

The Art of Telling Stories With Data

Bring clarity, simplicity, and flow to your visualizations (and dashboards)

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Are You Getting Your Point Across?

Working with data generally entails carefully examining it, interpreting it, and creating reports. But the single most important part of the job is effectively communicating the meaning of that data. People need to understand it — and why it matters — so they can use it to make decisions. You probably know the data better than anyone, so you're in the best position to communicate its importance. It's up to you to make sure that you're getting your point across.

This is not always easy — especially since you're faced with some perplexing problems:

- You have mountains of data.
- You need to extract what matters.
- You need to tailor how you present data to different audiences.
- You need to determine the best way to present the data.

Fortunately, you have an amazing tool available to you: **Visualization**.

Why Visualization Works

Visualization is wired into our brains. We do it automatically. And we do it at lightning speed. It helps us understand our world faster. It helps us:

- Discover patterns.
- See trends.
- Digest large amounts of data.
- Gain useful and actionable insights.

50%

of the cerebral cortex
is for visualizing.¹

The human
brain processes images

60,000

of the cerebral cortex is
for visualizing.¹

¹ <http://visionlab.harvard.edu/members/ken/Papers/100mitencyclopedia99.pdf>

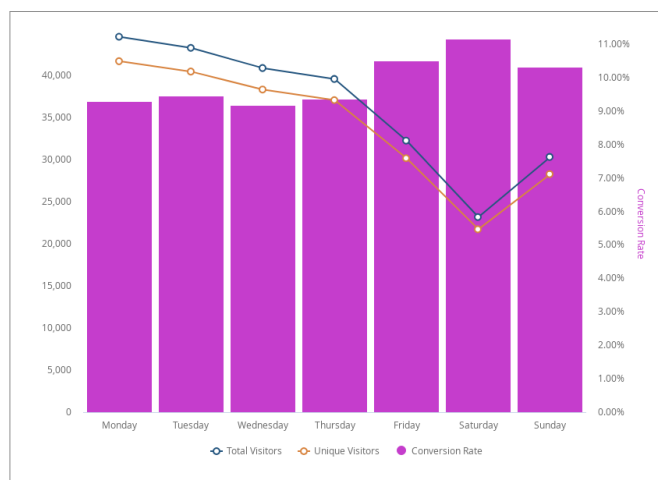
² <http://www.t-sciences.com/news/humans-process-visual-data-better>

Try it: Compare the impact of the text chart to the combined bar and line chart.

The text data chart provides you with accurate data for key aspects of an email campaign. Can you identify which day resulted in the fewest site visitor sessions? What about the fewest unique visitors? Which day had the highest overall conversion?

Events	Event Day of Week ^	Events Sessions Count	Visitors Unique Visitors	Funnel View Overall Conversion
1	Monday	44,608	41,701	9.30%
2	Tuesday	43,286	40,469	9.47%
3	Wednesday	40,886	38,333	9.19%
4	Thursday	39,587	37,077	9.36%
5	Friday	32,264	30,178	10.51%
6	Saturday	23,183	21,732	11.17%
7	Sunday	30,323	28,284	10.33%

What about here? Can you answer the questions posed for the table above using this visualization? It turns out that the answer to all of those questions is Saturday. But, to get that answer when viewing the table, you'd have to scan each column of data. In this visualization, you can see the answer immediately.



Is Your Campaign Working?

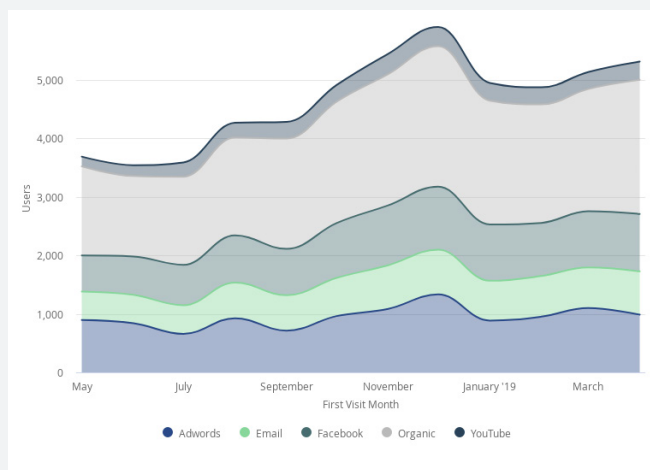
When trying to gauge the effectiveness of a campaign, marketing professionals will collect data showing factors like where their company's website traffic came from and what's the best time to advertise. The partial table below shows website visits by their origin source.

