this with a map showing your customers' locations and a scatter plot indicating which product categories you've sold. With these analyses in one place, you have a fundamentally different vantage point from which to understand your data and make better decisions.

Now you're starting to create your data's full story.

1 Bar

Bar charts are one of the most common ways to visualize data. Why? It's quick to compare information, revealing highs and lows at a glance. Bar charts are especially effective when you have numerical data that splits nicely into different categories so you can quickly see trends within your data.

When to use bar charts:

- **Comparing data across categories.** Examples: Volume of shirts in different sizes, website traffic by origination site, percent of spending by department.
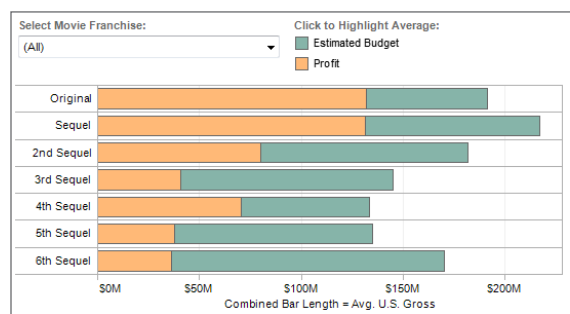

Figure 1: Tell stories with bar charts

Are film sequels profitable? In this example of a bar chart, you quickly get a sense of how profitable sequels are for box office franchises. Select the chart and use the drop-down filter to see the profit for your favorite movie franchise.

Also consider:

- **Include multiple bar charts on a dashboard.** Helps the viewer quickly compare related information instead of flipping through a bunch of spreadsheets or slides to answer a question.

- **Add color to bars for more impact.** Showing revenue performance with bars is informative, but overlaying color to reveal profitability provides immediate insight.

- **Use stacked bars or side-by-side bars.** Displaying related data on top of or next to each other gives depth to your analysis and addresses multiple questions at once.

- **Combine bar charts with maps.** Set the map to act as a "filter" so when you click on different regions the corresponding bar chart is displayed.

- **Put bars on both sides of an axis.** Plotting both positive and negative data points along a continuous axis is an effective way to spot trends.
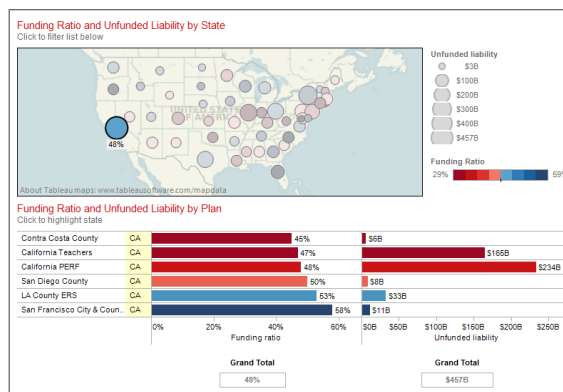

Figure 2: Combine bar charts and maps

Don't settle for a bar chart that leaves you scrolling to find the answers you seek. By combining a bar chart with a map, this dashboard showing public pension funding ratios in the U.S. provides rich information at a glance. When California is selected, for example, the bar chart filters to show state-specific information. Check out another state to see their funding ratio.

2 Line

Line charts are right up there with bars and pies as one of the most frequently used chart types. Line charts connect individual numeric data points. The result is a simple, straightforward way to visualize a sequence of values. Their primary use is to display trends over a period of time.

When to use line charts:

- **Viewing trends in data over time.** Examples: stock price change over a five-year period, website page views during a month, revenue growth by quarter.

Also consider:

- **Combine a line graph with bar charts.** A bar chart indicating the volume sold per day of a given stock combined with the line graph of the corresponding stock price can provide visual queues for further investigation.

