Data Visualisation

Chapter 4: Avoiding Deception

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Viewing slides…

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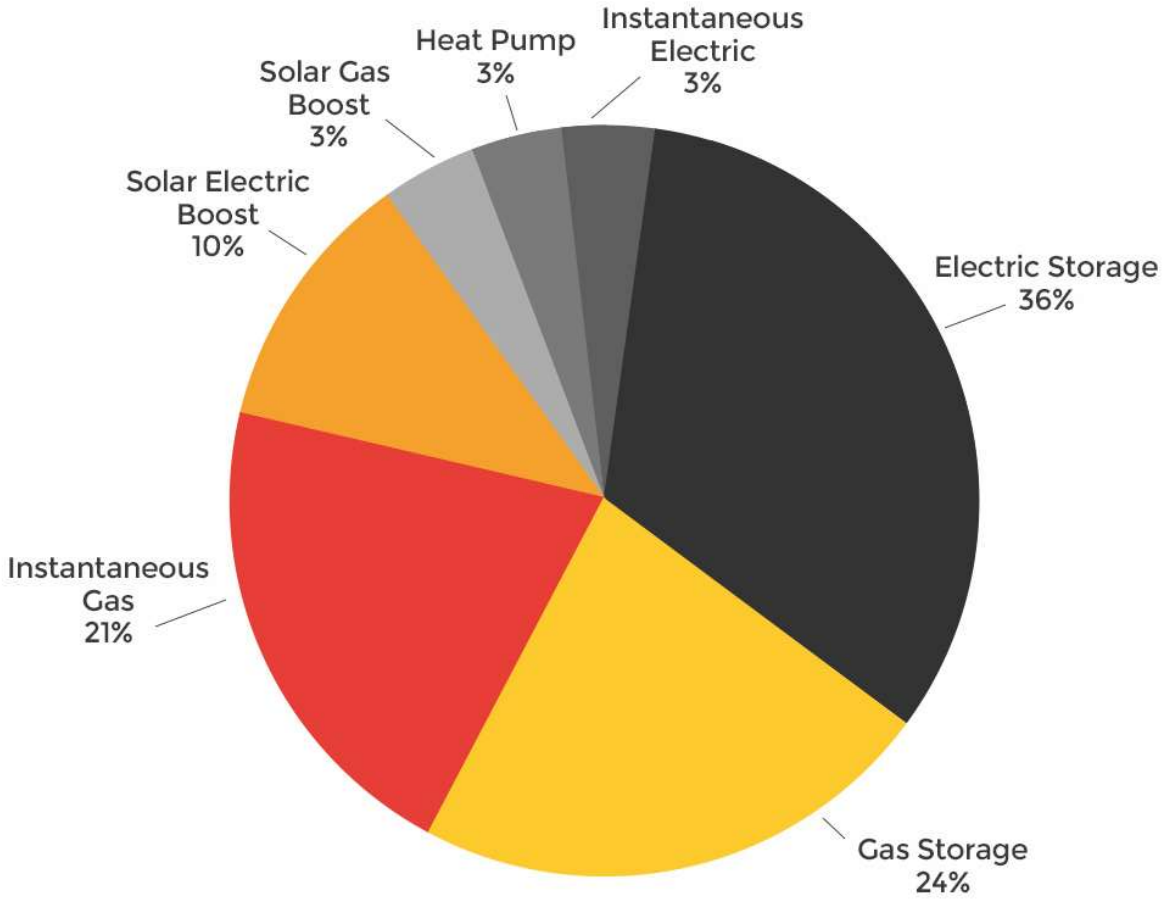
Deception

- “Never deceive the receiver” (Kirk 2012)
- What is deception in data visualisation?
  - “*a graphical depiction of information, designed with or without an intent to deceive, that may create a belief about the message and/or its components, which varies from the actual message.*” (p. 1471, Pandey et al. 2015)
- Deception implies intent, but does intent matter?
- Regardless of intent, poor designs can deceive.

The issue with pie charts

- Here is an example of a typical pie chart (Energy Rating 2019)…

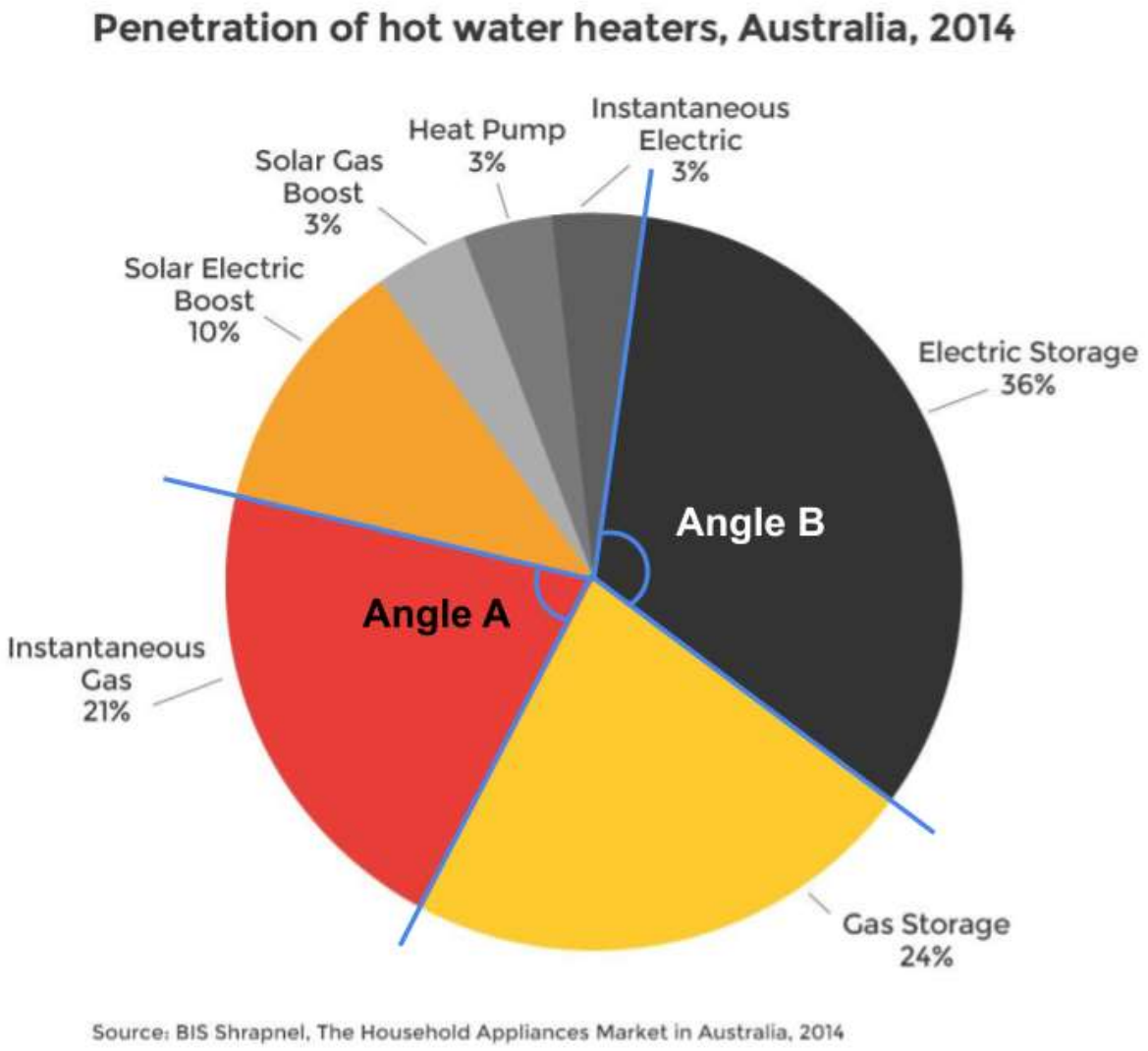
Penetration of hot water heaters, Australia, 2014



Source: BIS Shrapnel, The Household Appliances Market in Australia, 2014

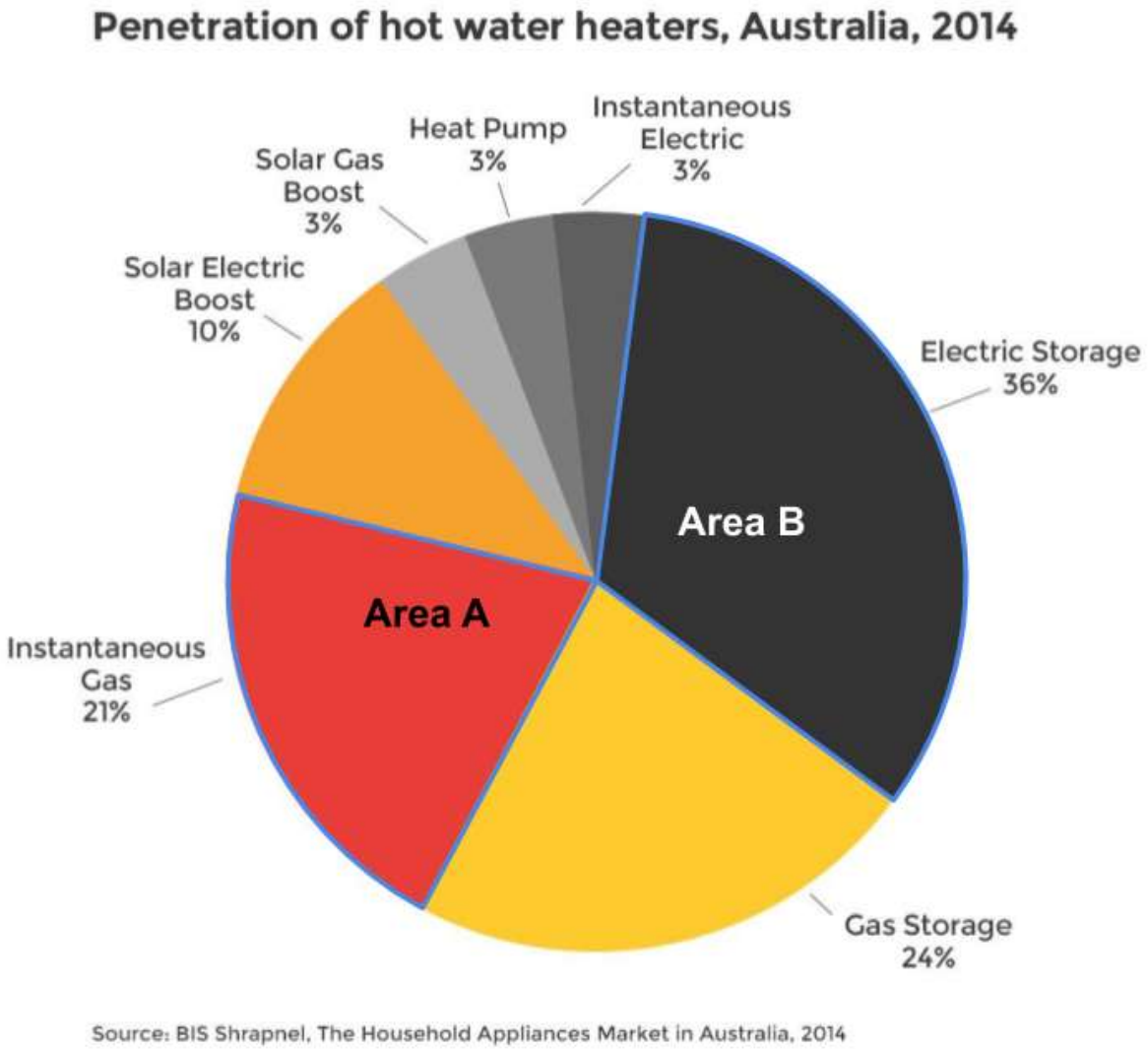
The issue with pie charts Cont.

