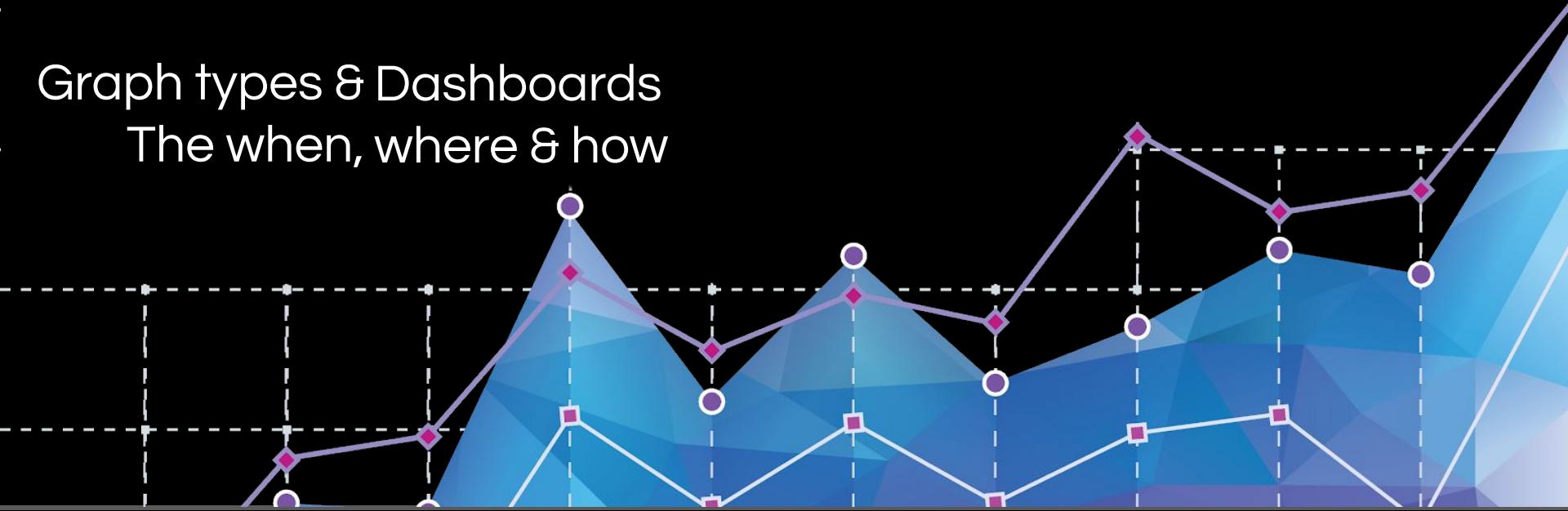


Session 3

Graph types & Dashboards

The when, where & how



This week:

Graphs. When, why & how.

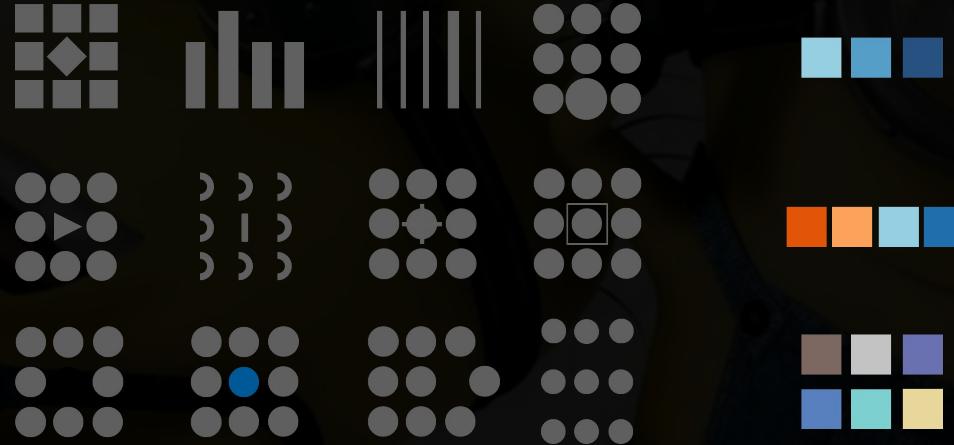
Dashboards.



Graphs - visual version of our data!

"Above all else, show the data! Graphics is *intelligence made visible*" Edward Tufte

Aim to "abuse" preattentive attributes of visual perception and use of colour.



Graphs - visual version of our data!

"Above all else, show the data! Graphics is *intelligence made visible*" Edward Tufte

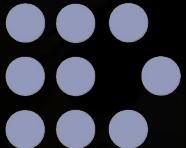
Precise Quantitative Comparisons



Length or Width

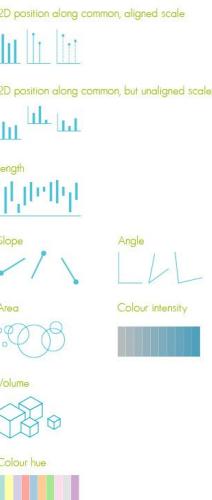
More analytical, higher in the chart (more standard).

Compromise between accuracy and visual interest required for the particular story.



2D Position

Allows more accurate comparisons

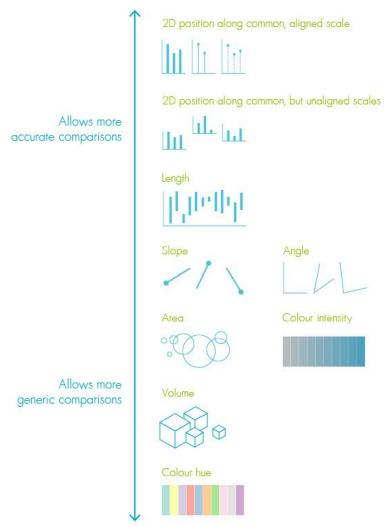
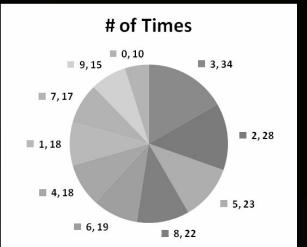
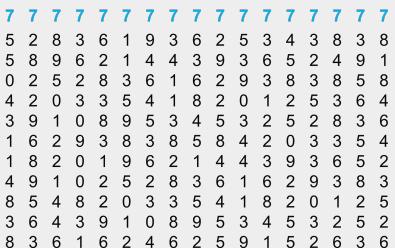


Allows more generic comparisons

Graphs - visual version of our data!

"Above all else, show the data! Graphics is *intelligence made visible*" Edward Tufte

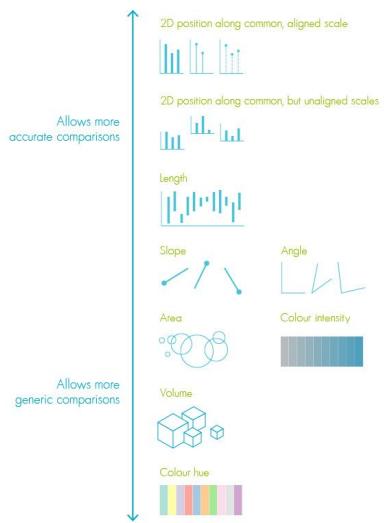
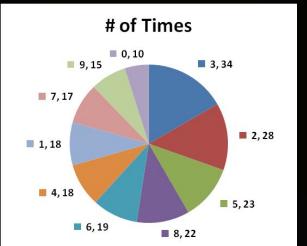
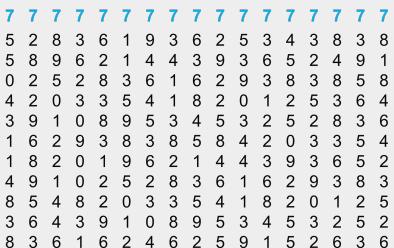
Precise Quantitative Comparisons



Graphs - visual version of our data!

"Above all else, show the data! Graphics is *intelligence made visible*" Edward Tufte

Precise Quantitative Comparisons



Graphs - visual version of our **data!**

"Above all else, show the data! Graphics is *intelligence made visible*" Edward Tufte

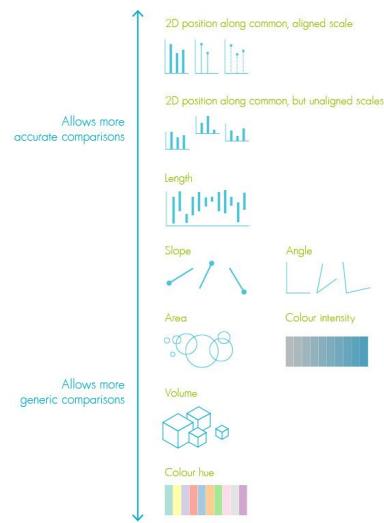
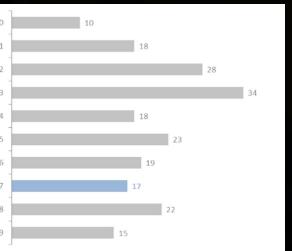
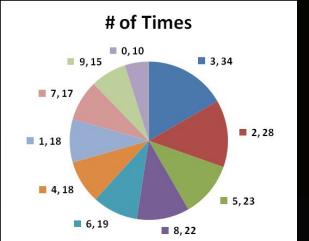
Precise Quantitative Comparisons



Length or Width



2D Position



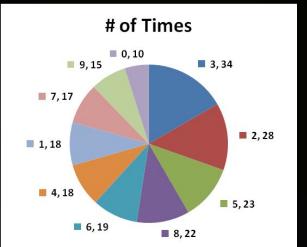
Graphs - visual version of our **data!**

"Above all else, show the data! Graphics is *intelligence made visible*" Edward Tufte

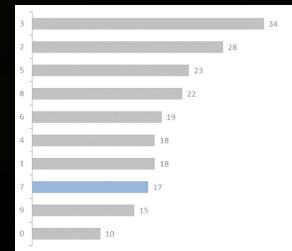
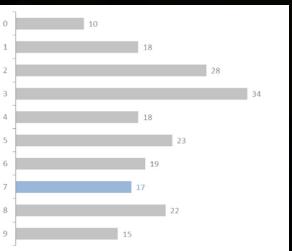
Precise Quantitative Comparisons



Length or Wid



2D Position

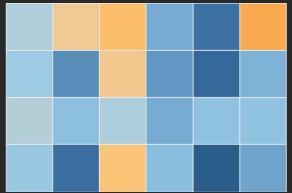
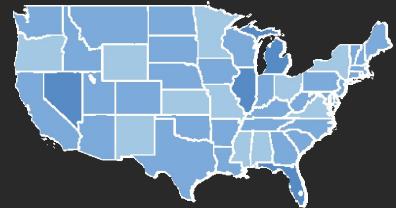
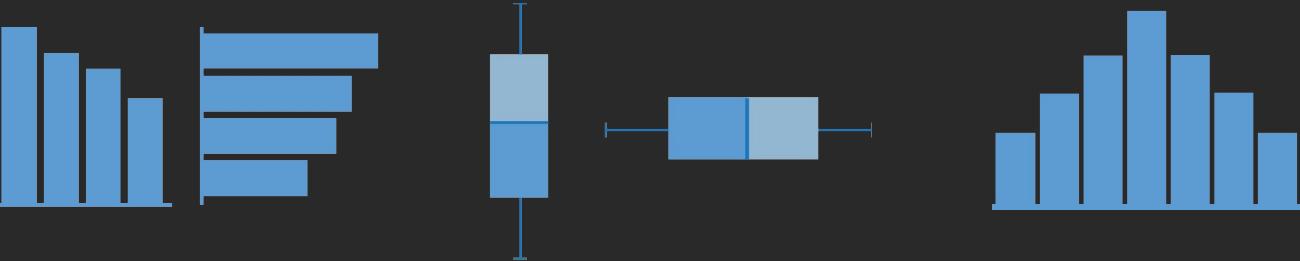


All graphs give the same information.

