

# COMS21202: Symbols, Patterns and Signals

## Information Visualisation

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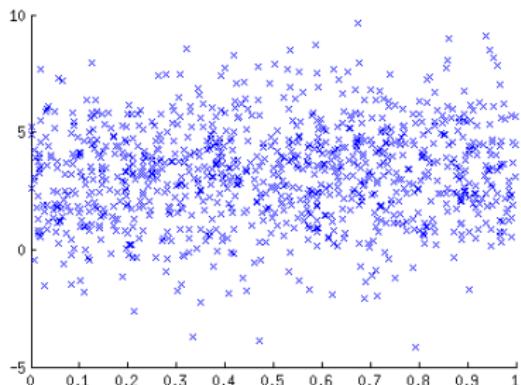
February 8, 2016

# Information Visualisation

- ▶ Information visualisation, as a research discipline, has emerged over the last 20 years
- ▶ Driven by the volumes of data and the accessibility of *big data*
- ▶ Characterised by large quantities of data - not necessarily numbers

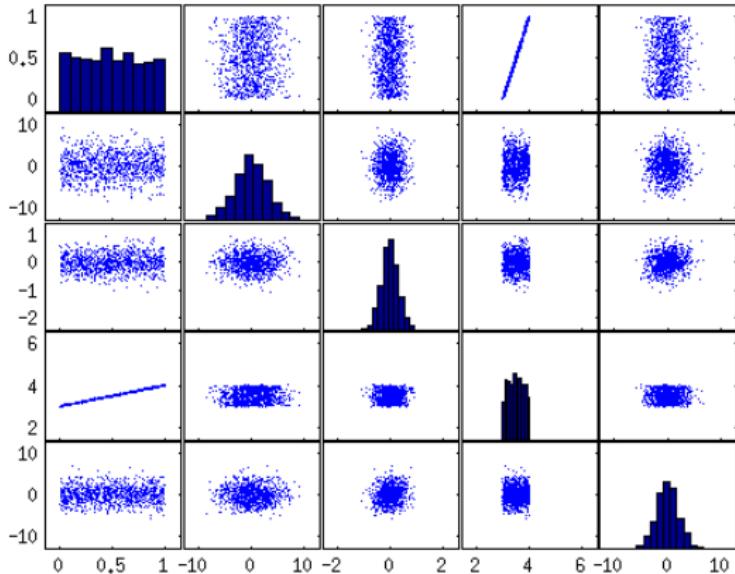
# Information Visualisation - Simple Graphs

## 1. Scatter Plot



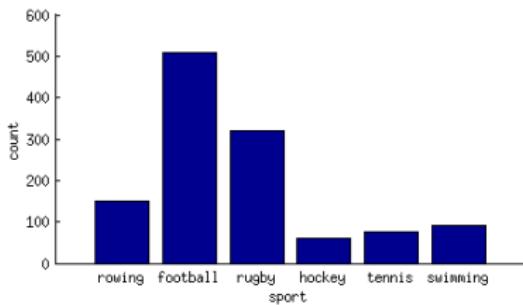
# Information Visualisation - Simple Graphs

1. Scatter Plot
2. Scatter Plot Matrix



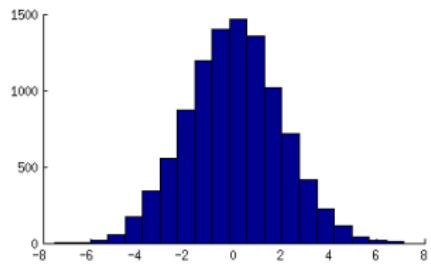
# Information Visualisation - Simple Graphs

1. Scatter Plot
2. Scatter Plot Matrix
3. Histogram
  - ▶ Discrete Variable  
**(bar chart)**



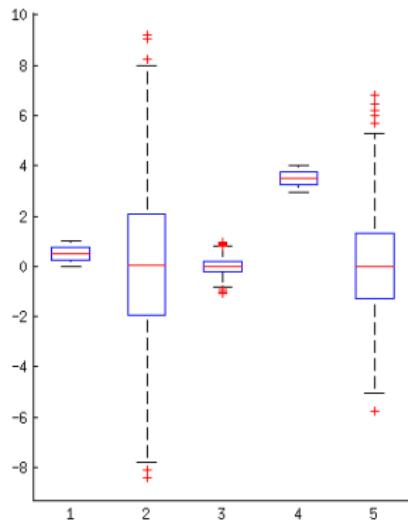
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3. Histogram
  - ▶ Discrete Variable
  - ▶ Continuous Variable
  - $\Delta v$ : width of bin
  - $c$ : bin number;  $0 \leq c \leq N$
  - $\min_x + c\Delta v \leq v < \min_x + (c + 1)\Delta v$



