

# ICSSR Research Methodology Workshop

December 18, 2015

## Data Visualisation: Types, Principles, and Tools

**Sumandro Chattapadhyay**  
sumandro@cis-india.org



# The Centre for Internet and Society

[cis-india.org](http://cis-india.org)

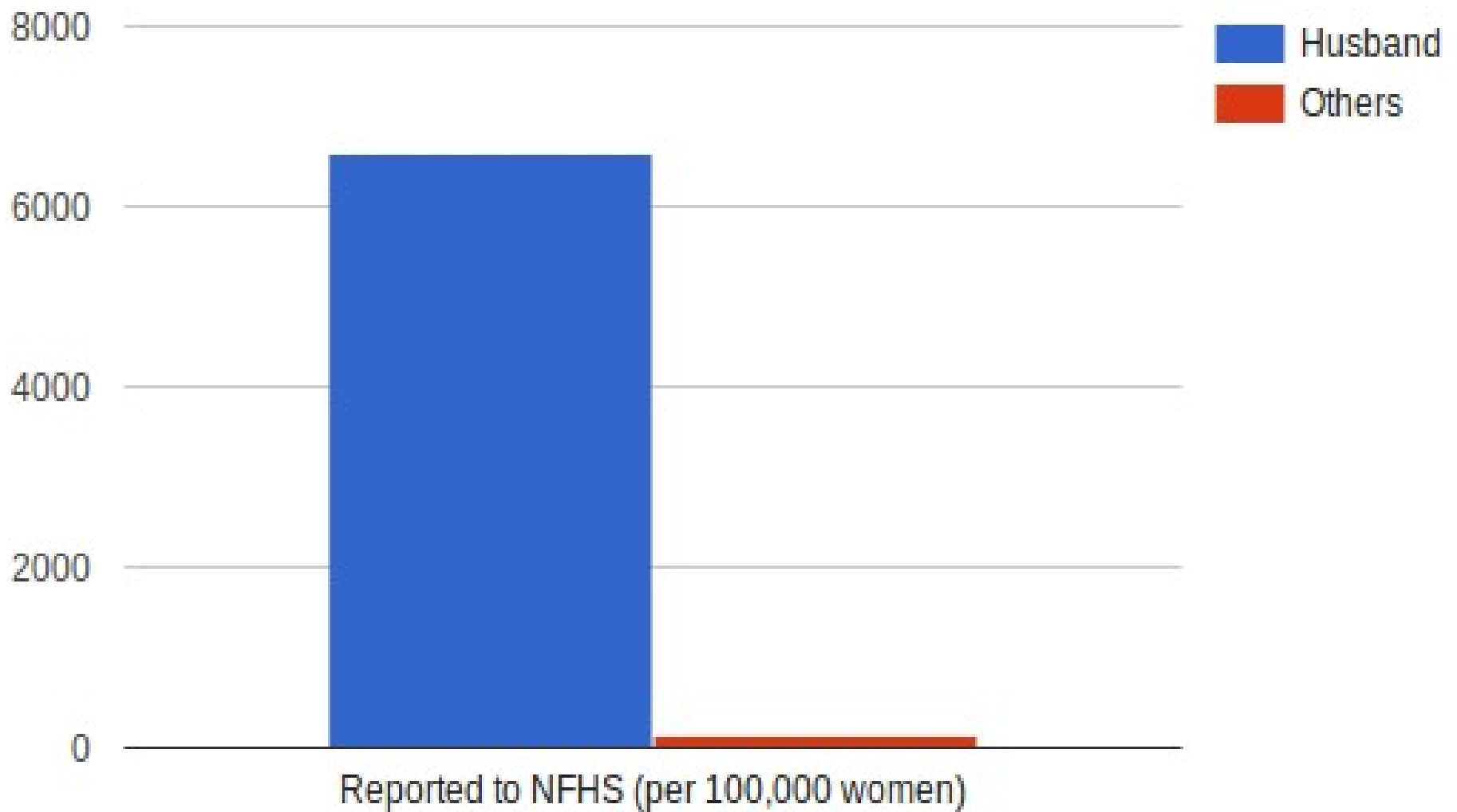
Established in 2008. Offices in Bengaluru and Delhi.

Works on issues of Internet governance and telecommunication policy, open knowledge and accessibility, privacy and cyber-security.

My work focuses on openness and e-governance policies, and critical research on internet and society in India.

