



Fondamenti di Analisi dei Dati

from **data analysis** to **predictive techniques**

Prof. Antonino Furnari (antonino.furnari@unict.it)

Corso di Studi in Informatica

Dip. di Matematica e Informatica

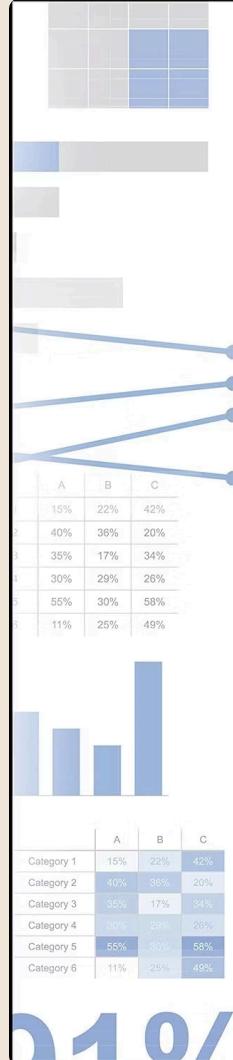
Università di Catania



Università
di Catania

Storytelling with Data

To move beyond default outputs and learn a systematic process for transforming data analysis into clear, compelling, and actionable narratives. This is a core competency for data scientists who need to communicate findings and influence decisions.



cole nussbaumer knaflic

storytelling with data

a data
visualization
guide for
business
professionals

WILEY

Storytelling with Data

The contents of this seminar are derived from the following book:

Knaflic, Cole. *Storytelling With Data: A Data Visualization Guide for Business Professionals*, Wiley, © 2015.

This presentation also includes visuals derived from the book, which can be found here, together with the source excel files:

<https://www.storytellingwithdata.com/book/downloads>

Please check the authors' page for more information about the book:



storytelling with data

storytelling with data

Don't simply show your data, tell a story with it! At storytelling with data, we share practical tips and...

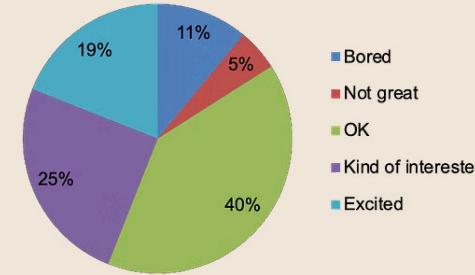
Bad Graphs Are Everywhere

We are surrounded by less-than-stellar visuals. Nobody sets out to make a bad graph, but it happens constantly, across all industries and roles.

This happens because we often rely on tool defaults, which can lead us towards ineffective designs like 3D charts, meaningless colour, and poor chart choices.

The Core Problem: Our tools don't know the story in our data; only we do. It takes a human—the analyst and communicator—to bring that story to life visually and contextually.

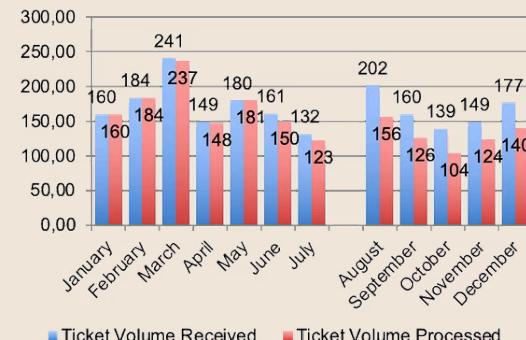
Survey Results



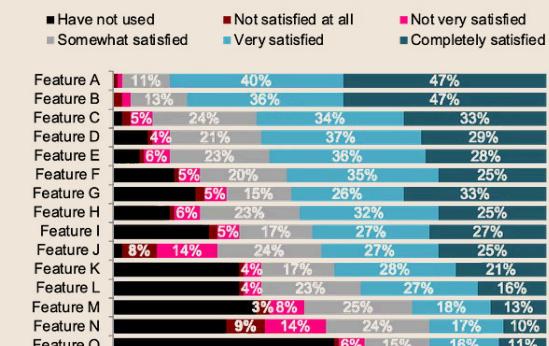
Non Profit Support



Ticket Trend



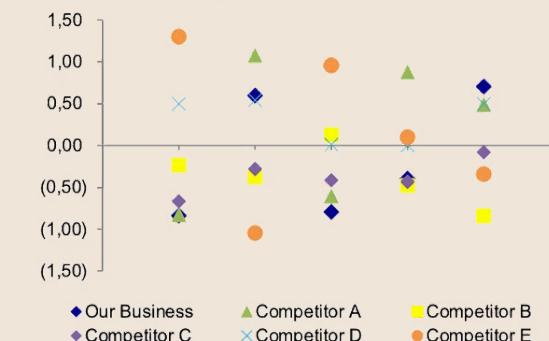
User Satisfaction



Our Customers



Weighted Performance Index



We Aren't Naturally Good at This

What We Learn

In school, we learn language (how to build sentences and stories) and maths (how to make sense of numbers), but **rarely are these two skills paired.**

Very few people are taught how to tell stories *with numbers*.

The Growing Gap

This leaves us poorly prepared for a skill that is increasingly in demand.

As technology enables us to collect vast amounts of data, the ability to visualise it and tell stories with it is key to turning raw data into information that drives better decision-making.



The Starting Point: A Default Graph

Before: A Typical Default Visual

This is what a standard graphing library (like Matplotlib or a spreadsheet programme) might produce. It is technically accurate but functionally poor.

High Cognitive Load

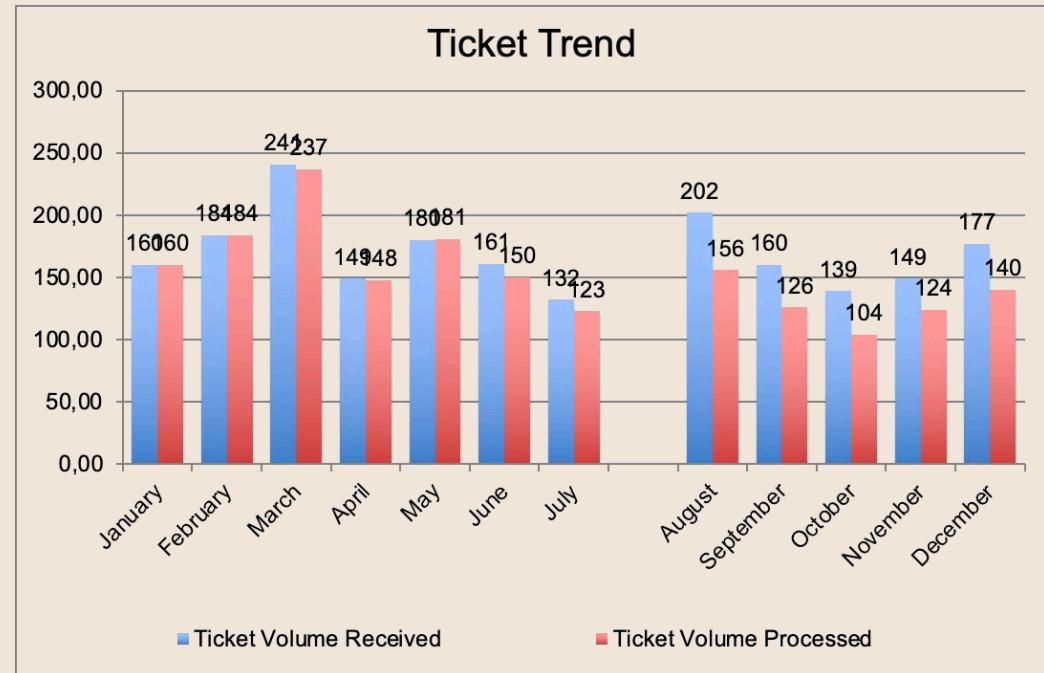
It's difficult to process. The viewer doesn't know where to look or what's important.

No Clear Narrative

What is the key insight or story? It isn't immediately obvious.

Simply Showing Data

This visual presents numbers without context or interpretation.



The Goal: An Explanatory Story

After: A Focused, Explanatory Visual

This version tells a clear and immediate story: "2 employees quit in May... and we haven't been able to catch up since".



Low Cognitive Load

The message is easy to understand because distractions are removed and key points are highlighted.



Clear Narrative

The visual guides the audience to the intended conclusion.



Telling a Story

This is telling a story with data, not merely showing it.

Please approve the hire of 2 FTE

to backfill those who quit in the past year

Ticket volume over time



Data source: XYZ Dashboard, as of 12/31/2014 | A detailed analysis on tickets processed per person and time to resolve issues was undertaken to inform this request and can be provided if needed.

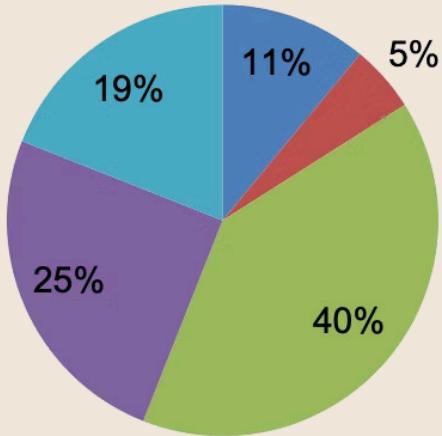
Our goal is to learn the process to get from the "before" to the "after".

Pilot Program Example (pre)

Survey Results

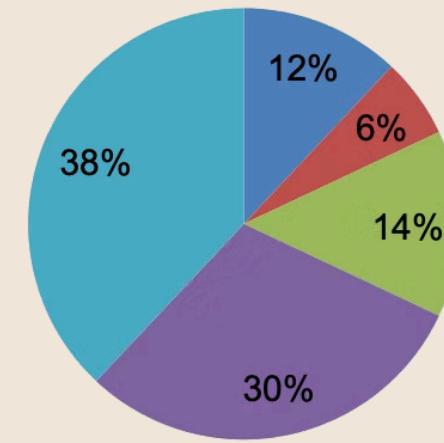
PRE: How do you feel about doing science?

■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited



POST: How do you feel about doing science?

■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited

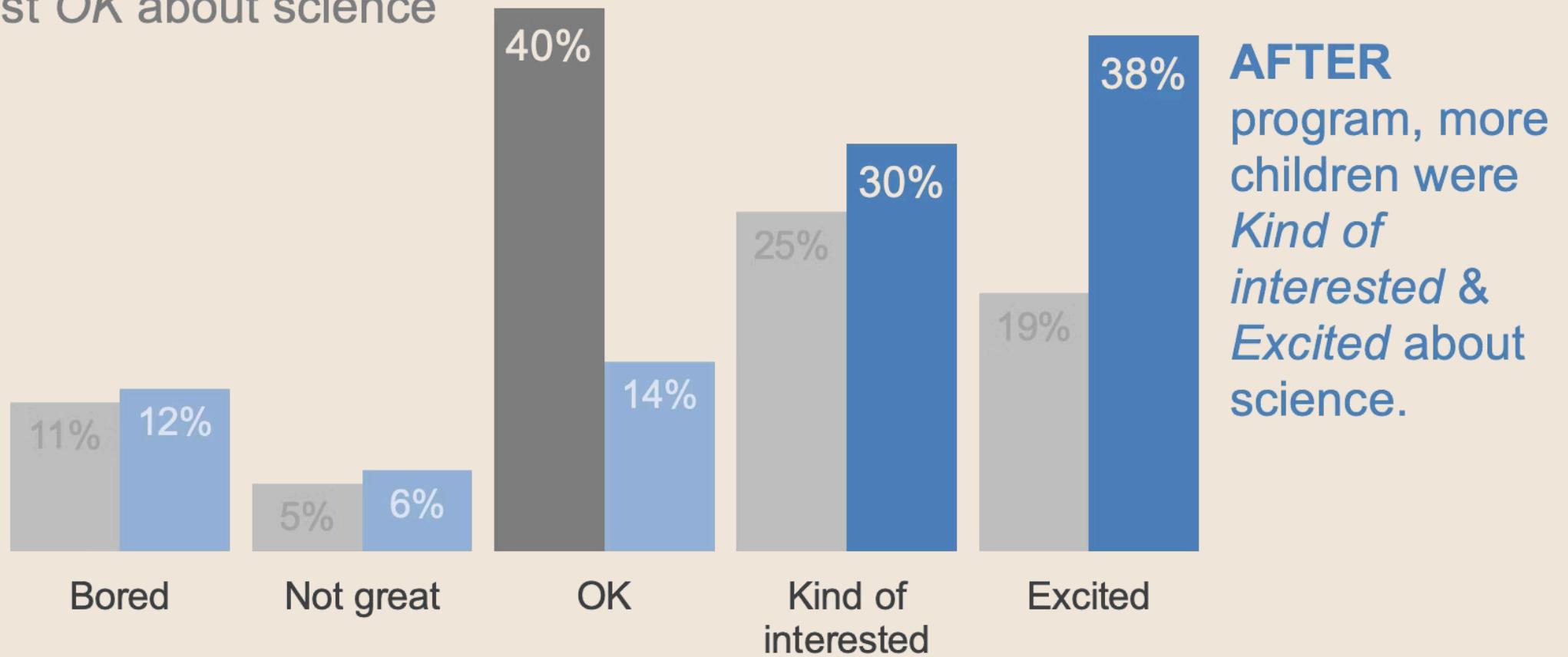


Pilot Program Example (post)

Pilot program was a success

How do you feel about science?

