

KEY PRINCIPLES OF DATA VISUALIZATION



Strive for **CLARITY & SIMPLICITY**

- *Maximize **impact**, minimize **noise***
- *If it doesn't **add value** or **serve a purpose**, get rid of it*



Focus on creating a **NARRATIVE**

- *Don't just show data, **tell a story***
- *Communicate key insights **clearly, quickly and powerfully***



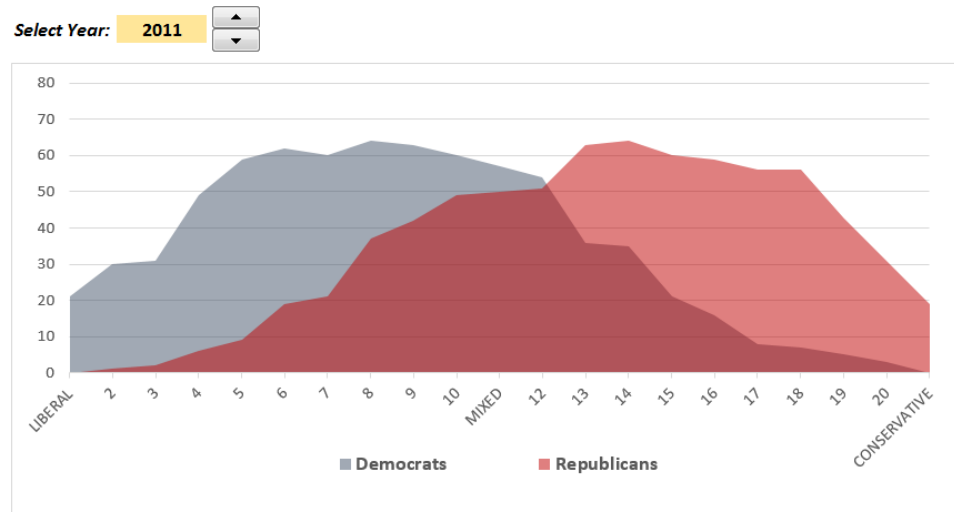
Strike a balance between **DESIGN & FUNCTION**

- *Selecting the right type of chart is **critical***
- ***Beautiful** is good, **functional** is better, **BOTH** is ideal*

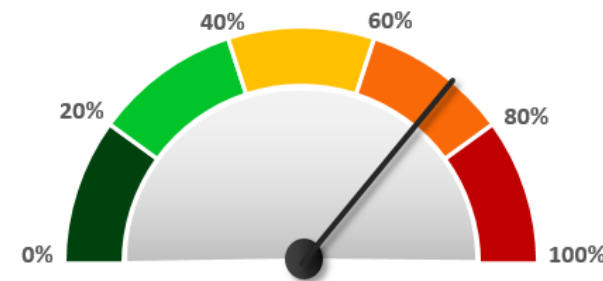
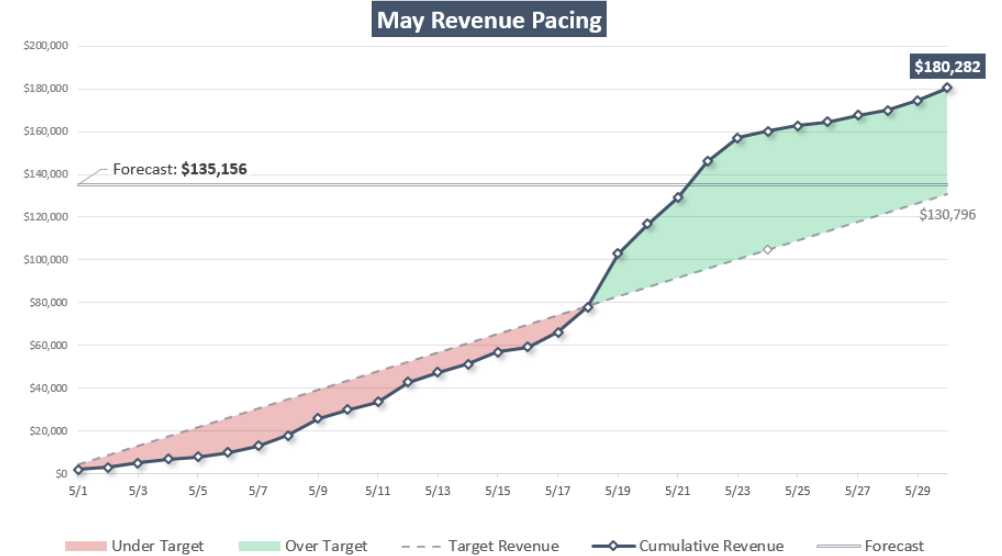
THE GOOD, THE BAD, AND THE UGLY

