



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

200
1822 - 2022

Data Visualization Tips For More Effective And Engaging Design

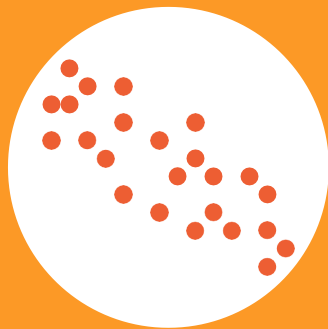
*Man Geni Addysg Uwch yng Nghymru
Where Higher Education Began in Wales*

www.uwtsd.ac.uk

1. FINDING THE STORY IN YOUR DATA

- Knowing story and their relationship will help select the proper visualization to best deliver your message.
- When analyzing data, search for patterns or interesting insights that can be a good starting place for finding your story, such as:

TRENDS

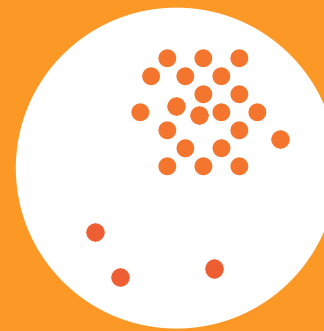


Example:
Ice cream sales over time

CORRELATIONS OUTLIERS



Example:
Ice cream sales vs.
temperature



Example:
Ice cream sales in an
unusual region

Ask yourself these questions:

- Who is my audience?
- What questions do they have?
- What answers am I finding for them?
- What am I trying to say?
- What other questions will my visualization inspire or what conversations may result?

KNOW YOUR DATA

Before understanding visualizations, you must understand the types of data that can be visualized and their relationships to each other. Here are some of the most common you are likely to encounter.

DATA TYPES



QUANTITATIVE

Data that can be counted or measured; all values are numerical.



DISCRETE

Numerical data that has a finite number of possible values. Example: Number of employees in the office.



CONTINUOUS

Data that is measured and has a value within a range. Example: Rainfall in a year.

3



CATEGORICAL

Data that can be sorted according to group or category. Example: Types of products sold.

2. Choose the right charts and graphs

- Bar charts are effective at comparing categories within a single measure.
- Effective when you have data that can be split into multiple categories.
- The line graph connects several distinct data points, presenting them as one continuous evolution.
- Histograms and box plots show where your data is clustered and can compare categories.
- Maps are a no brainer for visualizing location-specific questions or aiding geographical exploration.
- Pie charts are powerful for adding detail to other visualizations

3. Use predictable patterns for layouts

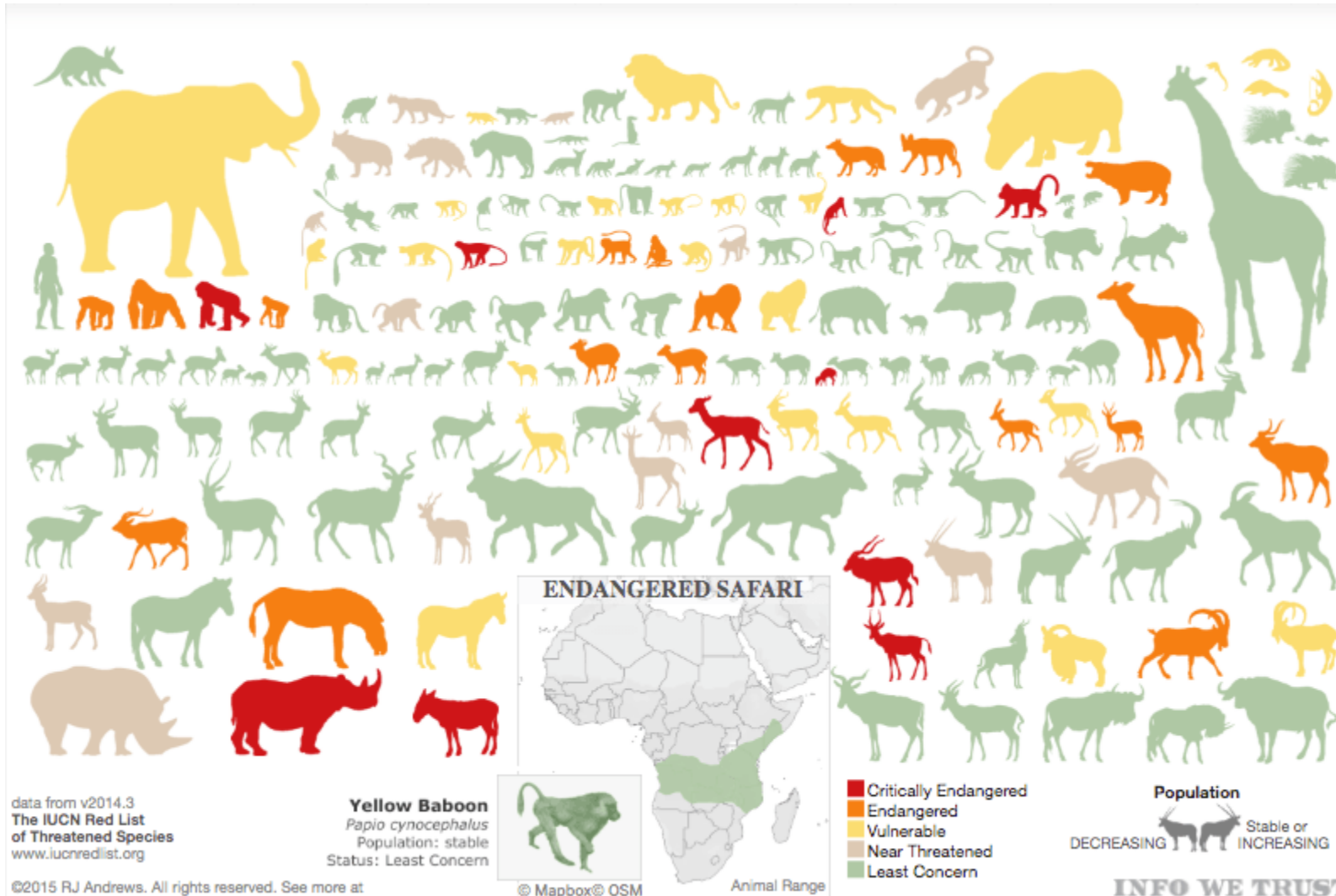
- Avoid random patterns as it don't make sense.
- The order or format(numeric, alphabetical, or sequential)- in which you present data makes sense to viewers.
- Example:

 If you are communicating in a language that reads left to right, then orient your visualization to adhere to that convention.

4. Tell data stories quickly with clear color cues

- Color is important—conveys so much without using words.
- Too many colors will create a harsh discordant sound,
- single color or too many shades of one color can cause the data to blend.
- Use intuitive colors that make sense to the viewer.
- Example:
 - Temperatures, use red to indicate heat and blue for cold