" Tableau is one of the best tools out there for creating really powerful and insightful visuals. We're using it for analytics that require great data visuals to help us tell the stories we're trying to tell to our executive management team. "

" But we also like to use Tableau to just make our lives easier, so that when we do one analysis it's very, very easy to replicate it again and again and again. "

– Dana Zuber, Vice President - Strategic Planning Manager, Wells Fargo

- **Shade the area under lines.** When you have two or more line charts, fill the space under the respective lines to create an area chart. This informs a viewer about the relative contribution that line contributes to the whole.
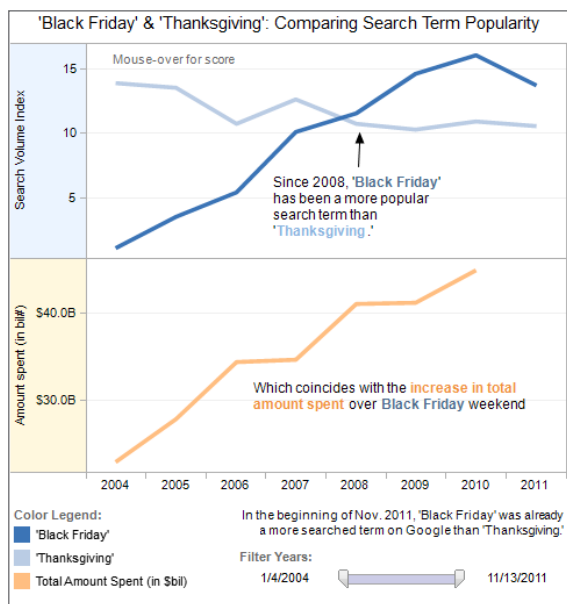

Figure 3: Basic lines reveal powerful insight

These two line charts illuminate the increasing popularity of "Black Friday" as an epic event in the United States. It's quick to see that Thanksgiving lost ground to the popular shopping period in 2008.
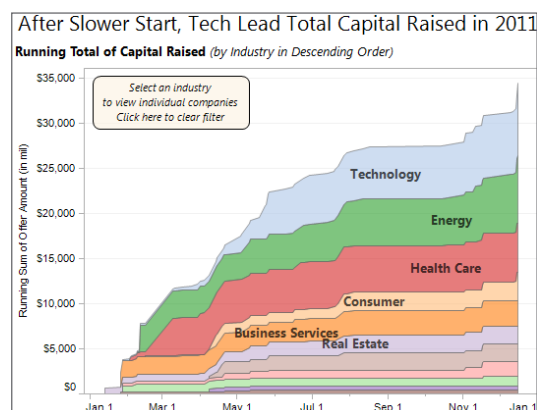

Figure 4: Transform line charts into area charts

Often when you have two or more sets of data in a line chart it can be helpful to shade the area under the line. In this chart, it's easy to tell that companies in the technology sector raised more capital than real estate in 2011.
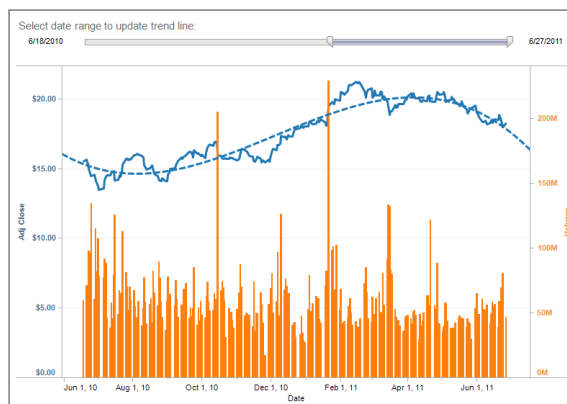

Figure 5: Combine line charts with bar and trend lines

Line charts are the most effective way to show change over time. In this case, GE's stock performance over a one-year period is joined with trading volume during the same time frame. At a glance you can tell there were two significant events, one resulting in a sell-off and the other a gain for shareholders. Click the graph and use the filter to select a different date range.

3 Pie

Pie charts should be used to show relative proportions – or percentages – of information. That's it. Despite this narrow recommendation for when to use pies, they are made with abandon. As a result, they are the most commonly mis-used chart type.

If you are trying to compare data, leave it to bars or stacked bars. Don't ask your viewer to translate pie wedges into relevant data or compare one pie to another. Key points from your data will be missed and the viewer has to work too hard.

When to use pie charts:

- **Showing proportions.** Examples: percentage of budget spent on different departments, response categories from a survey, breakdown of how Americans spend their leisure time.

Also consider:

- **Limit pie wedges to six.** If you have more than six proportions to communicate, consider a bar chart.