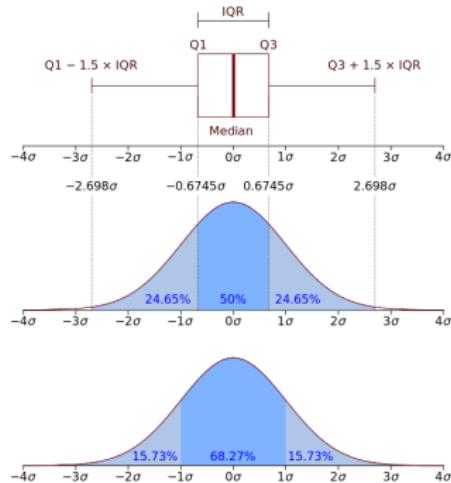
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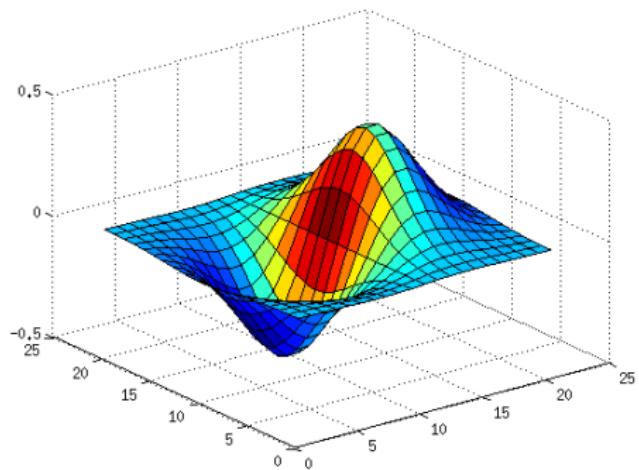
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source:Wikipedia(2015)

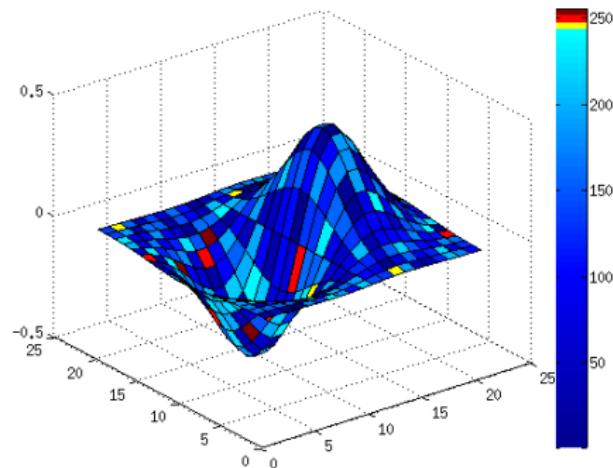
# Information Visualisation - Simple Graphs

1. Scatter Plot
2. Scatter Plot Matrix
3. Histogram
4. Box plot
5. Surface  
▶ 3D Data



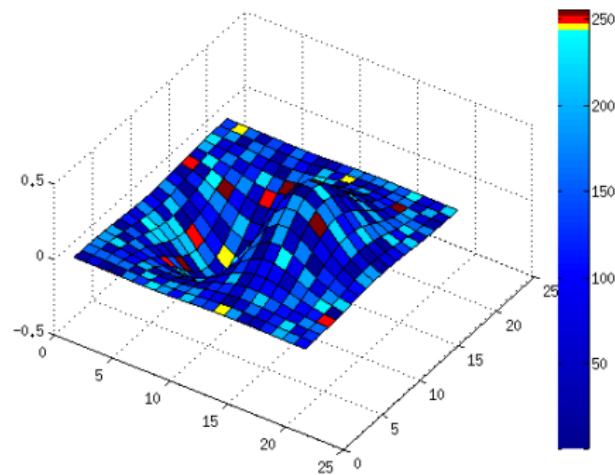
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- ▶ But it existed **before** computers!