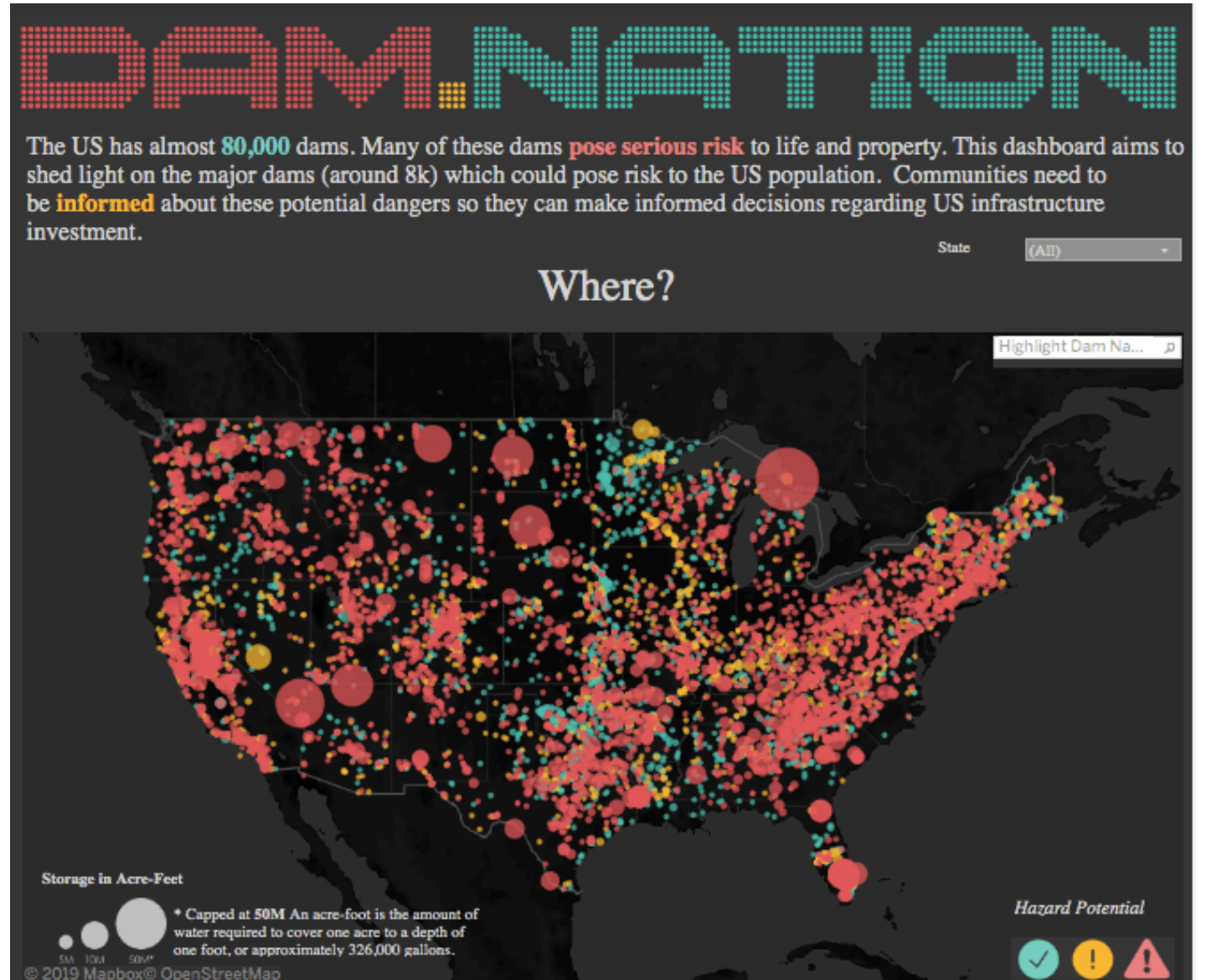
5. Incorporate contextual clues with shapes and designs



This chart on endangered species in Africa tells us at a quick glance what animals are endangered and how vulnerable they are.

6. Strategically use size to visualize values

- Size can help emphasize impressive information and add contextual clues.
- size can also denote scaled values.
- shape size can adjust based on data values.
- Using size to indicate values works well with maps.



7. Apply text carefully and intentionally

- choice of text can improve your visualization.
- When using text, make sure it points out important details.

Guidelines to help your visualizations from good to great:

- Place the most important view at the top, or in the upper left corner.
- Limit the number of views in your visualization to three or four.
- Group multiple filters together. A light border around them gives a subtle visual cue that they have shared features.

10 DATA DESIGN DOS AND DON'TS

Designing your data doesn't have to be overwhelming. With a basic understanding of how different data sets should be visualized, along with a few fundamental design tips and best practices, you can create more accurate, more effective data visualizations. Follow these 10 tips to ensure your design does your data justice.



1 | DO USE ONE COLOR TO REPRESENT EACH CATEGORY.



2 | DO ORDER DATA SETS USING LOGICAL HEIRARCHY.



3 | DO USE CALLOUTS TO HIGHLIGHT IMPORTANT OR INTERESTING INFORMATION.



4 | DO VISUALIZE DATA IN A WAY THAT IS EASY FOR READERS TO COMPARE VALUES.



5 | DO USE ICONS TO ENHANCE COMPREHENSION AND REDUCE UNNECESSARY LABELING.



6 | DON'T USE HIGH CONTRAST COLOR COMBINATIONS SUCH AS RED/GREEN OR BLUE/YELLOW.



7 | DON'T USE 3D CHARTS. THEY CAN SKEW PERCEPTION OF THE VISUALIZATION.



8 | DON'T ADD CHART JUNK. UNNECESSARY ILLUSTRATIONS, DROP SHADOWS, OR ORNAMENTATIONS DISTRACT FROM THE DATA.



9 | DON'T USE MORE THAN 6 COLORS IN A SINGLE LAYOUT.



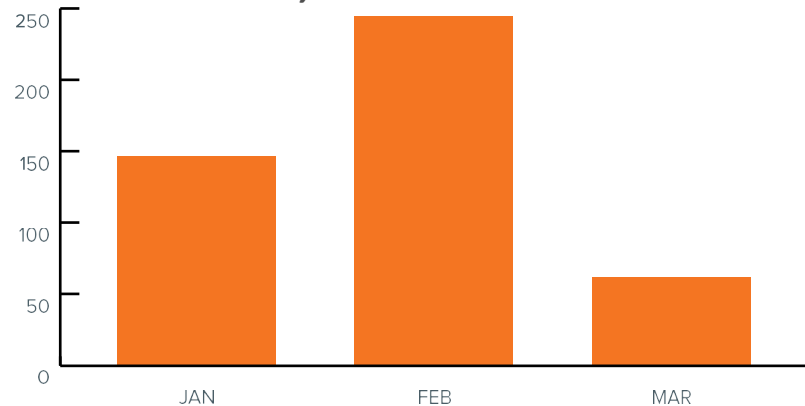
10 | DON'T USE DISTRACTING FONTS OR ELEMENTS (SUCH AS BOLD, ITALIC, OR UNDERLINED TEXT).

BAR CHART

Bar charts are very versatile. They are best used to show change over time, compare different categories, or compare parts of a whole.

VARIATIONS OF BAR CHARTS

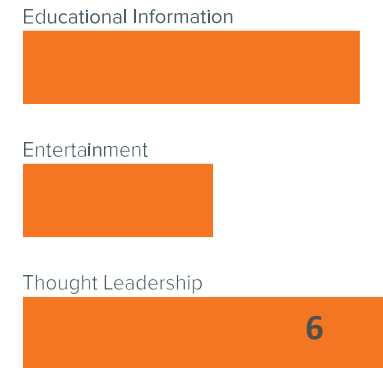
PAGE VIEWS, BY MONTH



VERTICAL (COLUMN CHART)

Best used for chronological data (time-series should always run left to right), or when visualizing negative values below the x-axis.

CONTENT PUBLISHED, BY CATEGORY



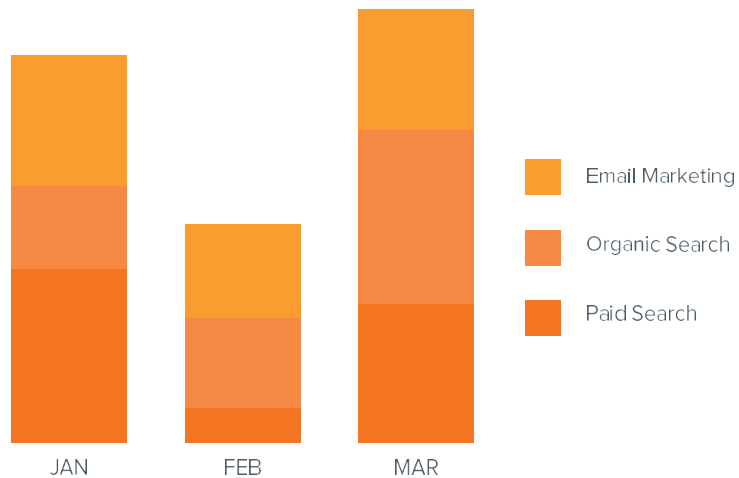
HORIZONTAL

Best used for data with long category labels.

BAR CHART

VARIATIONS OF BAR CHARTS (CONT.)