It becomes too hard to meaningfully interpret the pie pieces when the number of wedges gets too high.

- **Overlay pies on maps.** Pies can be an interesting way to highlight geographical trends in your data. If you choose to use this technique, use pies with only a couple of wedges to keep it easy to understand.
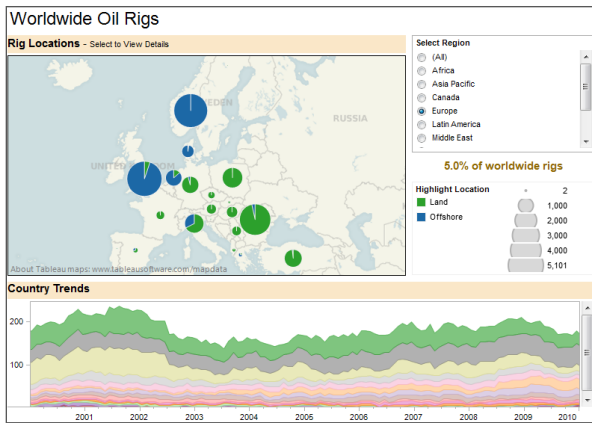

Figure 6: Use pies only to show proportions

Pie charts give viewers a fast way to understand proportional data. Using pie charts on this map shows the distribution of oil rigs on land vs. offshore in Europe.

4 Map

When you have any kind of location data – whether it's postal codes, state abbreviations, country names, or your own custom geocoding – you've got to see your data on a map. You wouldn't leave home to find a new restaurant without a map (or a GPS anyway), would you? So demand the same informative view from your data.

When to use maps:

- **Showing geocoded data.** Examples: Insurance claims by state, product export destinations by country, car accidents by zip code, custom sales territories.

Also consider:

- **Use maps as a filter for other types of charts, graphs, and tables.** Combine a map with other relevant data then use it as a filter to drill into your

data for robust investigation and discussion of data.

- **Layer bubble charts on top of maps.** Bubble charts represent the concentration of data and their varied size is a quick way to understand relative data. By layering bubbles on top of a map it is easy to interpret the geographical impact of different data points quickly.

- **Layer pie charts on top of maps.** As mentioned above, layering a pie chart on a map can be an interesting way to show regional trends. Keep the number of pie wedges small.
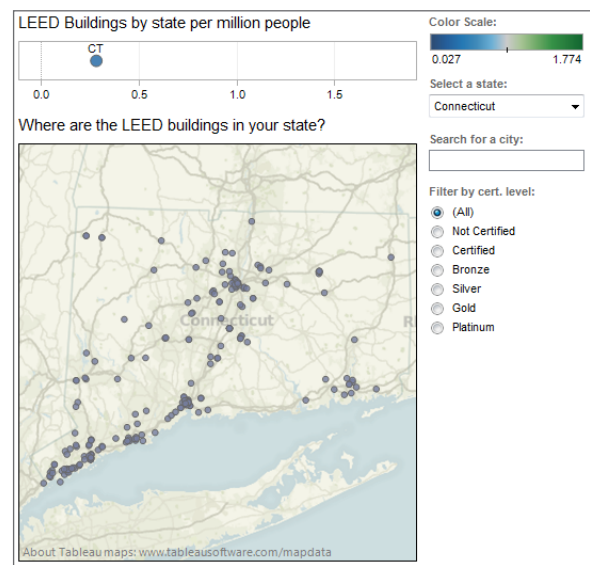

Figure 7: Provide street-level data on a map

Maps are a powerful way to visualize data. In this visualization you can zero in on every LEED certified building in the United States based on their street address. Select any state or city to find the greenest buildings in that area.

5 Scatter plot

Looking to dig a little deeper into some data, but not quite sure how – or if – different pieces of information relate? Scatter plots are an effective way to give you a sense of trends, concentrations and outliers that will direct you to where you want to focus your investigation efforts further.

When to use scatter plots:

- **Investigating the relationship between different**

" Visualizing data using color, shapes, positions on X and Y axes, bar charts, pie charts, whatever you use, " makes it instantly visible and instantly significant to the people who are looking at it. "

– Jon Boeckenstedt, Associate Vice President Enrollment Policy and Planning, DePaul University

variables. Examples: Male versus female likelihood of having lung cancer at different ages, technology early adopters' and laggards' purchase patterns of smart phones, shipping costs of different product categories to different regions.