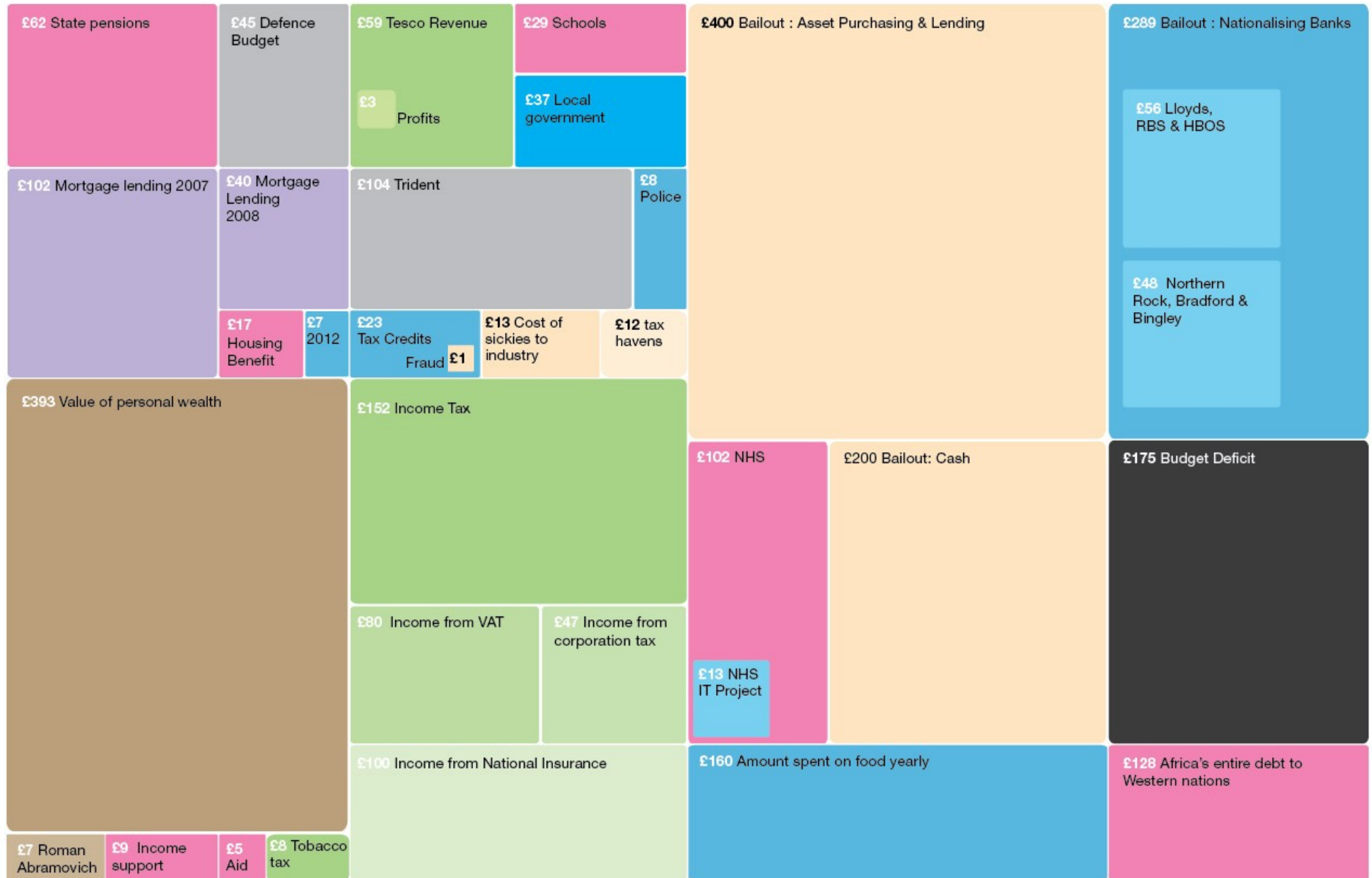
# Sexual Violence in India

Rukmini S, The Hindu



# The Billion Pound-o-Gram

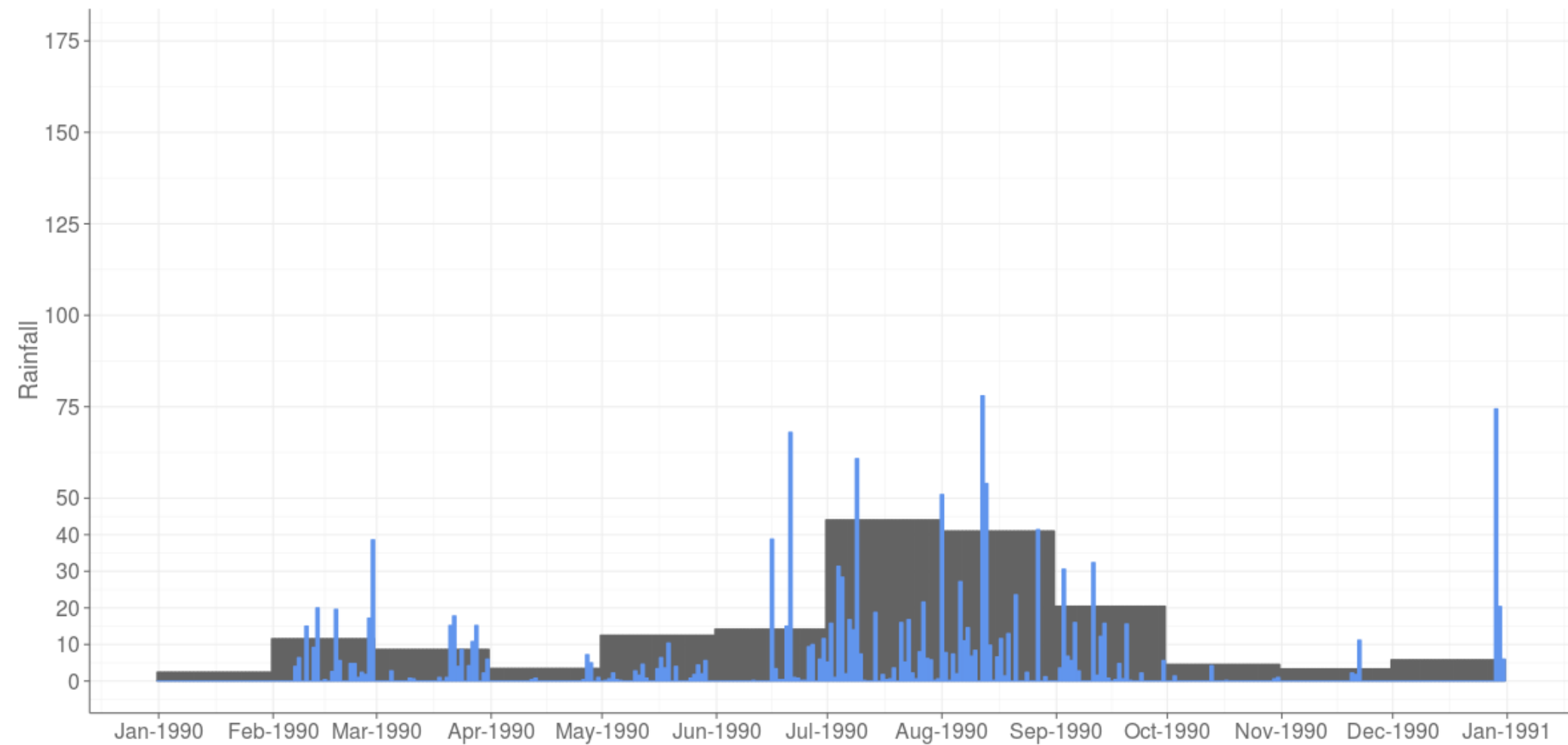
## David McCandless





# Rainfall in Kausani, 1990

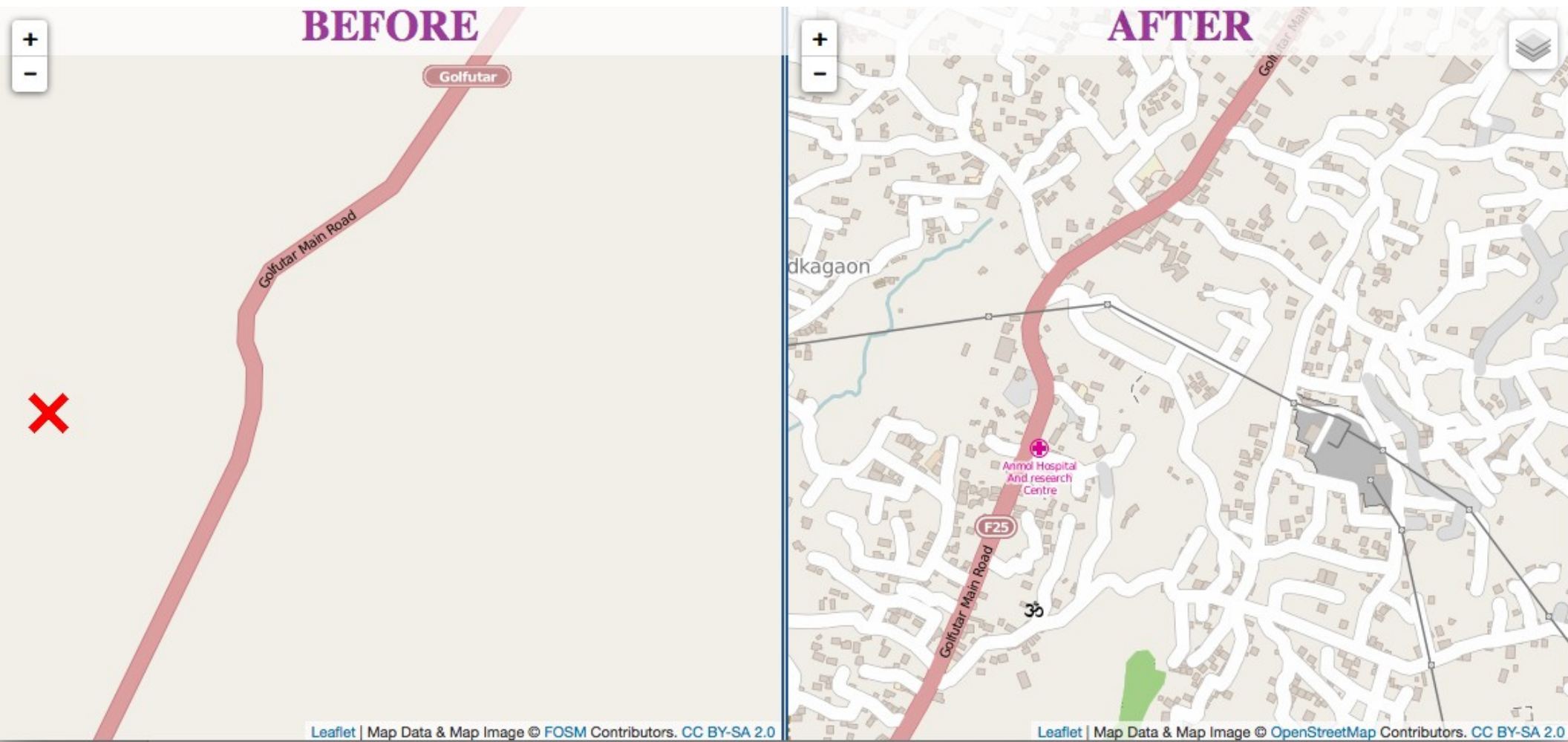
## India Water Portal





# OpenStreetMap - Kathmandu

## Contributions by Volunteers



# What is Data?

- **It depends on the context**
- **It depends on the question**
- **It depends on the (hypothetical) answer**



# Types of Data

- **Quantitative**
  - Discrete
  - Continuous
  - Categorical
- **Qualitative**
  - Quantified
  - Not-quantified
- **Spatial**
  - Rastar
  - Vector

# Types of Data Relationship

- **Comparison**
- **Ranking**
- **Part-to-Whole**
- **Distribution**
- **Time Series**
- **Map**
- **Correlation**

# Types of Data Visualisation

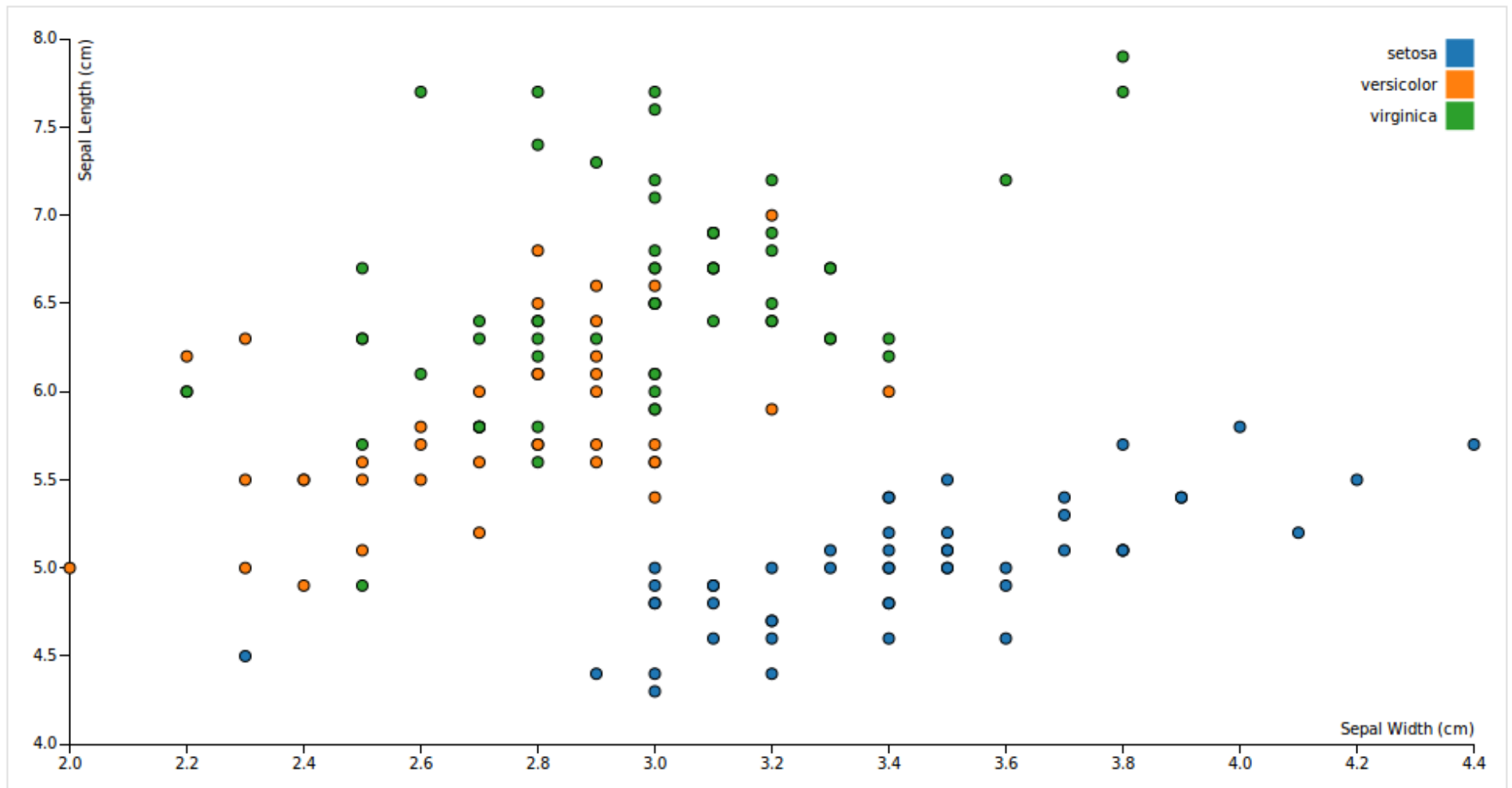
- **Various:** Scatterplot, Line Chart, Area Chart, and Bar Chart
- **Part-to-Whole:** Pie Chart, Tree Map, and Parallel Sets
- **Multiple Variables:** Radar Chart and Bubble Chart
- **Time:** Time Line, Flow Chart, and Steam Graph
- **Space:** Choropleth, Heatmap, Flow Map, and Cartogram