BEFORE program, the majority of children felt just OK about science

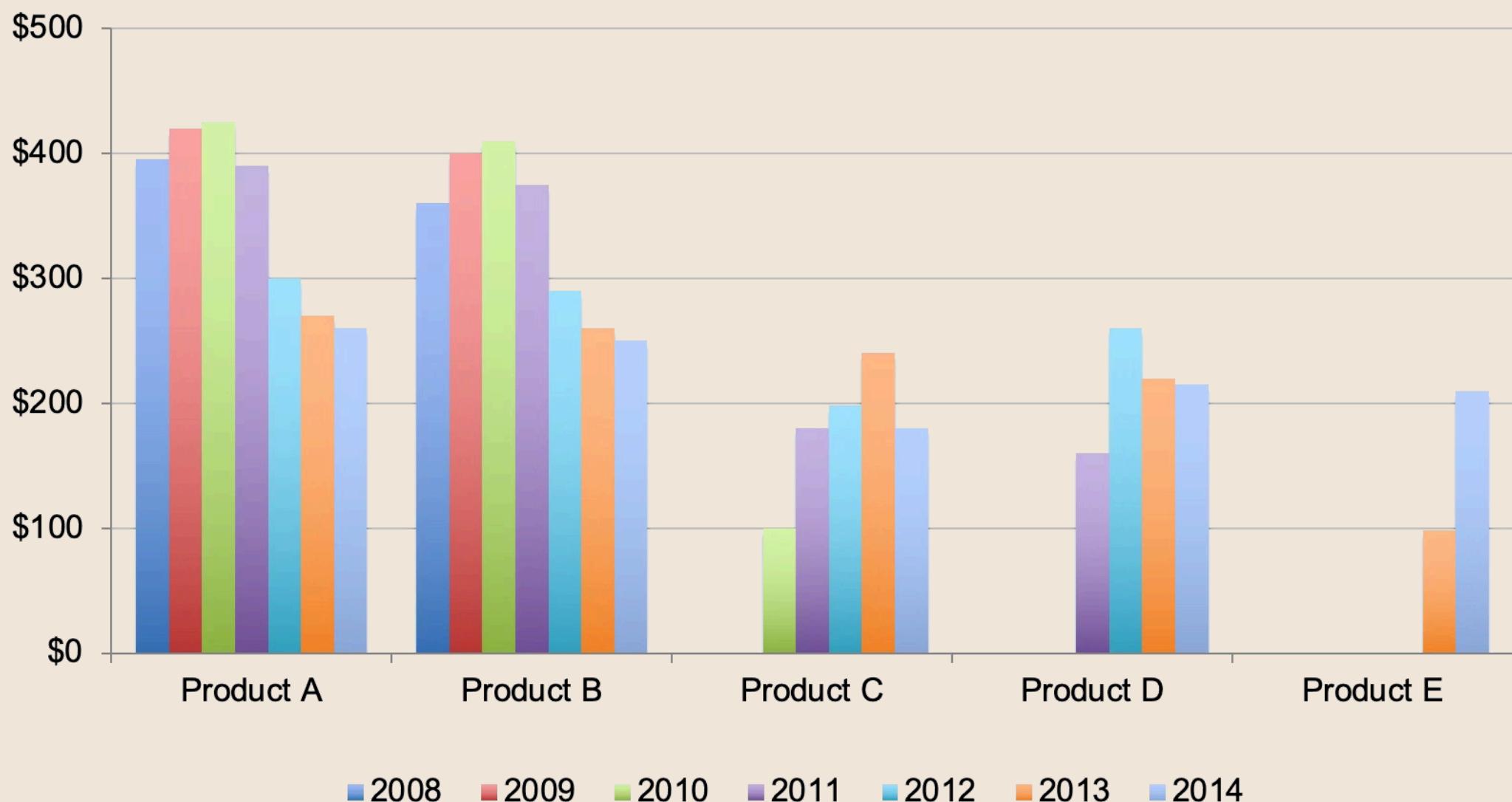


AFTER
program, more
children were
*Kind of
interested &
Excited* about
science.

Based on survey of 100 students conducted before and after pilot program (100% response rate on both surveys).

Average Retail Product Price Example (pre)

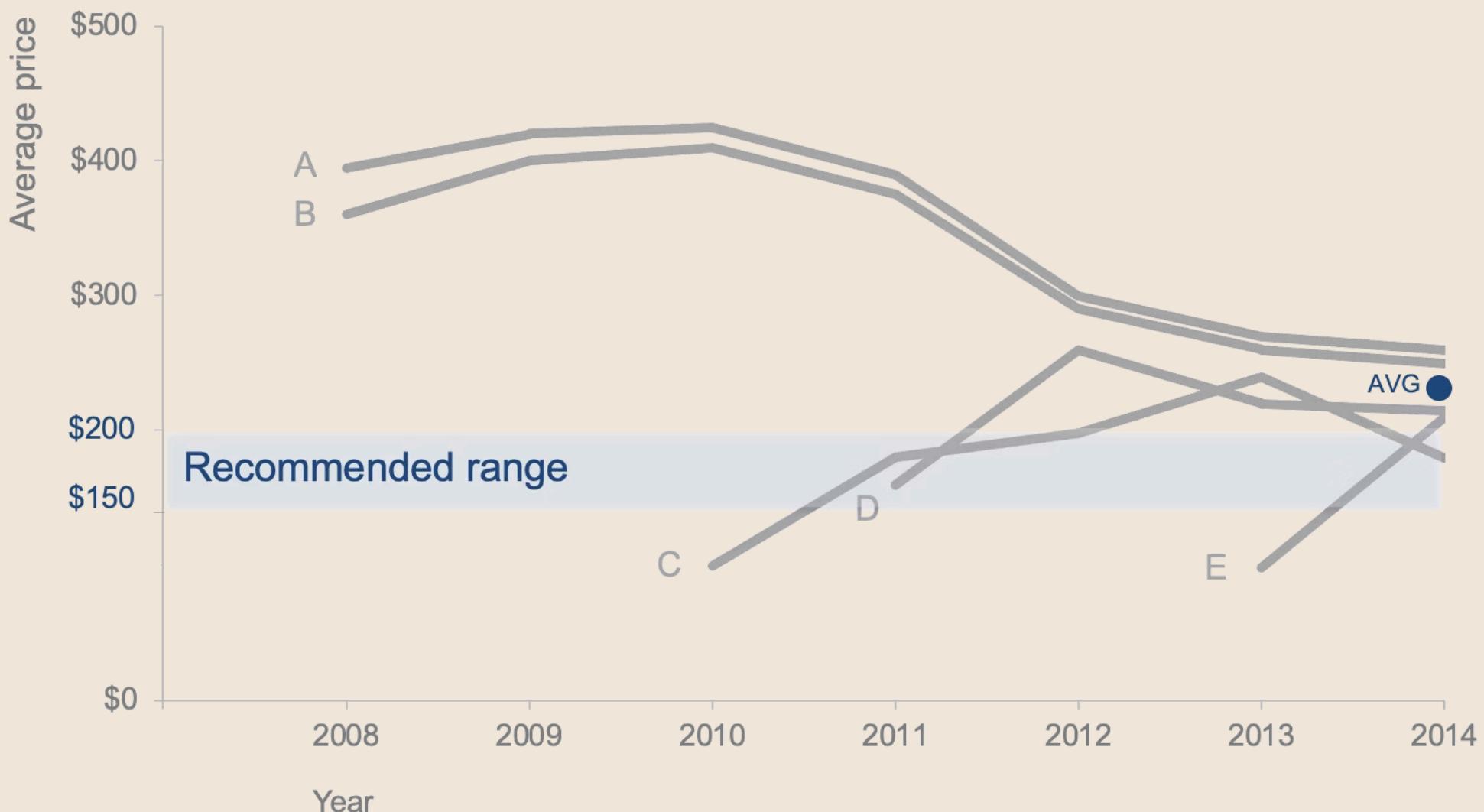
Average Retail Product Price Per Year



Average Retail Product Price Example (post)

To be competitive, we recommend introducing our product *below* the \$223 average price point in the **\$150-\$200** range

Retail price over time by product



Exploratory vs. Explanatory Analysis

Every data science project involves two distinct phases of analysis. Confusing them is the most common mistake in data communication.



Exploratory Analysis



This is the process of "hunting for pearls in oysters". You sift through the data, test hypotheses, and look at it in 100 different ways to find insights.

This work is for **you**.



Explanatory Analysis



This is where you present the two pearls you found. You have a specific story you want to tell and a specific message to communicate to your audience. This work is for **them**.

- ☐ **Critical mistake:** Resist the urge to show your audience all 100 oysters you opened. You are making them do the work of analysis, when your job is to present the insight.



Mastering Data Storytelling: The Six Core Lessons

To effectively communicate with data and influence decisions, we will explore six fundamental lessons that transform raw analysis into compelling narratives.



Lesson 1: Understand the Context

Knowing your audience and what specific questions they need answered will shape your entire approach.



Lesson 2: Choose an Effective Visual

Select the most appropriate chart type to clearly and accurately represent your data and insights.



Lesson 3: Eliminate Clutter

Strip away unnecessary elements that distract from your core message, making your visual easier to process.



Lesson 4: Focus Attention

Utilise preattentive attributes to guide your audience's eyes to the most critical parts of your data.



Lesson 5: Think Like a Designer

Apply aesthetic principles and best practices to ensure your visuals are not only clear but also engaging.



Lesson 6: Tell a Story

Weave your data into a coherent and persuasive narrative that prompts your audience to act.

Lesson 1: Understand the Context

Success in data visualisation **does not start with data visualisation; it starts with context**. Before creating any communication, you must be able to concisely answer three questions.

01

WHO is your audience?

Be specific. Avoid general audiences like "internal stakeholders". **The more you know about your audience, the better you can tailor your communication to resonate with them.**

Also, consider your relationship with them: do they trust you as an expert, or do you need to establish credibility?

02

WHAT do you need them to know or DO?

You should always want your audience to know or do something. If you can't articulate that, you should revisit whether you need to communicate at all.

As the analyst, **you are the subject matter expert**; take a confident stance in making recommendations. **Prompting action elicits a more productive reaction than simply presenting data.**

03

HOW can you use data to make your point?

Once you know the Who and What, you can turn to the data. **Data becomes the supporting evidence for the story you will tell.**

Context Example: The Science Programme

Let's apply the Who, What, and How framework to a scenario from the book.

Scenario: You are a 4th-grade science teacher who ran a pilot summer programme to improve kids' perceptions of science. You surveyed them before and after and believe the data shows a success story you can use to request funding.

WHO



The budget committee that controls the funding you need to continue the programme.

WHAT



The programme was a success, and we need a budget of £X to continue it.

HOW



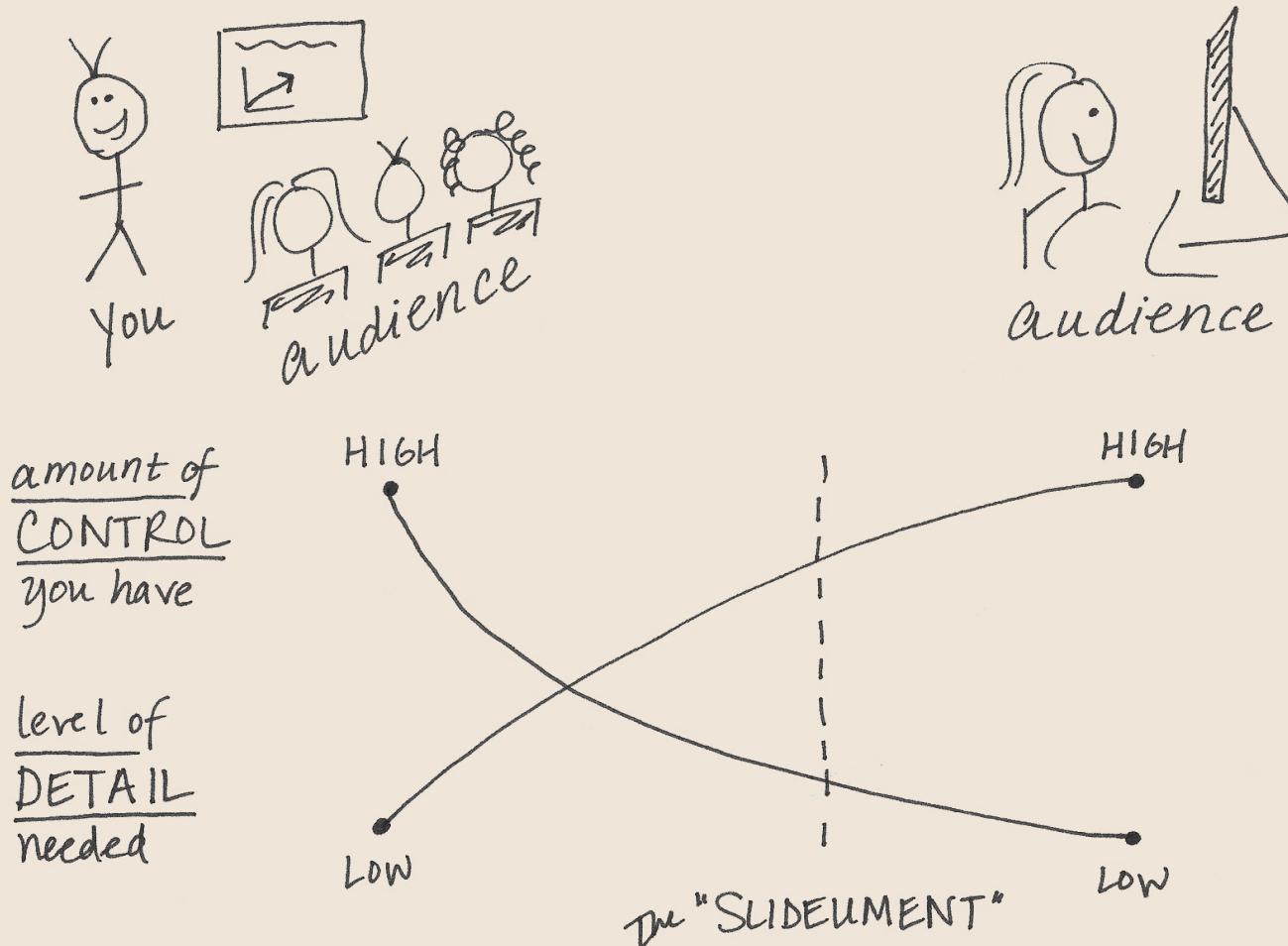
Illustrate the success using the pre- and post-programme survey data to show the increase in positive perceptions of science.