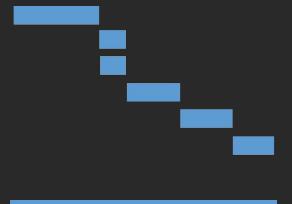
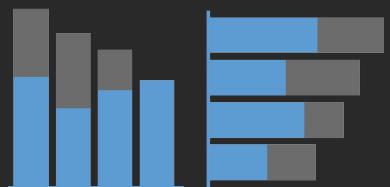
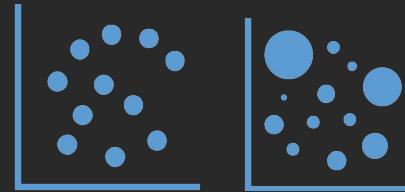
Clearly:
length + order comparison -
more precise comparison
angle, area and colour
comparison -
faster comparison

Allows more accurate comparisons

Common Types of Charts



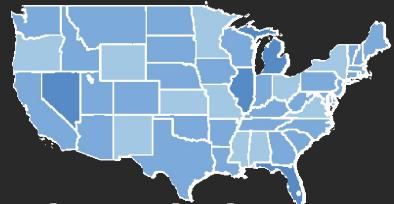
That you probably
recognise...



| | | |
|-----------|----------|----------|
| \$29,071 | \$17,307 | \$30,073 |
| \$2,603 | \$2,353 | \$5,079 |
| \$66,106 | \$53,891 | \$42,444 |
| \$20,173 | \$14,151 | \$26,664 |
| \$100,615 | \$58,304 | \$98,684 |
| \$71,613 | \$35,768 | \$70,533 |
| \$10,760 | \$8,319 | \$18,127 |
| \$39,140 | \$43,916 | \$84,755 |



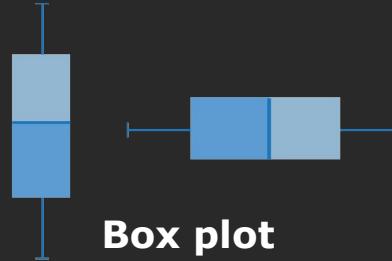
Common Types of Charts



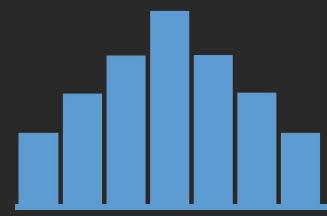
Choropleth map



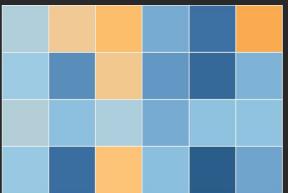
Bar chart



Box plot

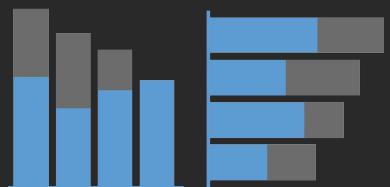


Histogram

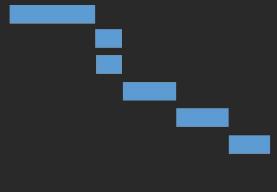


Heat map

That you probably
recognise...



Stacked Bar chart



Gantt chart

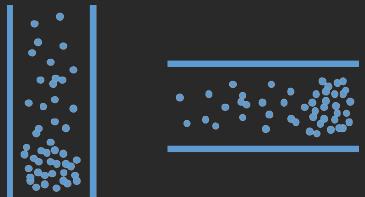
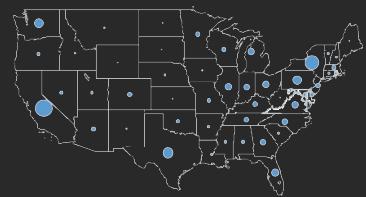
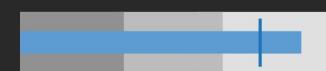
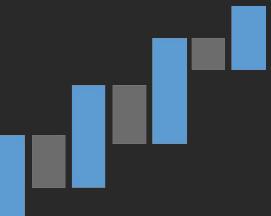
| | | |
|-----------|----------|----------|
| \$29,071 | \$17,307 | \$30,073 |
| \$2,603 | \$2,353 | \$5,079 |
| \$66,106 | \$53,891 | \$42,444 |
| \$20,173 | \$14,151 | \$26,664 |
| \$100,615 | \$58,304 | \$98,684 |
| \$71,613 | \$35,768 | \$70,533 |
| \$10,760 | \$8,319 | \$18,127 |
| \$39,140 | \$43,916 | \$84,755 |

Highlight table

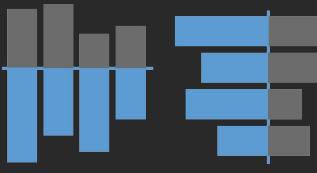
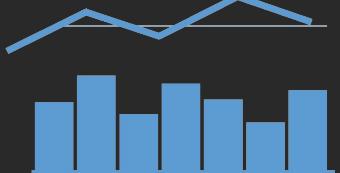
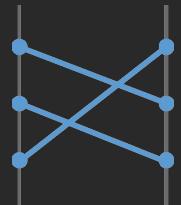
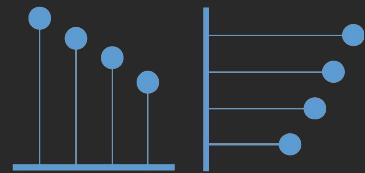


Line graph

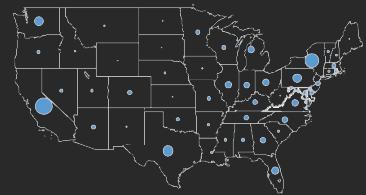
Common Types of Charts



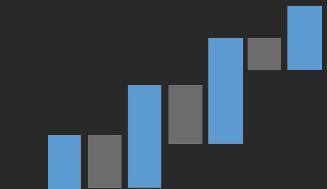
That you possibly
don't know...



Common Types of Charts



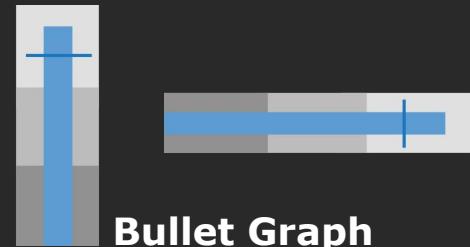
Symbol (dot) map



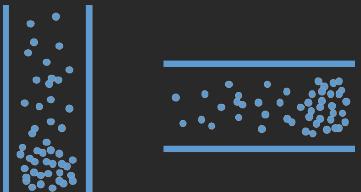
Waterfall chart



Dot plot

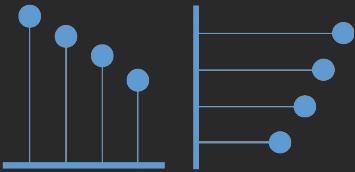


Bullet Graph

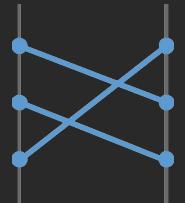


Dot plot with jitter

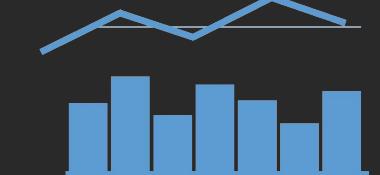
That you possibly
don't know...



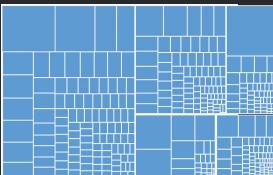
Lollipop chart



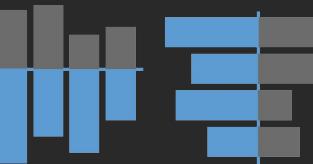
Slopegraph



Sparkline/sparkbar

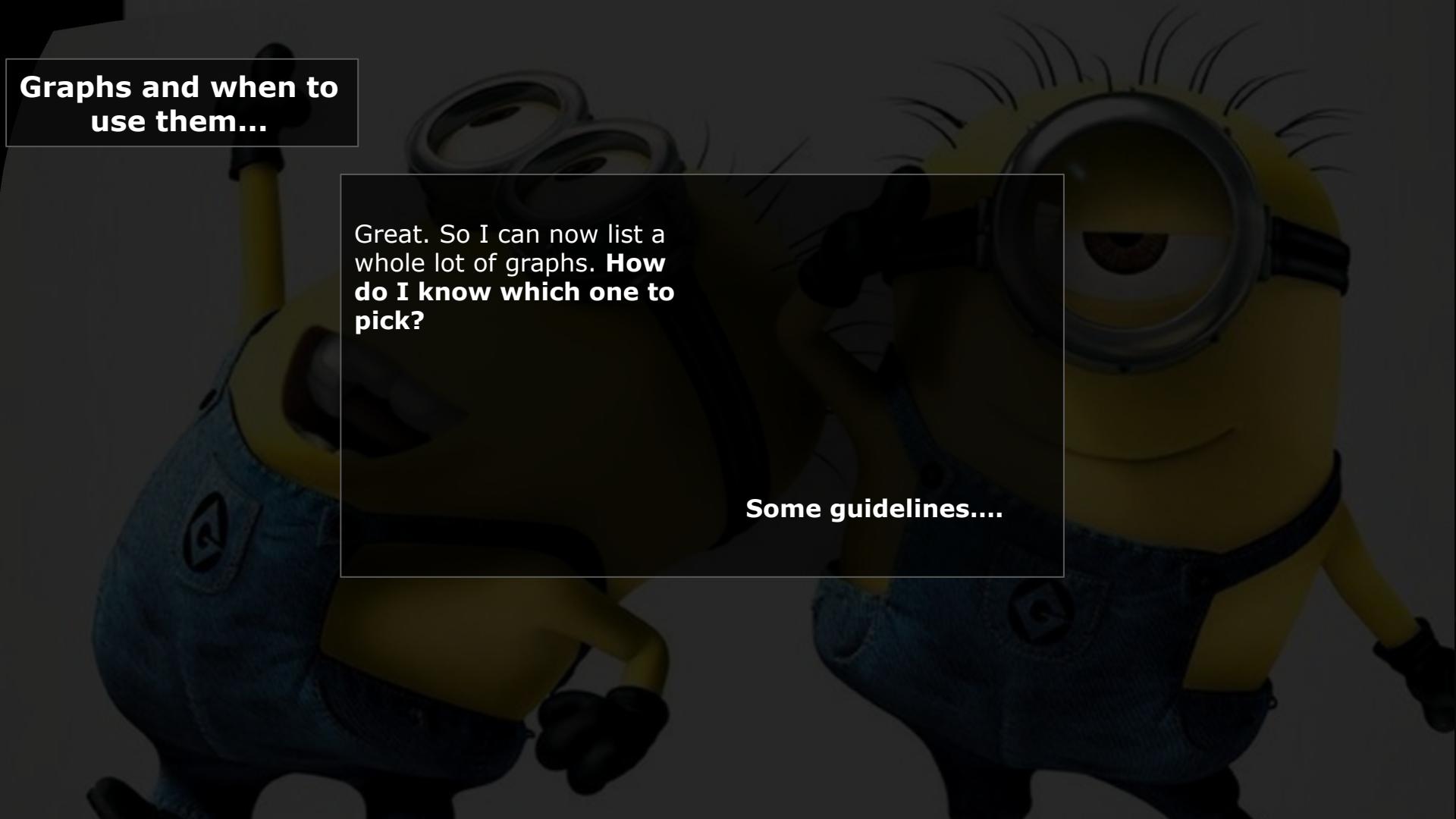


Treemap



Diverging bar chart

Graphs and when to use them...

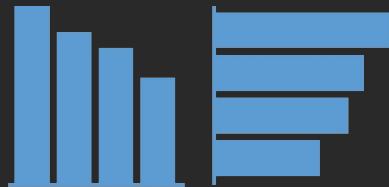


Great. So I can now list a whole lot of graphs. **How do I know which one to pick?**

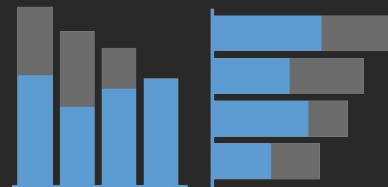
Some guidelines....

