

2

Graphical Excellence

The whole and the sum of its parts

GROUP I

GROUP II

GROUP III

GROUP IV

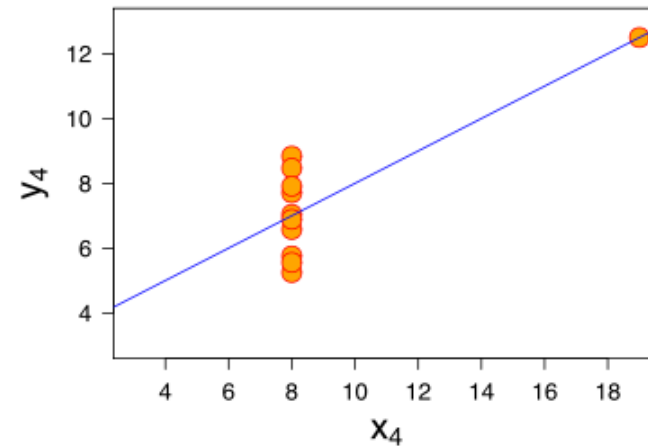
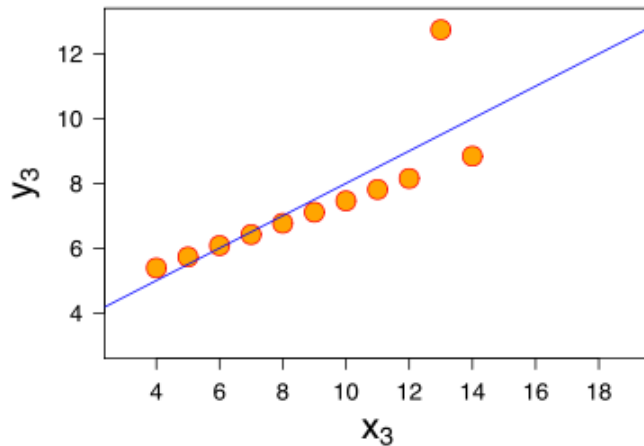
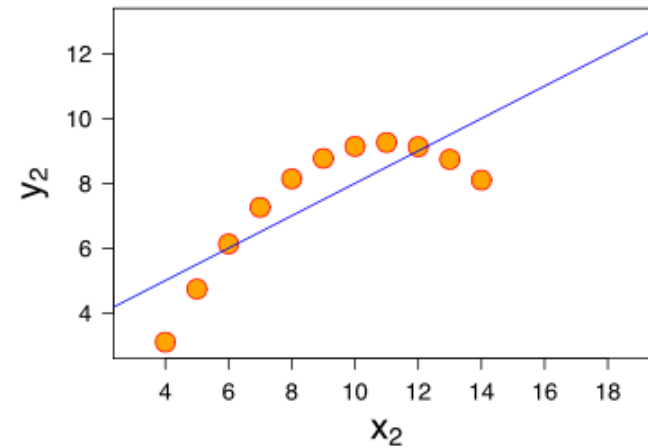
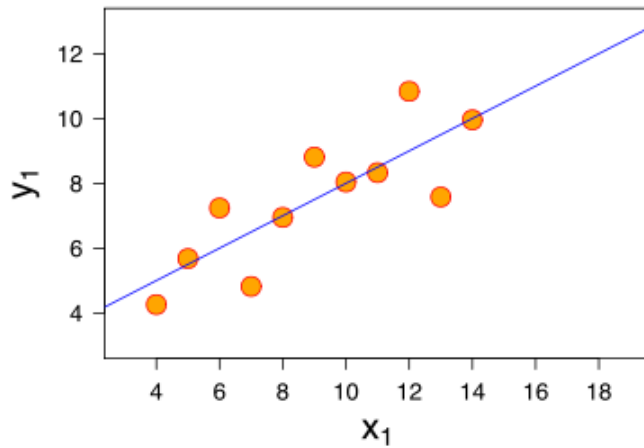
X	Y
10.0	8.04
8.0	6.95
13.0	7.58
9.0	8.81
11.0	8.33
14.0	9.96
6.0	7.24
4.0	4.26
12.0	10.84
7.0	4.82
5.0	5.68

X	Y
10.0	9.14
8.0	8.14
13.0	8.74
9.0	8.77
11.0	9.26
14.0	8.10
6.0	6.13
4.0	3.10
12.0	9.13
7.0	7.26
5.0	4.74

X	Y
10	7.46
8.0	6.77
13.0	12.74
9.0	7.11
11.0	7.81
14.0	8.84
6.0	6.08
4.0	5.39
12.0	8.15
7.0	6.42
5.0	5.73

X	Y
8.0	6.58
8.0	5.76
8.0	7.71
8.0	8.84
8.0	8.47
8.0	7.04
8.0	5.25
19.0	12.50
8.0	5.56
8.0	7.91
8.0	6.89

Please calculate: N, Mean of X's, Mean of Y's,
Equation of regression line,
and the Correlation Coefficient