# Types of Data Visualisation

## Various

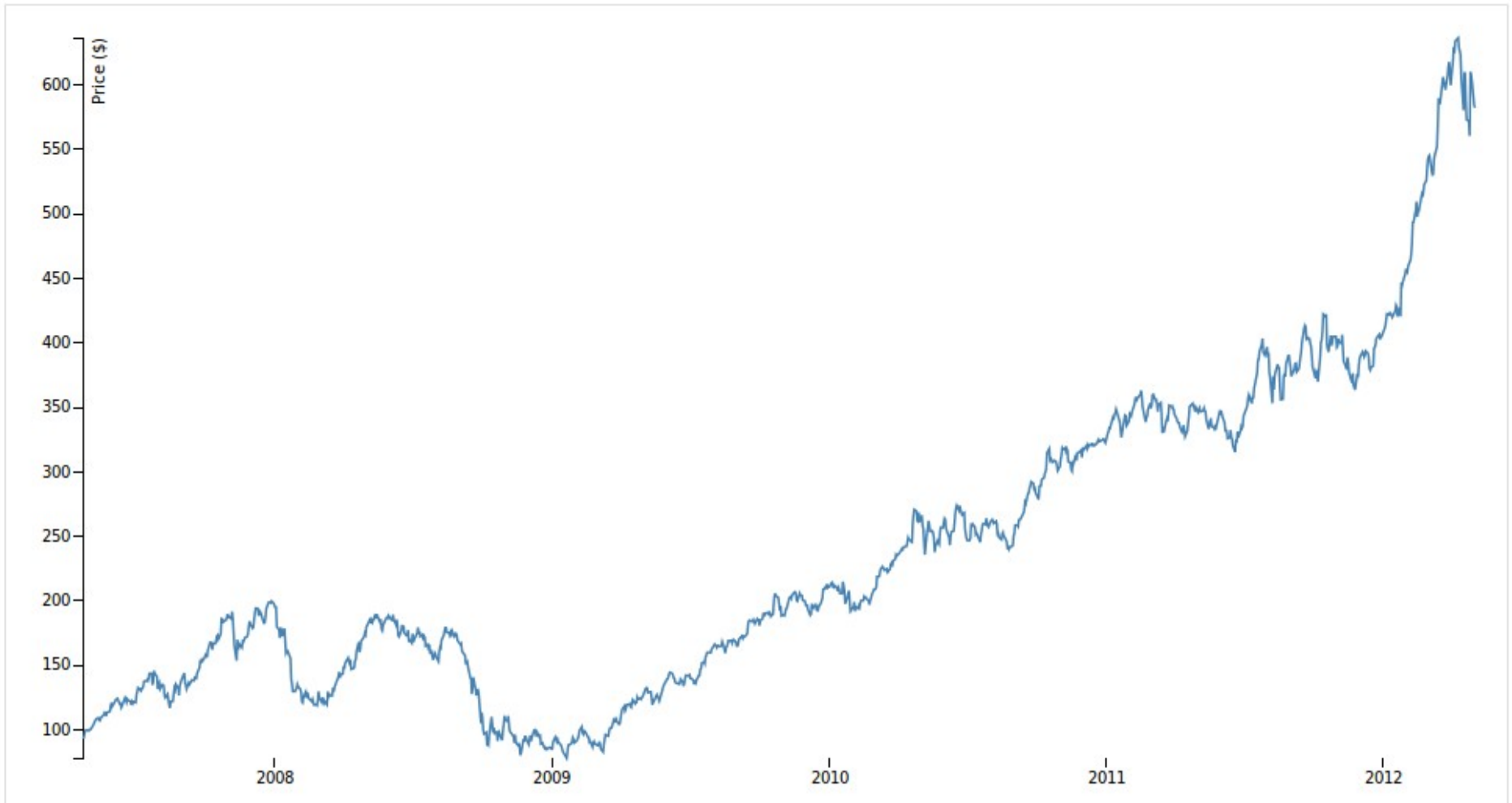
# Types of Data Visualisation

## Scatterplot



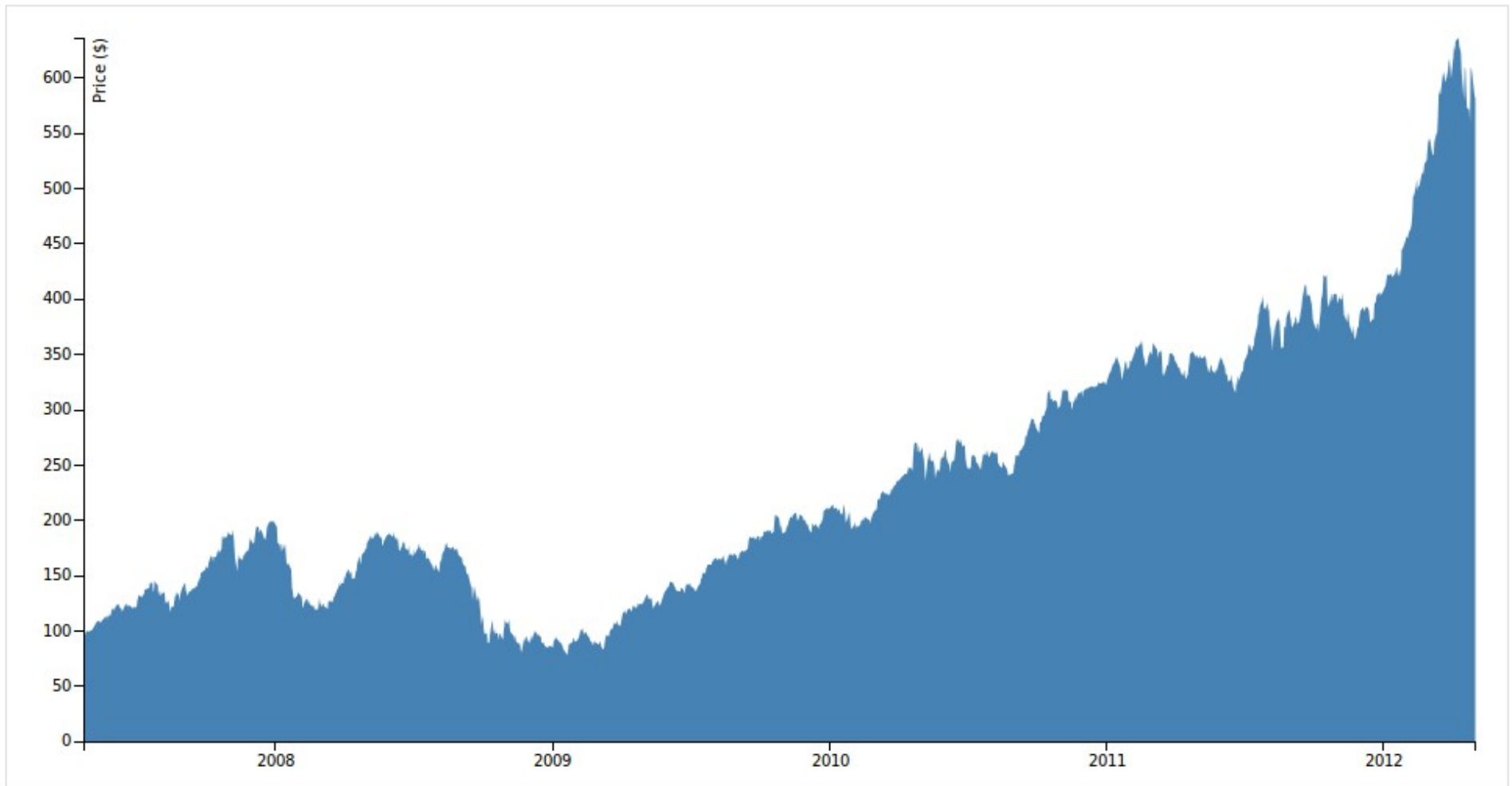
# Types of Data Visualisation

## Line Chart



# Types of Data Visualisation

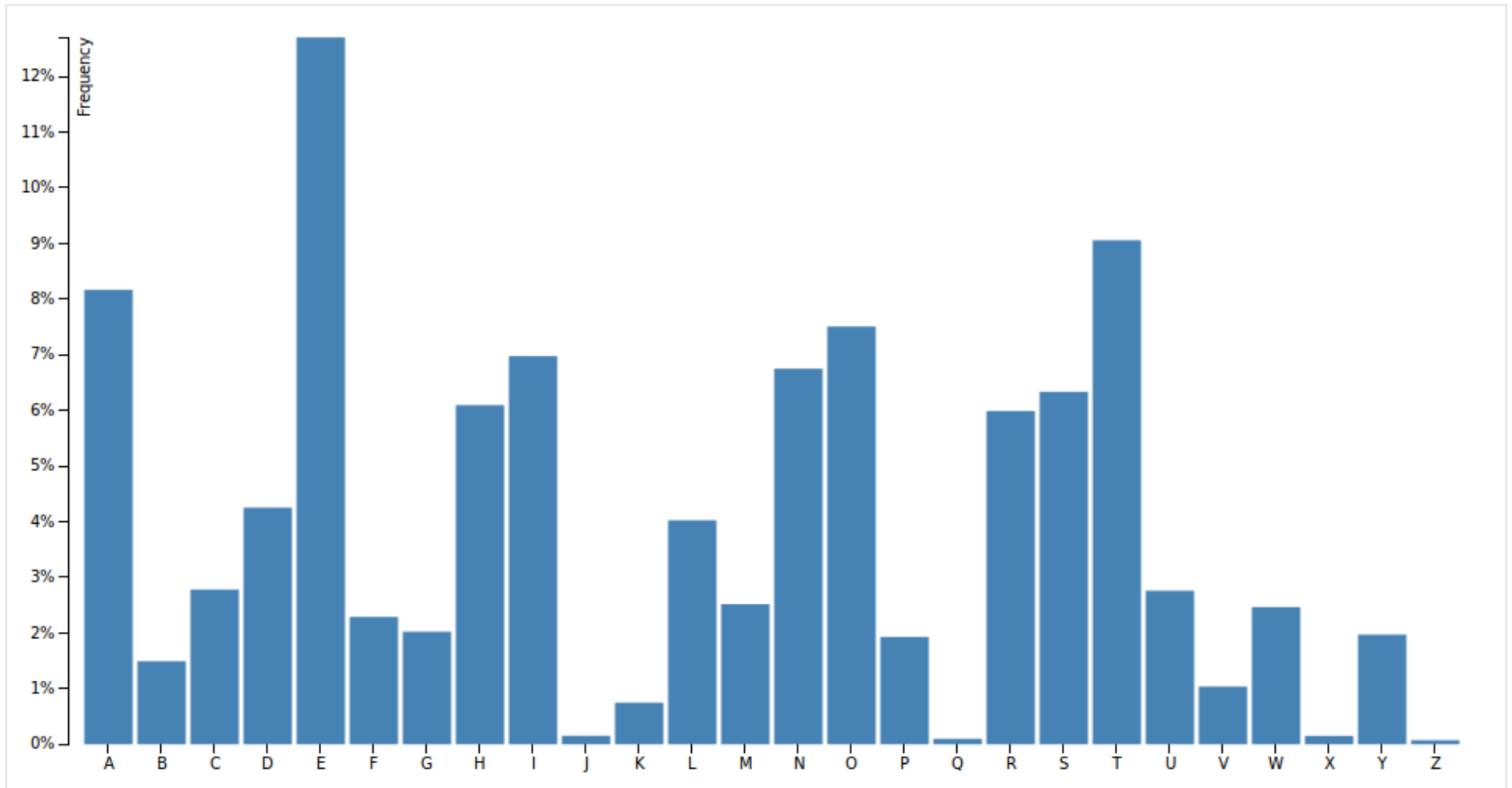
## Area Chart





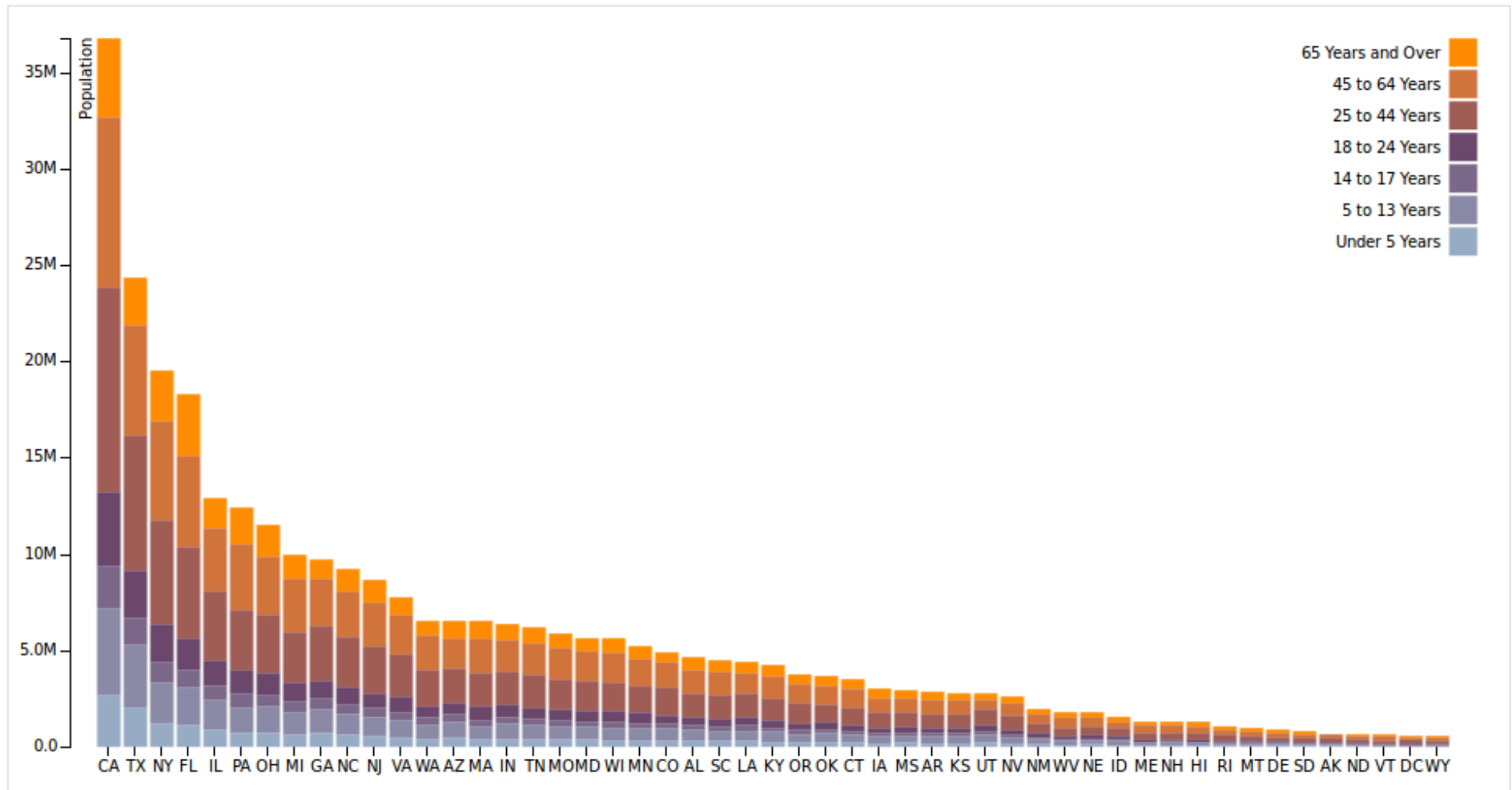
# Types of Data Visualisation

## Bar Chart



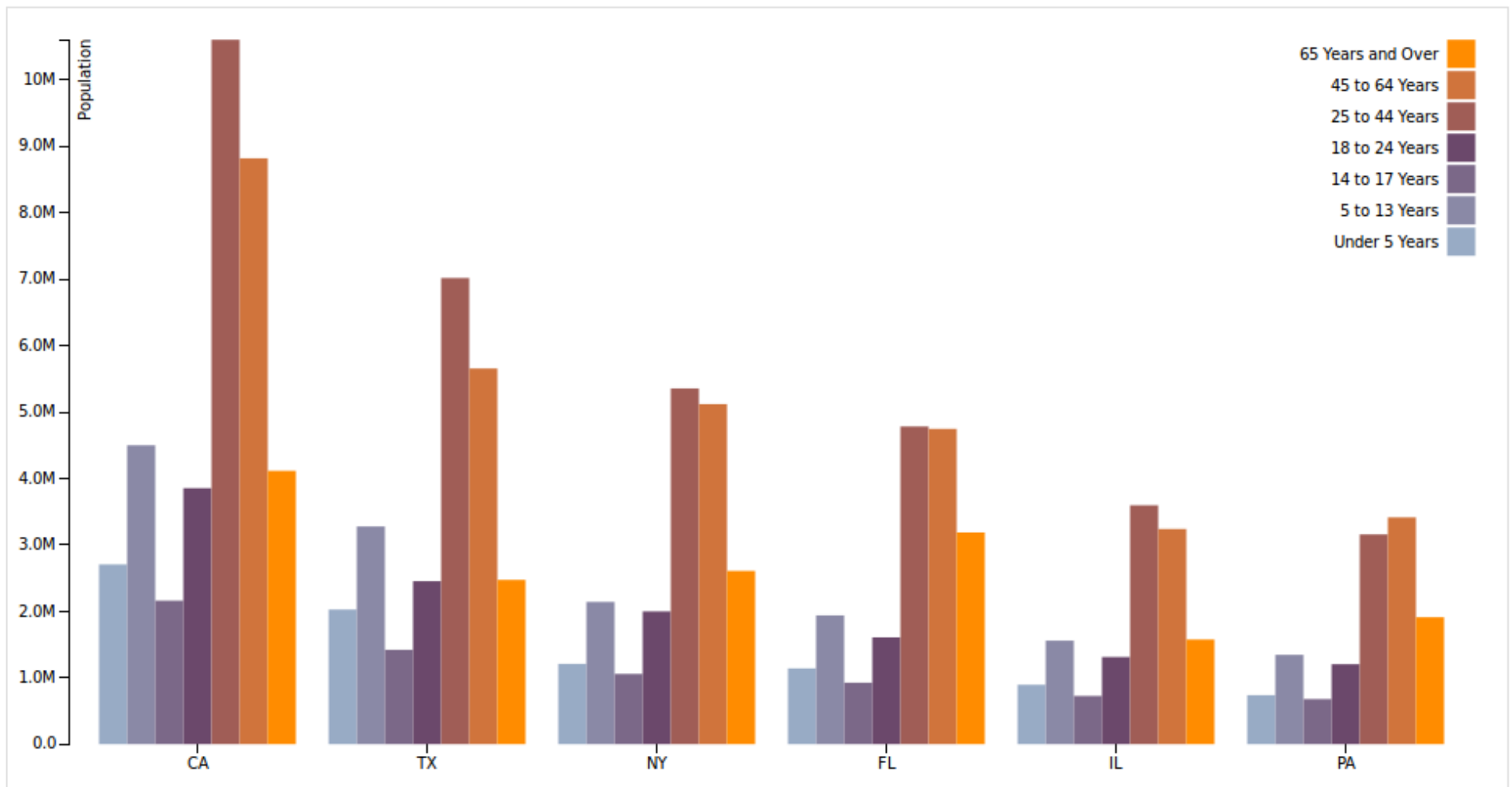