Site Acquisition Source >		Adwords	Email	Facebook	Organic	YouTube
First Visit Month ∨		Users	Users	Users	Users	Users
1	2019-04	986	742	981	2,294	313
2	2019-03	1,099	696	961	2,090	291
3	2019-02	953	695	909	2,026	292
4	2019-01	885	682	963	2,116	304
5	2018-12	1,333	765	1,079	2,403	327
6	2018-11	1,087	745	1,025	2,244	349
7	2018-10	963	652	938	2,076	287
8	2018-09	714	605	793	1,888	285
9	2018-08	926	609	807	1,674	253
10	2018-07	658	491	691	1,505	245
11	2018-06	841	485	656	1,376	186
12	2018-05	896	486	616	1,524	168

While this format clearly displays the number of visits from each source, it's hard to spot trends that would help you evaluate campaign effectiveness and create future campaigns. Presenting the same information in an overlay line chart more effectively draws out the story from the data.

From the line chart, you would see that:

- More visits came from organic traffic than from any other source.
- Traffic from all sources increases in September and drops off sharply after December.
- Overall site traffic is increasing across all sources.



How Visualization Can Impact Perception

When trying to gauge the effectiveness of a campaign, marketing professionals will collect data showing factors like where their company's website traffic came from and what's the best time to advertise. The partial table below shows website visits by their origin source.

Visualization is what we see, which influences the decisions we make. Perception is what we think matters based on what we see. That's why it's so important to choose the most appropriate visualization for your message.

- One type of visualization may be more effective than another depending on how it's used and who sees it. For instance, a chart that displays how values compare is different than a chart that displays an exact value of a single data point. Understanding the context of your users — what information they already have and what they need — is critical to using the right chart (see Use Case 1).
- Changes to a visualization can impact your user's perception of what you show. For example, a line chart is more effective than a column chart for showing trends over time, while a column chart is more effective than a line chart for comparing values among different categories.
- Certain types of visualizations can speed up our understanding of data. Once you've found the right data for your audience, choose the chart that best serves their needs and conveys the story behind the data.

Data Governance

Proper data governance is critical, especially when your data could influence decisions. It helps maintain the integrity of your data and validate your visualizations and the conclusions your users draw from them. Data governance is also key to ensuring compliance with data privacy laws, such as the European Union's General Data Protection Regulation (GDPR).

The three principles of data governance are:

- Capture all the relevant data and store it appropriately.
- Make access to data easy and working with the data intuitive.
- Provide strong security and control over who uses the data.

Choosing the Right Visualization

Consider these factors:

Who is your audience?

- Is it an executive who is interested in overall business performance?
- Is it the sales team that wants to determine whether or not they will hit their quota for the quarter?
- Is it the marketing team that needs to determine if their social media and email campaigns are effective?

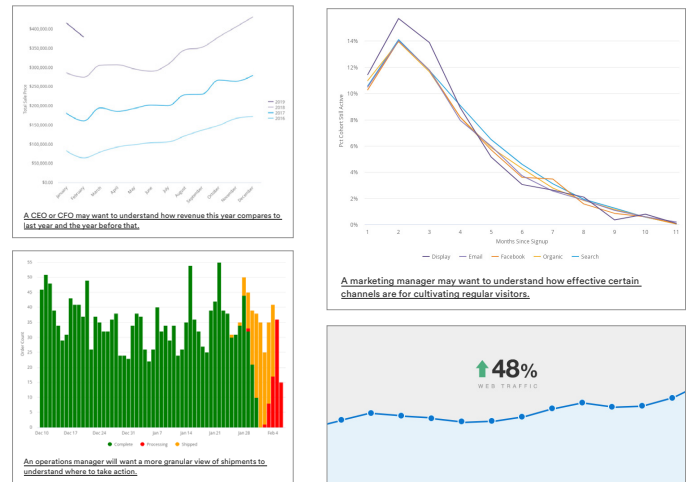
What is your goal?

- Are you building something that is referential, such as a report? Or a visualization that's meant to illuminate a specific point?
- Are you creating something that is operational, like a dashboard that people will continually check to help direct their workflow?

What are you trying to show or say?

- Are you comparing data across different categories (bar chart)?
- Are you highlighting changes over time (line chart)?
- Are you presenting a picture of the full data set (scatterplot or histogram)? A clear understanding of all these factors will help you zero in on a visualization that effectively speaks to your audience.

Different Users Have Different Questions and Require Different Data



Vanity Metrics

These types of data visualizations and metrics leave a positive impression. They are a lot like grades you get in school or the number of likes you receive for social media posts. In the business world, they do have a place and can be useful for marketing purposes — to gain a following, initiate partnerships or impress Wall Street, for example. If you're selling a service, your vanity metric is most often the number of people using your service. But, if your intention is to inspire action, other types of visualizations are generally more effective when it comes to helping people do their jobs better.

Example: Showing a large percentage of email "opens" may look good but does not help determine actual conversion rate. Metrics that show the percentage of subscribers who have taken action on that email are much more useful markers of the effectiveness of your campaign.