F.J. Anscombe, Graphs in Statistical Analysis, 1973

N: 11
 Mean X: 9.0
 Mean Y: 7.5

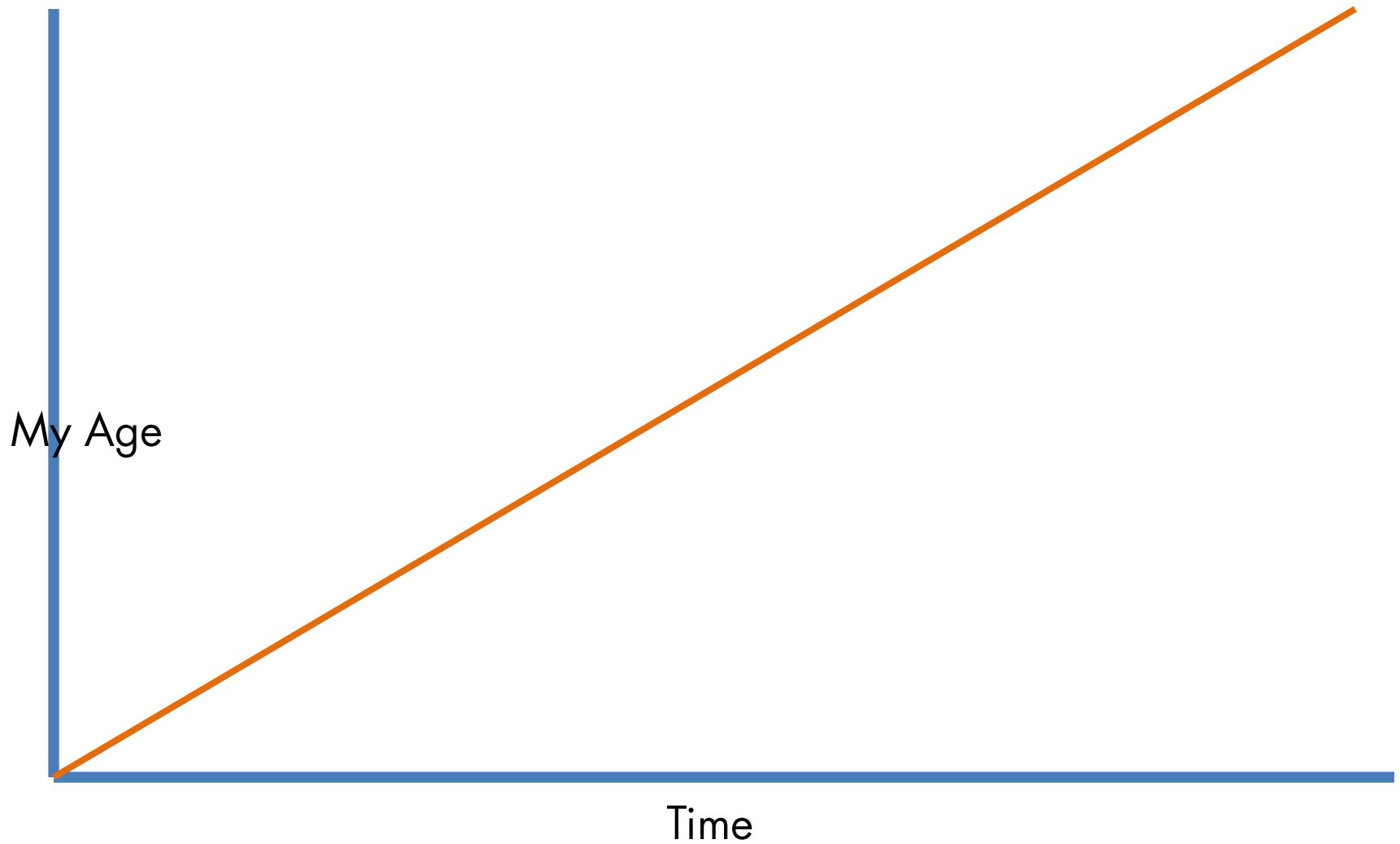
Equation of Regression Line: $y = 0.5x + 3$
 Correlation Coefficient: 0.82
 (Standard error of estimate of slope: 0.118)

“Above all else, show the data.”