# Types of Data Visualisation

## Stacked Bar Chart



# Types of Data Visualisation

## Grouped Bar Chart

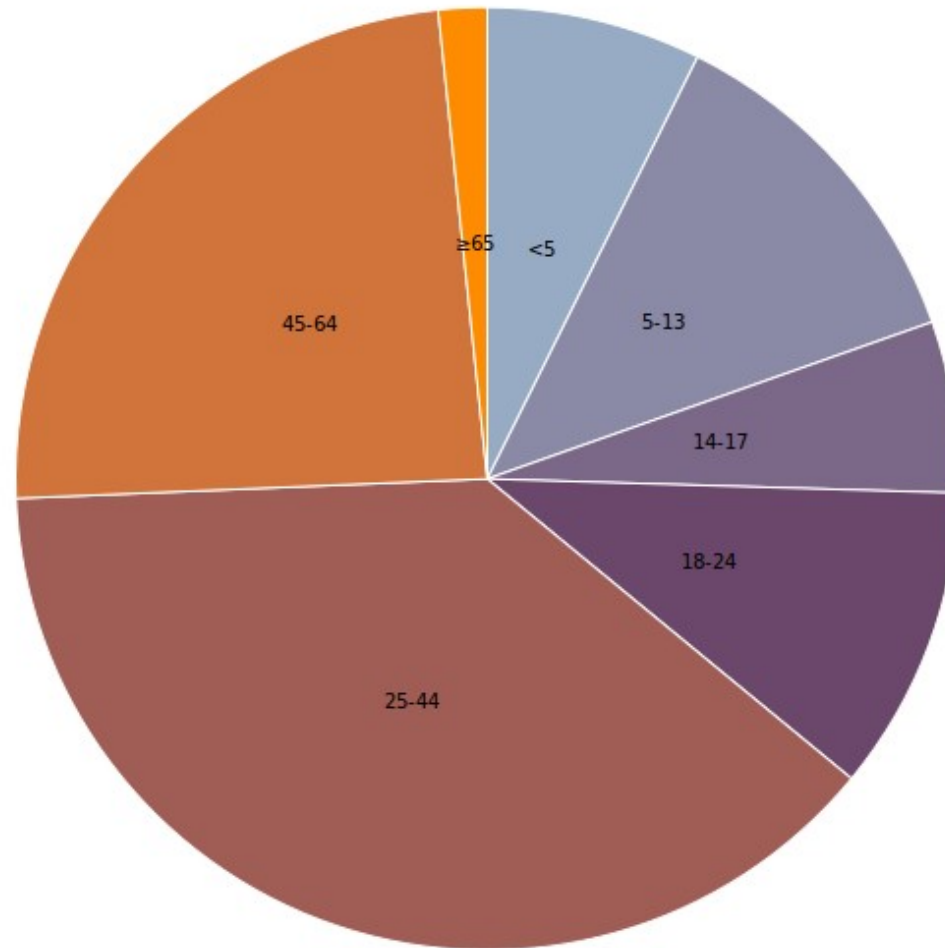


# Types of Data Visualisation

## Part-to-Whole

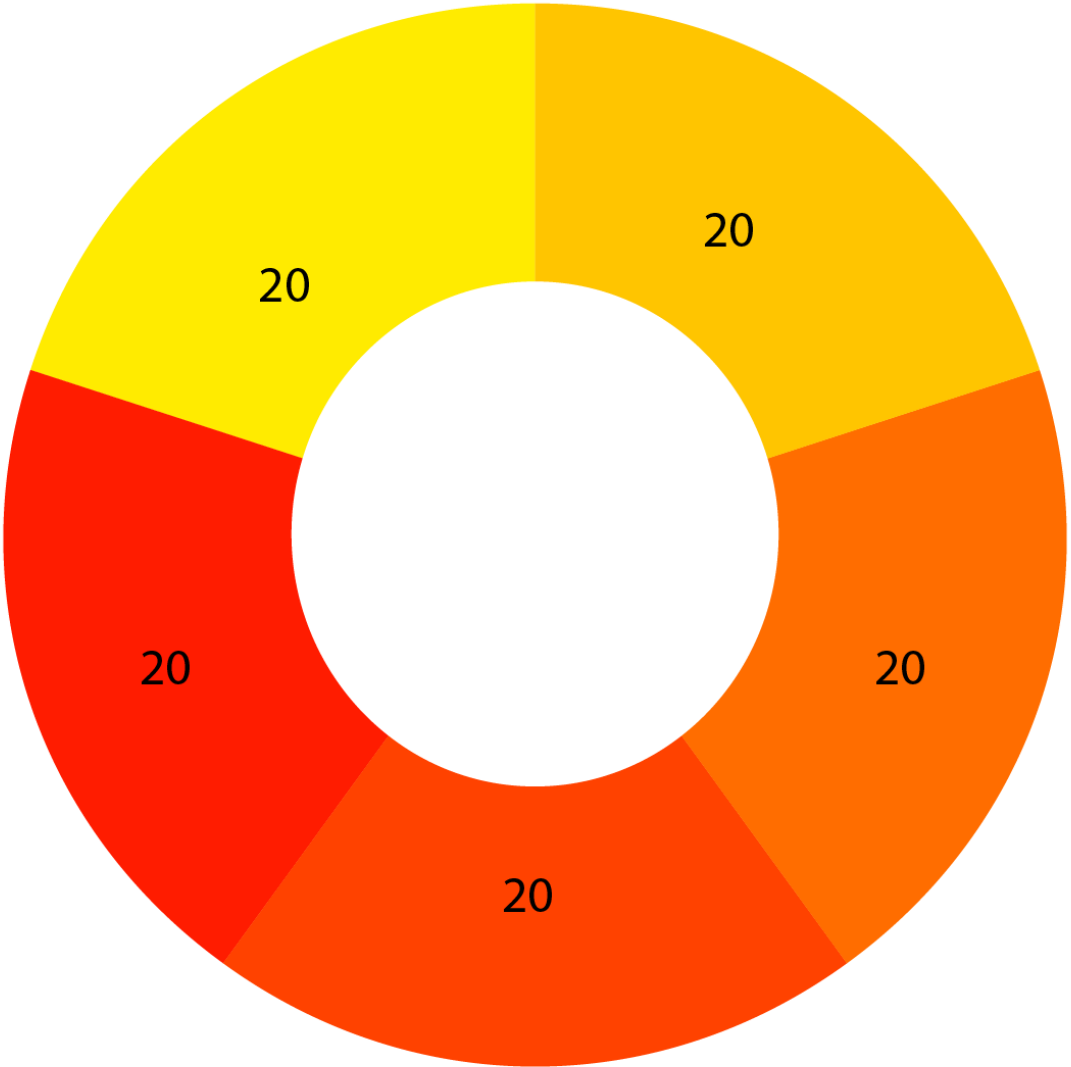
# Types of Data Visualisation

## Pie Chart



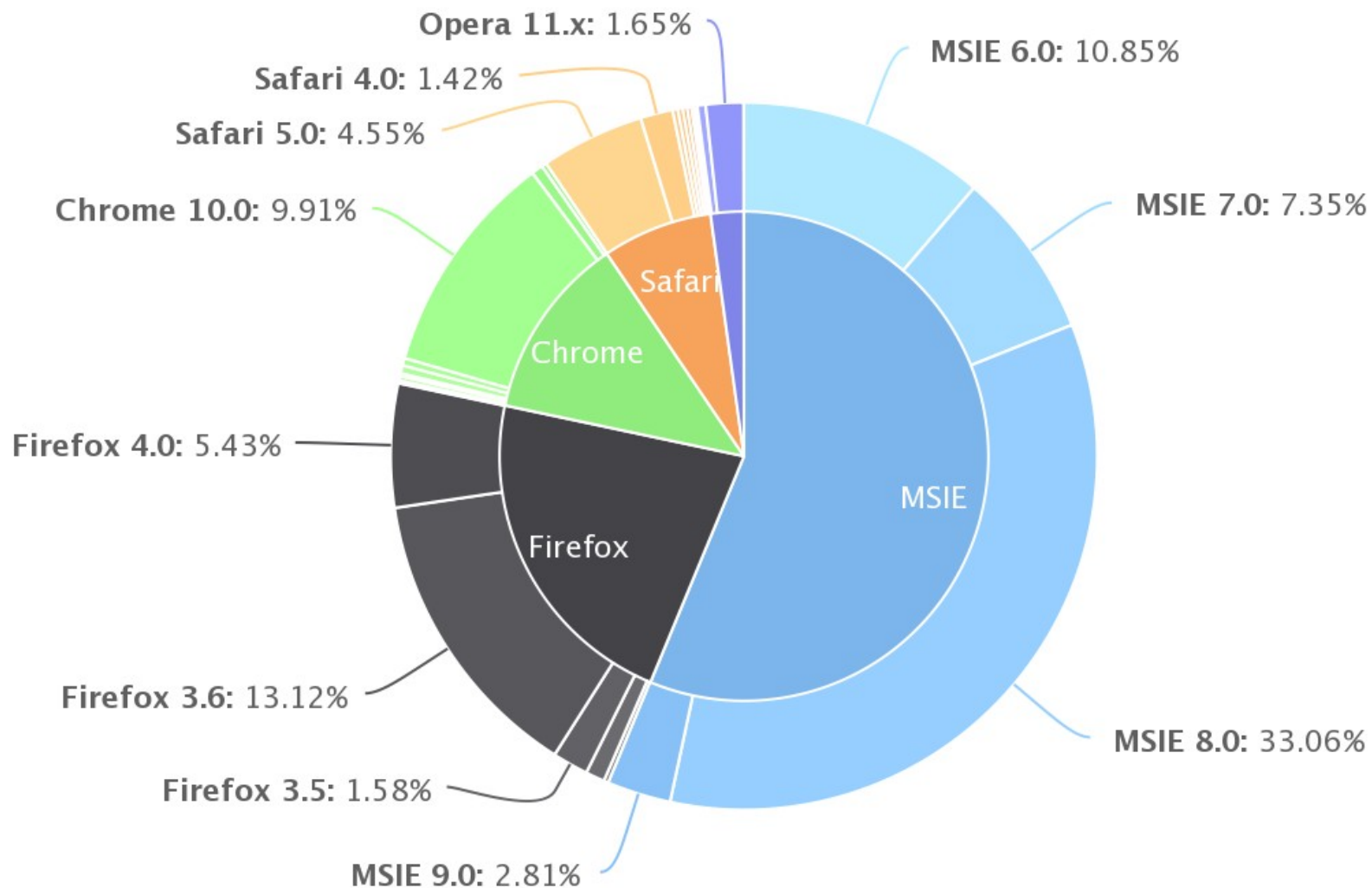
# Types of Data Visualisation

## Doughnut Chart



# Types of Data Visualisation

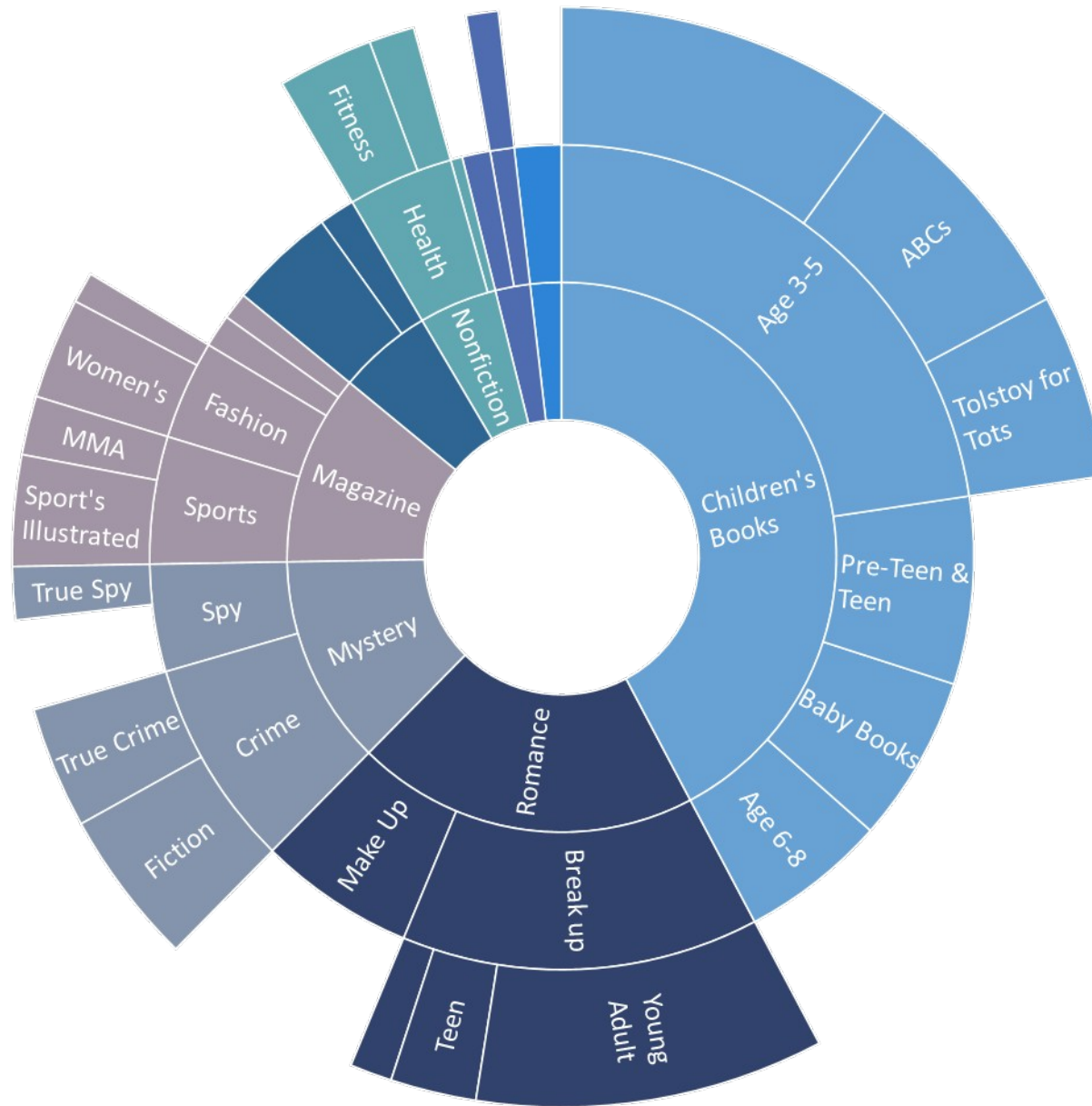
## Pie Chart (Two Layers)





