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Introduction to Data Analysis

DATA VISUALIZATION BASICS

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[with files from Stephen Davies | DAVHILL]

> “Discovery is no longer limited by the collection and processing of data, but rather management, analysis, and visualization.”

@DamianMingle

INFOGRAPHICS

Created for **story-telling** purposes (**subjective**)

Intended for a **specific** audience

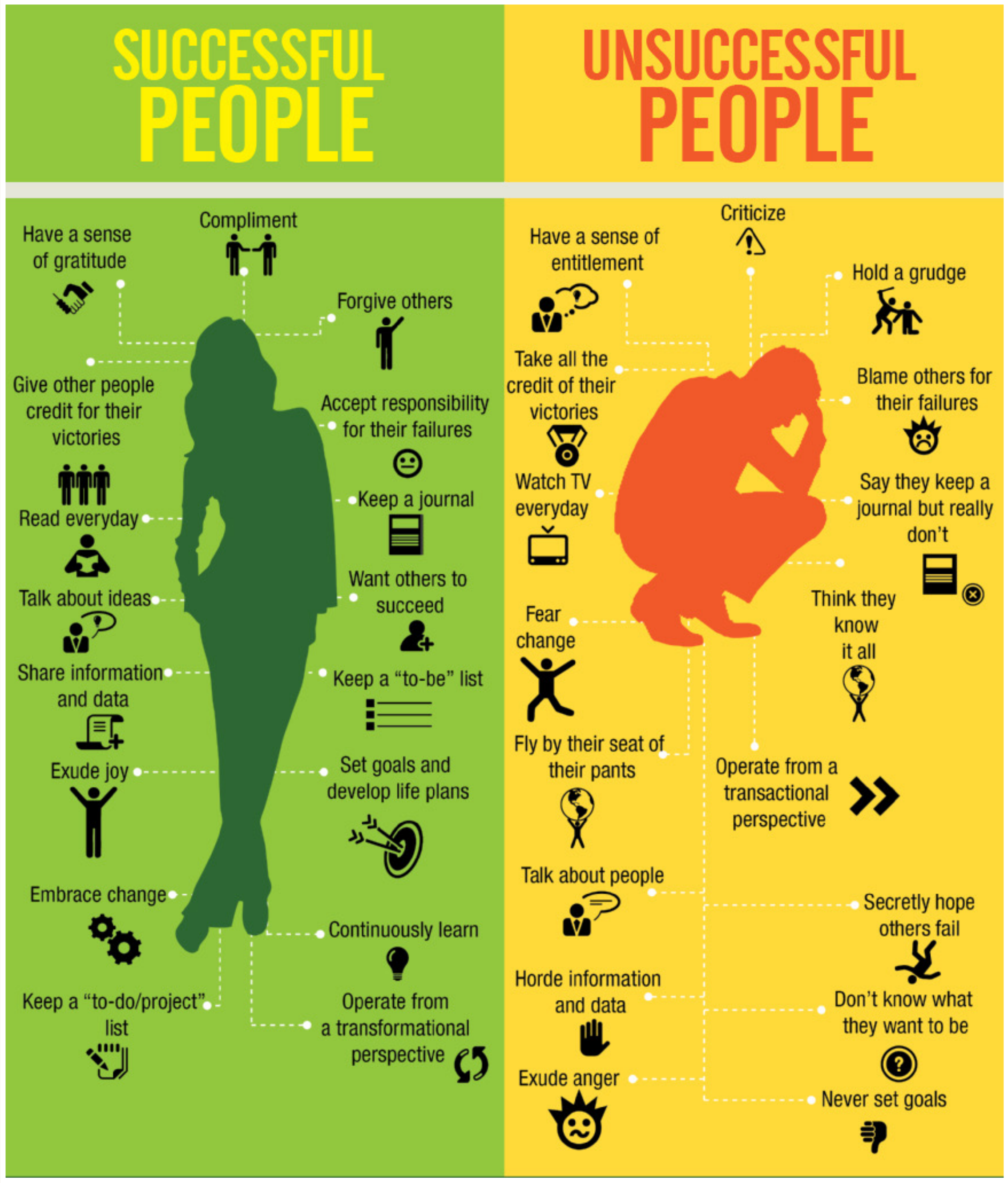
Self-contained and discrete

Graphic design aspect is key

Cannot usually be re-used with other data

Can incorporate **unquantifiable** information

[J.P. Blackard]



SUCCESSFUL PEOPLE

Have a sense of gratitude

Compliment

Forgive others

Give other people credit for their victories

Accept responsibility for their failures

Read everyday

Keep a journal

Talk about ideas

Want others to succeed

Share information and data

Keep a "to-be" list

Exude joy

Set goals and develop life plans

Embrace change

Continuously learn

Keep a "to-do/project" list

Operate from a transformational perspective

UNSUCCESSFUL PEOPLE

Have a sense of entitlement

Criticize

Hold a grudge

Take all the credit of their victories

Blame others for their failures

Watch TV everyday

Say they keep a journal but really don't

Fear change

Think they know it all

Fly by their seat of their pants

Operate from a transactional perspective

Talk about people

Secretly hope others fail

Horde information and data

Don't know what they want to be

Exude anger

Never set goals

[Author unknown]

DATA VISUALIZATION

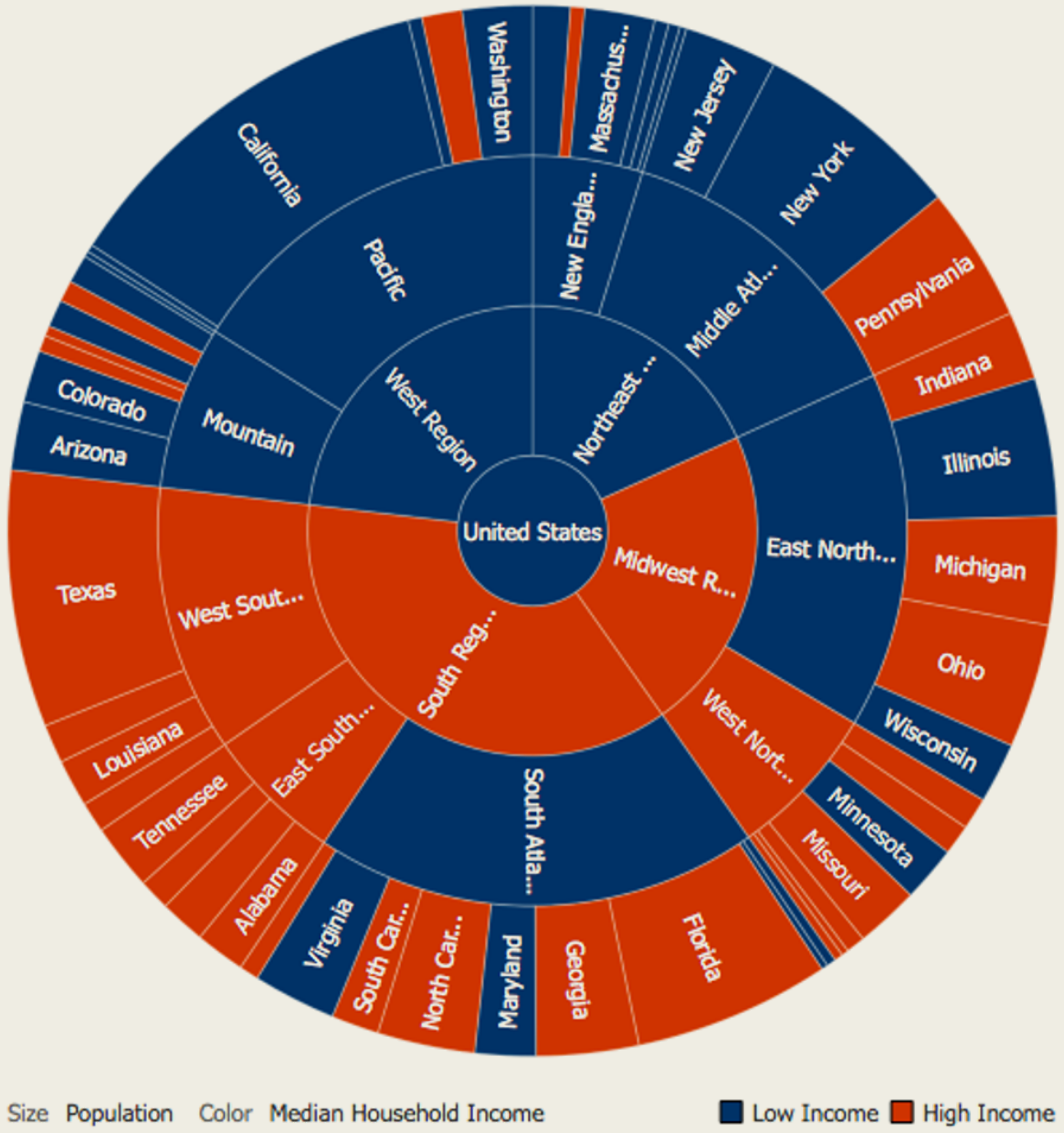
A **method**, as well as an item (**objective**)

Typically focuses on the **quantifiable**

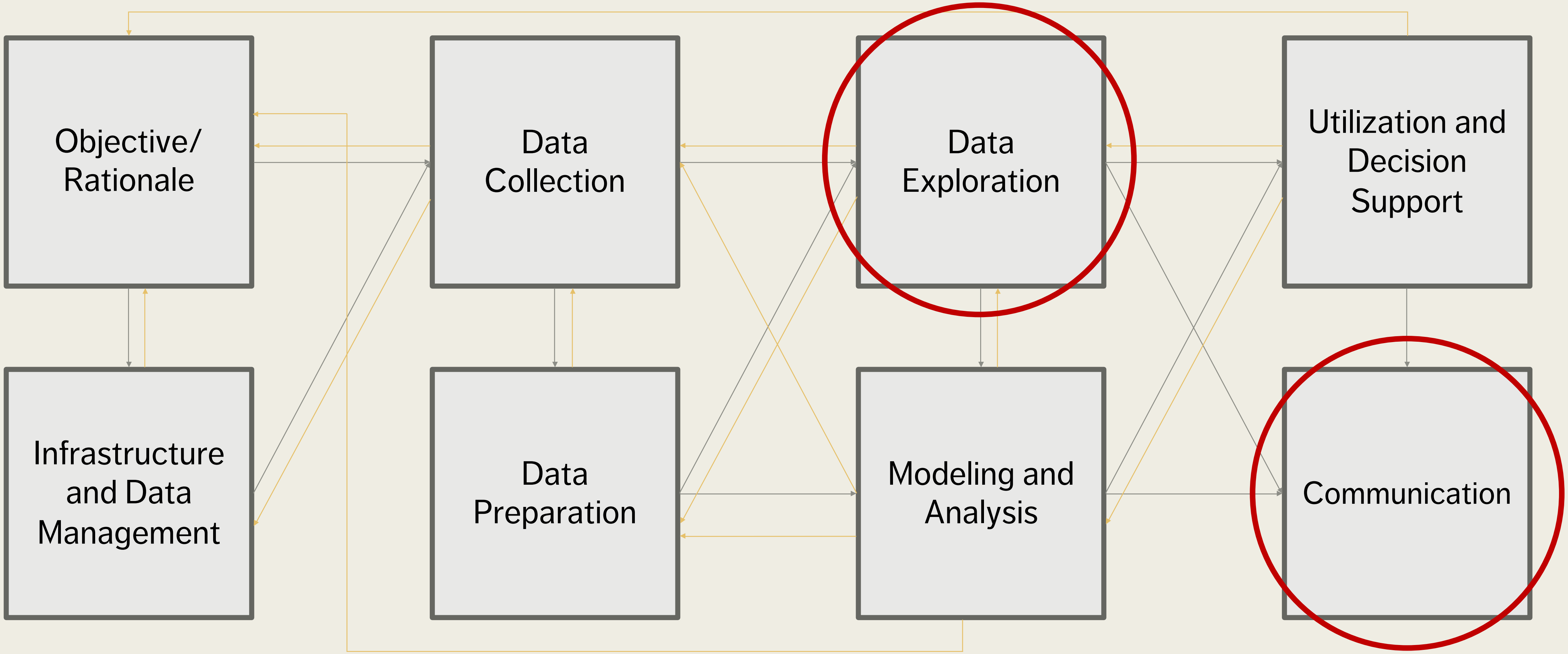
Used to make sense of the data or to make it **accessible** (datasets can be massive and unwieldy)

May be generated automatically

The look and feel are less important than the **insights conveyed** by the data



THE (MESSY) ANALYSIS PROCESS



PRE-ANALYSIS DATA VISUALIZATION

DATA VISUALIZATION BASICS

SOME BASIC QUESTIONS

What system does your data represent – objects, attributes, relationships?

How does it represent this system – i.e. the data model?

Who made this dataset? When? For what purpose?

Assuming a flat file – what do the rows represent? What do the columns represent?

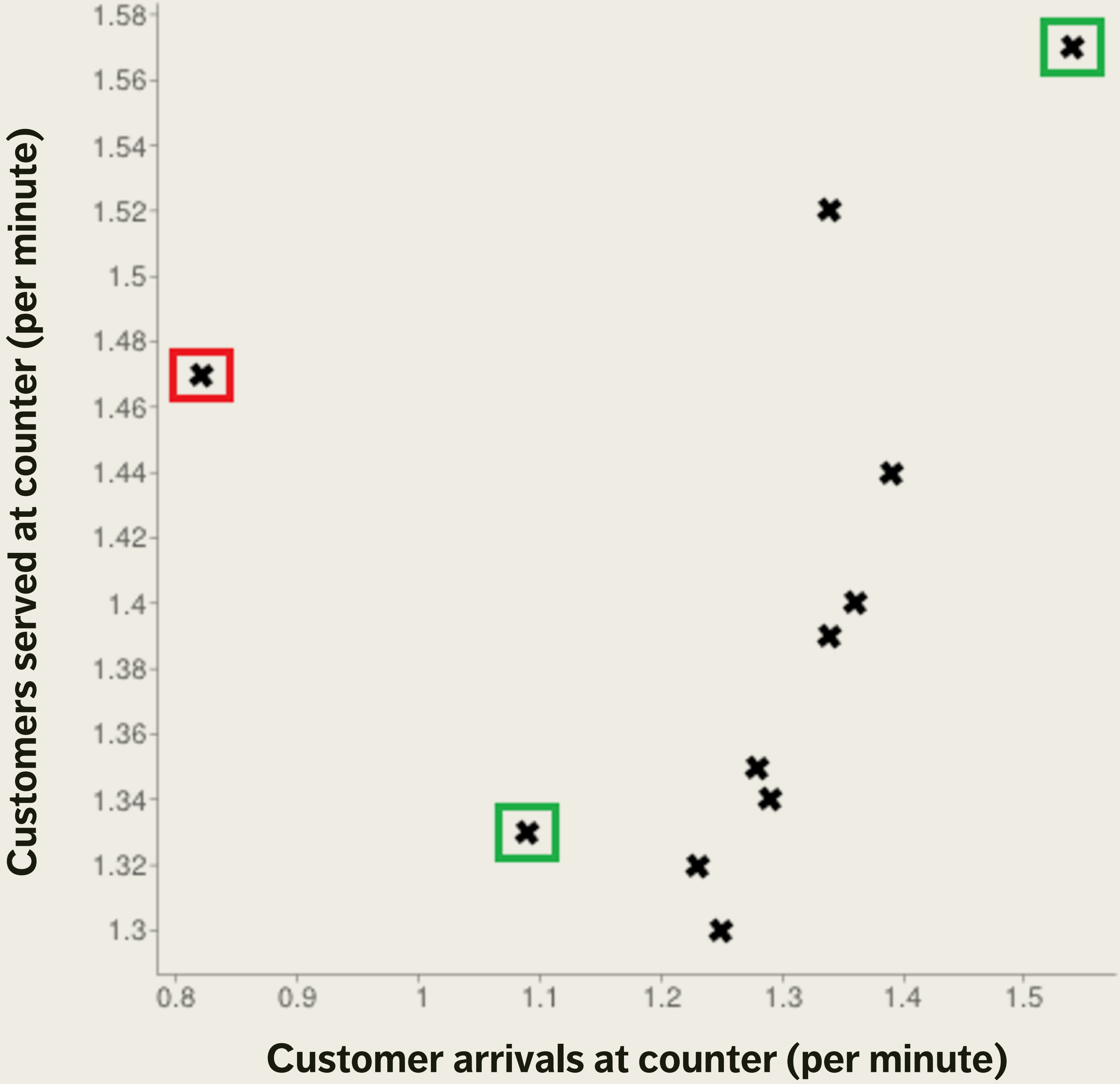
Do you even have enough information (e.g. **metadata**) to answer these questions? Where can you find more information?

PRE-ANALYSIS USE

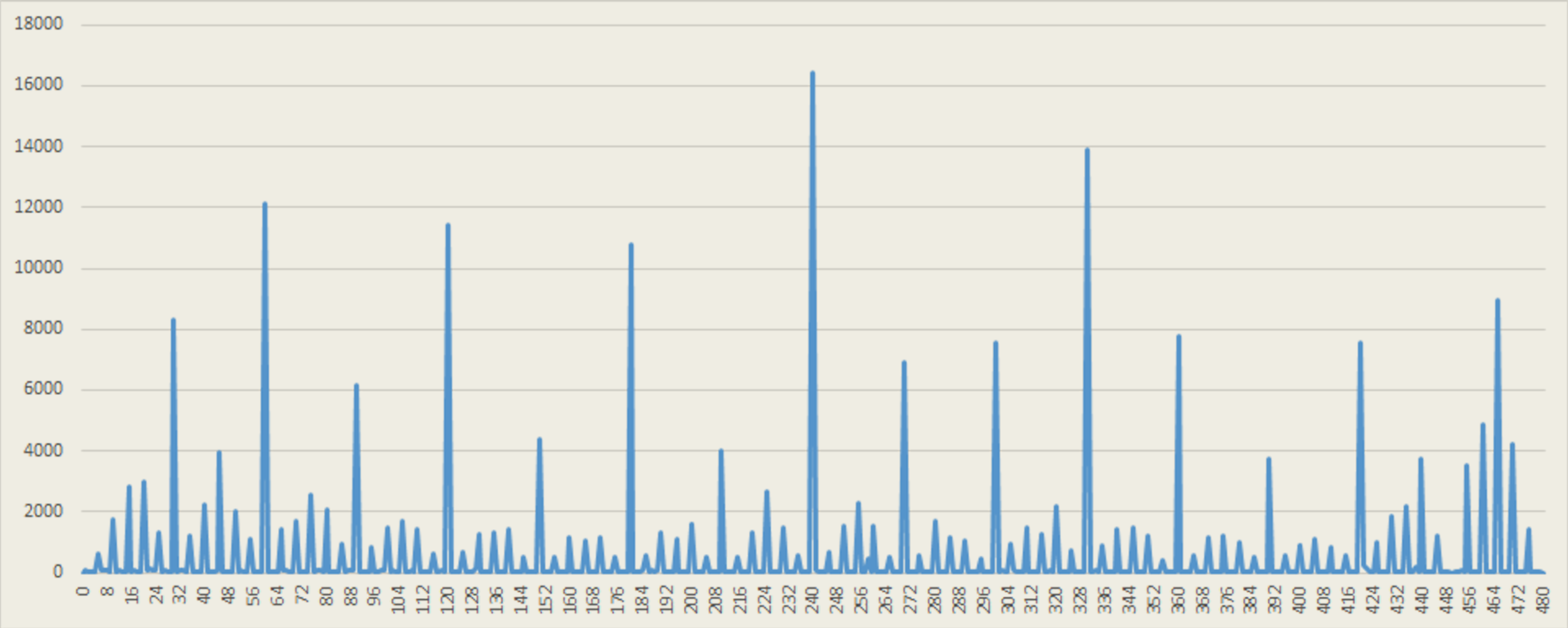
Data visualization can be used to set the stage for analysis:

- **detecting anomalous entries**
  invalid entries, missing values, outliers
- **shaping the data transformations**
  binning, standardization, Box-Cox transformations, PCA-like transformations
- **getting a sense for the data**
  data analysis as an art form, exploratory analysis
- **identifying hidden data structure**
  clustering, associations, patterns informing the next stage of analysis

[Personal dataset]

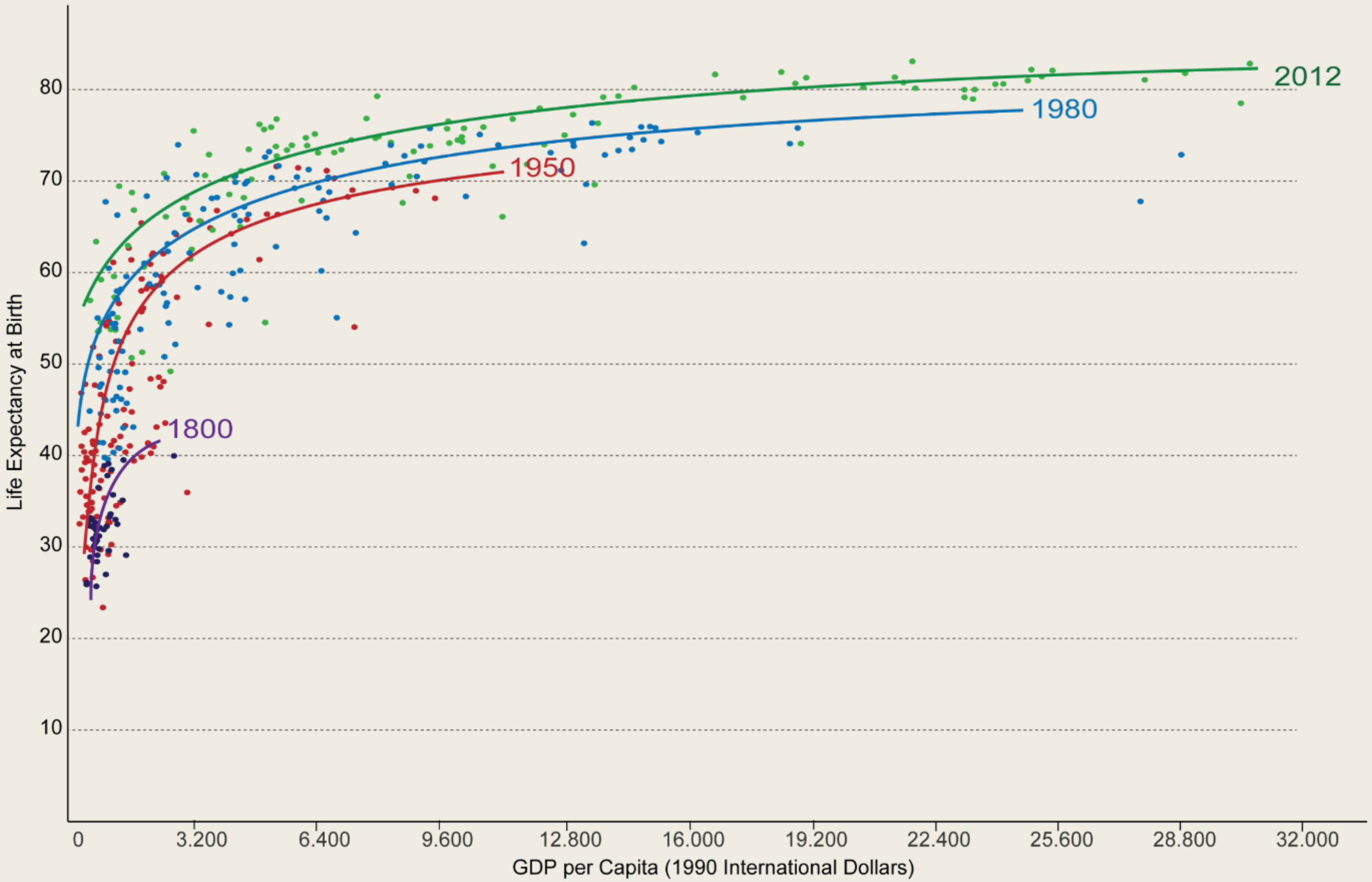


[Personal dataset]



Self-reported work hours (mins)

[https://ourworldindata.org/life-expectancy]



Our World in Data

Life Expectancy vs. GDP per Capita from 1800 to 2012 – by Max Roser

GDP per capita is measured in International Dollars. This is a currency that would buy a comparable amount of goods and services a U.S. dollar would buy in the United States in 1990. Therefore incomes are comparable across countries and across time.

