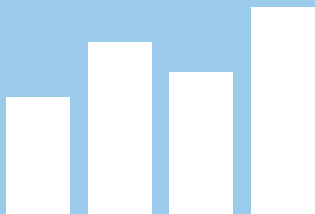


The logo for Domo, featuring the word "DOMO" in a blue, sans-serif font. The letters are slightly overlapping, with the 'D' and 'O' on the left being larger and more prominent than the 'M' and 'O' on the right. The logo is centered within a white square that is itself centered on the blue background.

DOMO



Visualization Quick Guide

A best practice guide to help you
find the right visualization for your data

WHAT IS DOMO?

Domo is a new form of business intelligence (BI) unlike anything before — an executive management platform delivered as a service that helps managers and executives transform the way they run their businesses.

A key component of Domo's executive management platform is the user interface, often referred to as a dashboard, which displays a collection of key performance indicators (KPIs) as interactive visualizations. This guide provides a quick reference for determining which visualization type offers the best representation of a given data set.

For more information or to contact Domo, visit www.domo.com.



INTRODUCTION

Data can often show a number of different relationships. For the development of effective dashboards, it is important to understand which relationship type is being shown, and then identify the best visualization to express that type.

Data relationship types include:

- Nominal
- Time Series
- Ranked
- Part-to-whole
- Frequency
- Correlation

The following pages detail these relationship types, along with the most effective visualizations for each type and best practices for those visualizations.

Several of the ideas and themes in this guide build upon the works of Stephen Few; in particular, *Show Me The Numbers* (2004) from Analytics Press and *Information Design* (2006) from O'Reilly Media.

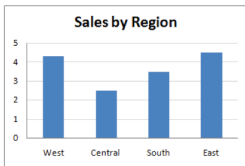


NOMINAL RELATIONSHIPS



NOMINAL - Individual values that are comparative but not connected.

Default Visualization



Best Practices

- Bar charts should be two dimensional with minimal distracting elements.
- Bars should be the same width and be equally spaced. It is recommended that the space between bars be larger or smaller (but not the same) as the bar width.
- The exception to spacing between bars is when a bar chart is used to show groups of nominal values.
- Use of color within bars should only be used to indicate a specific meaning that cannot be accomplished with the axis labels.
- Horizontal grid lines should be used to facilitate the comparison of values but should be thin and light. Vertical grid lines are generally not helpful.
- Horizontal ticks are typically not necessary when horizontal grid lines are used. Vertical ticks are typically not needed.
- Since the bar chart shows relative difference, it requires a zero-based scale.
- Bar charts can be displayed horizontally or vertically; however, a horizontal display is most useful to show ranking or to accommodate long labels.



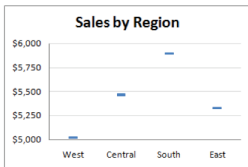
NOMINAL RELATIONSHIPS (Cont'd)



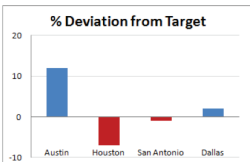
NOMINAL - Individual values that are comparative but not connected.

Variations

When a zero-point scale would make it hard to see the differences between nominal values, use a standard plot graph:



When the target is the focus and an overall number is less important, there is a variation of the bar chart that can provide good visibility:

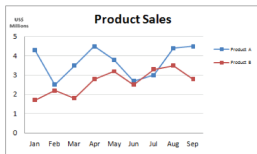


TIME SERIES RELATIONSHIPS

TIME SERIES - Showing values over time. Typically used to identify trends.



Default Visualization

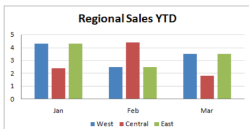


Best Practices

- Time should be displayed along the x-axis with equal time intervals.
- More than three or four lines on a chart can make it unreadable. Using selection boxes to toggle each data set on or off can provide additional data-density.
- Use both lines and points to provide visibility for actual values as well as the overall trend. The points should be clearly distinguishable.
- Use hovers to display actual values on points.

Variations

When comparing nominal values over time, and the comparison of values is more important than the trend, a bar graph can be more effective:



TIME SERIES RELATIONSHIPS (Cont'd)

TIME SERIES - Showing values over time. Typically used to identify trends.



The sparkline is a mini graph used to show a preview of time series data. Described as a “dataword” by American statistician Edward Tufte, the sparkline does not have a scale and is often inserted as an element within a table.



Best Practices for Sparklines

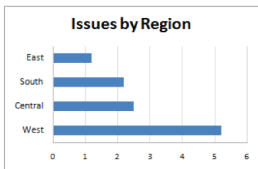
- Start with the most basic design and add additional elements only as necessary.
- Indicate the time range if possible.
- Two sparklines can be imposed over each other when comparison is important. Since there is no legend, each line should be color coded to match another element on the dashboard.
- If you need a scale to make the sparkline meaningful, consider using a line chart instead.



RANKED RELATIONSHIPS

RANKED - Organizes discrete elements in a worst-to-best (or best-to-worst) relationship.