Also consider:

- **Add a trend line/line of best fit.** By adding a trend line the correlation among your data becomes more clearly defined.

- **Incorporate filters.** By adding filters to your scatter plots, you can drill down into different views and details quickly to identify patterns in your data.

- **Use informative mark types.** The story behind some data can be enhanced with a relevant shape
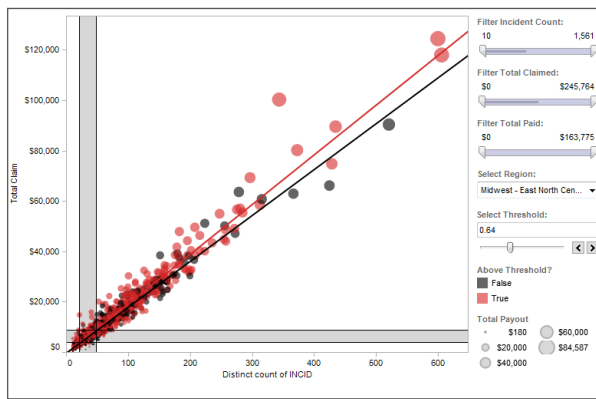

Figure 8: Can you spot the fraud?

Using scatter plots is a quick, effective way to spot outliers that might warrant further investigation. By creating this interactive scatter plot, an insurance investigator can quickly evaluate where they might have fraudulent activity.
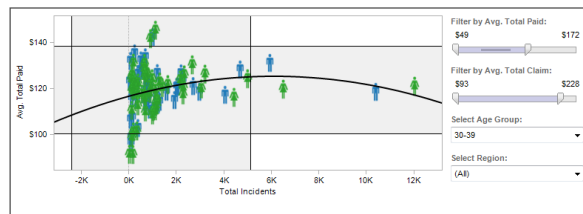

Figure 9: Who is most expensive to insure?

Use an informative icon or "mark type" such as the female and male icons for additional detail in your scatter plot. Select the graph and filter to see how demographics change insurance premium forecasting for an employer.

6 Gantt

Hitting deadlines is paramount to a project's success. Seeing what needs to be accomplished – and by when – is essential to make this happen. This is where a Gantt chart comes in. Gantt charts excel at illustrating the start and finish dates elements of a project.

While most associate Gantt charts with project management, they can be used to understand how other things such as people or machines vary over time. You could use a Gantt, for example, to do resource planning to see how long it took people to hit specific milestones, such as a certification level, and how that was distributed over time.
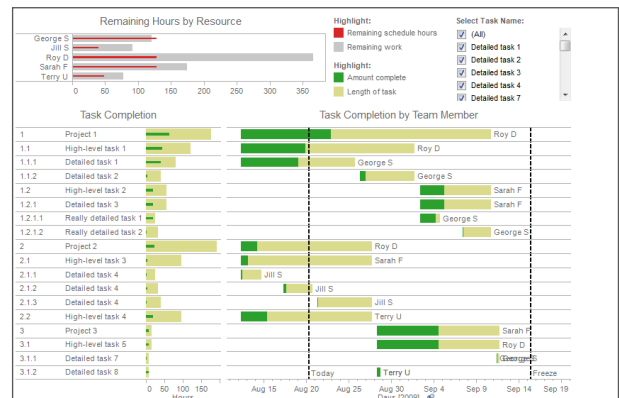

Figure 10: Manage project effectively

A Gantt chart is the centerpiece of this dashboard, providing a complete overview of tasks, owners, due dates, and status. By providing a menu of tasks at the top, a project manager can drill down as needed to make informed decisions.

When to use Gantt charts:

- **Displaying a project schedule.** Examples: illustrating key deliverables, owners, and deadlines.

- **Showing other things in use over time.** Examples: duration of a machine's use, availability of players on a team.

Also consider:

- **Adding color.** Changing the color of the bars within the Gantt chart quickly informs viewers about key aspects of the variable.

- **Combine maps and other chart types with Gantt charts.** Including Gantt charts in a dashboard with other chart types allows filtering and drill down to expand the insight provided.