# Historical Note - Ex1

## Napoleon's disastrous Russian campaign (1812)

*Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.*  
Dessiné par M. Minard, Inspecteur Général des Ponts et Chaussées en état-major.

Les nombreux hommes perdus sont représentés par les longueurs des lignes colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en lettres des pertes. 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 pris dans les messages de M. M. Cibot, de Ségur, de Tocqueville, de Chambry ou le journal intime de Jacob, pharmacien de l'Armée depuis le 23 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai superposé que le corps de l'Armée décomme du Maréchal Davout, qui arriva de ses succès sur Moscou au régime vers Ossouïa ou Witebsk, auquel temps mesché avec l'Armée.

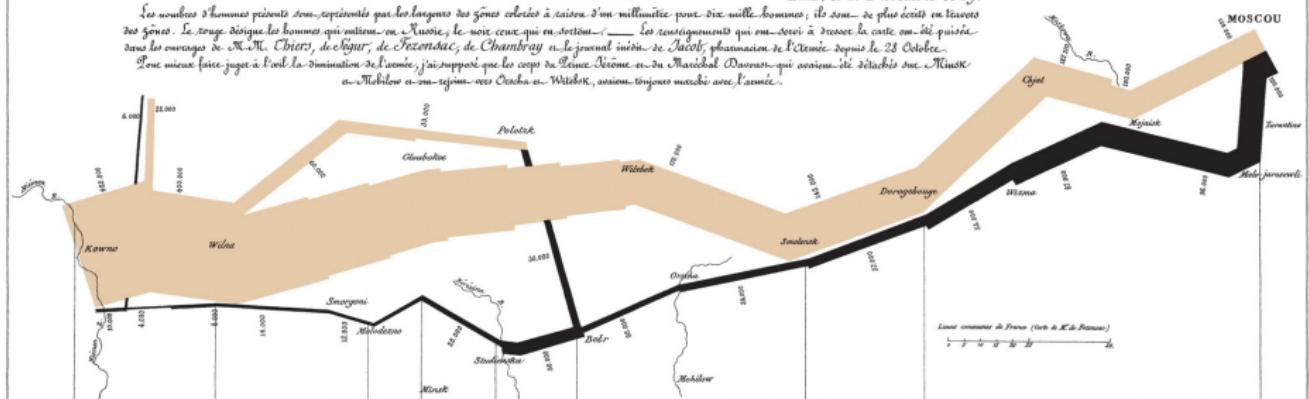
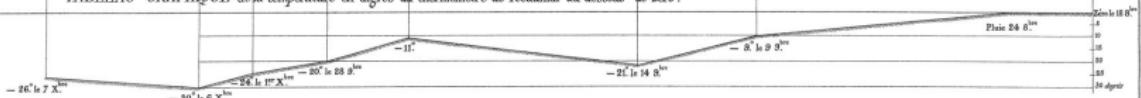


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.

Les Campagnes passent au gelé  
le Nidement, juillet.

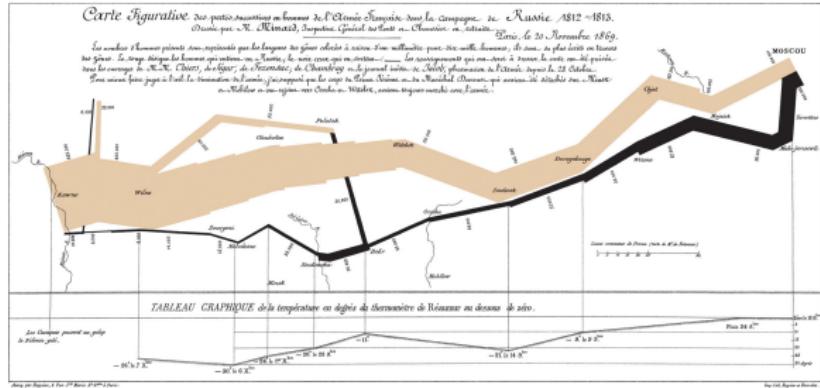


Arch. du Régiment, 8. Rue Félix Marie 25<sup>e</sup> arr. à Paris.

Imp. L. Regnier à Bourdeau.