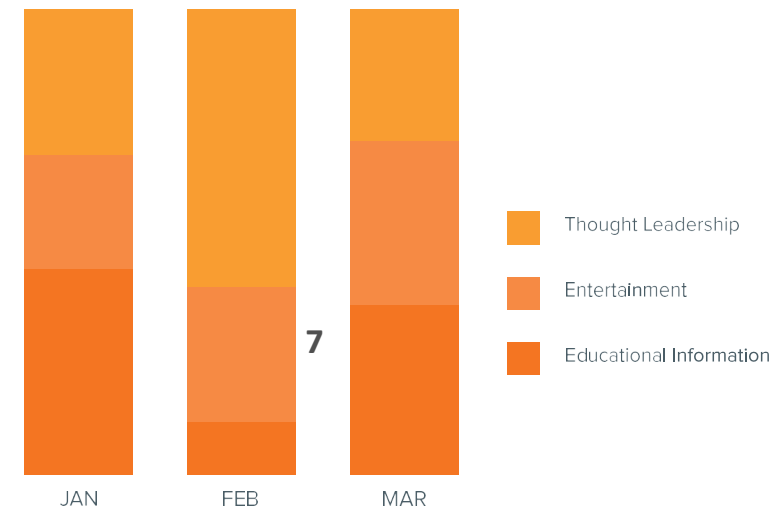
MONTHLY TRAFFIC, BY SOURCE



STACKED

Best used when there is a need to compare multiple part-to-whole relationships. These can use discrete or continuous data, oriented either vertically or horizontally.

PERCENTAGE OF CONTENT PUBLISHED, BY MONTH

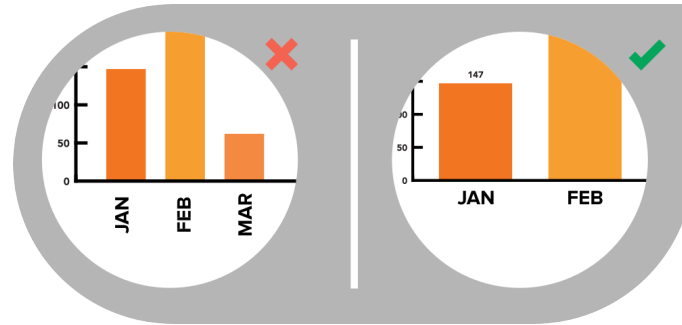


100% STACKED

Best used when the total value of each category is unimportant and percentage distribution of subcategories is the primary message.

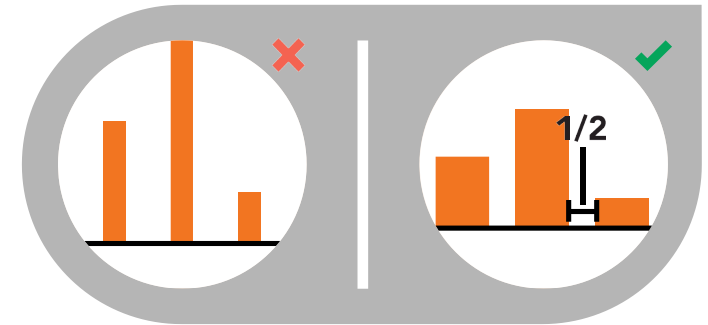
BAR CHART

DESIGN BEST PRACTICES



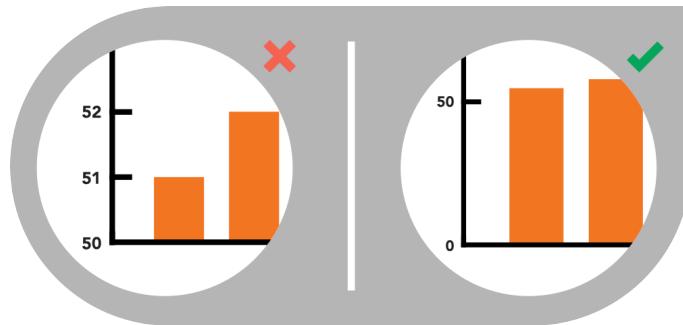
USE HORIZONTAL LABELS

Avoid steep diagonal or vertical type, as it can be difficult to read.



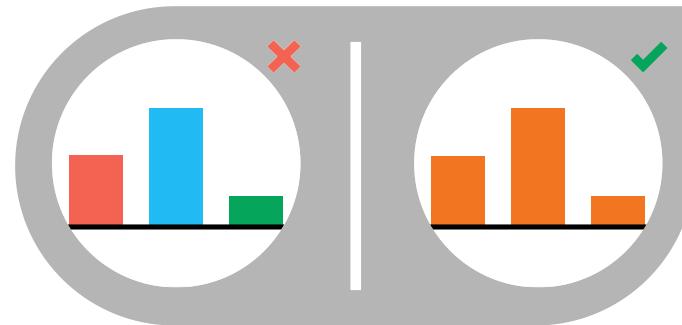
SPACE BARS APPROPRIATELY

Space between bars should be $\frac{1}{2}$ bar width.



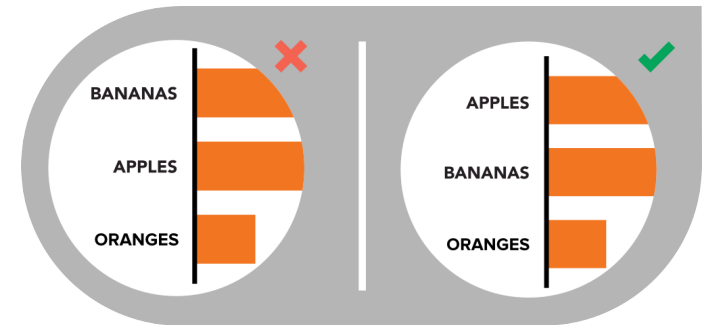
START THE Y-AXIS VALUE AT 0

Starting at a value above zero truncates the bars and doesn't accurately reflect the full value.



USE CONSISTENT COLORS

Use one color for bar charts. You may use an accent color to highlight a significant data point.



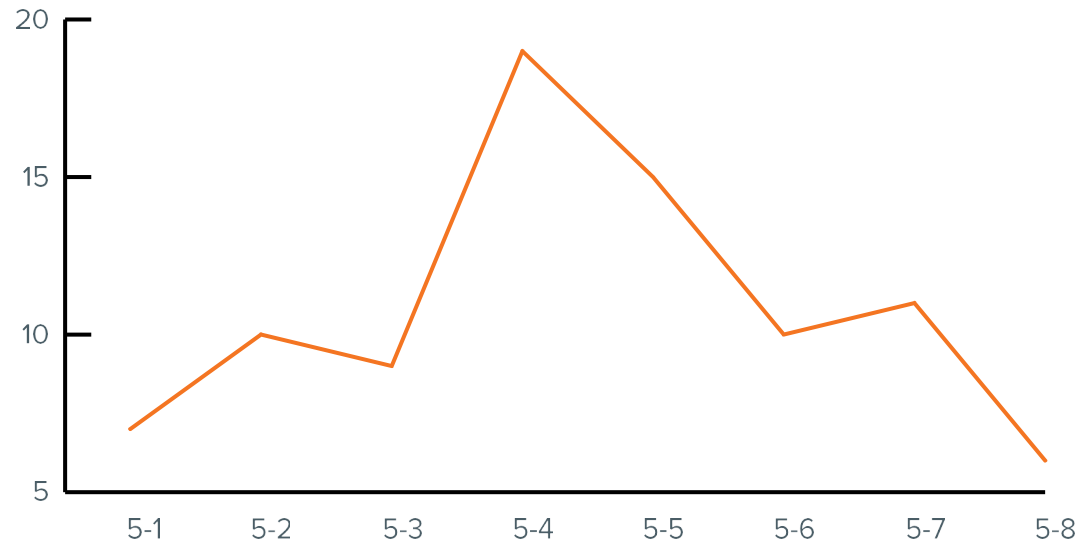
ORDER DATA APPROPRIATELY

Order categories alphabetically, sequentially, or by value.

LINE CHART

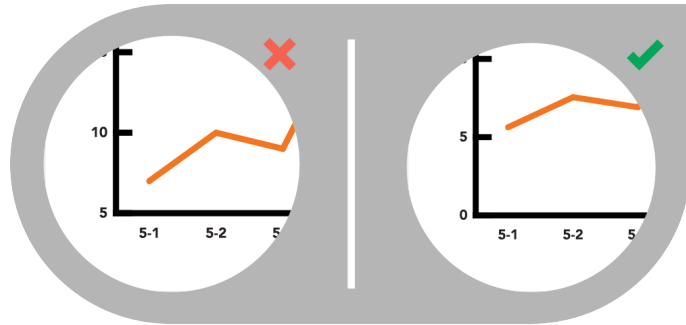
Line charts are used to show time-series relationships with continuous data. They help show trend, acceleration, deceleration, and volatility.