Figure 11: Who served the longest?

With a quick glance, this Gantt chart lets you know which U.S. senator held office the longest and which side of the aisle they represented. *Select the visualization* *and use the drop down menu to see criteria such as party.*

7 Bubble

Bubbles are not their own type of visualization but instead should be viewed as a technique to accentuate data on scatter plots or maps. People are drawn to using bubbles because the varied size of circles provides meaning about the data. When bubbles vary by color as well as size the impact is magnified.

When to use bubbles:

- **Showing the concentration of data along two axes.** Examples: sales concentration by product and geography, class attendance by department and time of day.

Also consider:

- **Accentuate data on scatter plots:** By varying the size and color of data points, a scatterplot can be transformed into a rich visualization that answers many questions at once.

- **Overlay on maps:** Bubbles quickly inform a viewer about relative concentration of data. Using these as an overlay on map puts geographically-related data in context quickly and effectively for a viewer.
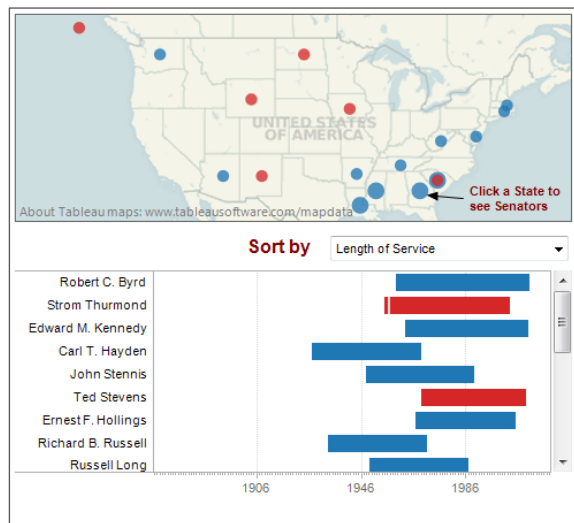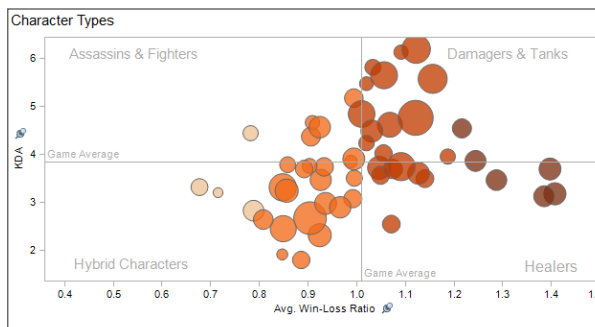

Figure 12: Add data depth with bubbles

In this scatter plot accentuated with bubbles, the varied size and color of circles make it quick to see how the game's players compare. *Click this dashboard then scroll over the bubbles to get instant access to more detailed information about each character.*

Figure 13: Oil imports and exports at a glance

It's easy to tell who buys and sells the most oil with green bubbles for net exporters and red for net importers overlaid on this map. *Select a country on the map and the dashboard reveals details about consumption history.*

8 Histogram

Use histograms when you want to see how your data are distributed across groups.

Say, for example, that you've got 100 pumpkins and you want to know how many weigh 2 pounds or less, 3-5 pounds, 6-10 pounds, etc. By grouping your data into these categories then plotting them with vertical bars

along an axis, you will see the distribution of your pumpkins according to weight. And, in the process, you've created a histogram.

At times you won't necessarily know which categorization approach makes sense for your data. You can use histograms to try different approaches to make sure you create groups that are balanced in size and relevant for your analysis.
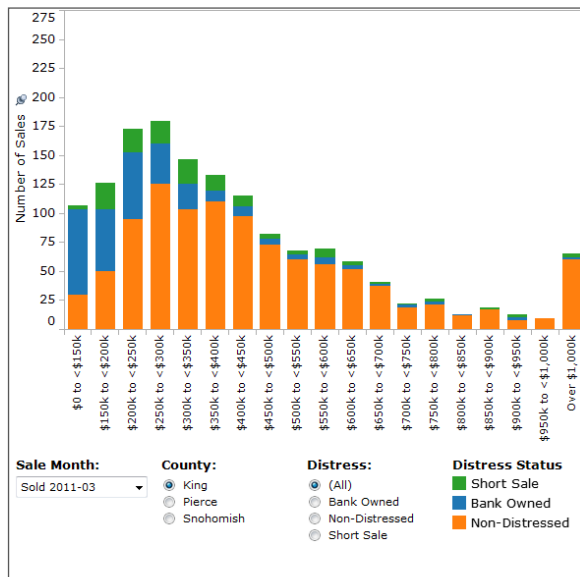

Figure 14: Which houses are selling?