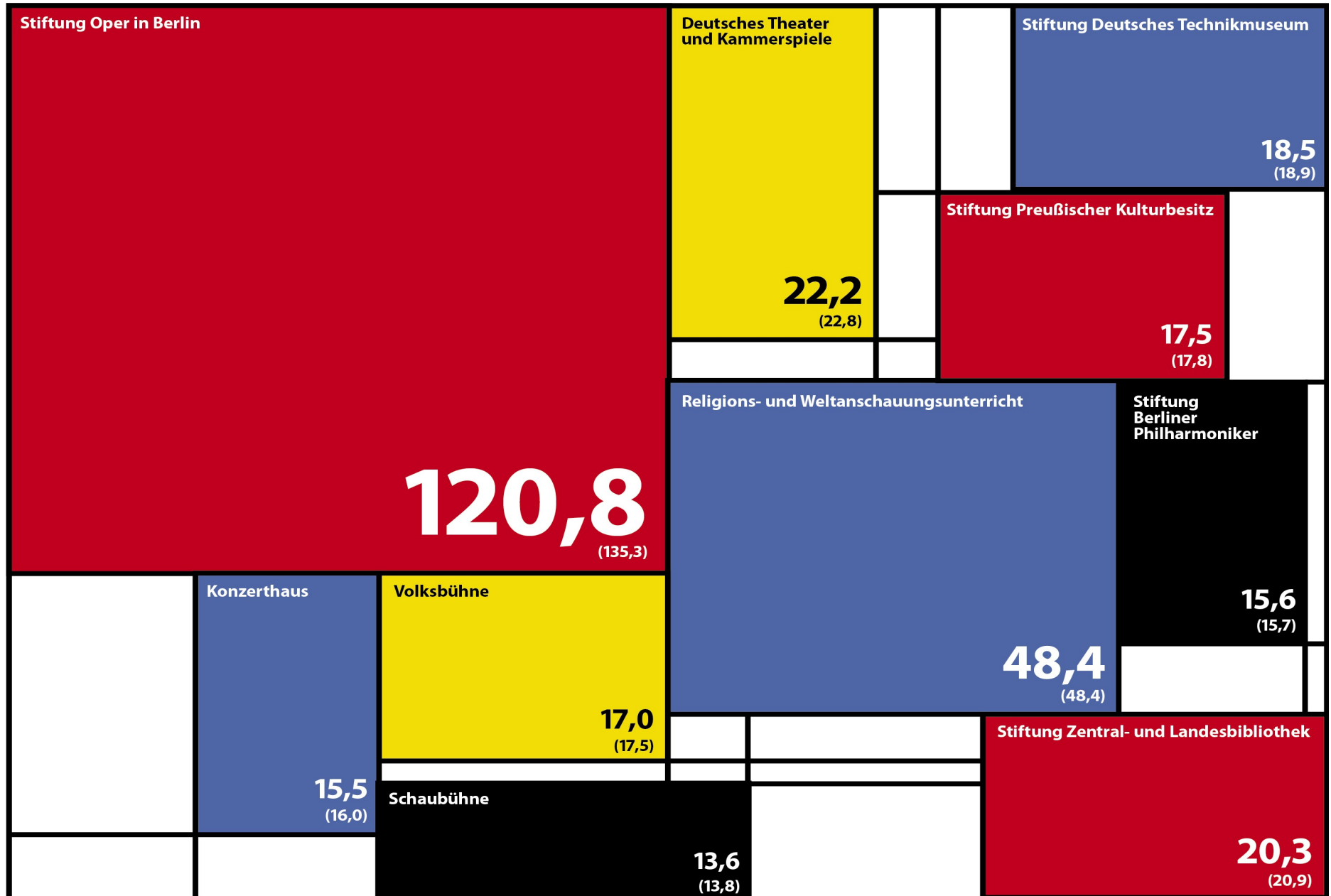
# Types of Data Visualisation

## Sunburst



# Types of Data Visualisation

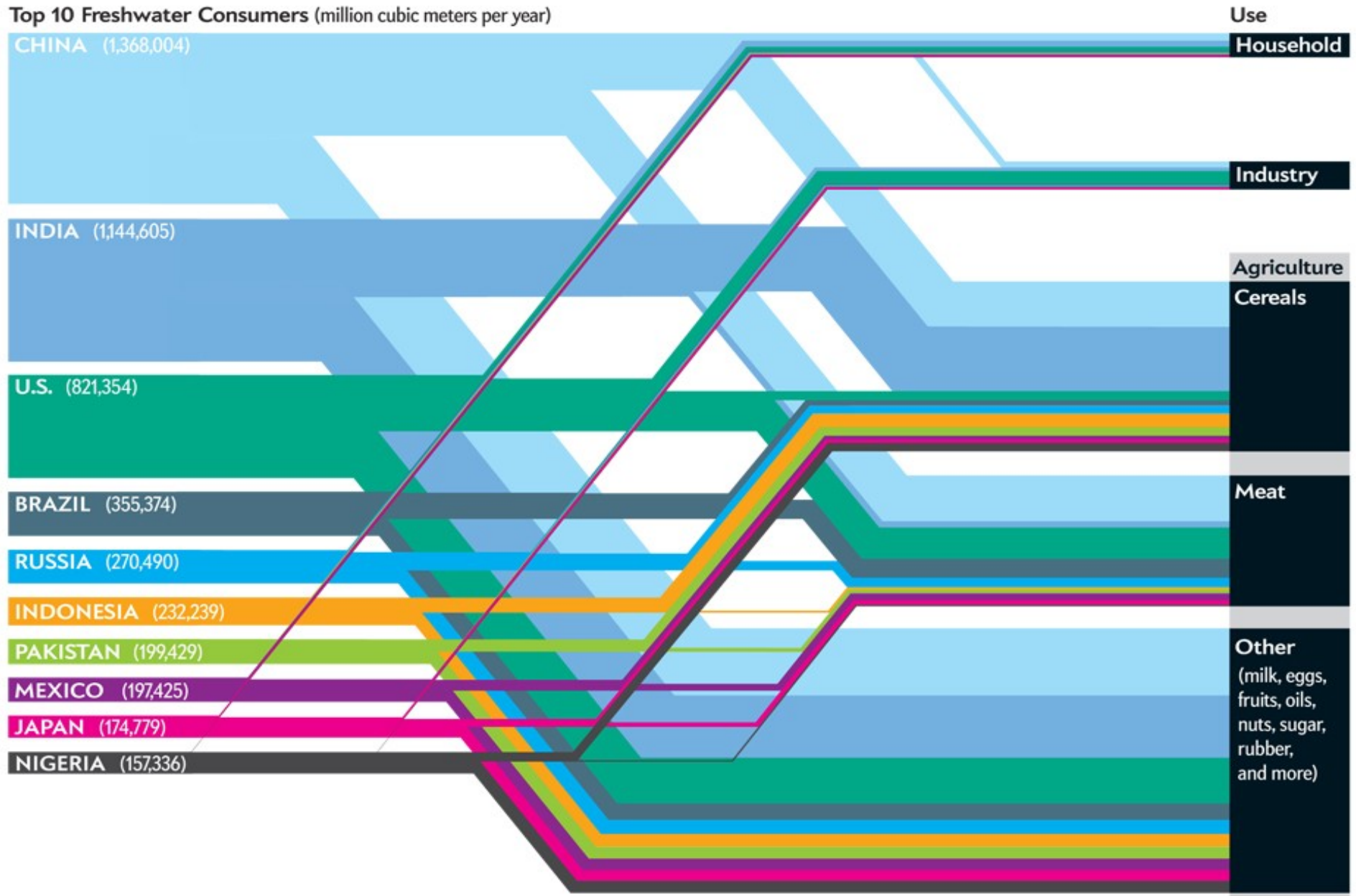
## Treemap



# Types of Data Visualisation

## Parallel Sets

Top 10 Freshwater Consumers (million cubic meters per year)