- Pie charts use angles to represent proportions



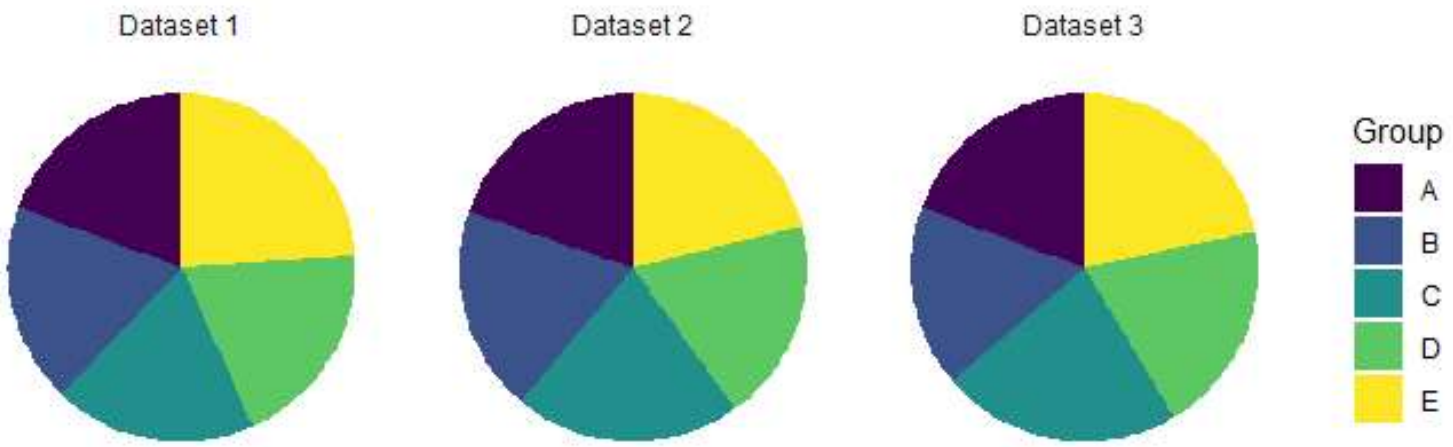
The issue with pie charts Cont. 2

- Pie charts also use area.



The issue with pie charts Cont. 3

- For each dataset, rank the groups from highest to lowest.

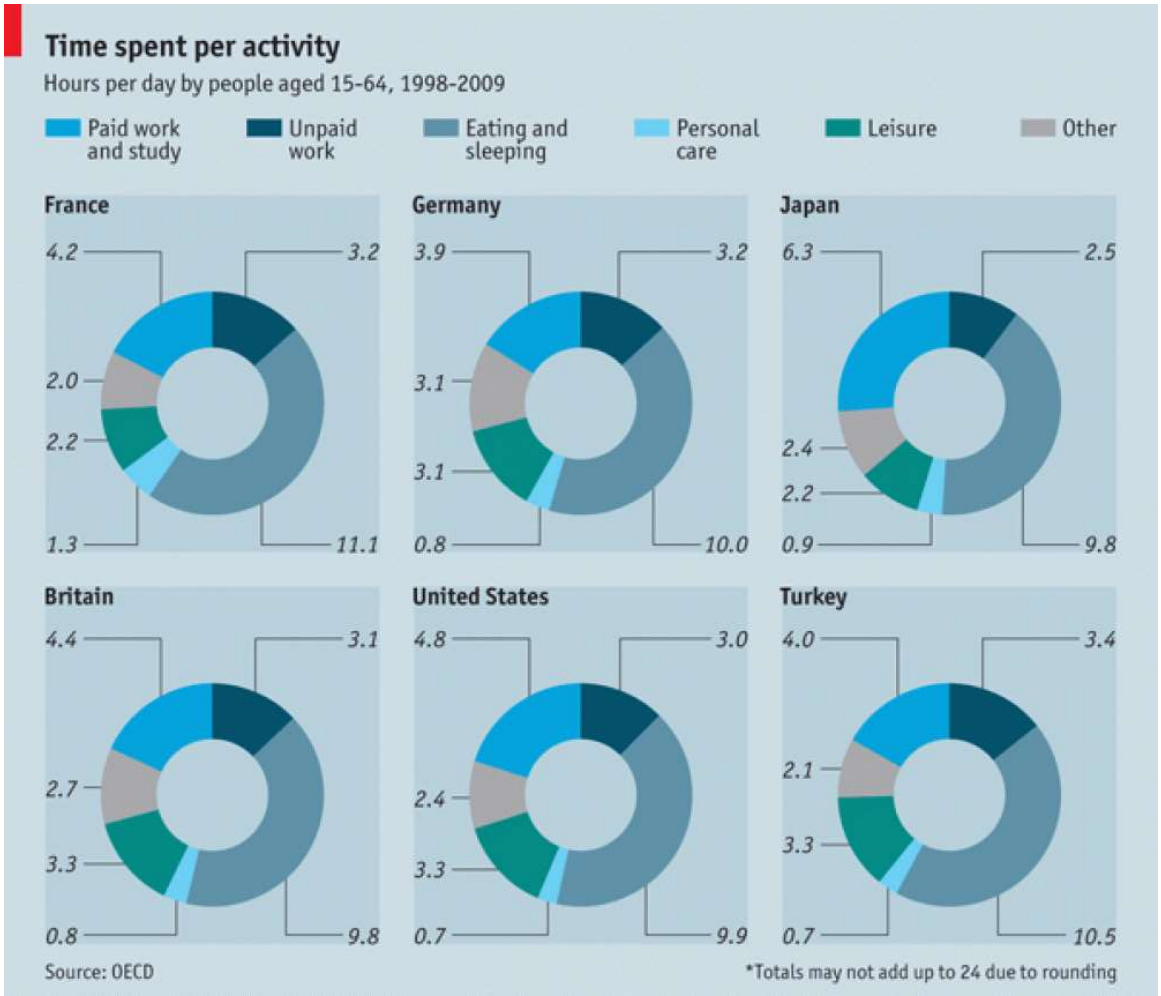


The issue with pie charts Cont. 4

- **Angle** and **area** are inferior to **position** in terms of accuracy.

Doughnuts?

- There are many variations of pie charts (The Economist Online 2011).

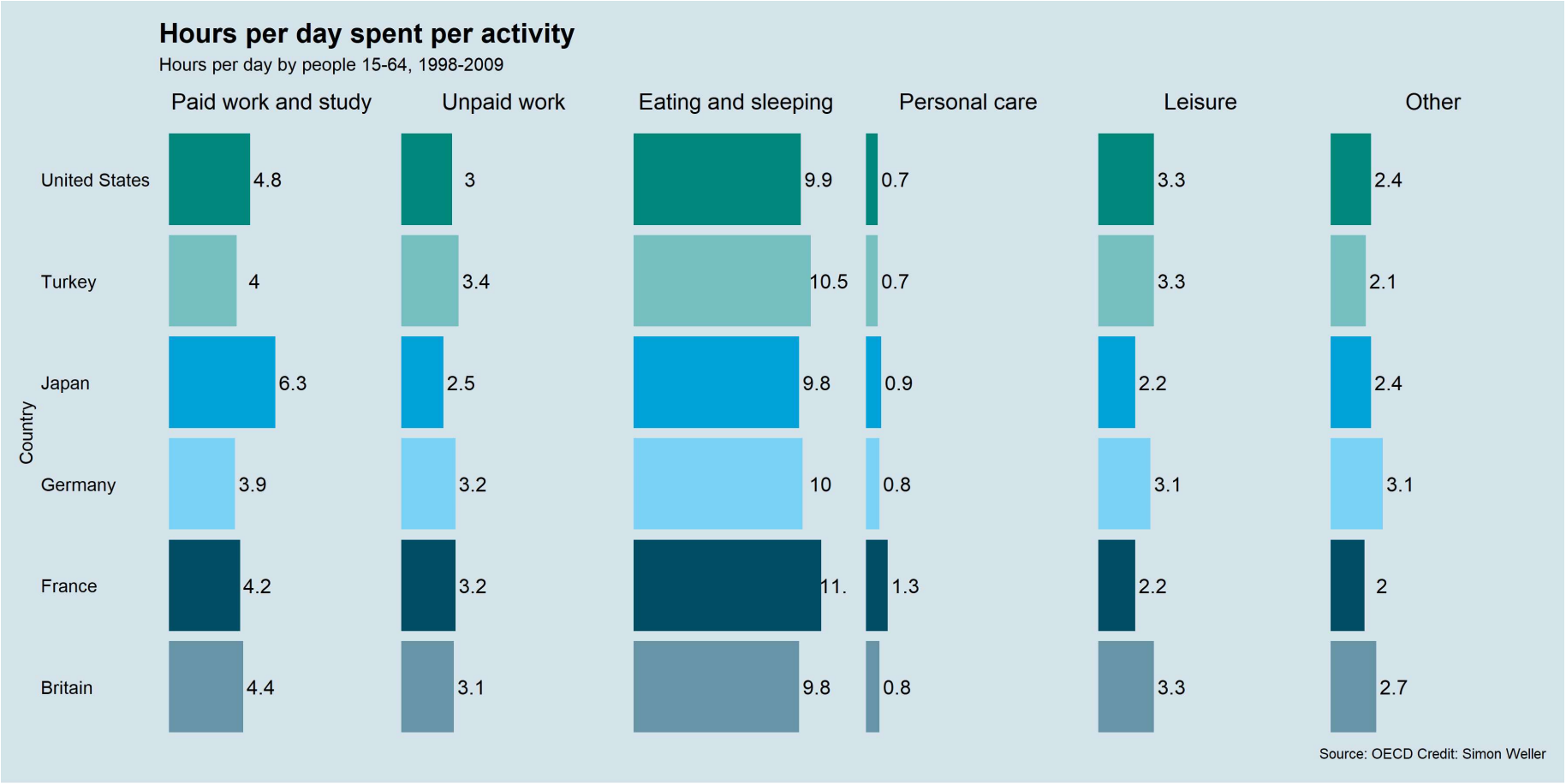


The issue with pie charts - Summary

- Area and angle lack visual accuracy compared to position (e.g. bar charts)
- Pie charts perform poorly when proportions are similar
- Pie charts rely on colour to differentiate between segments. Therefore, colour needs to be used with caution.
- Pie charts are limited in the number of categories they can present effectively.
- Pie charts with very small proportions are hard to see and label.

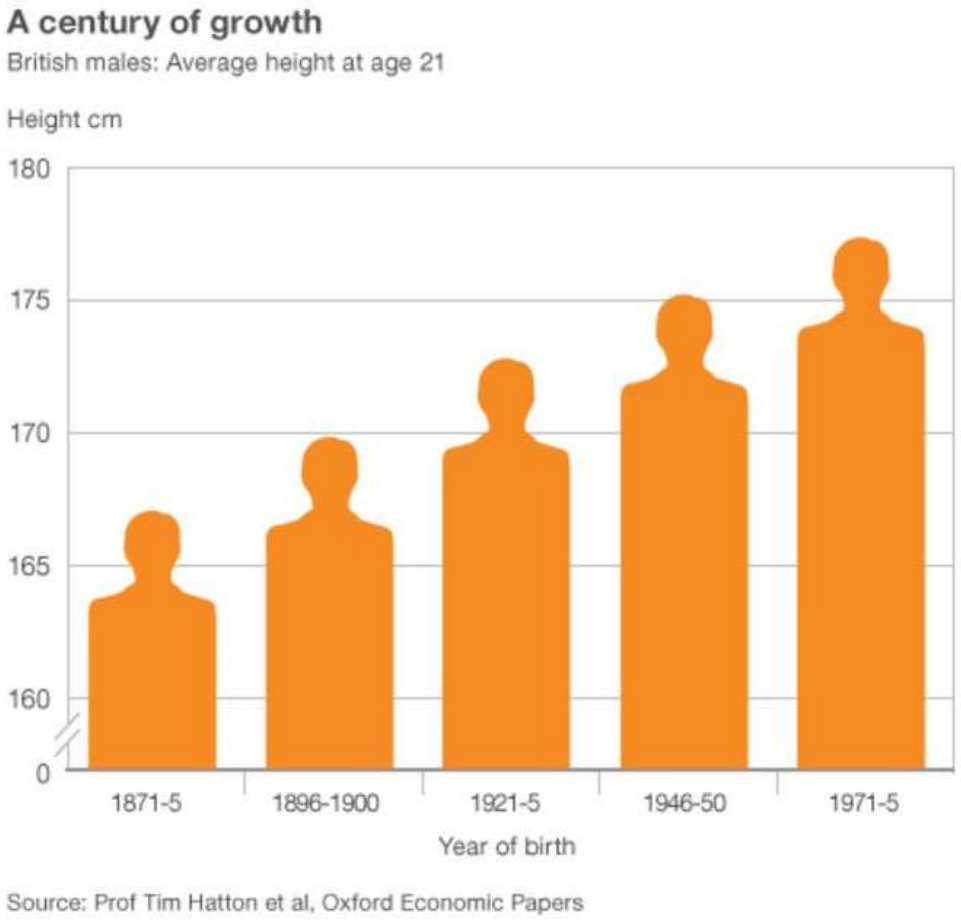
Avoding deception - Pie charts

- Simon Weller, a former student, fixed The Economist Online (2011)'s doughnut charts using faceted bar charts.



