

REPORTING FINDINGS

Designing Tables & Graphs

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**OPEN
MINDS.
GRAB
THE FUTURE.**

Overview

1. Goals & Uses
2. Data & Scales of Measurement
3. Table Design
4. Which Graph to Choose?
5. Graph Design

Goals & Uses

Communicating Data With Tables & Graphs

- Tables are used to display simple relationships between quantitative values and corresponding categorical items, which makes tables ideal for looking up and comparing individual values.
- Graphs are used to display relationships among and between sets of quantitative values by giving them shape.
- Whereas tables encode quantitative values as text, graphs encode quantitative values visually.

Source: Few, 2012: 44-5, 49.

When To Use Tables?

- You should use a Table when:
 - When you have a small number of observations to report (< 20);
 - You want to look up individual values;
 - When you want to compare individual values, but not entire series of values;
 - When you need to show precise values;
 - When the data involves more than one unit of measure;
 - When you want to show both summary and detailed values.

Source: Few, 2012: 44-5.

When To Use Graphs?

- You should use a Graph when:
 - When you have a large number of observations to report on (> 20);
 - When you need to present the overall trend/distribution of the data;
 - When you want to explore the (pattern of) relationship between variables (changes, differences, similarities, and exceptions)

Source: Few, 2012: 44-5.

Data & Scales of Measurement

Data & Scales of Measurement

Type of variable	Examples	Appropriate scale	Description
Quantitative/ numerical continuous	1.3, 5.7, 83, 1.5×10^{-2}	Continuous	Arbitrary numerical values. These can be integers, rational numbers, or real numbers.
Quantitative/ numerical discrete	1, 2, 3, 4	Discrete	Numbers in discrete units. These are most commonly but not necessarily integers. For example, the numbers 0.5, 1.0, 1.5 could also be treated as discrete if intermediate values cannot exist in the given dataset.
Qualitative/ categorical unordered	dog, cat, fish	Discrete	Categories without order. These are discrete and unique categories that have no inherent order. These variables are also called <i>factors</i> .
Qualitative/ categorical ordered	good, fair, poor	Discrete	Categories with order. These are discrete and unique categories with an order. For example, "fair" always lies between "good" and "poor." These variables are also called <i>ordered factors</i> .
Date or time	Jan. 5 2018, 8:03am	Continuous or discrete	Specific days and/or times. Also generic dates, such as July 4 or Dec. 25 (without year).
Text	The quick brown fox jumps over the lazy dog.	None, or discrete	Free-form text. Can be treated as categorical if needed.

- The decision on what form of visualisation to use (table vs. graph), and what type of type of table/graph display the data depends, primarily on the nature of the data and how it is measured (***scale of measurement***).

Table Design

Table Design: Terminology

2011 Travel Expenses						
Plan vs Actual						
		Plan	Actual	Variance		
Division	Dept	U.S. \$	U.S. \$	U.S. \$	%	
G&A	Operations	25,000	27,483	2,483	9.9%	
	IS	80,000	93,744	13,744	17.2%	
	HR	10,000	17,383	7,383	73.8%	
Sales	Field Sales	275,000	250,730	(24,270)	(8.8%)	
	Sales Ops	10,000	8,393	(1,607)	(16.1%)	
Finance	Marketing	25,000	22,304	(2,696)	(10.8%)	
	Accounting	5,000	6,394	1,394	27.9%	
	Corp Finance	20,000	17,384	(2,616)	(13.1%)	
	FP&A	5,000	4,383	(617)	(12.3%)	
Total		\$455,000	\$448,198	(6,802)	(1.5%)	

Source: Few, 2012: 157

Table Design: Key Components

Structural Components of Tables

- **Information Components**
- Support Components
- Data-related elements in the table.
- Typically:
 - Categorical labels;
 - Quantitative values;
 - Complementary text (ex. Titles, Column Headers).

Source: Few, 2012

Table Design: Key Components

Structural Components of Tables

- Information Components
 - **Support Components**
- Non-data elements that highlight or help to organize the data.
 - Typically:
 - Rules and grids;
 - Fill color;
 - White space and/or page breaks.