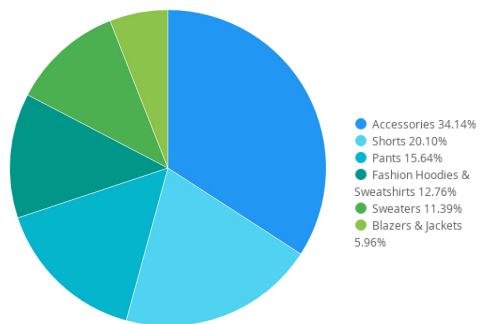
Use Case Example

Tailor Your Visualization to Your Audience

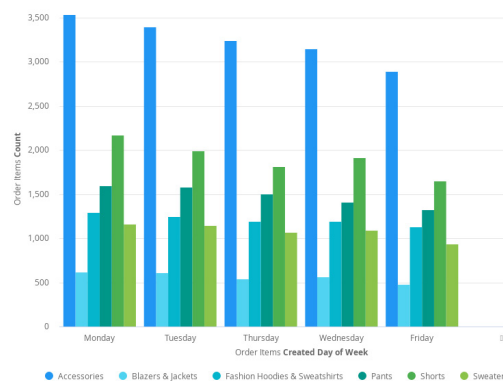
It's critical to understand the goals of your viewers when choosing your visualization.

For example:

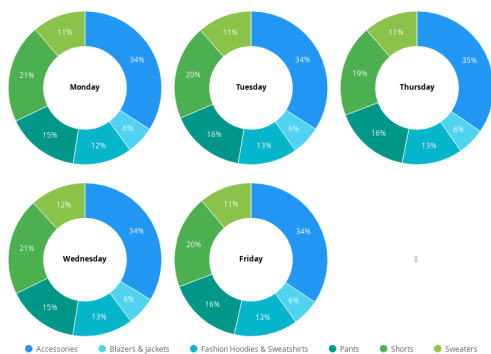
- Executives and business strategists will want an overview of their best-performing product lines.
- Marketing teams may be looking for detailed insights into consumer buying behavior to craft more targeted marketing campaigns.
- Product teams may want to drill down into a deeper level of insight to strategize product launches. There is no one-size-fits-all approach when audience needs differ so widely. Here are some ways you can satisfy all these requirements.



A high-level pie chart shows a breakdown of buying patterns by category for a defined season. This provides a great overview for executives and business strategists.



A column chart provides an even more granular level of detail. It shows the order items count for each category and each day of the week. This provides valuable information for production, fulfillment, sales teams, and inventory control teams.


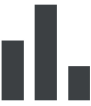






Donut charts, derived from the pie chart, show buying patterns according to category of apparel for each day of the week. This can help marketing teams develop email campaigns that either support the trends or stimulate consumers to engage in new buying behaviors.

What Makes an Effective Visualization

What Leaps Out at You?

Different types of visualization attributes, like length and position, change how people detect and interpret data and observe patterns. They also contribute to the level of accuracy in perception. With position and length, it is much easier to quantify how much longer or how much higher one data point is than another. On the other hand, color saturation — determining which circle is darker than the other — can be difficult to quantify.

Attributes that can help users better understand your visualizations (in descending order based on accuracy of perception)	
Position <ul style="list-style-type: none">• Along a common scale (bar/column chart).• On identical but non-aligned scales (timeline/Gantt chart/stacked bar or column).	
Length	
Slope of lines (which we tend to judge based on angles).	
Angle	
Area	
Color/Saturation	

Use Color for Clarity

Use color with purpose to highlight salient data. Strategic use of color can have a huge impact on our ability to detect certain patterns or see certain things in data.

- Colors should have meaning: saturation and hue can make a large difference in how certain elements are perceived. Color saturation in a bubble can indicate relative population density in a given geographical region.
- Color can turn apparent chaos into clarity by directing the eye and the mind.
- Too many colors can cause confusion.

How many 9s?

1894728069476837574904752
1036859164792019283650326
1176547840917246710867594

Confusing: Too many colors make it difficult to find the nines.

How many 9s?

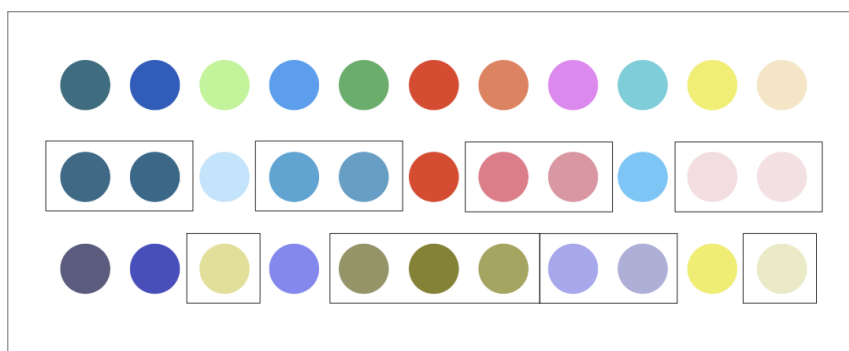
1894728069476837574904752
1036859164792019283650326
1176547840917246710867594

Clear: Limiting the number of colors makes it easy to find the nines.