The Communication Mechanism Continuum

The method you use to communicate has major implications for the level of detail needed and the control you have.

LIVE PRESENTATION WRITTEN DOC OR EMAIL



The 3-Minute Story & The Big Idea

Before building your communication, you must be able to articulate your core message concisely. This is often harder than being verbose.

The 3-Minute Story

If you only had three minutes, what would you say? This forces you to be clear on the main narrative and makes you independent of your slides.

A group of us in the science department were brainstorming ways to resolve an ongoing issue with incoming fourth-graders. When students arrive for their first science class, many bring the attitude that science is difficult and unenjoyable [...] We asked ourselves: What if we gave students earlier exposure to science? Could we influence their perception before they reach fourth grade? To explore this idea, we piloted a summer learning program [...] To evaluate the program's impact, we surveyed students before and after their participation. [...] After the program, nearly 70% of all students expressed some level of interest in the subject, indicating a significant shift toward positive perceptions. [...]

The Big Idea

This concept from Nancy Duarte boils the "so-what" down to a single sentence. It must:

1 Articulate your unique point of view

What makes your perspective distinct and valuable?

2 Convey what's at stake

Why does this matter? What happens if action isn't taken?

3 Be a complete sentence

Not a topic or a title, but a full, declarative statement.

The pilot summer learning program successfully improved students' perceptions of science. Based on this outcome, we recommend continuing the program in future years. We respectfully request budget approval to support its ongoing implementation and expansion.

Storyboarding: Plan Before You Build

Storyboarding is the single most important step to ensure your communication is on point. It is a visual outline of your content.

- **Advice:** Don't start with presentation software! It's too easy to get lost in slide-generating mode without a clear narrative structure.

Brainstorm Ideas

Get all your thoughts out without judging them.

Organise & Sequence

Group related ideas and determine the logical flow.

Refine & Edit

Remove anything that doesn't serve your core message.

Issue:
Kids have bad attitudes about science

Demonstrate Issue:
show student assignment grades Over course of year

Ideas for overcoming issue, including pilot program

Describe pilot program - goals, etc.

Show before & after survey data to demonstrate success of program

RECOMMENDATION:
pilot was a success let's expand it we need \$\$\$

Lesson 2: Choose an Effective Visual

A handful of visuals will cover the majority of your needs. Let the data and the desired relationship guide your choice.

91%

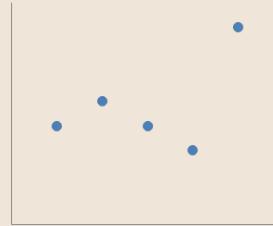
Simple text

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

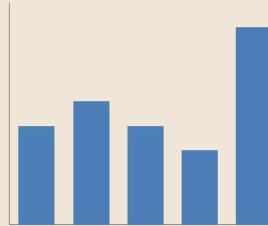
Table

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

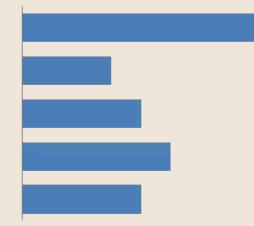
Heatmap



Scatterplot



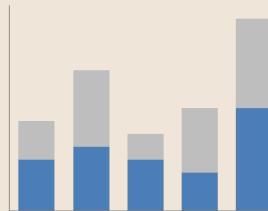
Vertical bar



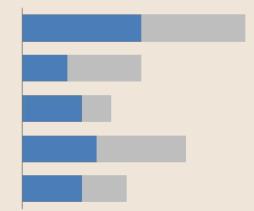
Horizontal bar



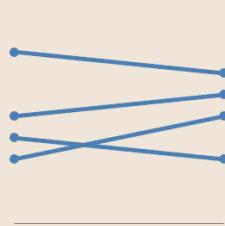
Line



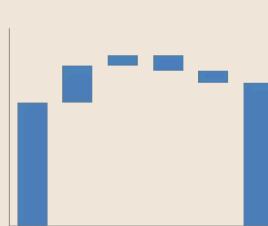
Stacked vertical bar



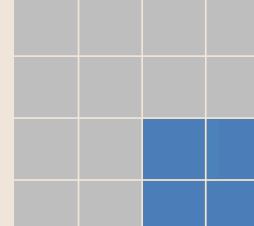
Stacked horizontal bar



Slopegraph



Waterfall



Square area

Simple Text

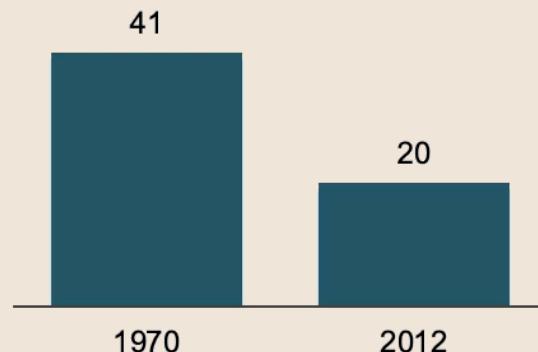
When you only have one or two numbers to share, **simple text can be the most effective way to communicate them.** Putting a single number in a large graph can cause it to lose its "oomph".

This can be much more intuitive and easy to read than other graphs.

For instance, compare the bar chart with the simple text alternative.

Children with a "Traditional" Stay-at-Home Mother

% of children with a married stay-at-home mother with a working husband



Note: Based on children younger than 18. Their mothers are categorized based on employment status in 1970 and 2012.

Source: Pew Research Center analysis of March Current Population Surveys Integrated Public Use Microdata Series (IPUMS-CPS), 1971 and 2013

Adapted from PEW RESEARCH CENTER

20%

of children had a **traditional stay-at-home mom** in 2012, compared to 41% in 1970

Tables

Tables interact with our verbal system—we *read* them. They are great for communicating with a mixed audience where each person will look for their particular row of interest, or when you need to show multiple units of measure.

Design Principle: The design should fade into the background. Use minimal borders and let the data stand out, not the structure of the table.

Heavy borders

Group	Metric A	Metric B	Metric C
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

Light borders

Group	Metric A	Metric B	Metric C
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

Minimal borders

Group	Metric A	Metric B	Metric C
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

Note how, in the second and third iterations, the data stands out more prominently than the structural components of the table—thanks to the use of light or minimal borders.

Heatmaps

A heatmap is a table that uses coloured cells to convey the relative magnitude of numbers, providing a quick visual cue to where high and low values are located.

This reduces the mental processing needed to find points of interest.

Table

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

Heatmap

LOW-HIGH

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

Scatterplots

Scatterplots are useful for showing the relationship between two continuous variables. They allow you to encode data on both an x- and y-axis to see what, if any, relationship exists. They are common in scientific fields but also have business use cases, like understanding the relationship between cost and miles driven.

The examples below show the cost per mile of a bus fleet. Adding color can help make the scatterplot easier to read. For instance, in the scatterplot on the right, we focus on the cases in which cost per mile is above average.

Cost per mile by miles driven



Cost per mile by miles driven



Cost per mile is higher than average when less than 1700 miles or more than 3300 miles were driven.

Line Graphs

Line graphs are most commonly used to plot continuous data, especially over time. The line implies a connection between points, which is why it works well for time-series data but not for categorical data.

They can typically show one, two or multiple series.

Single series



Two series



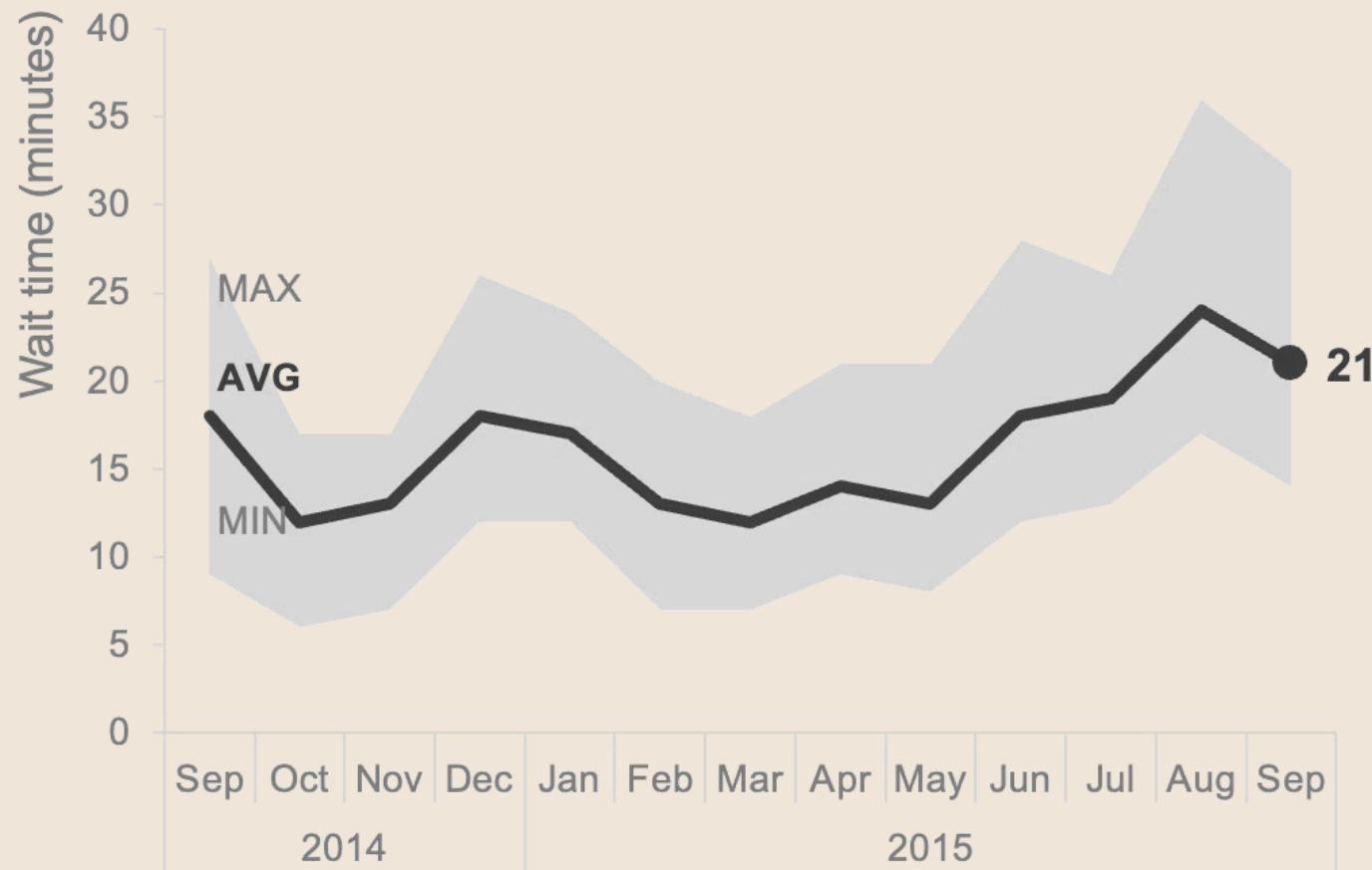
Multiple series



Showing average within range in a line graph

Passport control wait time

Past 13 months

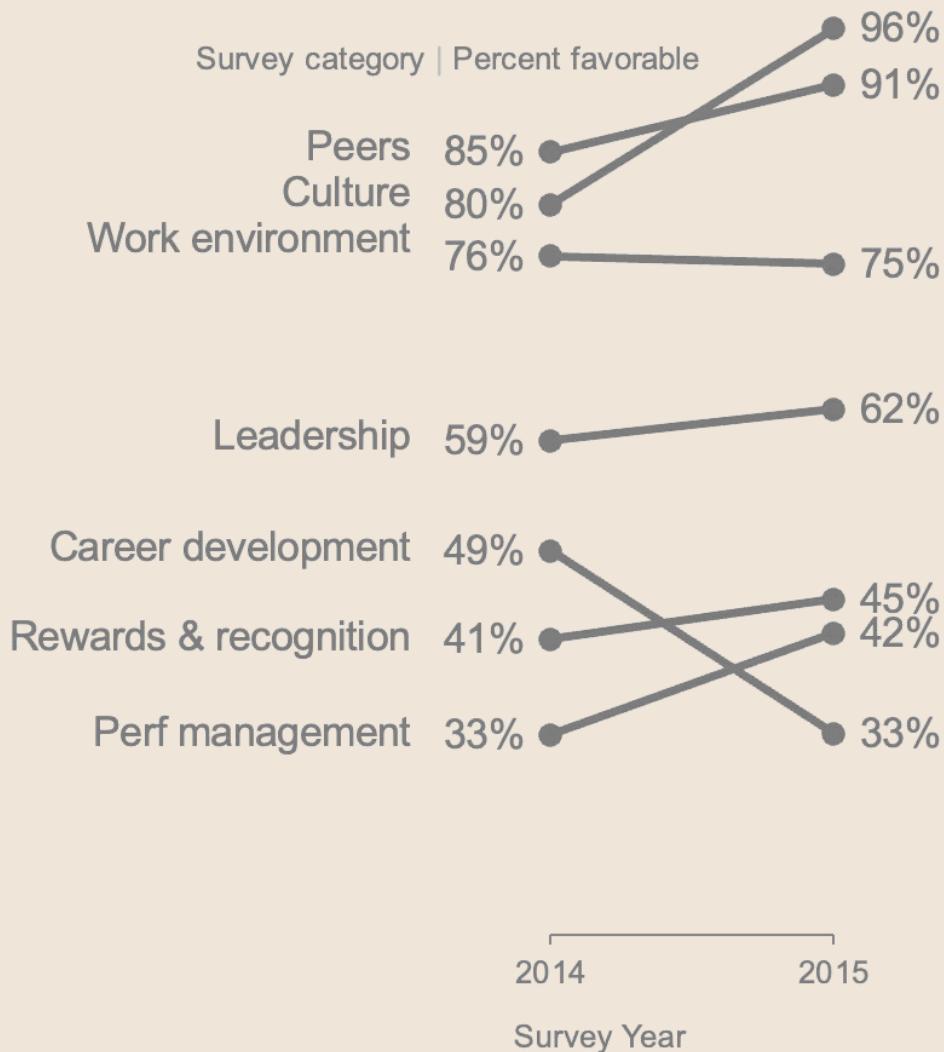


When we have a range of values (such as waiting times for passport control), line graphs can be used to show both the lower and upper extremes, and the average values.