THE GOOD

Dynamic formatting helps to strengthen the story



Clean, simple visualization with animation over time

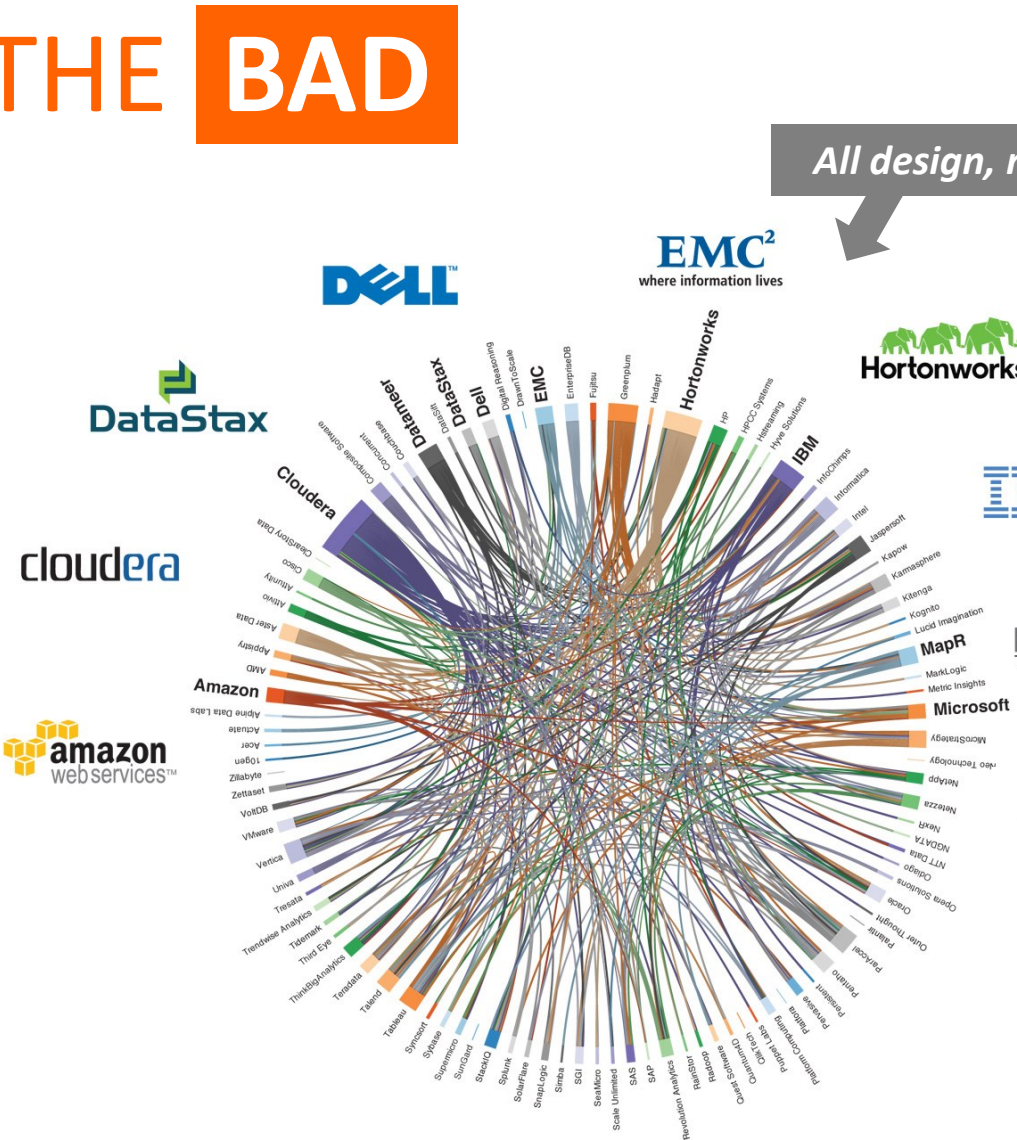


Simple, intuitive custom chart design

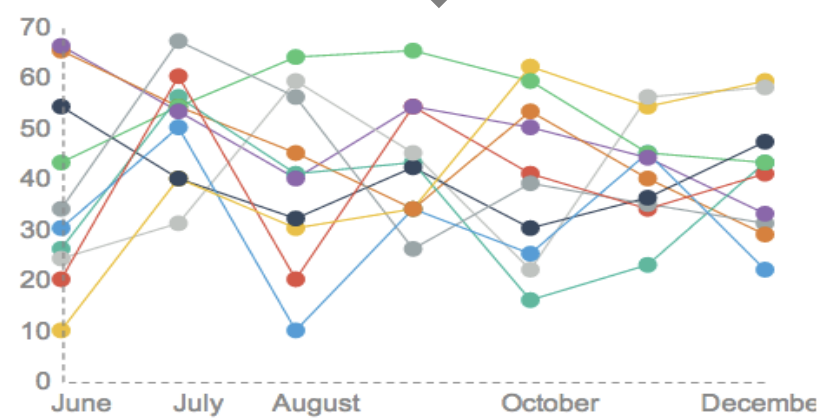
CURRENT ACCIDENT RISK

THE GOOD, THE BAD, AND THE UGLY

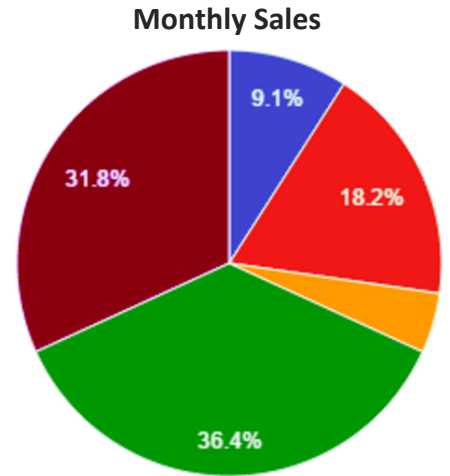
THE BAD



Busy, no clear narrative



Misleading chart type



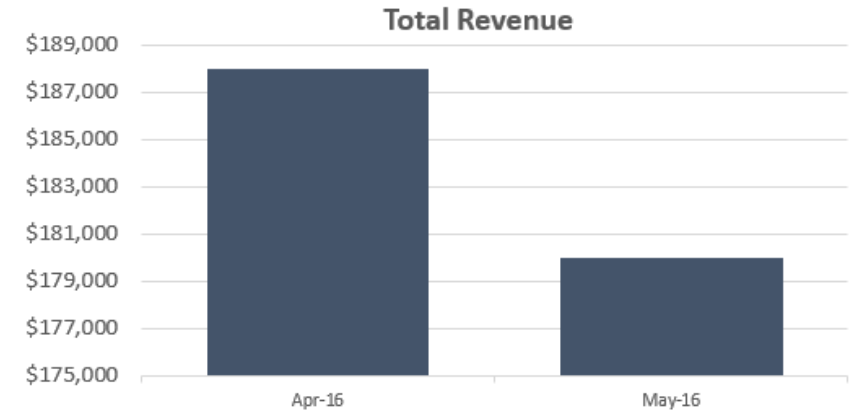
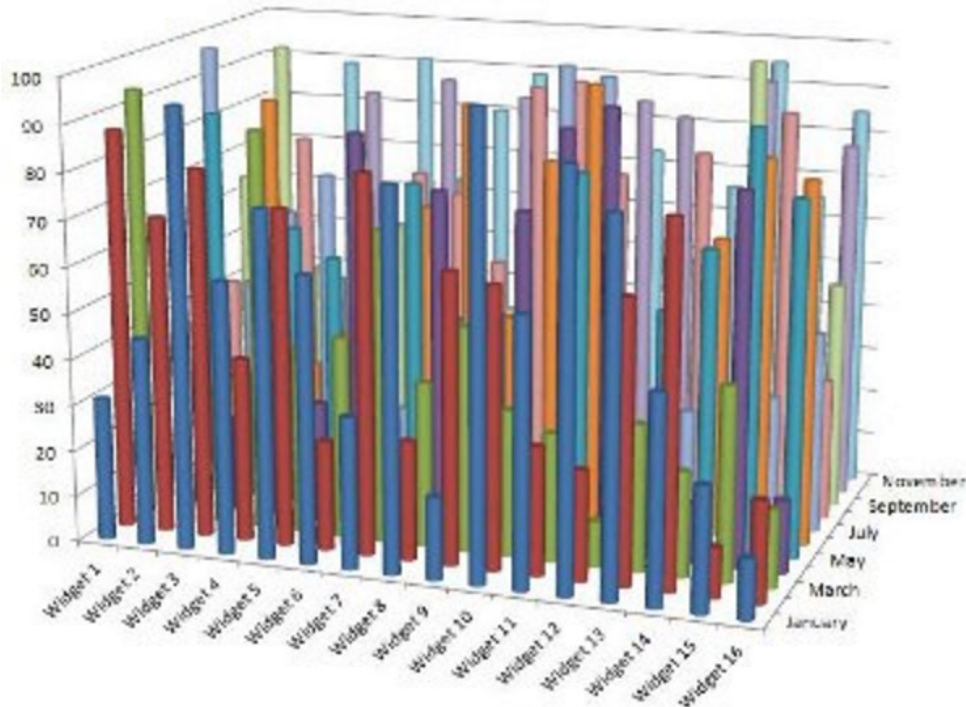
- Sep
- Oct
- Nov
- Dec
- Jan

THE GOOD, THE BAD, AND THE UGLY

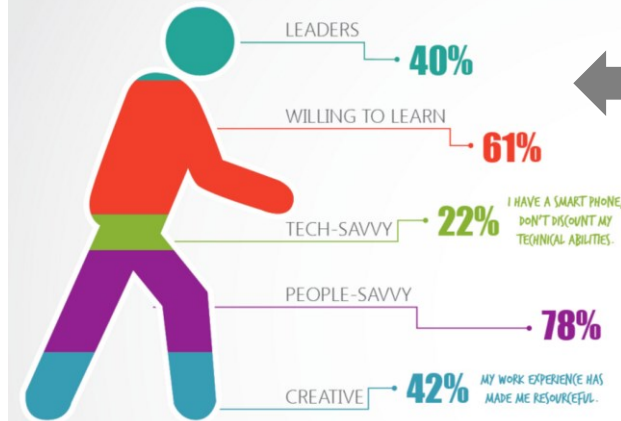
THE UGLY

Misleading y-axis scale

Too many elements, distracting 3D design



HOW BABY BOOMERS DESCRIBE THEMSELVES



Improper use of percentages & inconsistent scaling

THE 3 KEY QUESTIONS

1

What **type of data** are you working with?

- *Integer, real, categorical, time-series, geo-spatial, etc.*

2

What are you trying to **communicate**?

- *Relationship, comparison, composition, distribution, trending, etc.*

3

Who is the **end user** consuming this information?