DIRECT MARKETING VIEWS, BY DATE



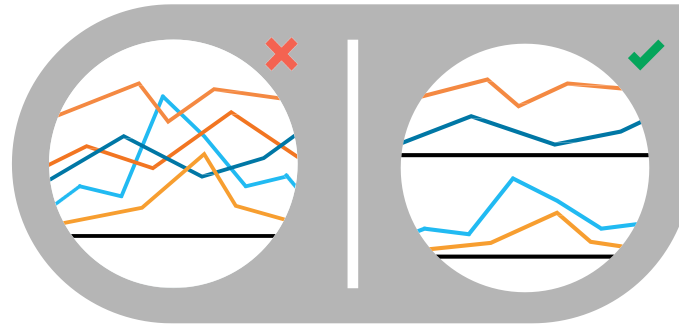
LINE CHART

DESIGN BEST PRACTICES



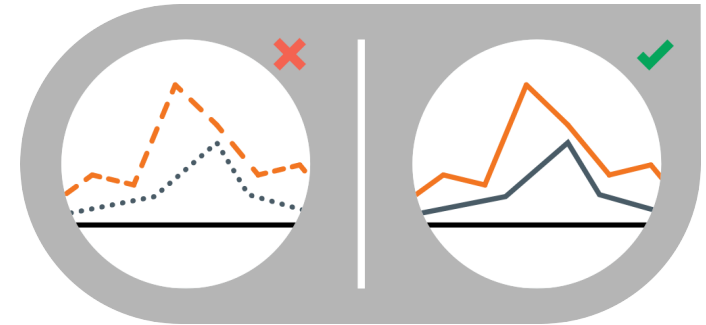
INCLUDE A ZERO BASELINE IF POSSIBLE

Although a line chart does not have to start at a zero baseline, it should be included if possible. If relatively small fluctuations in data are meaningful (e.g., in stock market data), you may truncate the scale to showcase these variances.



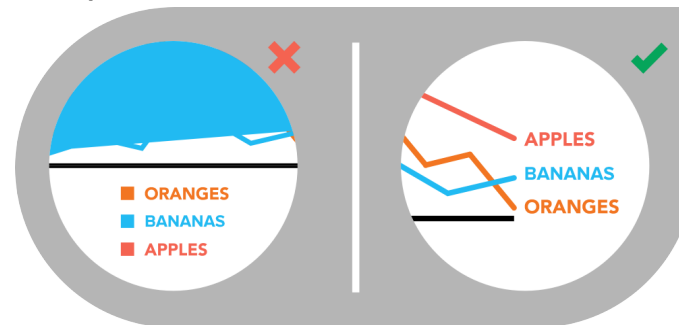
DON'T PLOT MORE THAN 4 LINES

If you need to display more, break them out into separate charts for better comparison.



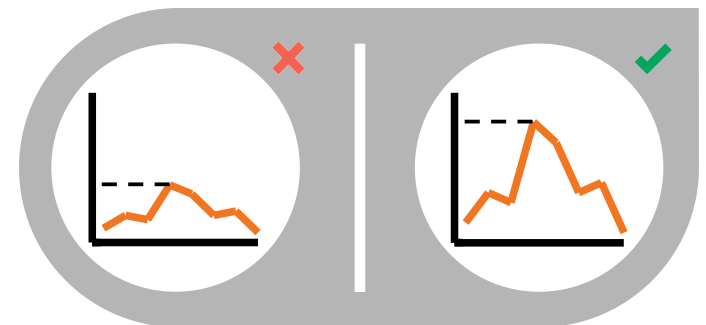
USE SOLID LINES ONLY

Dashed and dotted lines can be distracting.



LABEL THE LINES DIRECTLY

This lets readers quickly identify lines and corresponding labels instead of referencing a legend.

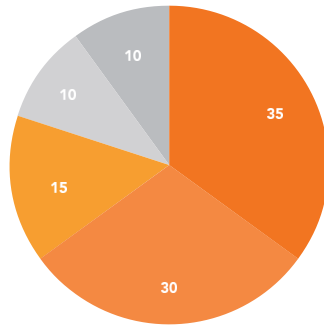


USE THE RIGHT HEIGHT

Plot all data points so that the line chart takes up approximately two-thirds of the y-axis' total scale.

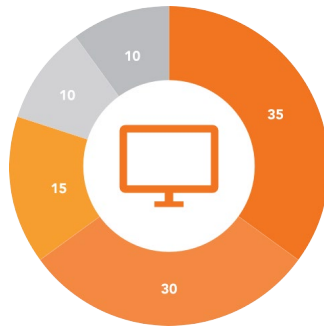
PIE CHART

VARIATIONS OF PIE CHARTS



STANDARD

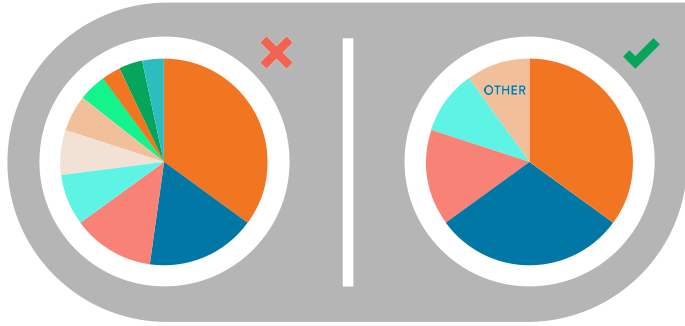
Used to show part-to-whole relationships.



DONUT

Stylistic variation that enables the inclusion of a total value or design element in the center.

Pie charts are best used for making part-to-whole comparisons with discrete or continuous data. They are most impactful with a small data set.



VISUALIZE NO MORE THAN 5 CATEGORIES PER CHART

It is difficult to differentiate between small values; depicting too many slices decreases the impact of the visualization. If needed, you can group smaller values into an “other” or “miscellaneous” category, but make sure it does not hide interesting or significant information.

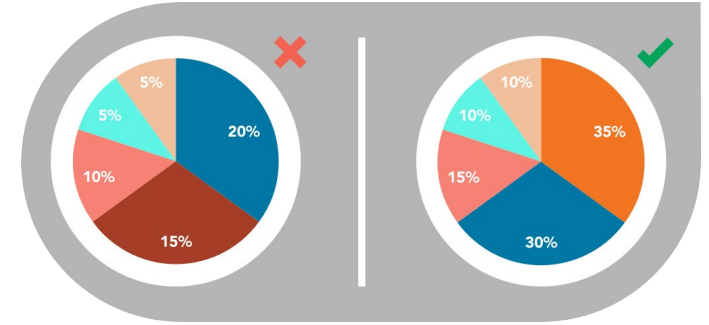
PIE CHART

DESIGN BEST PRACTICES



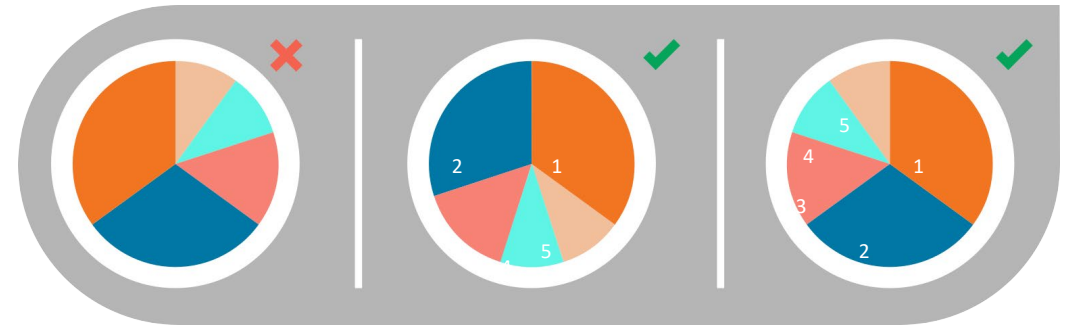
DON'T USE MULTIPLE PIE CHARTS FOR COMPARISON

Slice sizes are very difficult to compare side-by-side. Use a stacked bar chart instead.



MAKE SURE ALL DATA ADDS UP TO 100%

Verify that values total 100% and that pie slices are sized proportionate to their corresponding value.