Slopegraphs

Slopegraphs are a specific type of line graph that is useful for comparing two time periods or two points of comparison. They quickly show relative increases and decreases across different categories between the two points.

Employee feedback over time



Employee feedback over time



Bar Charts and Zero baseline

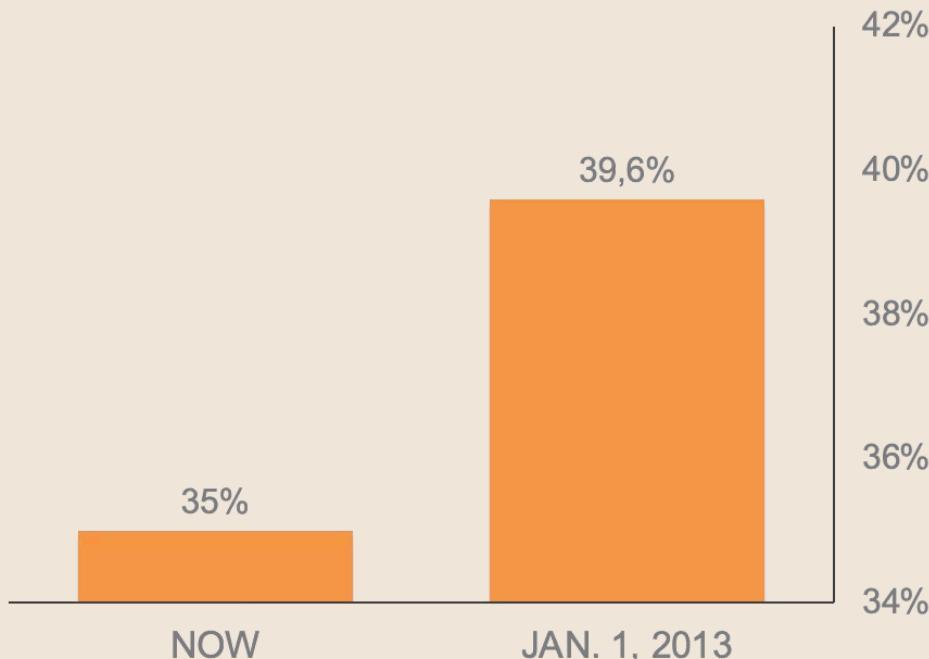
Bar charts are a go-to for categorical data because they are common and easy for our eyes to read. We compare the end points of the bars, so it's easy to see which category is biggest and by how much.

The Golden Rule: Bar Charts **MUST** Have a Zero Baseline

Because our eyes compare the relative length of the bars, starting the axis at a non-zero value creates a false visual comparison.

Non-zero baseline: as originally graphed

IF BUSH TAX CUTS EXPIRE
TOP TAX RATE



Zero baseline: as it should be graphed

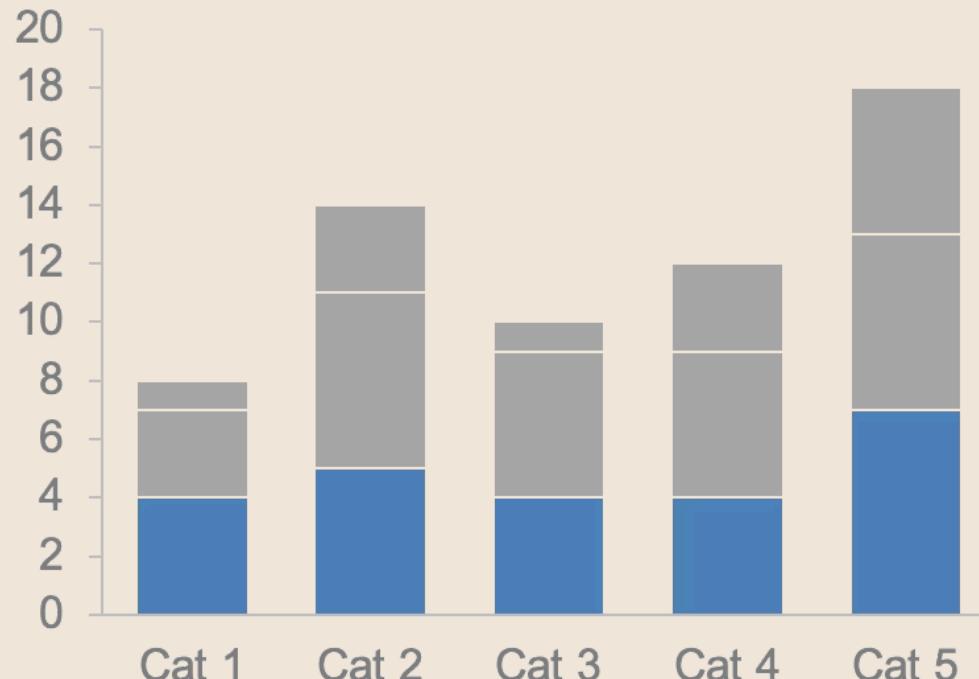
IF BUSH TAX CUTS EXPIRE
TOP TAX RATE



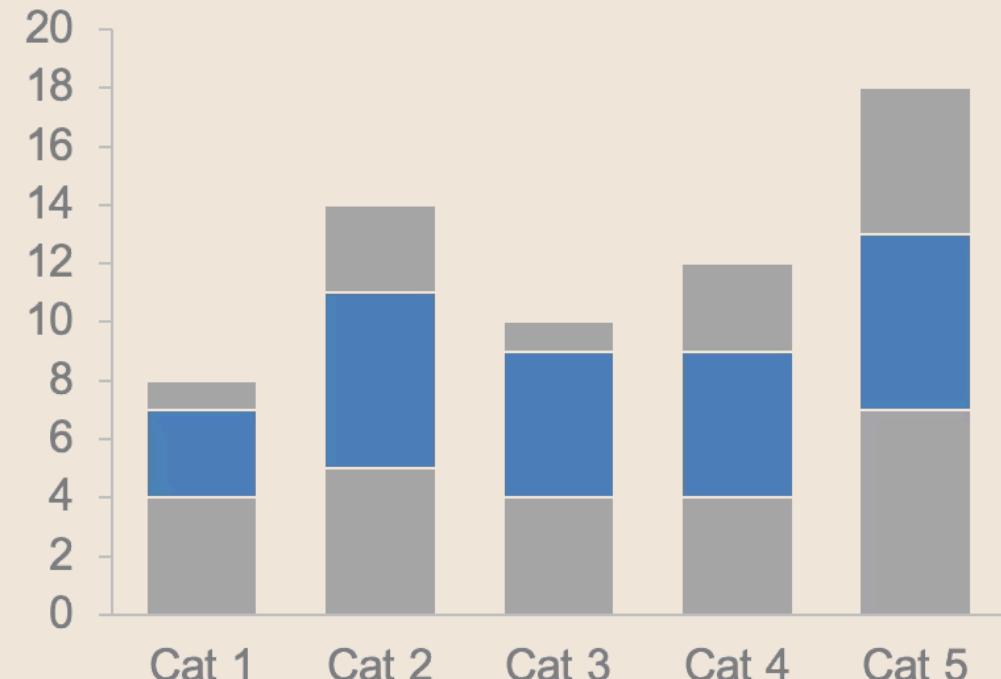
Stacked Bar Charts

Stacked vertical bar charts help compare category totals and subcomponents, but inconsistent baselines and overwhelming color schemes make it difficult to visually compare upper segments across categories.

Comparing **these** is easy



Comparing **these** is hard

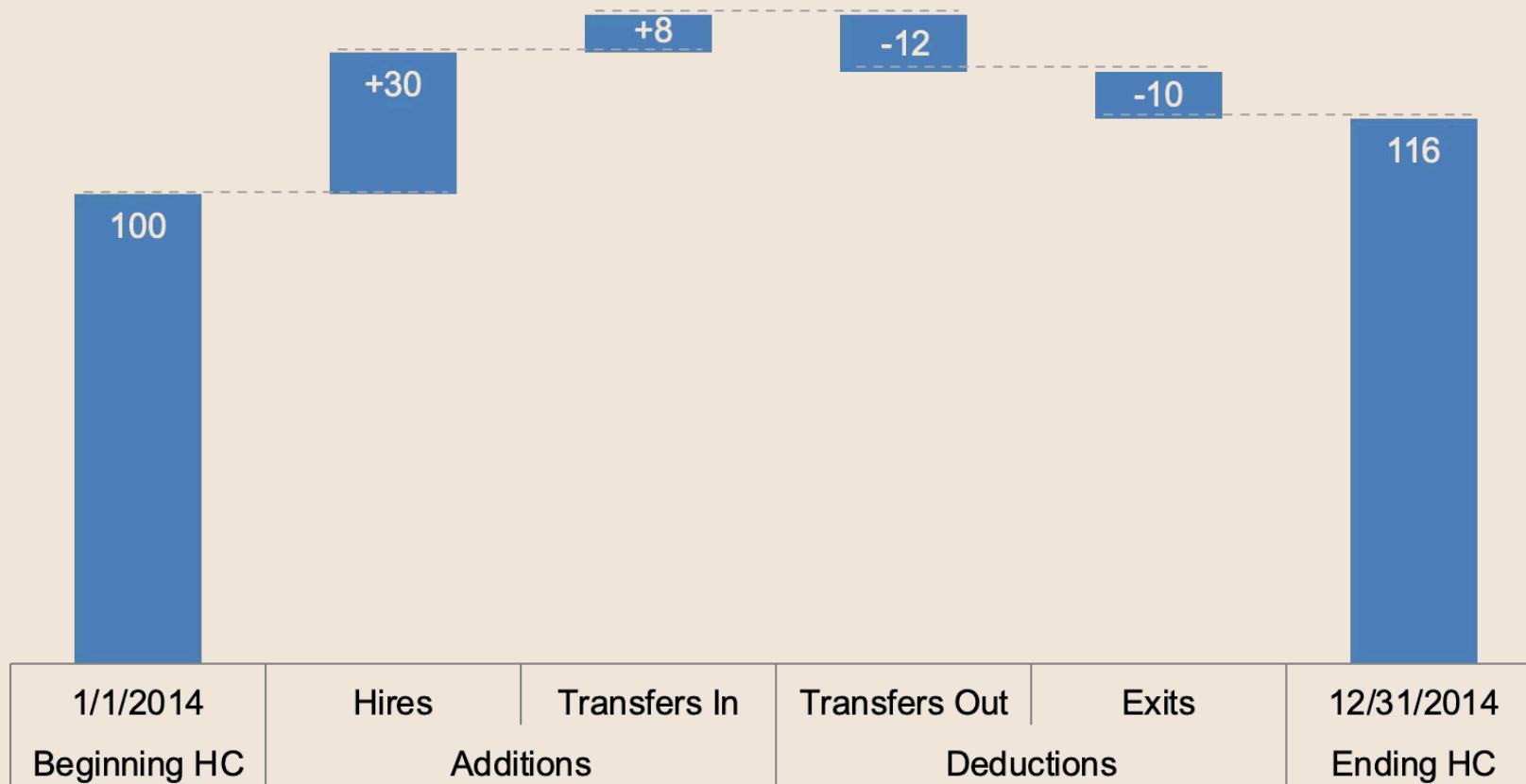


Waterfall charts

Waterfall charts break down changes over time—such as employee headcount—by visualizing starting values, incremental increases and decreases, and the resulting total.

2014 Headcount math

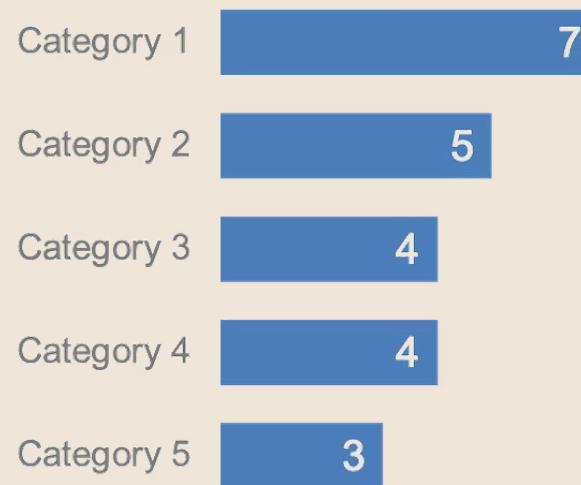
Though more employees transferred out of the team than transferred in, aggressive hiring means overall headcount (HC) increased 16% over the course of the year.



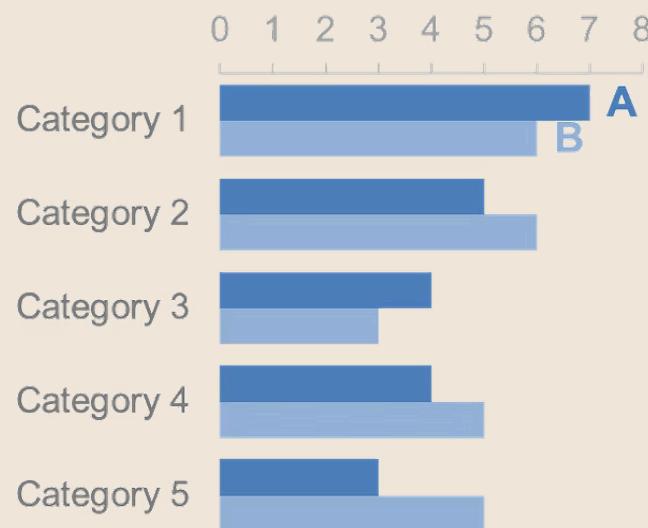
Horizontal Bar Charts

Horizontal bar charts are ideal for categorical data—especially with long labels—because they align with natural reading patterns, making category names easier to scan before interpreting the data.