Data sources: Data on life expectancy are from Gapminder.org; data on GDP per capita are from the 'New Maddison Project Database'.
The interactive data visualisation is available at OurWorldinData.org. There you find the raw data and more visualisations on this topic.

This graph displays the **correlation** between life expectancy and GDP per capita.

Countries with higher GDP have, **in general**, a higher life expectancy.

The relationship seems to follow a **logarithmic trend**: the unit increase in life expectancy per unit increase in GDP decreases as GDP per capita increases.

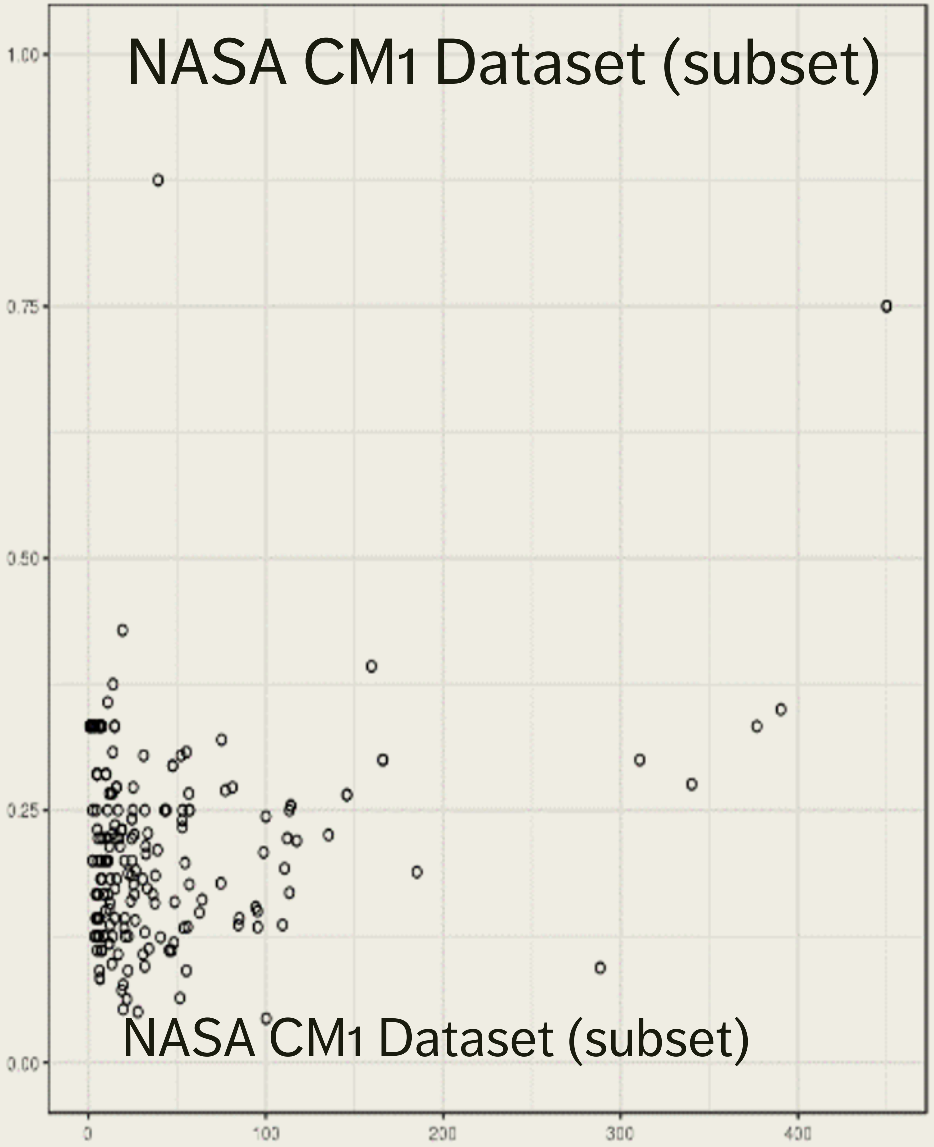
[http://promise.site.uottawa.ca/SERepository/datasets/cm1.arff]

REPRESENTING OBSERVATIONS

2 variables can be represented by position in the plane.

Additional factors can be depicted through:

- size
- color
- value
- texture
- line orientation
- shape
- (motion?)



NASA CM1 Dataset (subset)

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[http://promise.site.uottawa.ca/SERepository/datasets/cm1.arff]

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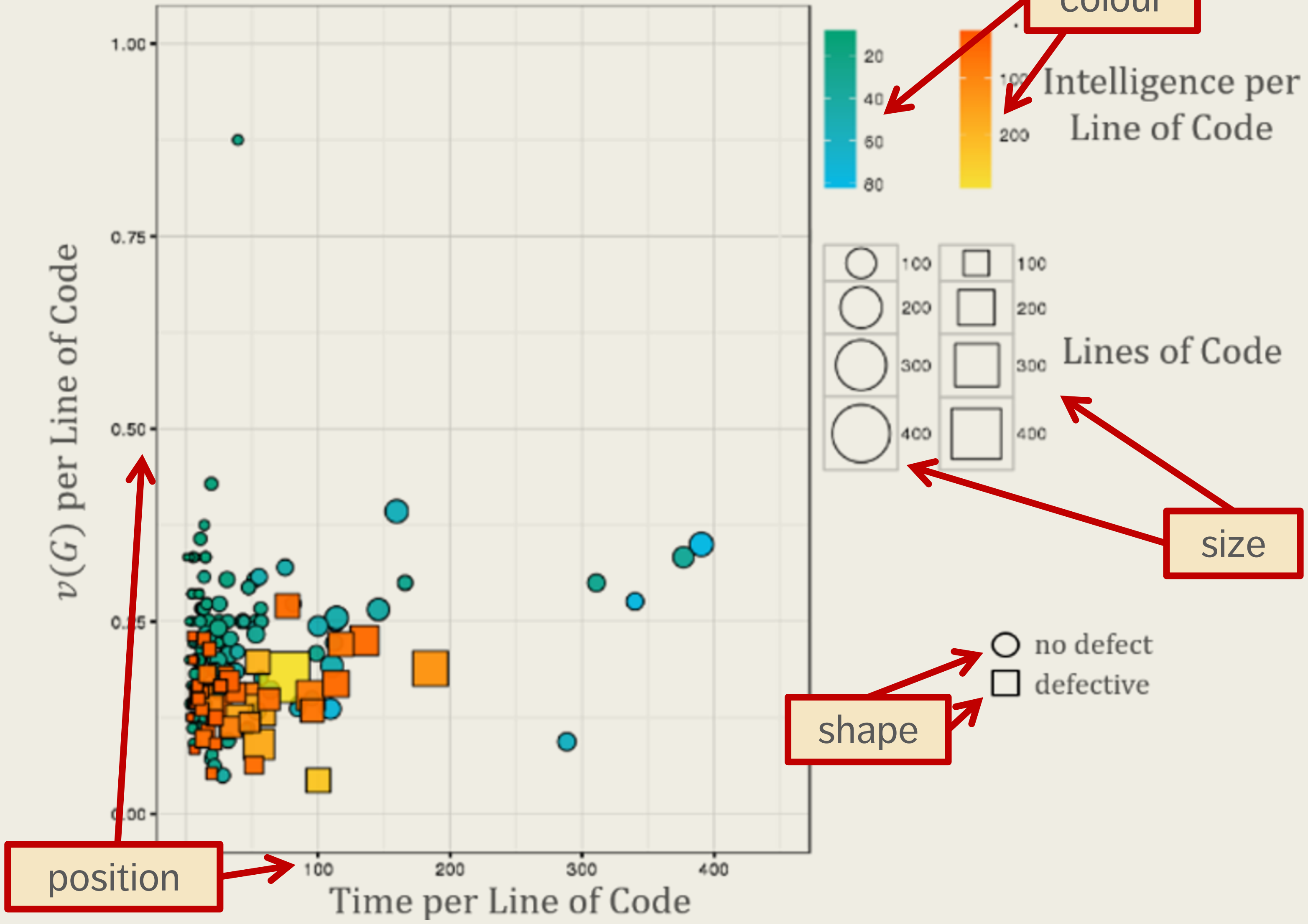


colour

size

shape

position

WORKHORSE VISUALIZATIONS

Line Chart/Rug Chart/Number Line

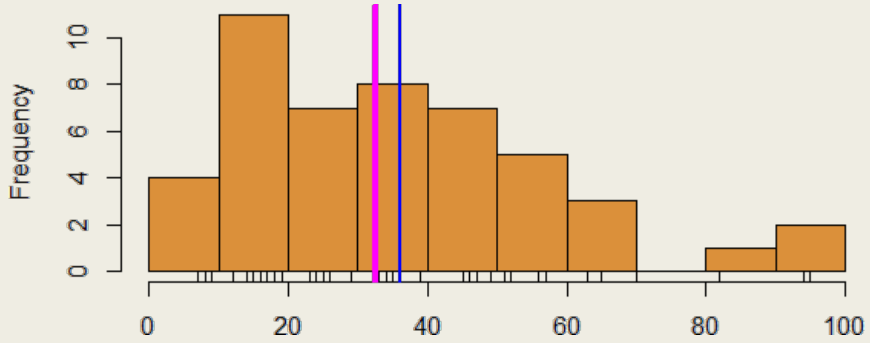
Histogram

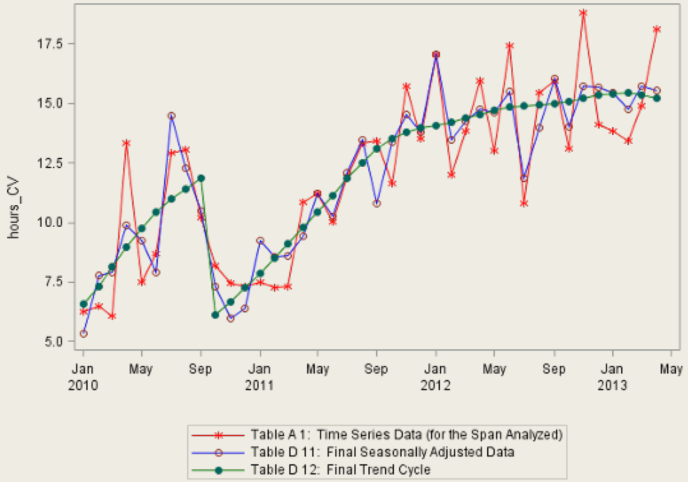
Line Graph

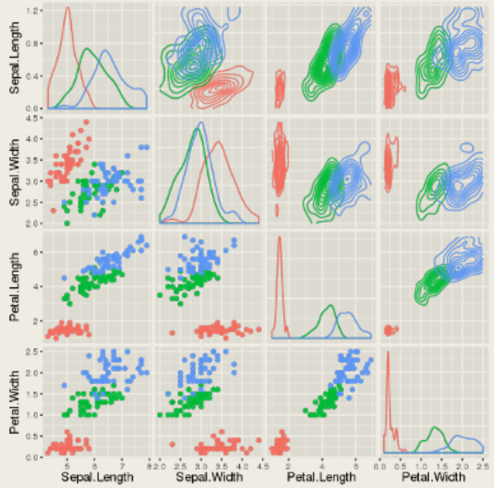
Boxplot

Bar Chart

Scatterplot







POST-ANALYSIS DATA VISUALIZATION

DATA VISUALIZATION BASICS

[E. Tufte, *Beautiful Evidence*]

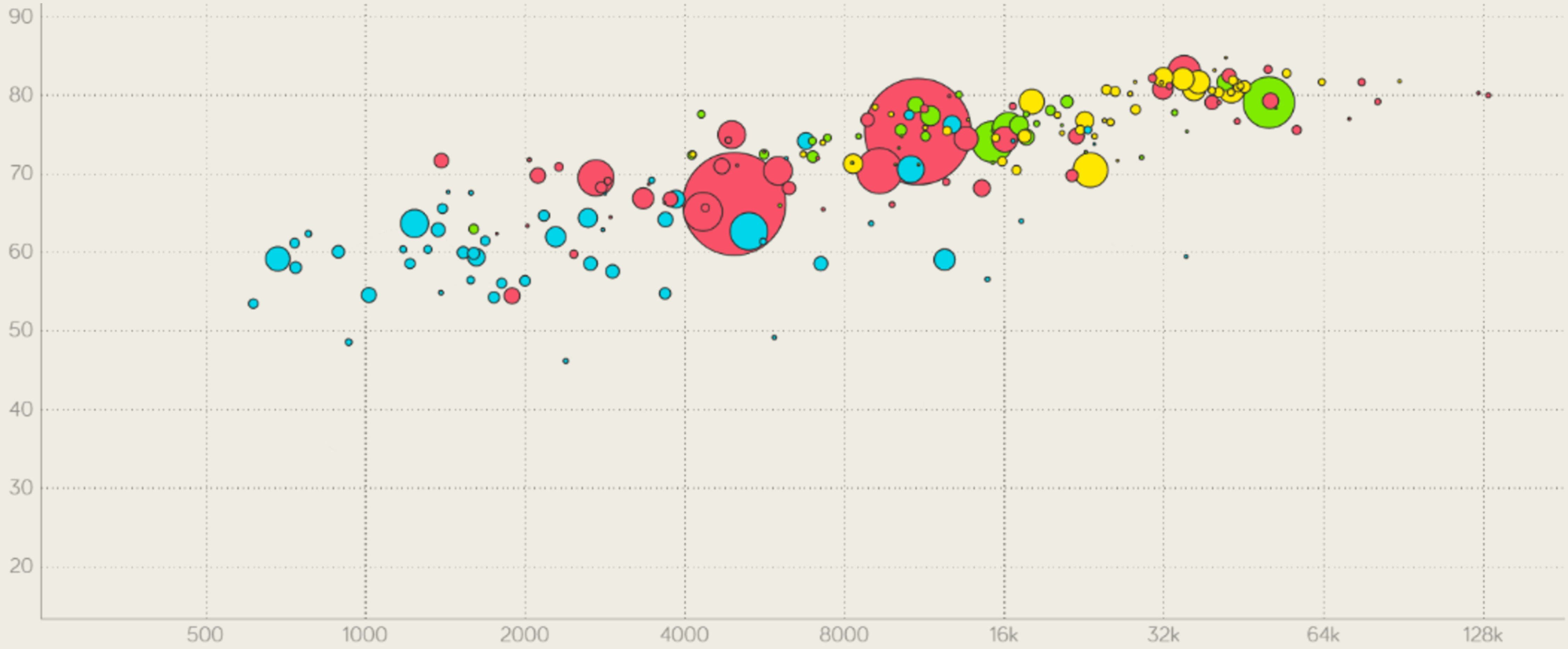
FUNDAMENTAL PRINCIPLES OF ANALYTICAL DESIGN

Reasoning and communicating our thoughts are intertwined with our lives in a causal and dynamic multivariate Universe.

Symmetry to visual displays of evidence: consumers should be seeking exactly what producers should be providing, namely

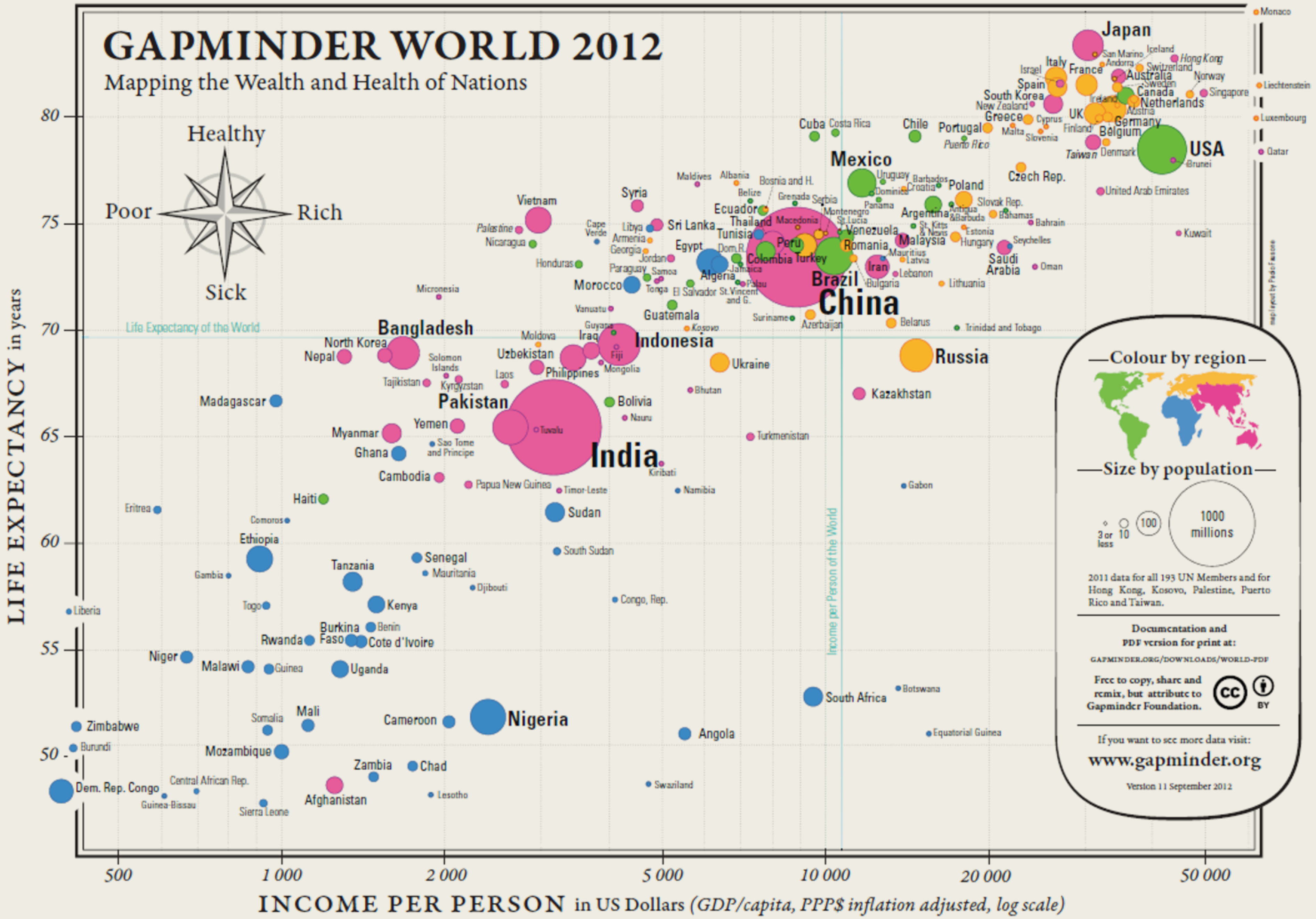
- meaningful comparisons
- causal networks and underlying structure
- multivariate links
- integrated and relevant data
- honest documentation
- primary focus on content

[Gapminder Foundation]



Non-Integrated Data

[Gapminder Foundation, https://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen]



2011 data for all 193 UN Members and for Hong Kong, Kosovo, Palestine, Puerto Rico and Taiwan.

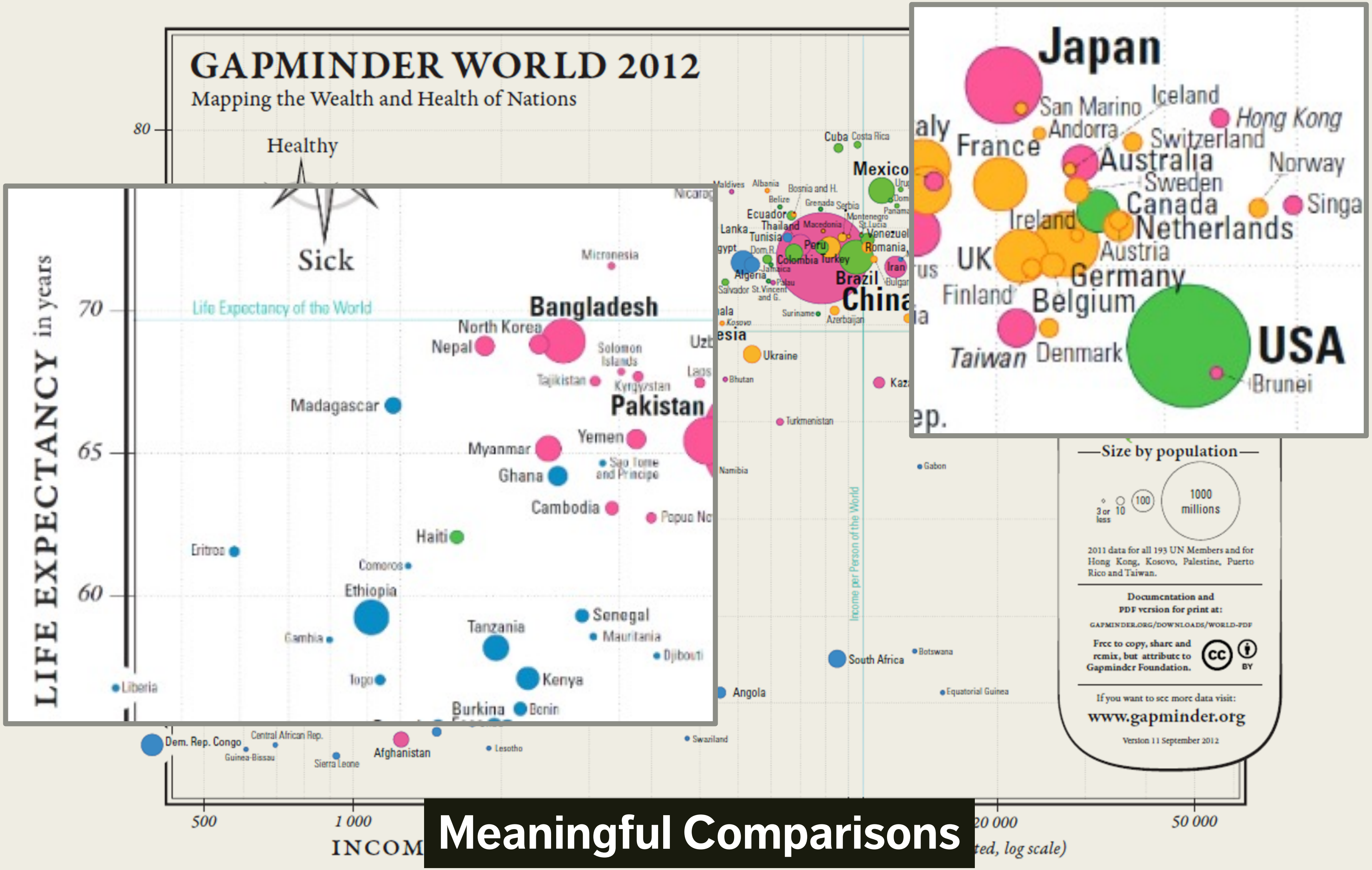
Documentation and PDF version for print at:
GAPMINDER.ORG/DOWNLOADS/WORLD-PDF

Free to copy, share and remix, but attribute to Gapminder Foundation.