ORDER SLICES CORRECTLY

There are two ways to order sections, both of which are meant to aid comprehension:

OPTION 1

Place the largest section at 12 o'clock, going clockwise. Place the second largest section at 12 o'clock, going counterclockwise. The remaining sections can be placed below, continuing

OPTION 2

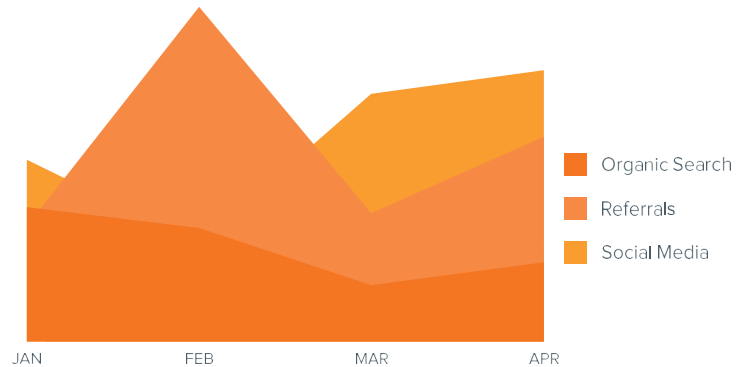
Start the largest section at 12 o'clock, going clockwise. Place remaining sections in descending order

AREA CHART

Area charts depict a time-series relationship, but they are different than line charts in that they can represent volume.

VARIATIONS OF AREA CHARTS

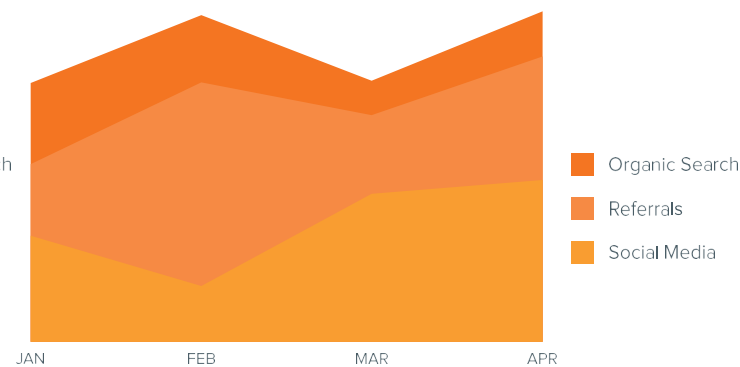
NEW CONTACTS, BY SOURCE



AREA CHART

Best used to show or compare a quantitative progression over time.

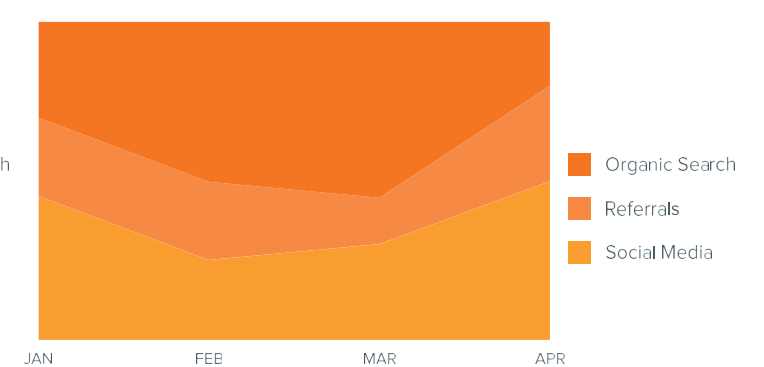
NEW CONTACTS, BY SOURCE



STACKED AREA

Best used to visualize part-to-whole relationships, helping show how each category contributes to the cumulative total.

NEW CONTACTS, BY SOURCE



100% STACKED AREA

Best used to show distribution of categories as part of a whole, where the cumulative total is unimportant.

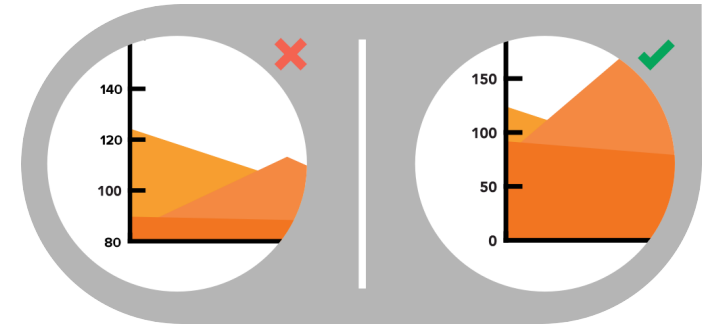
AREA CHART

DESIGN BEST PRACTICES



MAKE IT EASY TO READ

In stacked area charts, arrange data to position categories with highly variable data on the top of the chart and low variability on the bottom.



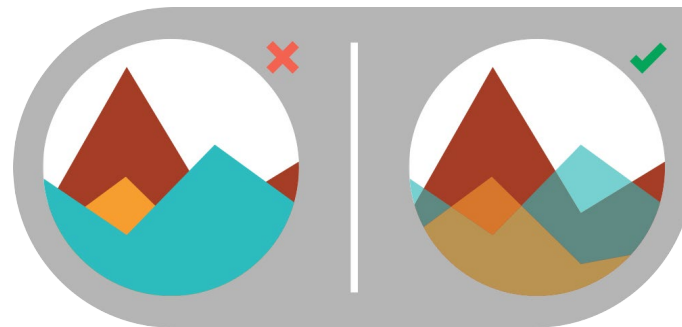
START Y-AXIS VALUE AT 0

Starting the axis above zero truncates the visualization of values.



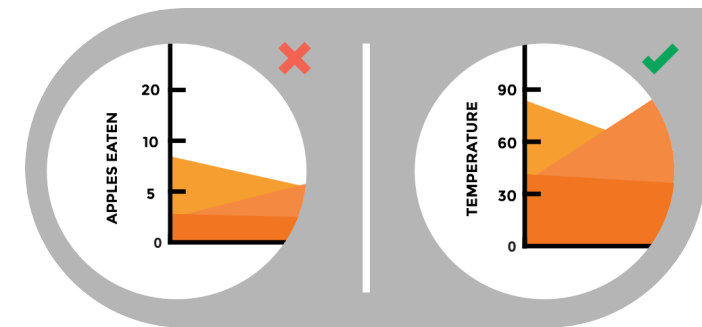
DON'T DISPLAY MORE THAN 4 DATA CATEGORIES

Too many will result in a cluttered visual that is difficult to decipher.



USE TRANSPARENT COLORS

In standard area charts, ensure data isn't obscured in the background by ordering thoughtfully and using transparency.