-Edward Tufte

Information is multivariate
Visualization reveals

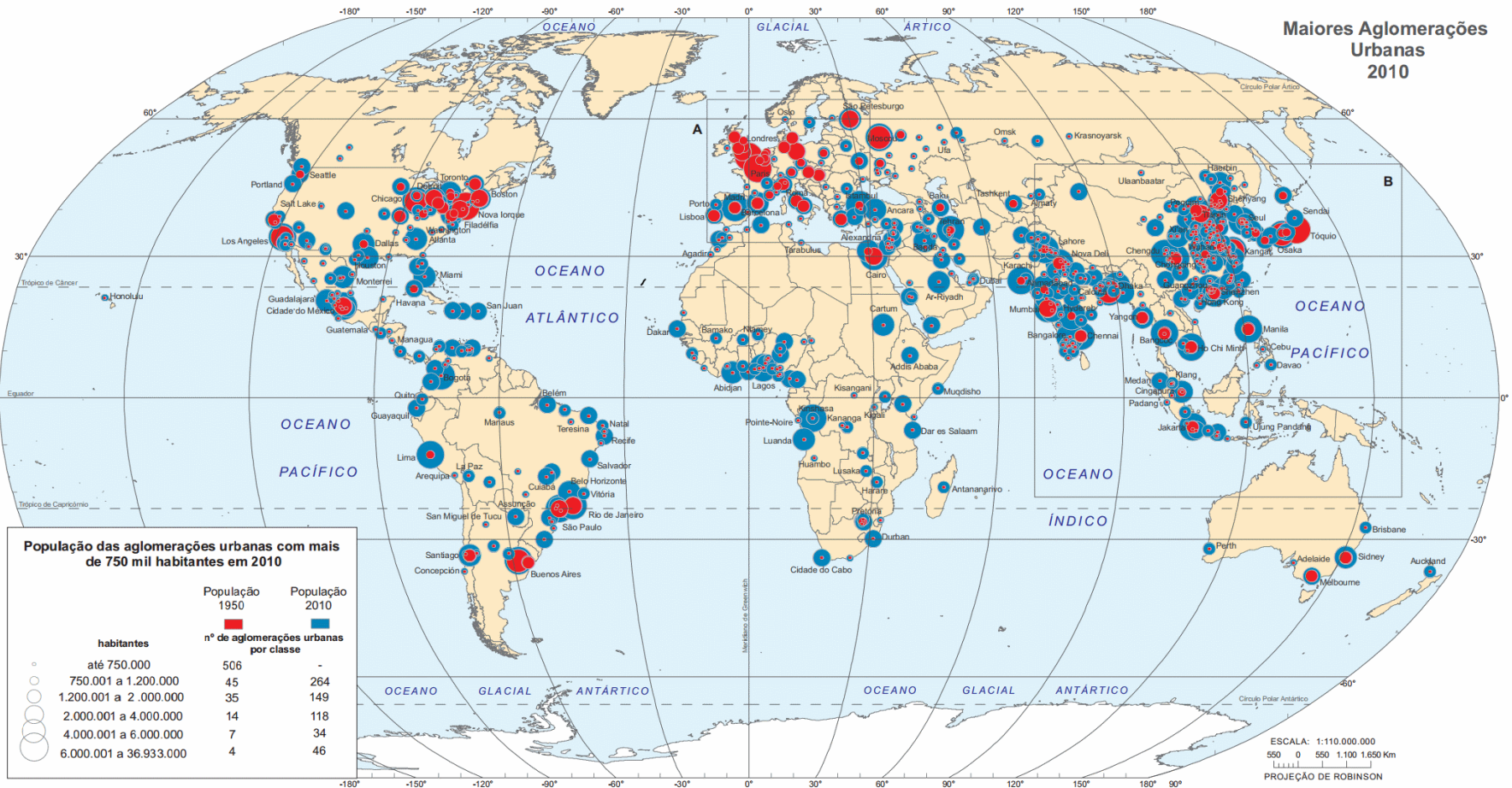
Information is multivariate



Information is multivariate

Aglomerações urbanas