How to Make Your Visualizations Color-Blind Friendly and Inclusive

The effectiveness of colors can be greatly hampered if your audience is color-blind. Take a look at these three color palettes.

The color palette below is our sample color scheme. These colors are displayed to show how someone without color blindness would see those colors. The second row shows how someone with blue-yellow color blindness, or tritanopia, would see that palette. The colors in boxes are virtually indistinguishable to a person who suffers from this form of color blindness. The third row shows how people who suffer from red-green color blindness (deuteranomaly) would see that palette. This is the most common form of color blindness. The colors in those boxes will be indistinguishable from each other. To ensure that everyone (and especially your intended audience) can understand your visualization, it's important to use a color-blind friendly palette.



How Do You Show Change and Context?

Let's explore the importance of context in visualization. If you were presented with a photo of a bug on a plain white surface, you wouldn't have any idea of its true size. But if you saw a photo of a human hand placed for scale next to the bug, you'd get a pretty good idea of how large the insect is. In the same way, displaying data in a vacuum doesn't contribute to our understanding of its significance. But, with context, we can draw conclusions about why the data matters. For example, a set of numbers alone might not mean much, but, when we compare those numbers to historical percentages or future projections, they do mean something and can provide insights.

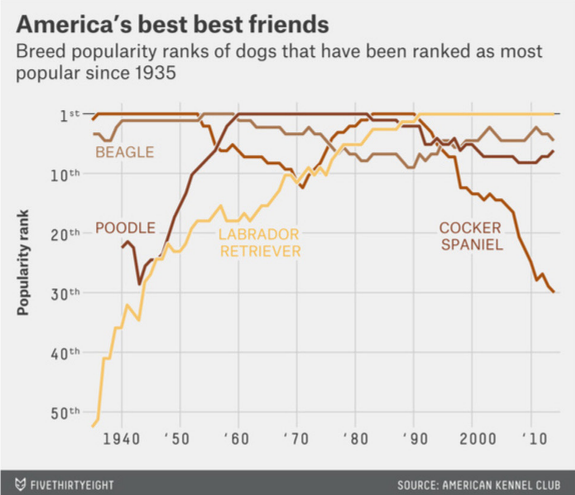
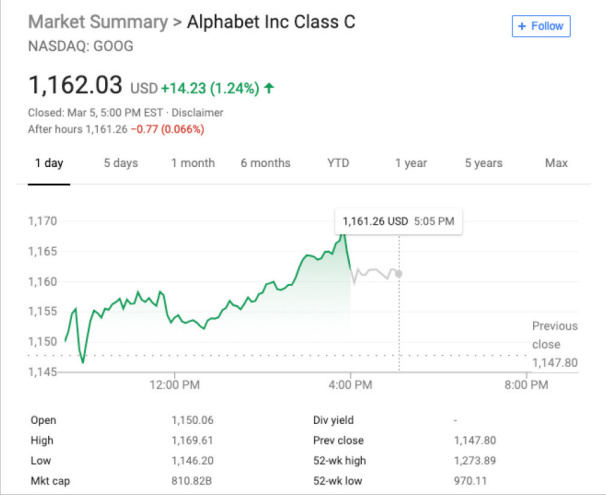
Tips

Line charts, area charts, and even single-value visualizations can be used to show changes over time and can be customized to present data in a stacked or stacked-percentage format. Strategically combining different types of charts to showcase comparisons in different data sets can add some helpful clarity. But, it can also risk cluttering your message. See the dual-axes chart in the Quick Reference Guide on pages 12-13.

How Does It Compare?