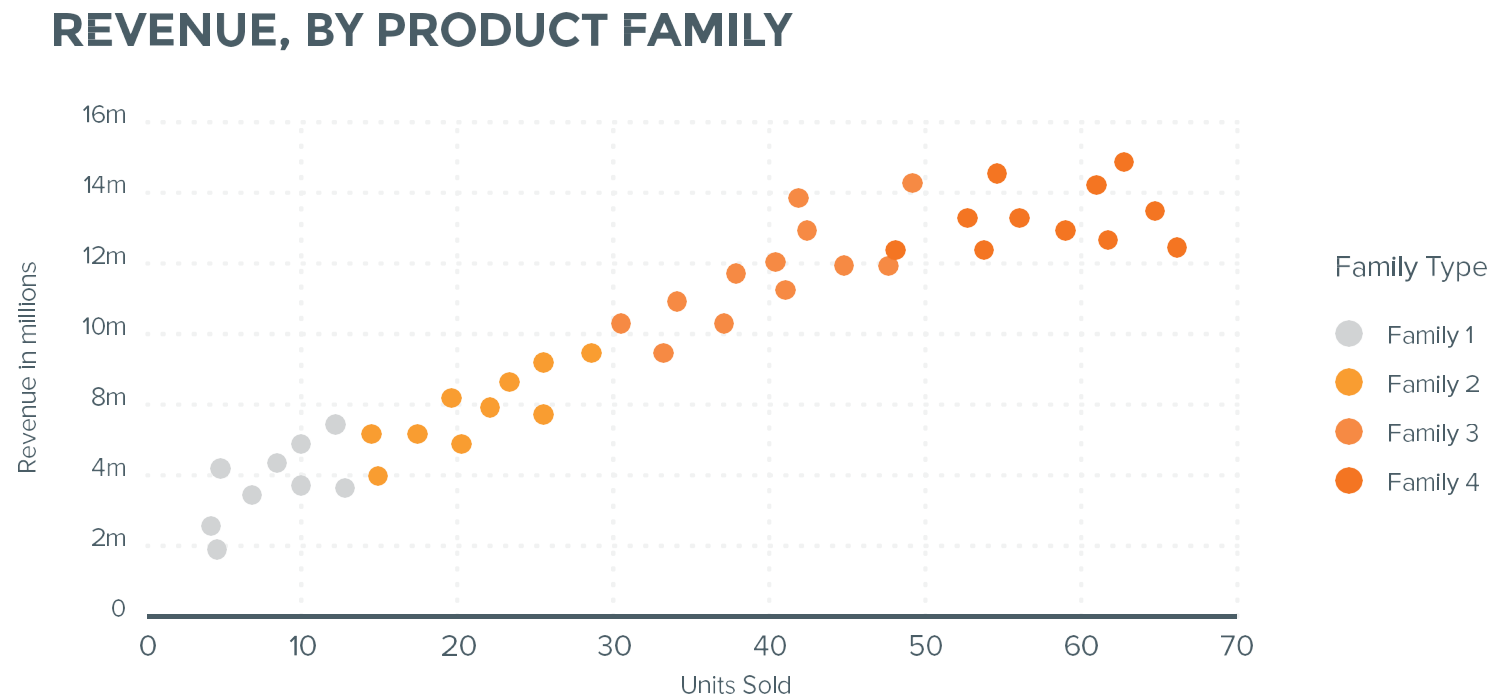


DON'T USE AREA CHARTS TO DISPLAY DISCRETE DATA

The connected lines imply intermediate values, which only exist with continuous data.

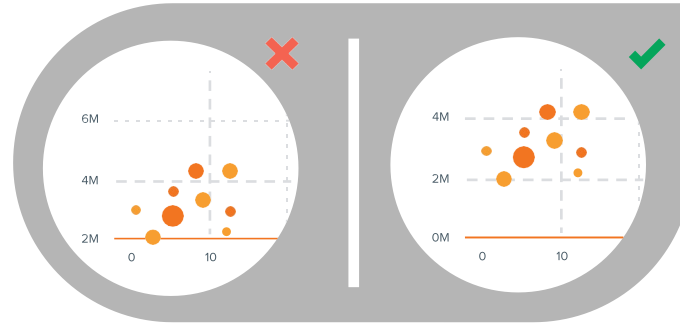
SCATTER PLOT

Scatter plots show the relationship between items based on two sets of variables. They are best used to show correlation in a large amount of data.



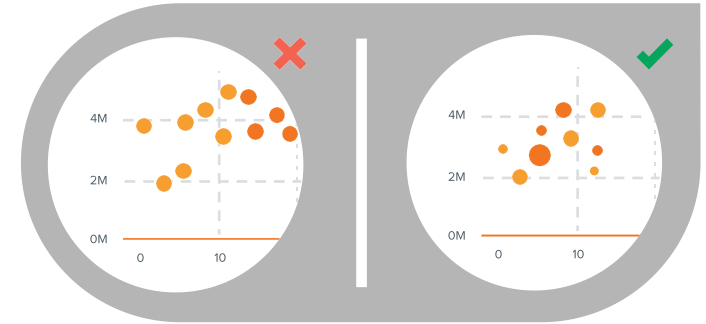
SCATTER PLOT

DESIGN BEST PRACTICES



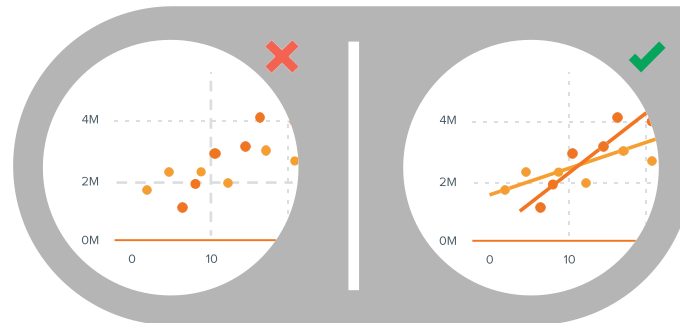
START Y-AXIS VALUE AT 0

Starting the axis above zero truncates the visualization of values.



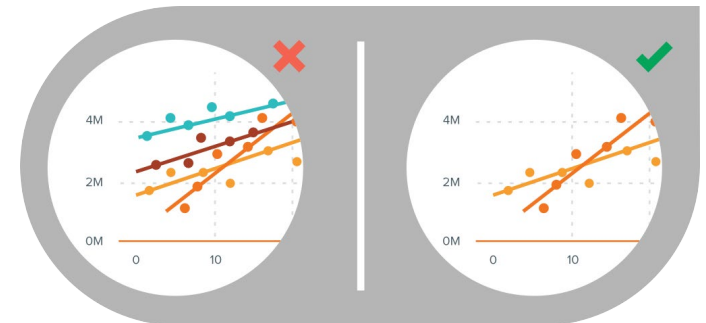
INCLUDE MORE VARIABLES

Use size and dot color to encode additional data variables.



USE TREND LINES

These help draw correlation between the variables to show trends.



DON'T COMPARE MORE THAN 2 TREND LINES

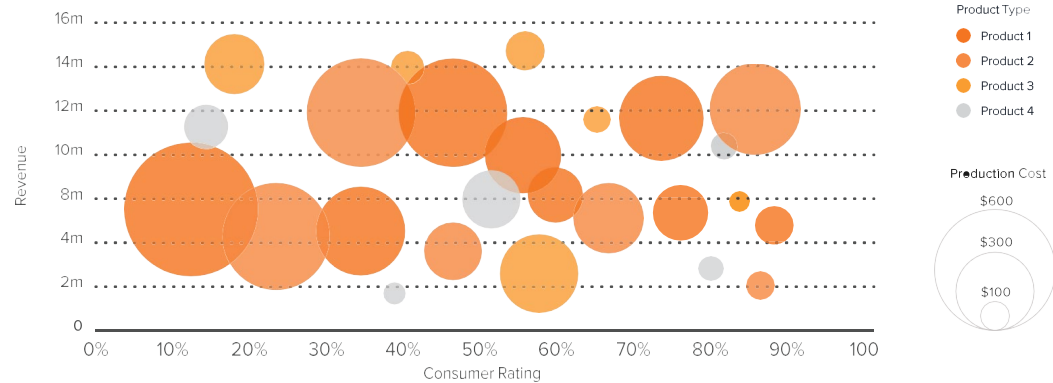
Too many lines make data difficult to interpret.

BUBBLE CHART

Bubble charts are good for displaying nominal comparisons or ranking relationships.

VARIATIONS OF BUBBLE CHARTS

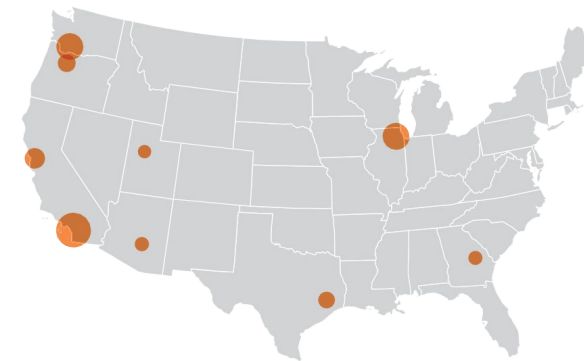
REVENUE VS. RATING



BUBBLE PLOT

This is a scatter plot with bubbles, best used to display an additional variable.

BIGGEST SALES INCREASE



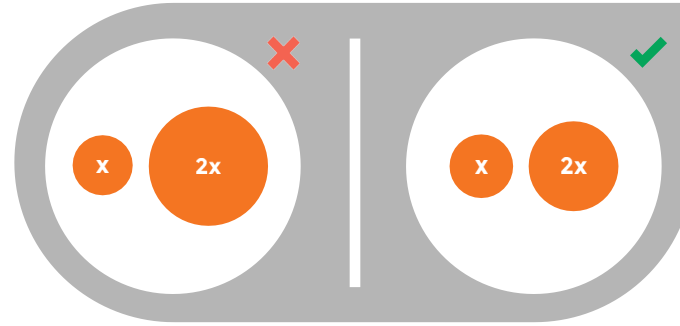
BUBBLE MAP

Best used for visualizing values for specific geographic regions.