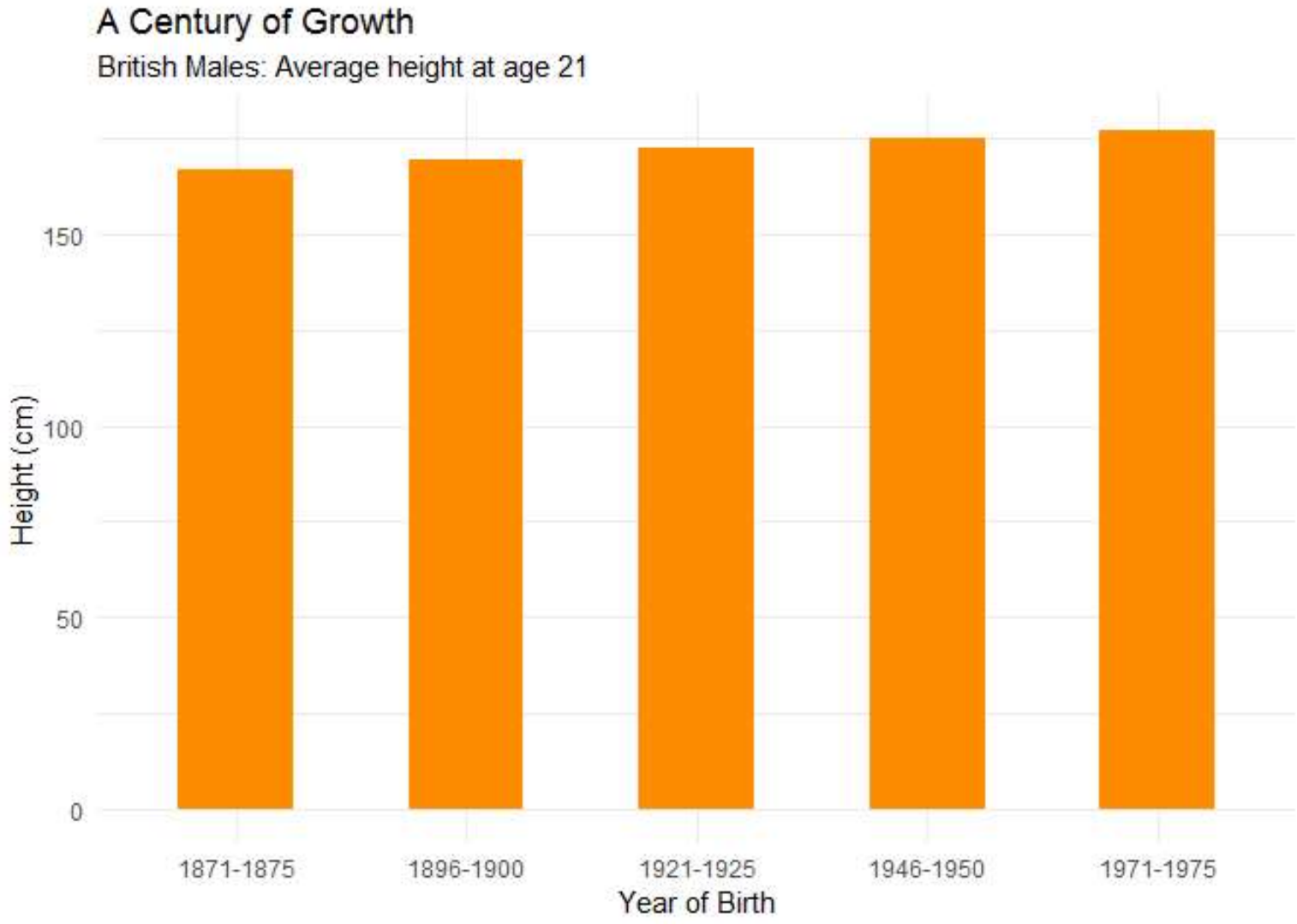
Truncated axes

- Think carefully about truncating your axes (Parkinson 2013).



Avoiding deception - Truncated axes

- Fixing the y-axis has a drastic visual effect.



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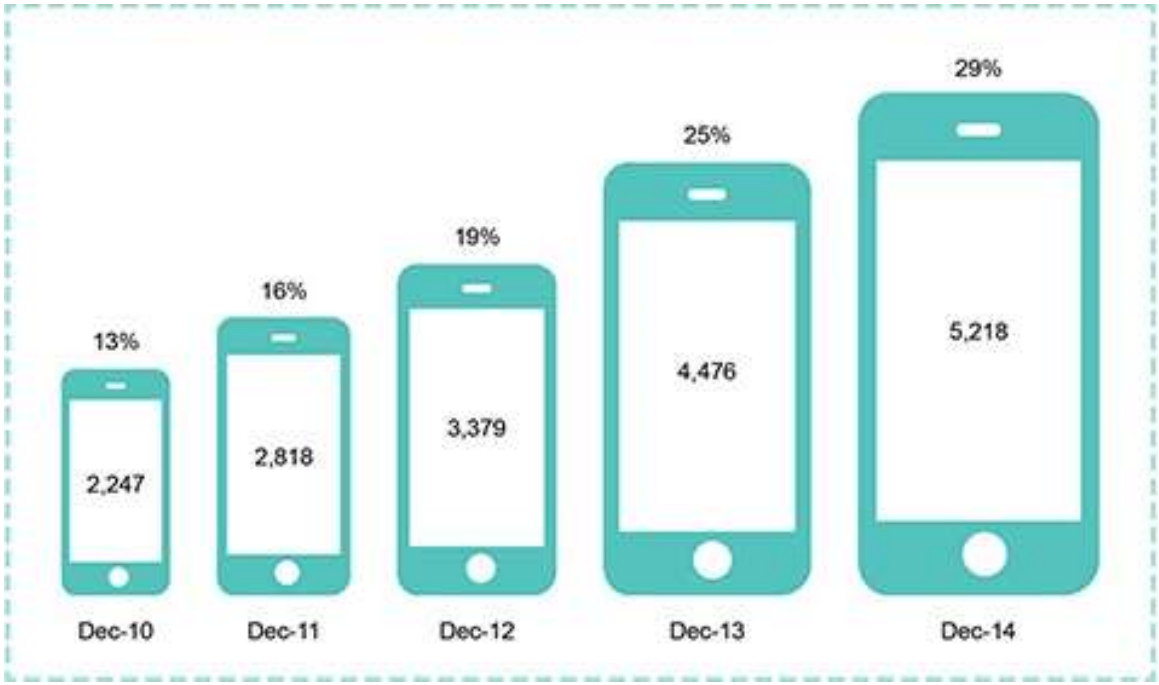
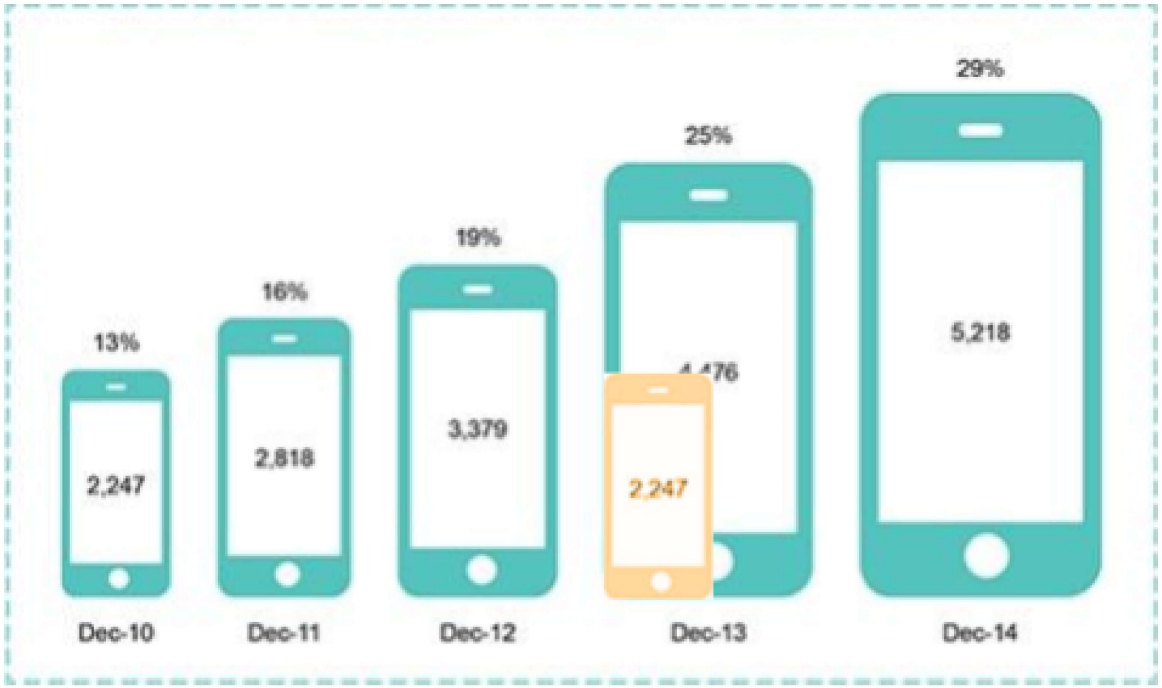
Using area or size to depict a quantity

- What is wrong with the following data visualisation (ACMA Research and Analysis Section 2015)?