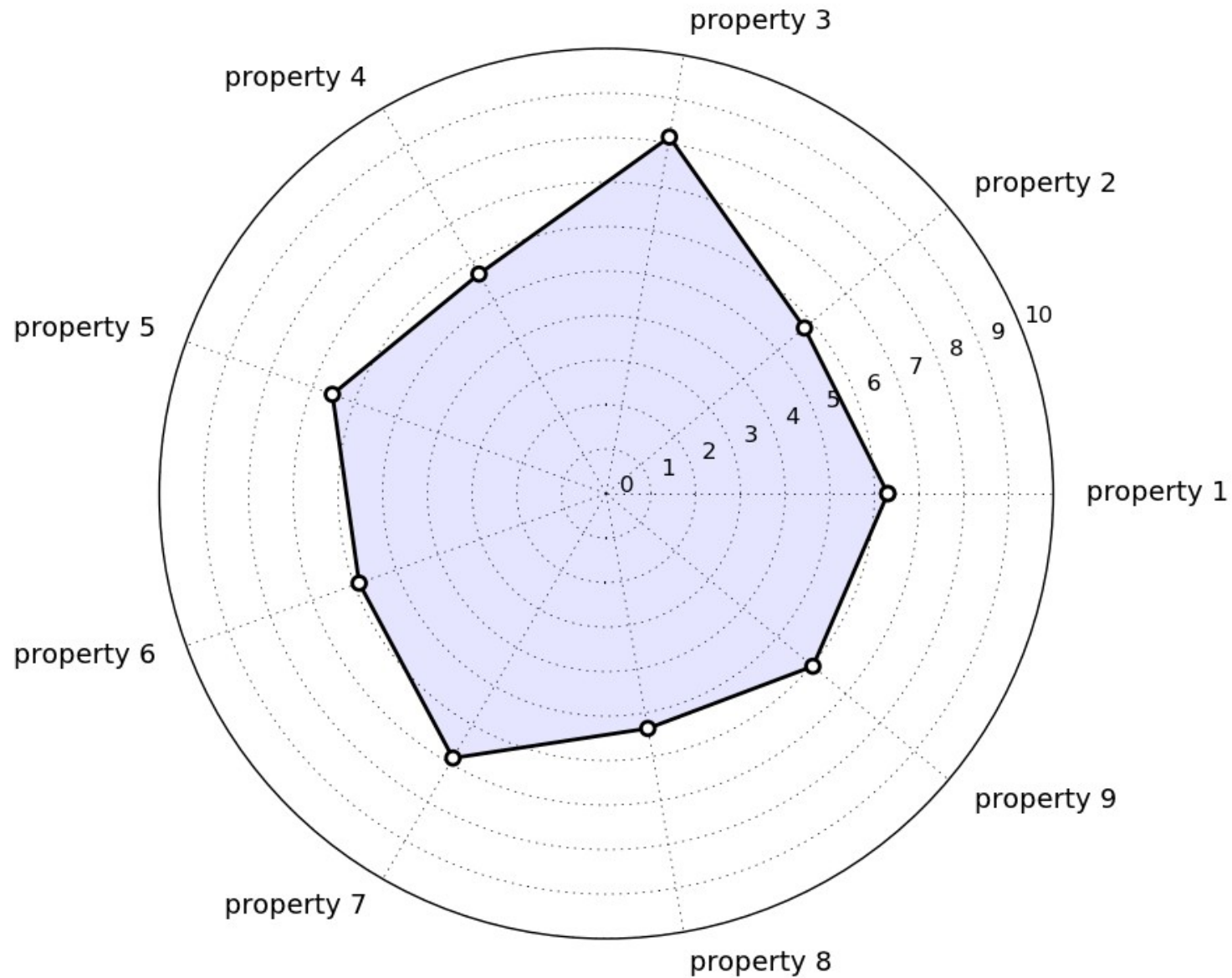


# Types of Data Visualisation

## Multiple Variables

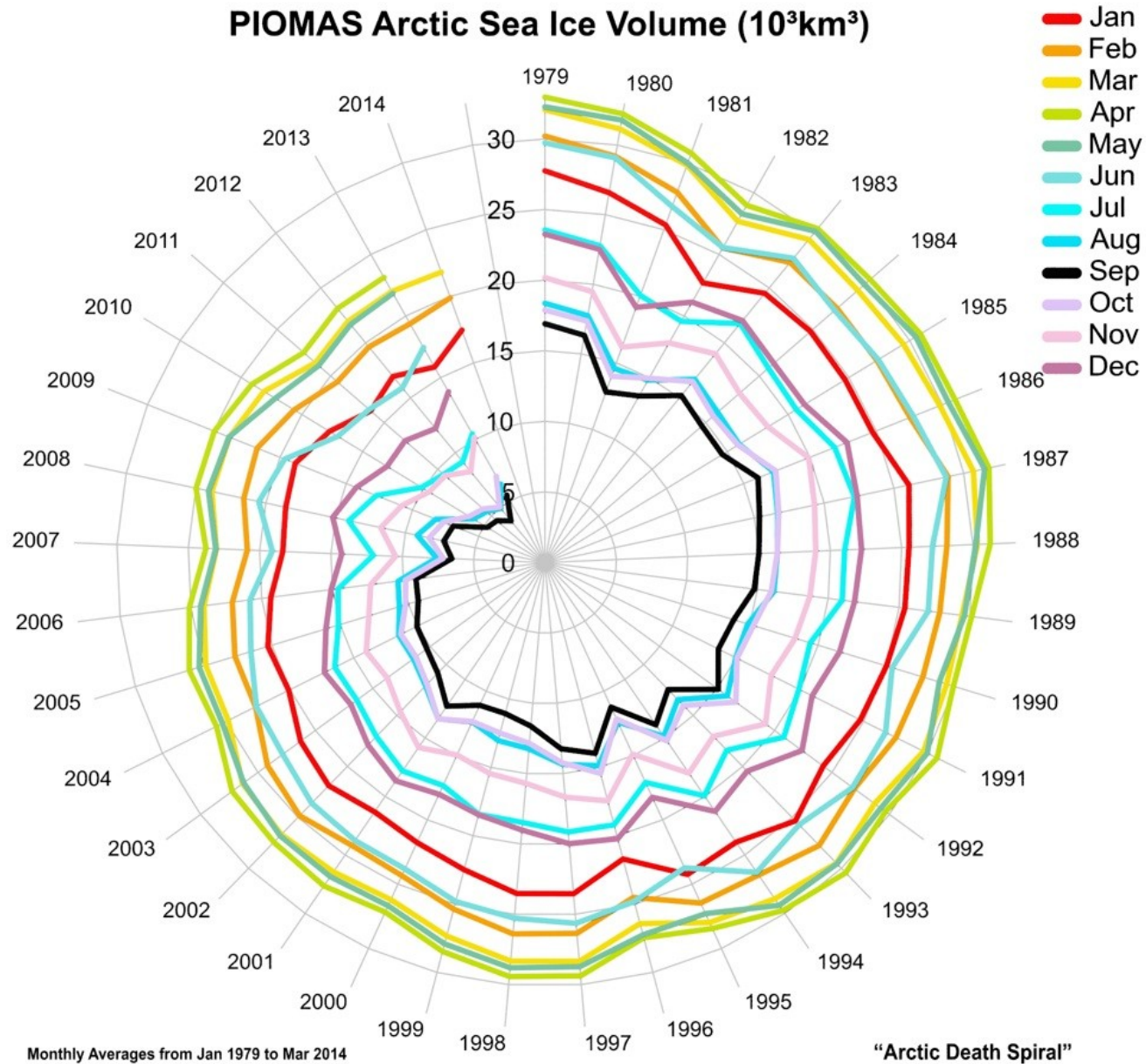
# Types of Data Visualisation

## Radar Chart (Discrete)



# Types of Data Visualisation

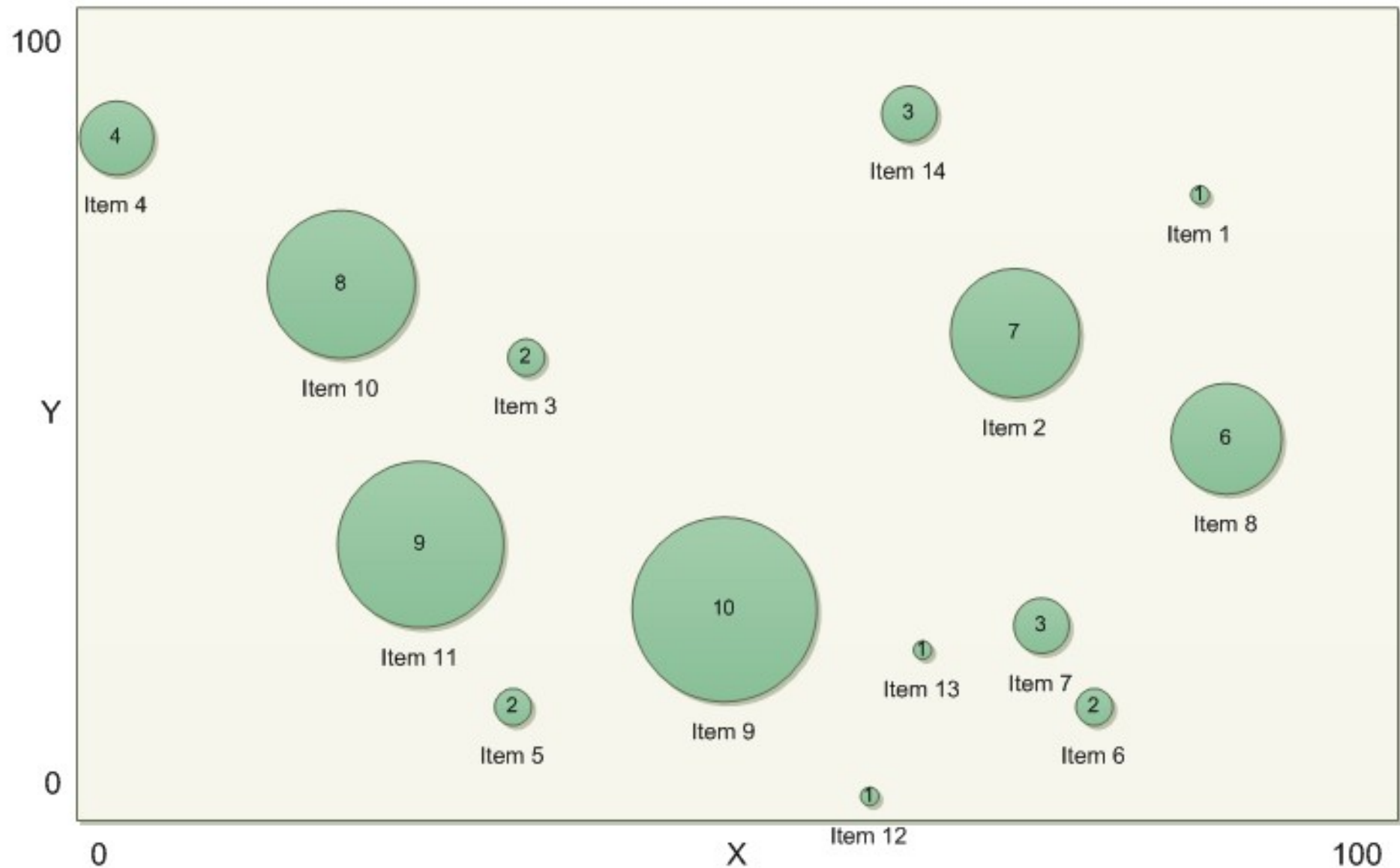
## Radar Chart (Continuous)