If you want to see more data visit:
www.gapminder.org

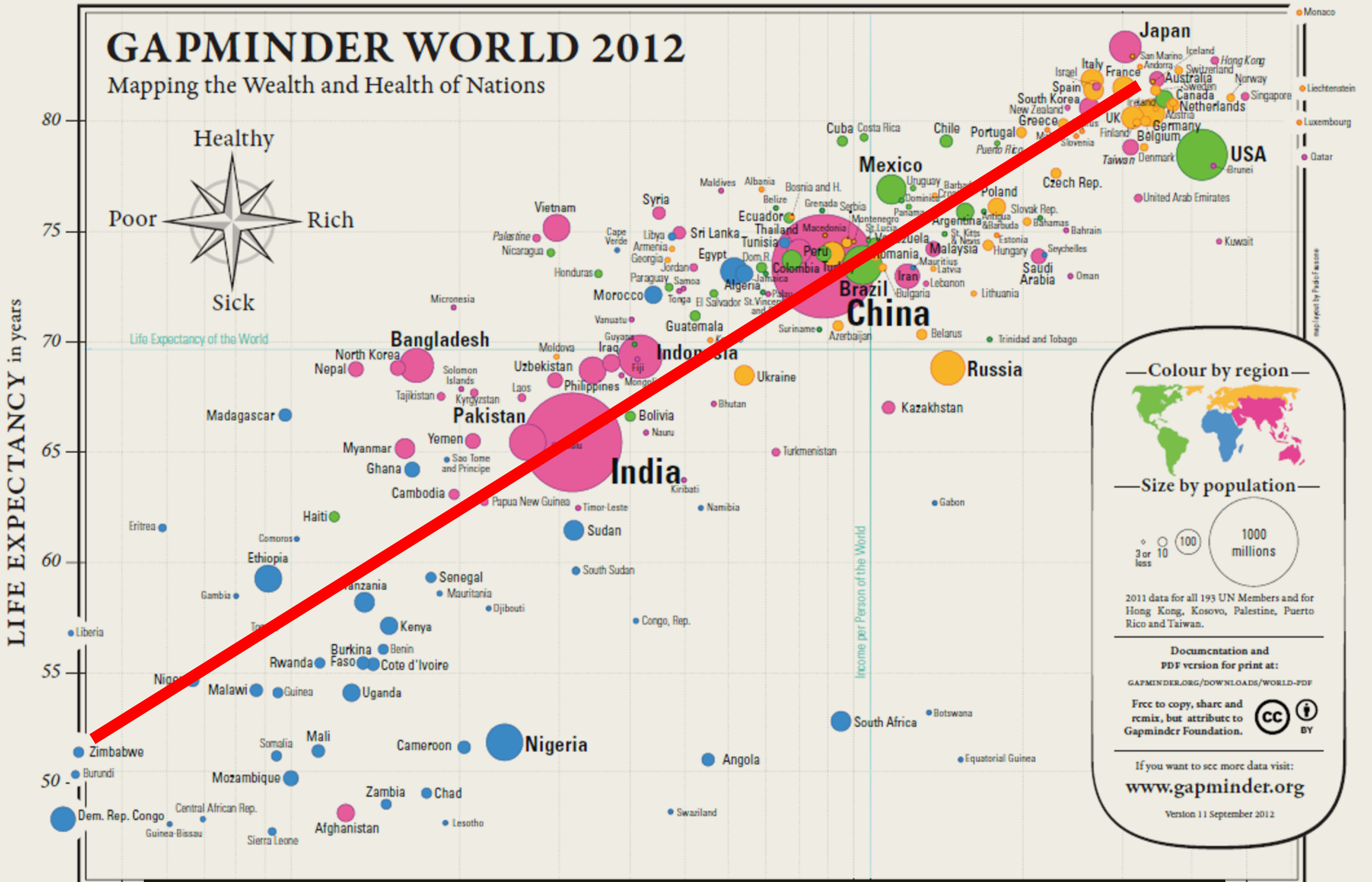
Version 11 September 2012

[Gapminder Foundation, https://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen]



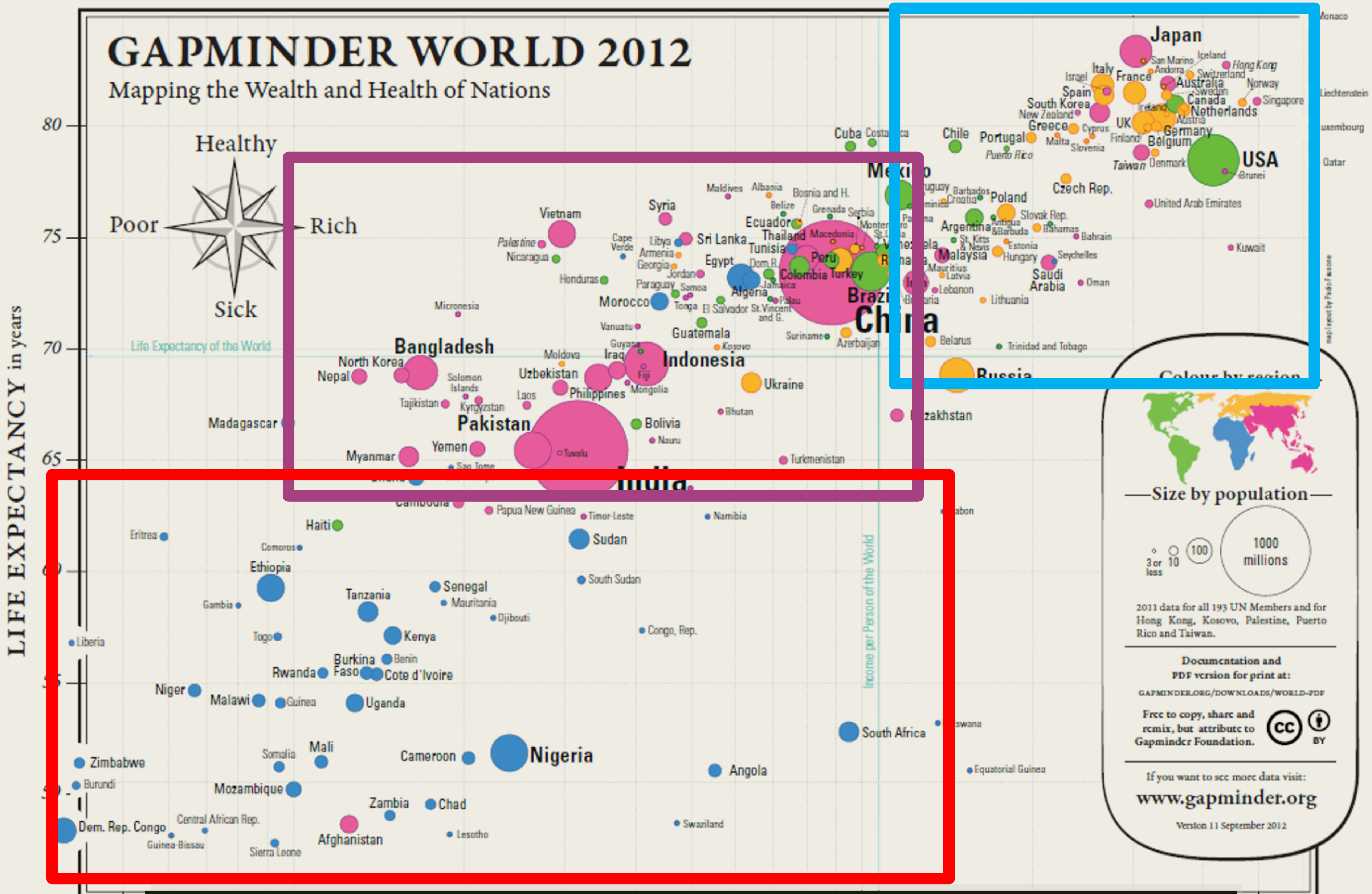
Meaningful Comparisons

[Gapminder Foundation, https://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen]



Underlying Structure and Multivariate Links

[Gapminder Foundation, https://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen]



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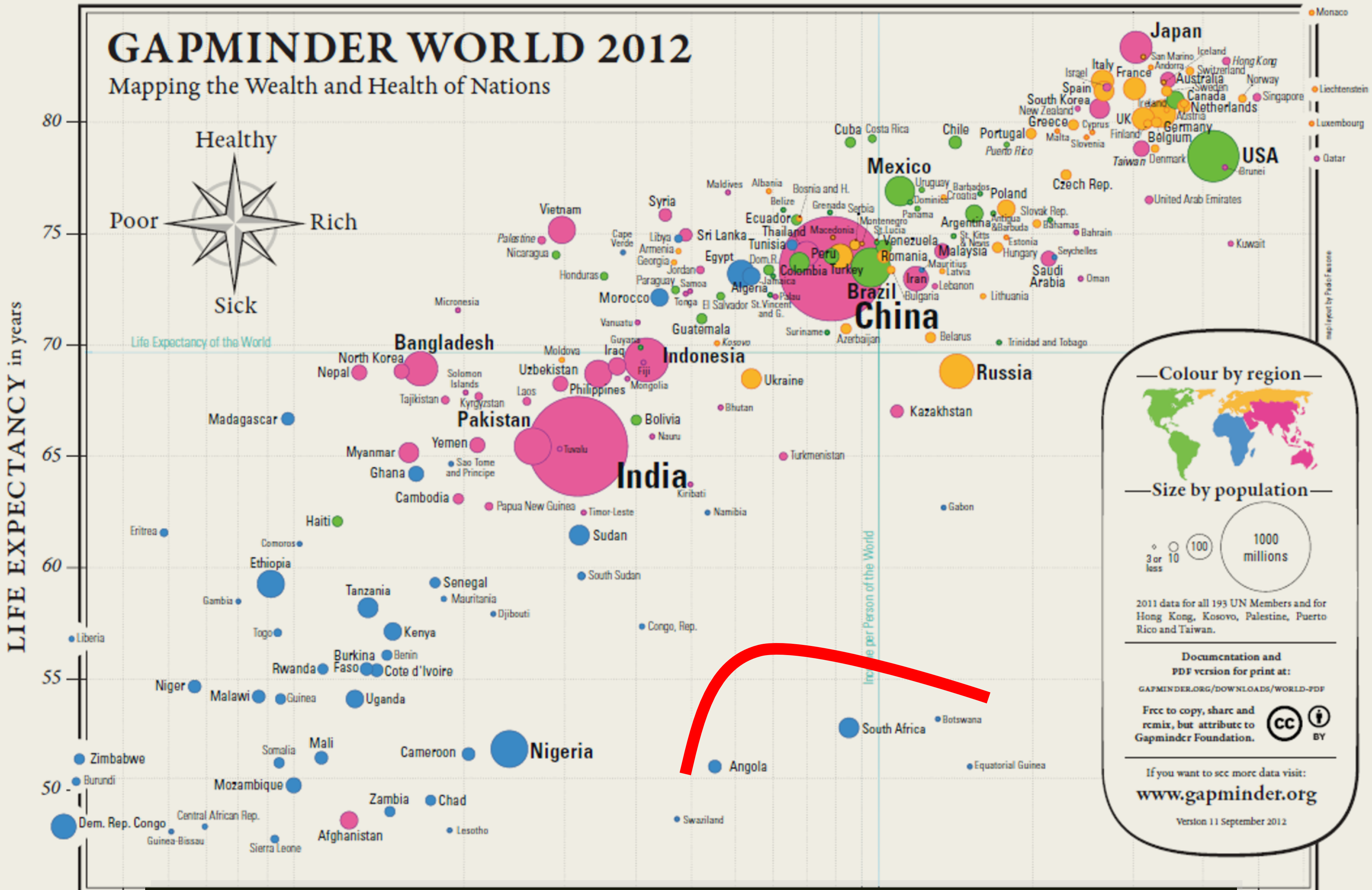

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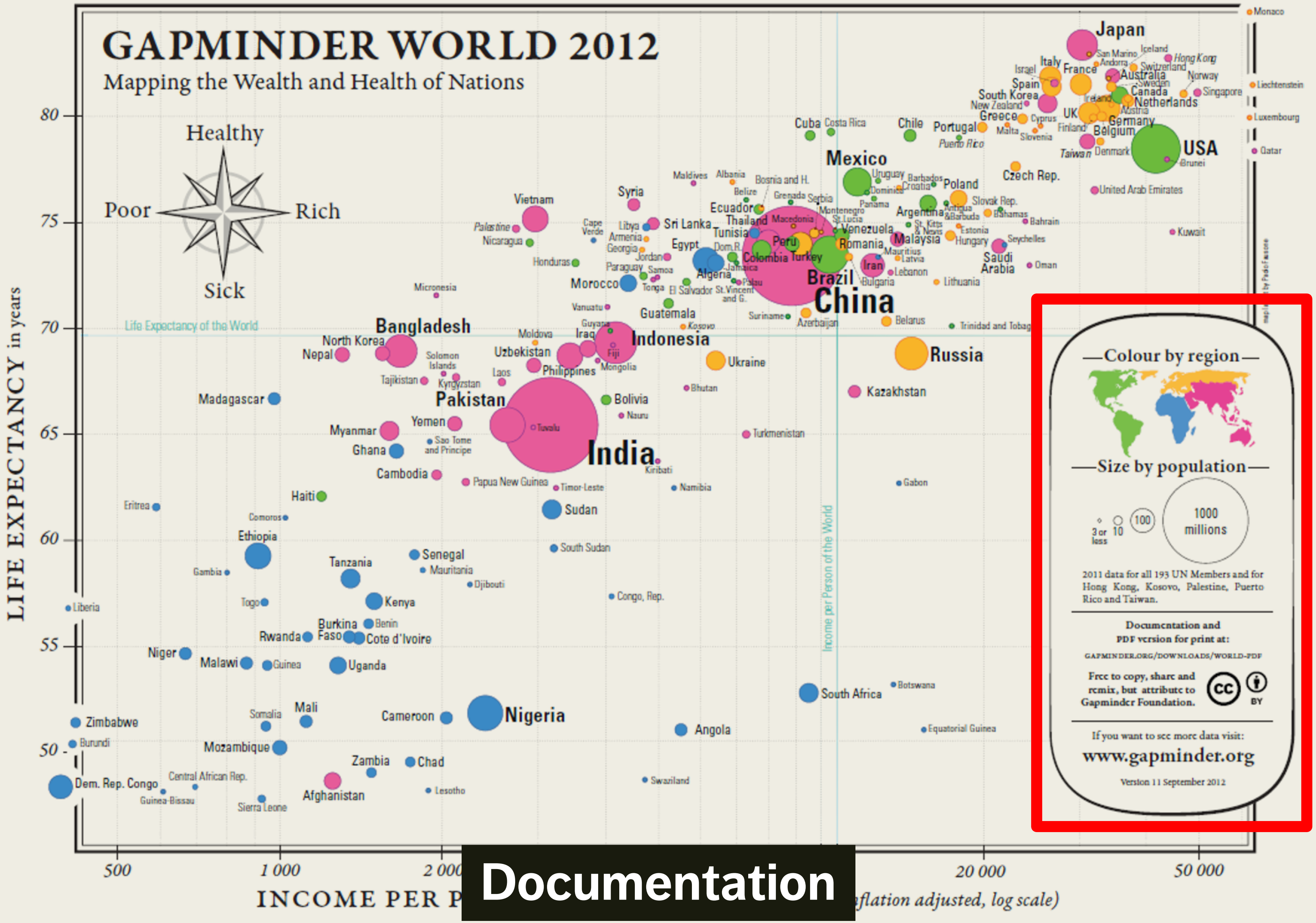

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www.gapminder.org

Version 11 September 2012

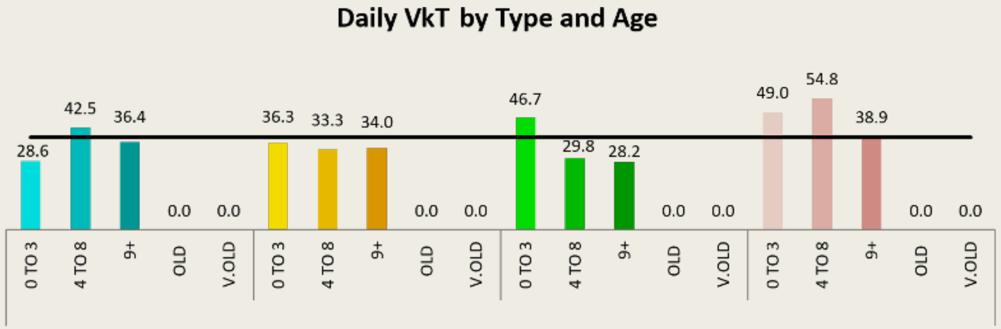
Documentation

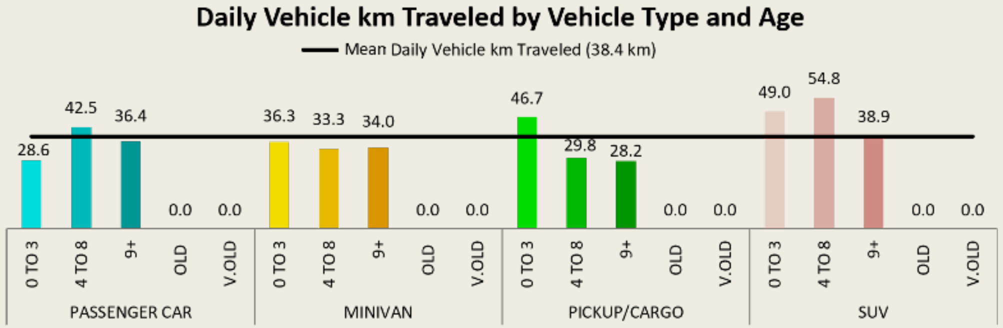
[http://flowingdata.com/tag/pitfalls]

BASIC RULES

1. Check the data
outliers, spikes, anomalies

2. Explain encoding
don't assume the reader knows what everything means





3. Label axes
knowing the scale is important

[http://flowingdata.com/tag/pitfalls]

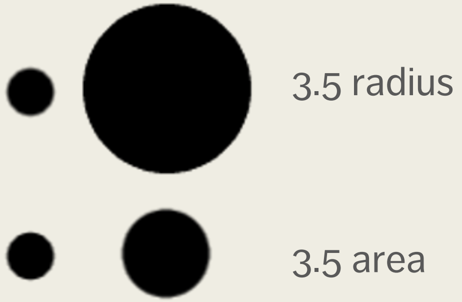
BASIC RULES

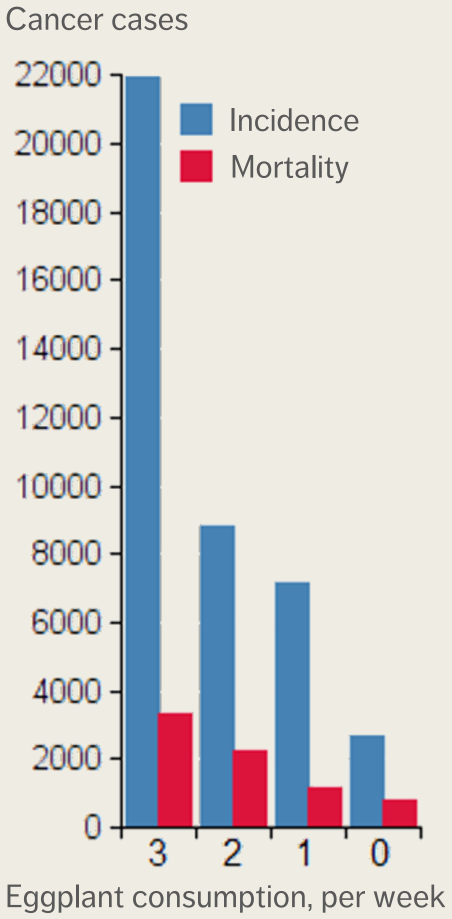
4. Include units
eliminate the need for guesswork

5. Keep your geometry in check
circles and 2D shape are sized by area, bar charts by length

6. Include your sources
protect yourself, and let those who want to dig deeper do so

7. Consider your audience
a poster can be wordy, a presentation should be minimalist





PRESENTING ANALYSIS RESULTS

Graphics should be clear and engaging.

Not every pretty picture tells a story, but if a story can't be told with pretty pictures, perhaps it’s time to re-think the story…

Graphical representation techniques appear regularly – it’s too early to tell which ones will stand the test of time.

Don’t be afraid to try something new if it helps **convey the message**.

[http://dataphys.org/list/]

A WORD ABOUT ACCESSIBILITY

Charts cannot usually be translated to Braille. Describing the features and emerging structures in a visualization is a possible solution… **if they can be spotted.**

Analysts must produce clear and meaningful visualizations, but they must also describe them and their features in a fashion that allows all to "see" the insights. This requires analysts to have “seen” all the insights, which is not always possible.

Conditions: colourblindness, low vision, motor impairment, cognitive disability, ADHD, etc.

Best Practices: high contrast text/elements, zoom/magnifications, keyboard navigation, assistive design, short summaries, undo/redo functionality, etc. [F. Elavsky]

A WORD ABOUT ACCESSIBILITY

Data Perception:

- texture-based representations
- text-to-speech
- sound/music
- odor-based or taste-based representations (?!?)

Sonifications:

- TRAPPIST Sounds : TRAPPIST-1 Planetary System Translated Directly Into Music
- Listening to data from the Large Hadron Collider, L. Asquith

TAKE-AWAYS

Is the point getting across? Integrated data helps convey the message.

Adding design elements can enhance our understanding of the data.

How we spot patterns affect what we get out of data presentations.

Data displays are not just about picking a random visualization method. The result varies depending on the structure of the data and the (combinations of) questions.