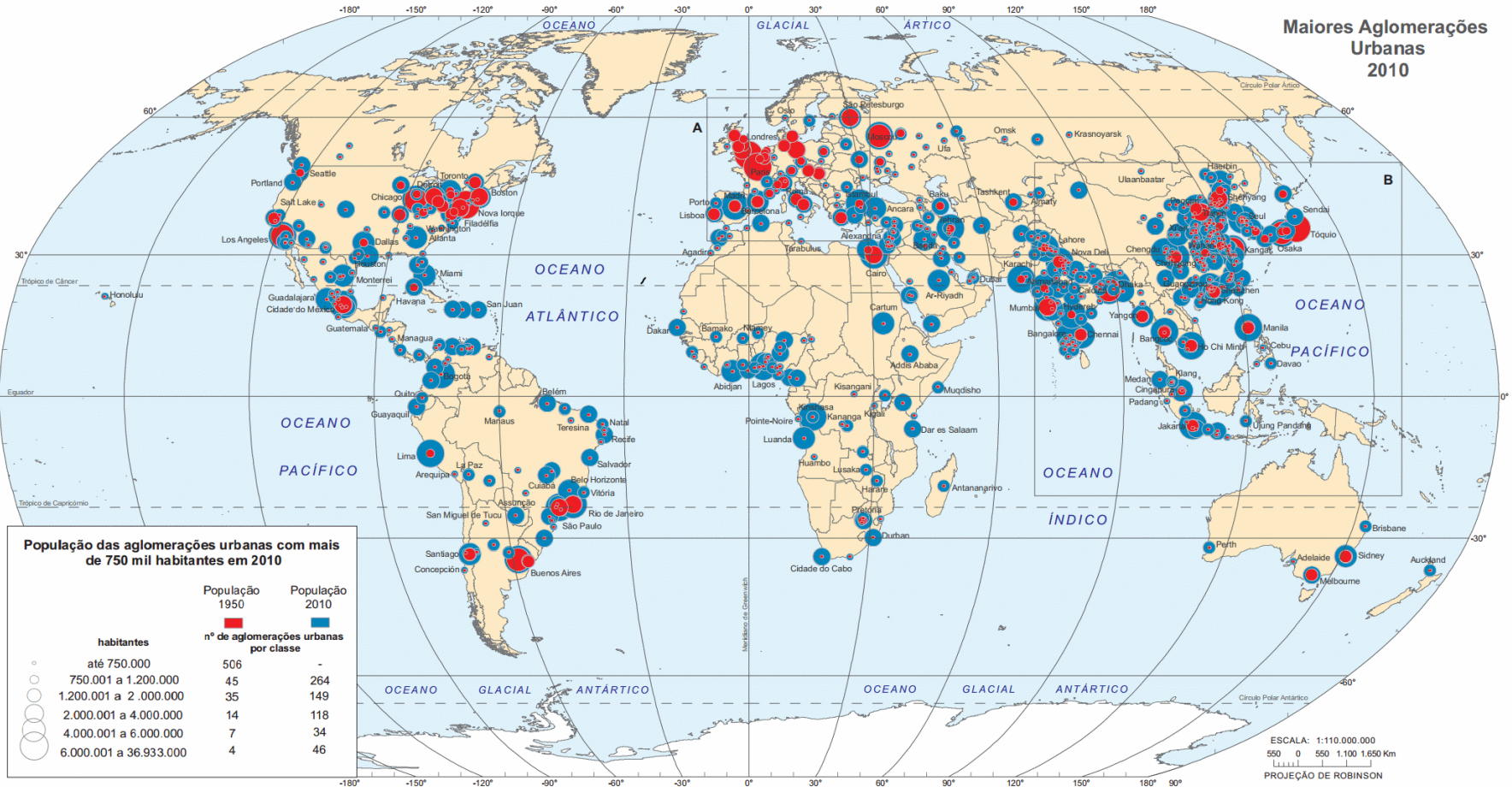
Maiores Aglomerações Urbanas 2010



Information is multivariate

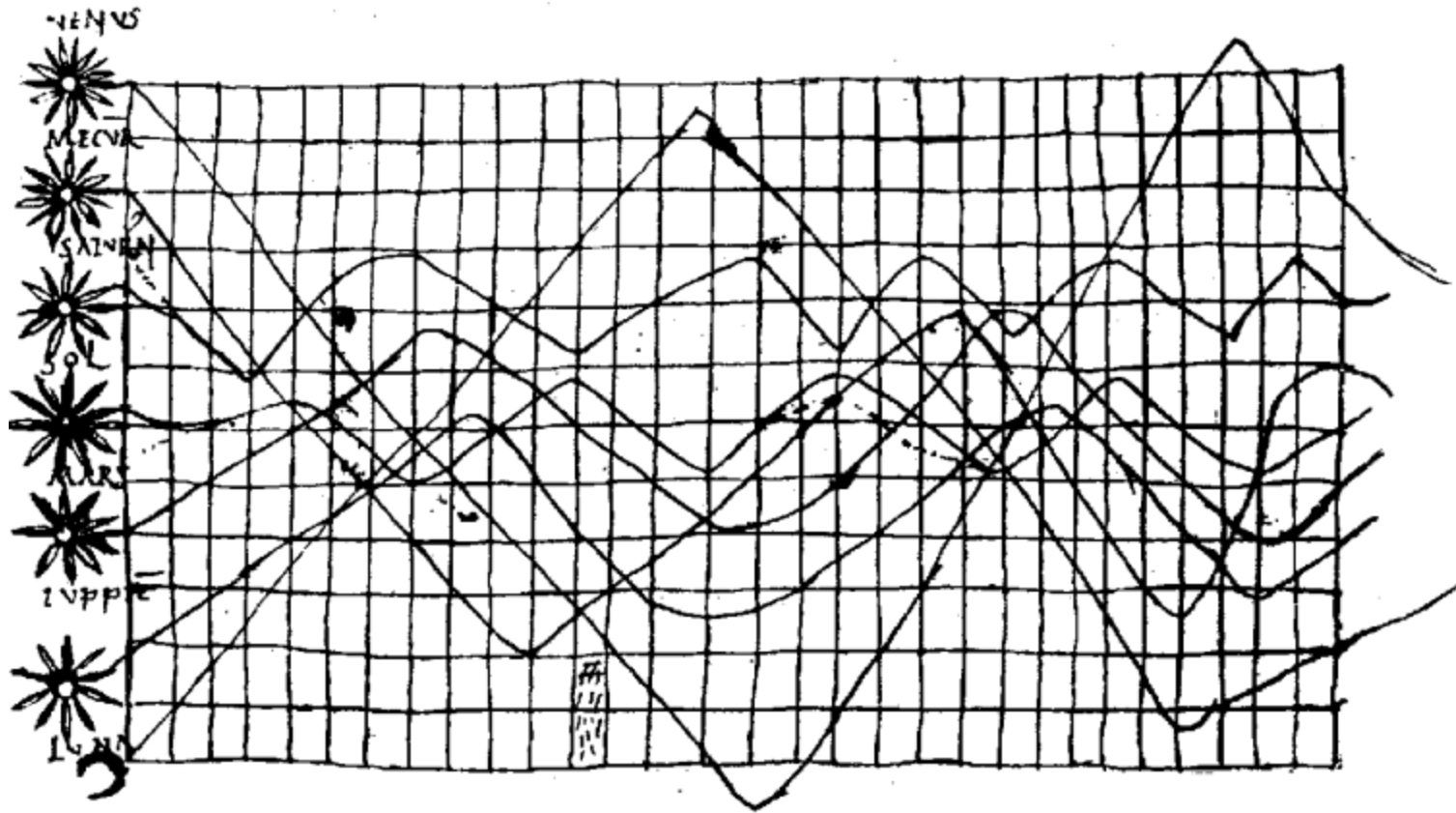
Aglomerações urbanas

Maiores Aglomerações Urbanas 2010