Source: Few, 2012

Table Design: Structure

By reference to the Direction of the Categories

- **Unidirectional** - Categorical items are laid out in one direction only (i.e., either across columns or down rows)
- Bidirectional: - Categorical items are laid out in both directions

Dept	Expense Type	Expenses
Finance	Compensation	160,383
	Supplies	5,038
	Travel	10,385
Sales	Compensation	683,879
	Supplies	193,378
	Travel	125,705
Total		\$1,178,768

Source: Few, 2012: 53-60.

Table Design: Structure

By reference to the Direction of the Categories

- Unidirectional - Categorical items are laid out in one direction only (i.e., either across columns or down rows)
- **Bidirectional:** – Categorical items are laid out in both directions

Expense Type by Dept	Finance	Sales	Total
Compensation	160,383	683,879	844,262
Supplies	5,038	193,378	198,416
Travel	10,385	125,705	136,090
Total	\$175,806	\$1,002,962	\$1,178,768

Source: Few, 2012: 53-60.

Table Design: Structure

Primary Function	Relationship Type	Relationship
Look-up	Quantitative-to-Categorical	Between a single set of quantitative values and a single set of categorical items
		Between a single set of quantitative values and the intersection of multiple categories
		Between a single set of quantitative values and the intersection of multiple hierarchical categories
Comparison	Quantitative-to-Quantitative	Among a single set of quantitative values associated with multiple categorical items
		Among distinct sets of quantitative values associated with a single categorical item

- In addition to thinking of how categorical variables are going to be laid out, you might should also try to consider what is the type of relation you are trying to illustrate.

Table Design: Structure

Table Designs

- **Quantitative-to-Categorical Relationships;**
- Quantitative-to-Quantitative Relationships.

Relationship	Structural Type	
	Unidirectional	Bidirectional
Between a single set of quantitative values and a single set of categorical items	Yes	Not applicable because there is only one set of categorical items
Between a single set of quantitative values and the intersection of multiple categories	Yes. Sometimes this structure is preferable because of convention.	Yes. This structure saves space.
Between a single set of quantitative values and the intersection of multiple hierarchical categories	Yes. This structure can clearly display the hierarchical relationship by placing the separate levels of the hierarchy side by side in adjacent columns.	Yes. However, this structure does not display the hierarchy as clearly if its separate levels are split between the columns and rows.

Source: Few, 2012: 53-60.

Table Design: Structure

Table Designs

- Quantitative-to-Categorical Relationships;
- **Quantitative-to-Quantitative Relationships.**

Relationship	Structural Type	
	Unidirectional	Bidirectional
Among a single set of quantitative values associated with multiple categorical items	Yes	Yes. This structure works especially well because the quantitative values are arranged closely together for easy comparison.
Among distinct sets of quantitative values associated with a single categorical item	Yes	Yes. However, this structure tends to get messy as you add multiple sets of quantitative values.

Source: Few, 2012: 53-60.

Table Design: Best Practices

Things to Look Out For

- **Number Format**
 - Date Format
 - Choice of Font
 - Formatting Text
 - Column Sequence
 - Rules & Grids
- Place a comma (or a space for European readers) to the left of every three whole-number digits (e.g., 1,393,033);
 - Truncate numbers by sets of three digits to the nearest thousand, million, billion. Declare that you've done so in the title or header;

Source: Few, 2012

Table Design: Best Practices

Things to Look Out For

- **Number Format**
 - Date Format
 - Choice of Font
 - Formatting Text
 - Column Sequence
 - Rules & Grids
- Round decimal numbers to the minimum level of precision necessary (ideally, maximum 2 decimal numbers).

Source: Few, 2012

Table Design: Best Practices

Things to Look Out For

- Number Format
 - **Date Format**
 - Choice of Font
 - Formatting Text
 - Column Sequence
 - Rules & Grids
- **Year:** As two-digit number - e.g., 22 rather than 2022.
 - **Month:**
 - As two-digit number - e.g., 02 rather than 2 for February;
 - As three-character word - e.g., Feb rather than February.
 - **Day:** As two-digit number- e.g., 01 rather than 1.