VISUALIZATION CATALOGUE

DATA VISUALIZATION BASICS

DATA DISPLAYS

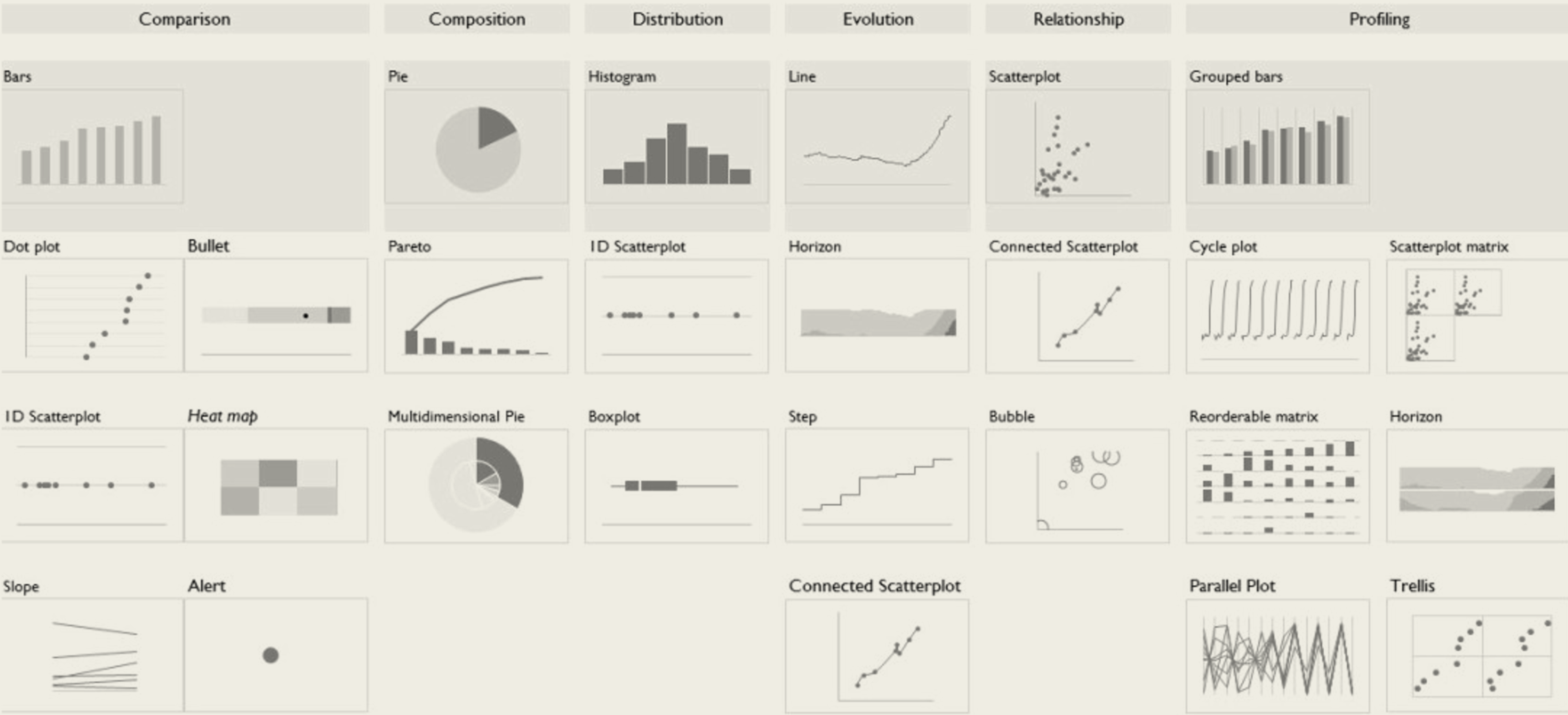
With data displays, we try to highlight:

1. a **relationship** (show a connection or correlation between two or more variables);
2. a **comparison** (set some variables apart from others, and display how those two variables interact);
3. a **composition** (collect different types of information that make up a whole and display them together), and
4. a **distribution** (lay out a collection of related or unrelated information to see how it correlates, if at all, and to understand if there's any interaction between the variables).

A CLASSIFICATION OF CHART TYPES

Data comparison charts

Data reduction charts



Comparison

- Bars
- Dot plot
- Bullet
- 1D Scatterplot
- *Heat map*
- Slope
- Alert

Composition

- Pie
- Pareto
- Multidimensional Pie

Distribution

- Histogram
- 1D Scatterplot
- Boxplot

Evolution

- Line
- Horizon
- Step
- Connected Scatterplot

Relationship

- Scatterplot
- Connected Scatterplot
- Bubble

Profiling

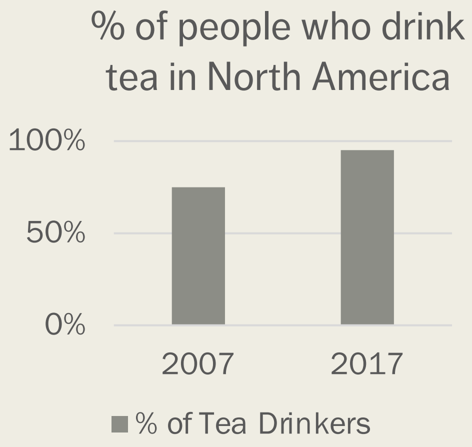
- Grouped bars
- Cycle plot
- Scatterplot matrix
- Reorderable matrix
- Horizon
- Parallel Plot
- Trellis

v 0.9

excelcharts.com

SIMPLE TEXT AND TABLES

One or two numbers to focus on may help “set the scene” and **draw focus** to an area of the report.



95% of the population drinks tea today compared to 75% in 2007

Tables interact with our **verbal** system (we **read** them):

- used to **compare** values
- audiences will look for **their** rows

Table design needs to blend into background:

- the data should stand out, not the borders
- dense table: use **alternating** row colour

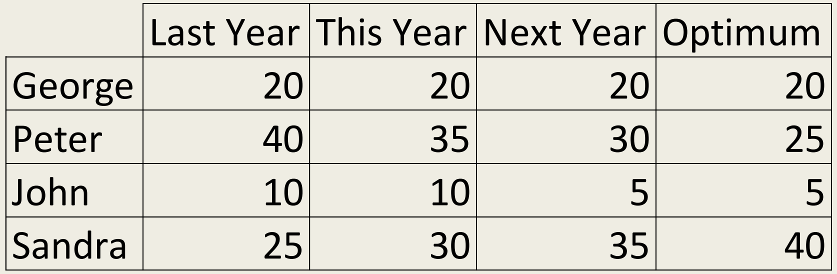
Leverage colour to convey magnitude:

- use **single colour saturation**
- use a legend to remove values

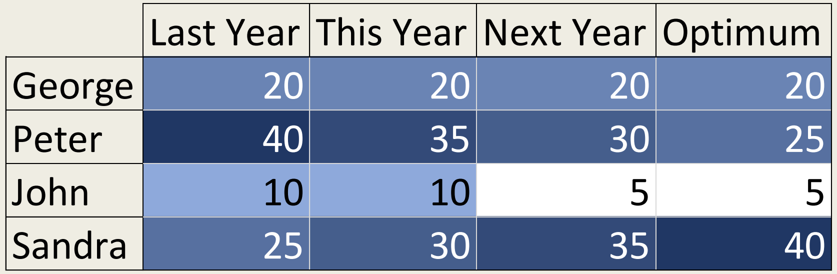
TABLES AND TABLE HEATMAPS

Name	Last Year	This Year
Ron	20	30
Fred	30	40
George	10	15

Name	Last Year	This Year
Ron	20	30
Fred	30	40
George	10	15



	Last Year	This Year	Next Year	Optimum
George	20	20	20	20
Peter	40	35	30	25
John	10	10	5	5
Sandra	25	30	35	40



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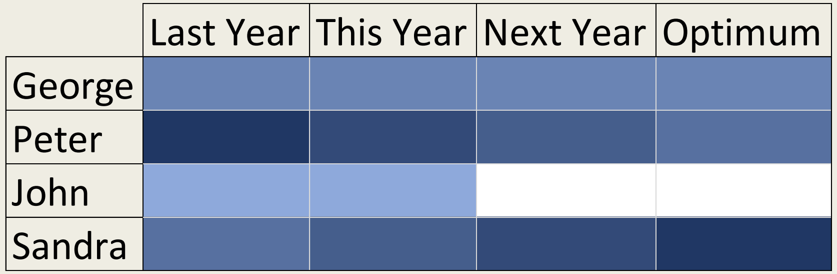


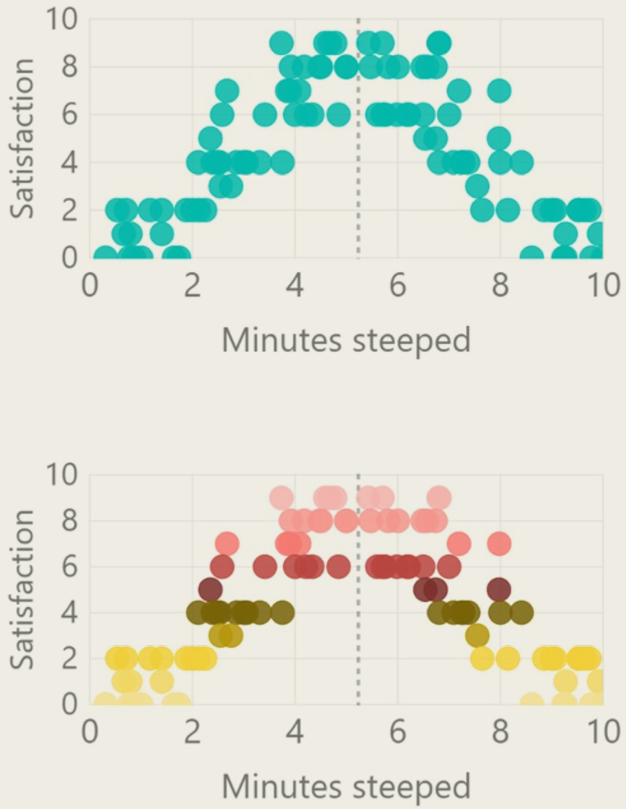
	Last Year	This Year	Next Year	Optimum
George				
Peter				
John				
Sandra				

SCATTERPLOTS

Show relationship between 2 variables (**scatterplot**) or 3 variables (**bubble plot**):

- use average lines (dotted lines) to provide context
- far fewer options in Power BI than in R or Excel
- consider using groupings to add clarity (e.g. **colour gradients**)

How long should the perfect cup of tea be steeped?



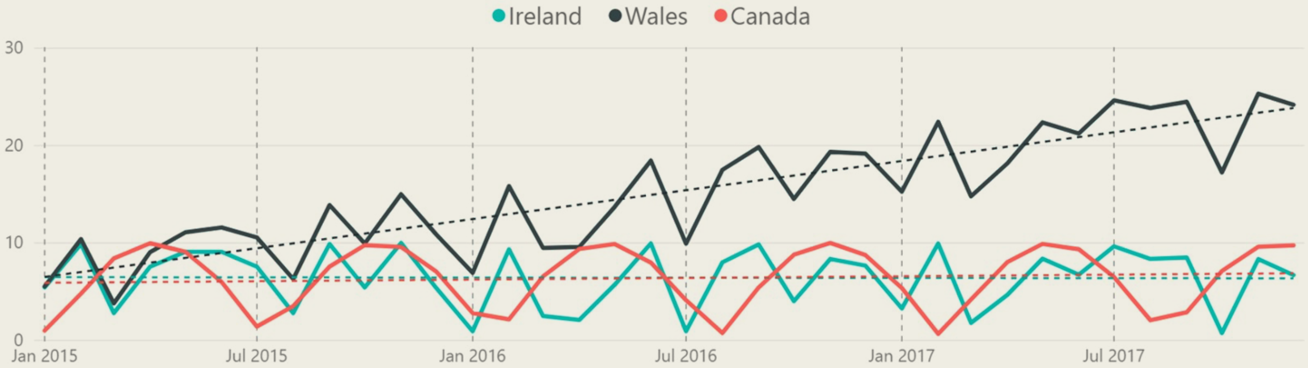
LINE CHARTS

Line chart can show a single series or multiple series of data (particularly useful for **time series**).

Axis scale should be **clear** and **relevant**.

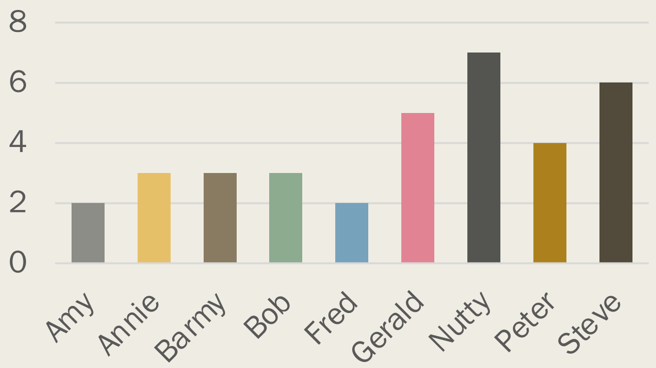
May wish to “**anchor**” y −axis if using dynamic filters

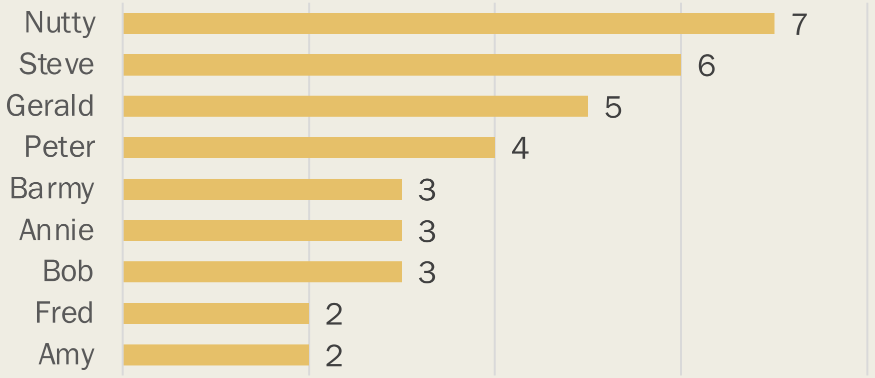
- otherwise the graph can jump around as people interact with it



Comparison of Countries – cups of tea drunk per week per person

BAR CHARTS





Versatile and useful.

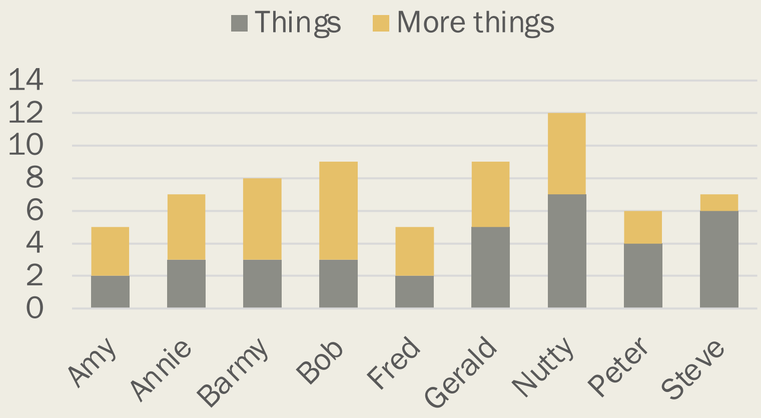
ALWAYS (?) use a zero baseline.

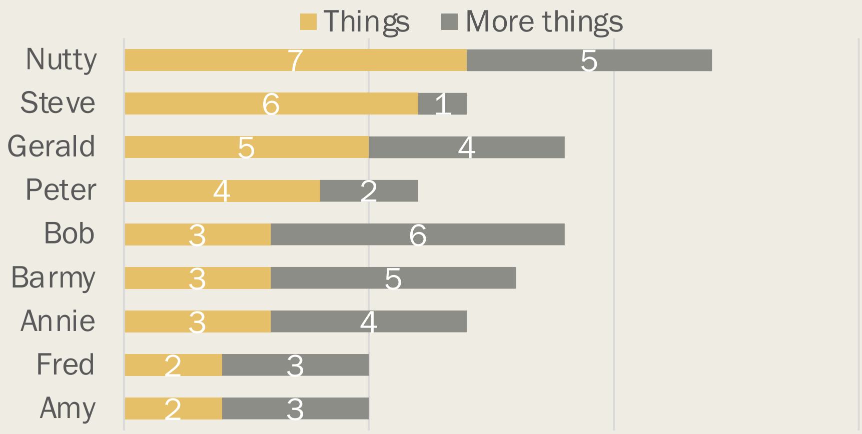
Use graph axis OR data labels: axis for broad statements, data labels for details.

Horizontal charts are apparently **easier to read** (according to many studies).

Think about the ordering of categories.

STACKED BAR CHARTS



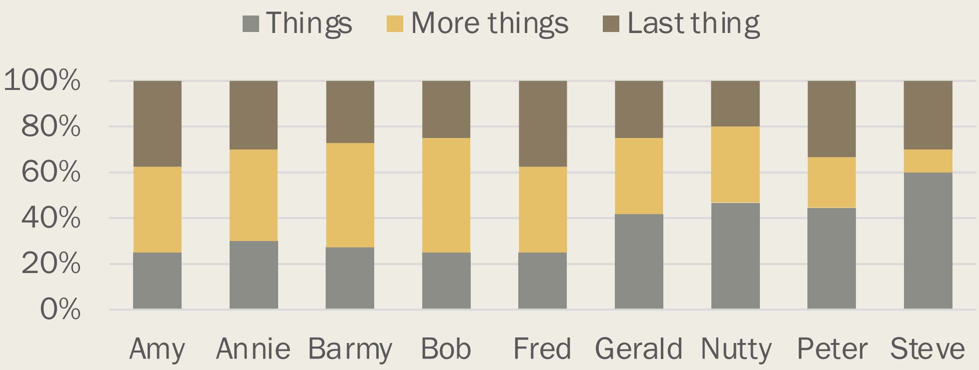


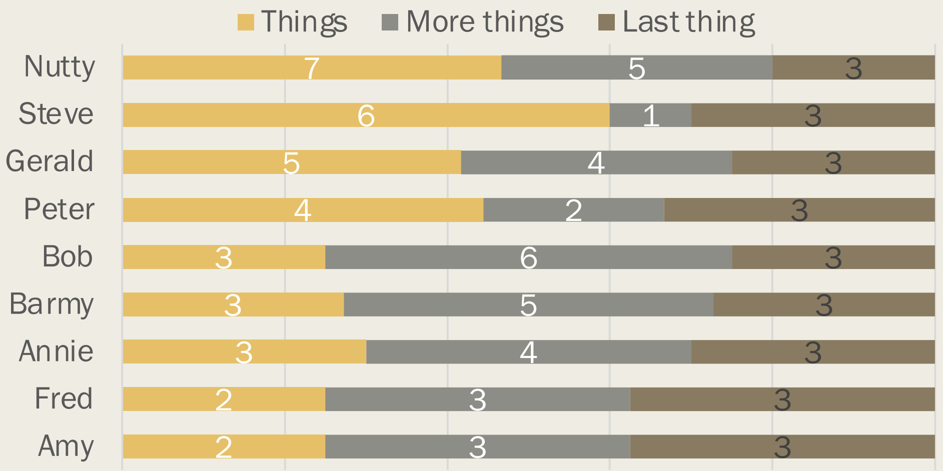
Designed for **comparing totals**, but can quickly become **overwhelming**.

Hard to sort / order.

Filtering is complicated in Power BI (what do you click on & how does the chart responds when the filter is clicked on?).

100% BAR CHARTS





Work well for visualizing **portions of a whole** on scale from negative to positive.

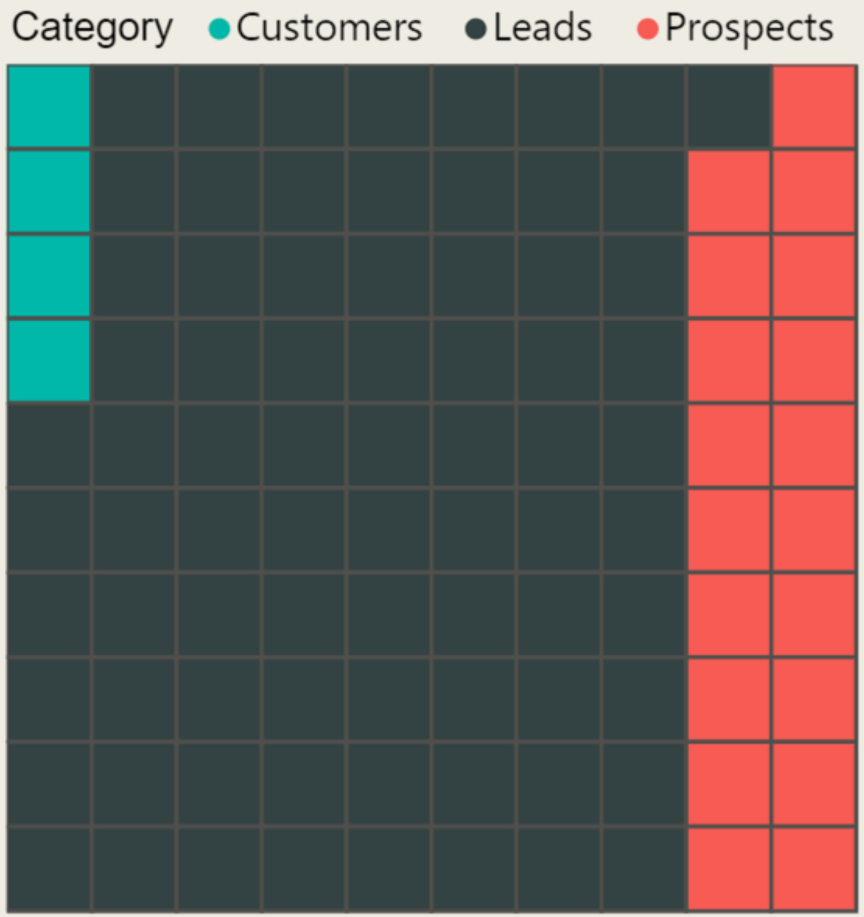
Consistent baseline on far left and right.

Easy to compare.

Problem: there is no relative measure to magnitude of data (unless labeled).

Again, research shows that horizonal charts are **easier to process**.

AREA CHARTS



Try to avoid: human brains have a hard time attributing a value to a 2D area…

… except for numbers with **vastly different** magnitudes.