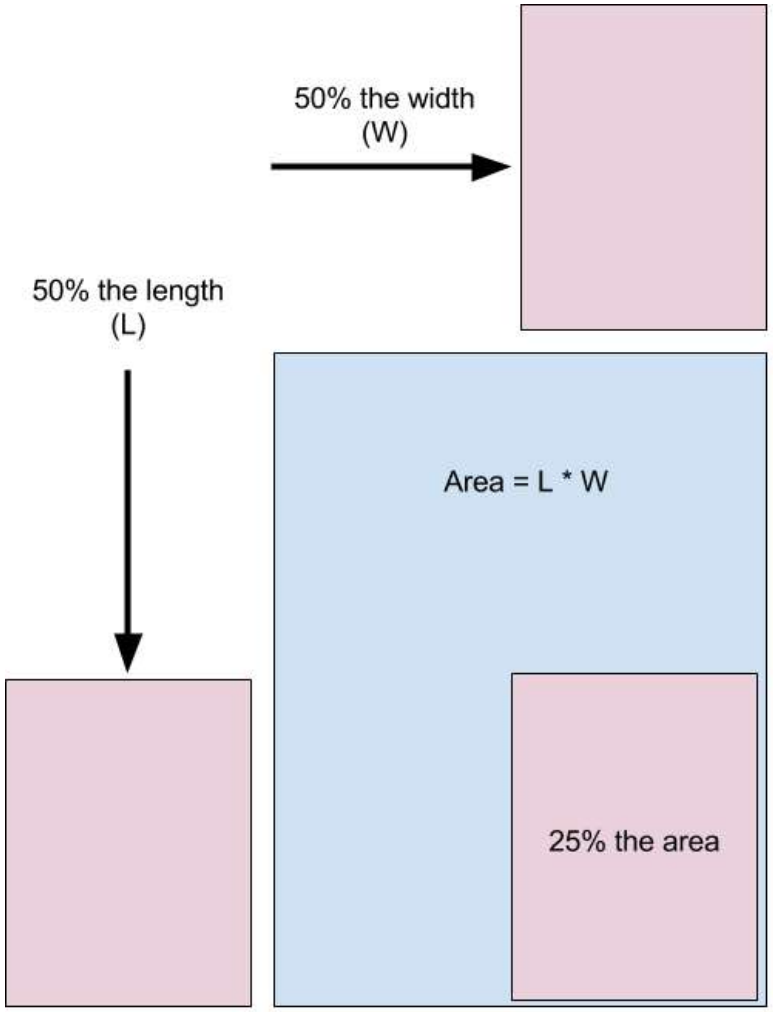
Using area or size to depict a quantity Cont.

- Area is not scaled correctly.



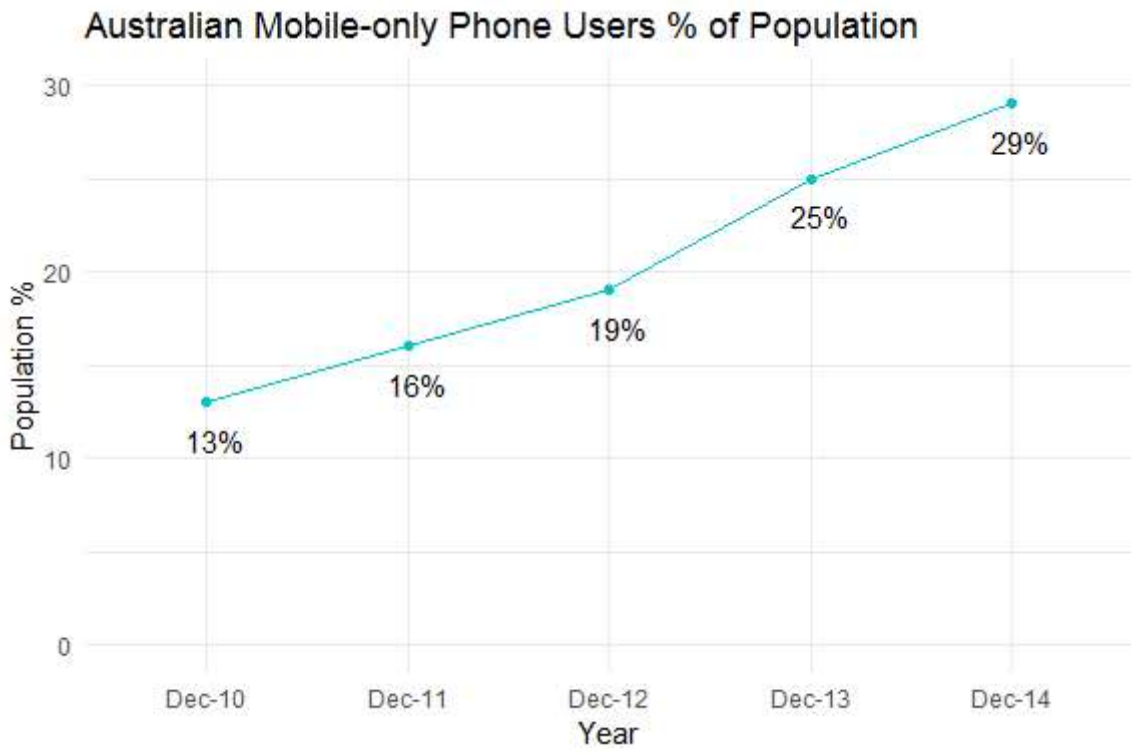
Using area or size to depict a quantity Cont. 2

- Area = L * W.



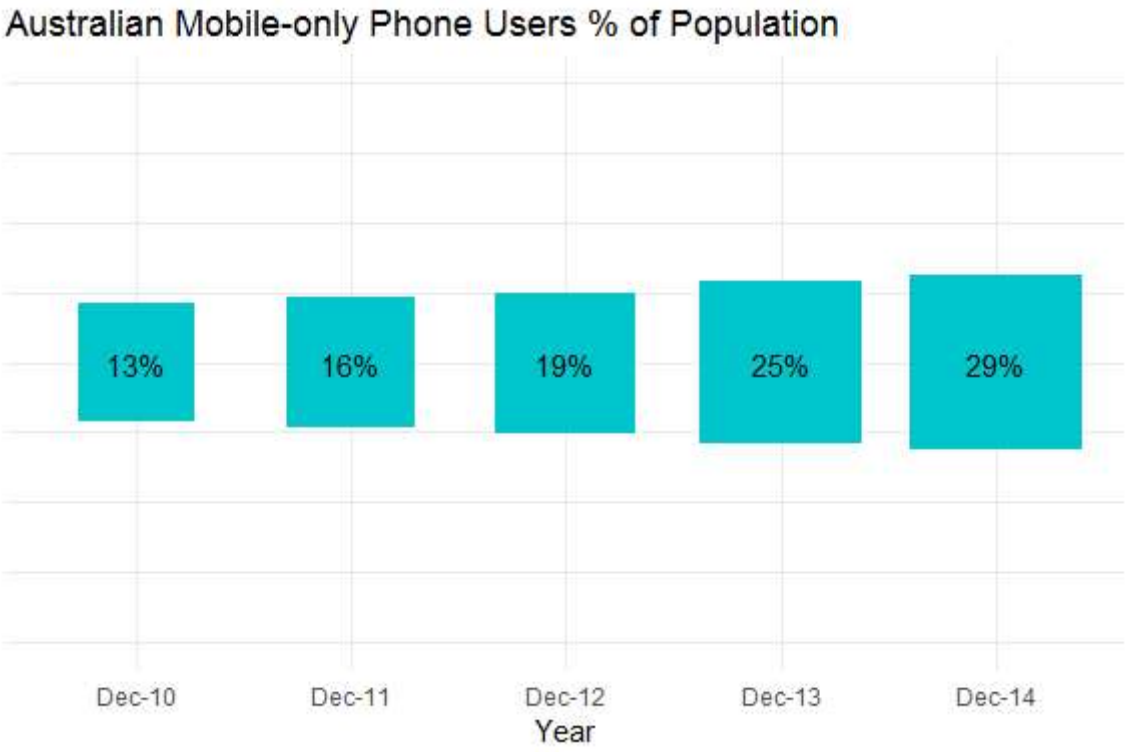
Avoiding deception - Area and size as quantity

- Fixed using a time-series plot.



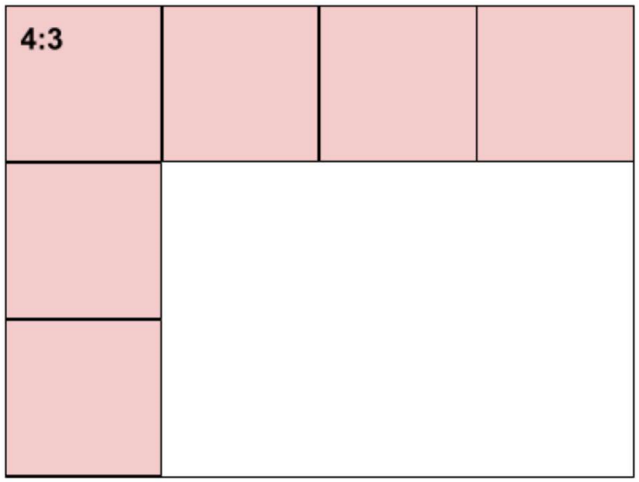
Avoiding deception - Area and size as quantity Cont.

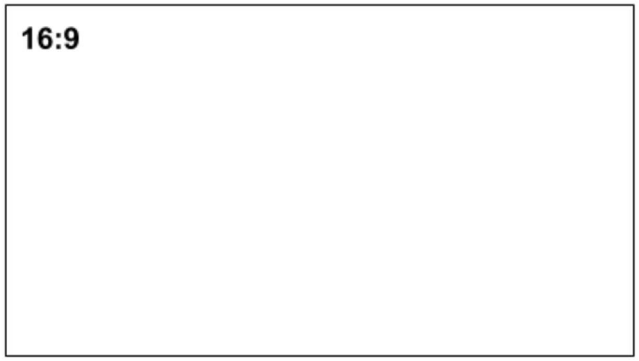
- When using size, use a 1:1 mapping (Pandey et al. 2015).

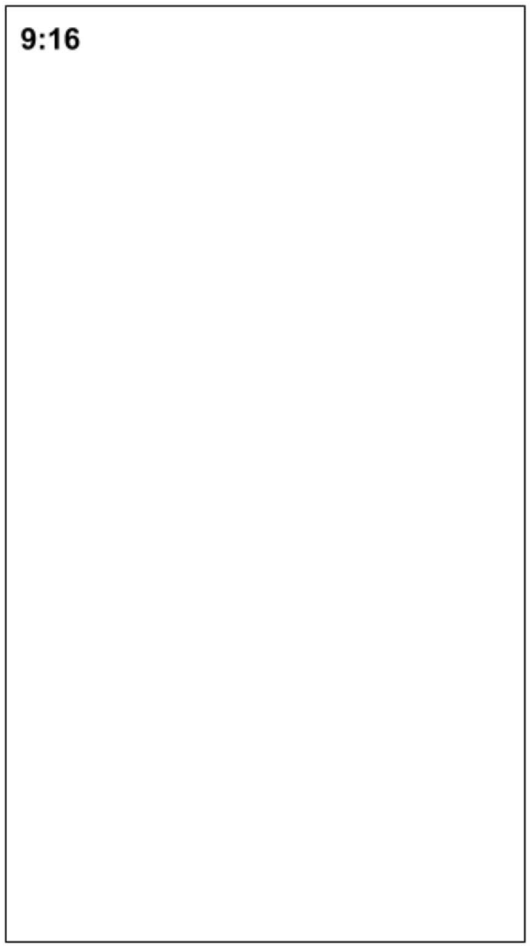


Changing plot aspect ratio

- Adjusting the aspect ratios of our plots can deceive.