Task:

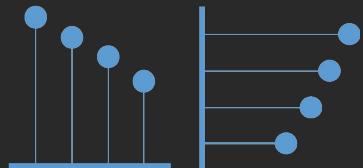
Comparing data across categories



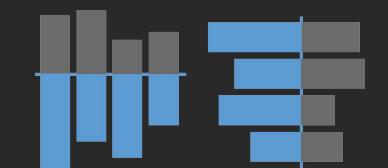
Bar chart



Stacked Bar chart



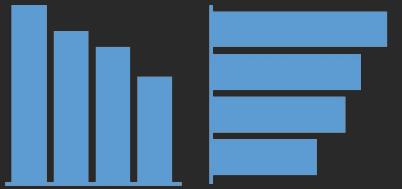
Lollipop chart



Diverging bar chart

Task:

Comparing data across categories



Bar chart



Stacked Bar chart

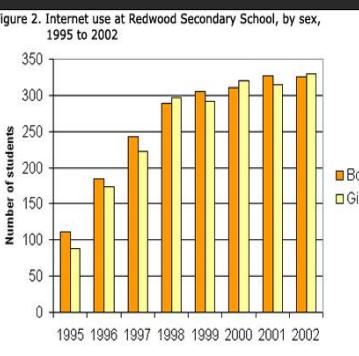
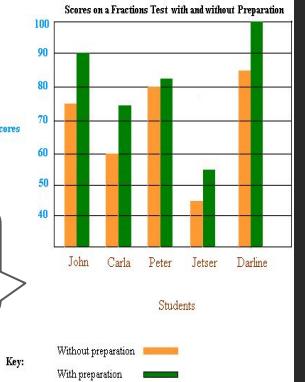


Lollipop chart



Diverging bar chart

May be
comparative.



The visual cue is **bar height**.

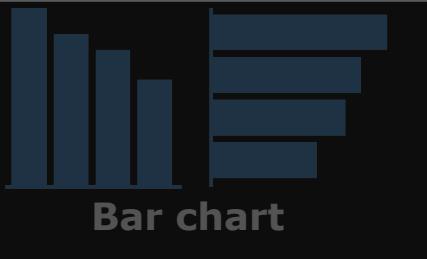
Bar width and spacing
do not represent
values.

Can show discrete (ordinal)
or continuous values
(with some kind of logical
binning).

x-axis can be inherently
ordered (e.g. time) or
ordered by value to aid
interpretation.

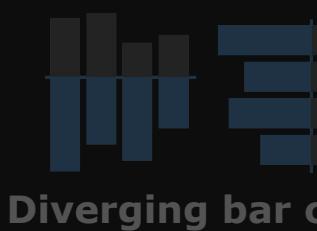
Task:

Comparing data across categories



Bars are coloured / shaded with proportions.

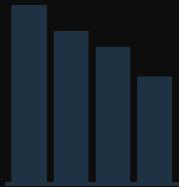
Caution: Don't slice into too many segments!



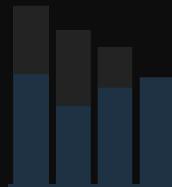
Are film sequels profitable? In this example of a bar chart, you quickly get a sense of how profitable sequels are for the box office franchises.

Task:

Comparing data across categories



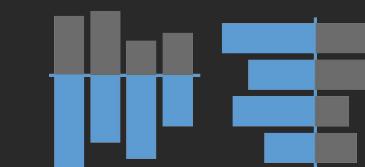
Bar chart



Stacked Bar chart

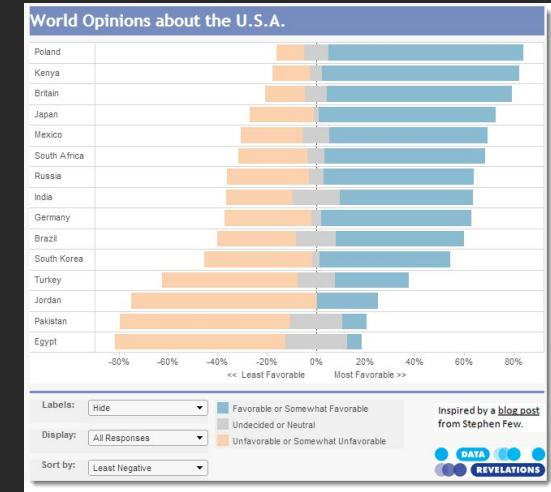


Lollipop chart



Diverging bar chart

Categorical comparisons where a mid-point is important.



Task:

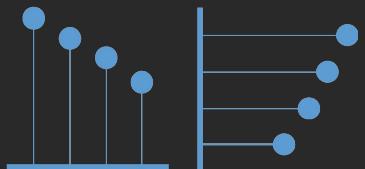
Comparing data across categories



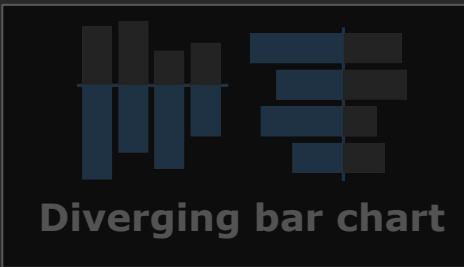
Bar chart



Stacked Bar chart



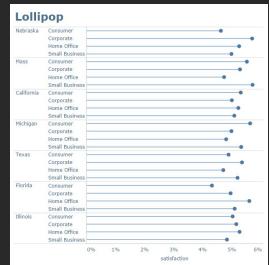
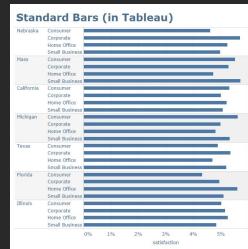
Lollipop chart



Diverging bar chart

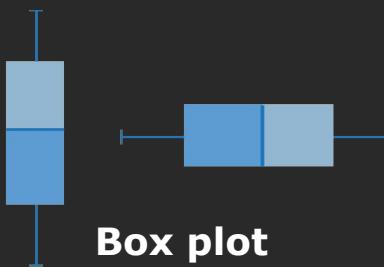
Use to get a different visual effect, particularly when there are many long bars (provides a better ink to data ratio*).

Do not use if many bars of same length - harder to compare than bar charts.



Task:

Showing / understanding
the distribution of your
data



Box plot



Histogram

Task:

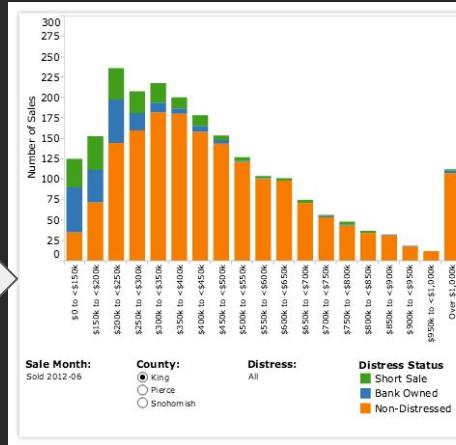
Showing / understanding
the distribution of your
data



Grouping is important!
(categorical data is easier than
continuous)

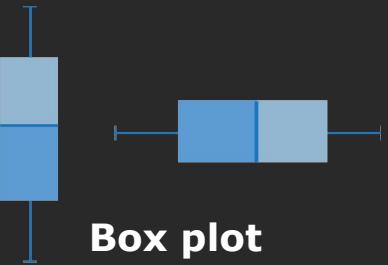
If interactive - add a filter
to enable users to drill
down into information.

Which houses are
selling? This histogram
shows which houses are
seeing the most sales in
a month.



Task:

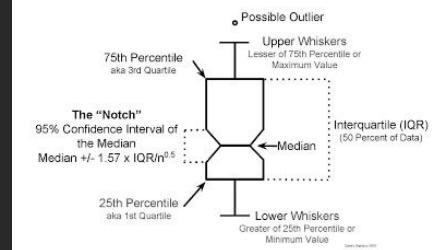
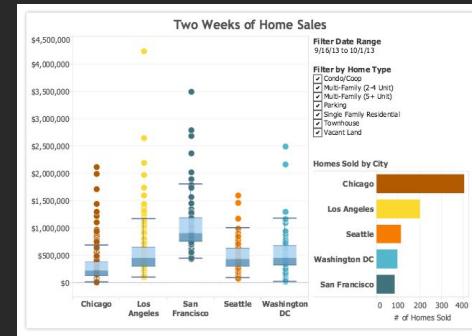
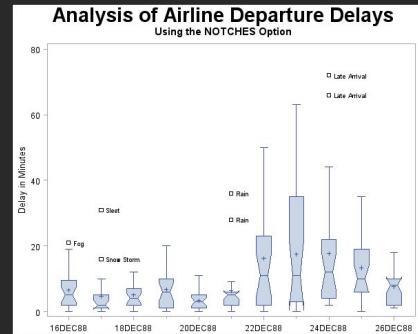
Showing / understanding
the distribution of your
data



Histogram

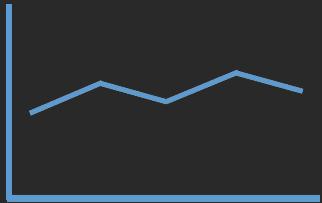
Quickly displays
distribution's median
(optionally mean),
quartiles, range and
outliers.

Can compare, can show
indications of statistical
significance.



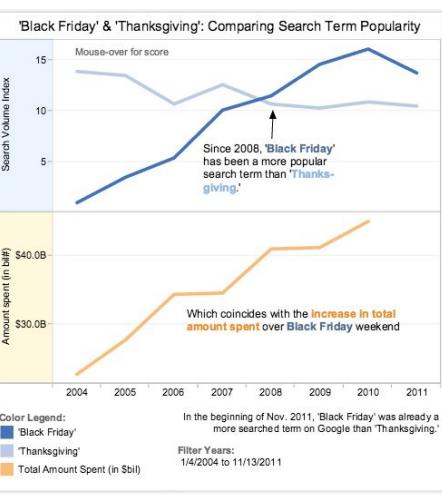
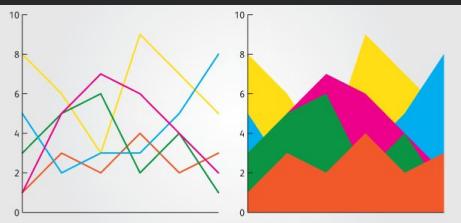
Task:

Viewing trends in data over time



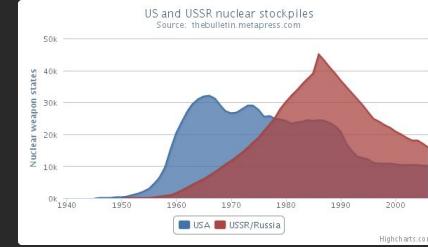
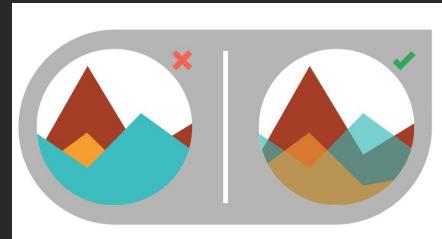
Line graph

Sometimes it might be worth filling area under the lines → **area chart**.
Maybe.



Basic lines reveal powerful insight. These two line charts illuminate the increasing popularity of "Black Friday" as an epic event in the United States.

It's quick to see that Thanksgiving lost ground to the popular shopping period in 2008.