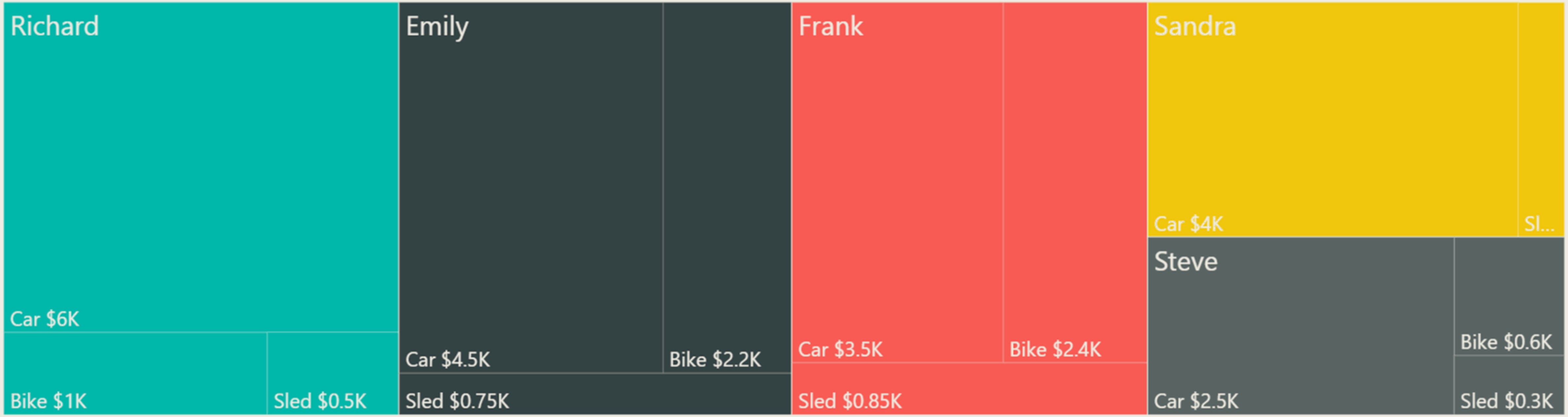
TREEMAPS

Simultaneously show **big picture** and **comparisons** easily.

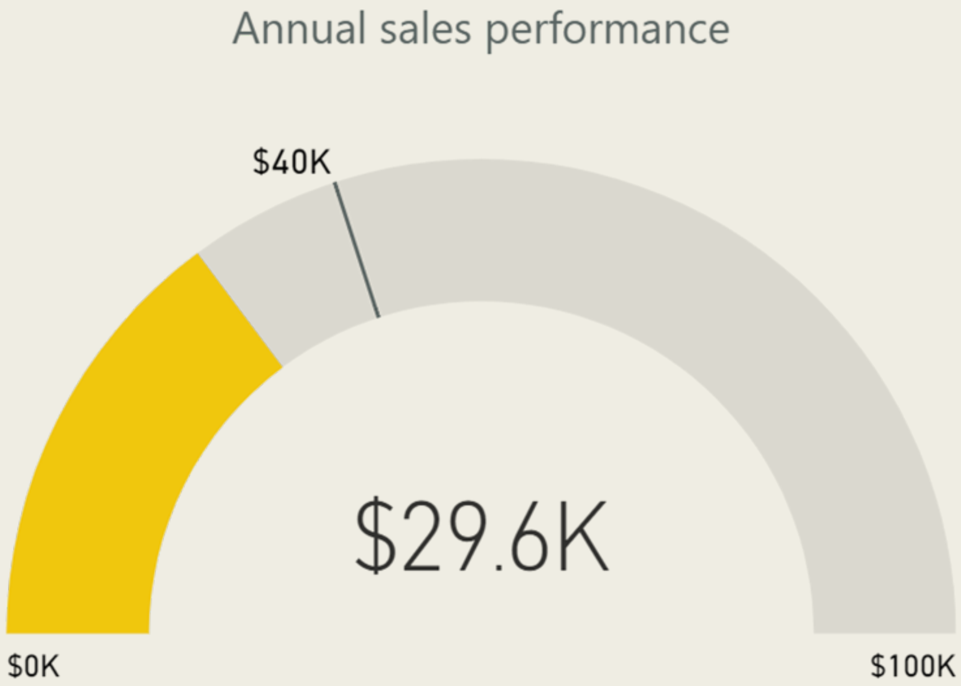
Easy to process data sub-categories.

Useful to prioritize “**big ticket items**” in dynamic dashboards.

Labeling and colouring are tricky.



GAUGE CHARTS



Often used as a dashboard component (with or without needle).

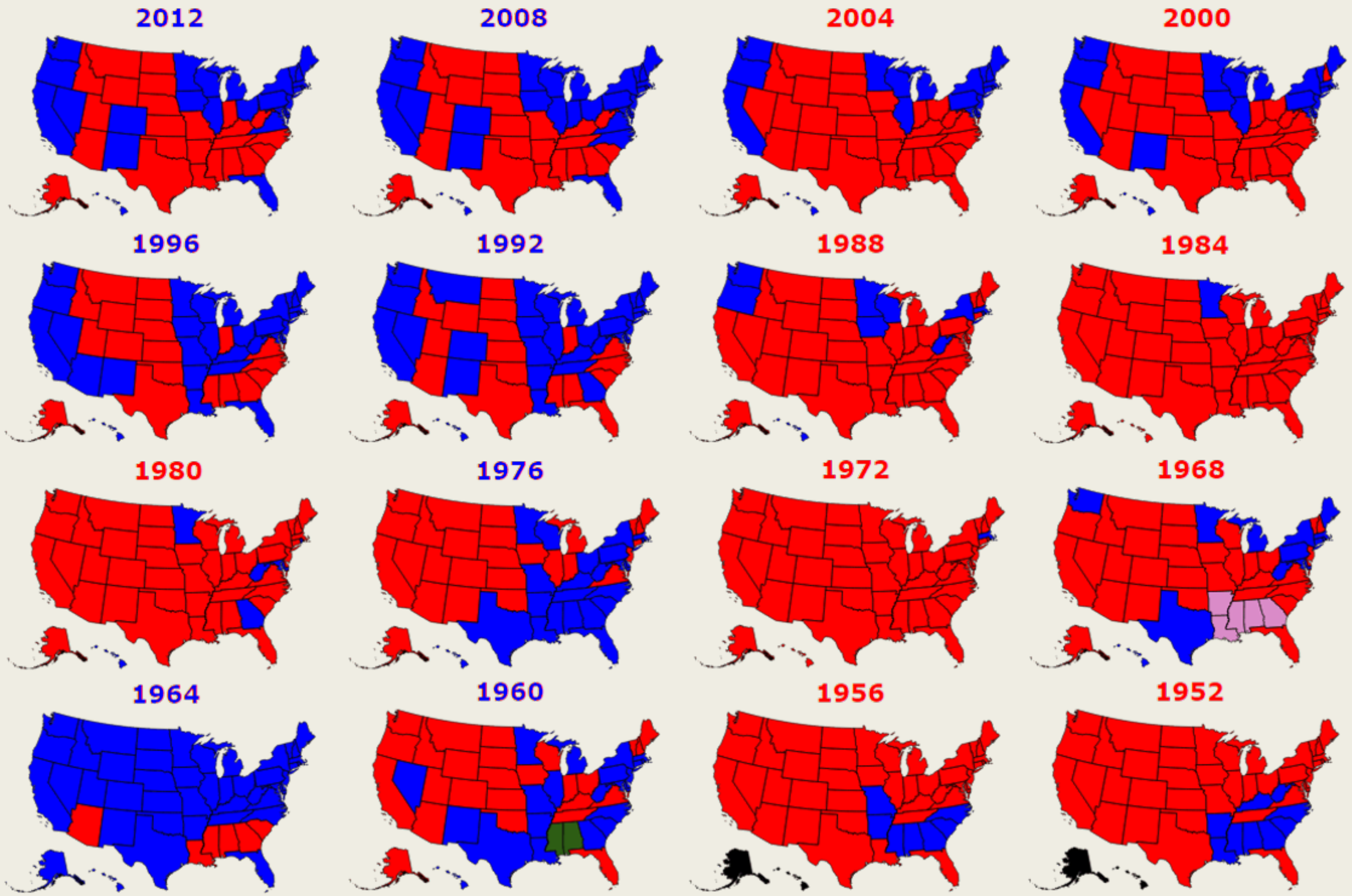
Display **single value measures** towards goal / KPI.

Great to **show progress** (a bit of a management fad, though...)

Displays information that can be quickly **scanned** and **understood**.

[Metrocosm.com]

SMALL MULTIPLES



U.S. Electoral College Results 1952 – 2012

OTHER CHART TYPES

Heatmaps and Choropleth Maps

Geographical Maps

Parallel Coordinates

Chernoff Faces

Word Clouds

Network Diagrams

Dendrograms and Trees

Sparklines

etc.

INTERACTIVE AND ANIMATED VISUALIZATIONS

Animation **does not always** improve a visualization. What insights can interactivity provide? That depends on the data, and on the visualization method.

Examples:

- The Clubs That Connect the World Cup, NY Times, 2014
- Who Marries Whom, Bloomberg, 2016
- Hipparcos Star Mapper, European Space Agency, 2016
- The Internet of Things – a Primer, Information is Beautiful, 2016
- The Genealogy and History of Popular Music Genres, Musicmap, 2016

INTERACTIVE AND ANIMATED VISUALIZATIONS

Examples (continued):

- Sequences Sunburst, Kerry Rodden, 2015
- Health and Wealth of Nations, Gapminder Foundation
- Mobius Transformations Revealed, Arnold D.N, Rogness, J, 2007
- Visualizing the Riemann ζ Function and Analytic Continuation, 3Blue1Brown, 2016
- Small Arms and Ammunition – Imports and Exports, Google, 2012
- The Evolution of the Web, Google, Hyperakt, Vizzuality, 2012
- peoplemovin, Carlo Zapponi, 2012

DISCUSSION

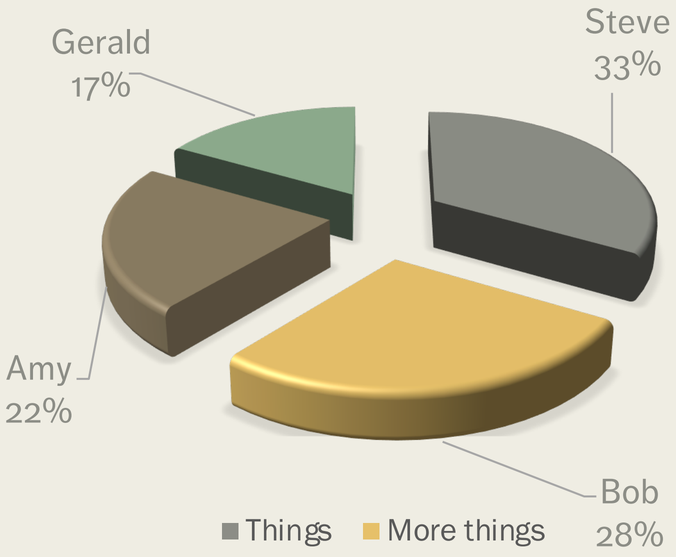
“There is always a danger that if certain types of visualization techniques take over, the kinds of questions that are particularly well-suited to providing data for these techniques will come to dominate the landscape, which will then affect data collection techniques, data availability, future interest, and so forth.” (P. Boily)

Even when done well, 85% of users don’t bother with interactive viz (NY Times).

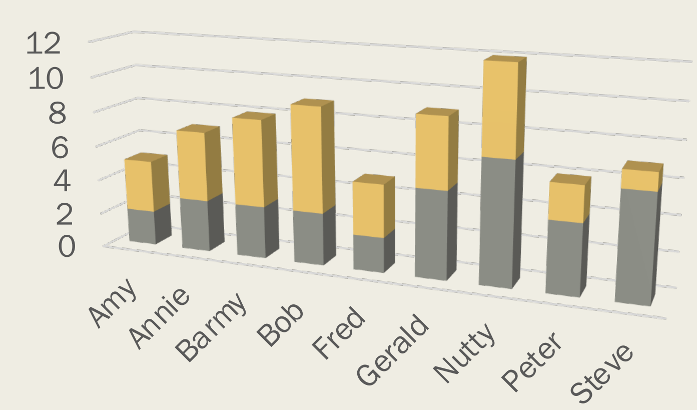
Take-Away: explore the data and try different methods

CHARTS TO AVOID (within reason)

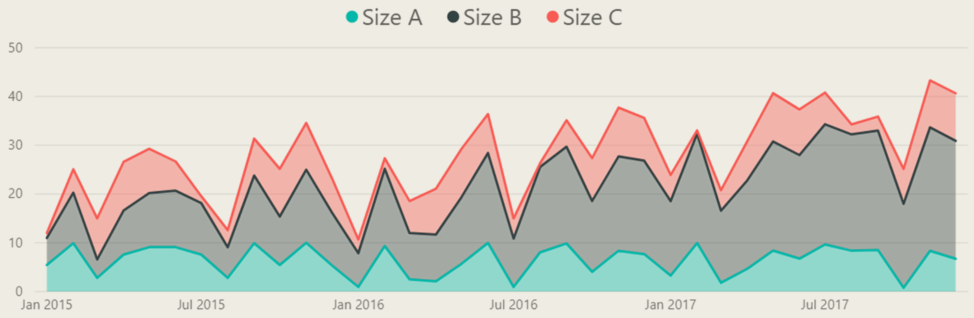
AVOID (?) anything with an arc (except gauge charts): pie, donut, etc: human brains have a hard time **comparing arcs** -- without labels, how different are Steve & Bob?

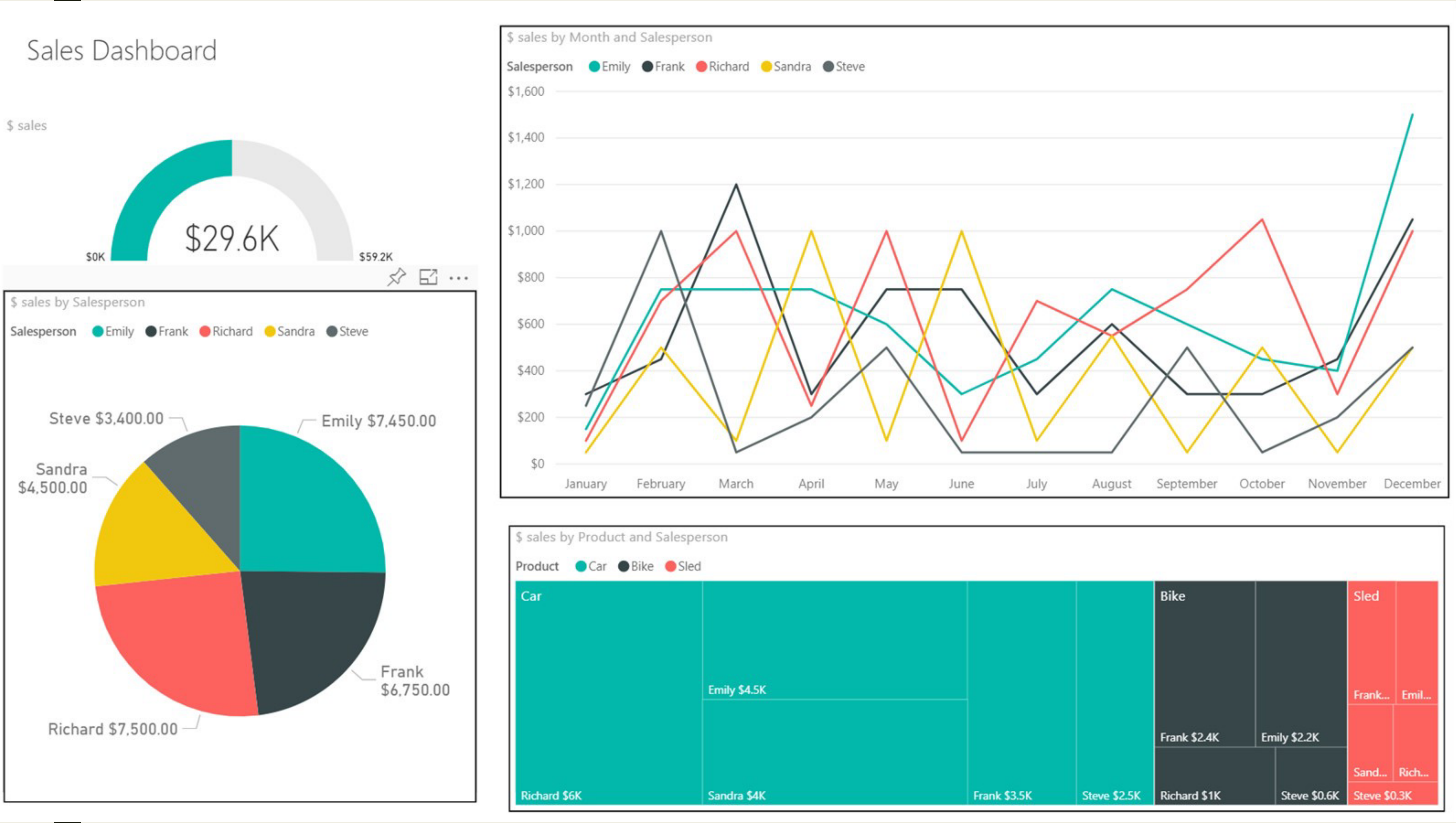


AVOID 3D charts: it is difficult to compare them visually (and they add **too much** clutter).

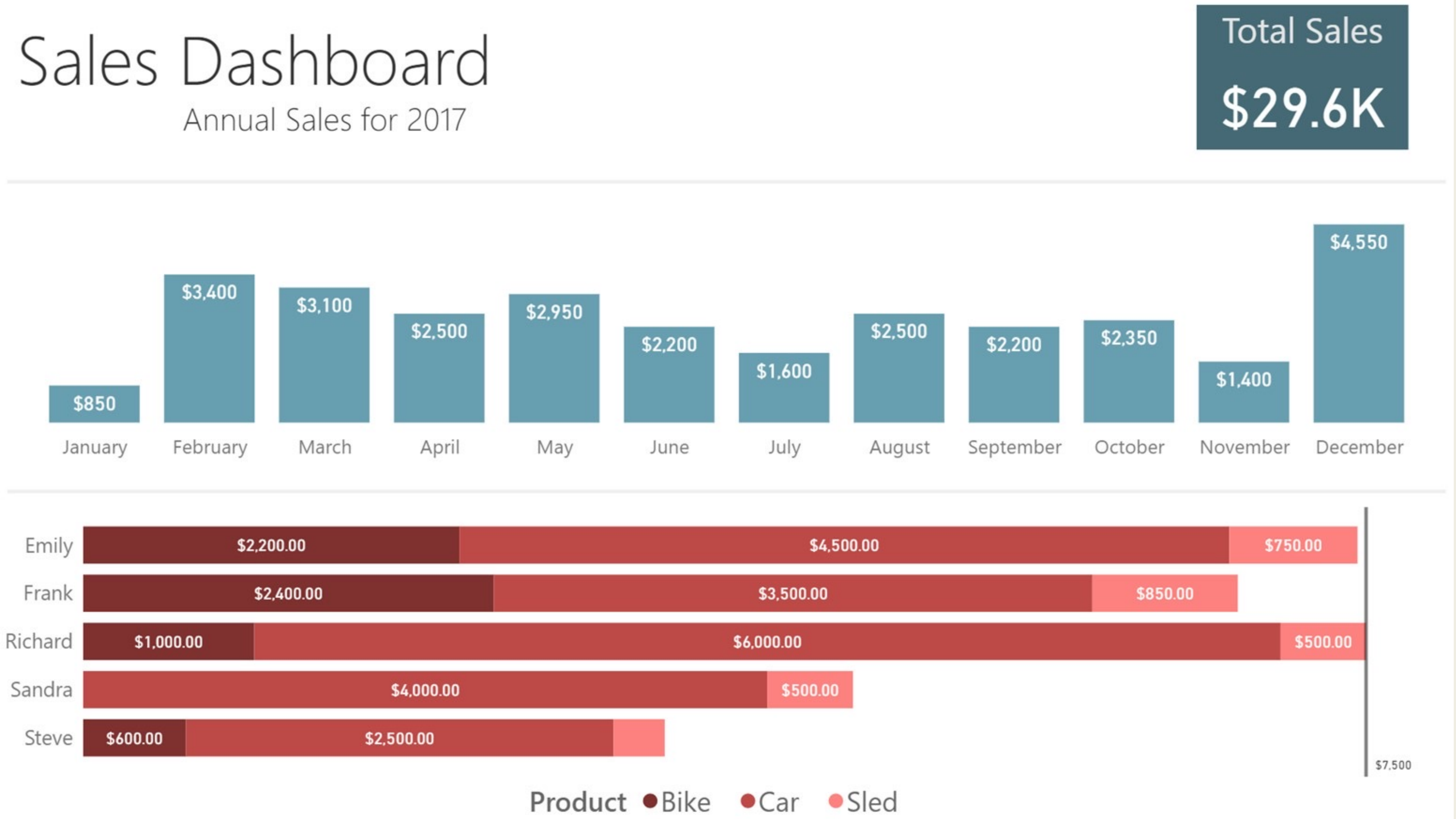


AVOID stacked area charts: way too confusing.





Sales Dashboard
$ sales
$29.6K
$0K
$59.2K
$ sales by Salesperson
Salesperson ● Emily ● Frank ● Richard ● Sandra ● Steve
Steve $3,400.00
Emily $7,450.00
Sandra $4,500.00
Frank $6,750.00
Richard $7,500.00
$ sales by Month and Salesperson
Salesperson ● Emily ● Frank ● Richard ● Sandra ● Steve
$1,600
$1,400
$1,200
$1,000
$800
$600
$400
$200
$0
January
February
March
April
May
June
July
August
September
October
November
December
$ sales by Product and Salesperson
Product ● Car ● Bike ● Sled
Car
Richard $6K
Emily $4.5K
Sandra $4K
Frank $3.5K
Steve $2.5K
Bike
Frank $2.4K
Emily $2.2K
Richard $1K
Steve $0.6K
Sled
Frank...
Emil...
Sand...
Rich...
Steve $0.3K



Sales Dashboard

Annual Sales for 2017

Total Sales

$29.6K

TAKE-AWAYS

Effective data visualizations **provide insights** and **facilitate understanding**.

The basic principles can guide your visualization design and consumption.

Be **creative** but keep your data and your representations **honest**.

Be mindful of attempts to distort trends and conclusions with flashy visuals.

Data and code should be made available along with the displays.

BASIC RULES OF DESIGN AND LAYOUT

DATA VISUALIZATION BASICS

VISUAL PROCESSING

Perception is **fragmented** – eyes are continuously scanning.