Further info <http://www.datavis.ca/gallery/re-minard.php>

# Historical Note - Ex1



- ▶ Charles Minard
- ▶ Six dimensions of data
  - ▶ Number of Napoleon's troops
  - ▶ Direction
  - ▶ Distance
  - ▶ Temperature
  - ▶ Location: Longitude and Latitude
  - ▶ Dates
- ▶ Acclaimed best statistical graphic ever drawn

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$$\text{Lie Factor (LF)} = \frac{\text{size of effect in visualisation}}{\text{size of effect in data}}$$

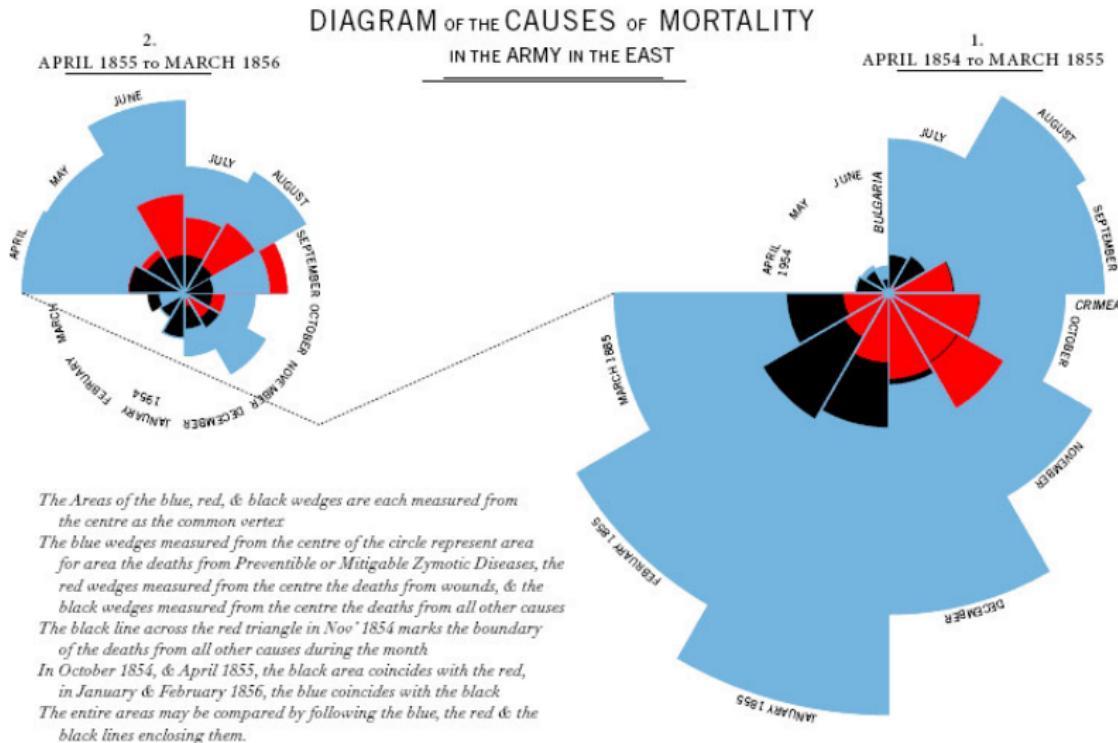
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$$\text{Lie Factor (LF)} = \frac{\text{size of effect in visualisation}}{\text{size of effect in data}}$$

- ▶  $LF > 1 \rightarrow$  over stating
- ▶  $LF < 1 \rightarrow$  under stating
- ▶  $2 \leq LF \leq 5$  is common

## Historical Note - Ex2

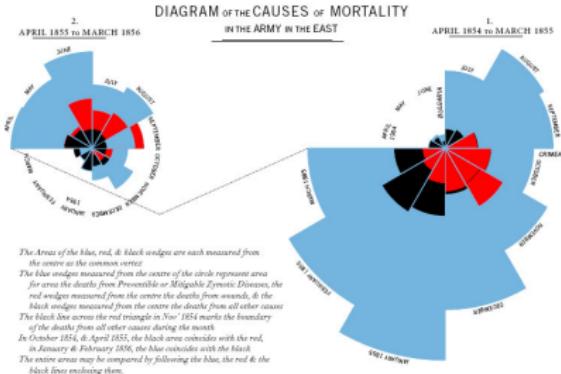


*The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex*

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic Diseases, the red wedges measured from the centre the deaths from wounds, & the black wedges measured from the centre the deaths from all other causes The black line across the red triangle in Nov' 1854 marks the boundary of the deaths from all other causes during the month

In October 1854, & April 1855, the black area coincides with the red,  
in January & February 1856, the blue coincides with the black  
The entire areas may be compared by following the blue, the red & the  
black lines enclosing them.