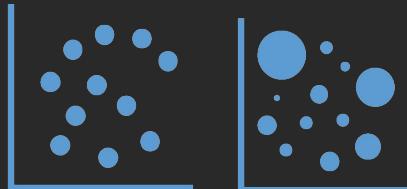


Task:

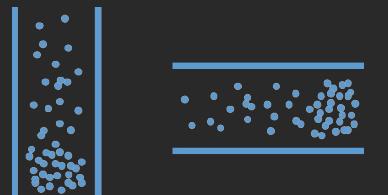
Investigating the relationship between different variables



Dot plot



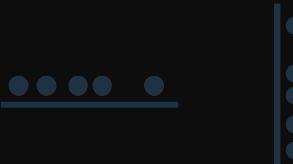
Scatter plot



Dot plot with jitter

Task:

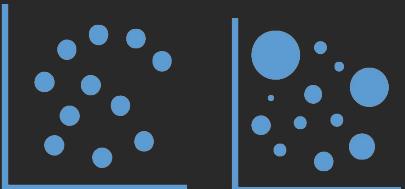
Investigating the relationship between different variables



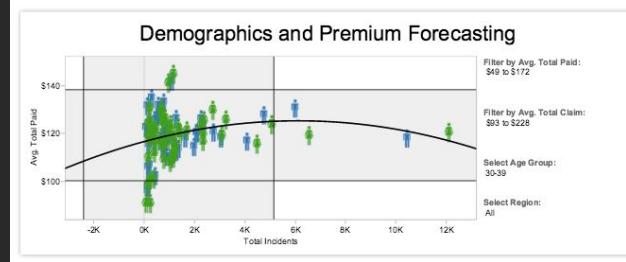
Dot plot



Dot plot with jitter



Scatter plot



Scatter plots show relationships between two variables (x-axis vs y-axis).

Can use colours and markers to give more information.

Can add trend lines etc.

If interactive can use filters.

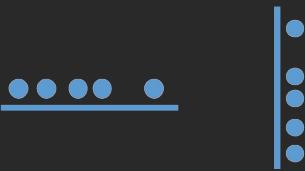
Who is most expensive to insure? (green female, blue male: one marker per region).

Total incidents is the number of payouts.

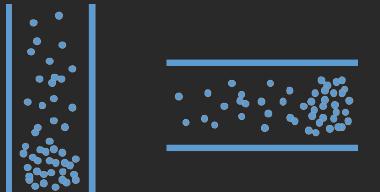
Avg paid is the premium paid.

Task:

Investigating the relationship between different variables



Dot plot



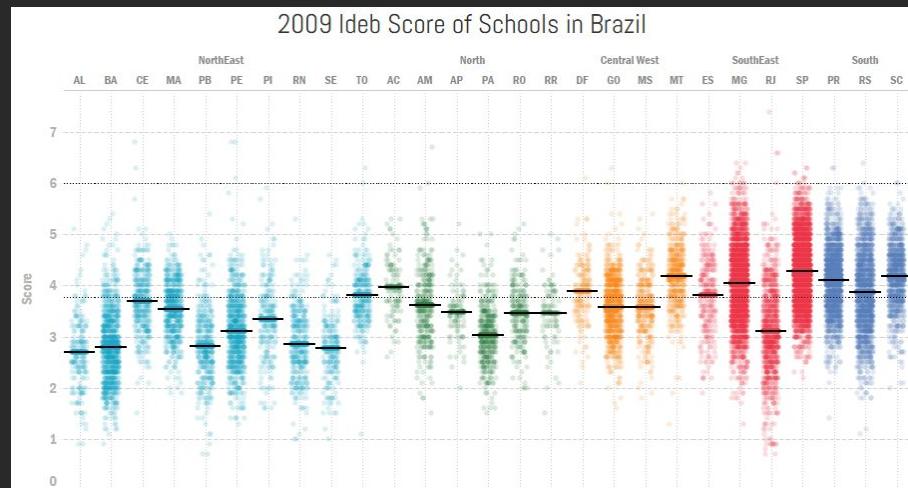
Dot plot with jitter



Scatter plot

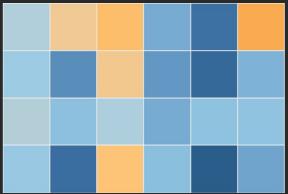
1D scatter plot.

Use jitter to highlight density and avoid data point overlap.



Task:

Showing the relationship between two factors.



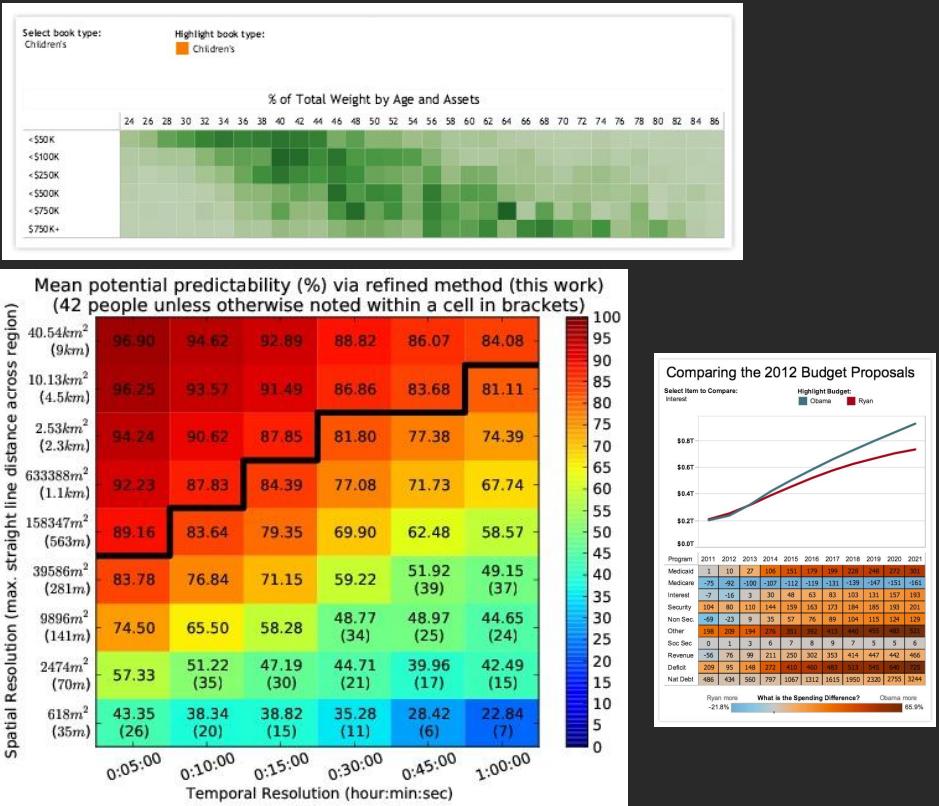
Heat map

| | | |
|-----------|----------|----------|
| \$29,071 | \$17,307 | \$30,073 |
| \$2,603 | \$2,353 | \$5,079 |
| \$66,106 | \$53,891 | \$42,444 |
| \$20,173 | \$14,151 | \$26,664 |
| \$100,615 | \$58,304 | \$98,684 |
| \$71,613 | \$35,768 | \$70,533 |
| \$10,760 | \$8,319 | \$18,127 |
| \$39,140 | \$43,916 | \$84,755 |

Highlight table

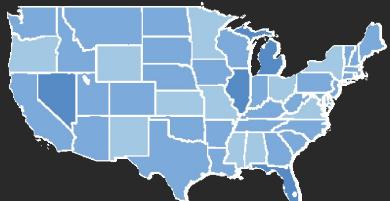
Can use the size of the square to show a second value, in addition to colour.

Consider combining with other chart types to show trends etc.

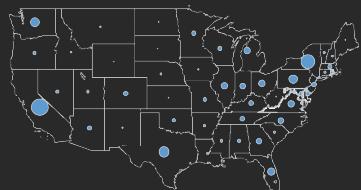


Task:

Showing geocoded (located) data



Choropleth map

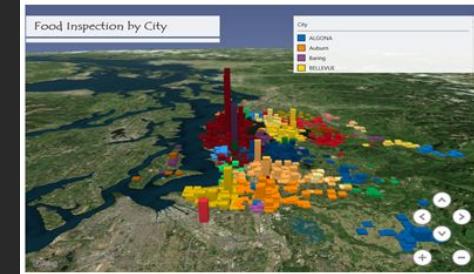
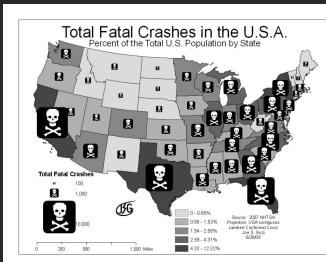
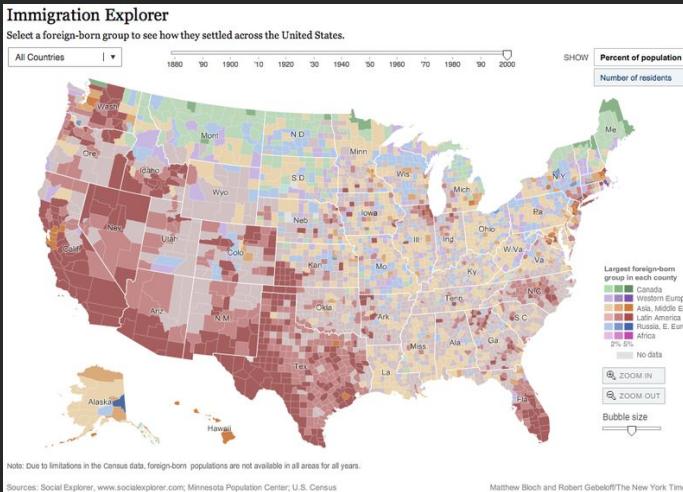


Symbol (dot) map

Use shading, colour and symbols to indicate values.

Use maps as a filter
(click to show) for other chart types.

Plot other chart types
(i.e. scatter) overtop of maps.



Task:

Displaying things in use over time.



Gantt chart

| Task Name | Q1 2009 | | | Q2 2009 | | | Q3 2009 | | |
|----------------|---------|---------|---------|---------|---------|---------|---------|---------|-----|
| | Dec '08 | Jan '09 | Feb '09 | Mar '09 | Apr '09 | May '09 | Jun '09 | Jul '09 | Aug |
| Planning | | | | | | | | | |
| Research | | | | | | | | | |
| Design | | | | | | | | | |
| Implementation | | | | | | | | | |
| Follow up | | | | | | | | | |

E.g. Displaying a project's schedule.

In this case "things" are project parts.



Task:

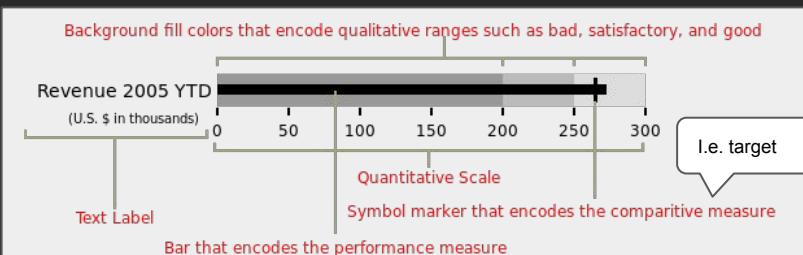
Evaluating performance of a metric against a goal



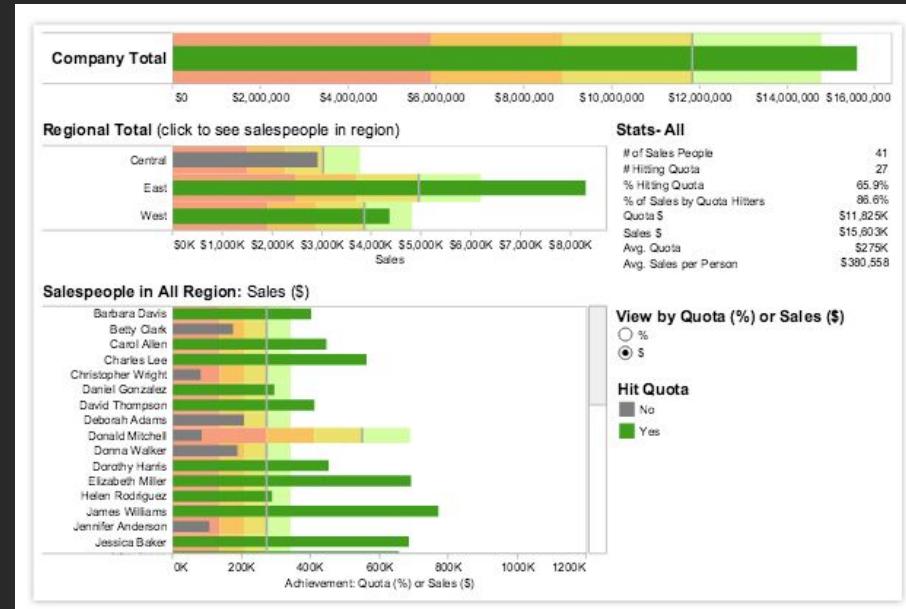
Bullet Graph

Uses colour to indicate achievement of thresholds.