Visual thinking seeks patterns

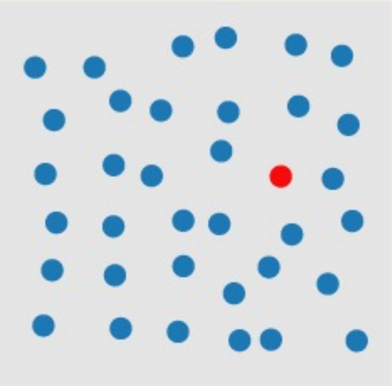
- **Pre-attentive processes:** fast, instinctive, efficient, multitasking
  gather information and build patterns:

  features → patterns → objects

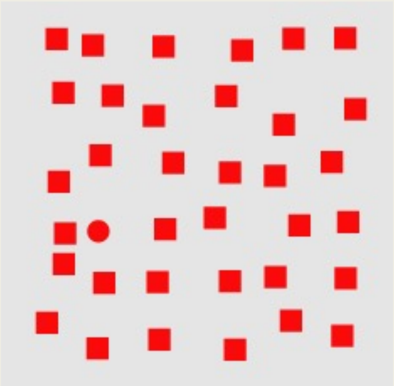
- **Attentive process:** slow, deliberate, focused
  discover features in the patterns:

  objects → patterns → features

pre-attentive



attentive



PRE-ATTENTIVE ATTRIBUTES

Pre-attentive attributes are the domain of iconic memory (brief): they

- help to define a hierarchy of focus
- push non-message impacting components into the background

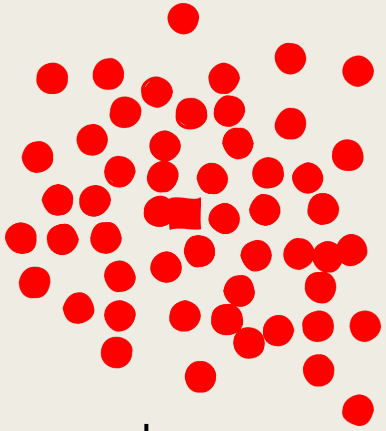
Use pre-attentive attributes to help **emphasize the story** (but don’t overdo them):

- easier to do in Excel and R, harder in Power BI

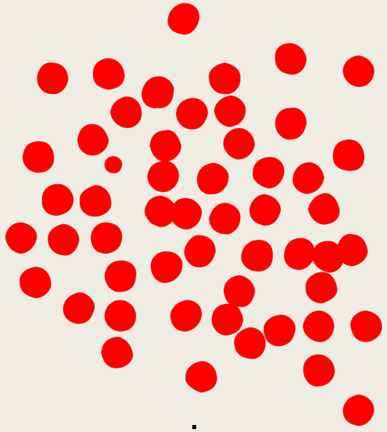
Challenge: highlighting one aspect of a chart can make other aspects harder to see.

[P. Boily, S. Davies, J. Schellinck, *The Practice of Data Visualization*]

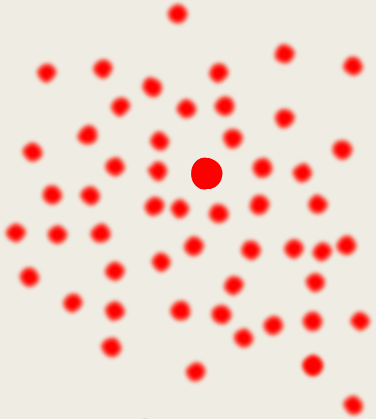
PRE-ATTENTIVE FEATURES



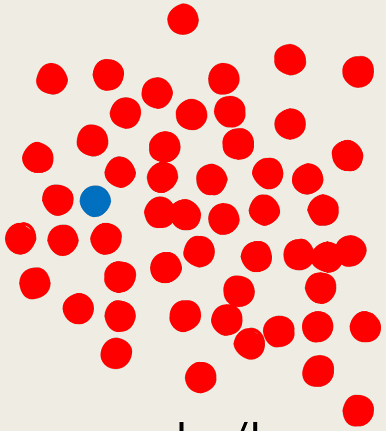
shape



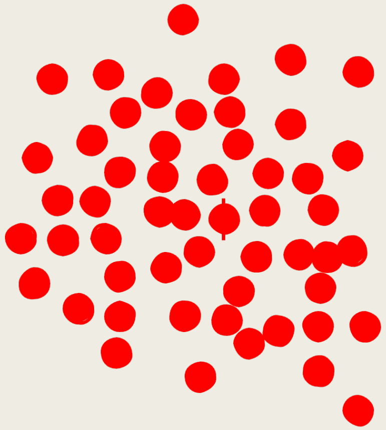
size



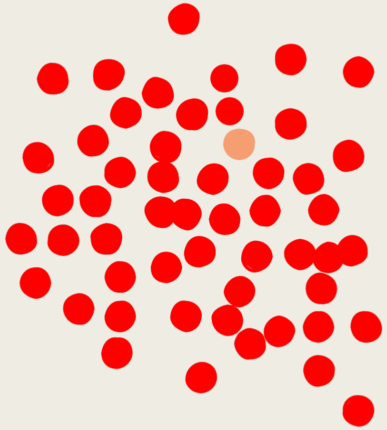
sharpness



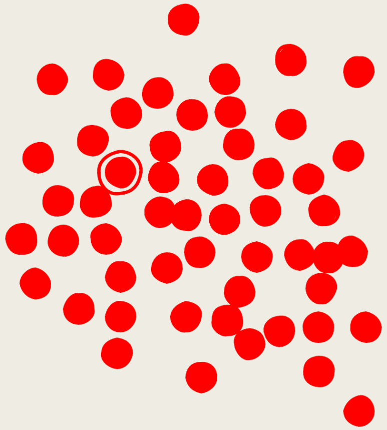
color/hue



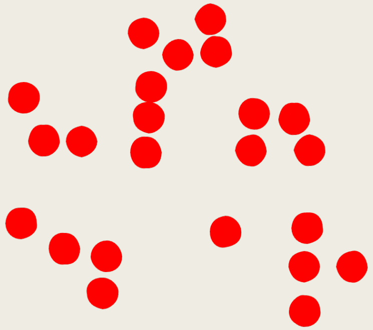
markings



intensity/value



enclosure



numerosity

[P. Boily, S. Davies, J. Schellinck, *The Practice of Data Visualization*]

PRE-ATTENTIVE ATTRIBUTES

How many 6’s are there on the next slide?

[P. Boily, S. Davies, J. Schellinck, *The Practice of Data Visualization*]

2869408609876

9348586748676

2967303986739

3967496749674

[P. Boily, S. Davies, J. Schellinck, *The Practice of Data Visualization*]

2869408609876

9348586748676

2967303986739

3967496749674

28**6**9408**6**0987**6**

934858**6**748**6**7**6**

29**6**730398**6**739

39**6**749**6**749**6**74

[P. Boily, S. Davies, J. Schellinck, *The Practice of Data Visualization*]

2869408609876

9348586748676

2967303986739

3967496749674

[P. Boily, S. Davies, J. Schellinck, *The Practice of Data Visualization*]

2869408609876

934858**67**48**67**6

29**67**30398**67**39

39**67**49**67**49**67**4

[P. Boily, S. Davies, J. Schellinck, *The Practice of Data Visualization*]

2869408609876

9348586748676

2967303986739

3967496749674

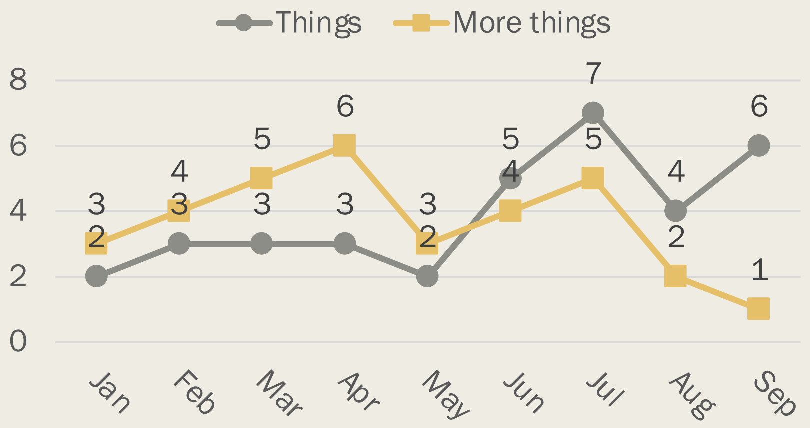
DECLUTTERING (or, Less is More)

CLUTTER IS THE ENEMY!

- every element on a page adds **cognitive load**
- identify anything that isn't adding value and **remove**
- think of cognitive load as mental effort required to process information (lower is better)
- Tufte refers to the **data to ink ratio** – "the larger the share of a graphic's ink devoted to data, the better"
- in Resonate, Duarte refers to this as "**maximizing the signal-to-noise ratio**" where the signal is the information or the story we want to communicate.

DECLUTTERING (or, Less is More)

Use **Gestalt Principles** to organize/highlight data in a chart.

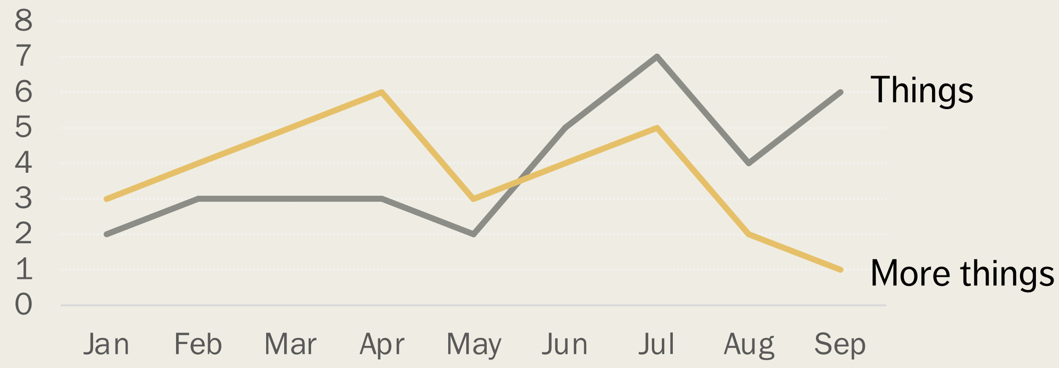


Align all the elements (graphs, text, lines, titles, etc.)

- DON'T rely on eye, use position boxes and values

Charts:

- remove border, gridlines, data markers
- clean up axis labels
- label data directly



DECLUTTERING (or, Less is More)

Use **consistent** font, font size, colour and alignment.

Don’t rotate text to anything other than 0 or 90 degrees.

Use **white space:**

- margins should remain free of text and visuals
- don’t stretch visuals to edge of page or too close to other visuals
- think of white space as a border

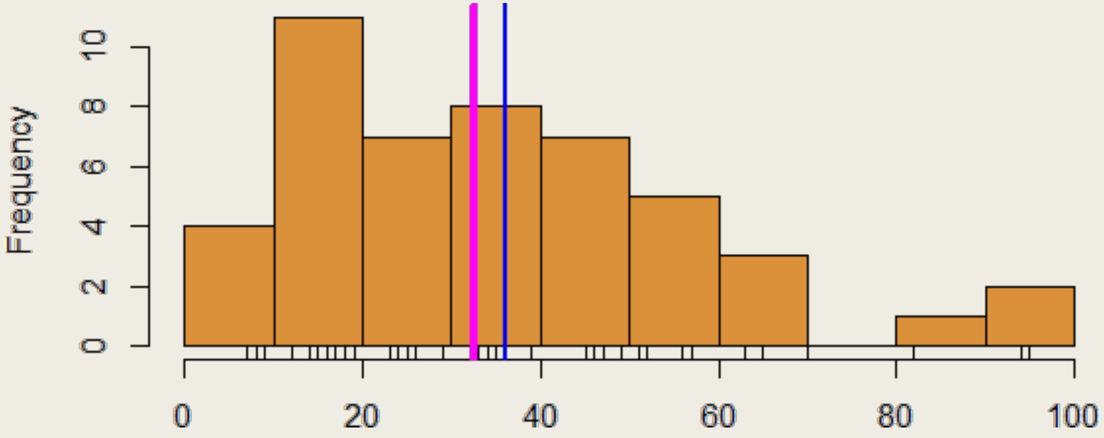
CHART SIZES

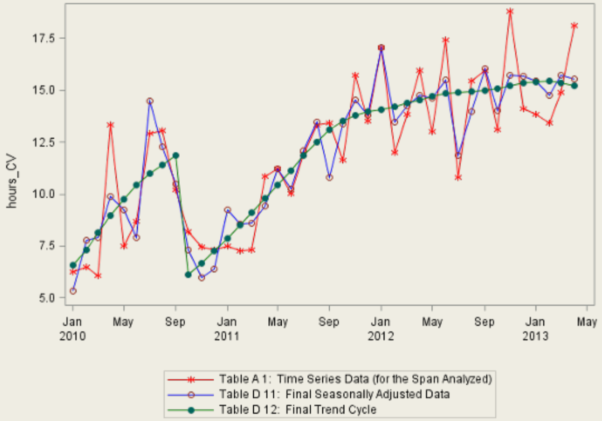
Assuming that the chart has been decluttered:

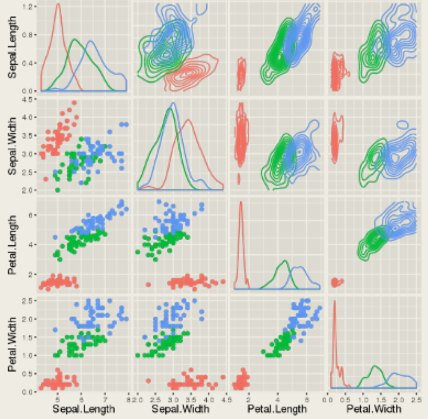
- things of equal importance size **similarly;**
- other things scale to **importance**.

As one rarely puts more than 3-4 charts on a page, there are limited size options.

Perennial exception: **geographical maps** may require more space.



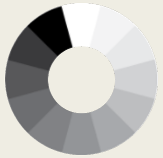




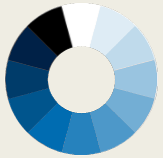
[http://www.deanenettles.com/webexamples/colorexamples]

COLOUR SCHEMES

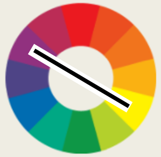
Achromatic



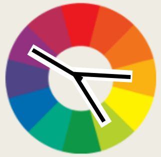
Monochromatic



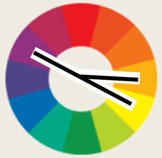
Complementary



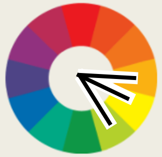
Split complementary



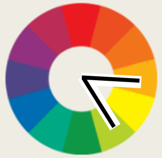
Split-Left/Right Complementary



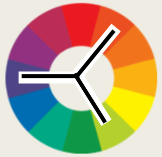
Analogous



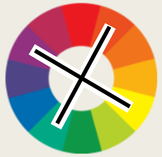
Colour Diad

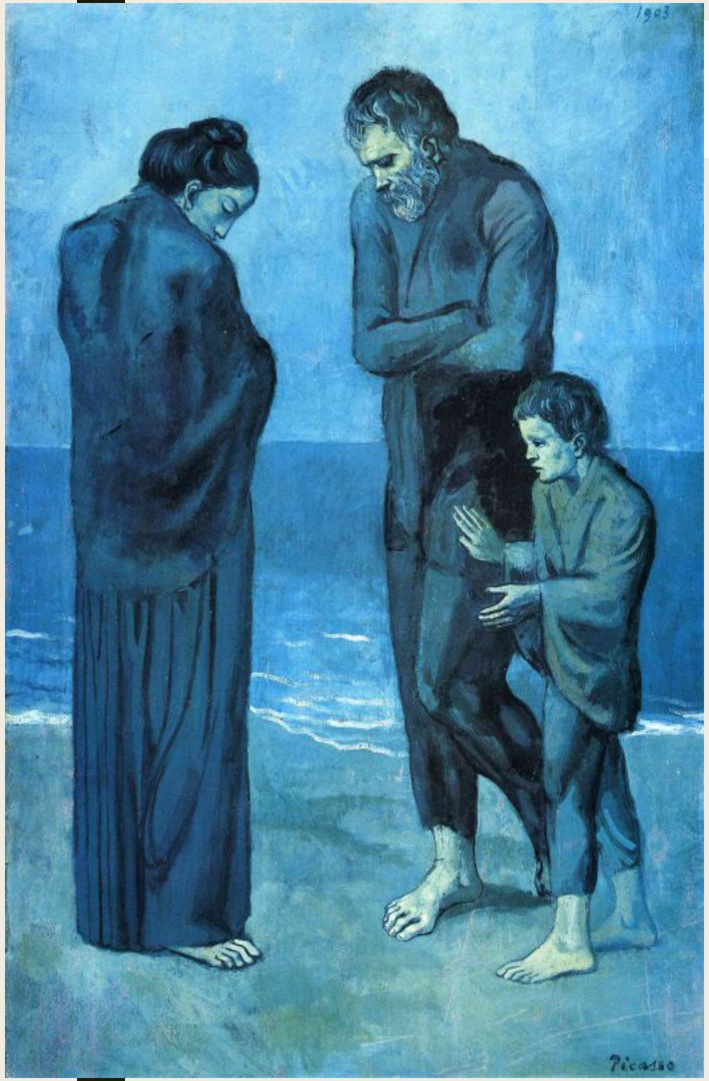


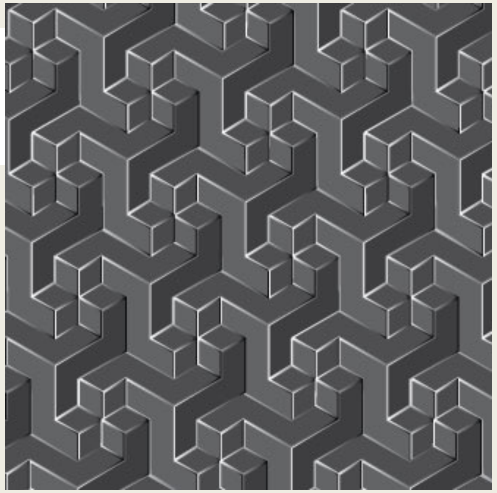
Colour Triad



Colour Tetrad







Can you identify the colour schemes underlying each of these images?

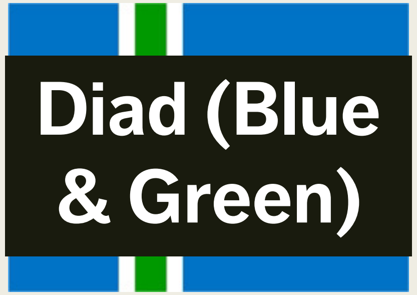
Monochromatic (Blues)

Can you identify the colour schemes underlying each of these images?

Tetrad

Analogous (Green & Yellow)

Split Complementary (Green, Orange & Blue)

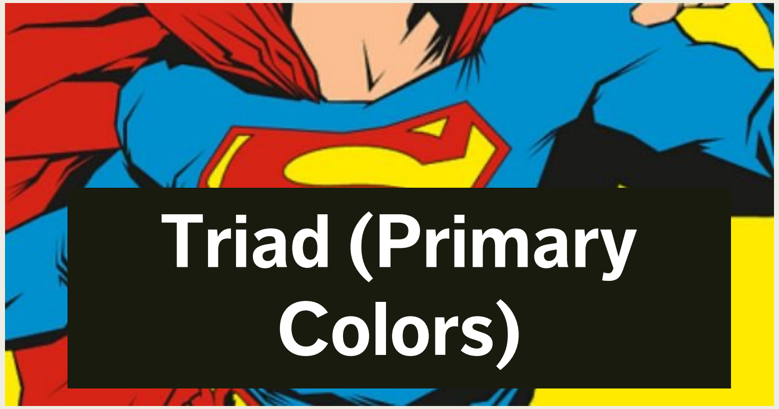


Diad (Blue & Green)

Diad (Green & Orange)

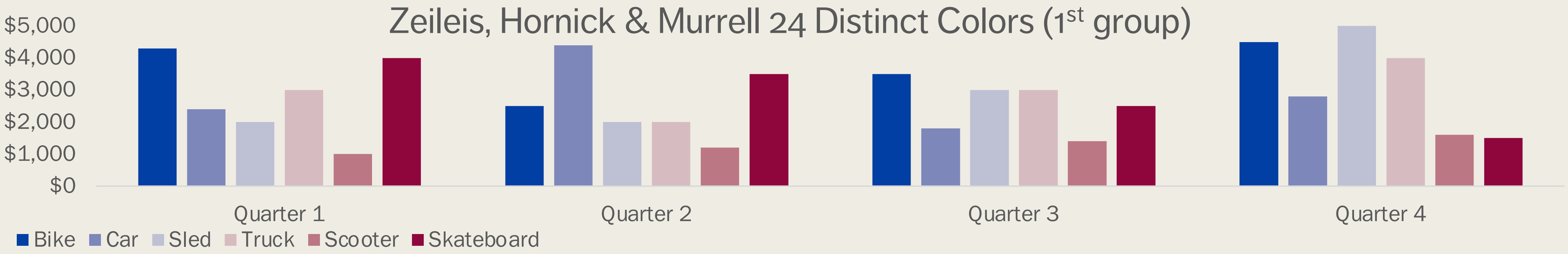
Diad (Red &Violet)

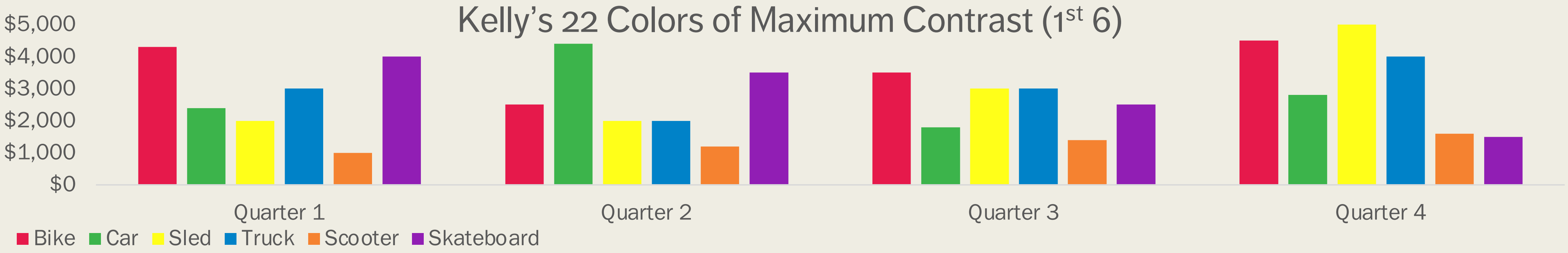
Achromatic

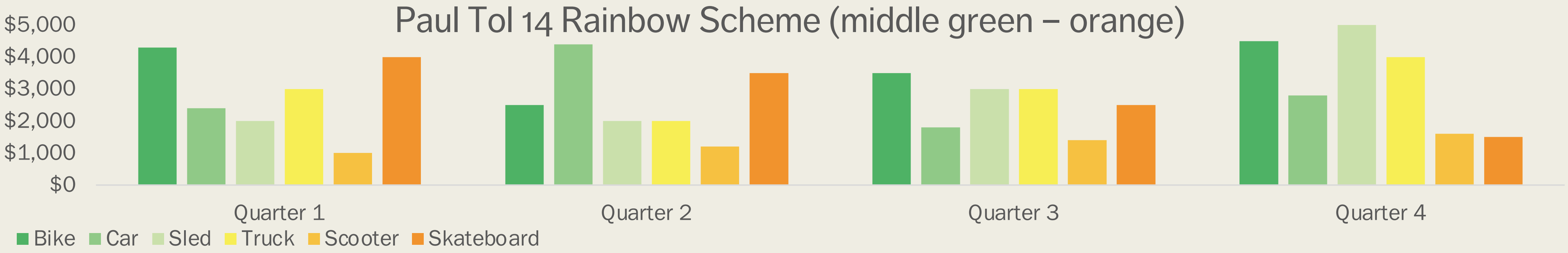


Triad (Primary Colors)

Complementary


Zeileis, Hornick & Murrell 24 Distinct Colors (1st group)
$5,000
$4,000
$3,000
$2,000
$1,000
$0
Quarter 1
Quarter 2
Quarter 3
Quarter 4
Bike
Car
Sled
Truck
Scooter
Skateboard


Kelly's 22 Colors of Maximum Contrast (1st 6)
$5,000
$4,000
$3,000
$2,000
$1,000
$0
Quarter 1
Quarter 2
Quarter 3
Quarter 4
Bike
Car
Sled
Truck
Scooter
Skateboard


Paul Tol 14 Rainbow Scheme (middle green – orange)
$5,000
$4,000
$3,000
$2,000
$1,000
$0
Quarter 1
Quarter 2
Quarter 3
Quarter 4
Bike
Car
Sled
Truck
Scooter
Skateboard

COLOUR SCHEMES

When it comes to colour, **less is more**: use it sparingly (graphic designers are taught to "get it right, in black and white").