## Historical Note - Ex2



- ▶ Florence Nightingale
  - ▶ Four dimensional data (date, disease1, disease2, disease3)
  - ▶ Histogram-style (area instead of height)
  - ▶ colours for the various dimensions (ordered max to min)

# Historical Note - Ex3



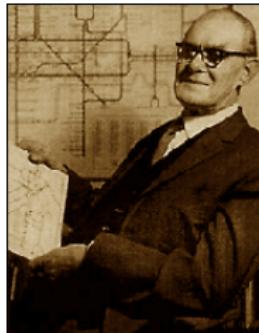
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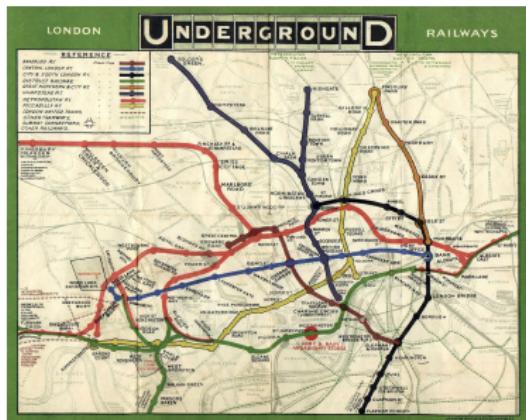
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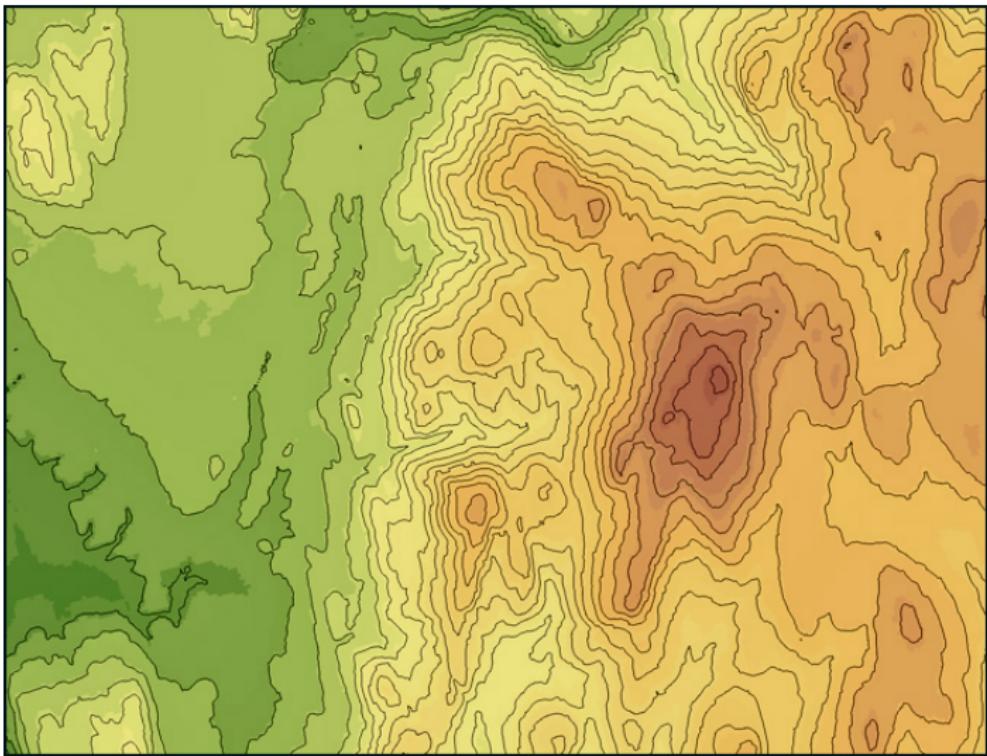