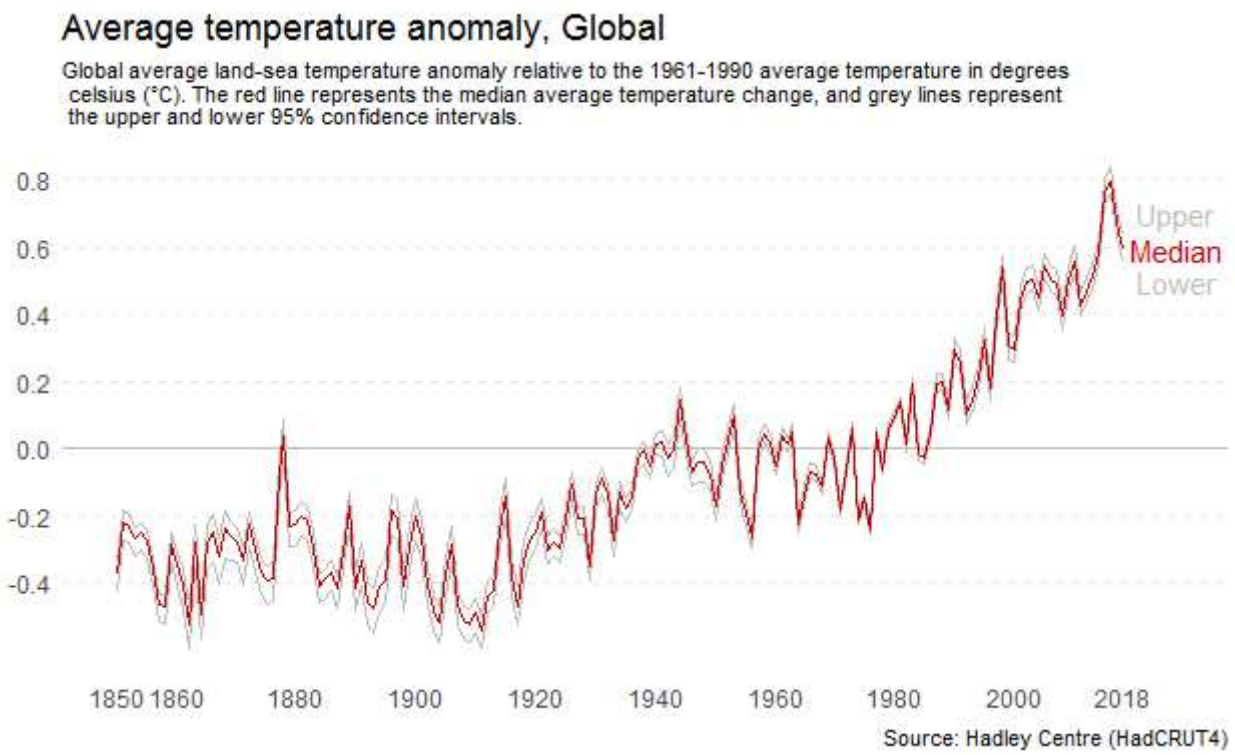






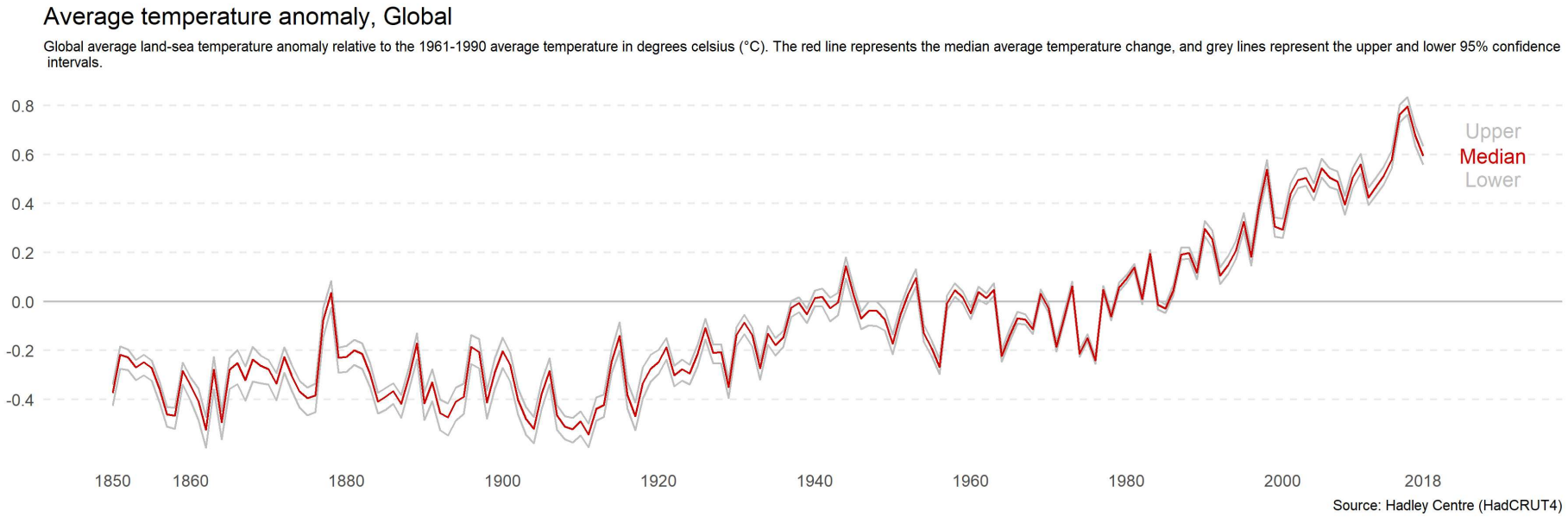
Changing plot aspect ratio Cont.

- A reproduction of the temperature anomaly time series plot by Ritchie and Roser (2017).



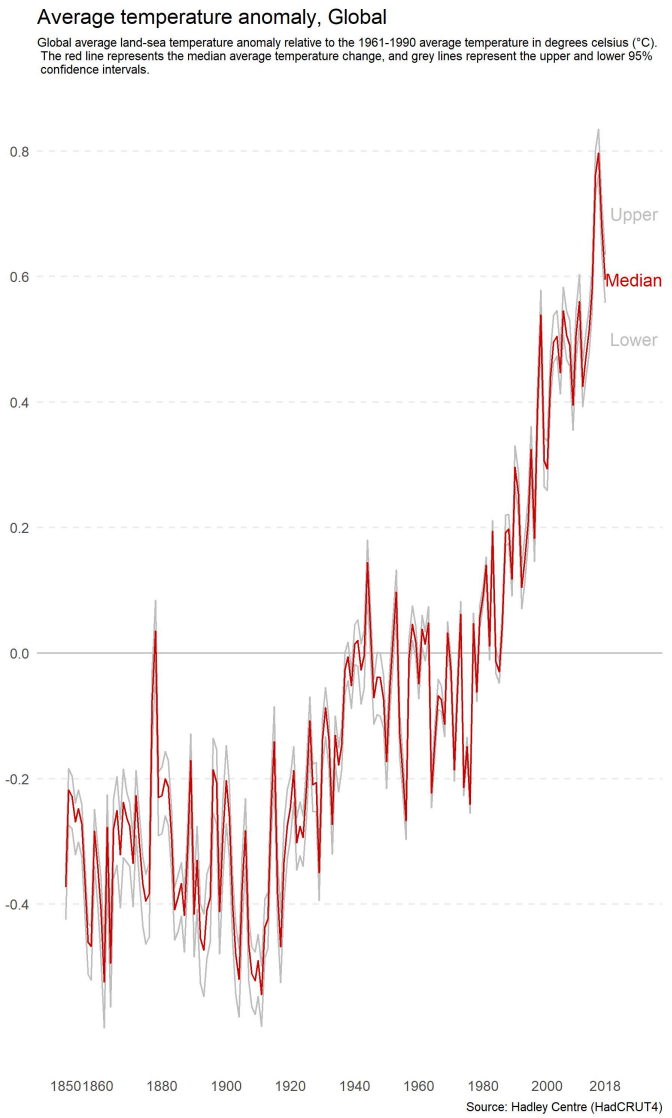
Changing plot aspect ratio Cont. 2

- Increasing the width of a plot relative to height minimise perceived change



Changing plot aspect ratio Cont. 3

- Increasing the height of a plot relative to width increases perceived change

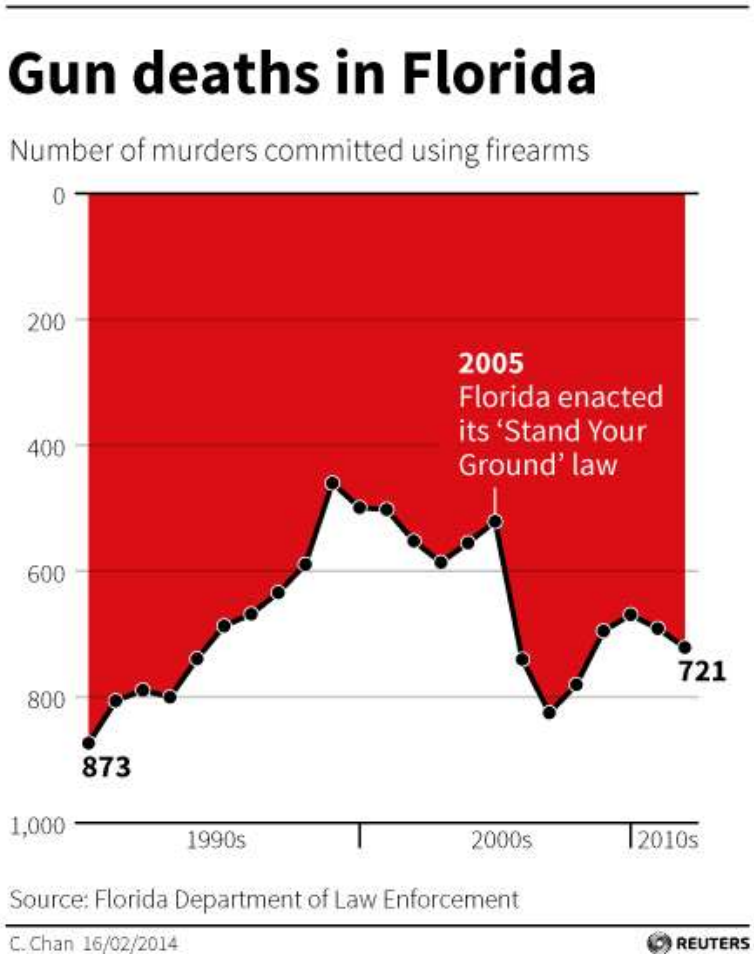


Avoiding deception - Plot aspect ratio

- Avoid extreme aspect ratios
- Consider the effect of dynamic scaling used by web browsers
- Set the aspect ratio to reflect an accurate account of the data

Ignoring convention

- Ignoring convention can deceive (Chan, 2014, as cited in Engel 2014).

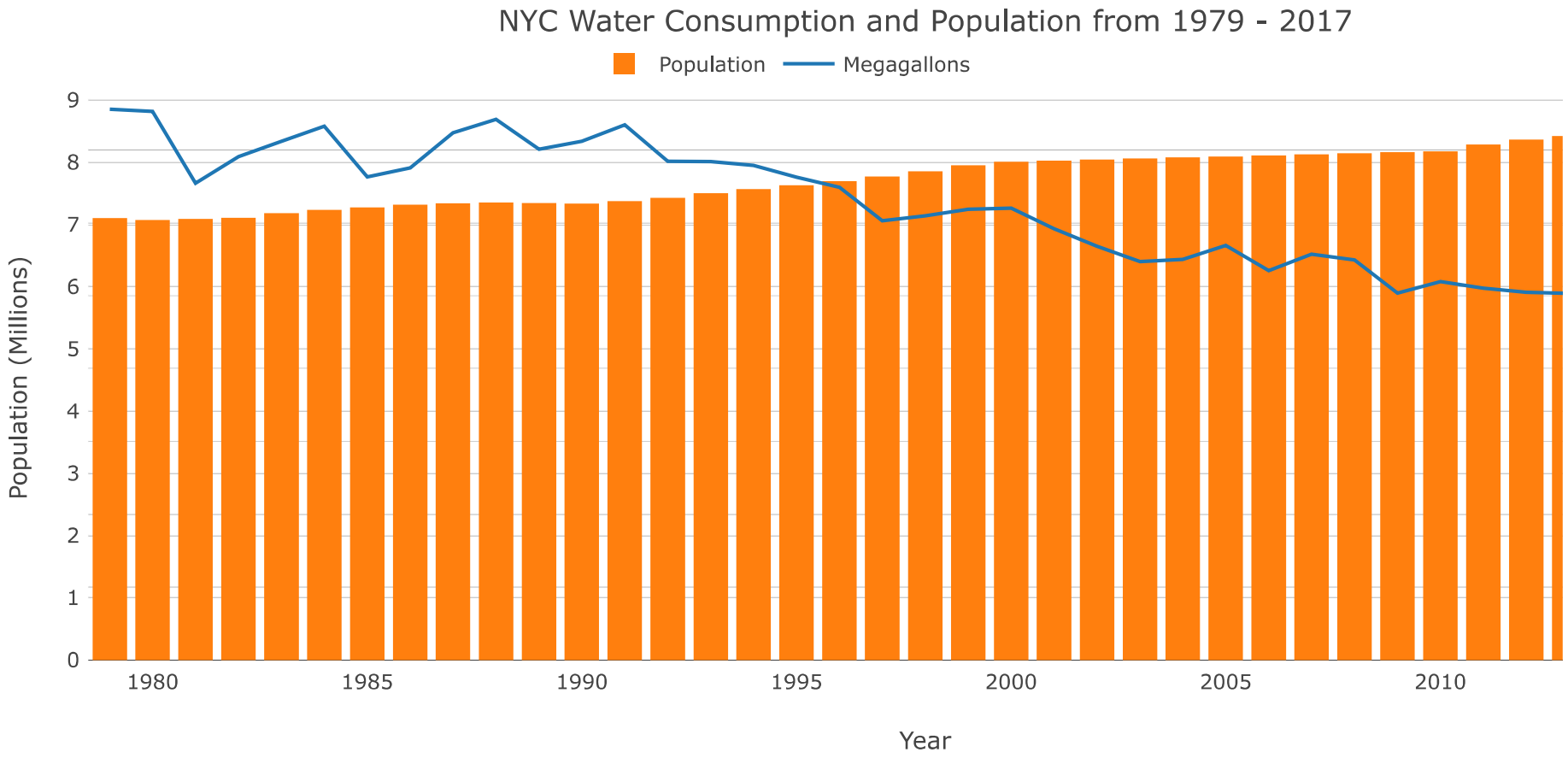


Avoding deception - Ignoring convention

- Stick to convention (Engel 2014).