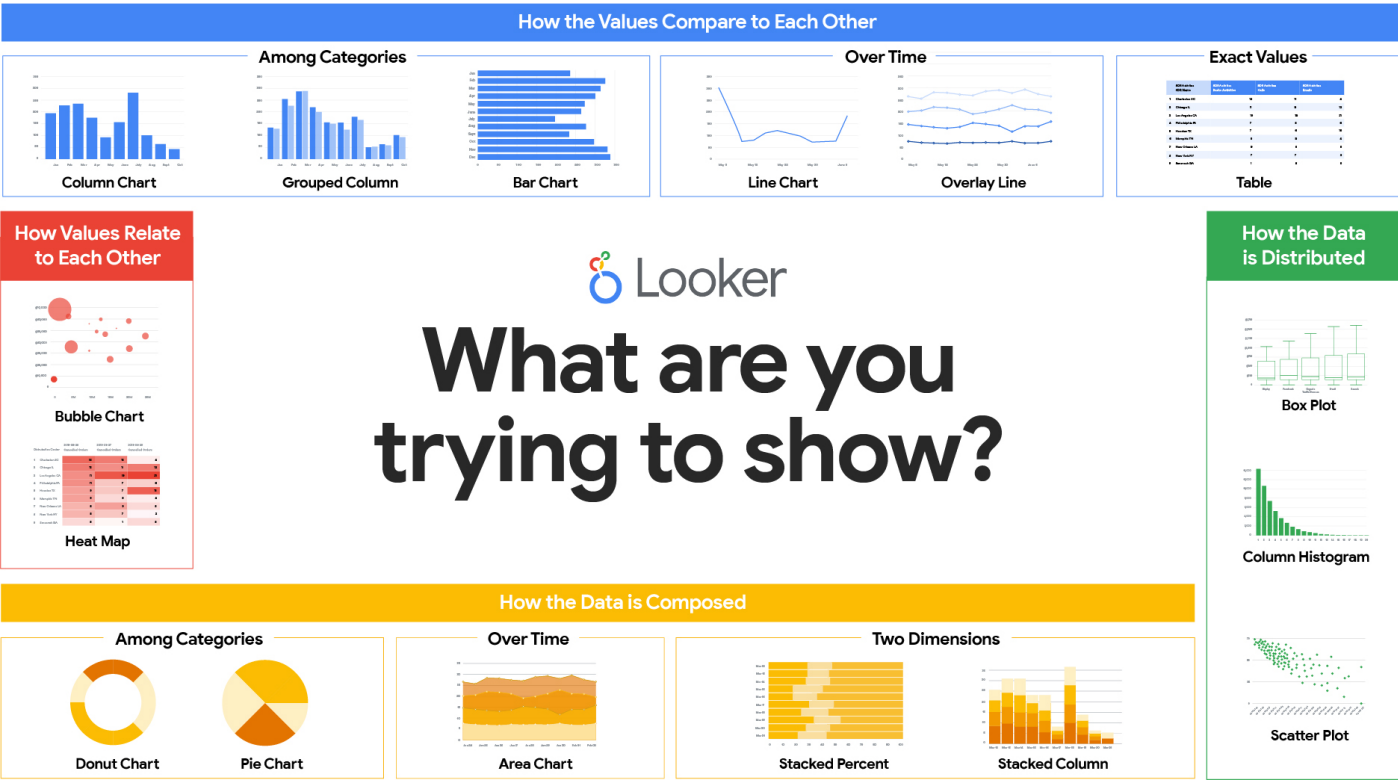
Single-value visualizations are great for showing one, two, or three important metrics. But, how do you know the significance of those metrics?

18-to-24-year-olds Who Voted in 2012	
Without Context	With Context
<div>18,306</div> <div>Orders This Year</div>	<div>18,306</div> <div>Orders This Year</div> <div>▲ 40% vs Same Period Last Year</div>
Interesting, but what does it mean? Is 45% low, or is it actually pretty good? How does it compare to the turnout for the rest of the population?	Add context through comparison. 45% is lower than the rest of the population. Now we can talk about ways to increase voter turnout for young people.

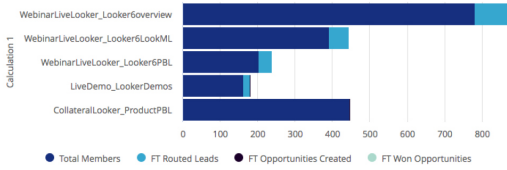
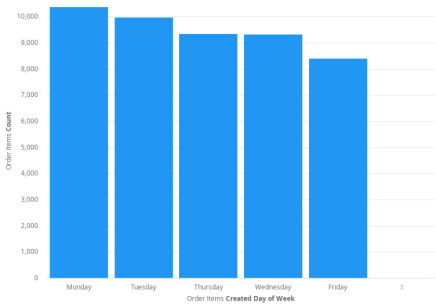
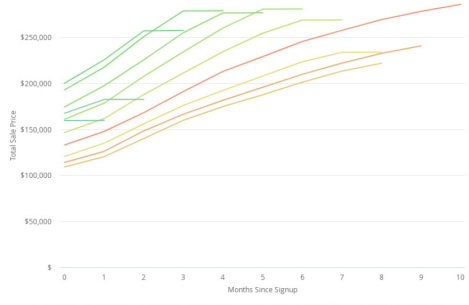
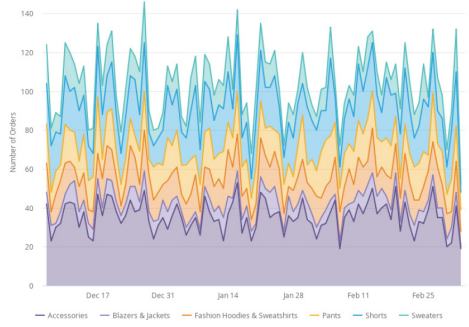
Learn vs. Act	
Static Visualization	Operational Visualization
<p>These one-off visualizations are used for reporting and storytelling capabilities.</p> <div><p>America's best best friends</p><p>Breed popularity ranks of dogs that have been ranked as most popular since 1935</p><p>Source: FiveThirtyEight</p></div>	<p>These visualizations are checked regularly, and updates can be scheduled or automated. They are used for helping the user decide how to act.</p> <div><p>Market Summary > Alphabet Inc Class C</p><p>NASDAQ: GOOG</p><p>1,162.03 USD +14.23 (1.24%) ↑</p><p>Closed: Mar 5, 5:00 PM EST - Disclaimer</p><p>After hours 1,161.26 -0.77 (0.06%)</p><p>1 day 5 days 1 month 6 months YTD 1 year 5 years Max</p><p>Source: Google</p></div>