This histogram shows which houses are seeing the most sales in a month. Explore for yourself how the histogram changes when you select a different month, county, or distress level.

When to use histograms:

• **Understanding the distribution of your data.** Examples: Number of customers by company size, student performance on an exam, frequency of a product defect.

Also consider:

• **Test different groupings of data.** When you are exploring your data and looking for groupings or "bins" that make sense, creating a variety of histograms can help you determine the most useful sets of data.

• **Add a filter.** By offering a way for the viewer to drill down into different categories of data, the histogram becomes a useful tool to explore a lot of data views quickly.

9 Bullet

When you've got a goal and want to track progress against it, bullet charts are for you.

At its heart, a bullet graph is a variation of a bar chart. It was designed to replace dashboard gauges, meters and thermometers. Why? Because those images typically don't display sufficient information and require valuable dashboard real estate.

Bullet graphs compare a primary measure (let's say, year-to-date revenue) to one or more other measures (such as annual revenue target) and presents this in the context of defined performance metrics (sales quota, for example). Looking at a bullet graph tells you instantly how the primary measure is performing against overall goals (such as how close a sales rep is to achieving her annual quota).

When to use bullet graphs:

• **Evaluating performance of a metric against a goal.** Examples: sales quota assessment, actual spending vs. budget, performance spectrum (great/good/poor).

Also consider:

• **Use color to illustrate achievement thresholds.** Including color, such as red, yellow, green as a backdrop to the primary measure lets the viewer quickly understand how performance measures against goals.

• **Add bullets to dashboards for summary insights.** Combining bullets with other chart types into a dashboard supports productive discussions about where attention is needed to accomplish objectives.

" Tableau has many great visualization capabilities. We use a lot of mapping, not only to show the geographnical location, but also to do a lot of geocoding and we map relationships with geocoding the distances. "

" It has been helping us to tell the story with visuals and it's great. "

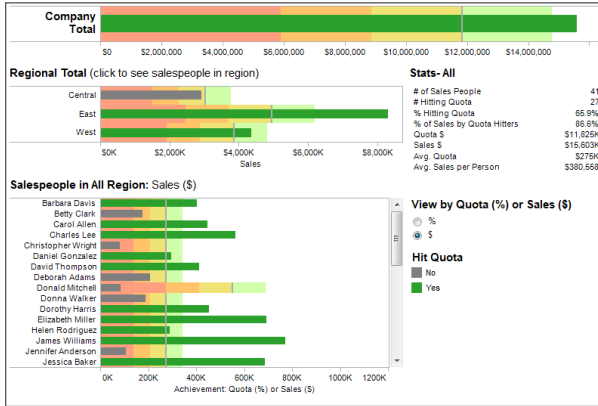– Marta Magnuszewska, Intelligence Data Analyst, Allstate Insurance

Figure 15: Have you hit your quota?

Tracking a sales team's progression to hitting its quota is a critical element to managing success. In this quota dashboard, a sales manager can quickly select to view her team's performance by quota percentage or sales amount as well as zero in on regional achievement.

10 Heat map

Heat maps are a great way to compare data across two categories using color. The effect is to quickly see where the intersection of the categories is strongest and weakest.

When to use heat maps:

- **Showing the relationship between two factors.** Examples: segmentation analysis of target market, product adoption across regions, sales leads by individual rep.

Also consider:

- **Vary the size of squares.** By adding a size variation for your squares, heat maps let you know the concentration of two intersecting factors, but add a third element. For example, a heat map could reveal a survey respondent's sports activity preference and the frequency with which they attend the event based on color, and the size of the square could reflect the number of respondents in that category.