Provides summary insights.



Tracking a sales team's progression to hitting its quota is a critical element to managing success.

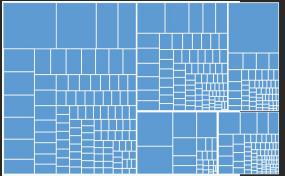


NLAB:

Data at Scale

Task:

Showing hierarchical data as a proportion of a whole



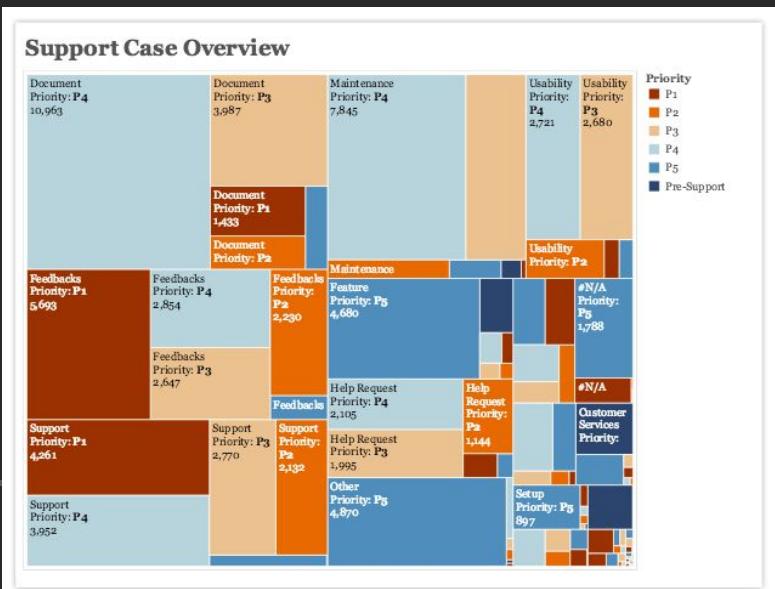
Treemap

Can also:

- Colour rectangles by category.
- Combine / embed treemaps with bar charts enabling **quantitative comparisons**.

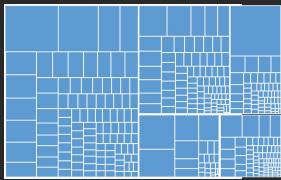
This treemap shows all of the company's support cases, broken by case type, and also priority level.

You can see that Document, Feedback, Support and Maintenance make up the lion share of support cases. However, in Feedback and Support, P1 cases make up the most number of cases, whereas most other categories are dominated by relatively mild P4 cases.



Task:

Showing hierarchical data as a proportion of a whole



Treemap

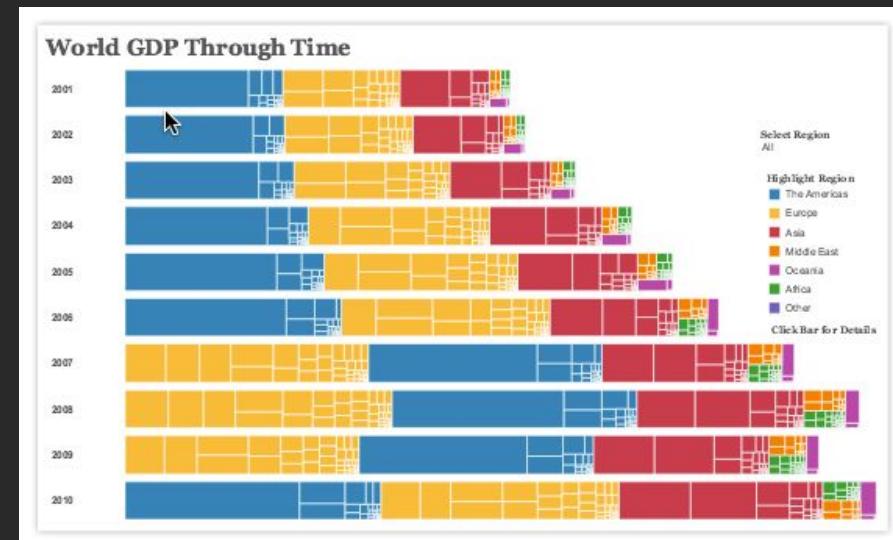
Can also:

- Colour rectangles by category.
- Combine / embed treemaps with bar charts enabling **quantitative comparisons**.

Visualizing World GDP.

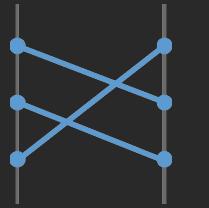
In this **treemap-bar combination chart**, we can see how overall GDP has grown over time (with the exception of 2009, when GDP fell),

Treemap shows region, then sub-region then country, etc.



Task:

Showing a comparison of rank (typically between two time periods)



Slopegraph

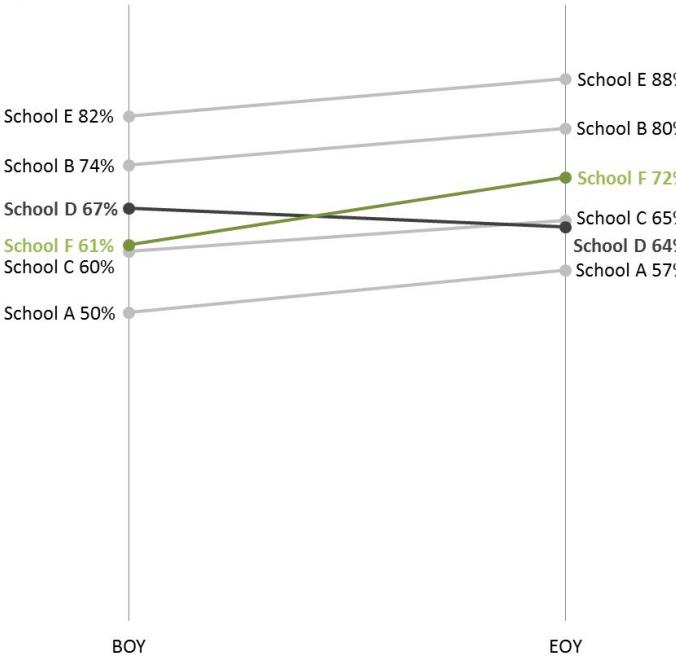
Typically shows how an entity changed rank over time.

Places focus strictly on the beginning and the end points.

Consider:

- using colour & thickness
- highlighting the most important changes with colour
- more than two time points

While most schools increased, only **School F** met growth targets. **School D** decreased.



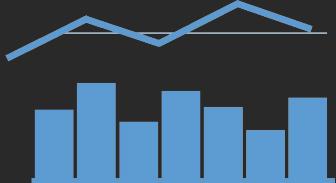
In this example, the slope graph compares school performance at the beginning of the year (BOY) to the end of the year (EOY).

Source:
Stephanie Evergreen

<http://www.betterevaluation.org/en/evaluation-options/slopegraph>

Task:

Show general trends / overall information, add extra context



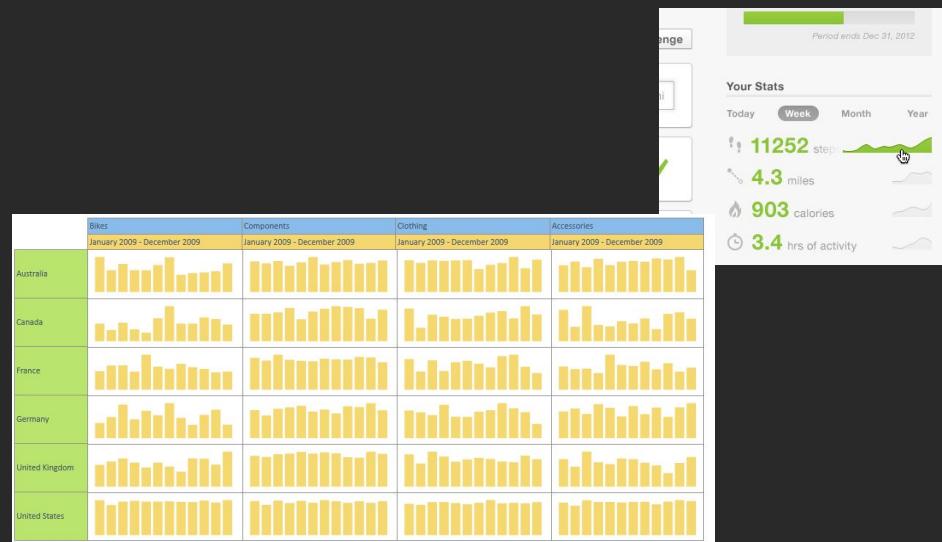
Sparkline/sparkbar

Small, word-sized graphic.

No: axis, labels etc.

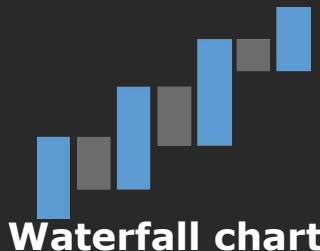
Context comes from related content.

Consider multiple sparkbars in a grid



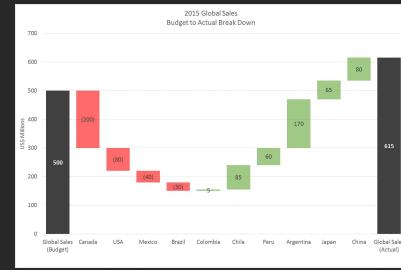
Task:

Showing the gradual transition (+/-) in the quantitative value



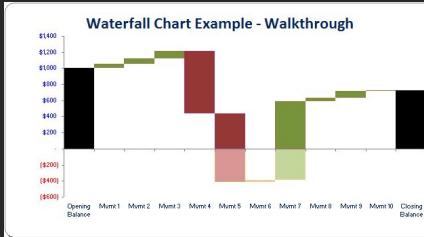
Waterfall chart

Modified bar chart showing **stepwise** increase / decrease in a value across the x-axis.



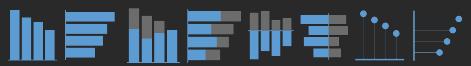
Typically the transition is across time, but could be between ordered categories.

Consider adding colour and data labels.

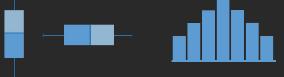




Comparing data across categories



Showing / understanding the distribution of your data



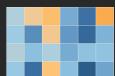
Viewing trends in data over time



Investigating the relationship between different variables



Showing the relationship between two factors



| | | |
|----------|----------|----------|
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |
| \$12,075 | \$17,817 | \$10,078 |

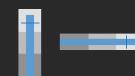
Showing geocoded (located) data



Displaying things in use over time



Evaluating performance of a metric against a goal



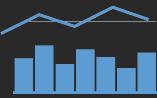
Showing hierarchical data as a proportion of a whole



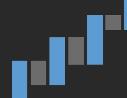
Showing a comparison of rank (typically between two time periods)



Show general trends / overall information, add extra context



Showing the gradual transition (+/-) in the quantitative value



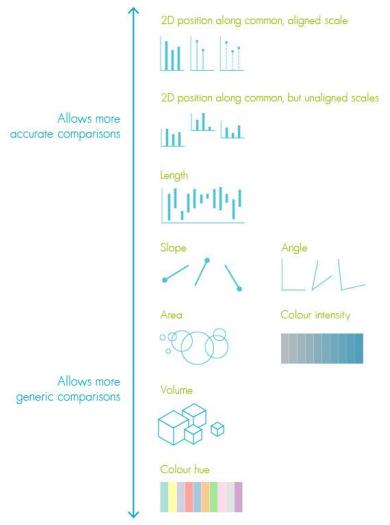
Common Types of Charts

Why? They ask the viewer to compare.

But **accurate comparisons** are hard.