- *Analyst, CEO, client, intern, etc.*

BAR & COLUMN CHARTS

COMMONLY USED FOR:

- Comparing numerical data across categories

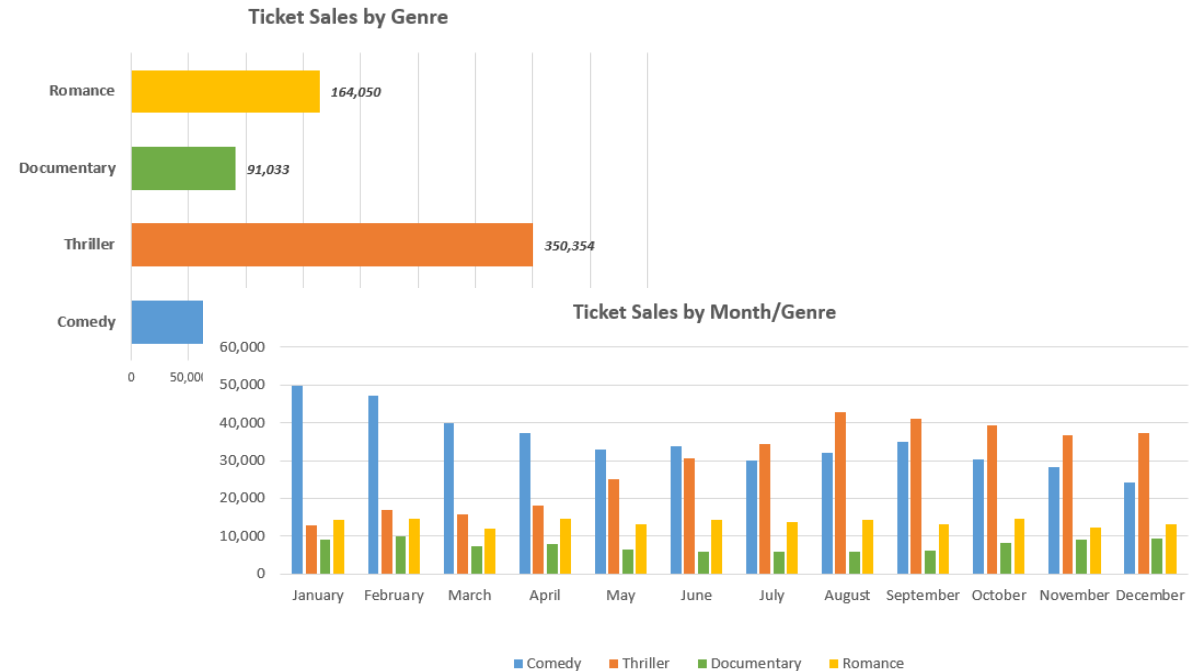
EXAMPLES:

- *Total sales by product type*
- *Population by country*
- *Revenue by department, by quarter*

PRO TIPS:

 Use **stacked** or **clustered** bars/columns to group by subcategory or compare multiple metrics

 Create **custom formatting rules** to color-code bars/columns based on their values



HISTOGRAMS & PARETO CHARTS

COMMONLY USED FOR:

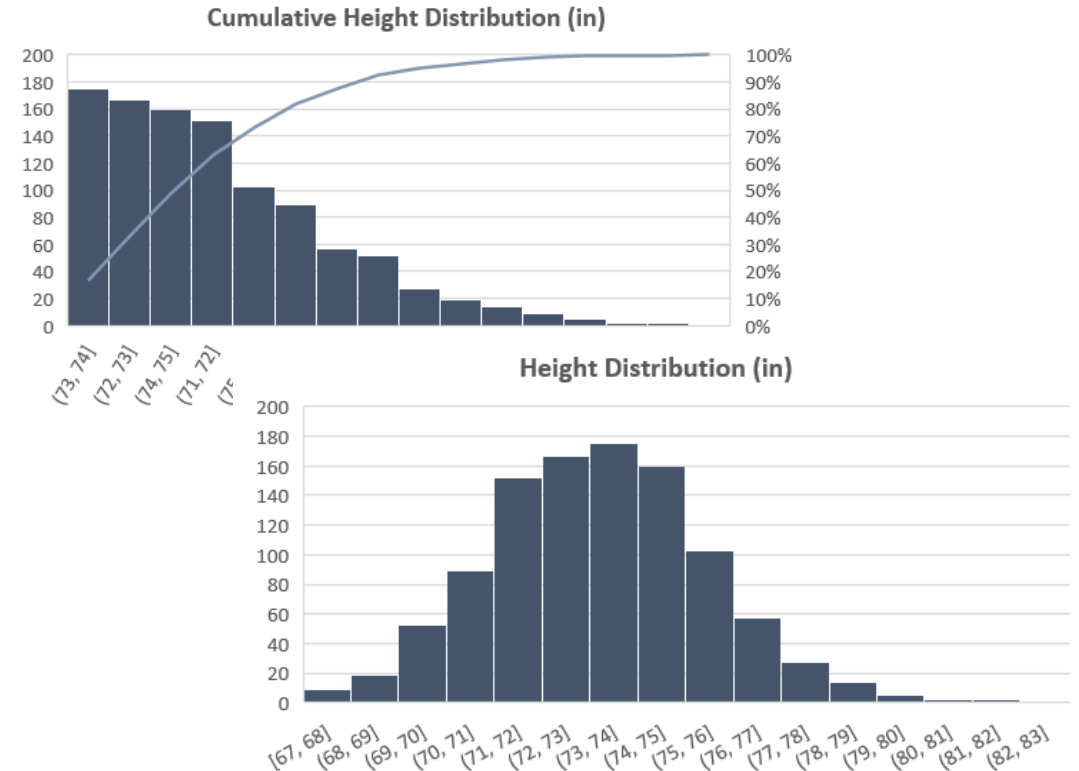
- Showing the distribution of a continuous data set

EXAMPLES:

- *Frequency of test scores among students*
- *Distribution of population by age group*
- *Distribution of heights or weights*

PRO TIPS:

- 👍 Adjust the bin size to customize the grouping of values
- 👍 Use Pareto Charts to show the cumulative impact of each bin, ordered by significance



LINE CHARTS

COMMONLY USED FOR:

- Visualizing trends over time

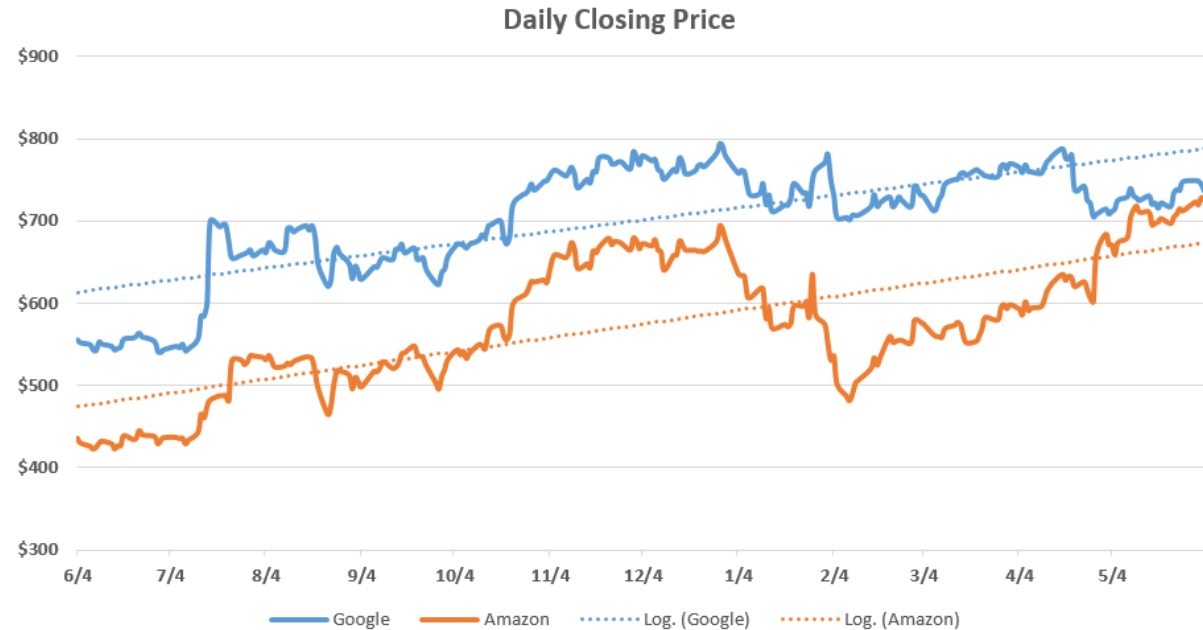
EXAMPLES:

- *Stock price by hour*
- *Average temperature by month*
- *Profit by quarter*

PRO TIPS:

 Use **linear** or **polynomial trendlines** to visualize patterns or forecast future periods

 Combine **line** & **column** charts to trend two variables on different scales



AREA CHARTS

COMMONLY USED FOR:

- Showing changes in data composition over time

EXAMPLES:

- *Sales by department, by month*
- *% of total downloads by browser, by week*
- *Population by continent, by decade*

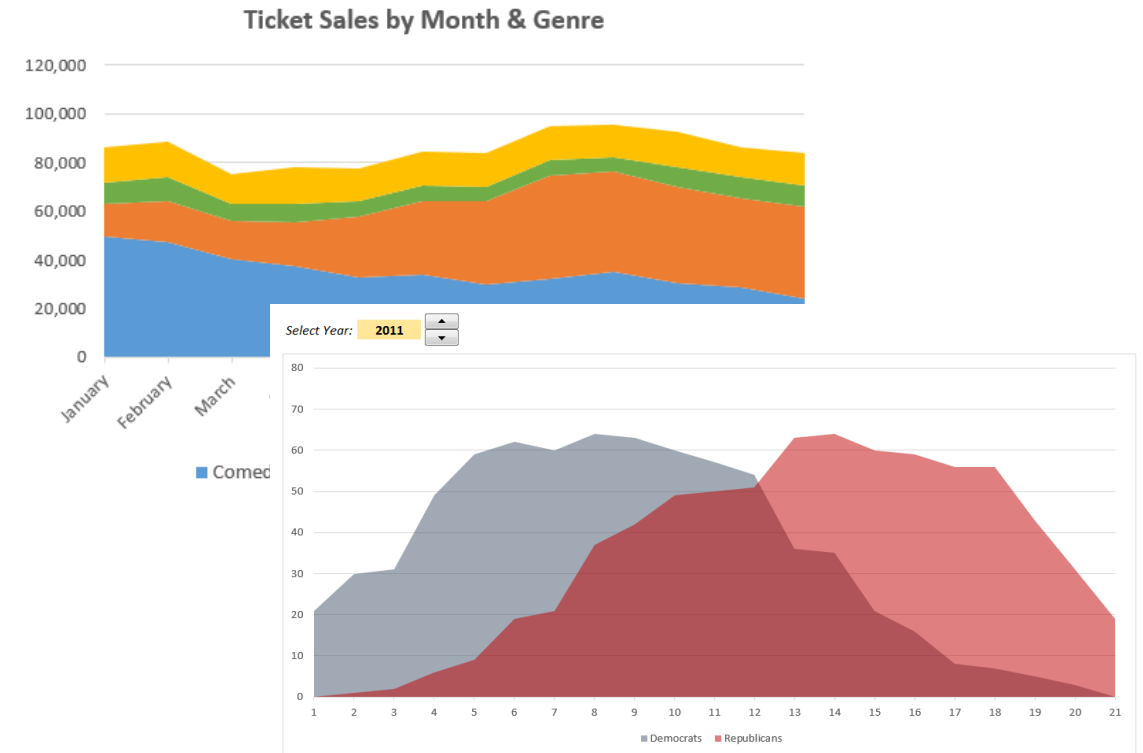
PRO TIPS:



Keep the number of unique categories relatively low (<6) to maintain clarity



Use **data validation** and **custom formatting** to dynamically highlight specific data series



PIE & DONUT CHARTS

COMMONLY USED FOR:

- **Comparing proportions totaling 100%**

EXAMPLES:

- *Percentage of budget spent by department*
- *Proportion of internet users by age range*
- *Breakdown of site traffic by source*

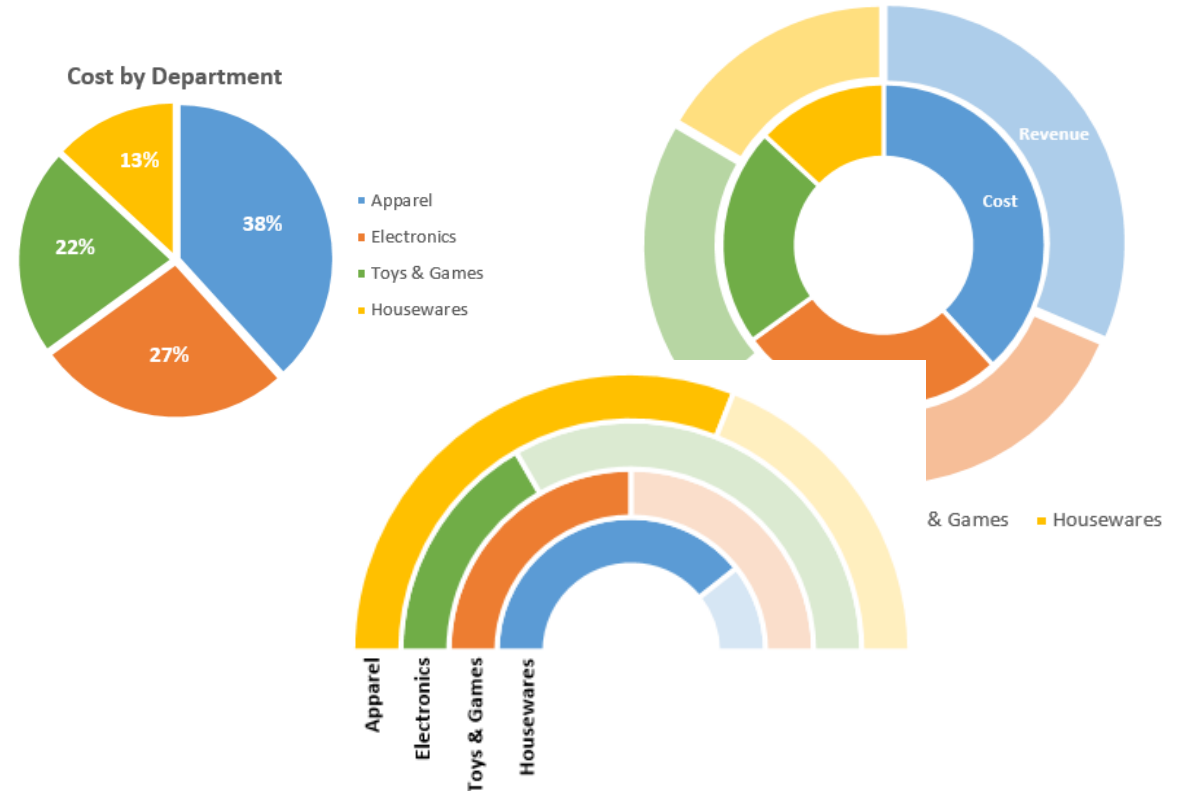
PRO TIPS:



Keep the **number of slices small (<6)** to maximize readability



Use a **donut chart** to visualize more than one series at once, or use transparent segments to create a custom “race track” visualization



SCATTER PLOTS


COMMONLY USED FOR:

- Exploring correlations or relationships between series

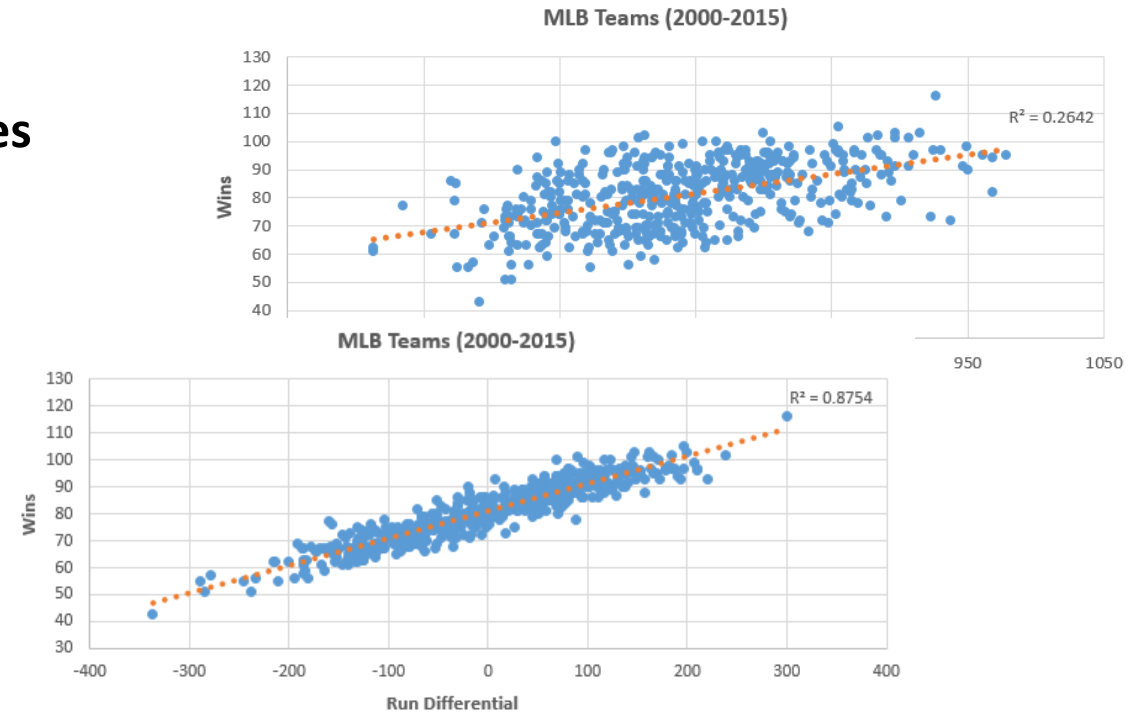
EXAMPLES:

- *Number of home runs and salary by player*
- *Ice cream sales and average temperature by day*
- *Hours of television watched by age*

PRO TIPS:

 Add a **trendline** or **line of best fit** to quantify the correlation between variables

 Remember that **correlation *does not* imply causation**



BUBBLE CHARTS

COMMONLY USED FOR:

- Adding a third dimension (size) to a scatter plot format

EXAMPLES:

- *Product sales (X), Revenue (Y), and Market Share (size) by Company*
- *Income per Capita (X), Life Expectancy (Y) and Population (size) by Country*

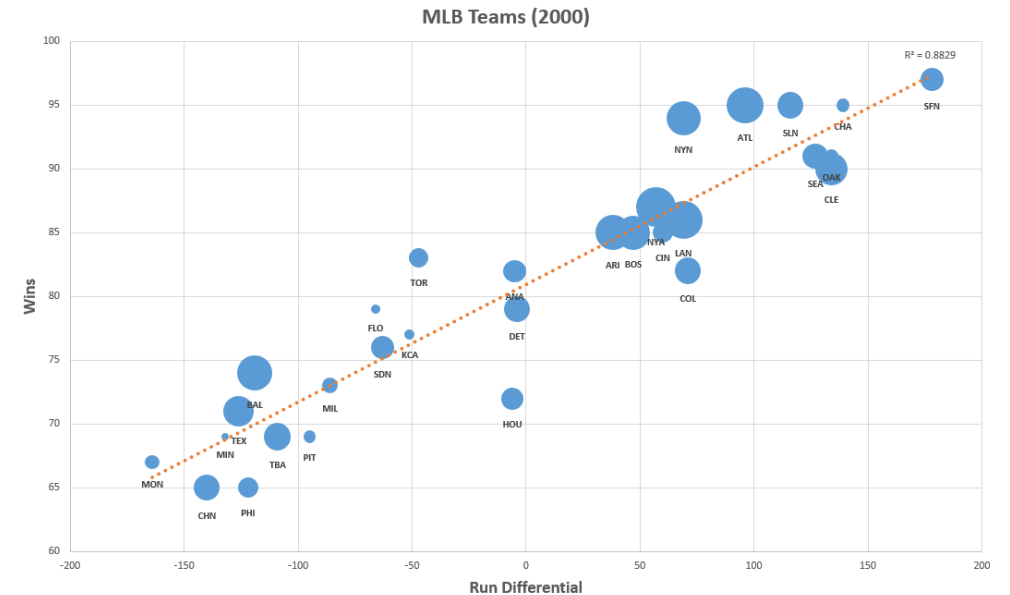
PRO TIPS:



Use **color** as a fourth dimension to differentiate between categories



Use **cell formulas** and **form controls** to create a dynamic, animated bubble chart



BOX & WHISKER CHARTS

COMMONLY USED FOR:

- Visualizing statistical characteristics across data series

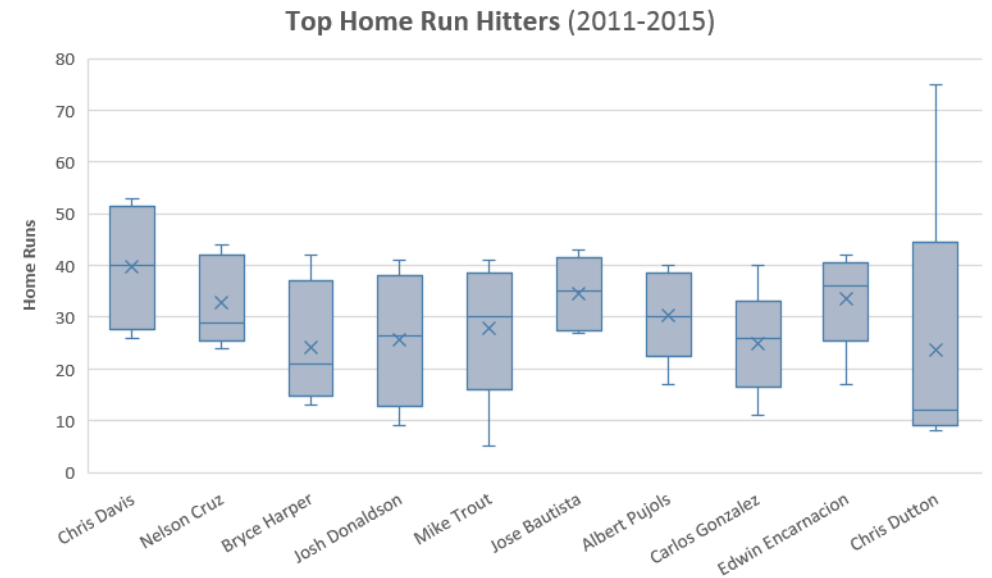
EXAMPLES:

- *Comparing historical annual rainfall across cities*
- *Analyzing distributions of values and identifying outliers*
- *Comparing mean and median height/weight by country*

PRO TIPS:



By default, quartiles are calculated by **excluding the median**; this calculation can be adjusted to **include** the median, but may significantly change the result (particularly for smaller data samples)



TREE MAPS & SUNBURST CHARTS

COMMONLY USED FOR:

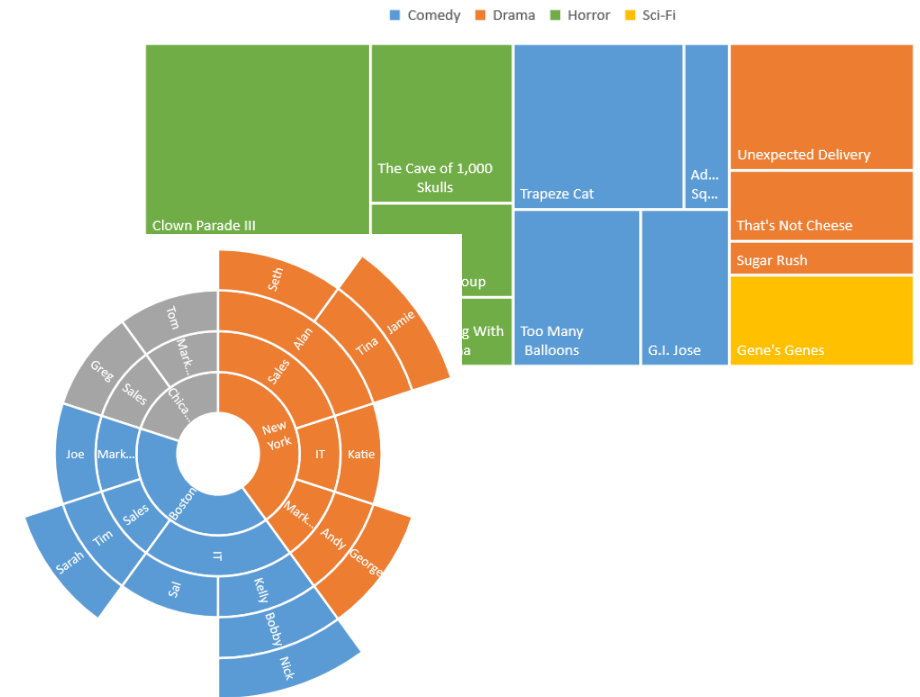
- Visualizing hierarchical data with natural groups/sub-groups

EXAMPLES:

- Revenue by Book Title, Sub-Genre, and Genre
- Number of Employees by Department and Office
- Population by City, State, and Region

PRO TIPS:

- Use **Tree Maps** when you are only visualizing 1 or 2 hierarchical levels (i.e. topic & sub-topic) or when relative sizes are important, and **Sunburst charts** to visualize the depth of multiple hierarchical levels
- Make sure your raw source data is **grouped** and **sorted** before creating hierarchical charts



WATERFALL CHARTS

COMMONLY USED FOR:

- Showing the net value after a series of positive and negative contributions

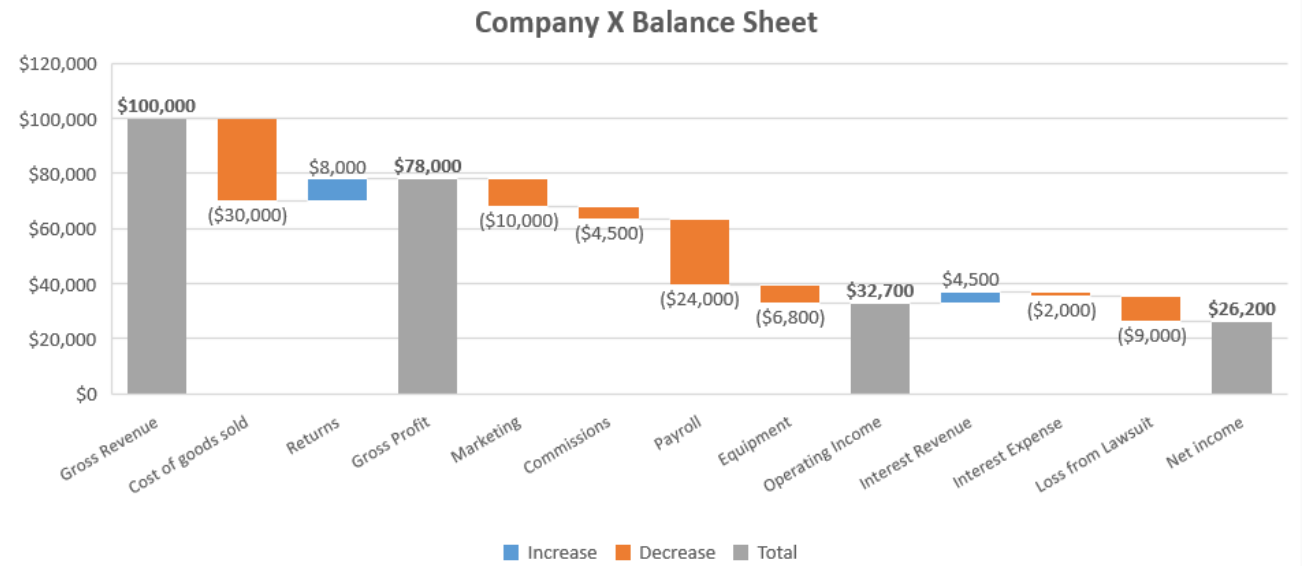
EXAMPLES:

- *Corporate balance sheet analysis*
- *Personal income and spending*

PRO TIPS:



Use **sub-totals** to create “checkpoints” and split up certain types of gains/losses (i.e. **Gross Revenue** - Cost of Goods Sold = **Gross Profit**, Gross Profit - Operating Expenses = **Operating Income**, etc.)



FUNNEL CHARTS



COMMONLY USED FOR:

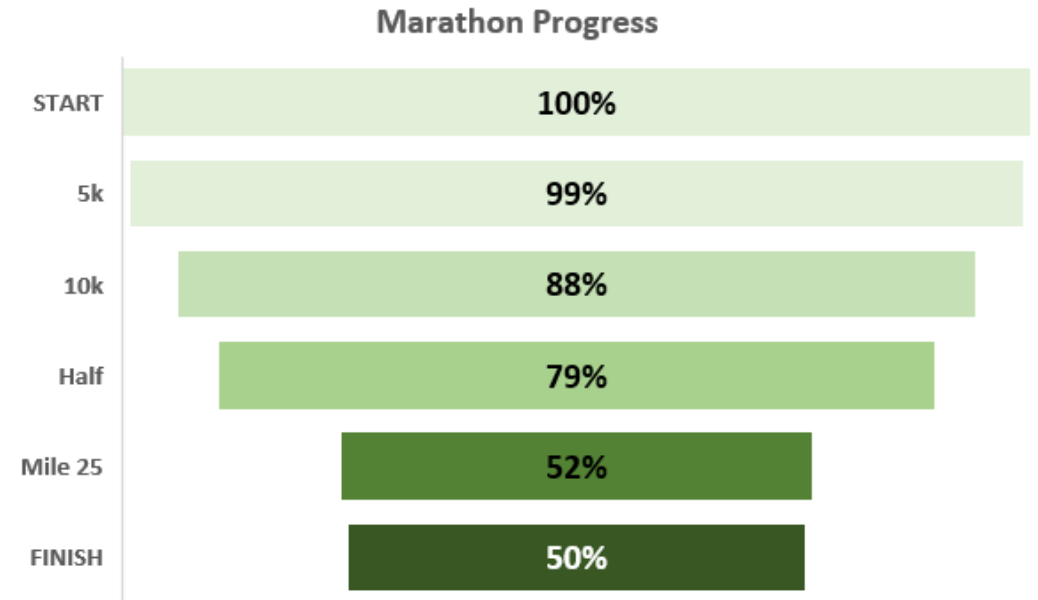
- Showing progress through the stages of a funnel

EXAMPLES:

- *Volume of views, clicks, and sales on an ecomm site*
- *Number of runners who reach each checkpoint in a marathon (5k, 10k, half, etc.)*

PRO TIPS:

-  Use “**percent of total**” calculations to show the % of users (rather than #) at each funnel stage
-  **Customize colors** to emphasize progression towards an end goal



RADAR CHARTS



COMMONLY USED FOR:

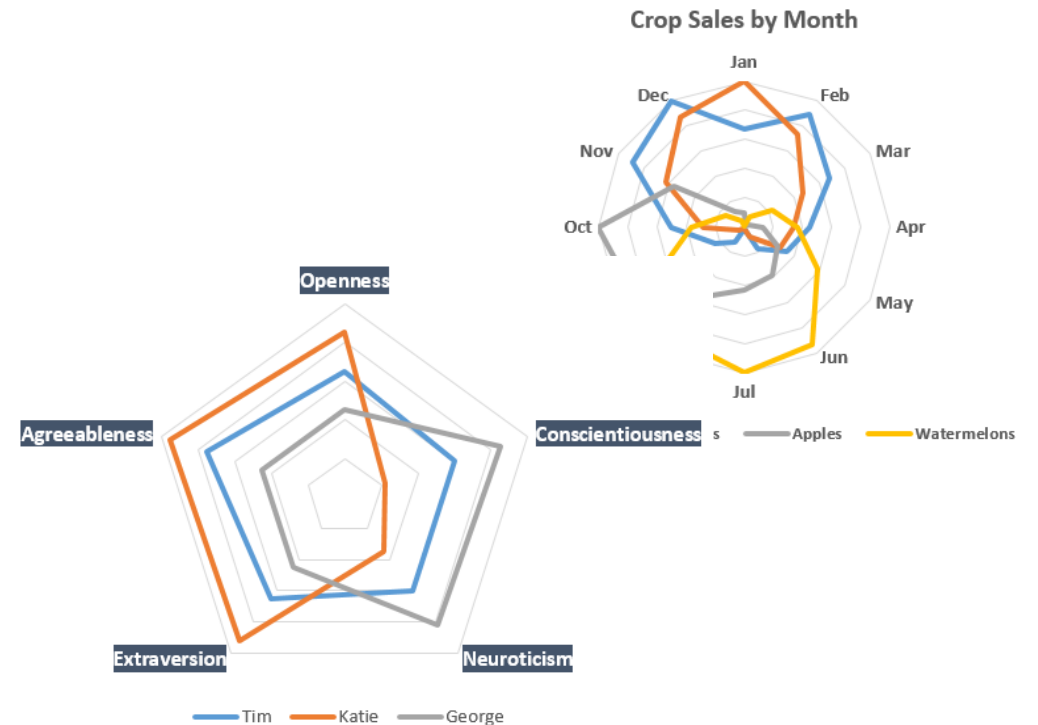
- Plotting three or more quantitative variables on a two-dimensional chart, relative to a central point

EXAMPLES:

- Comparing test scores across multiple subjects
- Sales of different types of vegetables, by month
- Visualizing personality test results across subjects

PRO TIPS:

-  **Normalize each metric to the same scale** (i.e. 0-1, 1-10, 1-100) to improve readability and create more intuitive comparisons across data series
-  **Limit the number of categories** or data series to minimize noise and maximize impact



SURFACE & CONTOUR CHARTS



COMMONLY USED FOR:

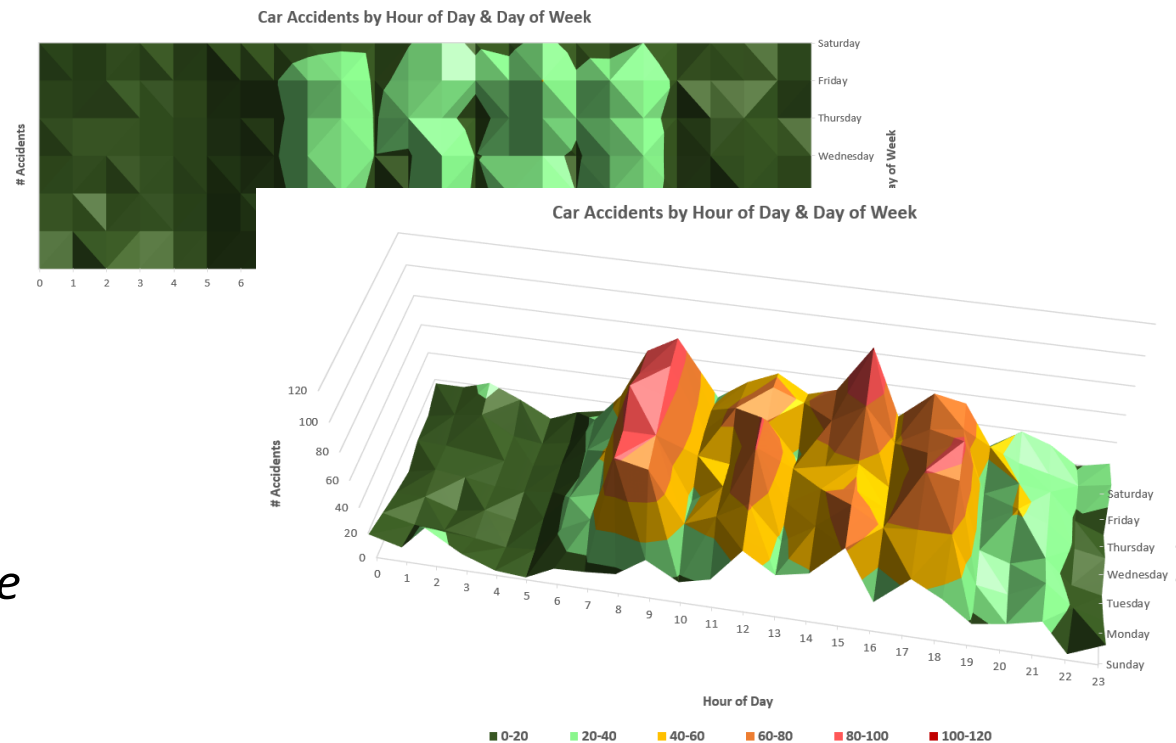
- Plotting data in three dimensions to find optimum combinations of values

EXAMPLES:

- Accident rates by hour of day and day of week
- Elevation by latitude and longitude
- Cookie deliciousness by oven temp and baking time

PRO TIPS:

-  Don't use surface charts if a simple **heat map** will tell the same story
-  Avoid using **wireframe** chart types when possible, as they can be difficult to interpret



STOCK CHARTS

COMMONLY USED FOR:

- Visualizing stock market data, including volume, high, low, open, and closing prices

EXAMPLES:

- *Facebook's daily stock performance in 2015*
- *High, low, and closing prices for Google in Q1*
- *Relative performance across multiple stocks*

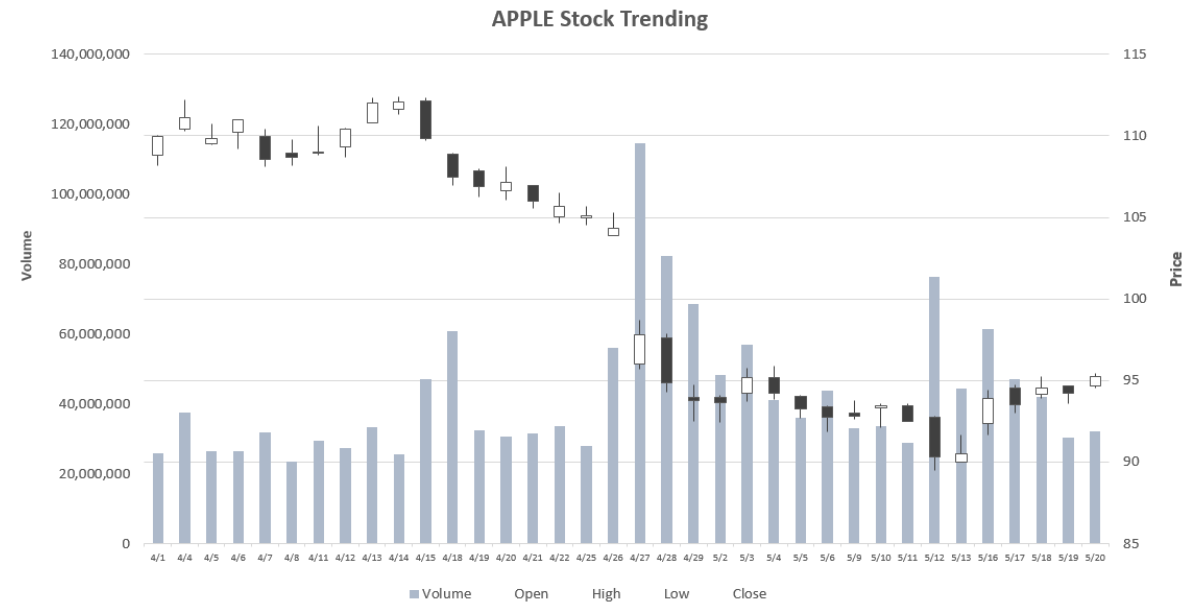
PRO TIPS:



Manually set **axis minimum/maximum values** to enhance readability



Switch from a **date** to a **text** axis to eliminate gaps when markets are closed



HEAT MAPS

COMMONLY USED FOR:

- Visualizing trends or relationships using color scales

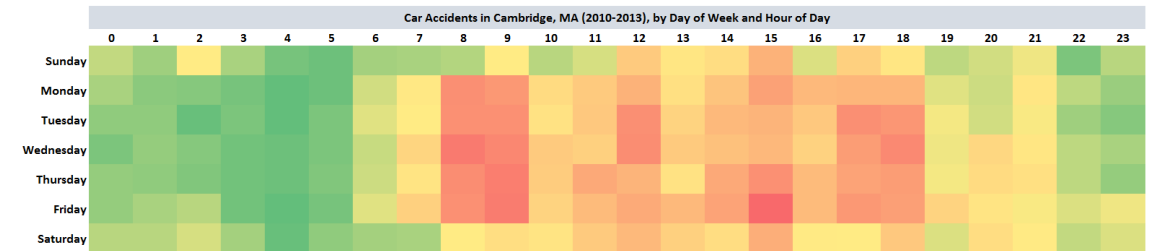
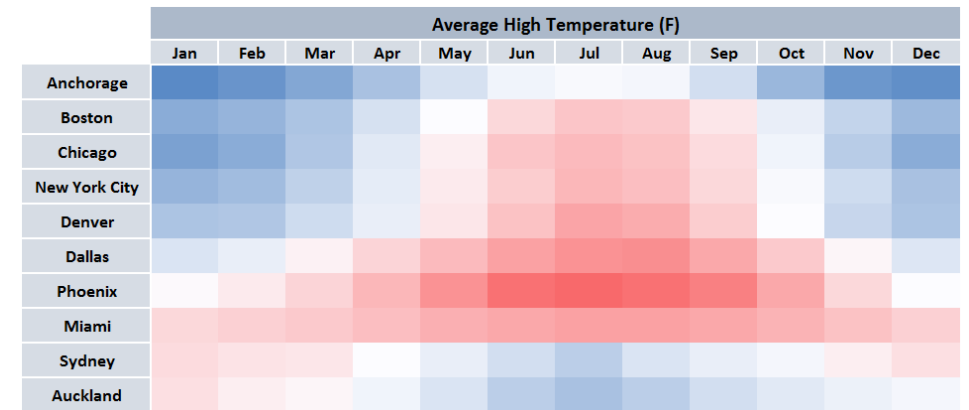
EXAMPLES:

- *Accident rates by time of day and day of week*
- *Average temperature by city, by month*
- *Average sentiment by hashtag*

PRO TIPS:

 Use intuitive color scales (i.e. **red to green**) and apply custom formatting to hide cell values (;;;)

 Use **data validation** and **cell formulas** to create dynamic heat maps based on user-entered values



GEOSPATIAL/CHOROPLETH MAP

COMMONLY USED FOR:

- Visualizing location-based data

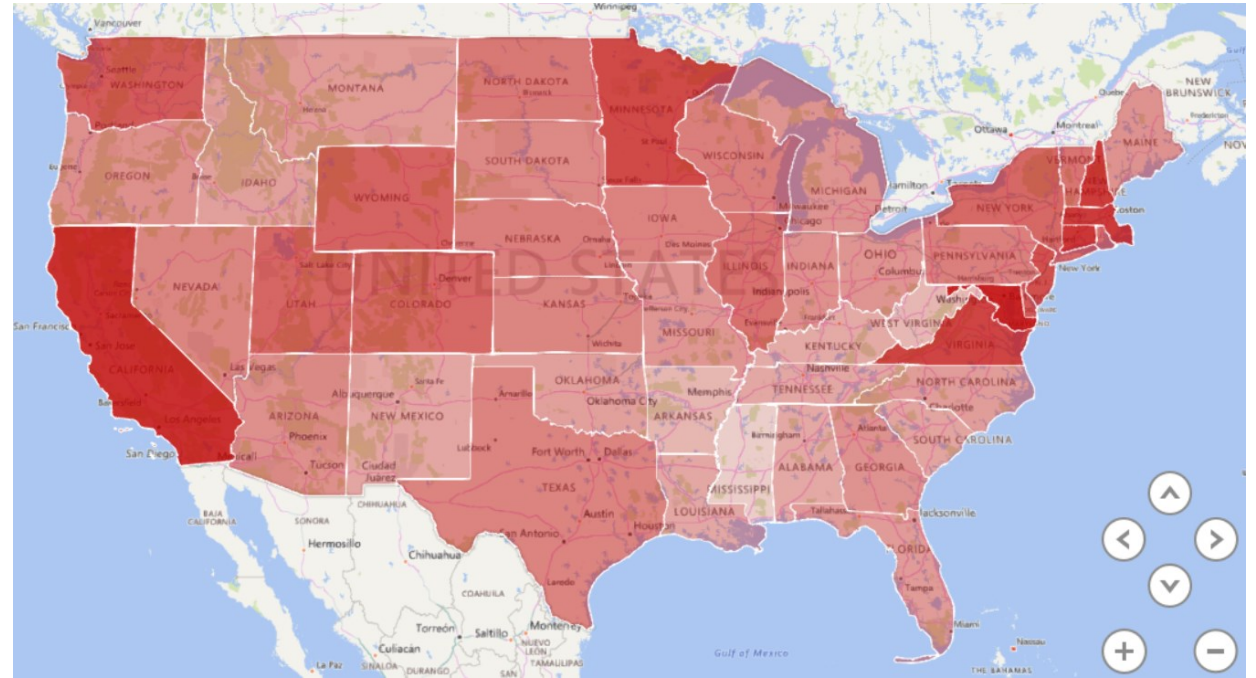
EXAMPLES:

- *Frequency of accidents by street address*
- *Unemployment rate by country*
- *Average rainfall by state*

PRO TIPS:

 Use Excel's **Power Map** plug-in to create geo-spatial visualizations and animate changes over time

 Utilize attributes like **color** and **size** to visualize multiple attributes at once



RESOURCES & NEXT STEPS

- ★ Check out **Excel Analytics – Advanced Formulas & Functions** to master advanced Excel formulas and analytics tools
 - *Stats functions, logical operators, conditional statements, text functions, array formulas, lookup/reference functions, formula-based formatting, and more*
- ★ Head to the following blogs/sites for additional support:
 - *support.office.com* for help with the basic (also check out Office 365)
 - *stackoverflow.com* for advanced forum support
 - *<https://sites.google.com/site/e90e50charts/>* for crazy advanced stuff
- ★ Rating and reviews are what keeps courses like this alive, so **please** share feedback (for better or for worse!)