- **Using something other than squares.** There are times when other types of marks help convey your data in a more impactful way.
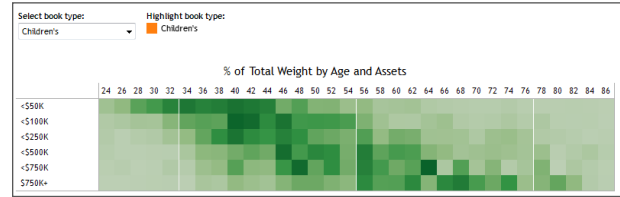

Figure 16: Who buys the most books?

In this market segmentation analysis, the heat map reveals a new campaign idea. High-income households of people in their sixties buy children's books. Perhaps it's time for a new grandparent-oriented campaign?

11 Highlight table

Highlight tables take heat maps one step further. In addition to showing how data intersects by using color, highlight tables add a number on top to provide additional detail.
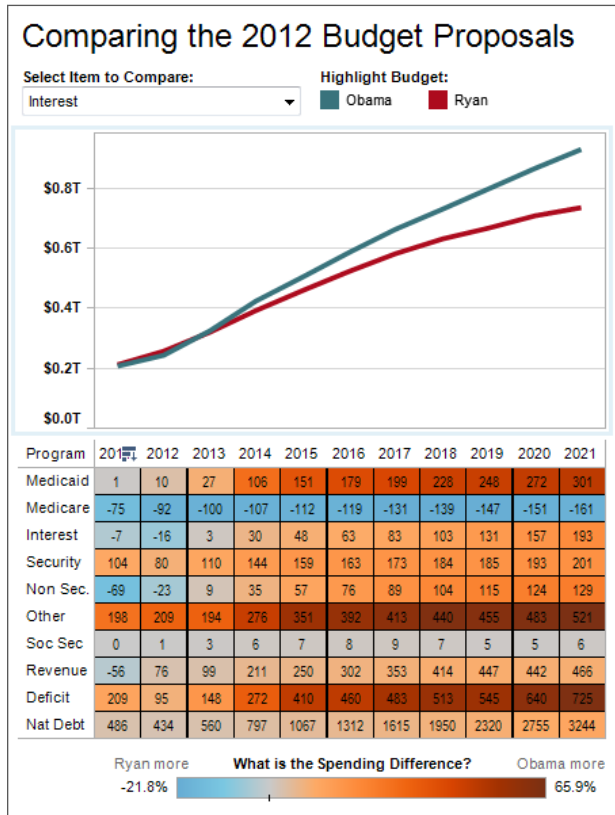

Figure 17: Highlight table shows spending difference

This highlight table compares two 2012 budget proposals for the U.S. Click the table to learn more.

When to use highlight tables:

• **Providing detailed information on heat maps.**

Examples: the percent of a market for different segments, sales numbers by a reps in a particular region, population of cities in different years.

Also consider:

• **Combine highlight tables with other chart types:**

Combining a line chart with a highlight table, for example, lets a viewer understand overall trends as well as quickly drill down into a specific cross section of data.

What's your data's story?

Connecting the dots between the data you have and the questions you want to answer is paramount. Selecting the right kind of chart is the first step to unleashing the insight your data can provide, but your data can offer much, much more.

Your chart should offer interactivity so that as you see the implications of your data you can continue drilling into the information to ask more questions. Combining charts in a dashboard is the next step to creating an environment where you can not only ask – but answer – your questions in real time.

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If a viz falls onto the web and no one sees it, did it happen? Lori likes data visualizations, but she likes them best when they get seen and used. She is happiest vizing away on Tableau Public and helping others become killer analysts. Lori's visualizations have appeared in the Washington Post, Los Angeles Times, Guardian Data Blog, Mashable, the liberal political site Daily Kos, the conservative site Hot Air. Lori earned a Ph.D. in Epidemiology at the University of Washington, a Master's in Public Health from the University of Illinois at Chicago, and B.A. in Biology at Northwestern University. @VisualLori

Check out the book **The Accidental Analyst: Show Your Data Who's Boss**, *by Eileen McDaniel, PhD, and Stephen McDaniel. You'll learn a detailed plan of attack to answer your everyday business questions and pick up many tips, tricks and shortcuts by following the illustrated examples.*