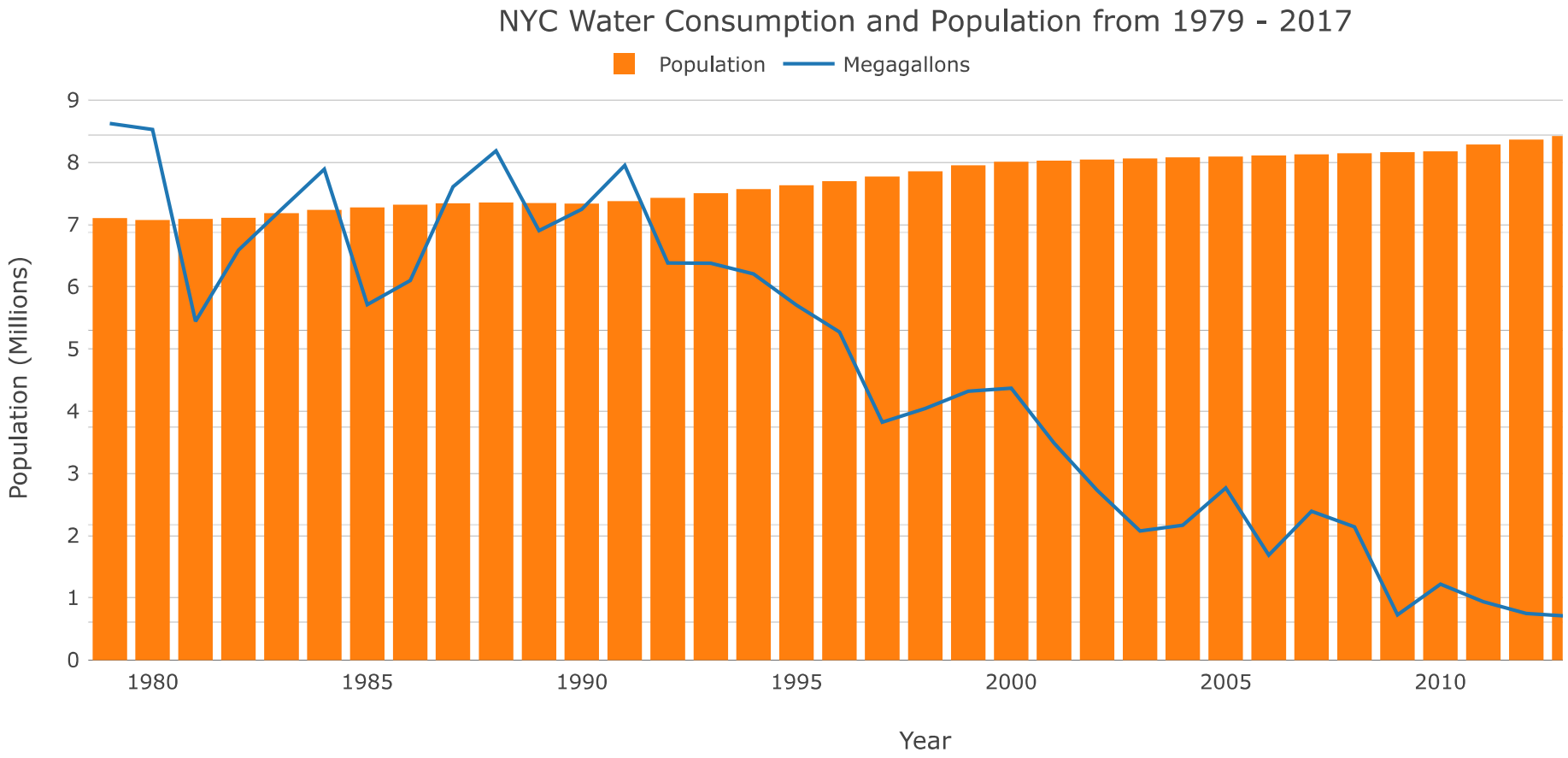
Dual axes

- NYC Water Consumption and Population 1979 - 2017.



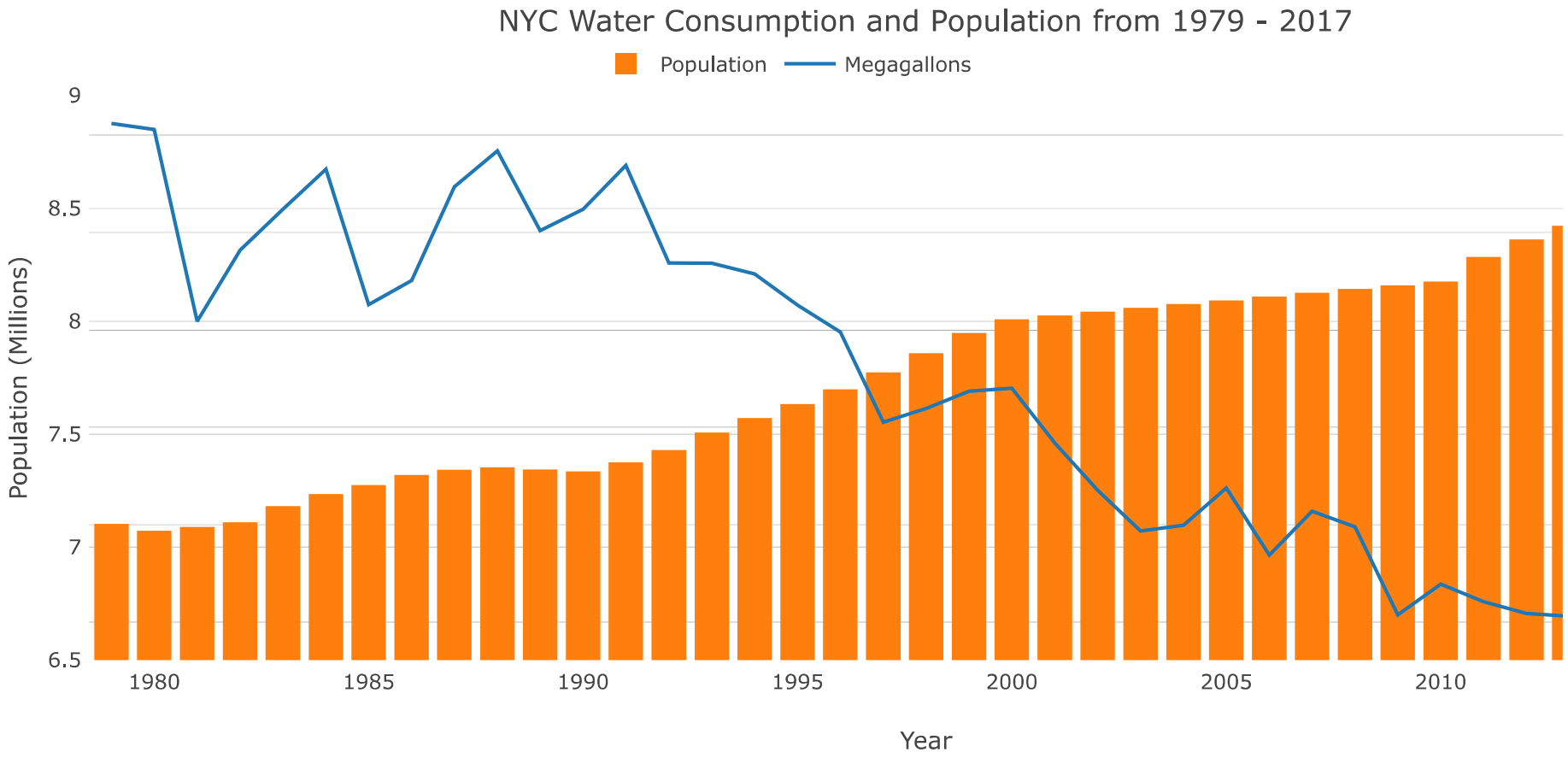
Dual axes Cont.

- Water use has plummeted!



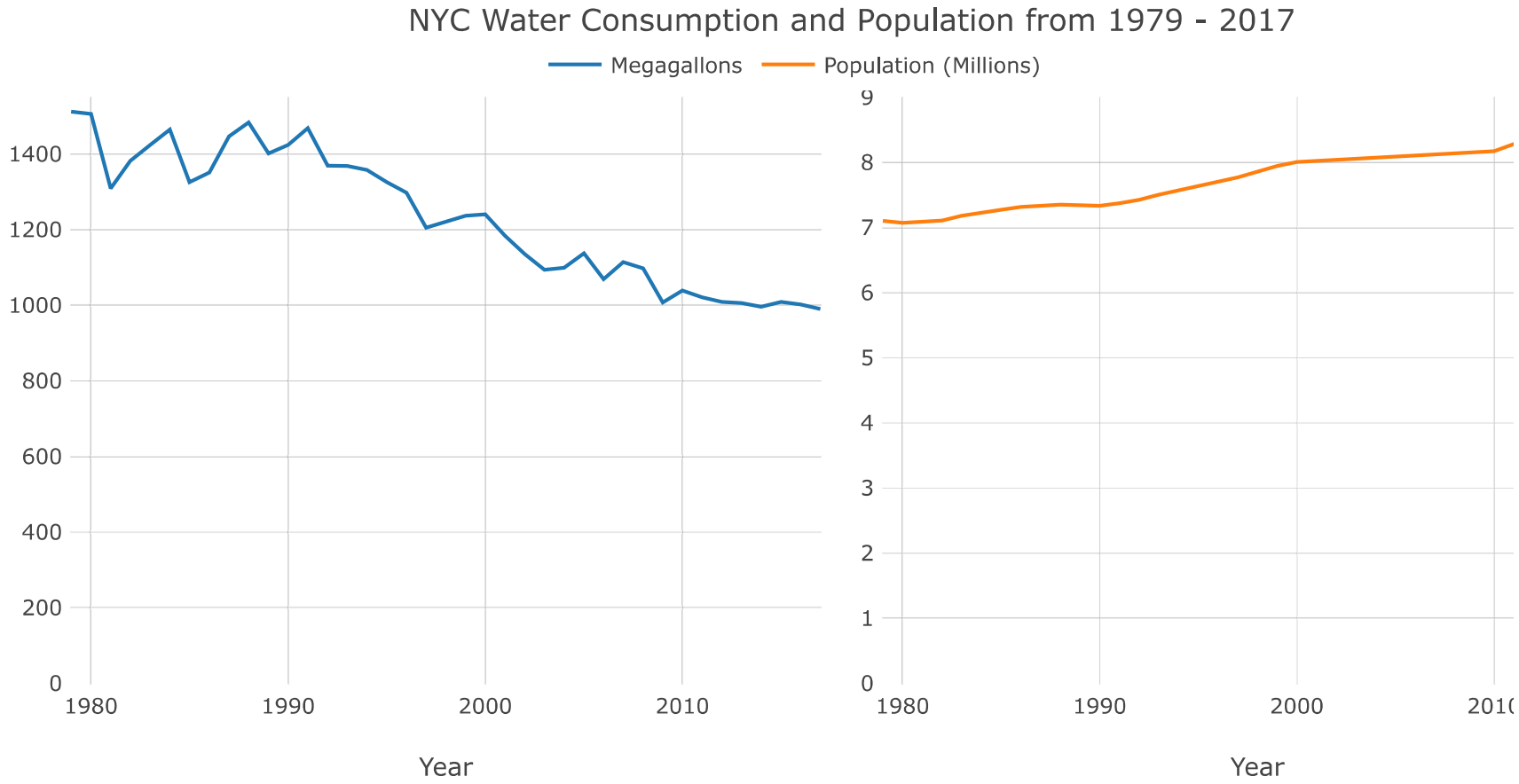
Dual axes Cont. 2

- Population has exploded!