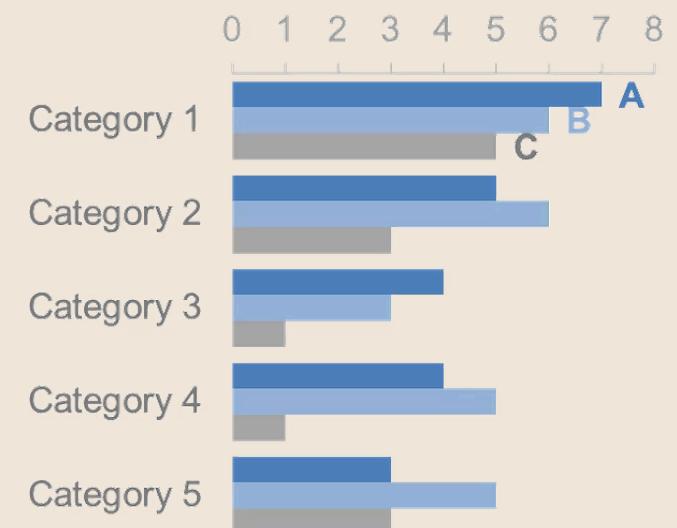
Single series



Two series



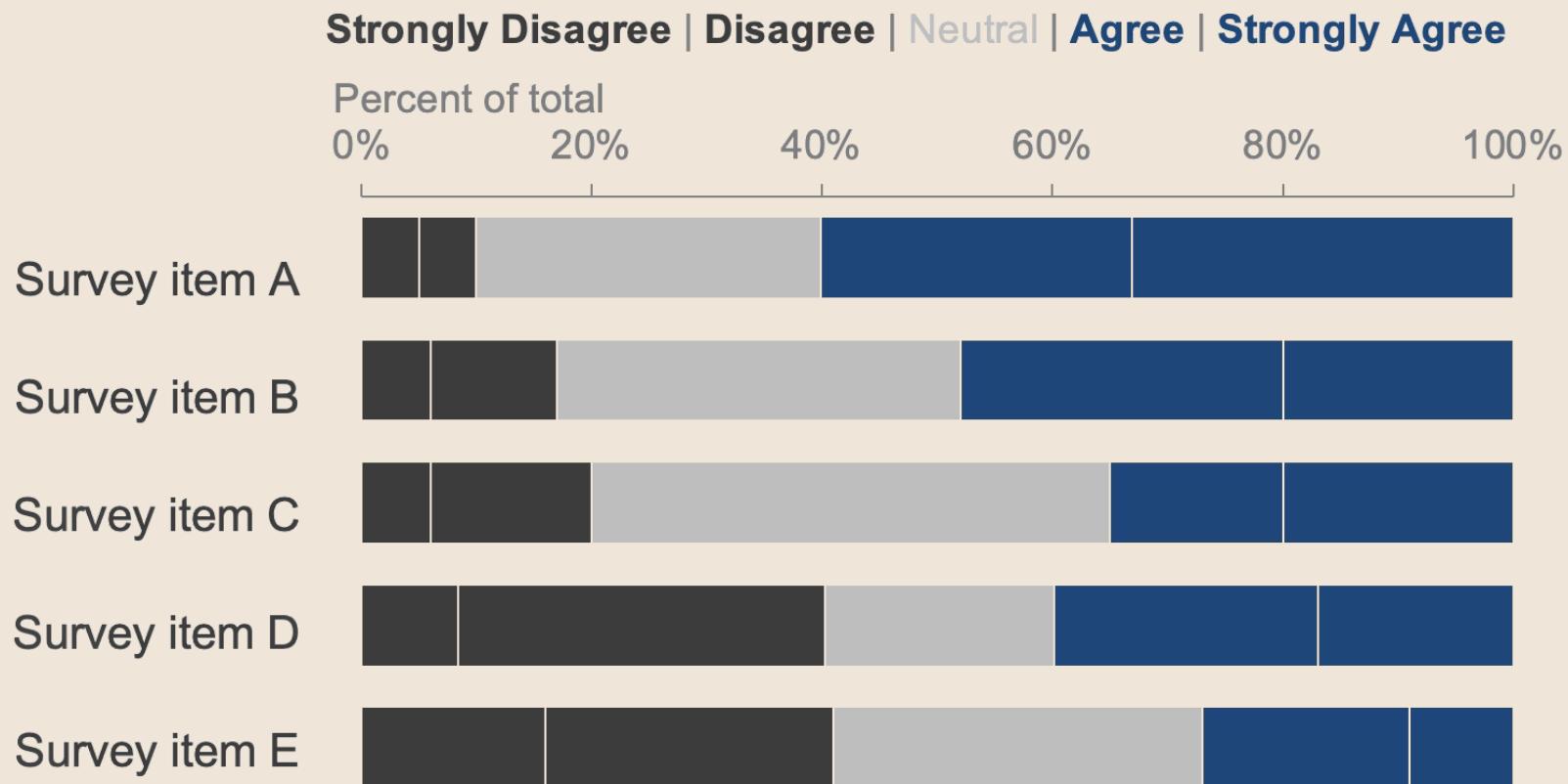
Multiple series



Stacked Horizontal Bar Charts

Stacked horizontal bar charts are useful for showing category totals and subcomponents—especially when structured to sum to 100%, enabling clear comparisons across a consistent left-right baseline, such as in Likert scale survey data.

Survey results



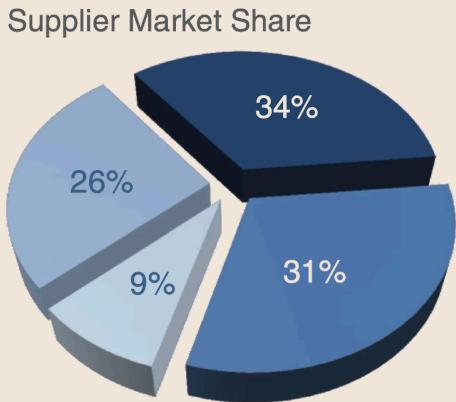
Visuals to AVOID

Some chart types are popular but are poor at encoding data for human perception.

Pie Charts are Evil

The human eye is not good at ascribing quantitative value to two-dimensional space and angles. This makes it nearly impossible to accurately compare segments, especially if they are close in size.

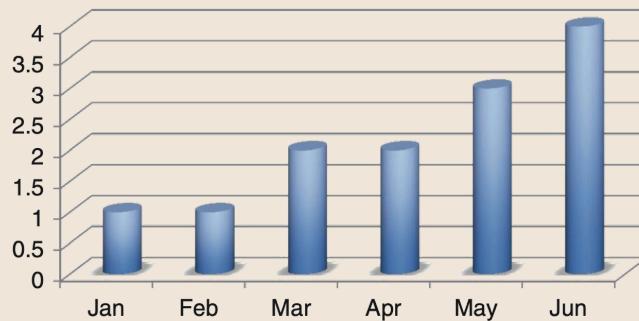
Solution: A bar chart is almost always a better alternative.



3D Charts

Never use 3D unless you are plotting a third, meaningful dimension. 3D effects are pure chartjunk—they add no new information, distort the data, and make visuals harder to read.

Number of issues

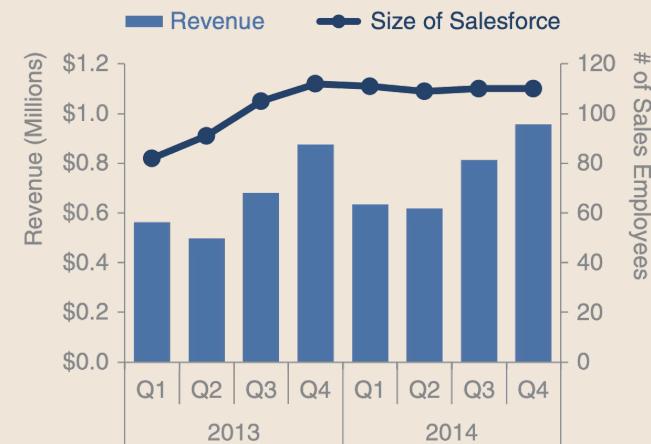


Secondary Y-Axis

Avoid using a second y-axis on the right side of a graph. It takes time for the audience to figure out which data to read against which axis.

Solution: Label data points directly or pull the graphs apart vertically.

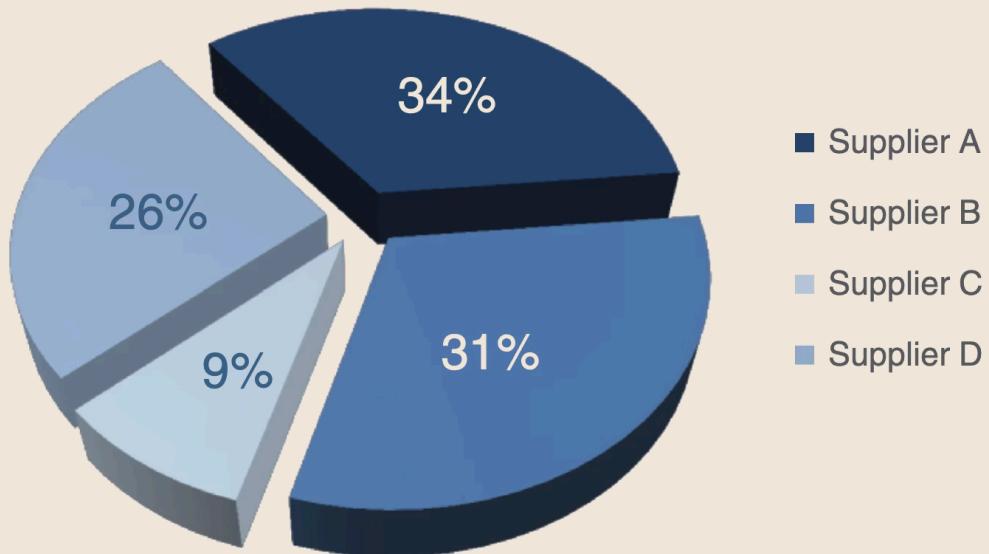
Secondary y-axis



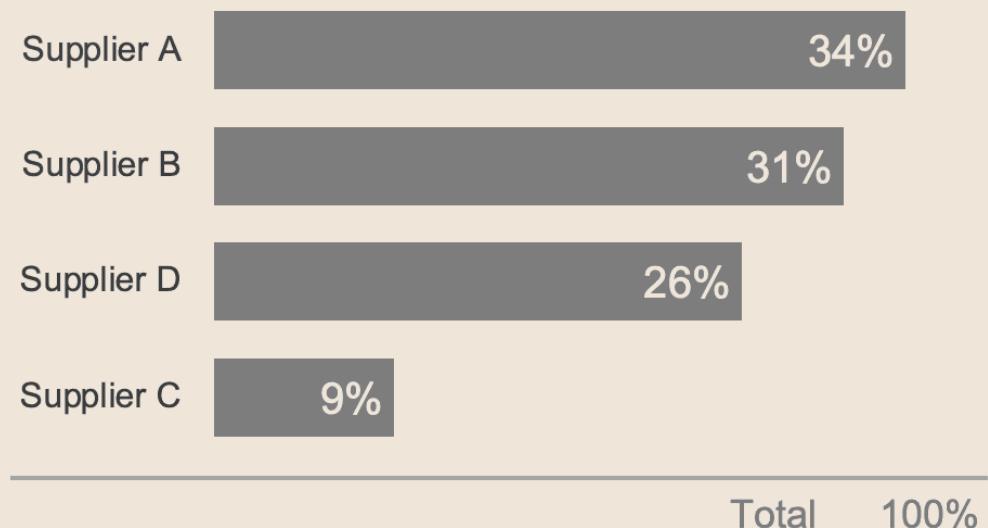
Pie Charts vs Bar Charts

Bar charts are usually better than pie charts.

Supplier Market Share

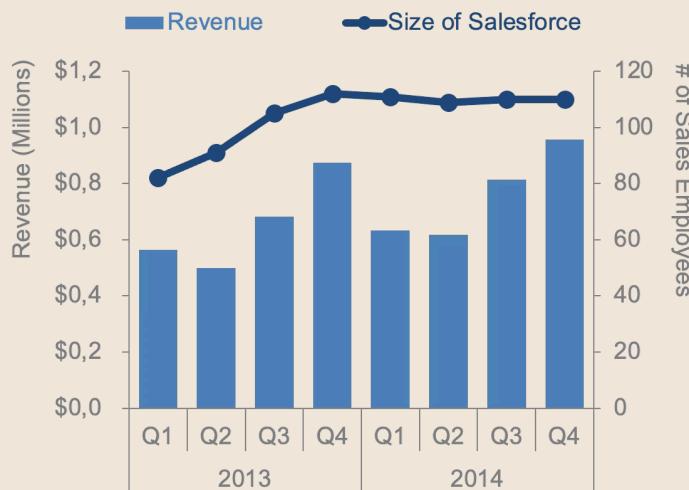


Supplier Market Share

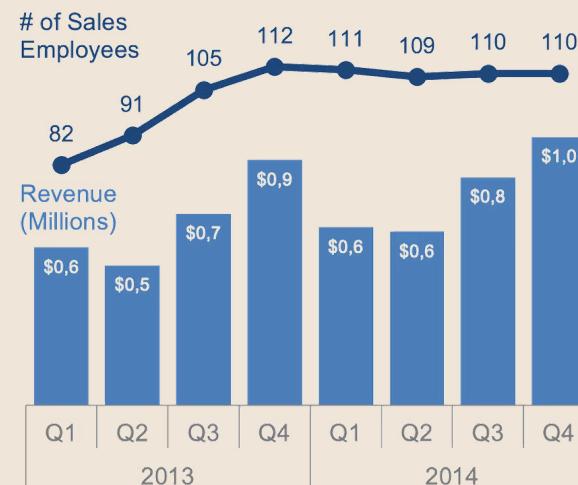


How to Avoid Secondary Axes

Secondary y-axis



Alternative 1: label directly



Alternative 2: pull apart vertically



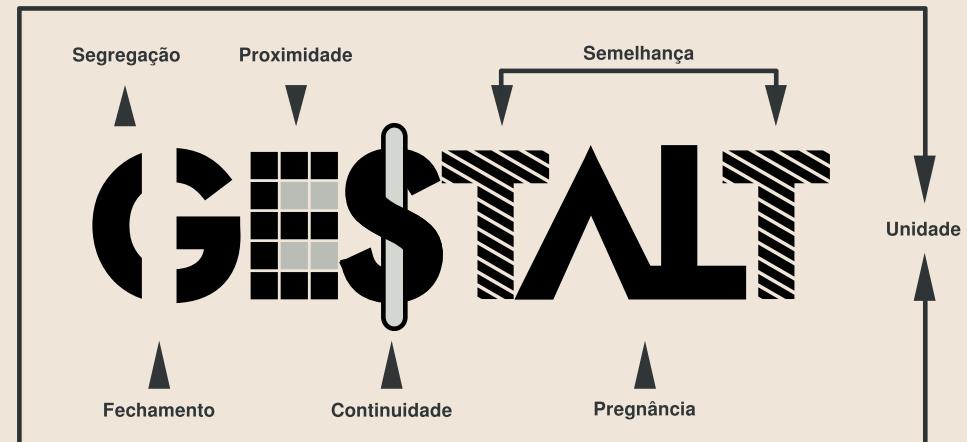
Lesson 3: Clutter in Your Enemy

Gestalt Psychology

Originating in early 20th-century Germany, Gestalt psychology was pioneered by Max Wertheimer, Kurt Koffka, and Wolfgang Köhler. They challenged the prevailing structuralist view that perception could be understood by breaking it down into its smallest components.