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# Contour Maps

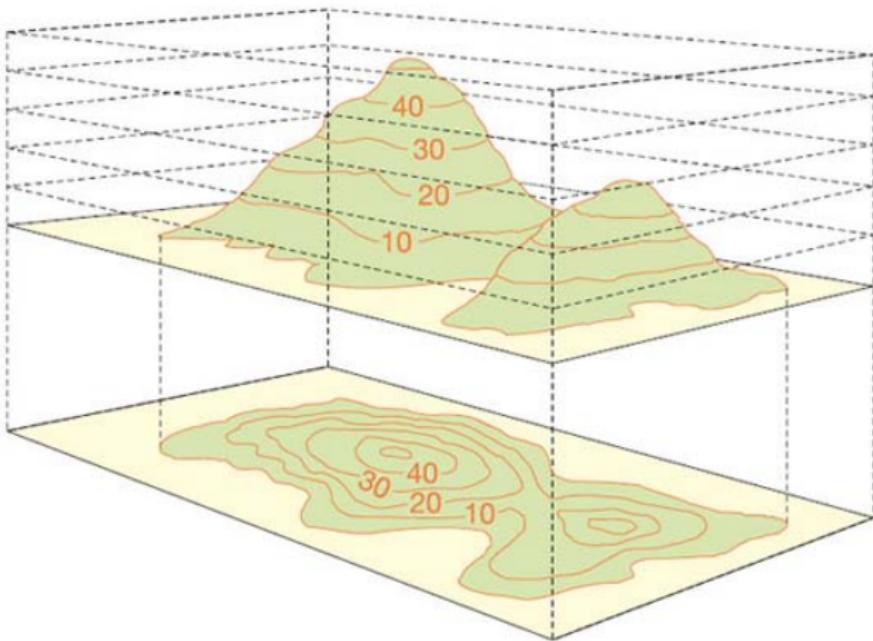


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# Contour Maps



source: [ordnancesurvey.co.uk](http://ordnancesurvey.co.uk)

# Flow Charts

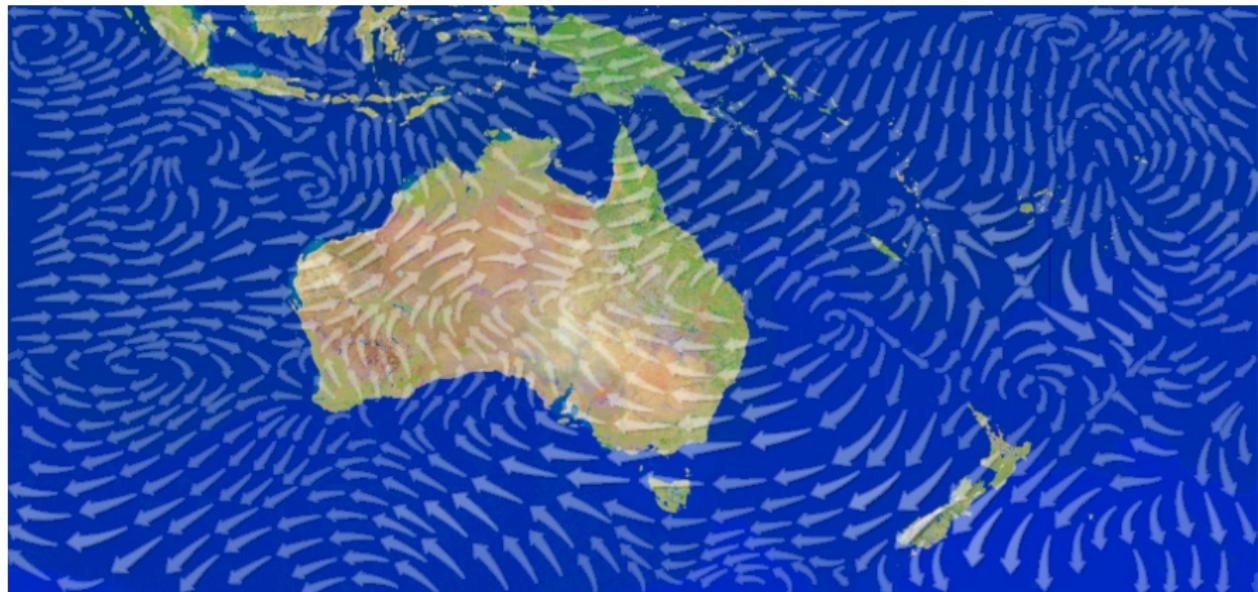
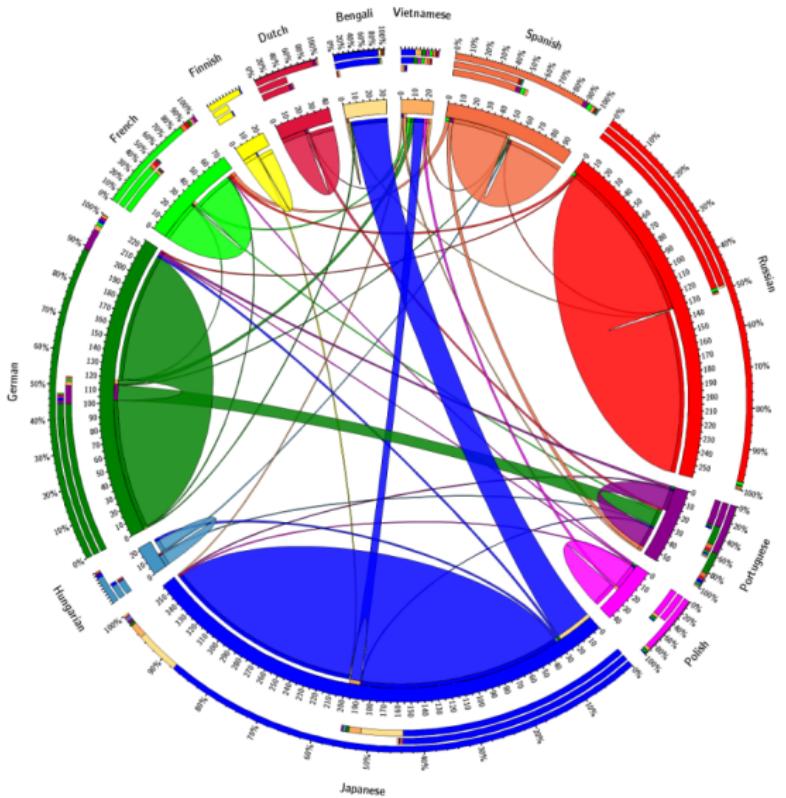