MAKE SURE LABELS ARE VISIBLE

All labels should be unobstructed and easily identified with the corresponding bubble.



SIZE BUBBLES APPROPRIATELY

Bubbles should be scaled according to area, not diameter.



DON'T USE ODD SHAPES

Avoid adding too much detail or using shapes that are not entirely circular; this can lead to inaccuracies.

BUBBLE CHART

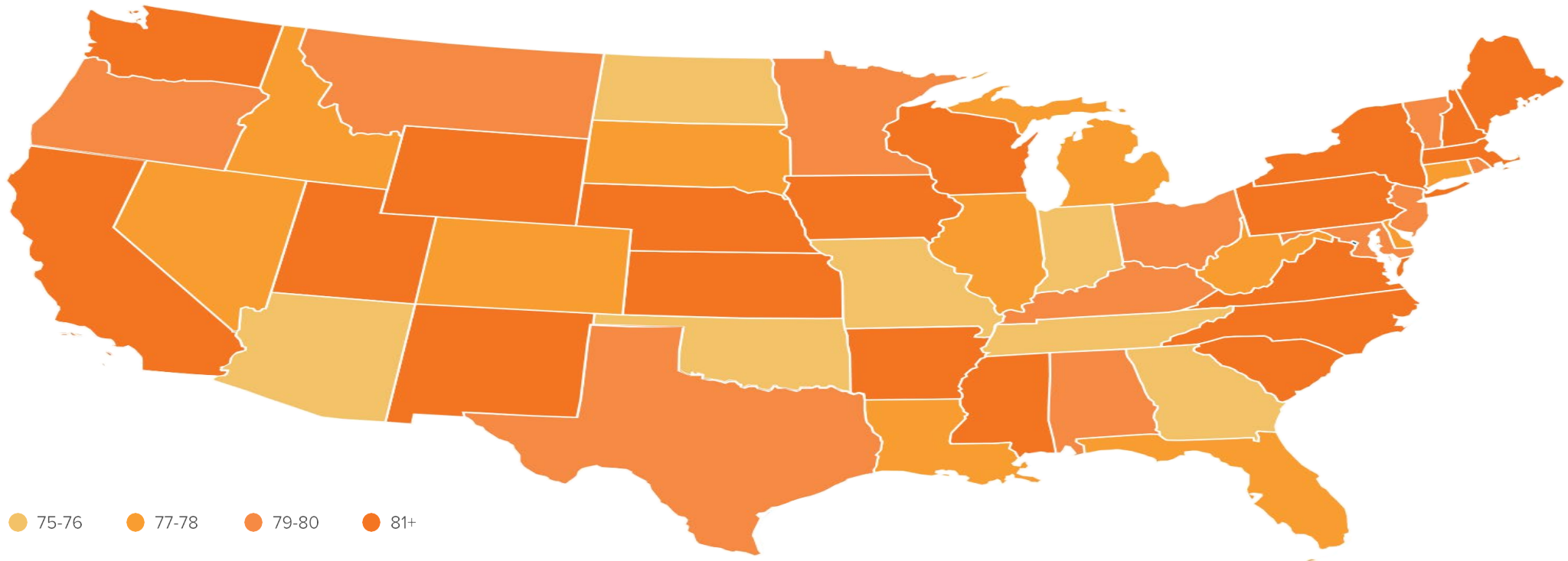
DESIGN BEST PRACTICES

HEAT MAP

Heat maps display categorical data, using intensity of color to represent values of geographic areas or data tables.

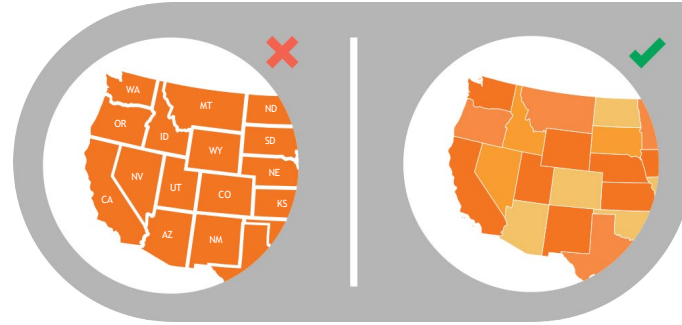


STATES WITH NEW SERVICE CONTRACTS



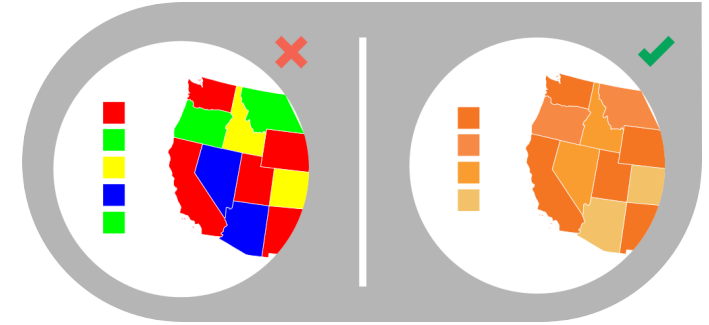
HEAT MAP

DESIGN BEST PRACTICES



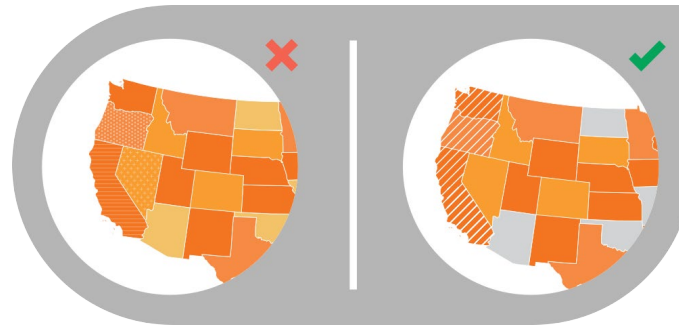
USE A SIMPLE MAP OUTLINE

These lines are meant to frame the data, not distract.



SELECT COLORS APPROPRIATELY

Some colors stand out more than others, giving unnecessary weight to that data. Instead, use a single color with varying shade or a spectrum between two analogous colors to show intensity. Also remember to intuitively code color intensity according to values.



USE PATTERNS SPARINGLY

A pattern overlay that indicates a second variable is acceptable, but using multiple is overwhelming and distracting.



CHOOSE APPROPRIATE DATA RANGES

Select 3-5 numerical ranges that enable fairly even distribution of data between them. Use +/- signs to extend high and low ranges.

- Exercise:

Analyse the following infographics and
write a report

London

51.51 N, 0.13 W

Mon 9 Dec @ 16:02:42

[Go to Map](#) - [Go to Grid](#) - [Change City](#)

WEATHER STATIONS (MULTIPLE SOURCES) 5

STATION	WIND SPEED	WIND GUSTS	DIRECTION	TEMPERATURE	HUMIDITY	RAIN TODAY	PRESSURE	FORECAST
CASA Office: Bloomsbury W1	8 mph	9 mph	SE ↘	11.5 °C	76%	0.0 mm	1027.9 mbar	Clear Night
Lambeth Meters: Brixton SW9	4.3 mph	4.3 mph	SW ↙	11.0 °C	83%	0.0 mm	1026.4 mbar	Clear Night
Hampstead NW3	3.6 mph	3.6 mph	S ↑	9.8 °C	84%	0.0 mm	1029.0 mbar	Clear Night

WEATHER (METAR) 848

London City Airport
Mostly clear
SW at 3 mph
11 C

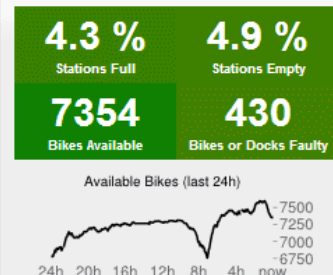
FORECAST (YAHOO! Wth) 1748

Mon	Tue
10 C Mostly Clear	9 C Partly Cloudy
	

TUBE LINE STATUS (TfL) 39

Bakerloo	Good Service
Central	Good Service
Circle	Good Service
District	Good Service
H & C	Good Service
Jubilee	Good Service
Metropolitan	Good Service
Northern	Good Service
Piccadilly	Good Service
Victoria	Good Service
W & C	Good Service
Overground	Good Service
DLR	Good Service