At its core, Gestalt psychology posits that **the human mind perceives objects as organised wholes rather than just a collection of parts**. The famous adage, "**the whole is greater than the sum of its parts**," perfectly encapsulates this idea.

This approach to understanding visual perception is **fundamental to creating effective data visualisations**, as it guides us on how to arrange elements so that information is understood intuitively and efficiently.



Gestalt Principles of Visual Perception (1)

To identify clutter, we first need to understand how our brains perceive order. The Gestalt School of Psychology defined principles for how people create order out of visual stimuli.

Proximity



Application Example



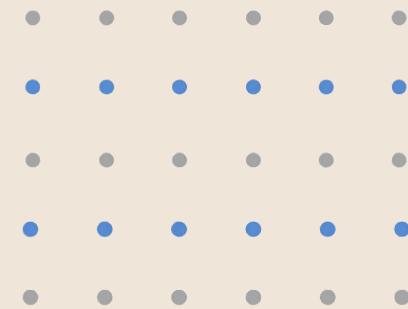
We think of objects that are physically close as belonging to a group.

Placing related items close to each other suggests grouping.

Similarity



Application Example



Objects of similar colour, shape, or size are perceived as related.

Using consistent colors for similar data points across different charts helps users quickly identify and compare information.

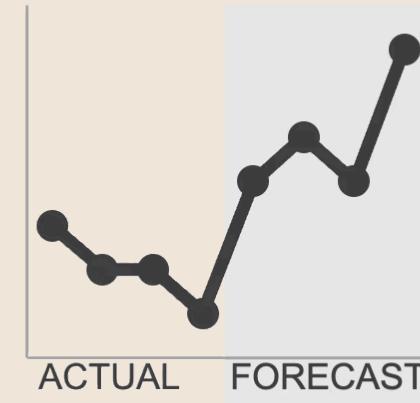
Gestalt Principles of Visual Perception (2)

Enclosure



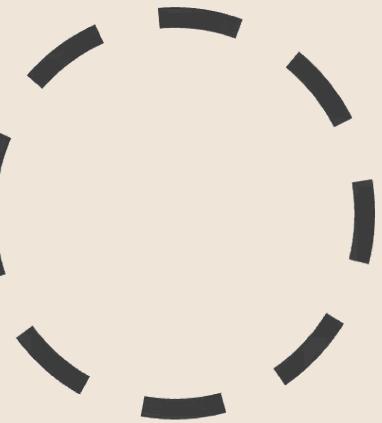
We think of objects physically enclosed together as a group. Light background shading is often enough.

Application Example



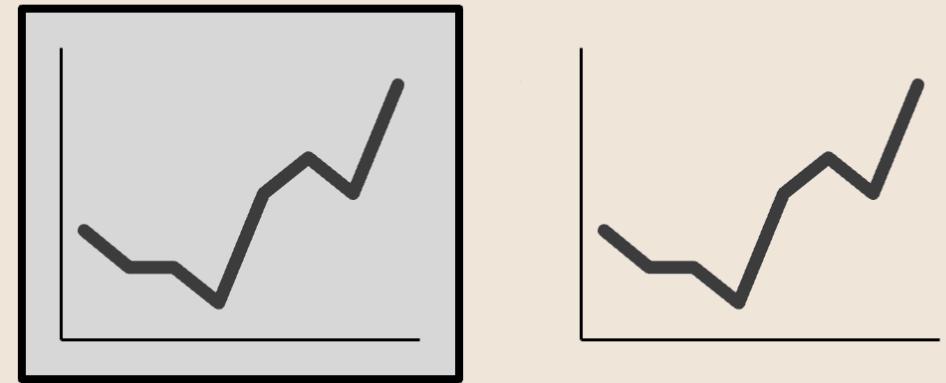
Using boxes, borders, or even subtle background shading to group related content, like a form or a card with related information, clearly separates it from other elements on the page.

Closure



Our eyes fill in missing gaps to perceive a single, recognisable shape.

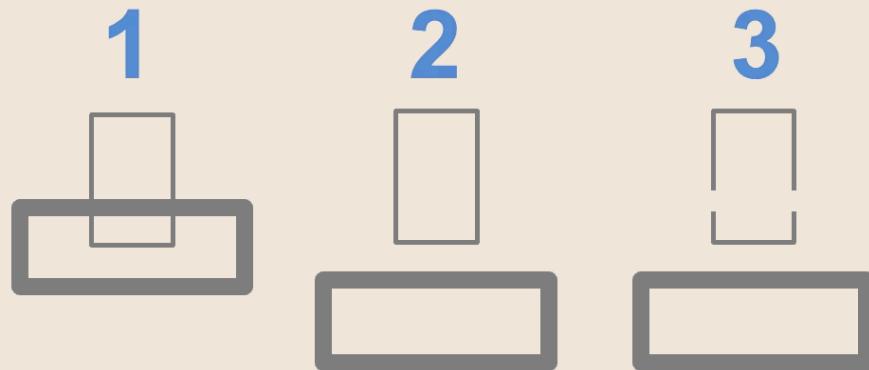
Application Example



This principle allows for minimalist designs, where the brain completes the missing information, reducing visual clutter without losing meaning (e.g., on the right).

Gestalt Principles of Visual Perception (3)

Continuity



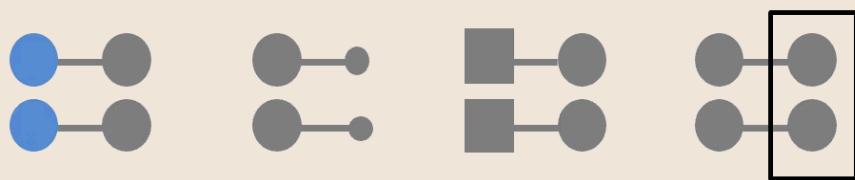
Our eyes seek the smoothest path and create continuity even where it doesn't explicitly exist.

Application Example



This allows again for minimalist design. The graph above is readable even if axes are missing.

Connection



We think of physically connected objects as part of a group. This is the principle that makes line graphs work.

Application Example

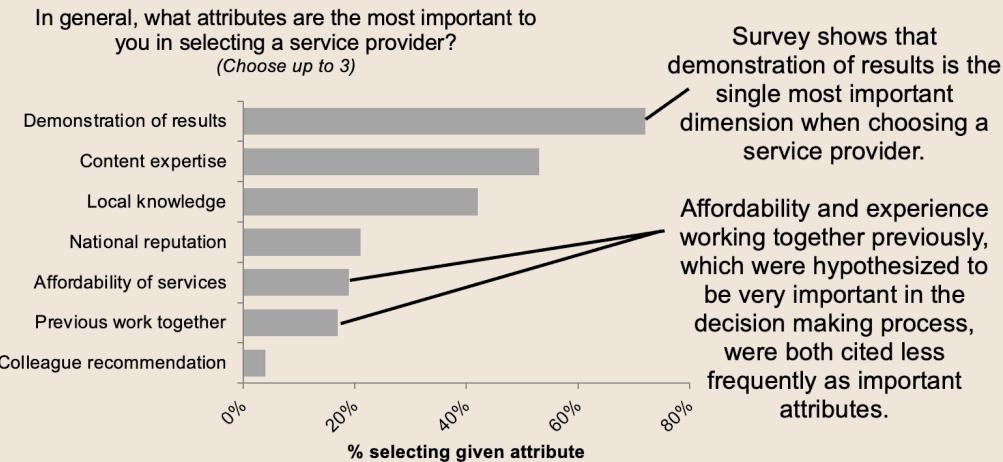


Connecting points explicitly with lines guide the viewer's eye through a sequence and indicates relationships between different elements.

Lack of Visual Order

Thoughtful design becomes invisible, allowing the message to shine—while poor design disrupts and distracts, burdening the audience.

Demonstrating effectiveness is most important consideration when selecting a provider



Data source: xyz; includes N number of survey respondents. Note that respondents were able to choose up to 3 options.

Demonstrating effectiveness is most important consideration when selecting a provider

In general, **what attributes are the most important** to you in selecting a service provider?



Data source: xyz; includes N number of survey respondents.
Note that respondents were able to choose up to 3 options.

Survey shows that **demonstration of results** is the single most important dimension when choosing a service provider.

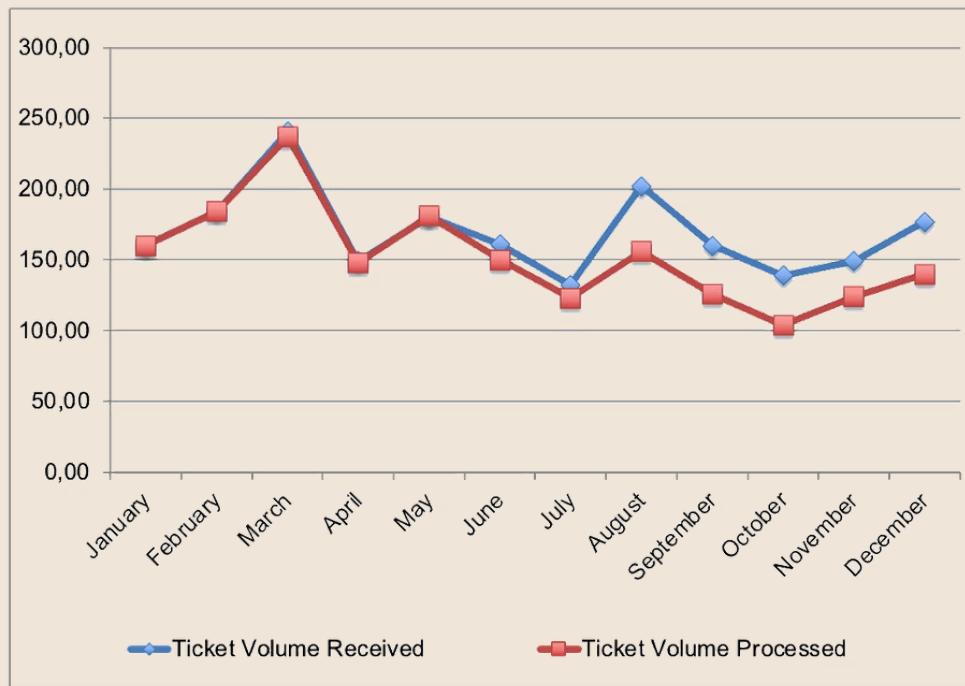
Affordability and experience working together previously, which were hypothesized to be very important in the decision making process, were both cited less frequently as important attributes.

Compare the two graphs above: the one on the left lacks visual order. The one on the right uses Gestalt principles to group things together and provide a much more readable and pleasing diagram.

Decluttering with Gestalt Principles

The application of Gestalt principles allow to declutter graphs. For example, compare the two graphs below:

BEFORE



AFTER



Focus Attention with Preattentive Attributes

A Quick Experiment: Count the 3s

756395068473
658663037576
860372658602
846589107830

Now, Count the 3s

756395068473
658663037576
860372658602
846589107830

How long did that take? You had to scan sequentially, which is slow.

That was instant. Why?

Your **iconic memory** is tuned to pick up specific visual signals called **preattentive attributes**. These are processed without conscious effort.

- ☐ If we use these attributes **strategically and sparingly**, we can guide our audience's eyes to **exactly where we want them to look**.

Lesson 4: Focus your Audience Attention Using Preattentive Attributes

Come the simple text on the left with no preattentive attributes, with the version on the right.

What are we doing well? Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. You sent me gaskets without me having to ask. Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!

What are we doing well?

Themes & example comments

- **Great products:** "These products are clearly the best in class."
- **Replacement parts are shipped when needed:** "You sent me gaskets without me having to ask, and I really needed them, too!"
- **Problems are resolved promptly:** "Bev in the billing office was quick to resolve a billing issue I had."
- **General customer service exceeds expectations:** "The account manager even called after normal business hours. *You have a great company - keep up the good work!*"

The text on the right uses preattentive attributes such as bold, color, and italic to make some elements stand out and guide the reading.

Using color to create a hierarchy of information

Top 10 design concerns



Of the top design concerns, three are noise-related.

Top 10 design concerns



Note how, without other visual cues, you are left to process all of the information. With no clues about what's important or should be paid attention to, it's the count the 3s exercise all over again.