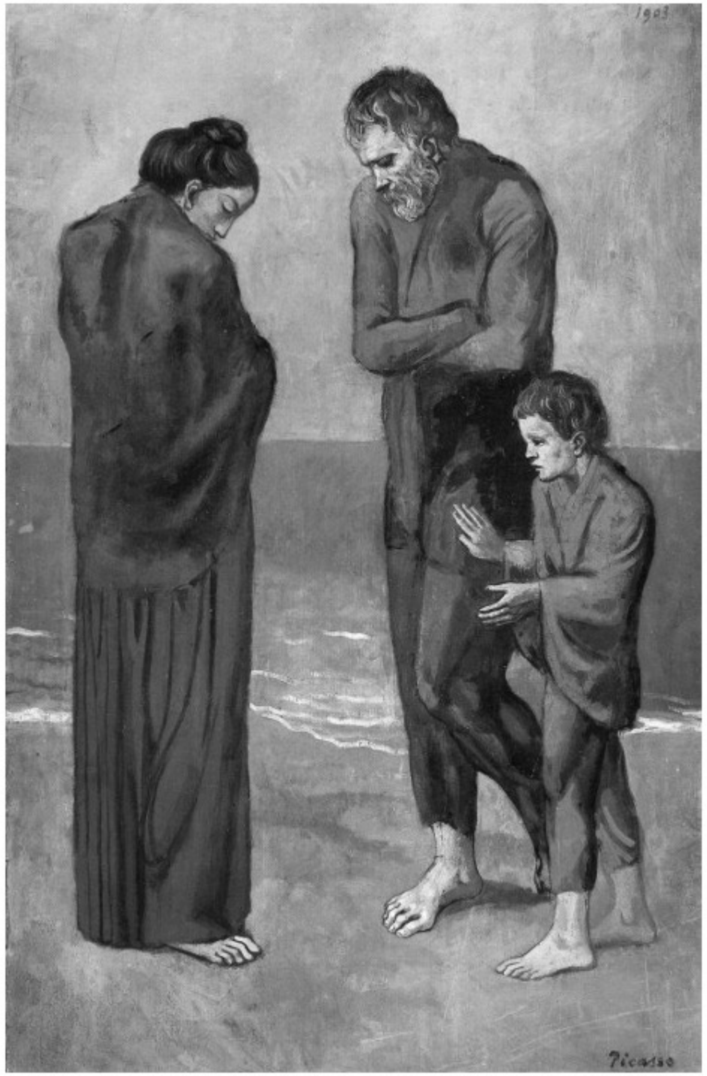
Based on the Gestalt Principles, **monochrome** schemes can be particularly effective.

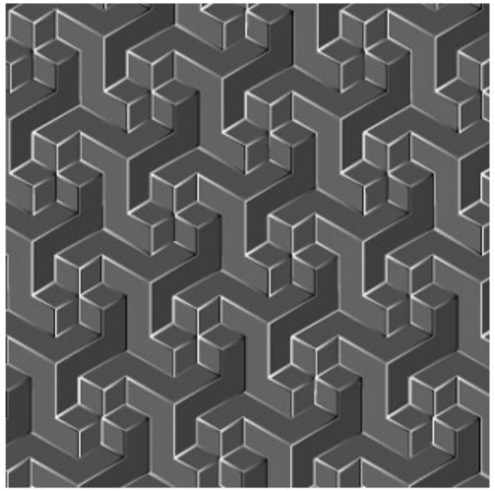
When appropriate, pick scheme based on corporate identity (this maximizes buy in).

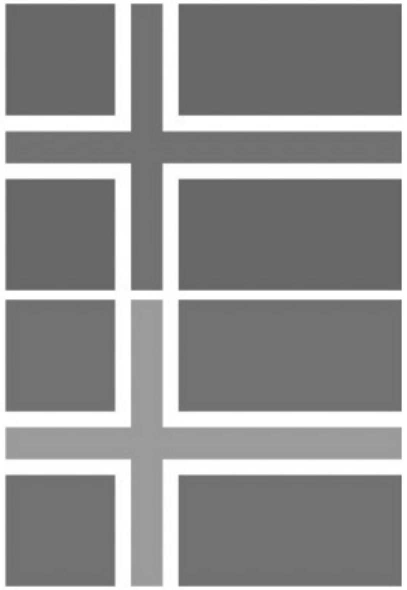
Create a template (and stick to it).

Upload images to see what charts look like in various flavours of colour-blindness:

- https://www.color-blindness.com/coblis-color-blindness-simulator (there are other tools)







Monochromatic achromatopsia (greys)

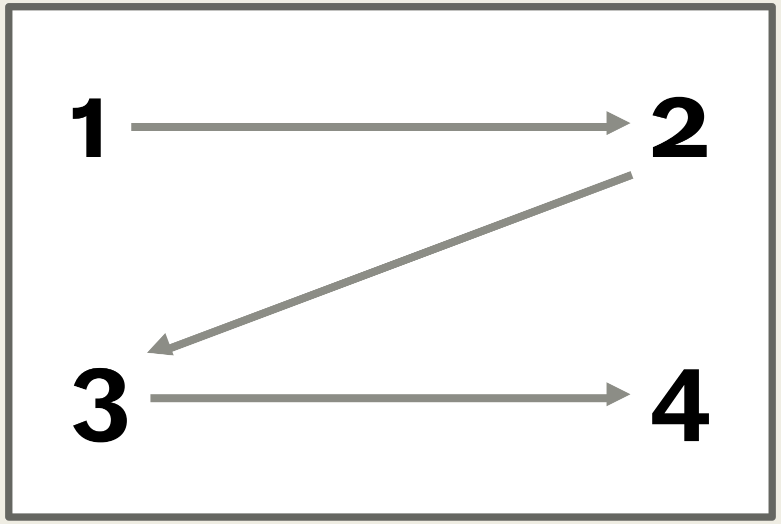
POSITION

How should the elements be placed in a chart or a dashboard?

In the West, most people start at the **top left** and zig- zag all the way to the **bottom right**.

Simple rule: don’t make people work too hard

- main message: top left/top right
- info in order of preference
- people concentrate less as they scan so get less complex as you move to bottom corner



DASHBOARDS

DATA VISUALIZATION BASICS

[Wexler, Shaffer, Cotgreave, *The Big Book of Dashboards*]

DASHBOARDS

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

Examples:

- interactive display that allows people to explore motor insurance claims by city, province, driver age, etc.
- PDF showing key audit metrics that gets e-mailed to a Department’s DG on a weekly basis.
- wall-mounted screen that shows call centre statistics in real-time.
- mobile app that allow hospital administrators to review wait times on an hourly- and daily-basis for the current year and the previous year.

SOME QUESTIONS TO PONDER

In a car's dashboard, a small number of **key indicators** (speed, gasoline level, lights, etc.) need to be understood **at a glance**. A dashboard design that does not take these two characteristics under consideration can have catastrophic consequences.

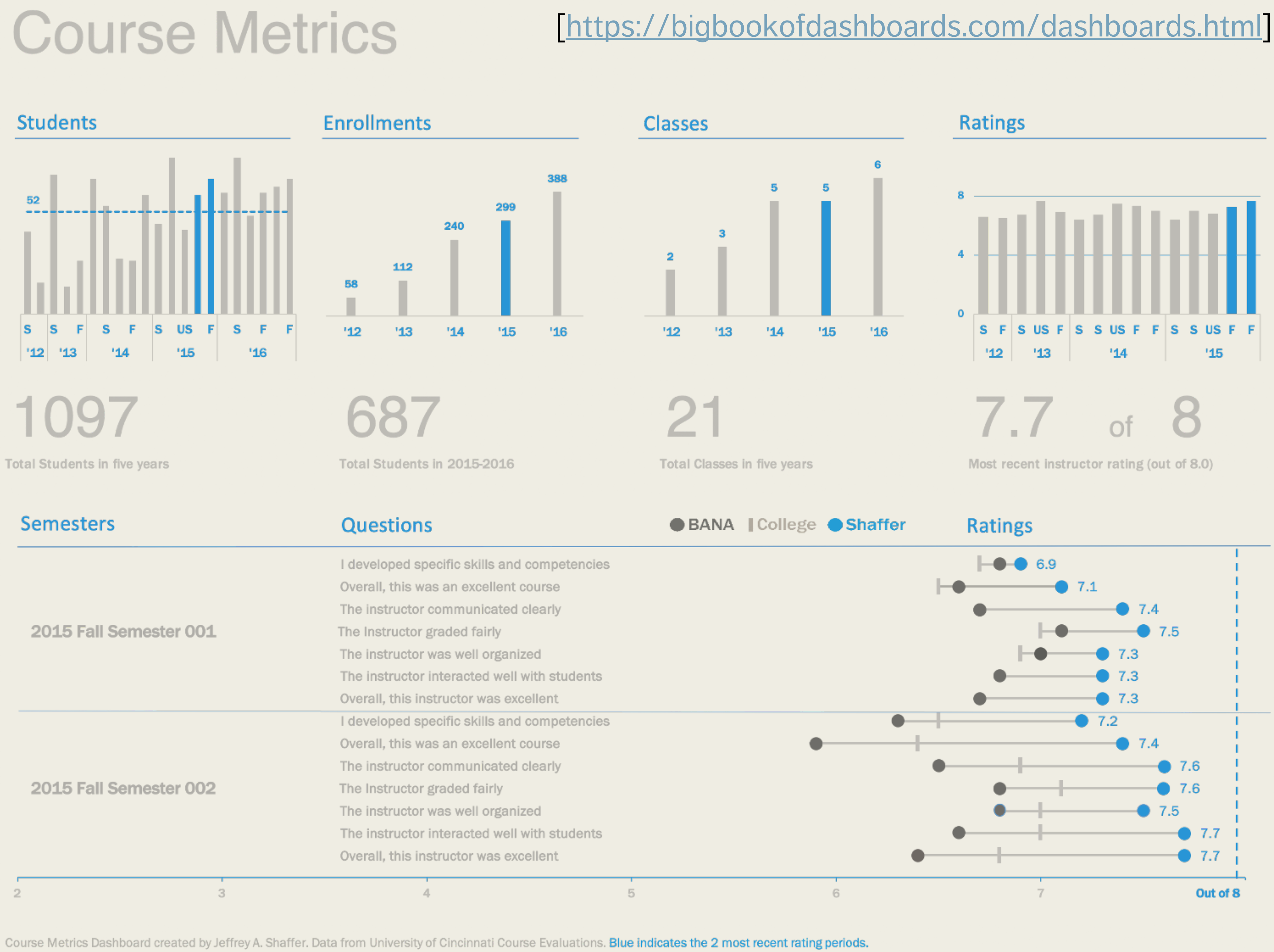
The following questions need to be answered prior to the dashboard being designed:

- Who is the dashboard's **consumer**?
- What **story** does the dashboard tell?
- What data (categories) will be used?
- What will **appear** on the dashboard?
- How can the dashboard **help** the consumer?

[https://bigbookofdashboards.com/dashboards.html]

Strengths:

- Easy-to-see key metrics
- Simple color scheme
- Potential to be static or interactive
- Both overview and details are clear



Course Metrics Dashboard created by Jeffrey A. Shaffer. Data from University of Cincinnati Course Evaluations. Blue indicates the 2 most recent rating periods.

DASHBOARD EVALUATION

There are no perfect dashboards – no collection of charts will ever suit everyone who encounters it.

All dashboards should be **truthful** and **functional**, but dashboards that are also **elegant** (delightful, enjoyable) will take you further.

All dashboards are **incomplete**. Good dashboards will still lead to dead ends, but they should allow users to ask: “Why? What is the root cause of a problem?”

Tools: Excel, Power BI, Tableau, R + Shiny, Geckoboard, Matillion, etc.

EXERCISE

Consider the following dashboards.

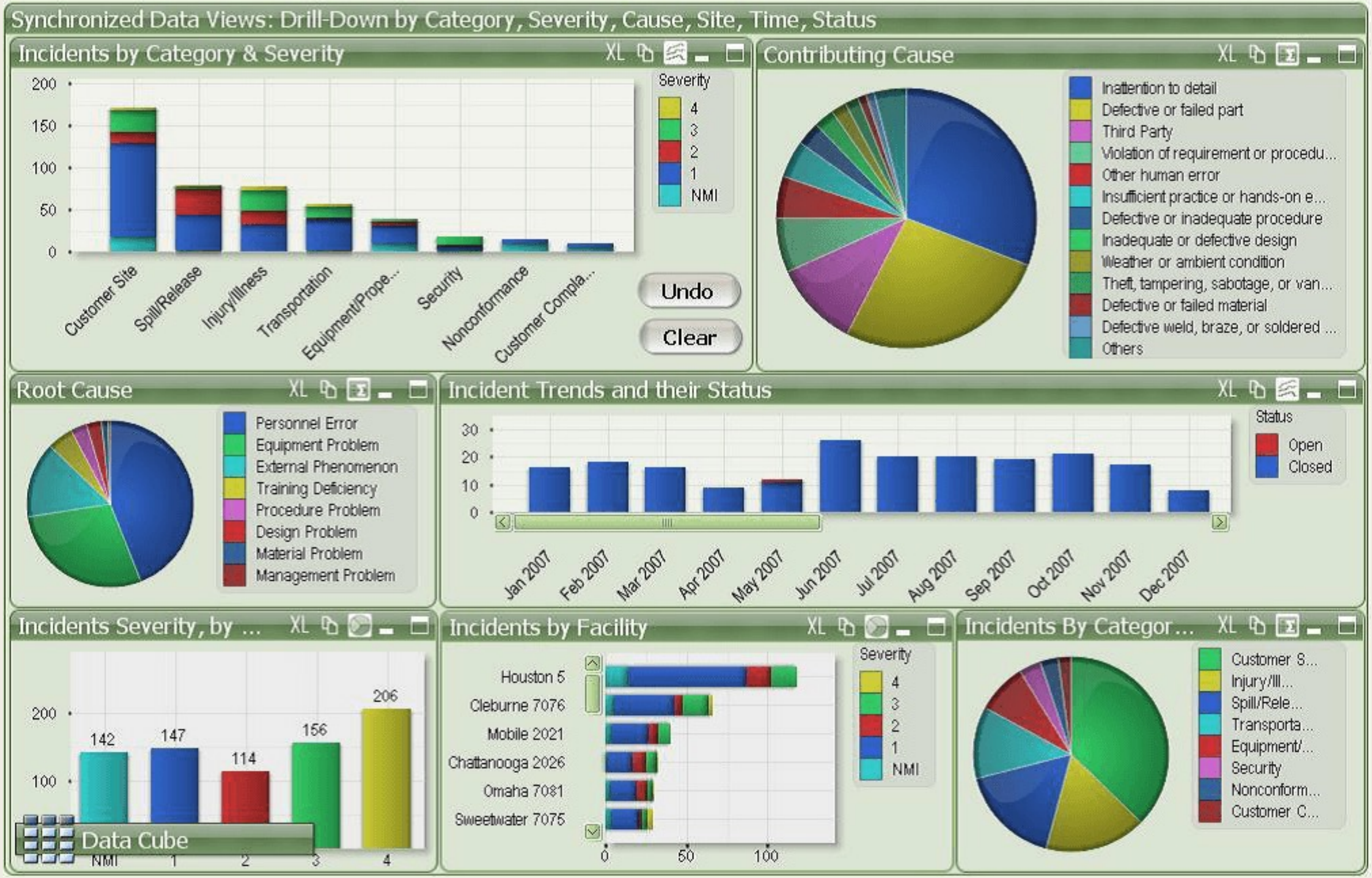
Can you figure out, at a glance, who their audience is?

What are their strengths?

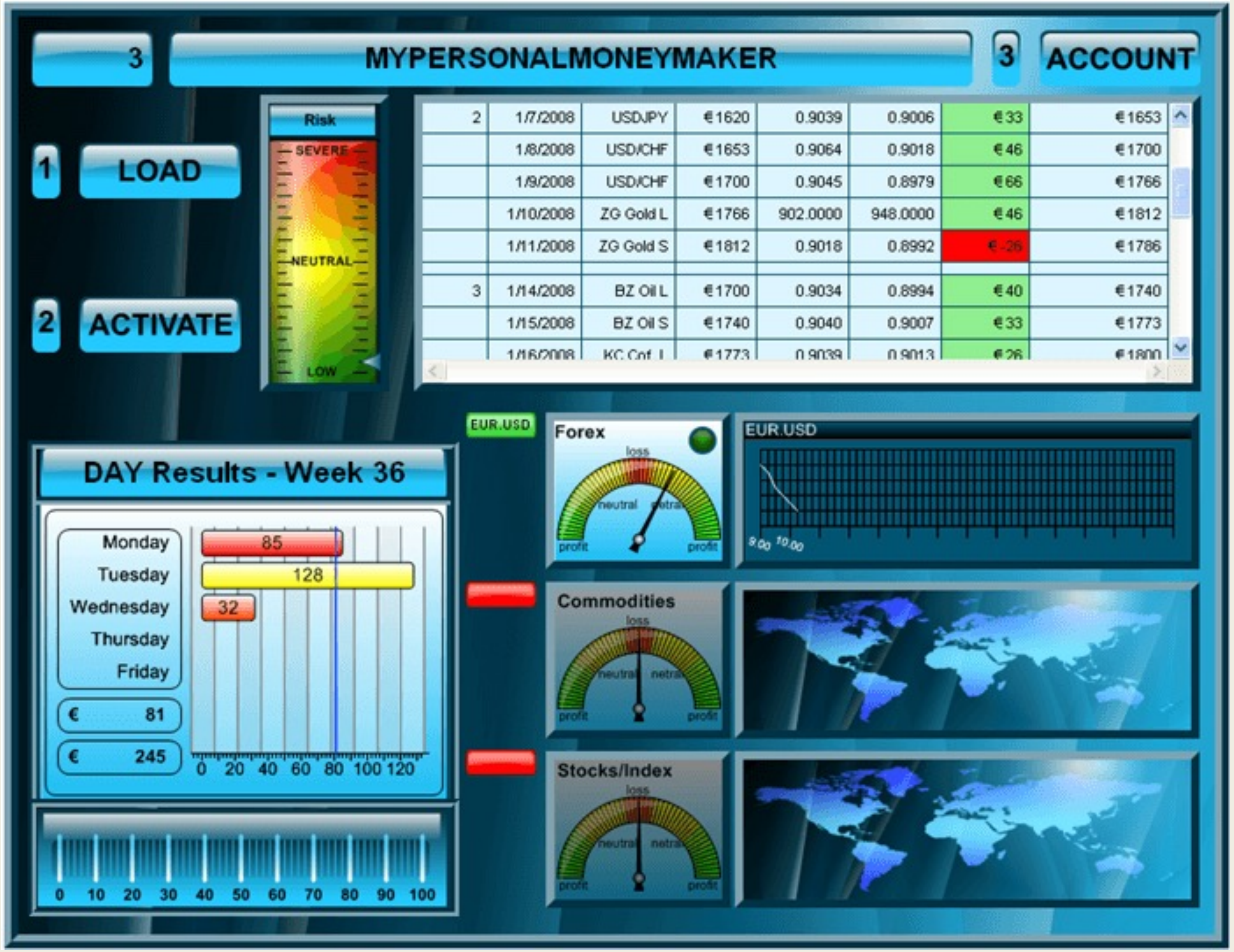
What are their limitations?

How would you improve them?