Bubble chart



Concentric Circles



Donut Chart

That you **think twice before using...**
(probably shouldn't use...)

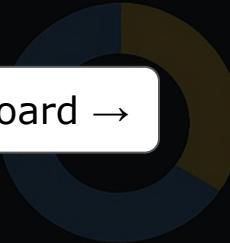
Least
Some
Most
More
Few
Word Cloud



Pie Chart

A quick introduction to: Dashboards

Dashboard →



A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance.

- Stephen Few (2004)

← Faceted analytical display

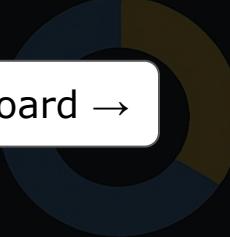


VS.



A quick introduction to: Dashboards

Dashboard →



A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance.

- Stephen Few (2004)



A dashboard is a visual display of data used to monitor conditions and/or facilitate understanding.

- The Big Book of Dashboards (2017)

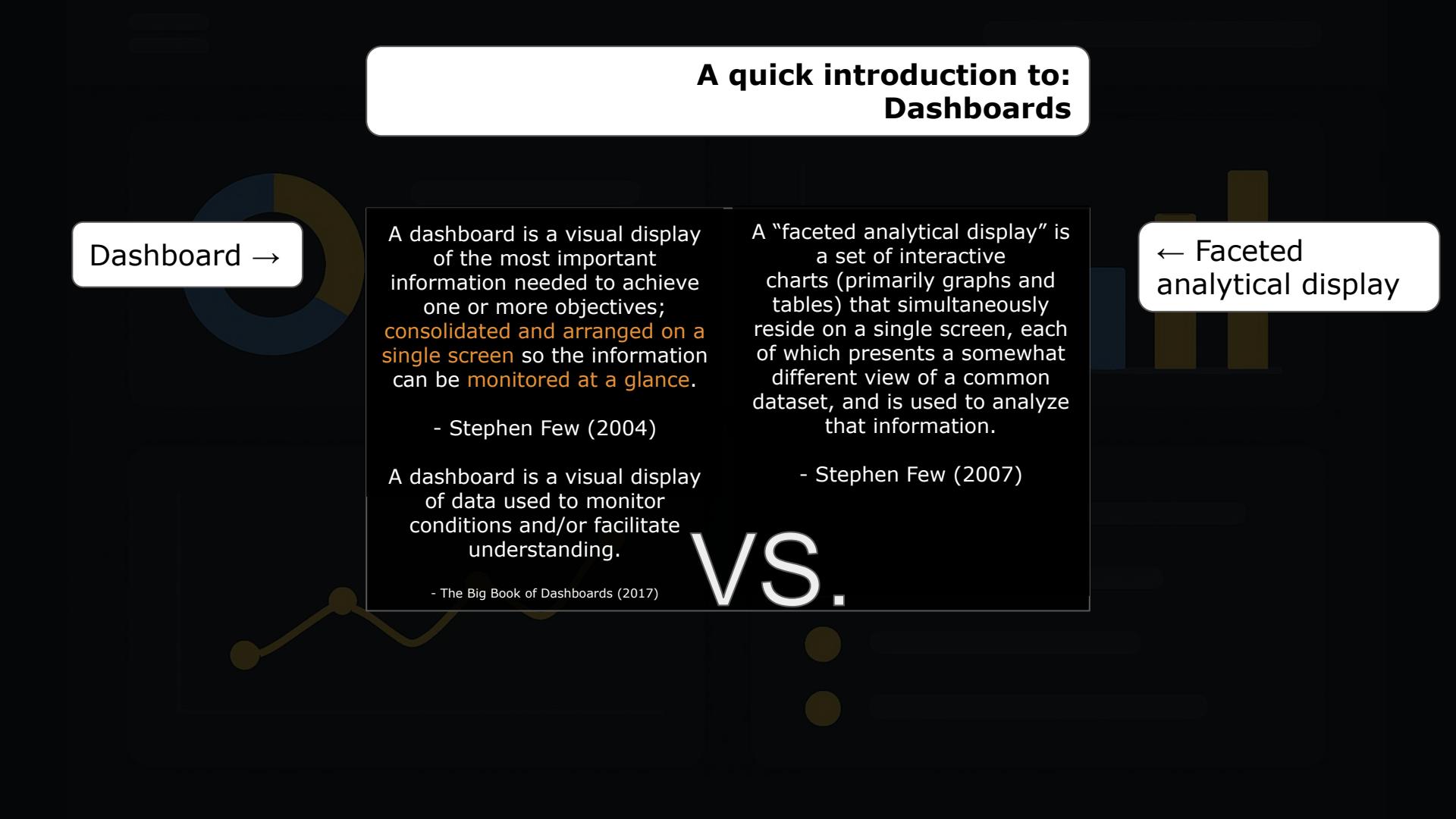


← Faceted analytical display

VS.

A quick introduction to: Dashboards

Dashboard →



A dashboard is a visual display of the most important information needed to achieve one or more objectives; **consolidated and arranged on a single screen** so the information can be **monitored at a glance**.

- Stephen Few (2004)

A dashboard is a visual display of data used to monitor conditions and/or facilitate understanding.

- The Big Book of Dashboards (2017)

A “faceted analytical display” is a set of interactive charts (primarily graphs and tables) that simultaneously reside on a single screen, each of which presents a somewhat different view of a common dataset, and is used to analyze that information.

- Stephen Few (2007)

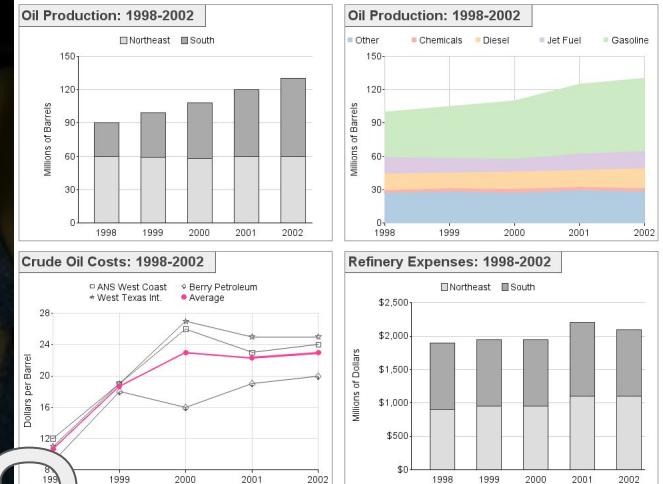
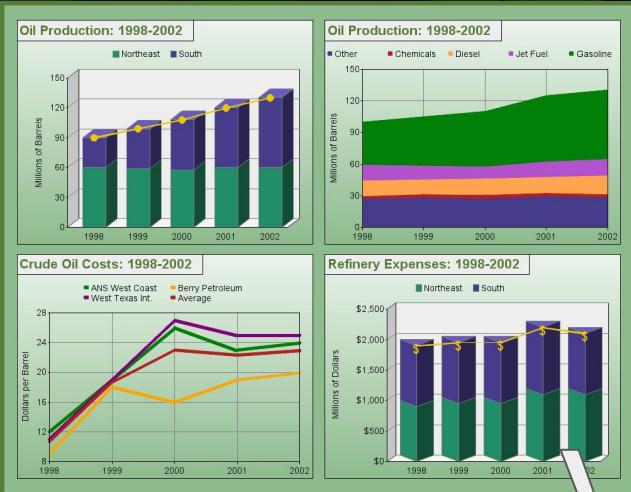
VS.

← Faceted analytical display

A quick introduction to: Dashboards

Presentation:

- clearly stated messages
- concise (data to ink ratio)
- direct
- customized to goals
- consistent layout - data changes over time, not layout

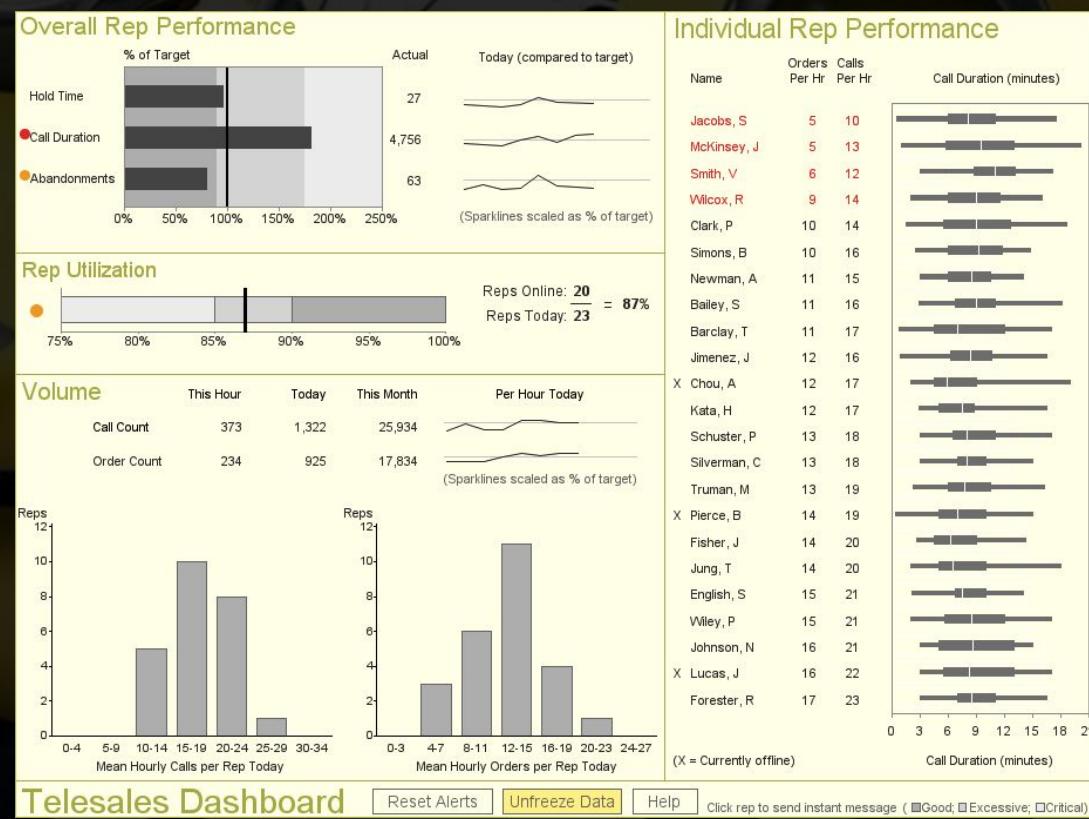


vs.