Ticket Volume Revisited

Preattentive attributes may make other things harder to see. Compare the two versions of this graph, where the ticket volume example has been revisited (right). We pushed axes and numbers to the background, highlighted processed and received with colors to highlight their hierarchy and indicated only the numbers we are actually interested in comparing.



Use Color Sparingly

The examples below show that "less is more". Using fewer colors makes the heatmap and table much easier to read.

Country Level Sales Rank Top 5 Drugs

Rainbow distribution in color indicates sales rank in given country from #1 (red) to #10 or higher (dark purple)

Country	A	B	C	D	E
AUS	1	2	3	6	7
BRA	1	3	4	5	6
CAN	2	3	6	12	8
CHI	1	2	8	4	7
FRA	3	2	4	8	10
GER	3	1	6	5	4
IND	4	1	8	10	5
ITA	2	4	10	9	8
MEX	1	5	4	6	3
RUS	4	3	7	9	12
SPA	2	3	4	5	11
TUR	7	2	3	4	8
UK	1	2	3	6	7
US	1	2	4	3	5

Top 5 drugs: country-level sales rank

COUNTRY	DRUG				
	1	2	3	4	5+
Australia	1	2	3	6	7
Brazil	1	3	4	5	6
Canada	2	3	6	12	8
China	1	2	8	4	7
France	3	2	4	8	10
Germany	3	1	6	5	4
India	4	1	8	10	5
Italy	2	4	10	9	8
Mexico	1	5	4	6	3
Russia	4	3	7	9	12
Spain	2	3	4	5	11
Turkey	7	2	3	4	8
United Kingdom	1	2	3	6	7
United States	1	2	4	3	5

Use color consistently

Always use color consistently, trying not to change colors across slides. Also, choose colors depending on context. In the example below, the client logo is green. We can decide to use the same color, draw attention with black, or use a complimentary color.

Leverage **brand color**



ClientLogo

Draw attention with **black**



ClientLogo

Use **complimentary color**



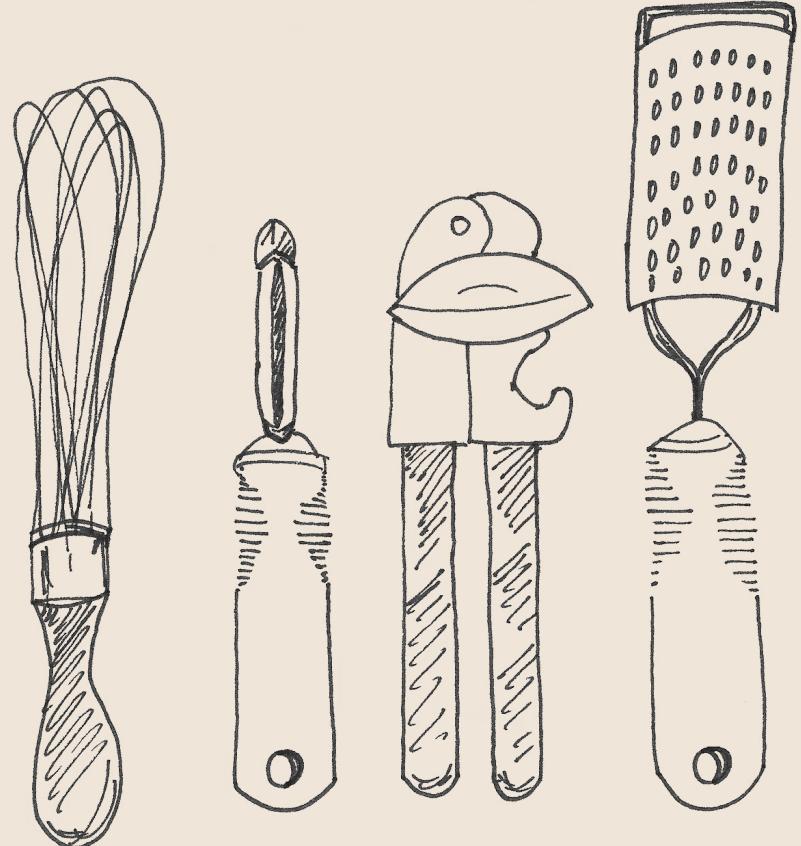
ClientLogo

Lesson 5: Think Like a Designer

Effective data visualization begins with function—what the audience needs to do with the data—and then adopts a form that supports clarity, accessibility, and aesthetic impact.

We will follow different principles:

- Eliminate distractions;
- Use text;
- Keep aesthetic in mind.

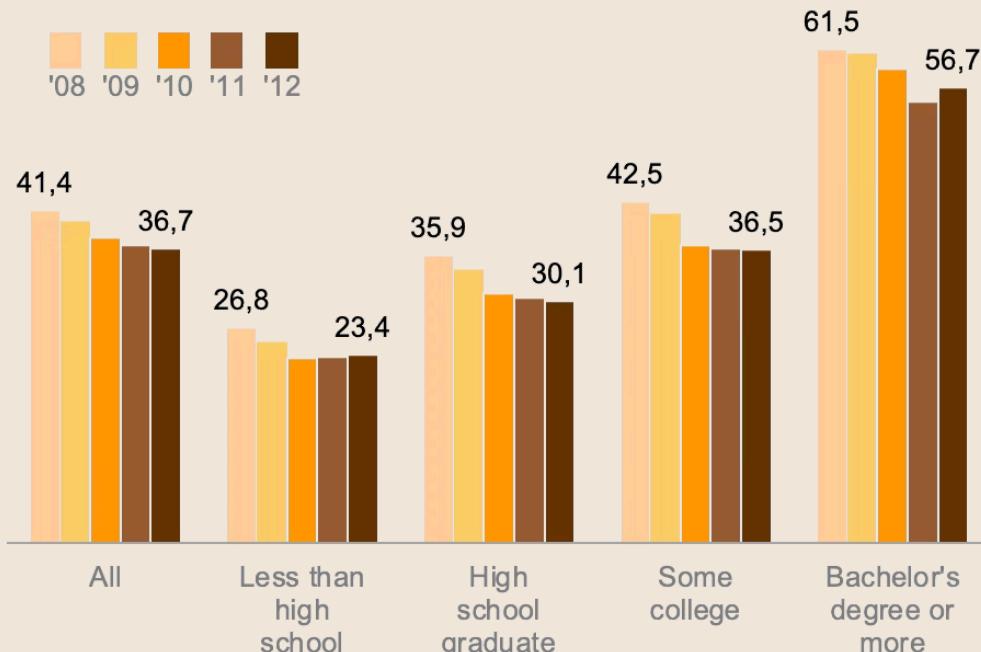


Eliminate Distractions

Identify anything that isn't adding informative value and remove it. Ask yourself: *would eliminating this change anything?* If the answer is no, take it out.
In the example below, we eliminated distractions passing from a bar chart to a line graph, then highlighted the most important bit of information.

New Marriage Rate by Education

Number of newly married adults per 1,000 marriage eligible adults



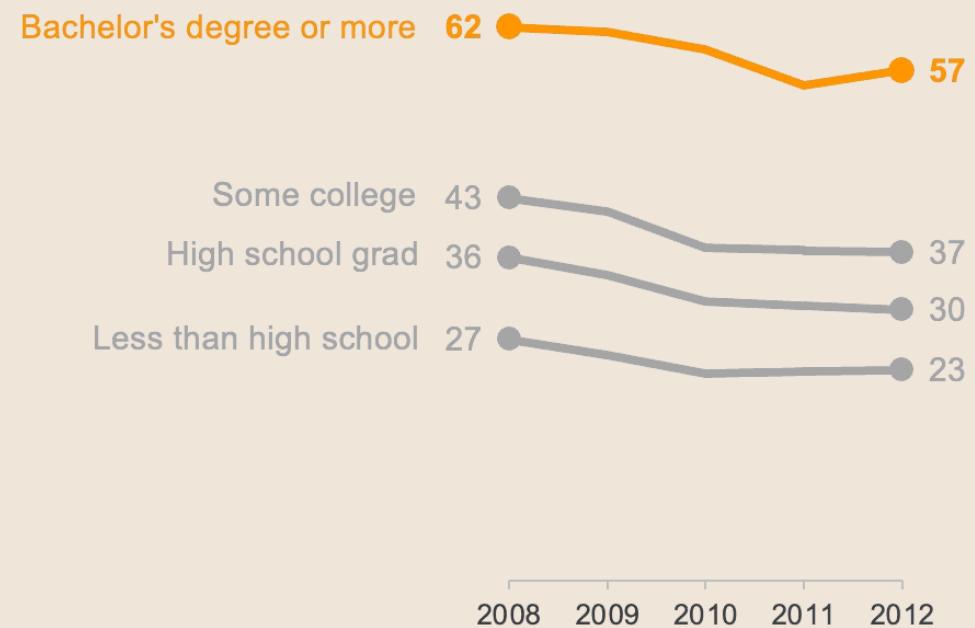
Note: Marriage eligible includes the newly married plus those widowed, divorced or never married at interview.

Source: US Census

Adapted from PEW RESEARCH CENTER

New marriage rate by education

Number of newly married adults per 1,000 marriage eligible adults



Note: Marriage eligible includes the newly married plus those widowed, divorced or never married at interview.

Source: US Census

Adapted from PEW RESEARCH CENTER

Text is Your Friend

Use text to make the graph clearer and more accessible.



Please approve the hire of 2 FTE

to backfill those who quit in the past year

Ticket volume over time



Data source: XYZ Dashboard, as of 12/31/2014 | A detailed analysis on tickets processed per person and time to resolve issues was undertaken to inform this request and can be provided if needed.



Aesthetics Matter

People perceive more aesthetic designs as easier to use, whether they actually are or not. Good aesthetics can make your audience more patient and accepting of your message.



Smart Use of Colour

Use it sparingly and strategically.
Colour should guide attention, not distract from the message.



Alignment

Create clean vertical and horizontal lines to establish a sense of cohesion and professionalism.

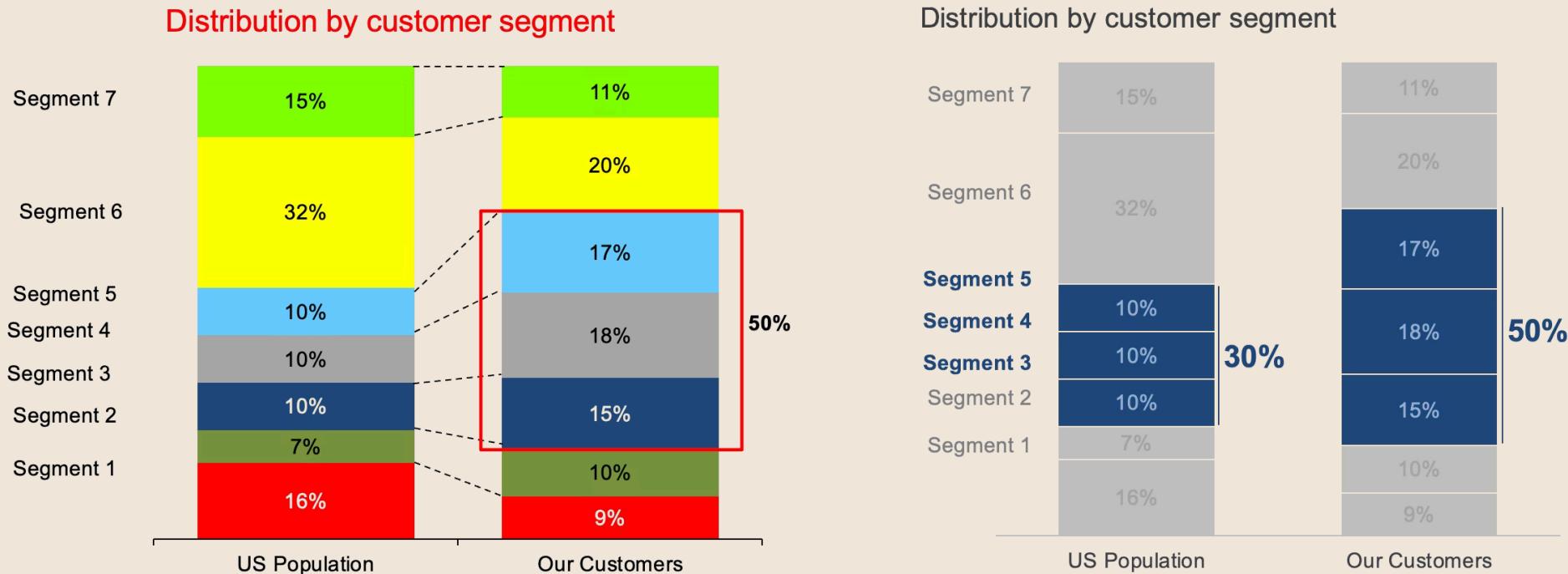


White Space

Use it strategically to draw attention to what's important. Don't fear empty space!

By paying attention to these aesthetic principles, you transform data into a compelling narrative that resonates with your audience and drives action.