Source: Few, 2012: 174

Table Design: Best Practices

Things to Look Out For

- Number Format
 - **Date Format**
 - Choice of Font
 - Formatting Text
 - Column Sequence
 - Rules & Grids
- Use a format that excludes portions of the date that provide more precision than necessary (e.g.: exclude day/month if not necessary).

Source: Few, 2012: 174

Table Design: Best Practices

Things to Look Out For

- Number Format
- Date Format
- **Choice of Font**
- Formatting Text
- Column Sequence
- Rules & Grids

Fine Legibility		Poor Legibility	
Serif	Sans-Serif	Serif	Sans-Serif
Times New Roman	Arial	Academy Engraved	Poplar Std Black
Palatino	Verdana	<i>Script</i>	SYNCHRO LET
Georgia	Helvetica	Playbill	SILOM

- Select a font that is legible, and use the same font throughout the table.
- Boldface, italicize, or change the color of fonts when useful to group or highlight.

Source: Few, 2012: 177.

Table Design: Best Practices

Things to Look Out For

- Number Format
- Date Format
- Choice of Font
- **Formatting Text**
- Column Sequence
- Rules & Grids

Sales	Sales	Sales
93,883.39	93,883.39	93,883.39
5,693,762.32	5,693,762.32	5,693,762.32
483.84	483.84	483.84
674,663.39	674,663.39	674,663.39
548.93	548.93	548.93
3,847.33	3,847.33	3,847.33
\$6,467,189.20	\$6,467,189.20	\$6,467,189.20

- Align numbers to the right, keeping the decimal points aligned as well.

Source: Few, 2012: 171-3.

Table Design: Best Practices

Things to Look Out For

- Number Format
- Date Format
- Choice of Font
- **Formatting Text**
- Column Sequence
- Rules & Grids

Product Code	Product Name	Product Code	Product Name	Product Code	Product Name
A1838	2-Door Sport	A1838	2-Door Sport	A1838	2-Door Sport
A89	4-Door Sport	A89	4-Door Sport	A89	4-Door Sport
J98488	2-Door Luxury	J98488	2-Door Luxury	J98488	2-Door Luxury
J3883	4-Door Luxury	J3883	4-Door Luxury	J3883	4-Door Luxury
K9288	2-Door Truck	K9288	2-Door Truck	K9288	2-Door Truck
K38733	4-Door Truck	K38733	4-Door Truck	K38733	4-Door Truck

- Text that expresses neither numbers nor dates works best when aligned to the left because we read from left to right.

Source: Few, 2012: 171-3.

Table Design: Best Practices

Things to Look Out For

- Number Format
- Date Format
- Choice of Font
- **Formatting Text**
- Column Sequence
- Rules & Grids

Product Code	Product Name	Product Code	Product Name	Product Code	Product Name
A1838	2-Door Sport	A1838	2-Door Sport	A1838	2-Door Sport
A89	4-Door Sport	A89	4-Door Sport	A89	4-Door Sport
J98488	2-Door Luxury	J98488	2-Door Luxury	J98488	2-Door Luxury
J3883	4-Door Luxury	J3883	4-Door Luxury	J3883	4-Door Luxury
K9288	2-Door Truck	K9288	2-Door Truck	K9288	2-Door Truck
K38733	4-Door Truck	K38733	4-Door Truck	K38733	4-Door Truck

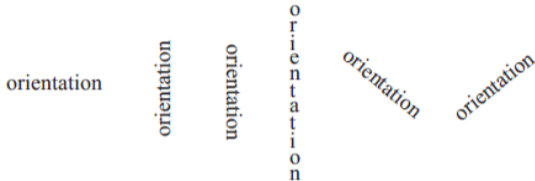
- Align to the center only when it helps to create space between columns and does not hamper readability.

Source: Few, 2012: 171-3.

Table Design: Best Practices

Things to Look Out For

- Number Format
- Date Format
- Choice of Font
- **Formatting Text**
- Column Sequence
- Rules & Grids



- Unlike in graphs, avoid other forms orientation other than horizontal (from left to right).