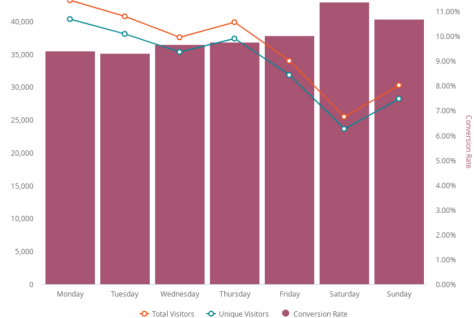
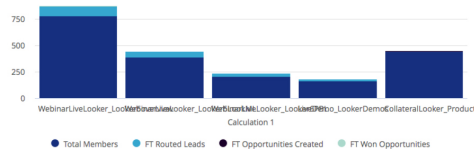
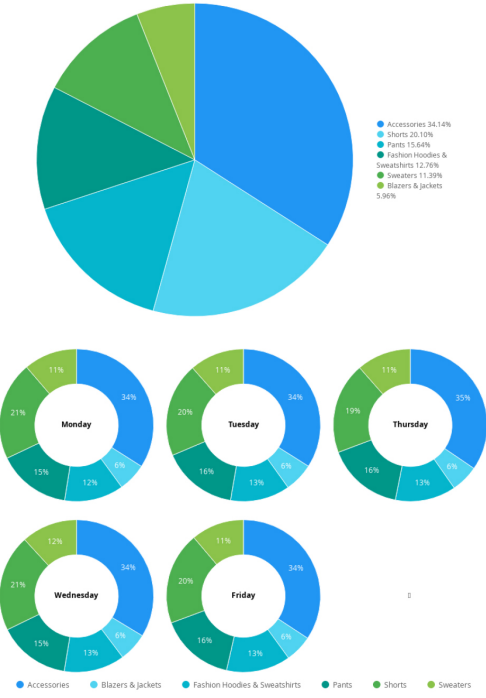
Choosing the Right Chart

Selecting the right chart is the first step to helping people better understand your data. The graphic below can help guide your choices based on what you're trying to convey.



Quick Reference Guide

Objective	Chart Type	How to Use It	Example
Compare two or more concrete categorical values	Bar	<ul style="list-style-type: none"> Features a horizontal orientation. Because of the way the eye tracks changes in charts, it's easier to see negative values as the eye scans down. When values assigned to each bar are long, they can collide with each other, or be forced into multiple line breaks, which gets in the way of legibility. 	
	Column	<ul style="list-style-type: none"> Features a vertical orientation. Flexible chart that can be used to compare one value over time, or across different categories. Becomes less effective with more than five categories. 	
Display continuous data, such as time	Line	<ul style="list-style-type: none"> Use for trend analysis. Compare performance among groups or for showing more than one measure. 	
	Area	<ul style="list-style-type: none"> Use for trend analysis. Show cumulative, part-to-whole relationships. 	

Objective	Chart Type	How to Use It	Example
Add complexity and show additional dimensions or measures	Dual-axes charts	<ul style="list-style-type: none"> Visualizes the relationship between two different measures. Use contrasting colors between different series. 	 <p>This dual-axes chart displays visitor metrics and conversion rate over a seven-day period. The left y-axis measures the number of visitors (0 to 40,000), and the right y-axis measures the conversion rate (0.00% to 11.00%). Total visitors (orange line with circles) and unique visitors (teal line with circles) are plotted against the left axis, while the conversion rate (maroon bars) is plotted against the right axis. The x-axis lists the days from Monday to Sunday.</p>
	Stacked bar or stacked area charts	<ul style="list-style-type: none"> Avoid using stacked charts to visualize statistics that don't accumulate (like averages). Avoid plotting too many lines or categories at once (five or fewer is best). 	 <p>This stacked bar chart visualizes four categories of metrics across several product lines. The y-axis represents the count (0 to 750). The categories are Total Members (dark blue), FT Routed Leads (light blue), FT Opportunities Created (dark blue), and FT Won Opportunities (light blue). The x-axis lists various product lines including Webinar, Live, Looker, and others.</p>
Show how a value, or measure, is split out across categories	Pie and donut charts	<ul style="list-style-type: none"> Provides a sense of the proportions that can be attributed to each category in a broad, general way. Should not be used for comparing individual sections to each other or for representing exact values. 	 <p>This section contains a large pie chart and five donut charts. The large pie chart shows the distribution of clothing items: Accessories (34.14%), Shorts (20.10%), Pants (15.64%), Fashion Hoodies & Sweatshirts (12.76%), Sweaters (11.39%), and Blazers & jackets (5.96%). The five donut charts show the distribution of these items for each day of the week (Monday, Tuesday, Thursday, Wednesday, Friday).</p>

Design an Intuitive Dashboard

Every dashboard starts with the “**Big Idea**” – your central theme or story. To effectively tell that story, consider your audience, and determine what they want to achieve with their dashboards.