Default Visualization



Since ranking is essentially a nominal comparison, the bar chart tends to be the most effective visualization.

Best Practices

- A horizontal layout is generally more compelling for ranked data.
- When using a horizontal layout, consider that the emphasis naturally appears on the object at the top, so you can choose whether to highlight the highest or lowest value, depending on your goals.
- Be aware that showing a small selection of data values (for example, the 'top five') can make the lowest look like a poor performer and should be clearly labeled to avoid confusion.

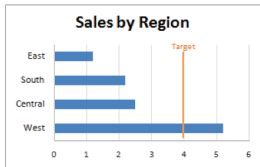


RANKED RELATIONSHIPS (Cont'd)

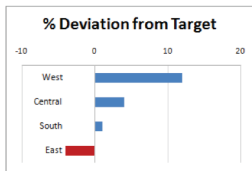
RANKED - Organizes discrete elements in a worst-to-best (or best-to-worst) relationship.

Variations

Targets can easily be shown for ranked items:



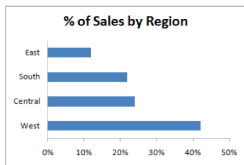
Ranked items can also be displayed as a deviation from a target, when the target is more important than reflecting the overall value:



PART-TO-WHOLE RELATIONSHIPS

PART-TO-WHOLE - Relates individual values as measures within a total. Part-to-whole data is often (but not always) expressed as a percentage.

Default Visualization



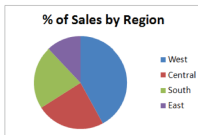
Since ranking is essentially a nominal comparison, the bar chart tends to be the most effective visualization.

Best Practices

- Ranking part-to-whole data makes each value easier to compare.
- If using a percentage, be sure to mark the axis clearly to avoid confusion.

Variations

A pie chart is not a best-practice visualization, because it relies on the eye's ability to judge area. However, when one is used, be sure to follow these best practices:



- Sequence the sections from largest to smallest, with any 'other' category being shown as the last item (regardless of size).
- Values must add up to 100 percent.
- A legend must be used.

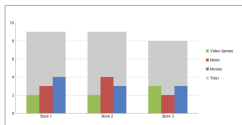


PART-TO-WHOLE RELATIONSHIPS (Cont'd)

PART-TO-WHOLE - Relates individual values as measures within a total. Part-to-whole data is often (but not always) expressed as a percentage.

Variations (Cont'd)

When comparing multiple series of part-to-whole data, consider the double column bar chart to communicate the overall and individual values of each series:



FREQUENCY RELATIONSHIPS

FREQUENCY - Shows how often something occurs and is usually the distribution within a defined set of ranges.

Default Visualization



Showing a single set of frequency data is fairly straightforward and is typically done with a histogram, which is essentially a bar chart or a line graph.

Best Practices

- The ranges should be kept as equal as possible or the data will appear skewed. The exception includes data sets where a grouping for less or more than a certain value makes sense (open ended).
- Use a bar graph histogram when the actual value of each range is important; use the line version when the overall shape is the focus.

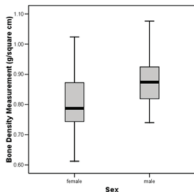


FREQUENCY RELATIONSHIPS (Cont'd)

FREQUENCY - Shows how often something occurs and is usually the distribution within a defined set of ranges.

Variations

The line graph histogram can compare a few series of frequency data but is limited by the fact that more than four lines becomes difficult to read. A Princeton Professor named John Tukey developed a specific visualization type to accommodate this situation, the Box Plot:



Best Practices for Box Plots

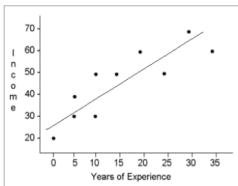
- Keep bar widths and spacing between bars the same for each data series; otherwise, there is an implied meaning.
- Include a key if the box plot shows additional elements such as outliers.
- Group data series next to each other for direct comparison.
- The function of a box plot might not be instantly understandable by all audiences. Some explanation might be required. Its use in dashboards is somewhat limited – the box plot is more often used to display research data.



CORRELATION RELATIONSHIPS

CORRELATION - Displays the relationship between two (or more) variables on a set of data points.

Default Visualization



In the simplest form, correlation is shown using data points on an x-y axis, known as a Scatterplot, often with a trend line.

Best Practices

- Clearly label each axis to avoid confusion.
- Only plot against values that have a correlative relationship, unless the goal of the chart is to identify whether correlation exists.
- Use a scale that provides the best visibility for your data, which is not necessarily a zero-start.
- Use hovers to provide additional information about specific data points.
- When data points overlap, consider using circles (with a transparent center) rather than solidly filled dots. Another useful technique is to make the data point marker smaller.

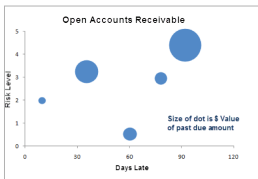


CORRELATION RELATIONSHIPS (Cont'd)

CORRELATION - Displays the relationship between two (or more) variables on a set of data points.