Source: Few, 2012: 178.

Table Design: Best Practices

Things to Look Out For

- Number Format
- Date Format
- Choice of Font
- Formatting Text
- **Column Sequence**
- Rules & Grids

Product	Units Sold	Last Year's Revenue	This Year's Revenue	Fcst Revenue	Planned Revenue
Product A	938	159,497	187,600	175,000	160,000
Product B	1,093	123,007	114,765	130,000	125,000
Product C	3,882	45,384	62,112	53,000	50,000
Product D	873	41,003	36,666	38,000	40,000
Product E	72	2,485	2,088	4,000	5,000
Total	6,858	\$371,376	\$403,231	\$400,000	\$380,000

- Columns containing sets of quantitative values that you want your readers to easily compare should be placed as close to one another as possible.

Source: Few, 2012: 168-70.

Table Design: Best Practices

Things to Look Out For

- Number Format
- Date Format
- Choice of Font
- Formatting Text
- Column Sequence
- **Rules & Grids**

Product	Jan	Feb	Mar	Apr	May	Jun
Product 01	93,993	84,773	88,833	95,838	93,874	83,994
Product 02	87,413	78,839	82,615	89,129	87,303	78,114
Product 03	90,036	81,204	85,093	91,803	89,922	80,458
Product 04	92,737	83,640	87,646	94,557	92,620	82,872
Product 05	83,733	75,520	79,137	85,377	83,627	74,826
Total	447,913	403,976	423,323	456,705	447,346	400,264

- Avoid the delineation of columns and rows is the at the same time;
- Avoid using a boundary around the table.

Source: Few, 2012: 160-2.

Table Design: Best Practices

Things to Look Out For

- Number Format
- Date Format
- Choice of Font
- Formatting Text
- Column Sequence
- **Rules & Grids**

Product	Jan	Feb	Mar	Apr	May	Jun	Total
Product 01	93,993	84,773	88,833	95,838	93,874	83,994	541,305
Product 02	87,413	78,839	82,615	89,129	87,303	78,114	503,414
Product 03	90,036	81,204	85,093	91,803	89,922	80,458	518,516
Product 04	92,737	83,640	87,646	94,557	92,620	82,872	534,072
Product 05	83,733	75,520	79,137	85,377	83,627	74,826	482,220
Total	447,913	403,976	423,323	456,705	447,346	400,264	2,579,526

- Be parsimonious with the use of rules, and only when it helps to highlight particular data.

Source: Few, 2012: 160–2.

Which Graph to Choose?

Which Graph to Choose?

By Reference to the Type of Data

- Amounts;
- Proportions;
- Distributions;
- Geospatial Data;

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Data

- **Amounts;**
- Proportions;
- Distributions;
- Geospatial Data;



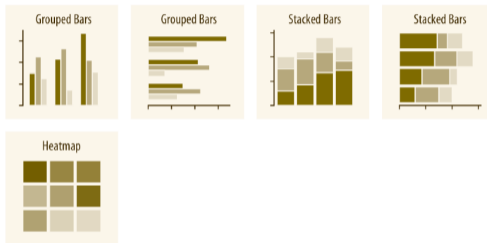
- When using data from a single variable/category.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Data

- **Amounts;**
- Proportions;
- Distributions;
- Geospatial Data;



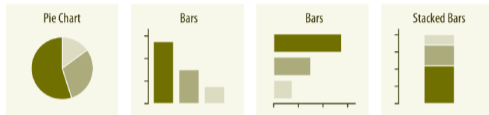
- If there are two or more sets of categories.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Data

- Amounts;
- **Proportions;**
- Distributions;
- Geospatial Data;



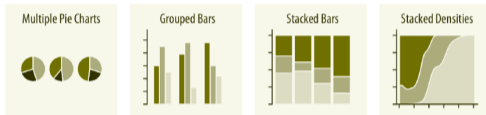
- When looking at data from a single variable.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Data

- Amounts;
- **Proportions;**
- Distributions;
- Geospatial Data;