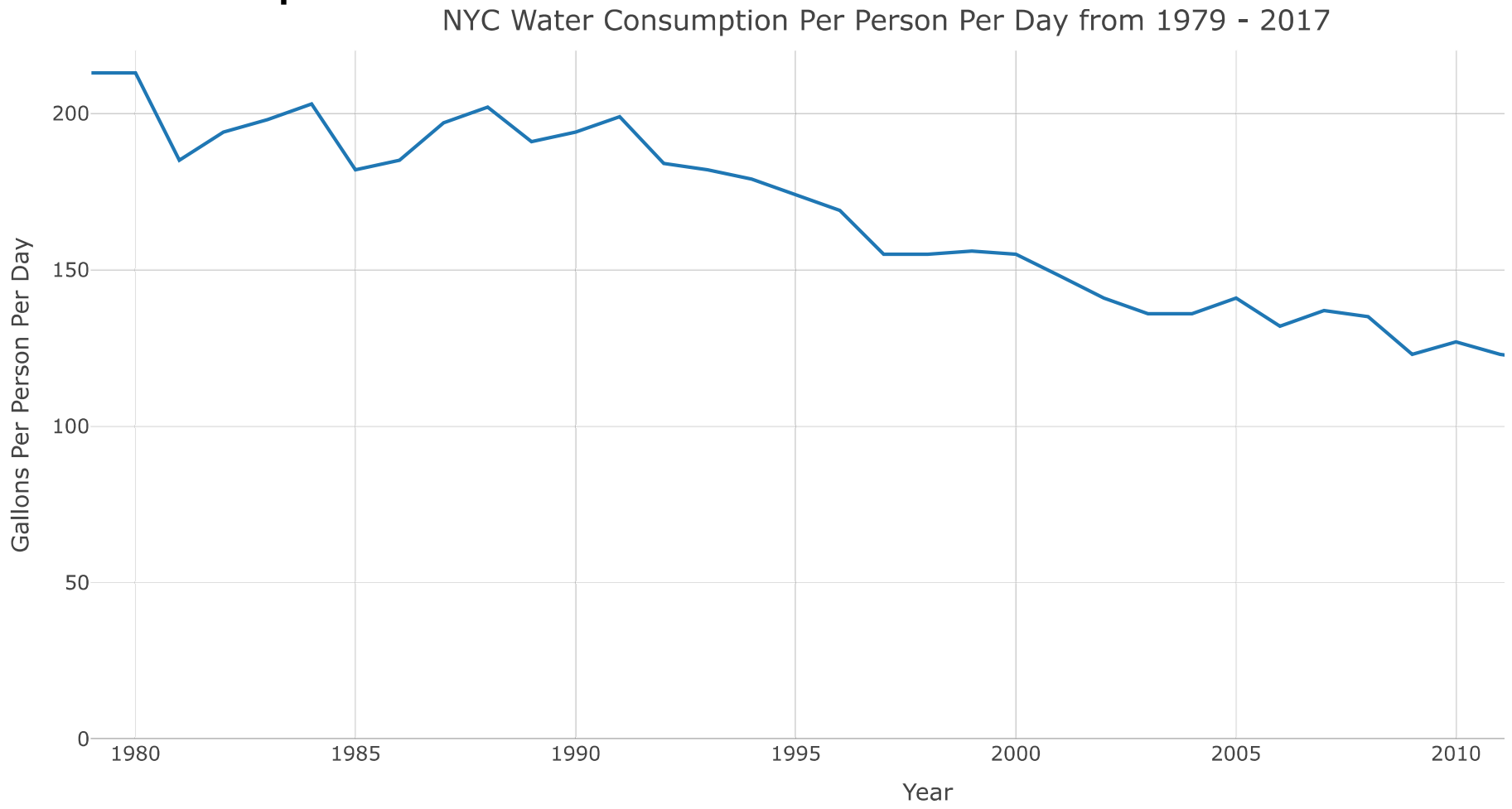
Avoding deception - Dual axes

- Avoid dual-axis plots - better alternatives are available
- Side-by-side, or broken charts, are a preferred alternative to dual axes plots (Isenberg et al. 2011).



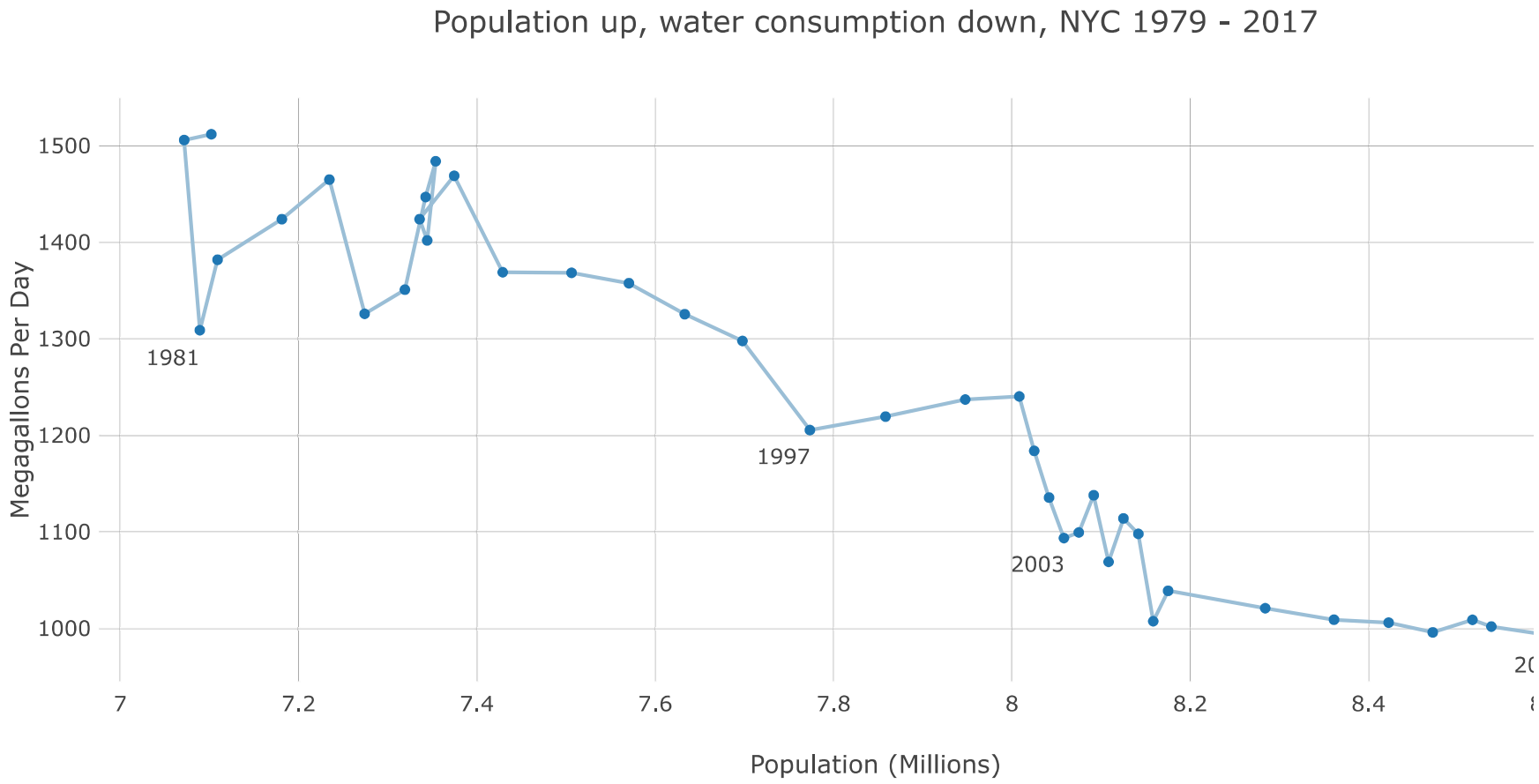
Avoding deception - Dual axes Cont.

- A ratio of two quantitative variables avoids dual axes.



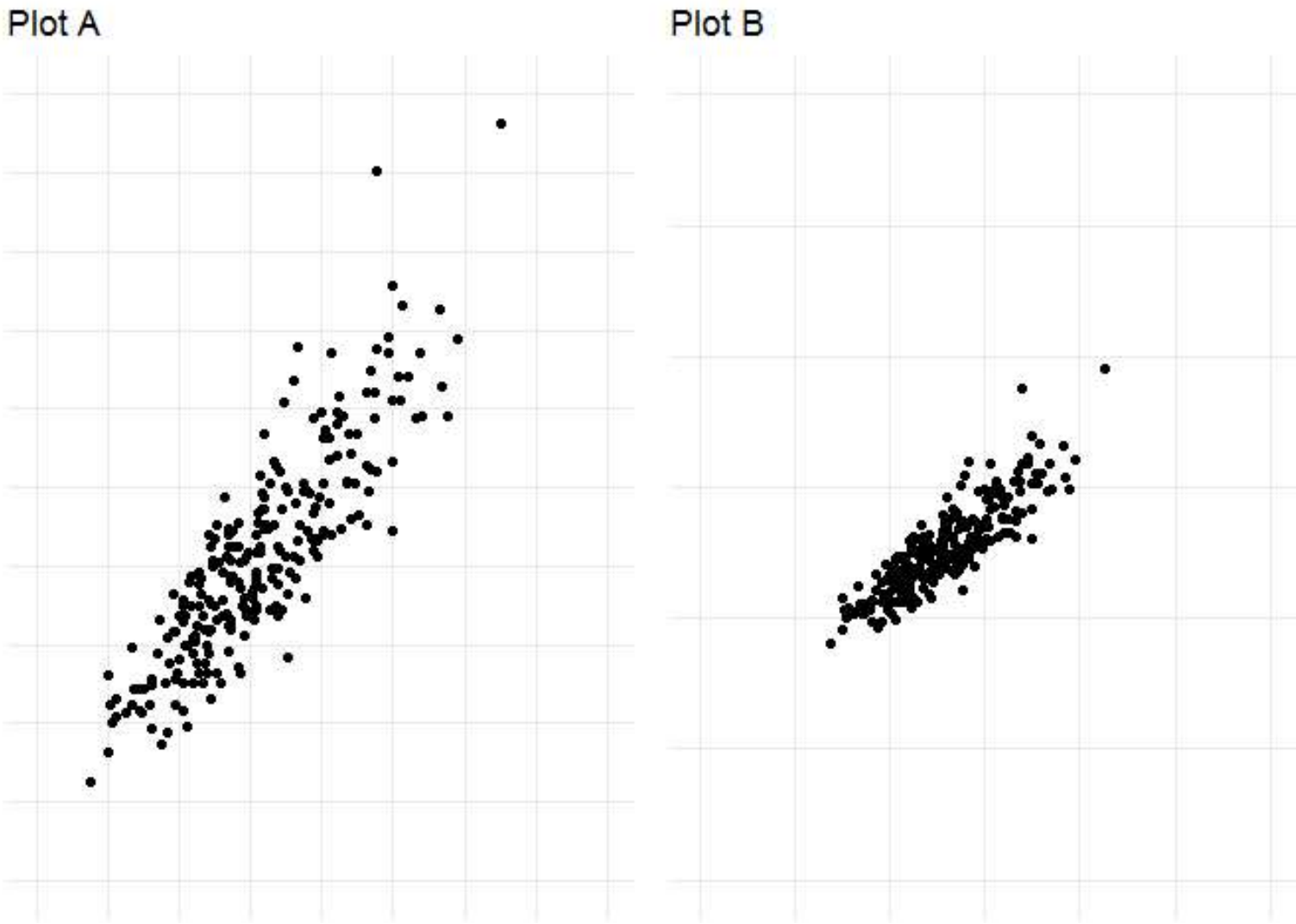
Avoding deception - Dual axes Cont. 2

- Connecting points by time allows the viewer to correlate two time-based variables.