Latitude, Longitude, 1950 Population, 2010 Population, City name, Land or Water

Information is multivariate

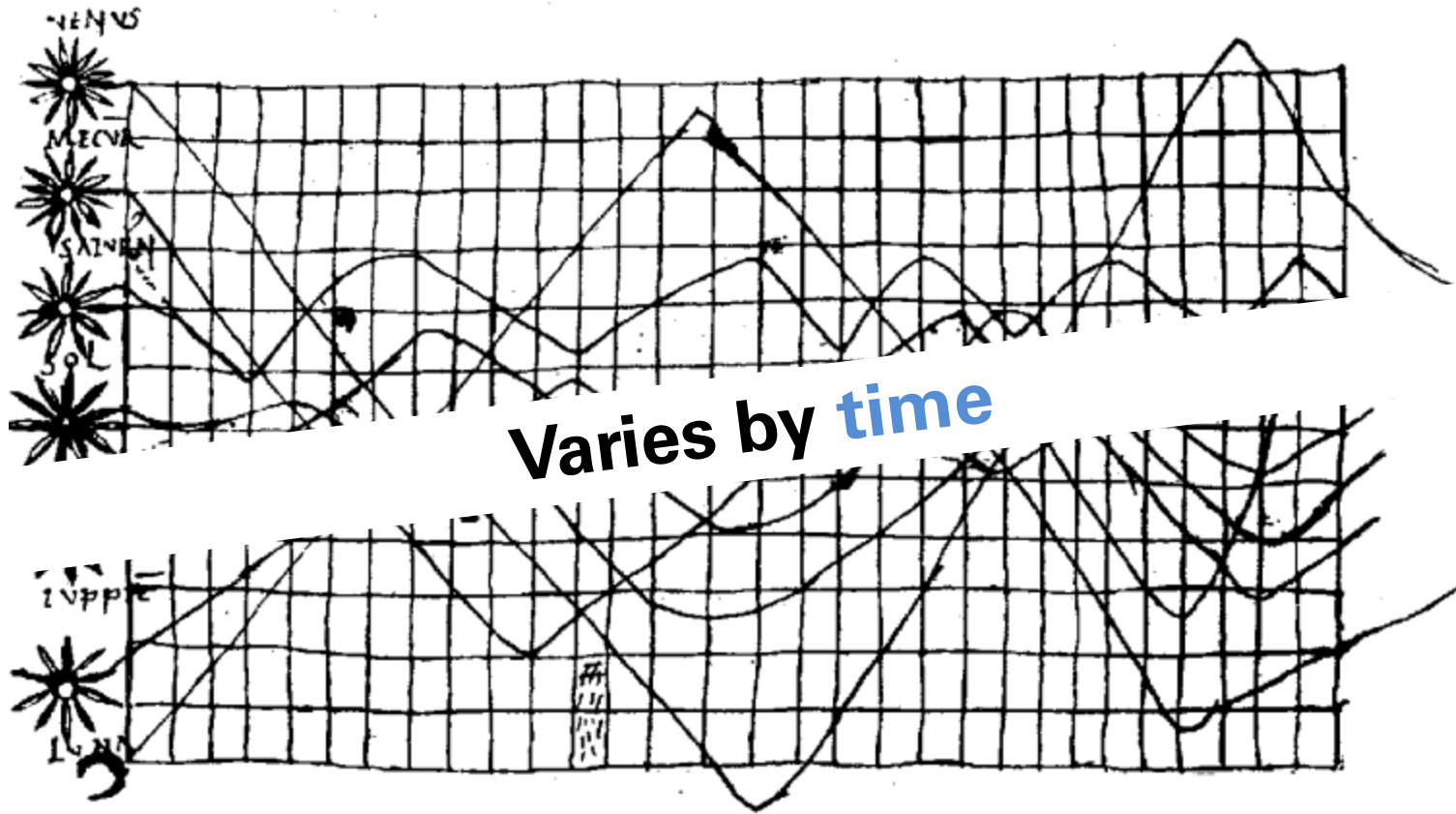


“Planetary Movements”