Variations

Some data has a third correlative dimension, which can be accommodated in a scatterplot by varying the size of the 'dot'. This visualization type is often called a Bubble Chart:



Best Practices for Bubble Charts

- Clearly identify all axes, including the third, which might require an additional label.
- Use hovers to allow the user to view additional information about each data point.
- If data points are close together, consider using an unfilled circle rather than a 'dot' so that overlapping points can be seen.
- If time is one of the dimensions, place it on the x-axis for maximum clarity.
- Using size for the third dimension makes big differences easy to spot but not small ones. If differences are small but noteworthy, consider using color or shape instead.



TABLES

TABLES - Due to their multi-dimensional nature, tables are effective when it is not clear what questions the user is trying to answer.

While it might be debated whether tables are really a visualization type or not, the fact remains that they have their place in dashboards. When appropriately used, tables have the following advantages:

- Tables can show multiple data series over multiple dimensions.
- Tables can adapt to the viewers needs through user-controlled sorting.
- Tables can integrate other visualizations, particularly sparklines and icons.

Best Practices

Columns vs. Rows

- Time series data should be displayed left-to-right for maximum readability.
- If one set of dimensions has just a few divisions while another has many, the larger number is best displayed as rows with fewer columns.
- Unless overridden by the two previous rules, use columns for dimensions whose values are in most need of comparison.

Sequence of Columns

- If there is a hierarchical relationship between elements, the column sequence (from left-to-right) should reflect that.
- Any values that are calculated should be placed in the column to the right of the metric from which they are calculated.



TABLES (Cont'd)

TABLES - Due to their multi-dimensional nature, tables are effective when it is not clear what questions the user is trying to answer.

Best Practices (Cont'd)

Number Formatting

- Whenever numbers represent a specific unit, such as dollars or a percentage, the appropriate symbol should be used in each cell, not just in the header.
- For large numbers, use commas to indicate thousands. If all numbers in a series are of the same minimum size, truncate the values.
- Display only as much precision as is necessary for the table to fulfill its purpose.



MAPS

MAPS - Because of their visual appeal, maps can be effective visualizations in specific situations.

When to Use Maps

- To categorize regions into four or fewer groups. A U.S. map showing states in red or blue for Republican vs. Democrat is a good example. More than four groups can be difficult to interpret.
- When proximity of the geographic locations adds meaning to the data, such as a map showing outbreaks of a virus.
- When the user understands the environment in primarily a geographic sense.
- When the geographic data is multilayered, such as sales by state and each store within the state.

Best Practices

Perhaps the most important best practice relating to maps is the decision whether or not to use one. Beyond that, there are several rules that apply only to maps:

- Use different colors to identify different status (such as Republican vs. Democrat).
- Use shades of the same color to indicate degree or size of the same value (such as population size). However, do not use more than three shades if accurate determination of the particular shade is necessary.
- Use hovers to provide additional data on-demand.
- The overall size of a map will be determined by the readability of the smallest regions. If space doesn't allow that, consider a different visualization type.



CHARACTERISTICS OF EFFECTIVE DASHBOARDS

While the best practices for individual visualizations is important, how visualizations are combined into a complete executive tool (often called a dashboard) is equally important. The following sections contain key information on the characteristics of effective dashboards and rules for dashboard layout.

A dashboard is a collection of visualizations brought together to form an insightful view of some area of organizational performance. Effective dashboards contribute to a viewer's ability to make decisions about their organization.

In addition to the correct selection of visualization types for individual metrics, and the best practices used to make each visualization as meaningful as possible, an effective dashboard:

- Acts as a spotlighting mechanism, de-emphasizing normal values and drawing attention to the exceptions.
- Is based on a specific objective (or set of objectives) and provides insight which helps the owner to make decisions to reach those goals.
- Provides details on-demand, which allow the viewer to determine how much information they need about a particular topic.
- Begins with summary information (relevant to the owner) and provides a hierarchical navigation that allows a viewer to view more specific information as it is needed.
- Balances aesthetics with efficient communication.
- Is developed in phases and is updated to reflect the current business need.



RULES FOR DASHBOARD LAYOUT

1. Organize KPIs into views with visualizations in natural groupings.

The first step in organizing a dashboard layout is to ensure that the right metrics are on the right views. If your dashboard truly has a single owner, identify whether the metrics create any 'natural' groupings.

2. Match outcomes with their drivers and display the relationship.

For most dashboards, it makes sense to show outcome metrics before the metrics that drive them.

3. Encourage appropriate comparisons (and discourage inappropriate ones).

Proximity and similarity in dashboards will often prompt comparisons. Dashboard designers need to use these as tools, and make sure they aren't misused by creating false comparisons.

4. Consider KPI priority or importance.

In the Western world, reading moves left-to-right and top-to-bottom, which creates an implied priority for items that are aligned in that manner. As a result, metrics within a particular view should be organized based on their relative importance whenever possible, with the most important in the top-left position.

5. Aesthetics.

If none of the other rules apply, simply organize KPIs into the layout that looks the best.





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