Image courtesy of Greg Turk

# Circular Graphs



Source: AlNoamany et al (2013). Who and What Links to the Internet Archive

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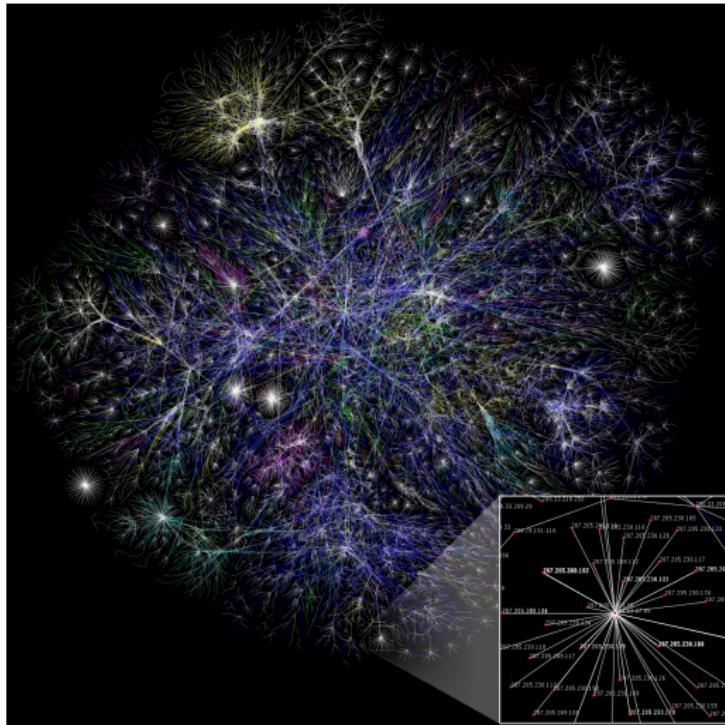
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## Wordles



Source: Wikipedia(2015)

# Graphs and Hierarchies



Source: Wikipedia(2015)

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# Further Reading

- ▶ **Visualization Handbook**  
Hansen and Johnson (2004)