# Types of Data Visualisation

## Bubble Chart



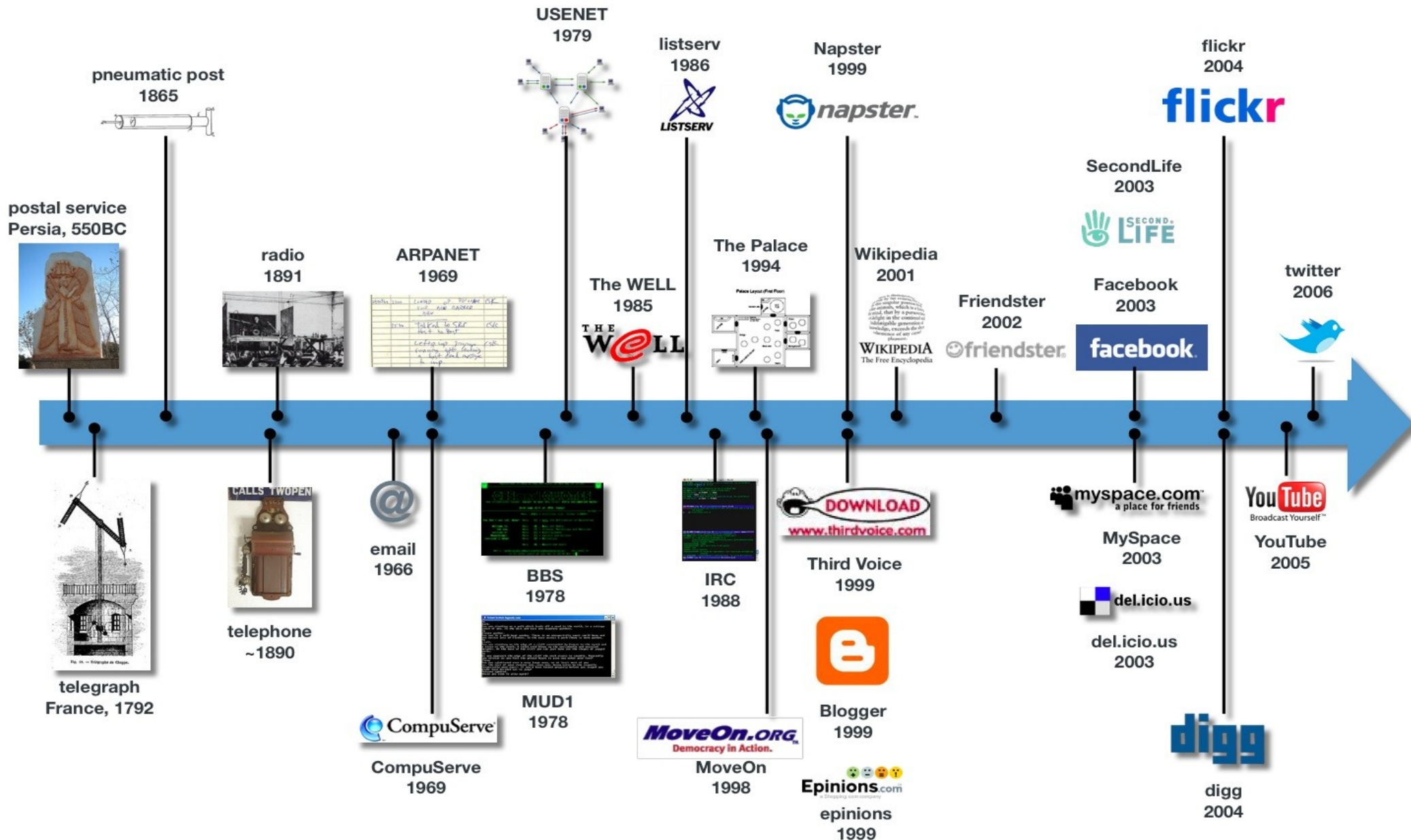


# Types of Data Visualisation

## Time

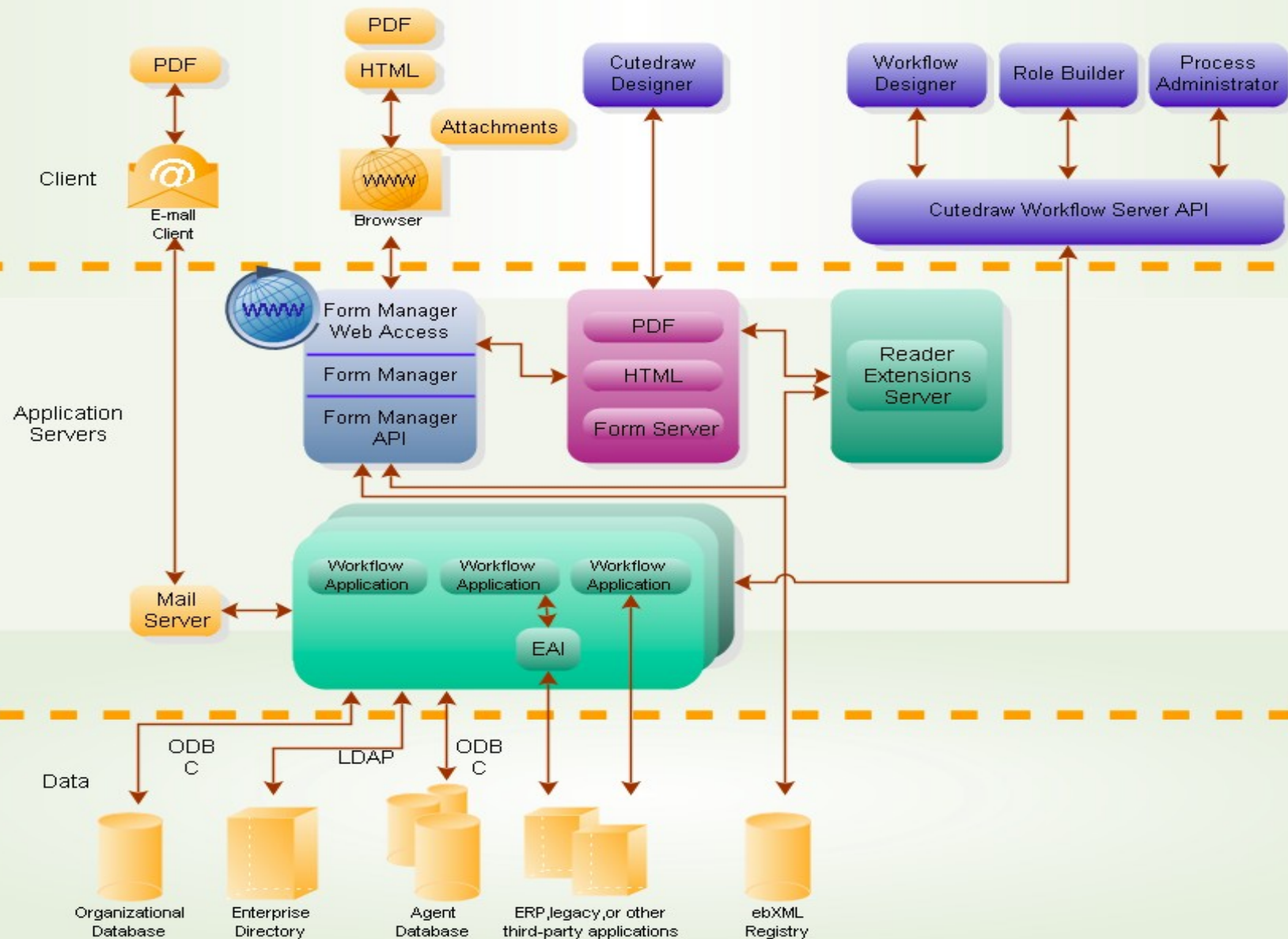
# Types of Data Visualisation

## Time Line



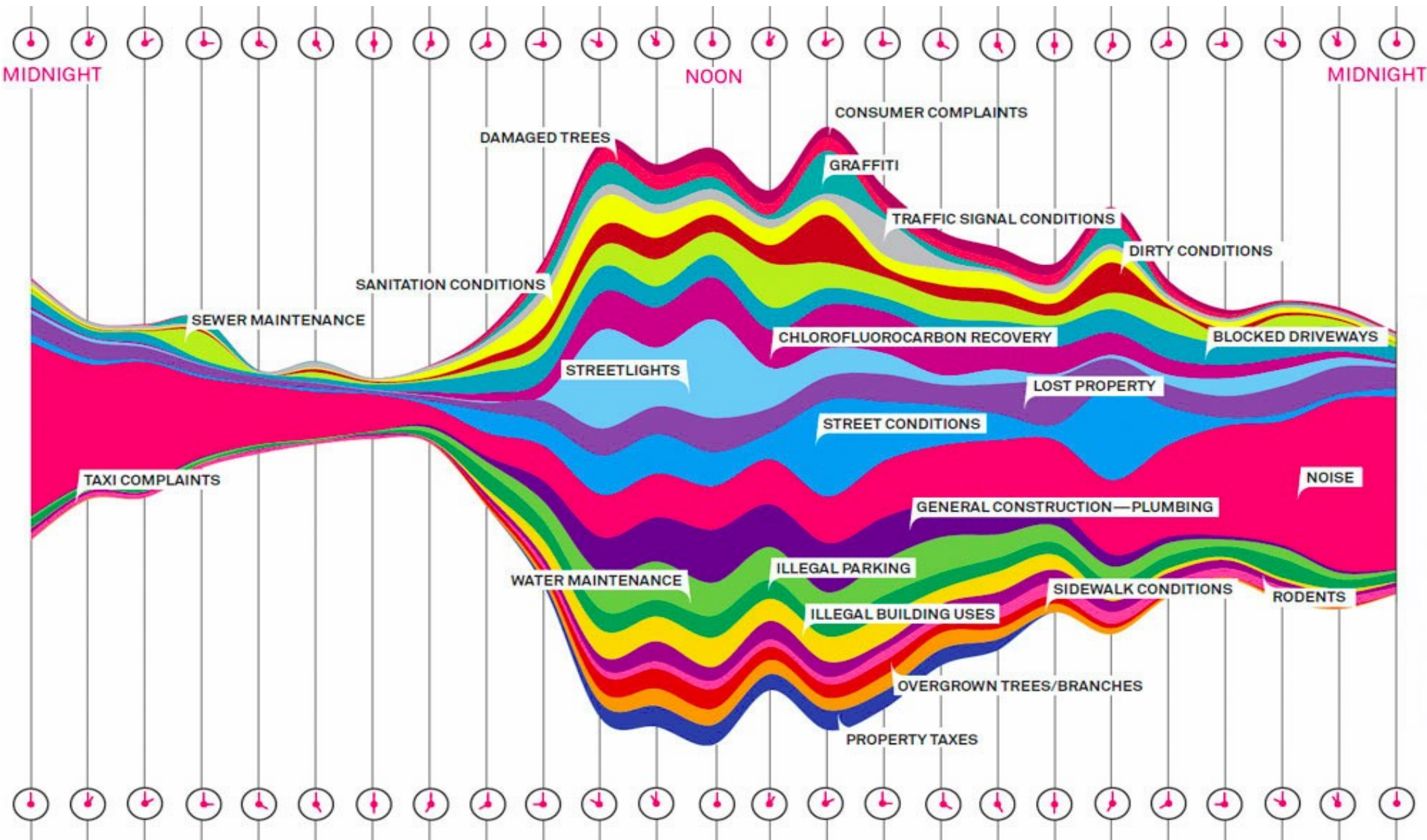
# Types of Data Visualisation

## Flow Chart



# Types of Data Visualisation

## Steam Graph

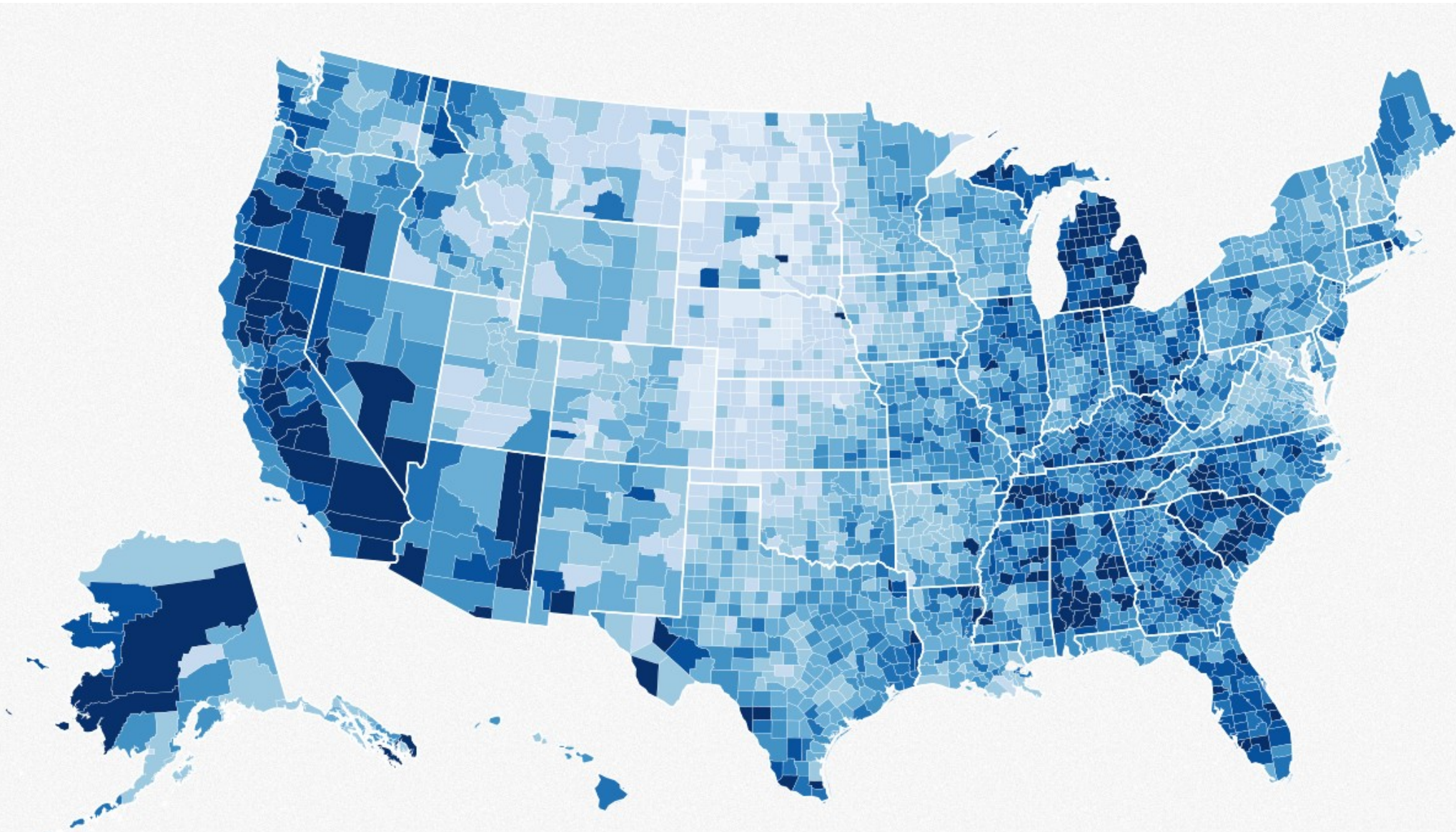


# Types of Data Visualisation Space



# Types of Data Visualisation

## Choropleth



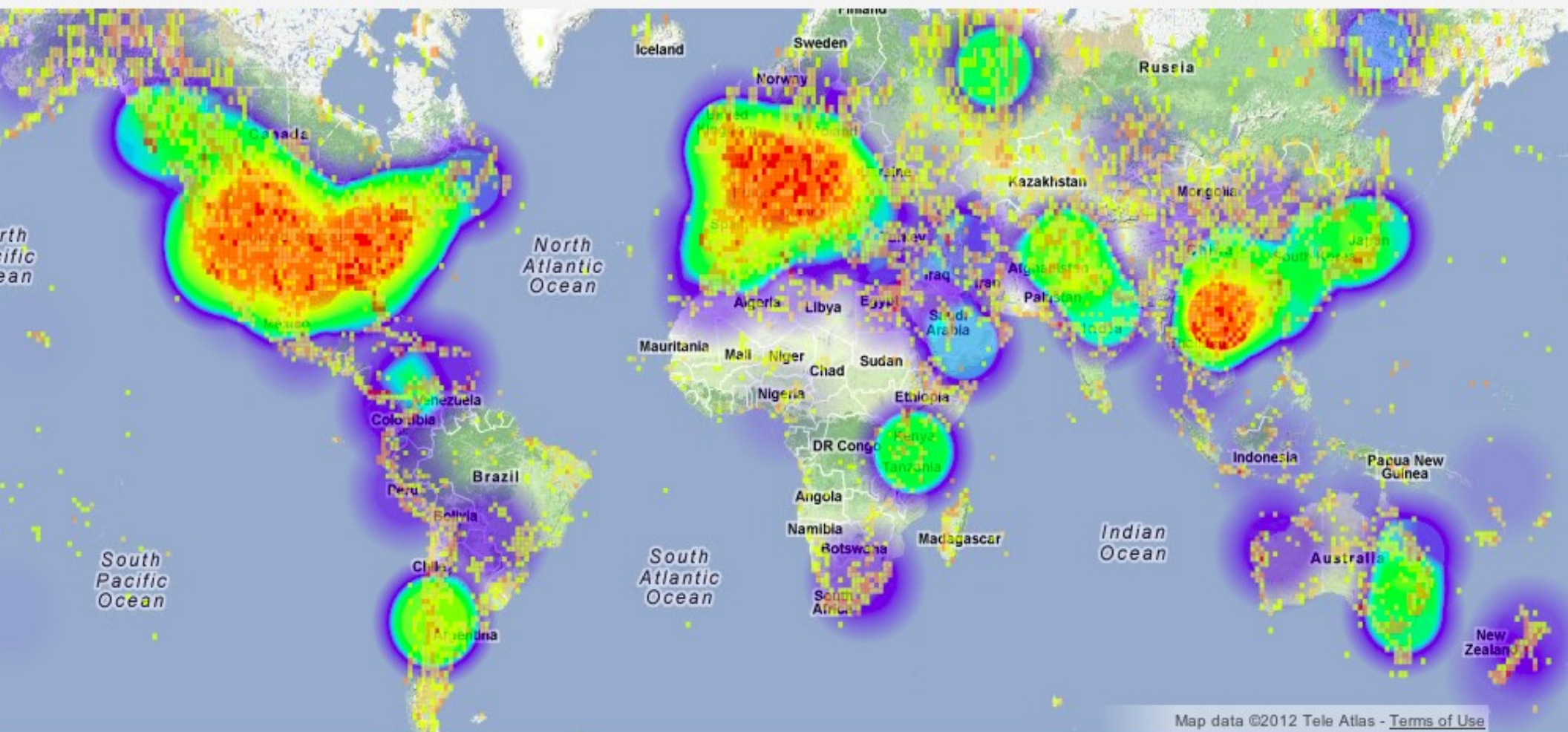


# Types of Data Visualisation

## Heatmap

earth-base » data-driven science » fossils » about

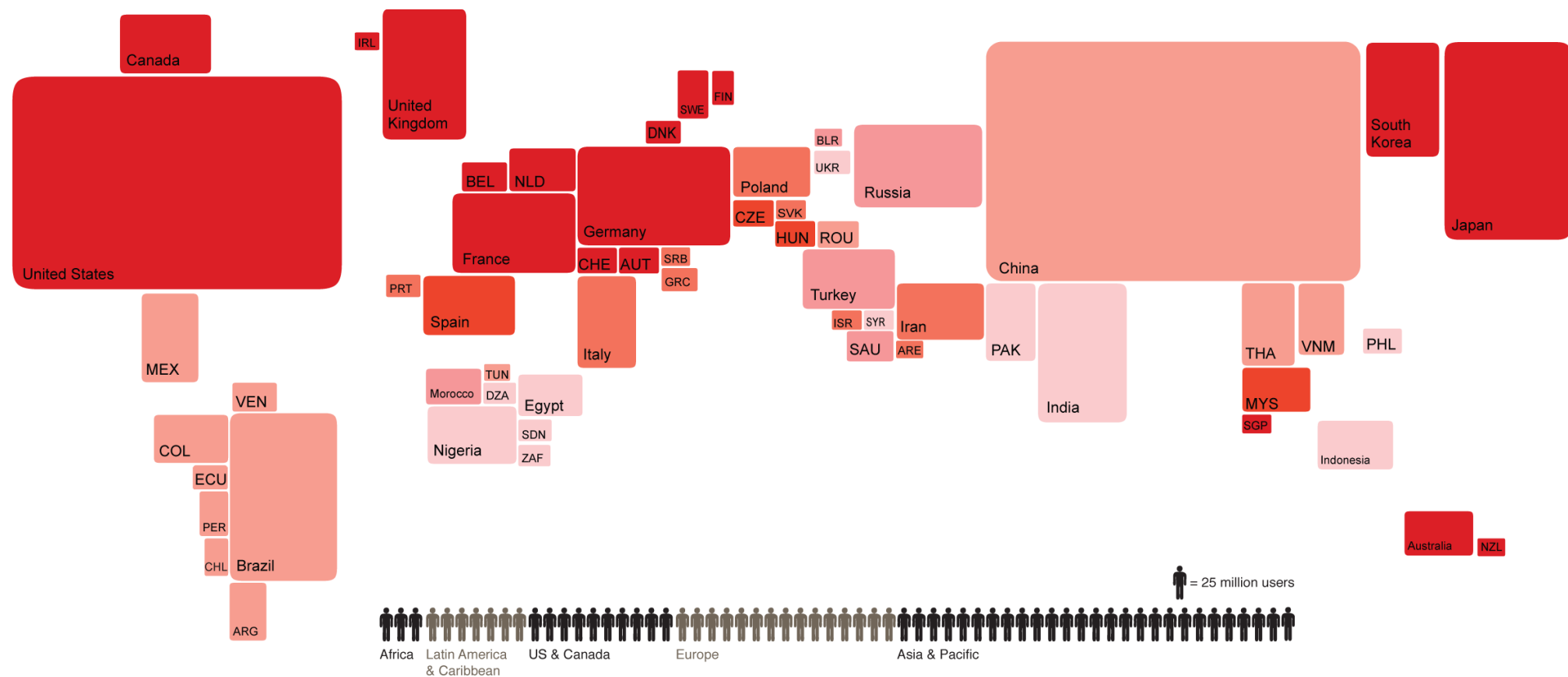
Scale = 1 : 111M 77.34, 62.59 ♂



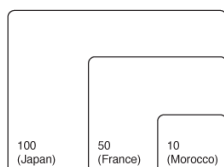


# Types of Data Visualisation

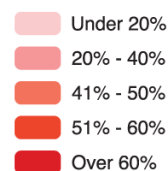
## Cartogram



Total number of Internet users (in millions), 2008



Internet penetration (% population)



### Internet Penetration

Visualization and analysis by Dr Mark Graham, Scott A. Hale and Monica Stephens in collaboration with Dr Corinne M. Flick and the Convoco Foundation.

This map and other visualizations can be found on the OII visualization website at <http://www.oii.ox.ac.uk/vis/>

Copyright © Oxford Internet Institute in cooperation with Dr. Corinne M. Flick and the Convoco Foundation 2011

This publication is released under the Creative Commons Attribution-NonCommercial-NoDerivs [CC BY-NC-ND] license.



# Types of Data Visualisation

## Flow Map

### *Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.*

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davoust qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Wilna, avaient toujours marché avec l'armée.

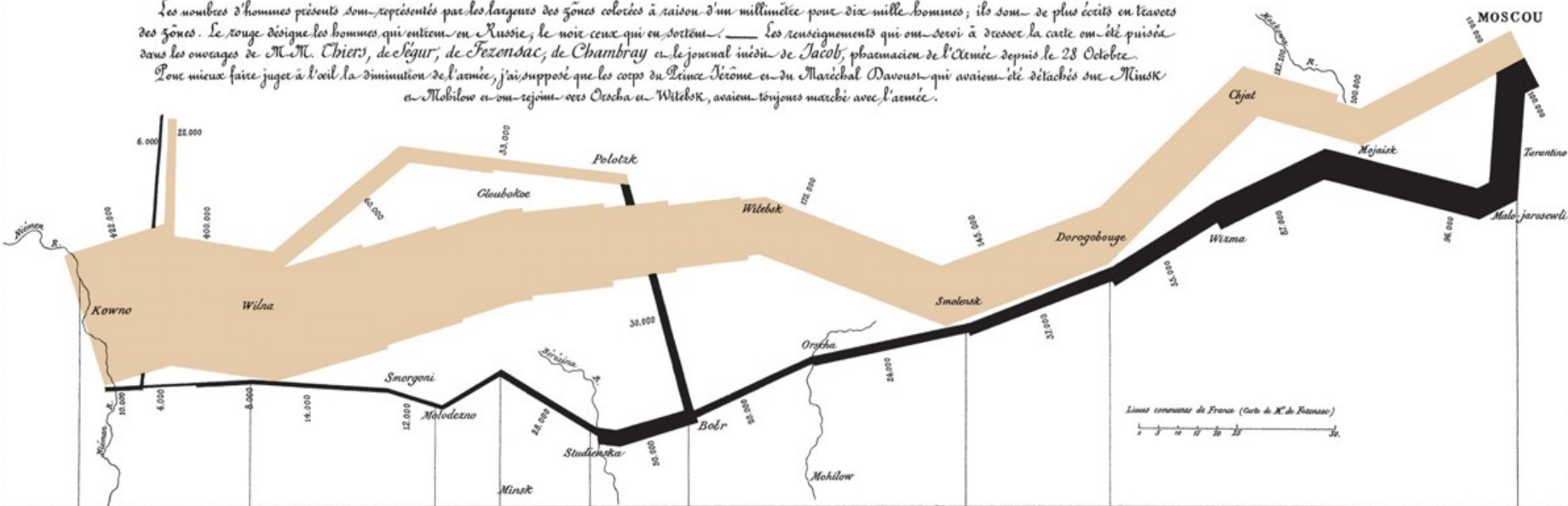
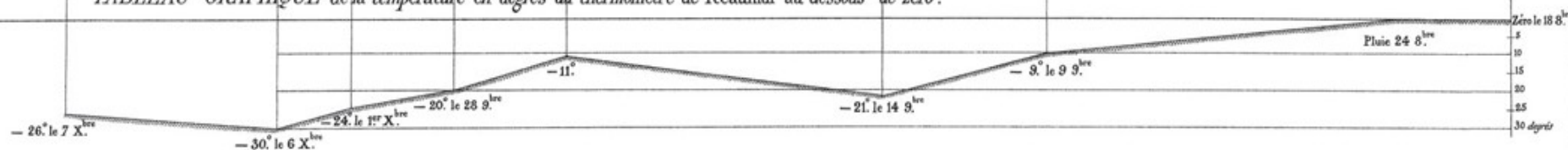


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Les Cosaques passent au galop le Niemen gelé.

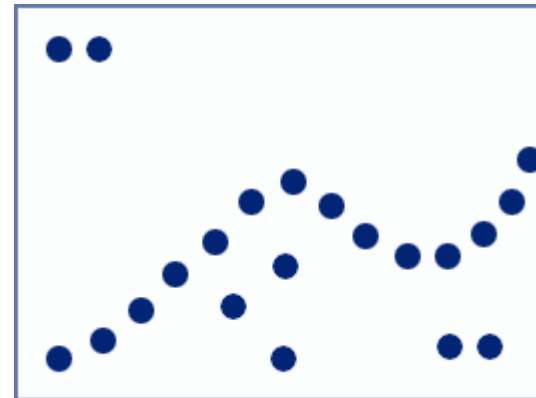
# Principles of Data Visualisation

## Gestalt Principles

Law of Proximity



Law of Familiarity



Law of Enclosure

Law of Closure

Law of Continuity

# Principles of Data Visualisation

## Edward Tufte: Principles of Graphic Excellence (Excerpt)

- **Show the data**
- **Induce the viewer to think about the substance of the findings rather than the methodology, the graphical design, or other aspects**
- **Avoid distorting what the data have to say**
- **Encourage the eye to compare different pieces of data**
- **Reveal the data at several levels of detail, from a broad overview to the fine structure**
- **Serve a clear purpose**
- **Be closely integrated with the statistical and verbal descriptions of the data set**