A quick introduction to: Dashboards

Presentation:

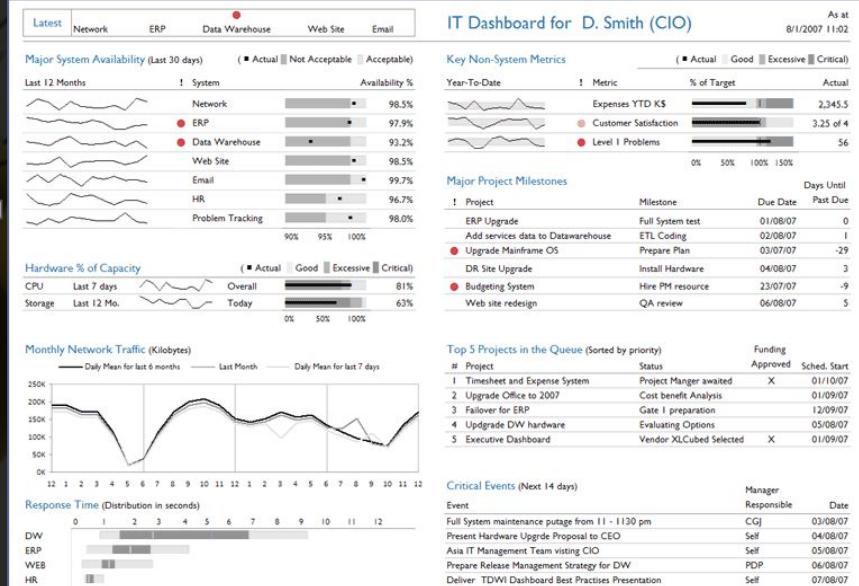
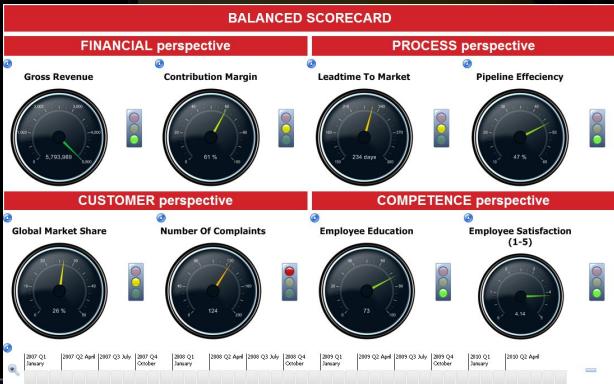
- clearly stated messages
- concise (data to ink ratio)
- direct
- customized to goals
- consistent layout - data changes over time, not layout



A quick introduction to: Dashboards

Presentation:

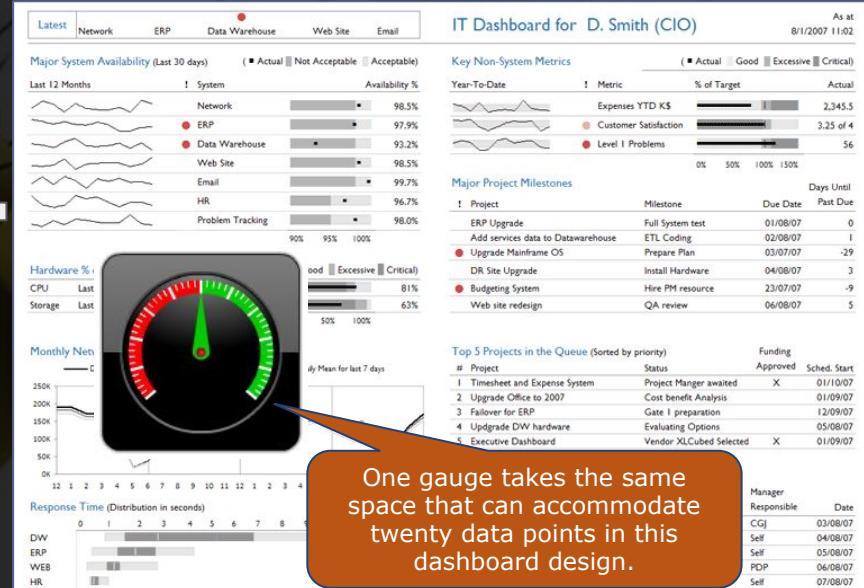
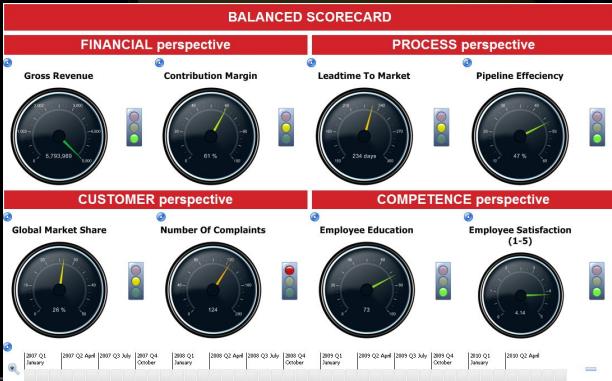
- Avoid useless bling



A quick introduction to: Dashboards

Presentation:

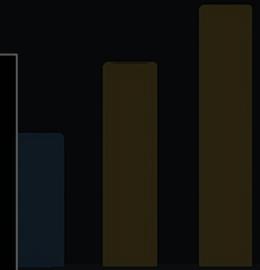
- Avoid useless bling



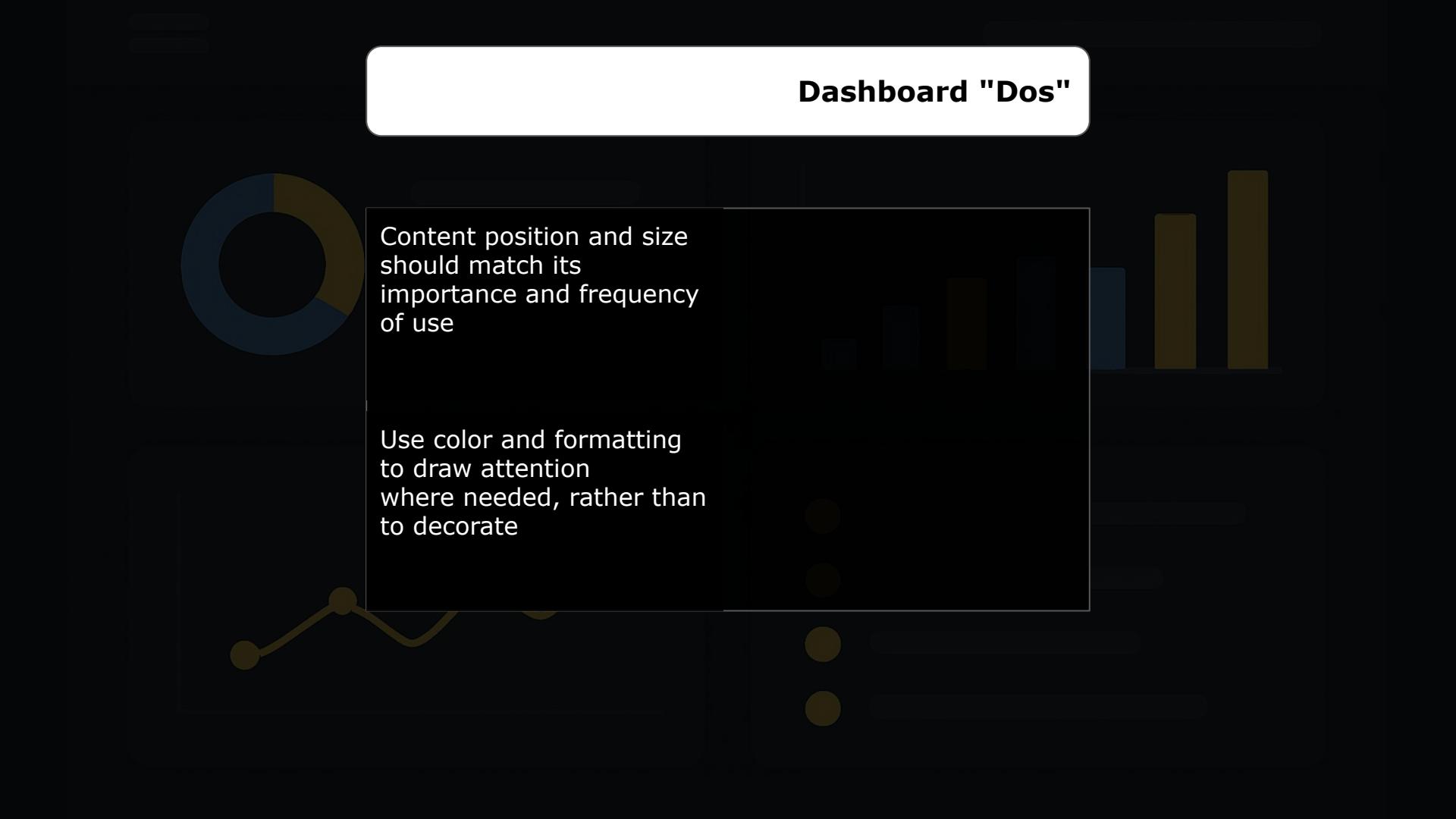
Dashboard "Dos"



Content position and size
should match its
importance and frequency
of use



Dashboard "Dos"



Content position and size should match its importance and frequency of use

Use color and formatting to draw attention where needed, rather than to decorate

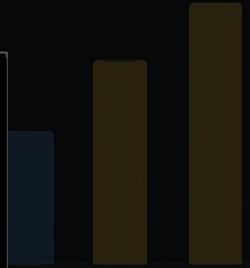
Dashboard "Dos"



Content position and size should match its importance and frequency of use

Use color and formatting to draw attention where needed, rather than to decorate

Visually associate data and content that is related



Dashboard "Dos"

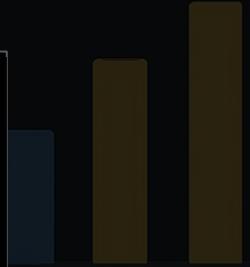


Content position and size should match its importance and frequency of use

Use color and formatting to draw attention where needed, rather than to decorate

Visually associate data and content that is related

Use the needs of the user to drive the layout, rather than forcing layout with an inflexible grid (note: this is a consideration when choosing tools)



Dashboard "Dos"



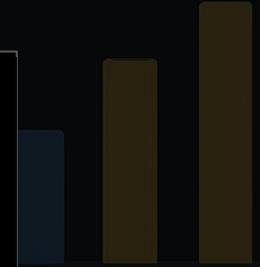
Content position and size should match its importance and frequency of use

Visually associate data and content that is related

When deciding on placement, consider how the eye will scan the page...

Use color and formatting to draw attention where needed, rather than to decorate

Use the needs of the user to drive the layout, rather than forcing layout with an inflexible grid (note: this is a consideration when choosing tools)

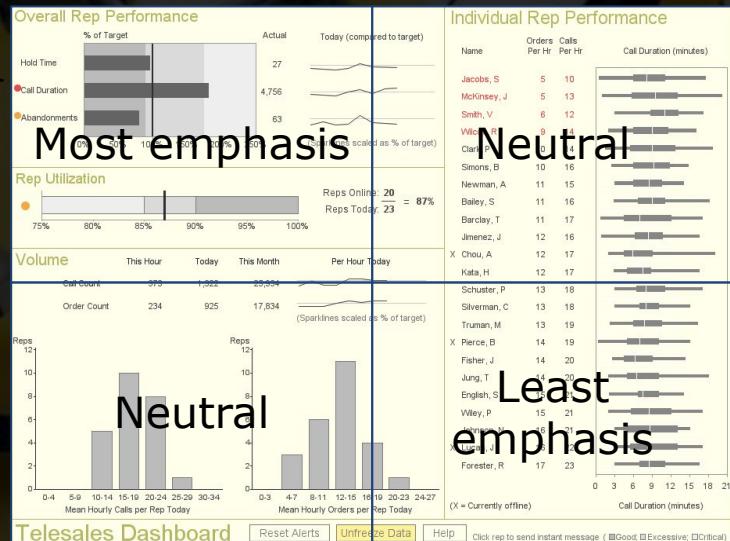


Eye tracking results: for Dashboards

| | | | |
|--|---------------|----------------|--|
| | Most emphasis | Neutral | |
| | Neutral | Least emphasis | |

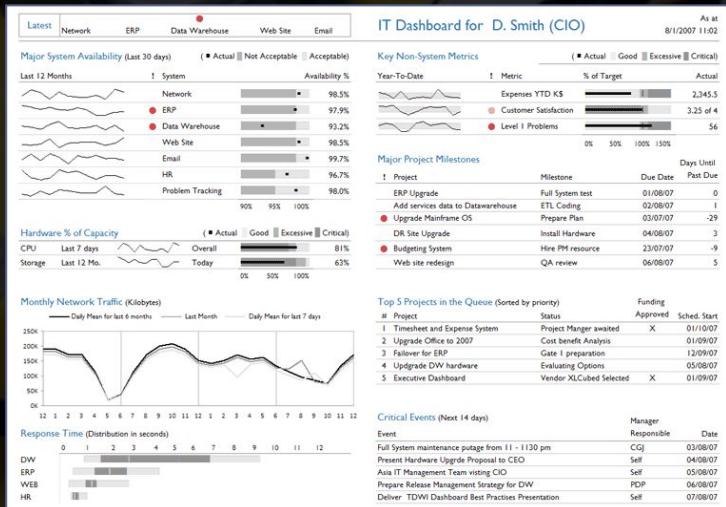
Example: Sales Team Dashboard

The most important information about overall rep performance is in the top left quadrant.