Macrobius Boetius in Isagog 10th century

Reprinted by H.G. Funkhouser, 1936

Information is multivariate

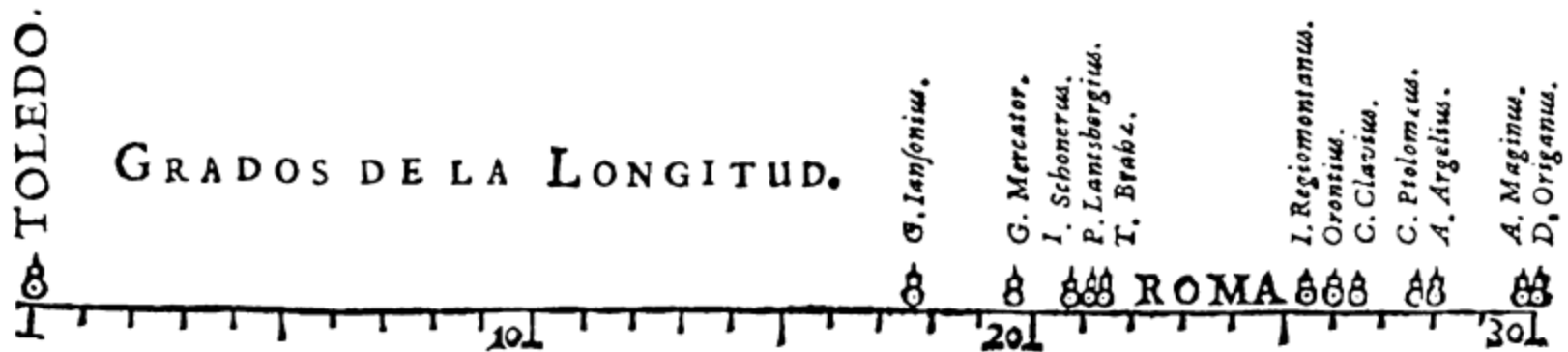


“Planetary Movements”

Macrobius Boetius in Isagog 10th century

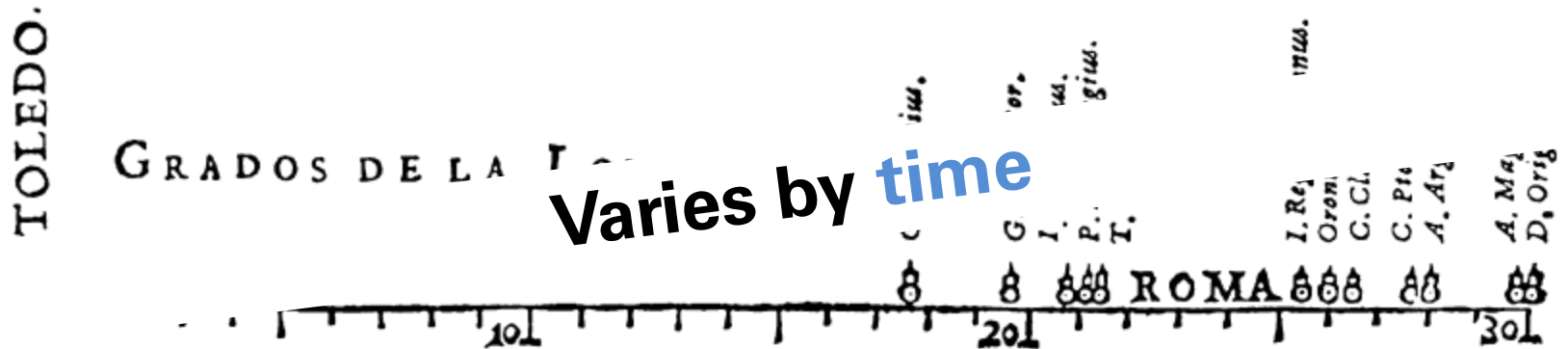
Reprinted by H.G. Funkhouser, 1936

Information is multivariate



Variations in Determination of Longitude from Toledo to Rome
Michael Florent van Langren 1644

Information is multivariate



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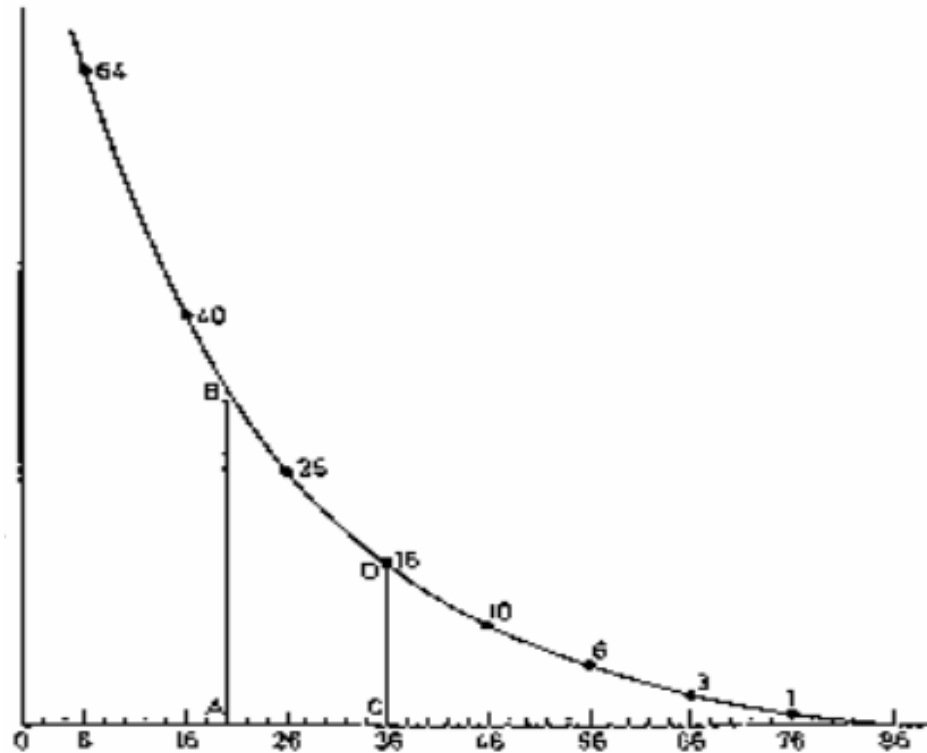