- Define your audience and determine what users care about by gathering requirements. Find out how they intend to use the information.
- Choose the best visualizations and arrange the information in a way that makes sense to the people who will use it. The choices you make will have a significant impact on the message that people take away from your dashboard.
- You want the chart to say what you mean and to be easily understood by the viewer – clarity is key.
- Label axes and measurements clearly. Start axes at zero to avoid confusion.
- Keep it simple and streamlined and avoid too many bells and whistles. Make sure that everything on the dashboard will help users do their jobs better.

Three Key Guiding Principles of Impactful Dashboard Creation

Clarity: Viewers should not have to guess about what the content of a dashboard means. The dashboard and its tiles should have descriptive names, and metrics should be defined – leaving no room for confusion.

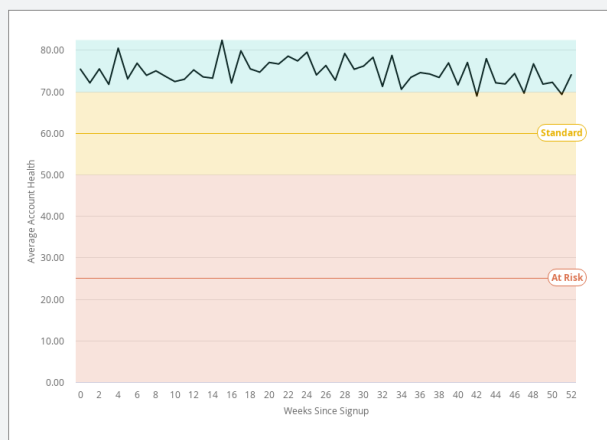
Simplicity: Include only the information needed to tell the data story. Every tile should have a purpose and contribute to the “Big Idea.” No extraneous detail is included, so be sure to remove any unnecessary text. Interactive drilldowns and links provide access to more details.

Flow: Guide the user’s eyes to what they should focus on. Arrange the content of the dashboard as a steady, logical, well-organized stream of information that considers how we read information: from left to right and top to bottom. In general, establish a hierarchy of information – from high level, like a newspaper headline, to more detail. Highlight what’s important with color. Use margins and titles to frame the visualizations, break up the story into sections, and keep everything in a section to one page if possible.

Use Case Example

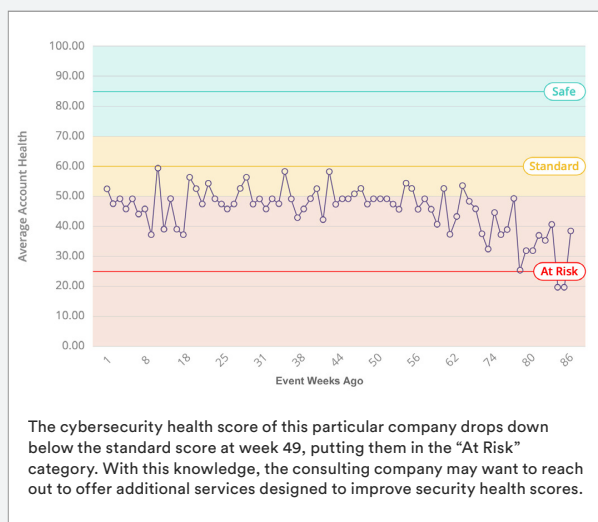
Drilling Down to Details With Links and Filters

Charts that show characteristics of your customer base can offer valuable information on their overall needs and how well you're responding to them. But, what if you wanted information on a specific customer? Here's a chart from an information security consulting company that conducts assessments, providing insights into which cyber threats and vulnerabilities pose the most risk to organizations. The chart below shows the aggregate health score of those enrolled in their program. (The Y axis indicates health score).



But how do users get details on a specific customer? This information would help account managers and sales managers improve customer security health profiles and customer satisfaction.

Using interactive visualization that makes it easy for users to drill down into more detail can provide answers faster. You can construct drill paths or set filters that let you start from a high-level chart and ultimately view individual customer accounts. Once a filter for a particular company is applied to the chart above, the result provides a very different picture than the aggregate health score chart.



Use Case 1

Goal

What's the best way to show company growth?

Audience

Company executives, public and investor relations personnel, investors

Considerations

When trying to analyze a company's progress, executives and others are likely to pose questions such as:

- "How much money did we make this quarter?"
- "Are we trending positive or negative?"
- "Will we hit our end-of-quarter goal?"

There are a number of ways you could approach these questions. One way might be in the form of a single-value visualization.