# Principles of Data Visualisation

## Manuel Lima: Information Visualization Manifesto (Excerpt)

- **Form follows function**
- **Start with a question**
- **Interactivity is key**
- **Cite your source**
- **The power of narrative**
- **Do not glorify aesthetics**
- **Embrace time**
- **Avoid gratuitous visualisations**

# Tools for Working with Data

- **Collection**
- **Organisation**
- **Analysis**
- **Visualisation**

# Tools for Working with Data Collection

- **Nokia Data Gathering**
- **Open Data Kit**
- **RapidSMS**
- **OpenStreetMap and Field Papers**
- **Ushahidi and Crowdmap**
- **Google Earth**
- **Tabula**

# Tools for Working with Data Organisation

- **Open Refine**
- **Mr. Data Converter**
- **CKAN**
- **GitHub and GitLab**



# Tools for Working with Data Analysis

- **Microsoft Excel and Libre Office Calc**
- **SPSS and Stata**
- **R and R Studio**
- **GRASS and Quantum GIS**

# Tools for Working with Data Visualisation

- **ManyEyes and Tableau**
- **Google Fusion Tables and Google Chart Tools**
- **Datawrapper and RAW**
- **D3.js, Recline.js, Raphaël, and Tangle**
- **Graph Commons, Gephi, Arbor.js, and Sigma.js**
- **Leaflet.js, GeoCommons, CartoDB, and MapBox Studio**
- **Timeline JS and StoryMap JS**
- **Processing**
- **ColorBrewer**

# What is Open Data?

- **Open for studying**
- **Open for using**
- **Open for making products and services**
- **Open for sharing**

# What is the 'Open Data Movement'?

- **A movement for open data practices by everyone – government, non-government / civil society organisations, international organisations, researchers, everyone.**
- **A movement that recognises that allowing other people to see, use, and share your data is a good thing for everyone**
- **A movement to make data available for decision-making, but also to understand how decisions are made**
- **A movement that is distributed, and took forward by different people in different contexts – no single international leader!**

# How to Contribute to Open Data Movement?

- **Open up the data you have**
- **Contribute to open data projects (like OpenStreetMap)**
- **Ask the government to open up data (via [data.gov.in](https://data.gov.in))**
- **Ask all organisations you work with to open up data**
- **Help organisations to open up their data**

**(and join DataMeet: [datameet.org](https://datameet.org))**

# ICSSR Research Methodology Workshop

December 18, 2015

**Thank you.**

**CIS:** [cis-india.org](http://cis-india.org)  
**Twitter:** [@cis\\_india](https://twitter.com/cis_india)

**Personal:** [ajantriaks.net](http://ajantriaks.net)  
**Twitter:** [@ajantriaks](https://twitter.com/ajantriaks)

**Sumandro Chattapadhyay**  
[sumandro@cis-india.org](mailto:sumandro@cis-india.org)