Chart of Mortality
Christiaan Huygens 1669

Information is multivariate

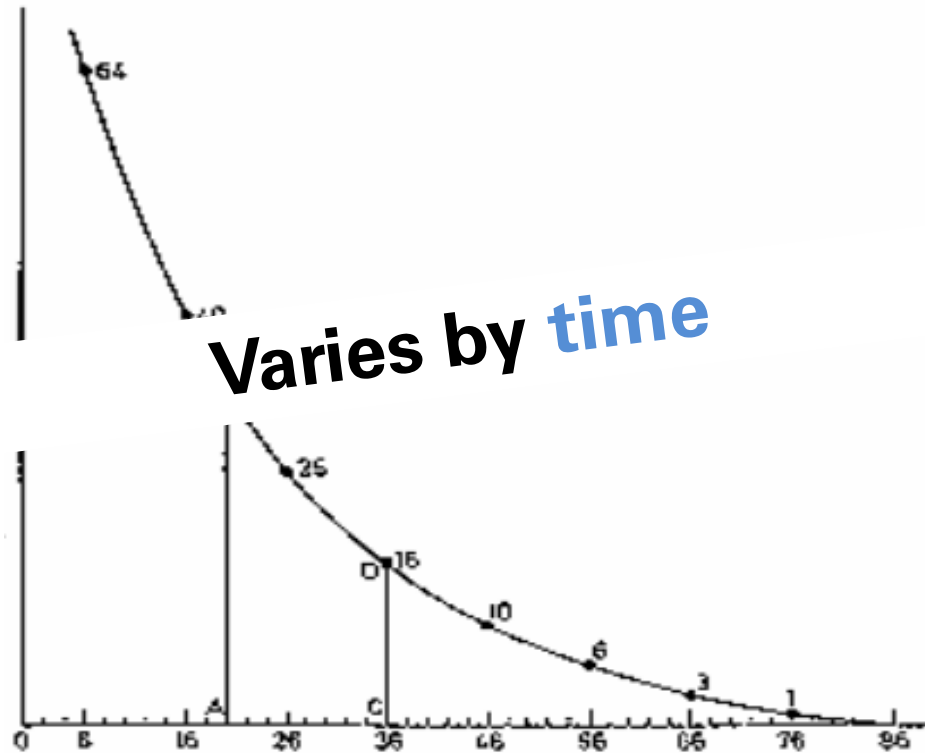
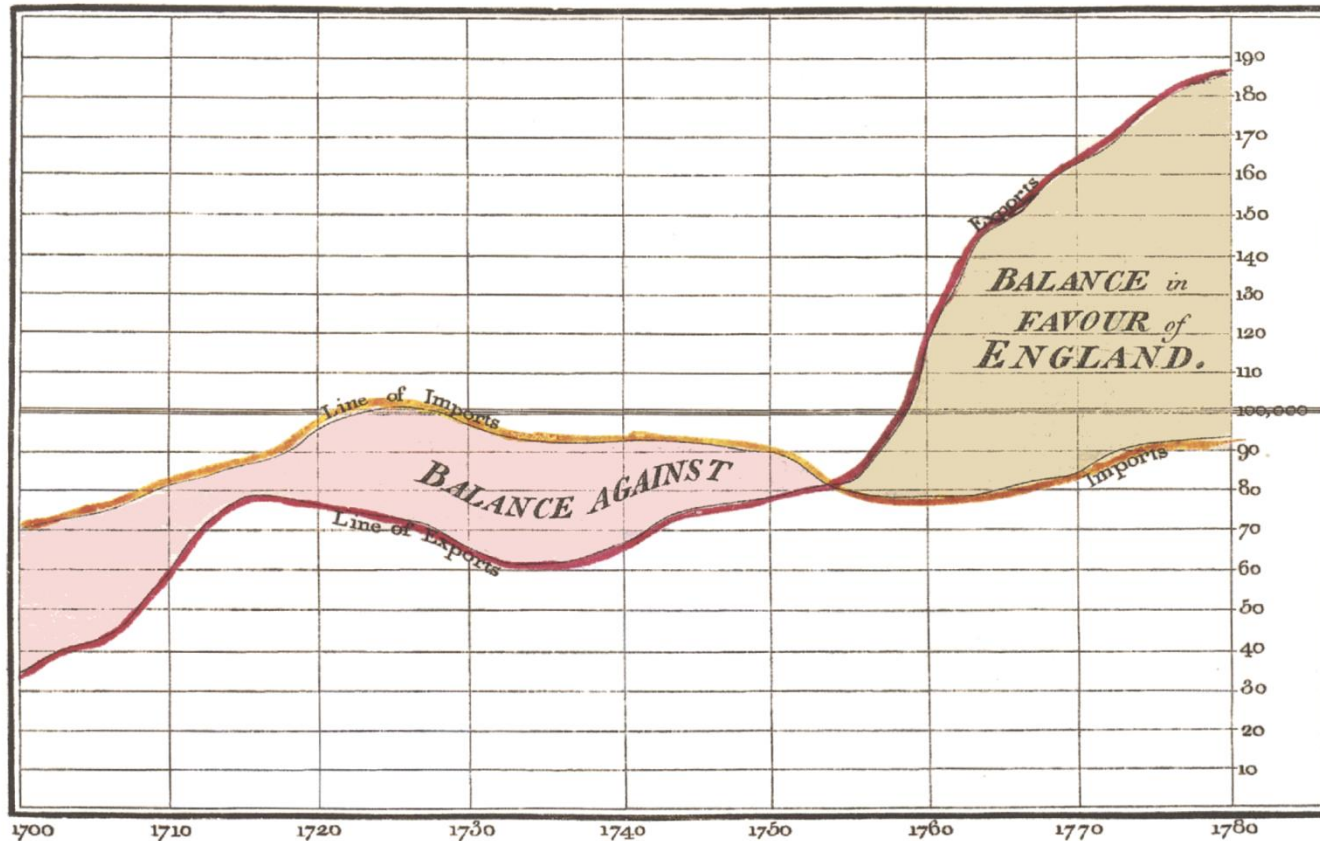