BIKE SHARING (TfL) 38



IN SERVICE (TfL) 9

7197
London buses

378
Underground trains

AIR POLLUTION (DEFRA) 1748

	µg/m ³ TIME AVERG	OZONE	NO ₂	SO ₂	PM _{2.5}	PM ₁₀
Bloomsbury		13	38	4	9	10
Marylebone Rd		9	16	26	22	34
N Kensington		14	40	?	12	18

RADS (CASA) 1

CASA Office Desk ±
6
cpm (uncalibrated)

RIVER LEVEL (PLA) 248

Thames (Tower Pier)
4.13
metres

STOCKS (YAHOO) 7

FTSE 100 Index
6552.34
+0.35 (0.01%)

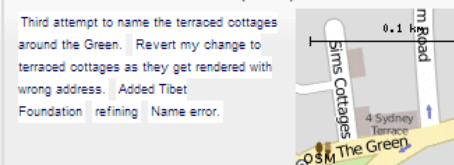
RANDOM TRAFFIC CAMERAS (TfL) 10



BBC LONDON NEWS (BBC) 48



OPENSTREETMAP UPDATES (OSM) 248



ELECTRICITY (N.GRID) 29

Demand (Great Britain)
48211
MW

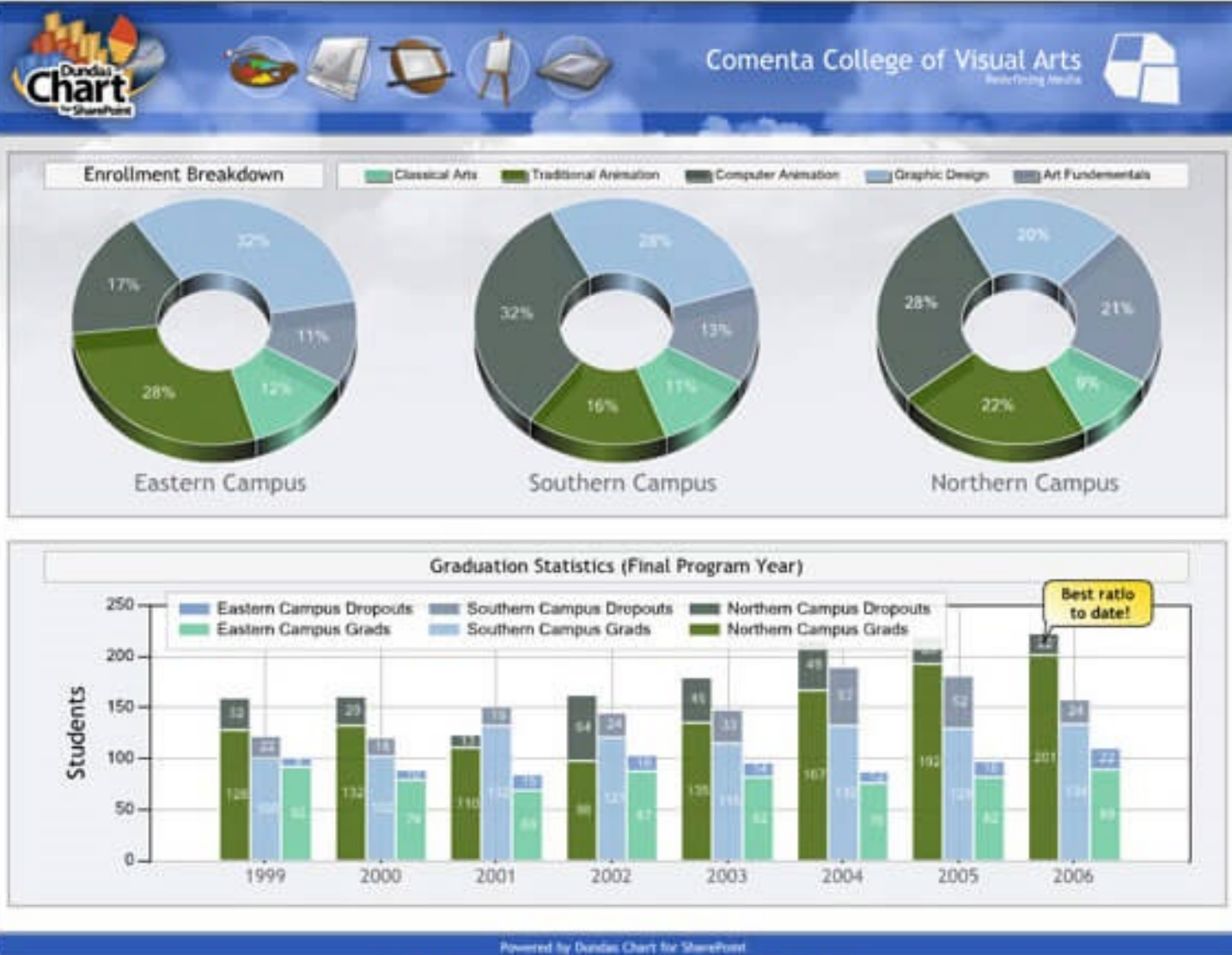
MOOD (LSE MAPPINESS) 38

8% unhappier
than the long term
average for here

13% happier
than the whole
country right now

TWITTER TRENDS FOR LONDON 198

MPs **#NFL** **Christmas** **#Confident** **Xmas** **#ashes** **London**
#RIPAlexTurner **#12DaysofJonesDAY9** **Waca**



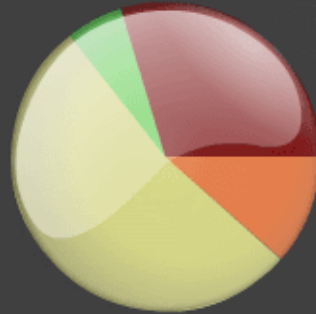
Digital Dashboard, Education Metrics

TIB At A Glance



Program Metrics

Statewide Project Inventory

[Open](#)

- Application
- Design
- Bid
- Construction
- Closeout

● TIA ● UATA ● SCPP ● Total

● Project Inventory ● Future Obligation ● Completed Projects

Active Projects

371

Rem. Commitment

\$339,003,068*

Completed (FYTD)

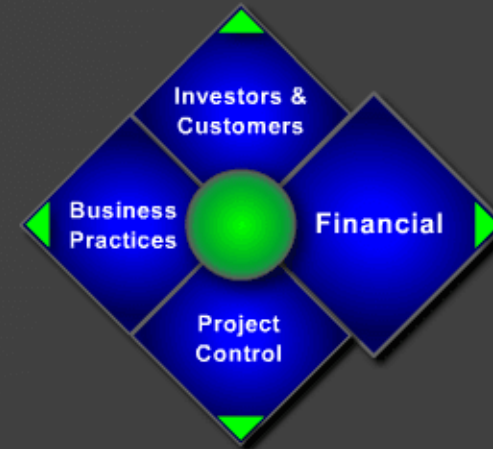
2

Under Construction

171

Agency Status

TIB Balanced Scorecard

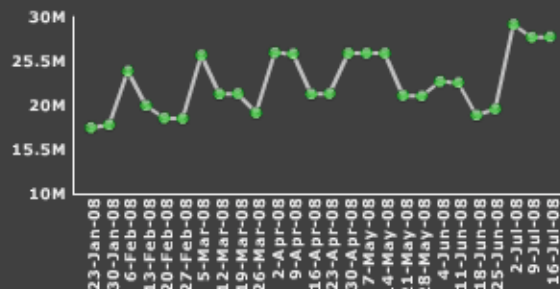


Sustainable Financial Management

- Account Balances
- Expenditures Vs. Revenue
- Payments Vs. Allotments
- Outstanding Payments

Financial Health

Fund Balances

[Open](#)

● TIA ● UATA ● SCPP ● Total

● Fund Balances ● Project Expenditures ● Accounts Payable

TIA Fund Balance

\$15,204,017

UATA Fund Balance

\$8,842,294

SCPP Fund Balance

\$3,593,312

Transactions (MTD)

23

Payments (MTD)

\$2,769,040.91

Fund Balances are as of 07/16/2008