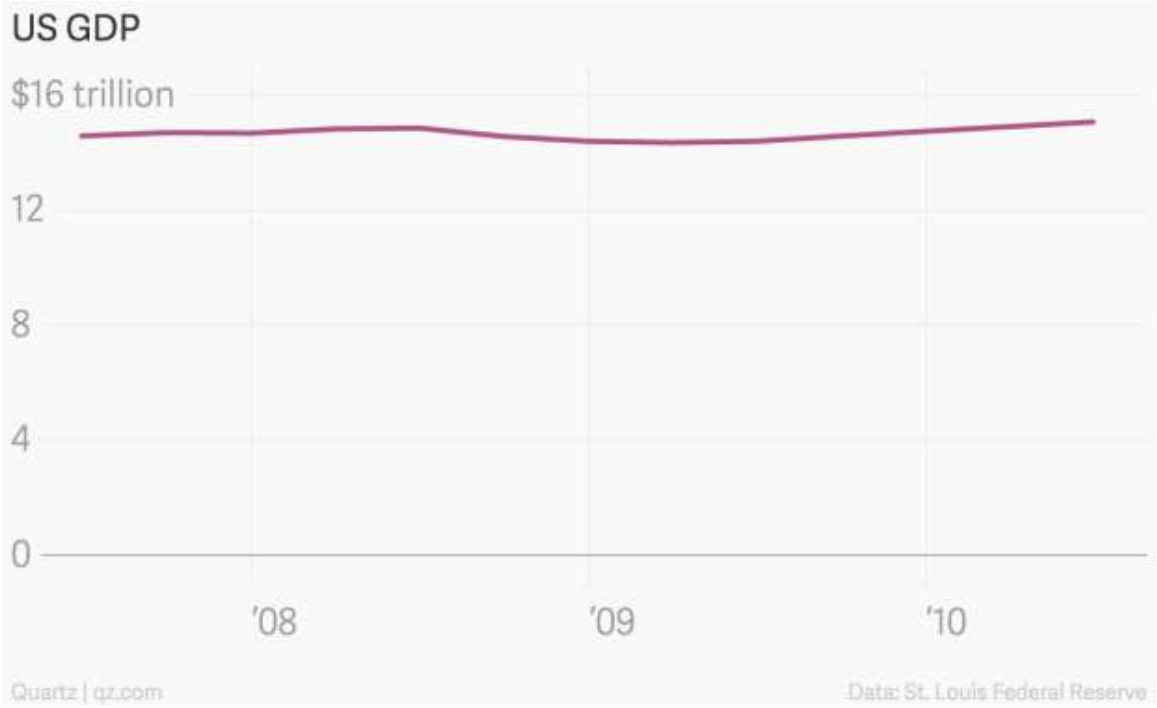
Other poor scaling methods

- Zooming out in a scatter plot can exaggerate trends (Cleverland, Diaconis, and McGill 1982).



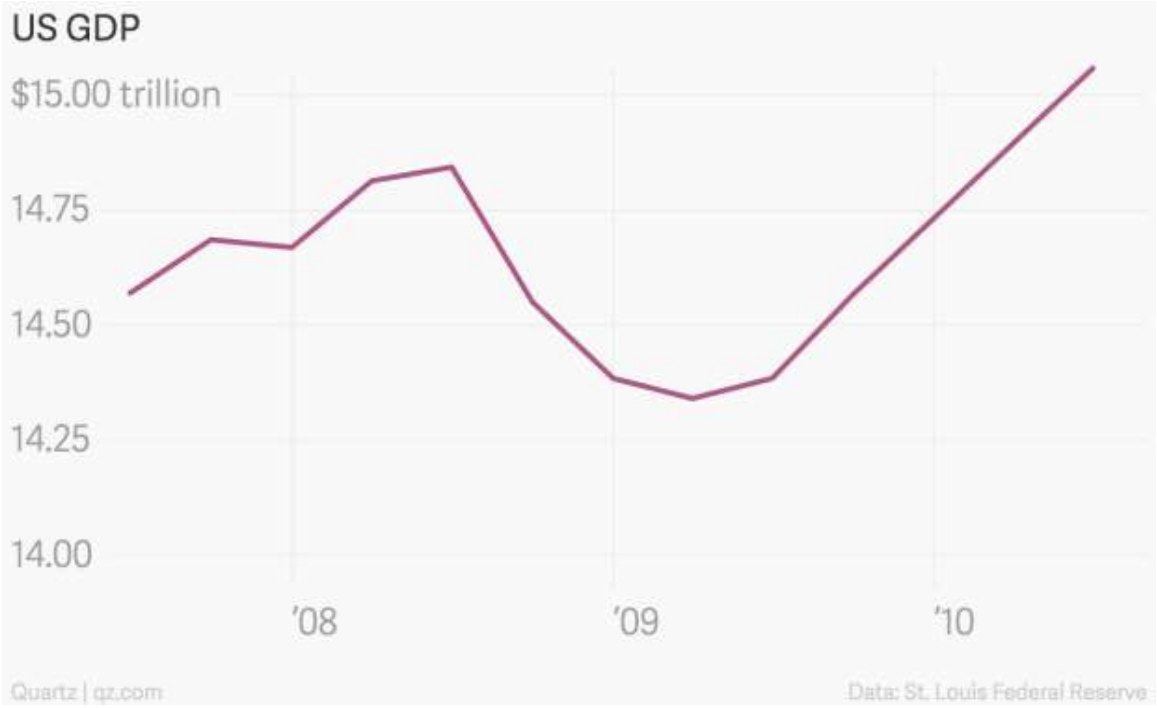
Other poor scaling methods Cont.

- Because the y-axis scale starts at 0, the time series trend is barely noticeable (Yanofsky 2015)



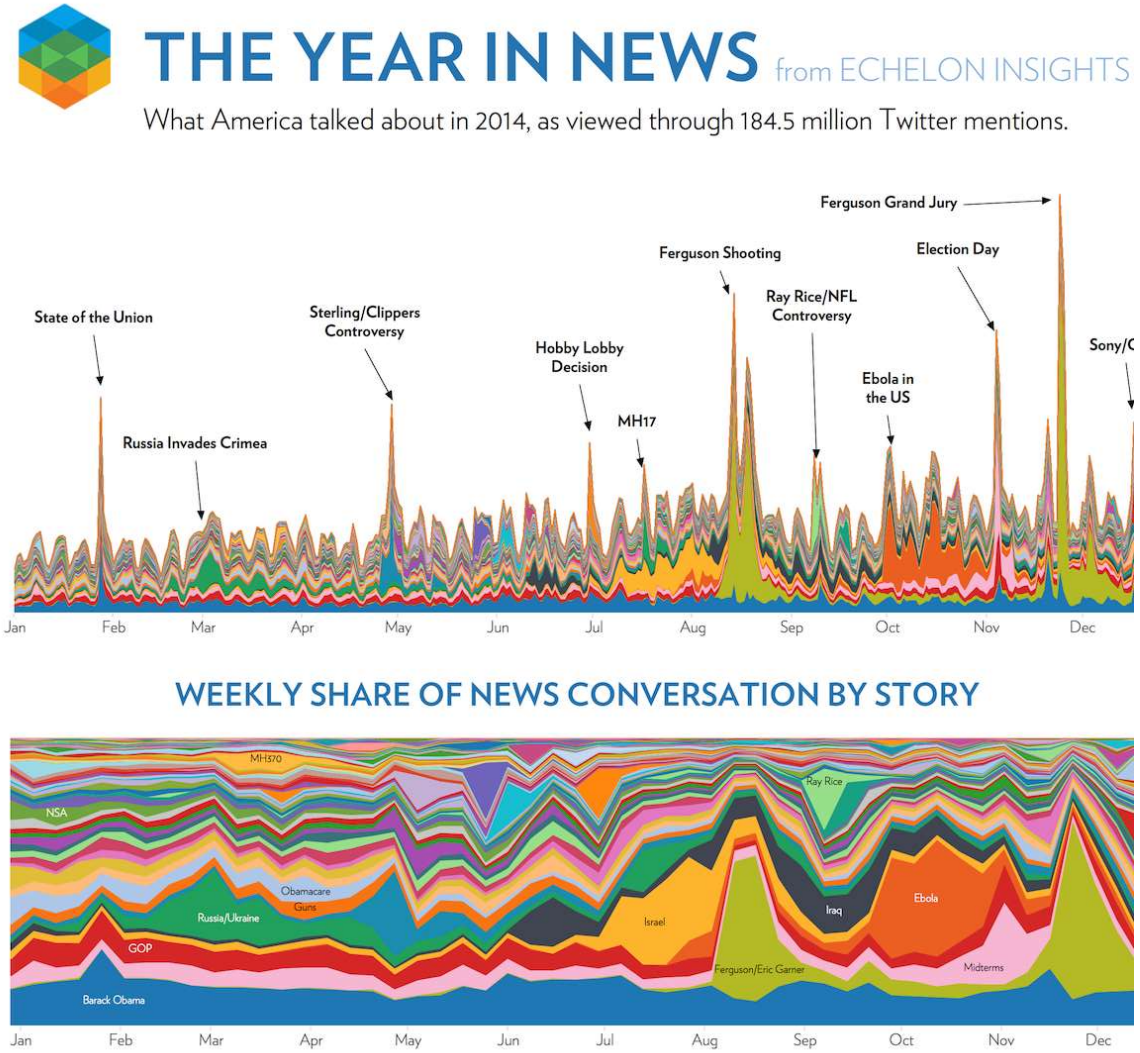
Avoding deception - Poor scaling

- Be clear on what you are trying to communicate and communicate accurately (Yanofsky 2015).



Visual bombardment

- Visual bombardment confuses your audience (Echelon Insights 2014).



Avoiding deception - Visual Bombardment

- Recall Kirk (2012)'s third guiding principle…
  - *Creating accessibility through intuitive design*

References

ACMA Research and Analysis Section. 2015. “Australians get mobile.” https://www.acma.gov.au/theACMA/engage-blogs/engage-blogs/Research-snapshots/Australians-get-mobile.

Cleverland, W. S., P. Diaconis, and R. McGill. 1982. “Variables on scatterplots look more highly correlated when the scales are increased.” *Science* 216 (4550): 1138–41. doi:10.1126/science.216.4550.1138.

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