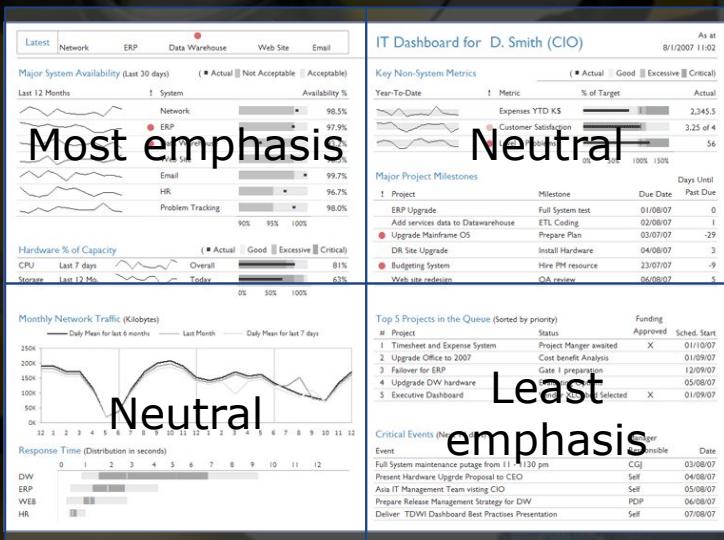
Example: Sales Team Dashboard

The most important information about overall rep performance is in the top left quadrant.



Example: CIO Dashboard

Critical information:
“System Availability”



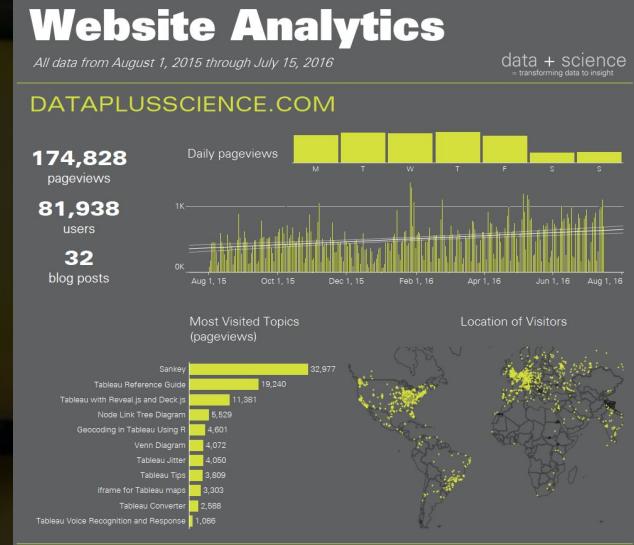
The neutral areas are filled with non-system metrics and overall monthly network traffic.

Neutral

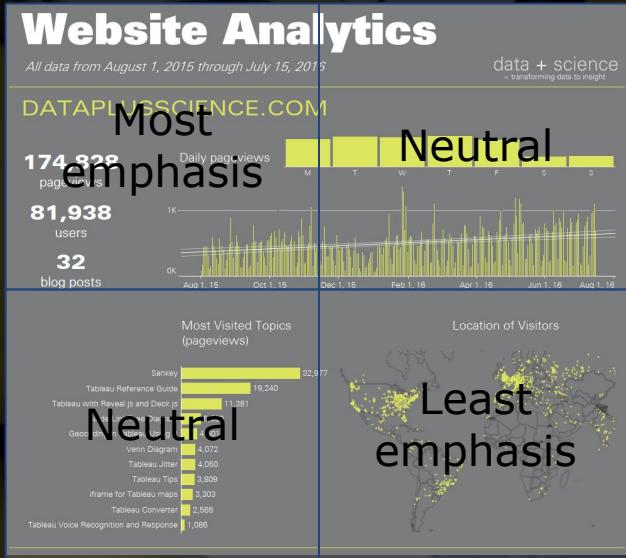
Least
emphasis

The least important information are the project status updates.

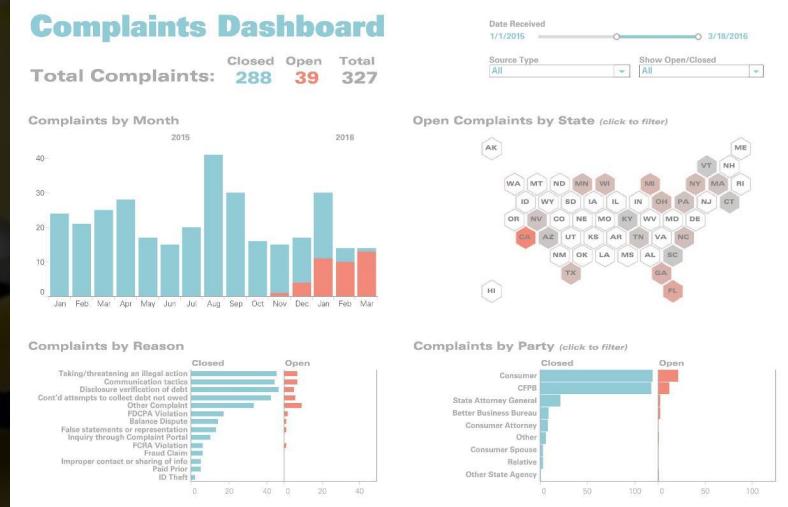
Example: Website Dashboard



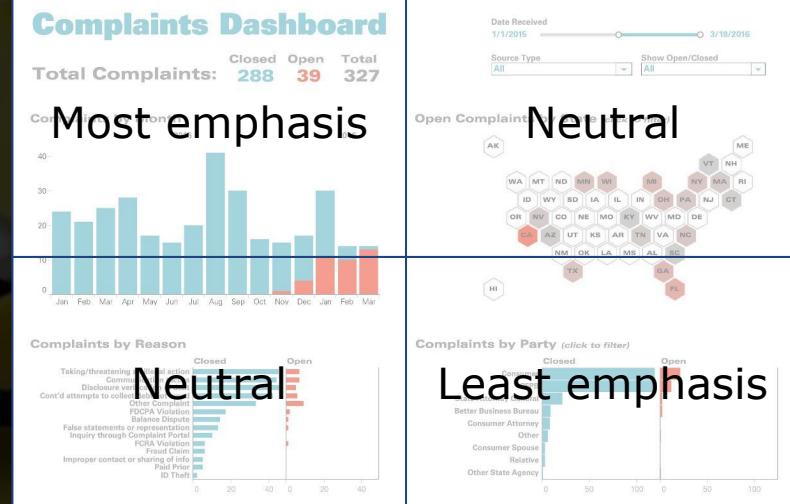
Example: Website Dashboard



Example: Complaints Dashboard



Example: Complaints Dashboard



Neutral

Least emphasis

Dashboards **MUST** show actionable insights!

Rules for Actionable Visualizations

1. The question to answer must be identifiable

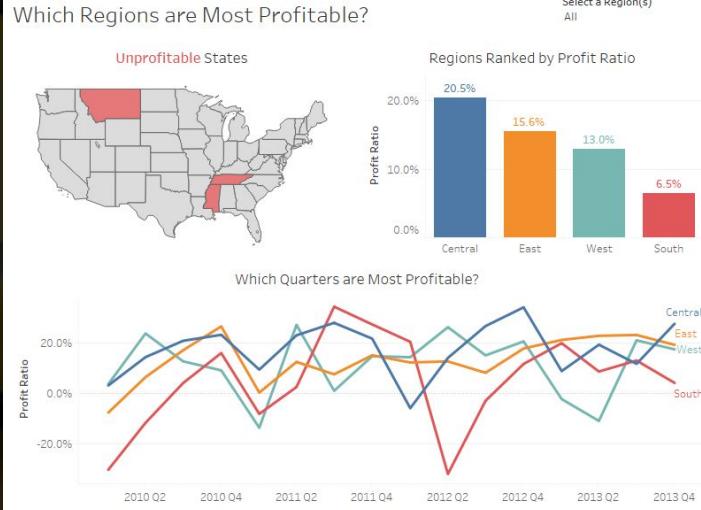
Articulate the question you wish to answer and write it out:

"I want to know who my best customers are."

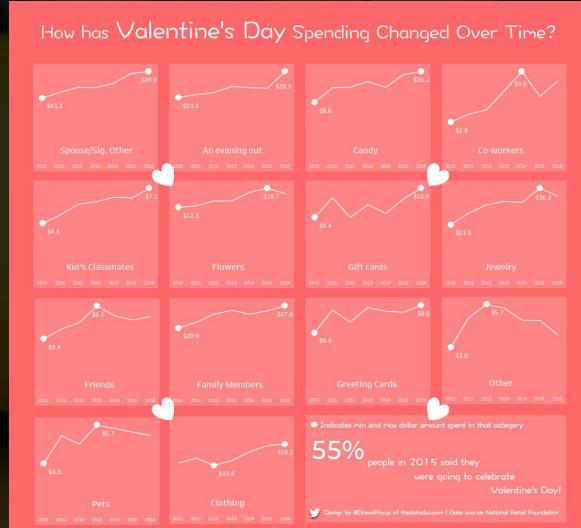
"I need to be able to identify customers at risk."

"How is our sales team performing against its goals?"

The question to answer must be identifiable



The question to answer must be identifiable



The question to answer must be identifiable



Dashboards MUST show actionable insights!

Rules for Actionable Visualizations

2. The data needed must be available

In some cases, you may need to create it, based on conditions in the data you already have, or by bringing in additional data from another source.



Dashboards MUST show actionable insights!

Rules for Actionable Visualizations

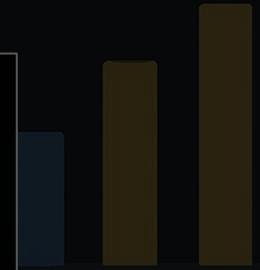


3. The visualization should be tailored to the person who will use the information

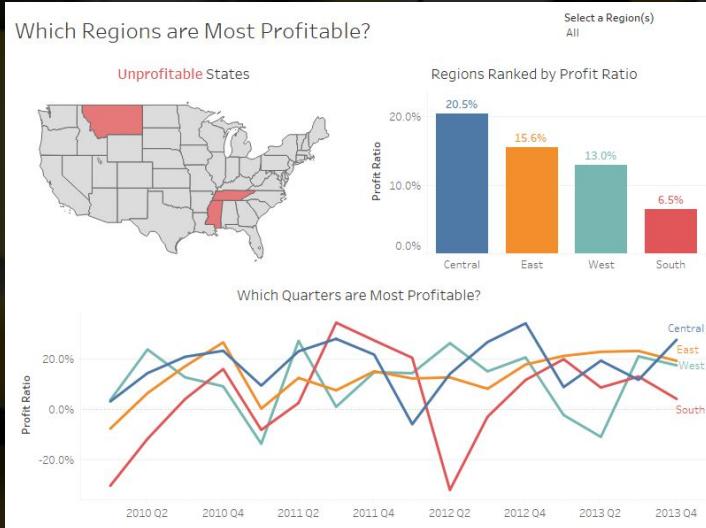
Your audience may be "the general public" but in other cases, it's the VP of Finance. You may discover you need more than one to cover all levels of the organisation!

4. The story uncovered in the visualization should be evident

The viewer should not need an advanced degree in statistics to interpret the visualization, or have to make leaps of logic to understand what the data really means.



The story uncovered in the visualization should be evident

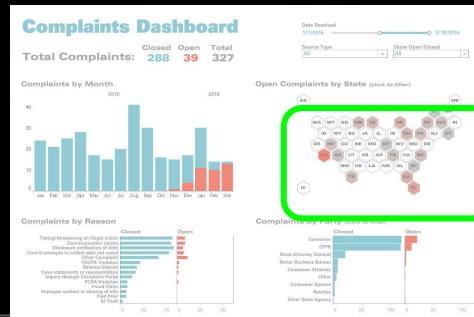


Dashboards MUST show actionable insights!

Rules for Actionable Visualizations

5. The action required should be clear

Framed by the original question, this answers "what do I need to do?" based on the findings.



Interactive provides drill down.