Aesthetic Matter - Example

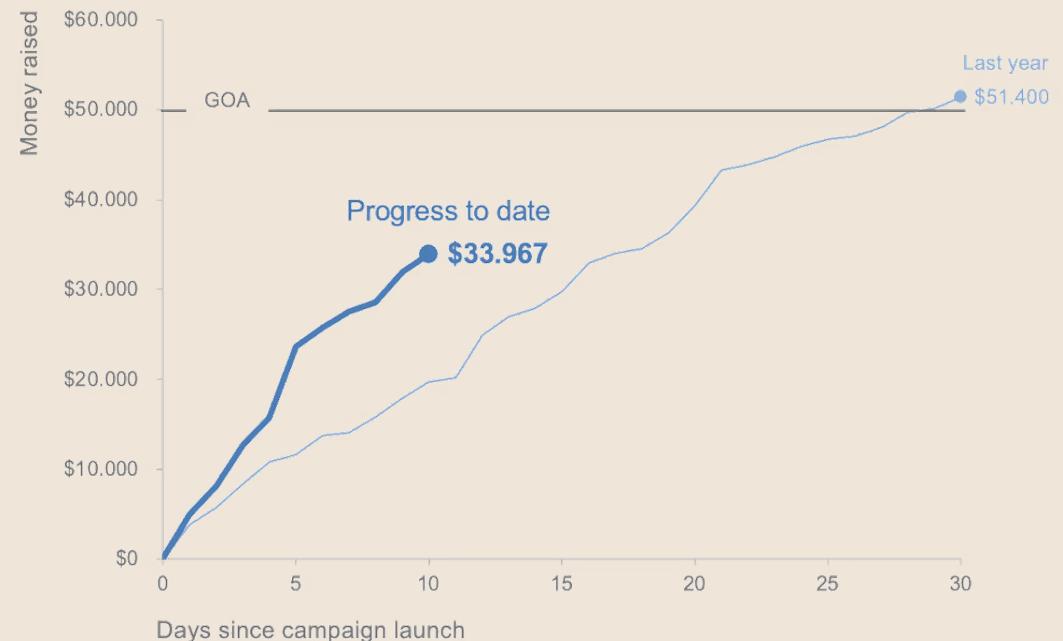


Design in Action (1)

What works in this graphic:

- **Clear labeling:** Graph title, vertical axis title, and horizontal axis title are all present and informative. Lines are labeled directly, without need to reference a legend
- **Effective use of text:** Supports accessibility and clarity throughout the visual
- **Visual hierarchy:** The “Progress to date” trend is emphasized using color, line thickness, data markers, and text size
- **Thoughtful color choices:** Dark grey for titles ensures contrast without overpowering; black reserved for standout elements
- **Contextual comparisons:** Reference lines (e.g., \$50,000 goal, last year’s data) are included but visually de-emphasized
- **Intentional axis formatting:** Y-axis labels retain full numbers for intuitive reading
- **Smart x-axis labeling:** Labels every 5th day to highlight trends without clutter; alternative grouping (e.g., weekly) suggested

Annual giving campaign progress



Design in Action (2)

What works in this graphic:

- **Clear distinction between actual and forecast data:** Solid line for actuals, dotted line for forecasts
- **Direct labeling:** “ACTUAL” and “FORECAST” clearly marked under the x-axis for quick scanning
- **Visual hierarchy:** Graph title, key dates, and relevant data points are emphasized; other elements are muted in grey
- **Selective data markers:** Only used where annotations exist, improving clarity and reducing clutter
- **Thoughtful marker styling:** White with blue outline for actuals; smaller solid blue for forecasts to avoid visual noise
- **Bold numeric anchor:** Final actual value (\$108) is bolded to signal its importance as a forecast reference
- **Minimal y-axis labeling:** Preserves scale for trend recognition without distracting with excessive detail
- **Forecast labels included:** Helps communicate expectations clearly
- **Consistent text sizing:** Only graph title and footnote deviate intentionally for emphasis and de-emphasis
- **Footnote placement:** Low priority and unobtrusive, aiding interpretation without drawing attention

Sales over time



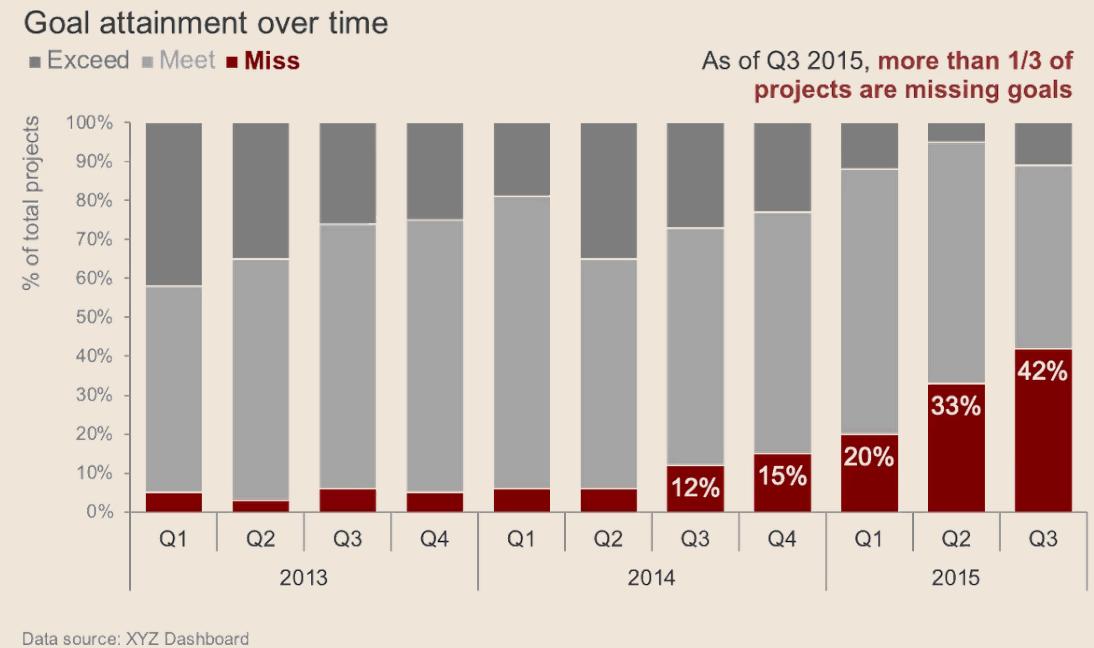
Data source: Sales Dashboard; annual figures are as of 12/31 of the given year.

*Use this footnote to explain what is driving the 10% annual growth forecast assumption.

Design in Action (3)

What works in this graphic:

- **Clear alignment:** Graph title, legend, y-axis title, and footnote are neatly aligned on the left; explanatory text is right-aligned with the final data bar for proximity
- **Intentional color use:** Burnt red highlights key data (missed goals); all other elements are in shades of grey to reduce visual noise
- **Emphasis through contrast:** White-on-red numeric labels and large text draw attention to priority data points
- **Category ordering:** “Miss” to “Exceed” scale is stacked bottom to top, aiding trend visibility for high- and low-priority comparisons
- **Consistent baselines:** “Miss” and “Exceed” categories align with the x-axis and top of the chart, making changes over time easy to track
- **Accessible labeling:** Titles for graph and axes, plus super-categories (years) on the x-axis, improve readability
- **Supportive annotation:** Top-right text reinforces the key message; footnote adds context about total project count over time



Design in Action (4)

What works in this graphic:

- **Stacked layout shows additions, attrition, and unmet need clearly using positive and negative space**
- **Color coding reinforces meaning:** blue for current directors, green for additions, desaturated blue for attrition, outline for gaps
- **Bold black text and numbers highlight the key message:** unmet need
- **Stacking order supports interpretation:** base = current, bottom = attrition, top = additions and gap
- **Text sizing and placement guide attention without clutter**
- **Footnote included for context, de-emphasized by design**



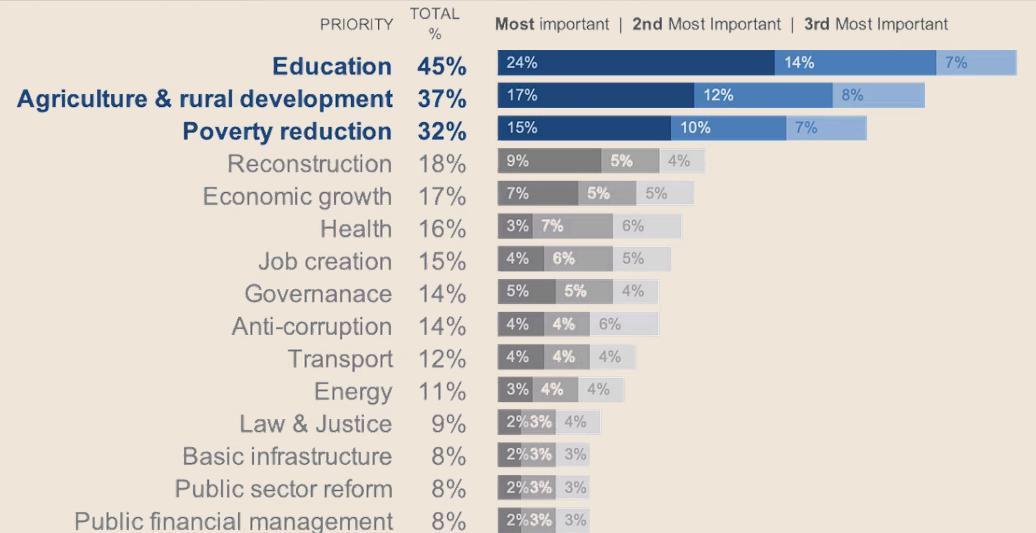
A footnote explaining relevant forecast assumptions and methodology would go here.

Design in Action (5)

What works in this graph:

- Horizontal stacked bars improve readability of long category names
- Descending order by total % guides interpretation, with top priorities shown first
- Color shading distinguishes 1st, 2nd, and 3rd priorities and ties related elements together
- De-emphasized data labels use small, left-aligned, light-colored text to reduce clutter
- No x-axis—values are labeled directly for clarity
- Clear titles and legend support accessibility; bolded keywords aid quick scanning
- Footnote adds context without distracting from the main message

Top 15 development priorities, according to survey



N = 4,392. Based on responses to item, *When considering development priorities, which one development priority is the most important? Which one is the second most important priority? Which one is the third most important priority?* Respondents chose from a list. Top 15 shown.

Lesson 6: Tell a Story



Stories resonate more than raw data, engaging audiences and making your message memorable.

The Classic Narrative Structure

01

The Beginning (The Plot)

Set context, introduce conflict. Answer "Why care?" – the "what is" state.

02

The Middle (The Twists)

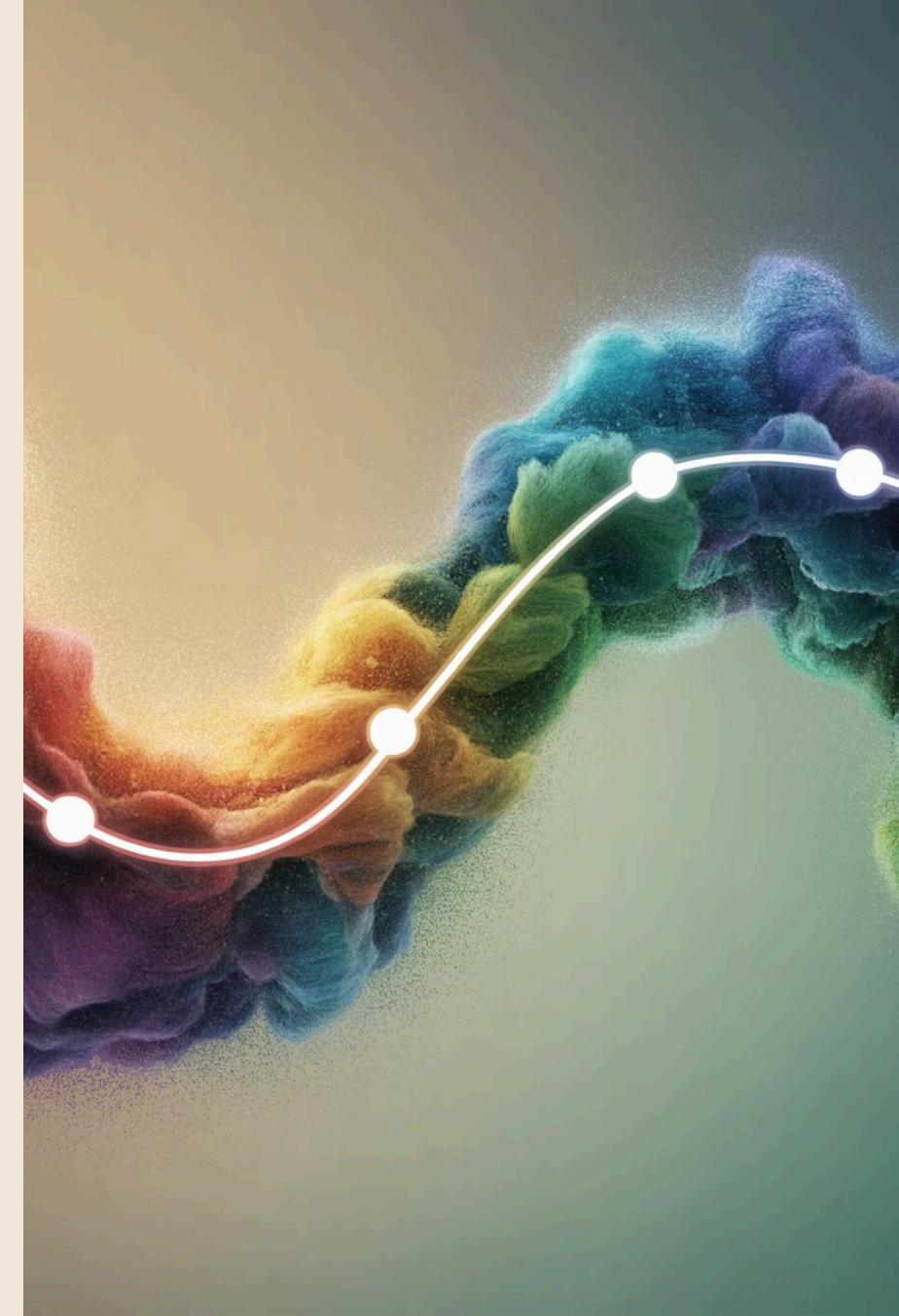
Present evidence, analysis, and solutions. Detail the "what could be."

03

The End (The Resolution)

Conclude with a clear call to action. What should your audience *do*?

Conflict and tension are crucial. The dynamic between "what is" and "what could be" engages your audience.



Conclusions and Next Steps



We Have Explored:

- Bad graphics are everywhere
- The importance of context
- Choosing an effective visual
- Clutter is your enemy
- Focus your audience's attention
- Think like a designer
- How to tell a story with data
- Examples of design

In next lectures, we will look at predictive analysis.

References

- Knafllic, Cole. Storytelling With Data: A Data Visualization Guide for Business Professionals, Wiley, © 2015.