[https://www.matillion.com/wp-content/uploads/2014/11/qlikview-poor-use-of-dashboard-software.png]



[https://www.geckoboard.com/assets/2-terrible-dashboard-example-min.png]



2	1/7/2008	USDJPY	€1620	0.9039	0.9006	€33	€1653
	1/8/2008	USD/CHF	€1653	0.9064	0.9018	€46	€1700
	1/9/2008	USD/CHF	€1700	0.9045	0.8979	€66	€1766
	1/10/2008	ZG Gold L	€1766	902.0000	948.0000	€46	€1812
	1/11/2008	ZG Gold S	€1812	0.9018	0.8992	€-26	€1786
3	1/14/2008	BZ Oil L	€1700	0.9034	0.8994	€40	€1740
	1/15/2008	BZ Oil S	€1740	0.9040	0.9007	€33	€1773
	1/16/2008	KC Cof. L	€1773	0.9039	0.9013	€26	€1800

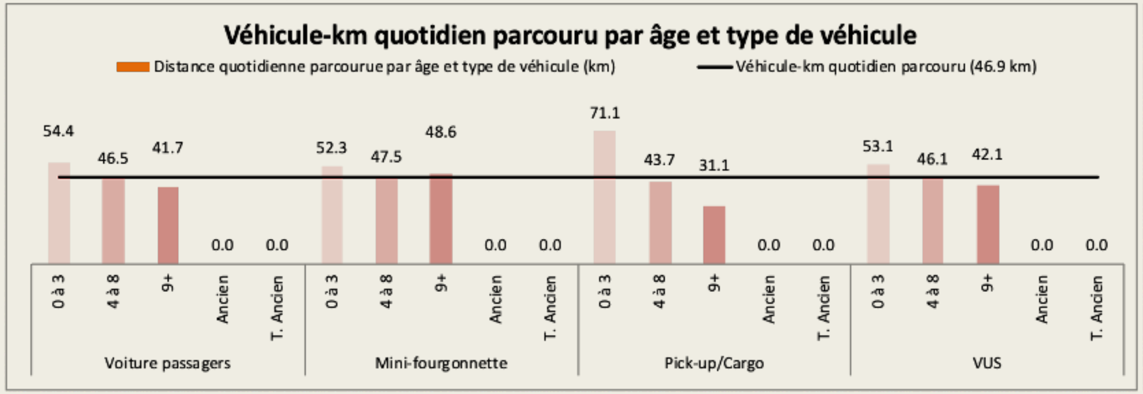
€ 81

€ 245

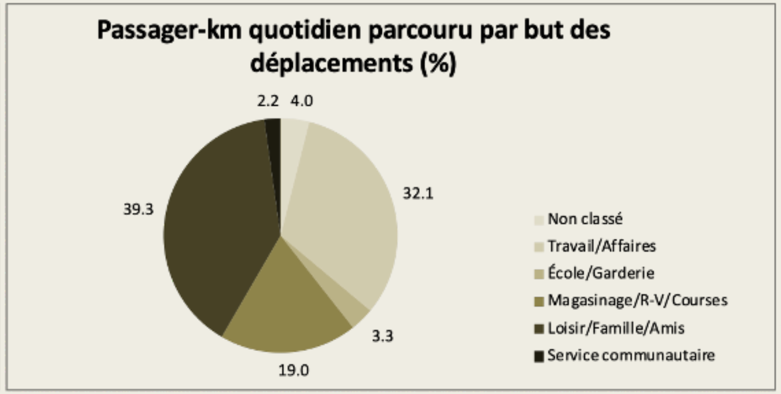
Ontario – 1er trimestre 2012

[Personal file]

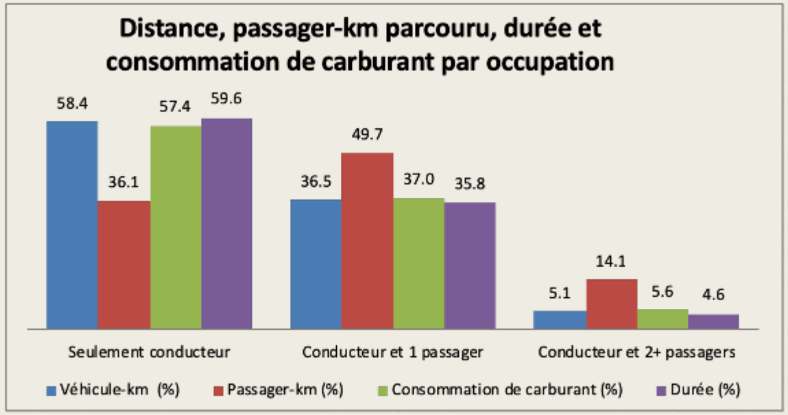
Caractéristiques des déplacements



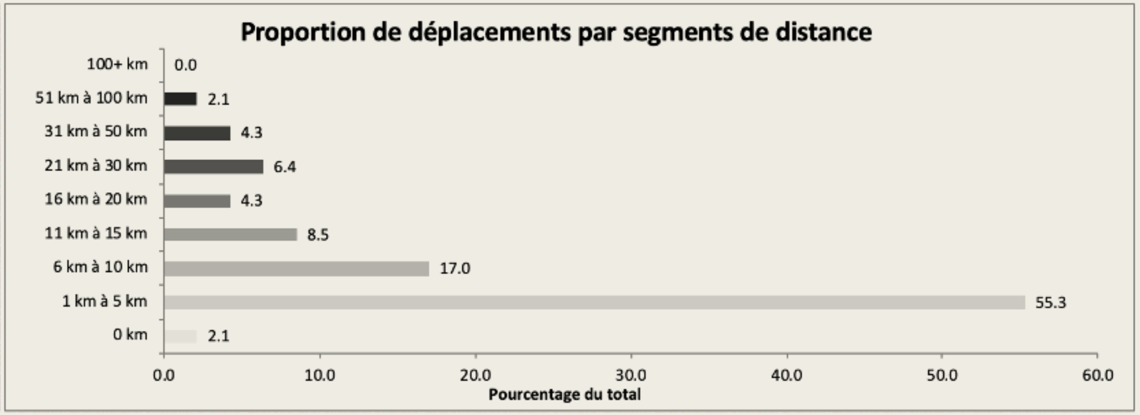
Véhicule-km quotidien parcouru par âge et type de véhicule



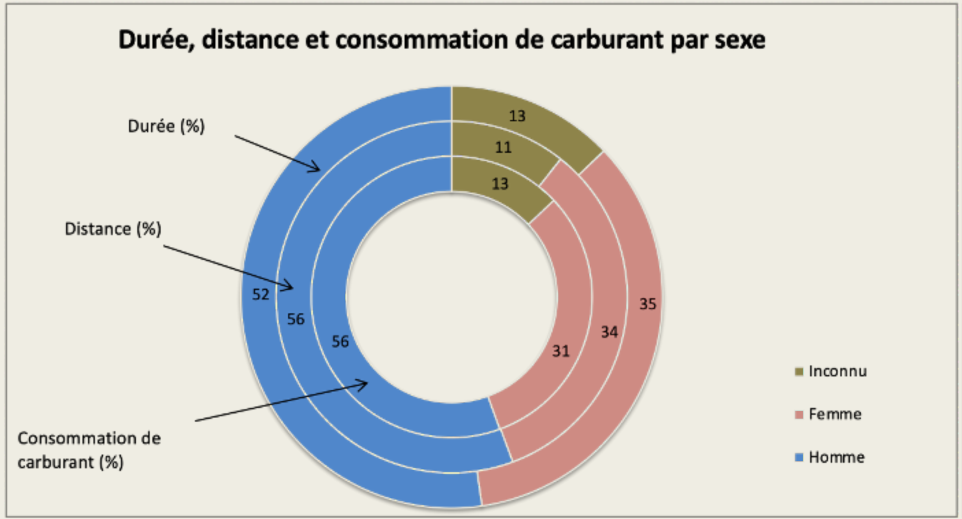
Passager-km quotidien parcouru par but des déplacements (%)



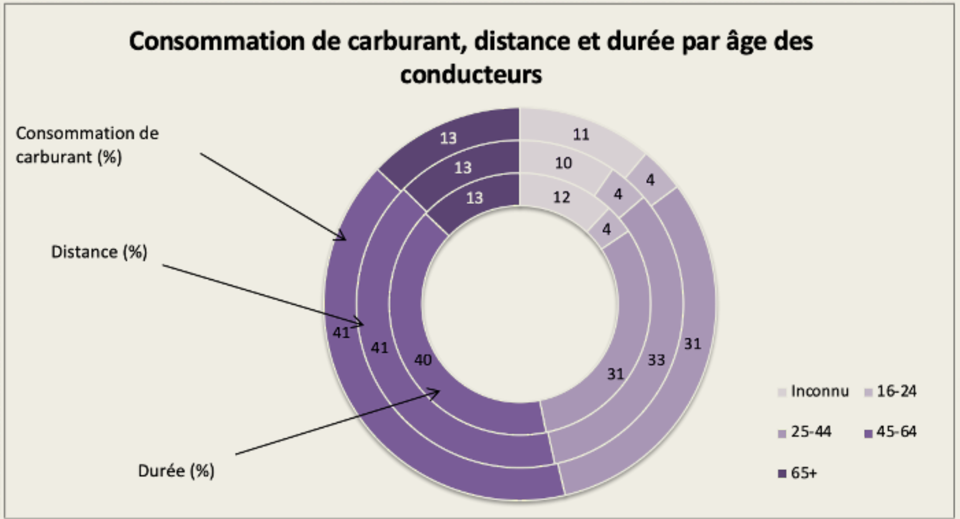
Distance, passager-km parcouru, durée et consommation de carburant par occupation



Proportion de déplacements par segments de distance



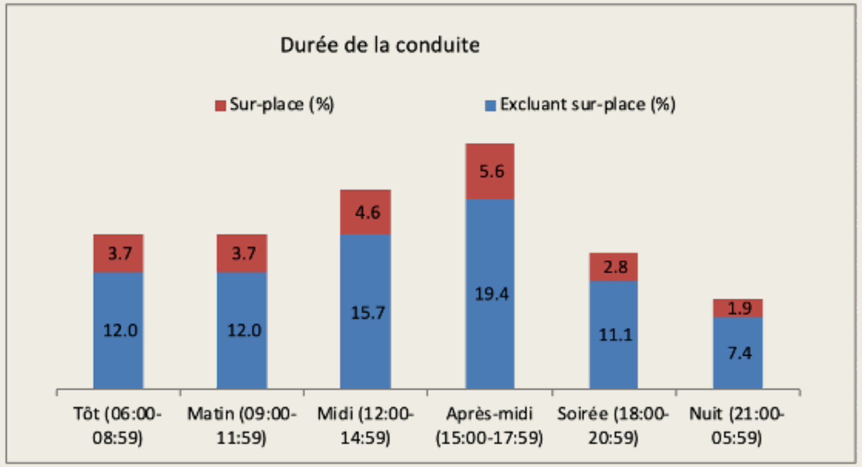
Durée, distance et consommation de carburant par sexe

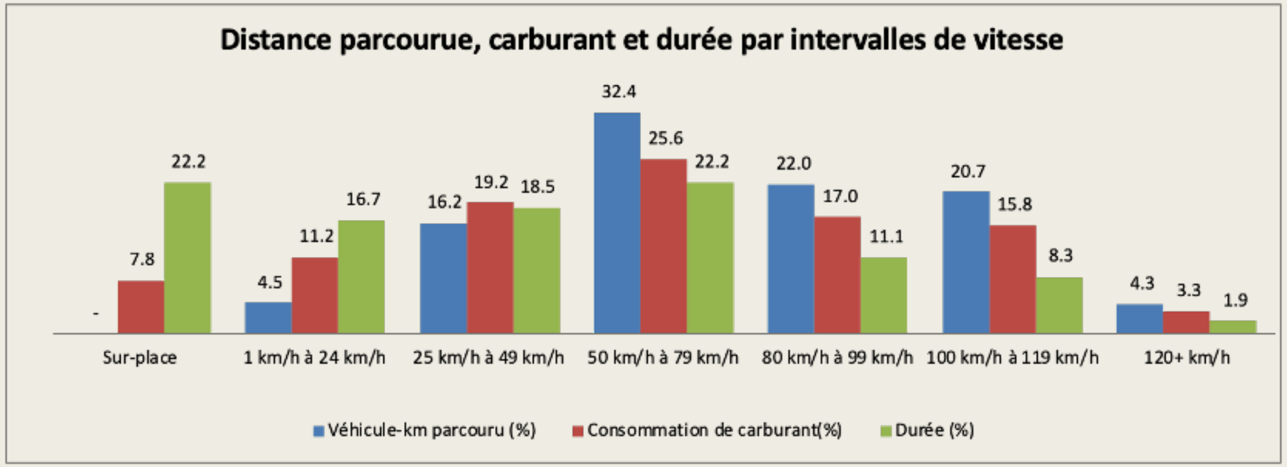


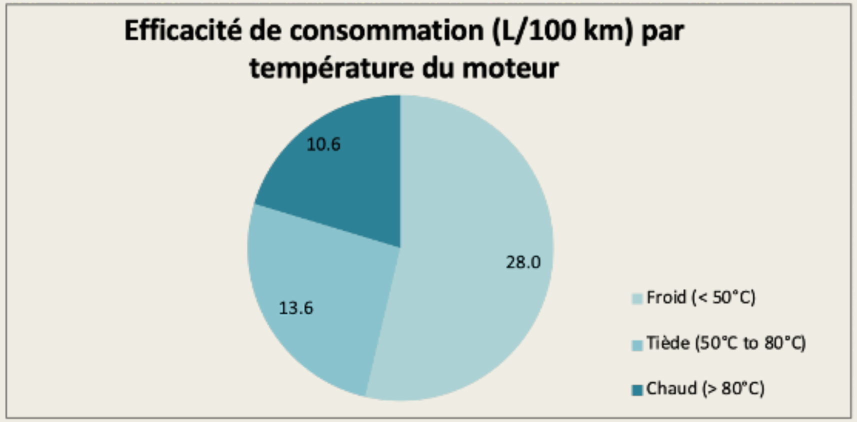
Consommation de carburant, distance et durée par âge des conducteurs

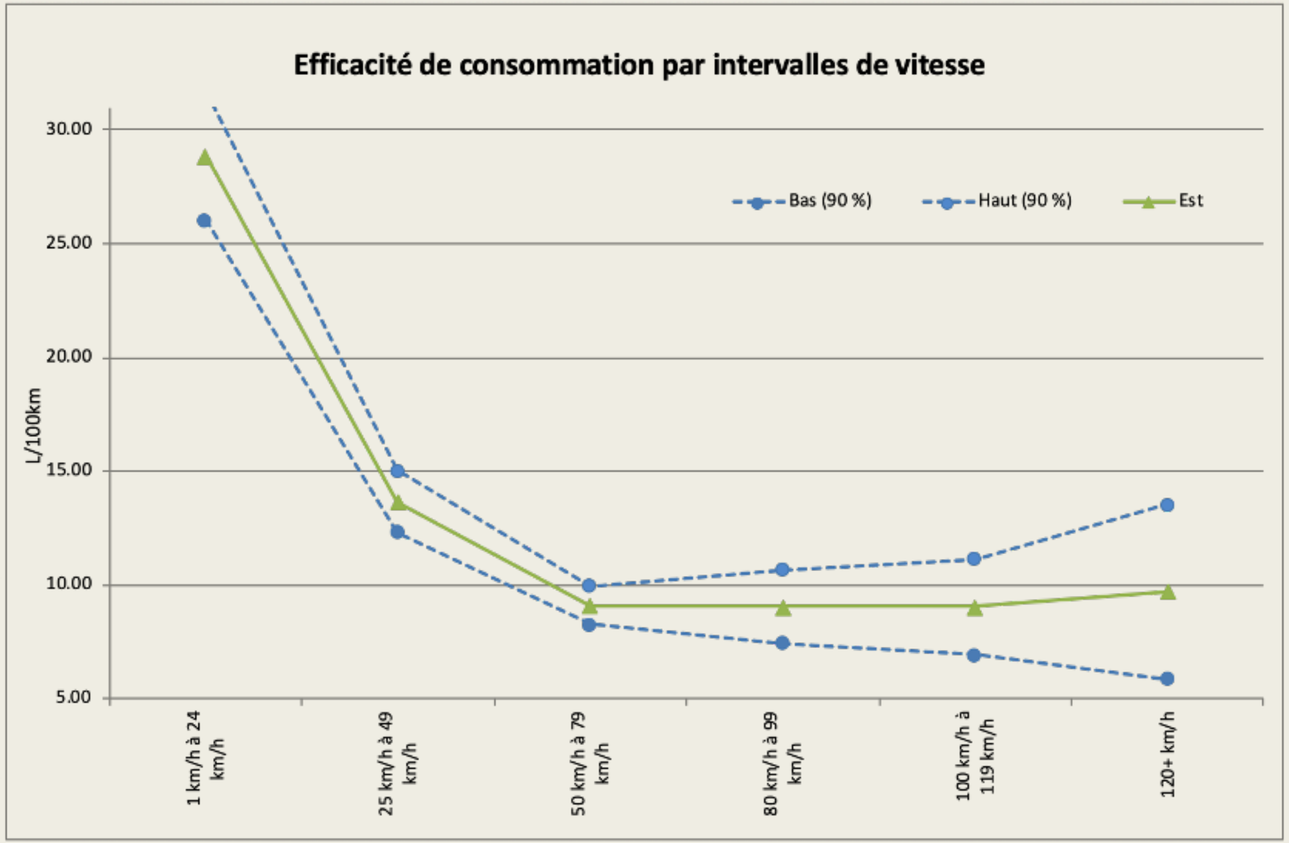
Ontario – 1er trimestre 2012

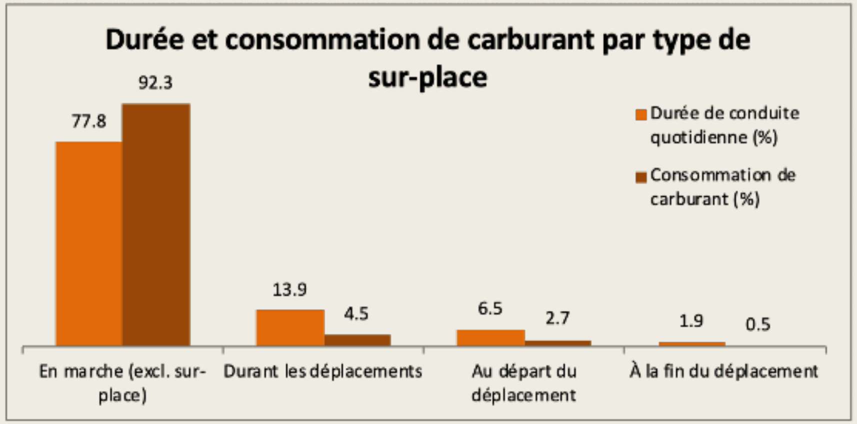
Sous-caractéristiques des déplacements


Durée de la conduite


Distance parcourue, carburant et durée par intervalles de vitesse


Efficacité de consommation (L/100 km) par température du moteur

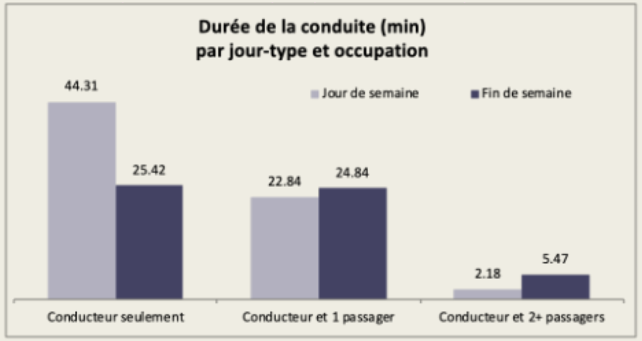

Efficacité de consommation par intervalles de vitesse

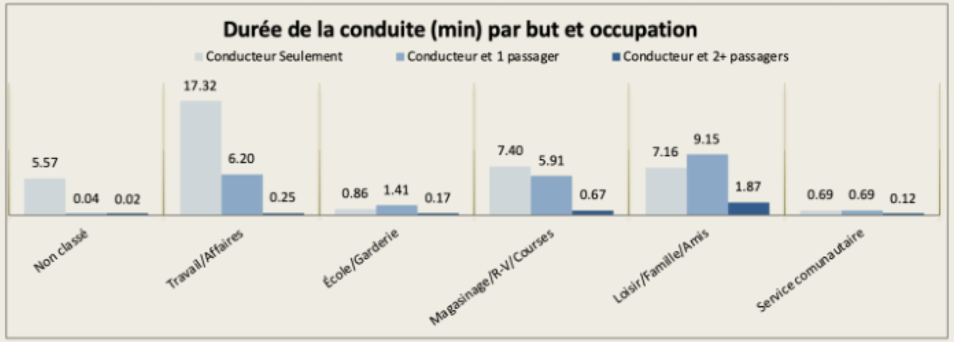

Durée et consommation de carburant par type de sur-place

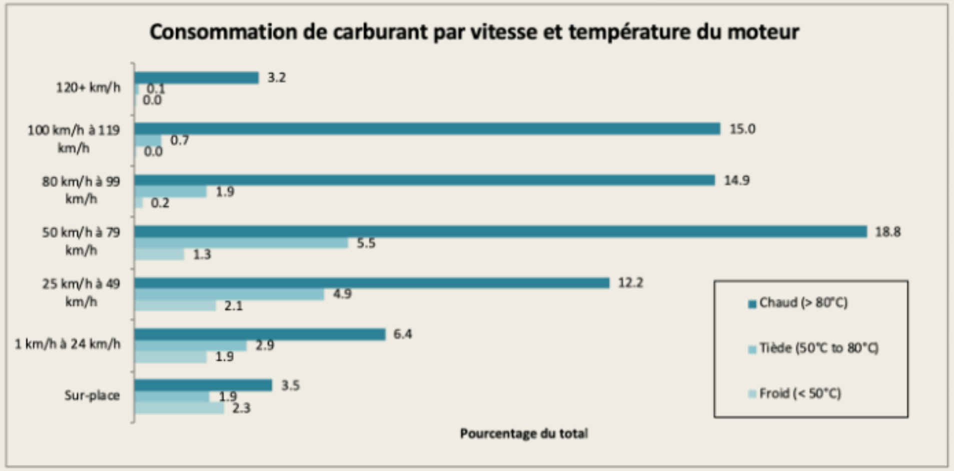
[Personal file]

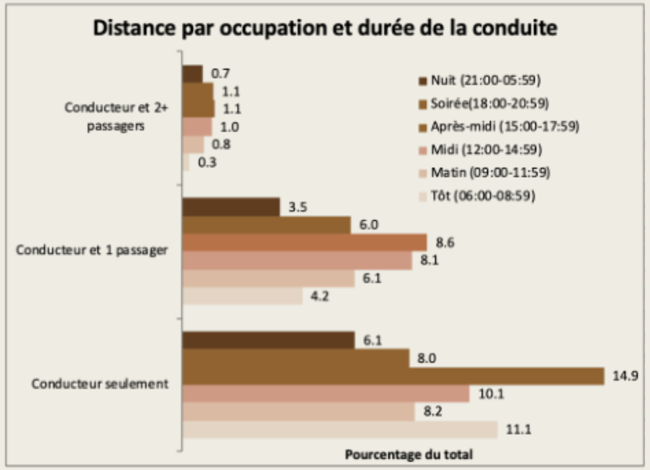
Ontario – 1er trimestre 2012

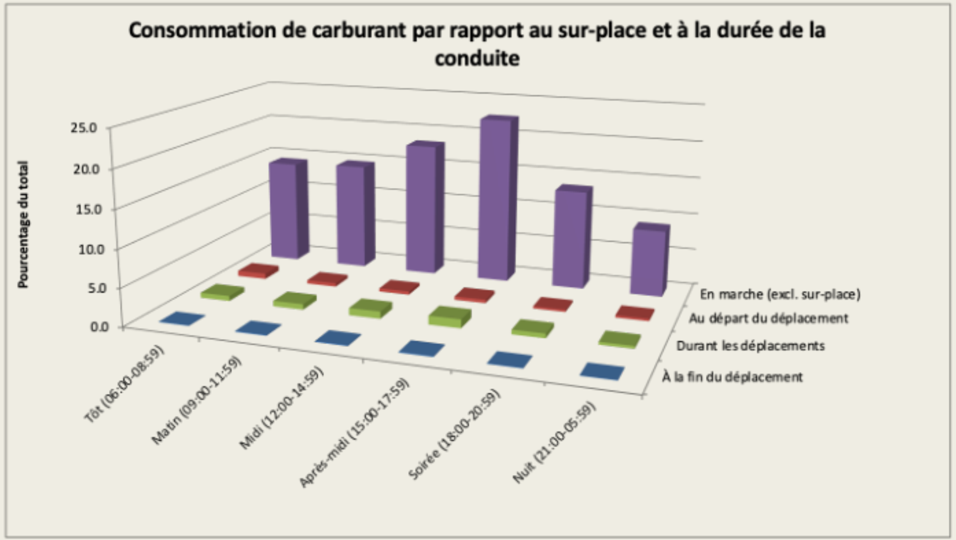
Caractéristiques mixtes sur les déplacements


Durée de la conduite (min) par jour-type et occupation


Durée de la conduite (min) par but et occupation


Consommation de carburant par vitesse et température du moteur


Distance par occupation et durée de la conduite


Consommation de carburant par rapport au sur-place et à la durée de la conduite

WHAT IS WRONG WITH THEM?

Dashboard #1: not glanceable, overuse of colour, pie charts, …

Dashboard #2: 3D visualizations, distracting borders and background, lack of filtered data, insufficient labels and context, …

Dashboards #3: where to begin …

EXERCISE

In teams or individually, identify a scenario for which a dashboard could prove useful.

Determine specific questions that the dashboard could help answer or insights that it could provide.

Identify data sources and data elements that could be fed into your dashboard.

Design a display (with pen and paper) with mock charts.

What are the strengths and limitations of your dashboard? Is it functional? Elegant?