- When comparing multiple sets of proportions;
- When visualizing multiple sets of proportions or changes in proportions across conditions.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Data

- Amounts;
- **Proportions;**
- Distributions;
- Geospatial Data;



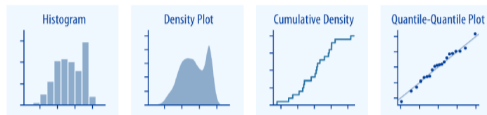
- When proportions are specified according to multiple grouping variables.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Data

- Amounts;
- Proportions;
- **Distributions;**
- Geospatial Data;



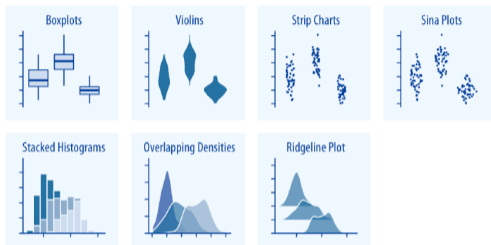
- Histograms and density plots provide the most intuitive visualizations of a distribution, but require arbitrary parameter choices and can be misleading.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Data

- Amounts;
- Proportions;
- **Distributions;**
- Geospatial Data;



- Useful when we want to visualize many distributions at once and/or if we are primarily interested in overall shifts among the distributions.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Data

- Amounts;
- Proportions;
- Distributions;
- **Geospatial Data;**



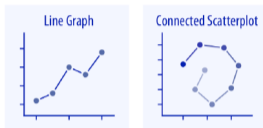
- Help to visualise cross-country comparisons;
- In some cases, it may be helpful to distort the different regions according to some other quantity (e.g., population number) or simplify each region into a square.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Pattern/
Relationship

- **Change Over Time;**
- X-Y Relationships.



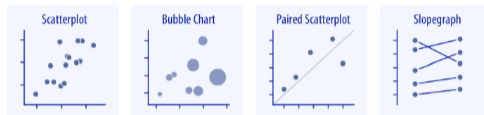
- When the x axis represents time / temporal sequence.

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Pattern/
Relationship

- Change Over Time;
- **X-Y Relationships.**



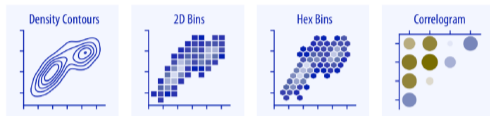
- Use when comparing continuous data (and or paired-data.).

Source: Wilke, 2019: 37-44.

Which Graph to Choose?

By Reference to the Type of Pattern/
Relationship

- Change Over Time;
- **X-Y Relationships.**

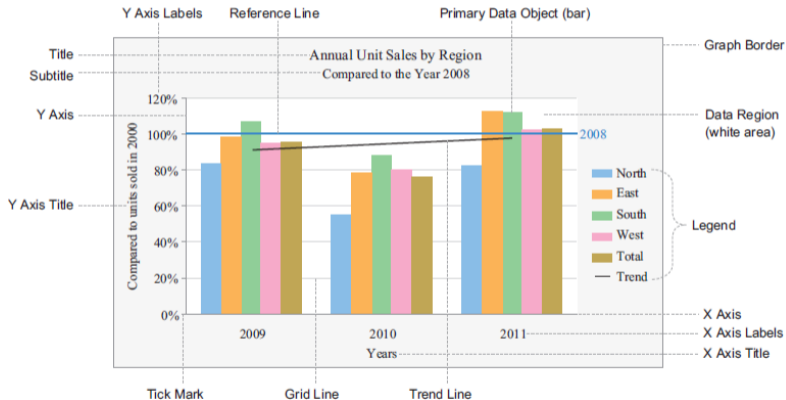


- For large numbers of points, regular scatterplots can become uninformative due to overplotting. Use these alternatives instead.

Source: Wilke, 2019: 37-44.