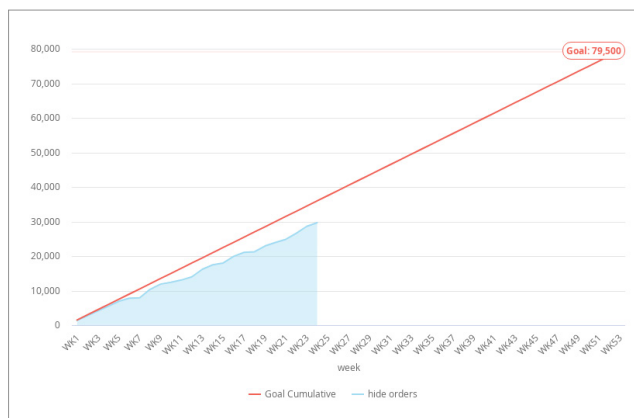


This visualization provides a quick and precise measure of growth. It's perfect for situations where you're in a meeting where a "yes" or "no" answer on growth is not good enough. Participants want an exact number. It's important to note that both

the person presenting this number — and the audience — are likely to have more context on the overall financial situation than a typical audience. They're so close to the business and the numbers that they'll know, based on the number alone, whether they'll hit the end-of-quarter goal.

Those less familiar with the top-level numbers won't have that same context. For instance, sales teams may want to see whether they're on track to hit their quotas. Marketing teams may need to gauge campaign effectiveness on a week-to-week basis. A single, exact number will have less meaning.

It's more important for these teams to simply know whether they're headed in the right direction. This chart below, showing a trend line with a goal, does the trick.



Recommendation

Both of these visualizations are acceptable ways to show growth, but choosing the most effective one requires knowing:

- Who is your audience?
- What context does your audience have?
- How will they use the information?

Use Case 2

Goal

What's the best way to direct users' attention to the most important issues?

Audience

Operations team

Considerations

For many service and support organizations, prioritizing their work is key to effectively resolving issues. That's why it's important for them to know where to focus their attention.

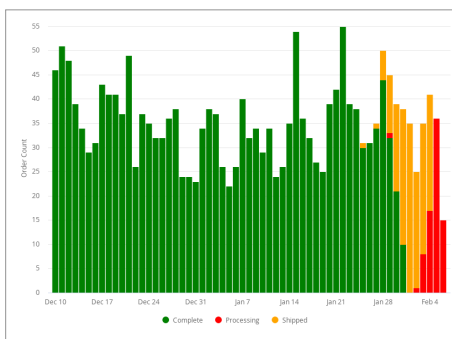
Operational visualizations can be a good choice for this audience because they:

- Direct a user's attention to issues that are most urgent and pressing
- Provide a queue of issues to be addressed.

Where tables might not be effective for some audiences (see "Is Your Campaign Working?"), they actually work well for operational dashboards, as they provide valuable information about individual tasks that need to be addressed. This table shows specific orders that require immediate attention.

	Order ID	Name	Email	Created Date ^	Status	Item Name
1	139411	Debra Bunch	dbunch@yahoo.com	2019-01-29	Processing	Ray-Ban RB2132 New Wayfarer Sunglasses
2	140456	Jessica Thompson	jthompson@gmail.com	2019-02-02	Processing	Champion Women's Cotton Fitness Bra
3	140668	Ethelene Goodman	ethelenegoodman@gmail.com	2019-02-03	Processing	Champion Men's Double Dry Training T-Shirt
4	140664	Timothy Haynes	timothyhaynes@aol.com	2019-02-03	Processing	Ray-Ban RB2132 New Wayfarer Sunglasses
5	236581	Kimberly Harris	kharris@gmail.com	2019-02-03	Processing	AA1938 Alternative Unisex 4.4 oz. Long-Sleeve Raglan Henley
6	140625	Alan Murray	alanmurray@gmail.com	2019-02-03	Processing	Ray-Ban RB2132 New Wayfarer Sunglasses
7	163729	Diana Baillargeon	dbaillargeon@yahoo.com	2019-02-03	Processing	Hue Women's Super Opaque Sheer To Waist Tight

At the same time, some nontabular visualizations can be helpful for shipping and logistics. For example, an operations and logistics manager may benefit from a bird's-eye view of the data provided by this bar chart.



Recommendation

For someone who needs to quickly take action on urgent issues, masking information behind a visualization like a bar chart or a line graph is often less helpful than just presenting it in a table. The individual details are needed to successfully resolve the issue. At the same time, some bar charts and other visualizations make it easy for team leaders to click on key sections and drill down (through links) to more information, so they can decide whether action is needed.

Conclusion

Using the right visualizations is key to demonstrating what your data means and why it matters to your audience. When you help people visualize data in ways that they can quickly process, you make it easier for them to understand trends and outcomes. This empowers them to do their jobs better. By mastering the art of visualization, you can more clearly highlight your most important insights and, overall, become a much better communicator.

Resources

Want to master the art of communicating through visualization? Check out these helpful tools.

[Best Practice: Visualize Data Effectively Dashboard](#)

[Requirements Gathering WorksheetVisualization](#)

[Chart Selection Map](#)