Graph Design

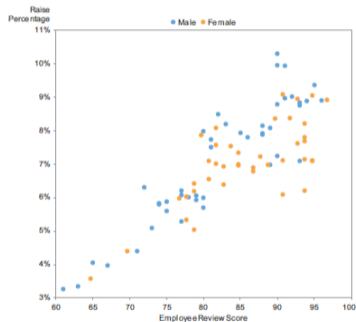
Graph Design: Terminology



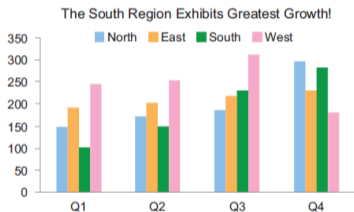
Source: Few, 2012: 205

Graph Design: Best Practices

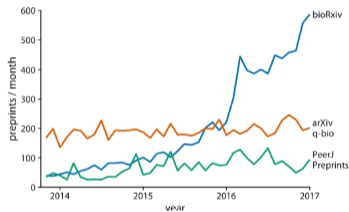
Dot/Point Graphs



Bar Graphs



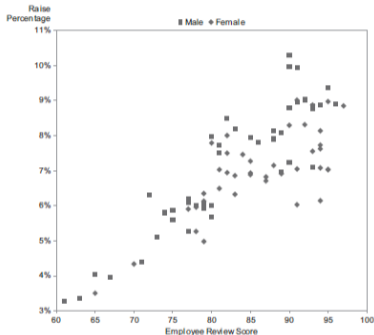
Line Graphs



Graph Design: Best Practices

Points/Dots Graphs

- **Keep points easy to perceive**
- Avoid Over-Plotting (overlapping points)

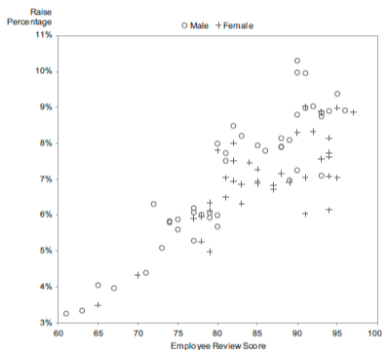


Source: Few, 2012: 178.

Graph Design: Best Practices

Points/Dots Graphs

- **Keep points easy to perceive**
- Avoid Over-Plotting (overlapping points)



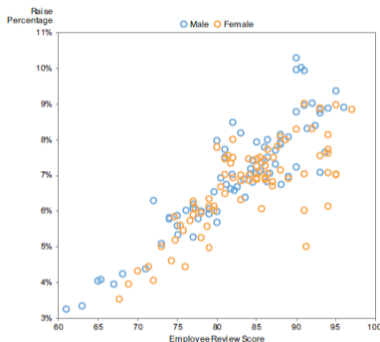
- Use easy to read symbols: ○ □ △ + ×

Source: Few, 2012: 178.

Graph Design: Best Practices

Points/Dots Graphs

- Keep points easy to perceive
- **Avoid Over-Plotting (overlapping points)**



- Use shapes that reduce the problem of overlapping points.

Graph Design: Best Practices

Bar Graphs

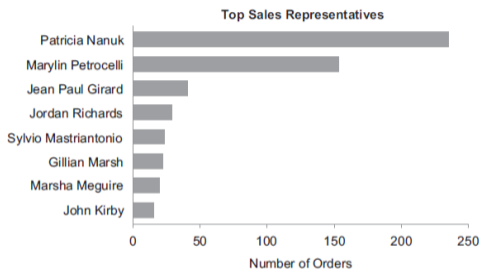
- Orientation
- Proximity
- Colour Fills
- Borders
- Base value

Source: Few, 2012: 178.

Graph Design: Best Practices

Bar Graphs

- **Orientation**
- Proximity
- Colour Fills
- Borders
- Base value



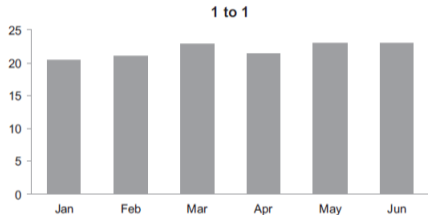
- Use horizontal bars if difficult to get categorical labels to fit side by side under vertical bars.

Source: Few, 2012: 178.

Graph Design: Best Practices

Bar Graphs

- Orientation
- **Proximity**
- Colour Fills
- Borders
- Base value



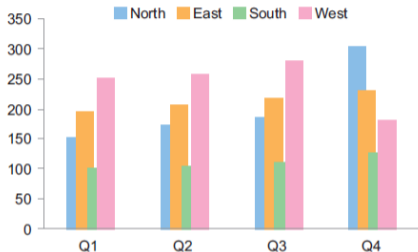
- Keep a balance between the width of the bars and the white space that separates them.
- 1:1 ratio as ideal. Or something between 1:1.5 to 1:0.5.

Source: Few, 2012: 178.

Graph Design: Best Practices

Bar Graphs

- Orientation
- **Proximity**
- Colour Fills
- Borders
- Base value



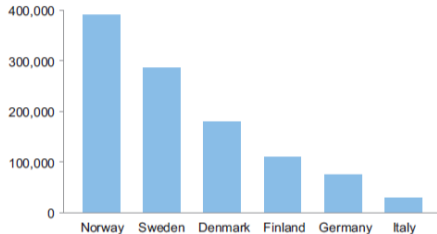
- Avoid overlapping bars, as in most cases they reduce the clarity of the graph.

Source: Few, 2012: 178.

Graph Design: Best Practices

Bar Graphs

- Orientation
- Proximity
- **Colour Fills**
- Borders
- Base value



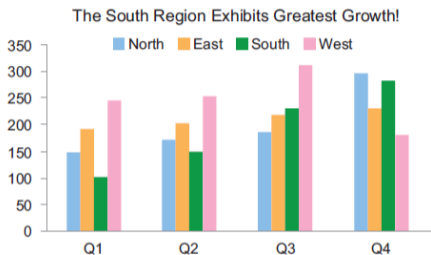
- Use only one fill colour per set of related values.

Source: Few, 2012: 178.

Graph Design: Best Practices

Bar Graphs

- Orientation
- Proximity
- **Colour Fills**
- Borders
- Base value



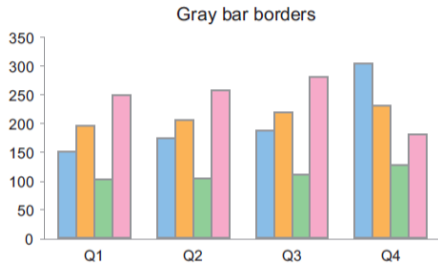
- Use fairly balanced colours for data sets that are equal in importance.
- Use more intense colours when you wish to highlight particular values.

Source: Few, 2012: 178.

Graph Design: Best Practices

Bar Graphs

- Orientation
- Proximity
- Colour Fills
- **Borders**
- Base value

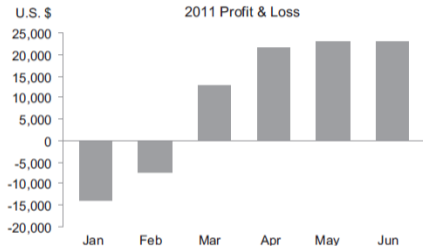


- Borders add a visual component without adding information.
- Use only make bars stand out against the background.
- Use subtle colours (gray or white)

Graph Design: Best Practices

Bar Graphs

- Orientation
- Proximity
- Colour Fills
- Borders
- **Base value**



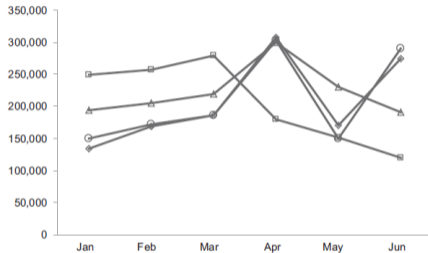
- The axis upon which the bars rest does not necessarily need to intersect the other axis at its lowest value.

Source: Few, 2012: 178.

Graph Design: Best Practices

Line Graphs

- **Distinguishing Lines**
- Reference Lines



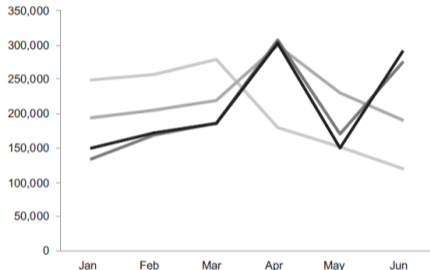
- Lines that look too much alike are hard to trace as they cross one another.

Source: Few, 2012: 217-20.

Graph Design: Best Practices

Line Graphs

- **Distinguishing Lines**
- Reference Lines



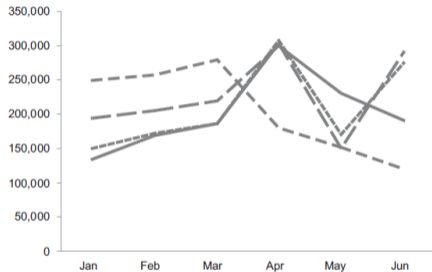
- If colour printing is not available, try variations in the colour intensity.

Source: Few, 2012: 217-20.

Graph Design: Best Practices

Line Graphs

- **Distinguishing Lines**
- Reference Lines



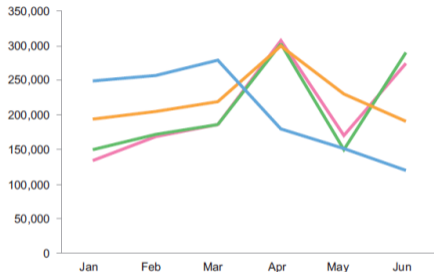
- If colour printing is not available, try variations in the line style.

Source: Few, 2012: 217-20.

Graph Design: Best Practices

Line Graphs

- **Distinguishing Lines**
- Reference Lines



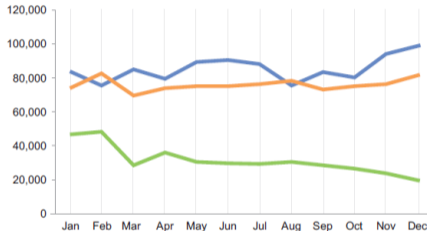
- Still, using different colours is the best form of differentiating the lines in a graph.

Source: Few, 2012: 217-20.

Graph Design: Best Practices

Line Graphs

- **Distinguishing Lines**
- Reference Lines



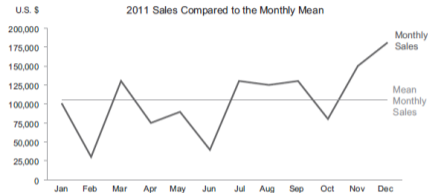
- If you need to highlight data points in the lines, consider using 'points' or vertical grid-lines.

Source: Few, 2012: 217-20.

Graph Design: Best Practices

Line Graphs

- Distinguishing Lines
- **Reference Lines**



- Reference lines provide useful context for interpreting the data:
 - A measure of the norm (central tendency);

Source: Few, 2012: 217-20.

Graph Design: Best Practices

Line Graphs

- Distinguishing Lines
- **Reference Lines**



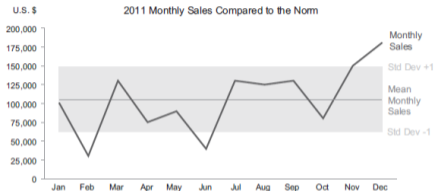
- Reference lines provide useful context for interpreting the data:
 - A measure of the 'normal' boundaries (max/min, percentiles, standard deviations);

Source: Few, 2012: 228-9.

Graph Design: Best Practices

Line Graphs

- Distinguishing Lines
- **Reference Lines**



- Using a coloured area can improve readability.

Source: Few, 2012: 228-9.

Task: 7



- **WHO:** Individual.
- **WHAT:** Graph / Table / Datapoint that summarises the gap/problem you are trying to explore in your MFW.
- **WHERE:** Ms Teams.
- **SUBMISSION:** 28th of April, 23:59.



Amílcar Moreira

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University of Lisbon

May 23, 2025