Chart of Mortality
Christiaan Huygens 1669

Information is multivariate

Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780.



The Bottom line is divided into Years, the Right hand line into L10,000 each.

Published as the Act directs, 14th May 1786. by Wth Playfair

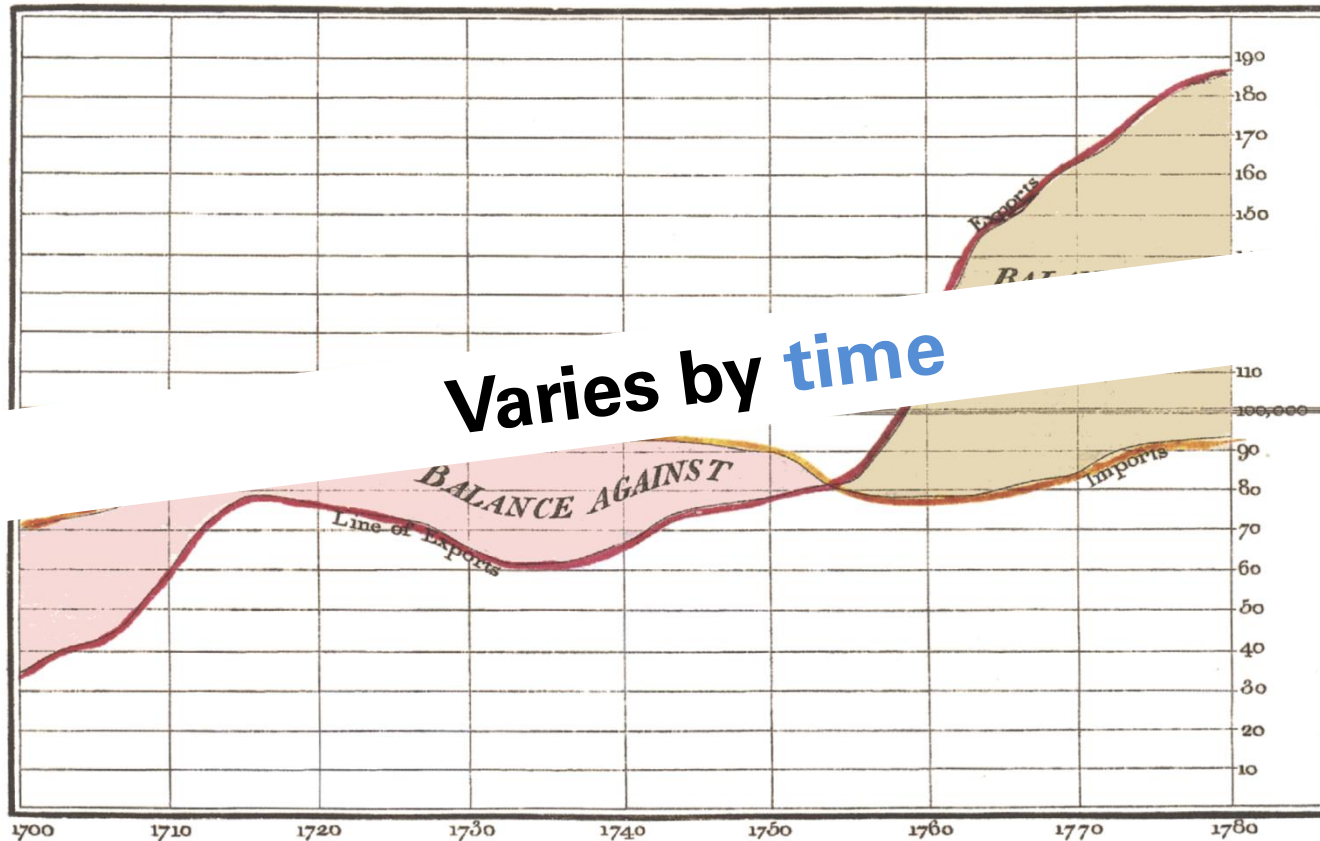
Neale sculpt 352, Strand, London.

Exports and Imports to and from Denmark & Norway from 1700 to 1780

William Playfair, Commercial and Political Atlas, 1786

Information is multivariate

Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780.



Varies by time

The Bottom line is divided into Years, the Right hand line into L10,000 each.

Published as the Act directs, 14th May 1786. by Wth Playfair

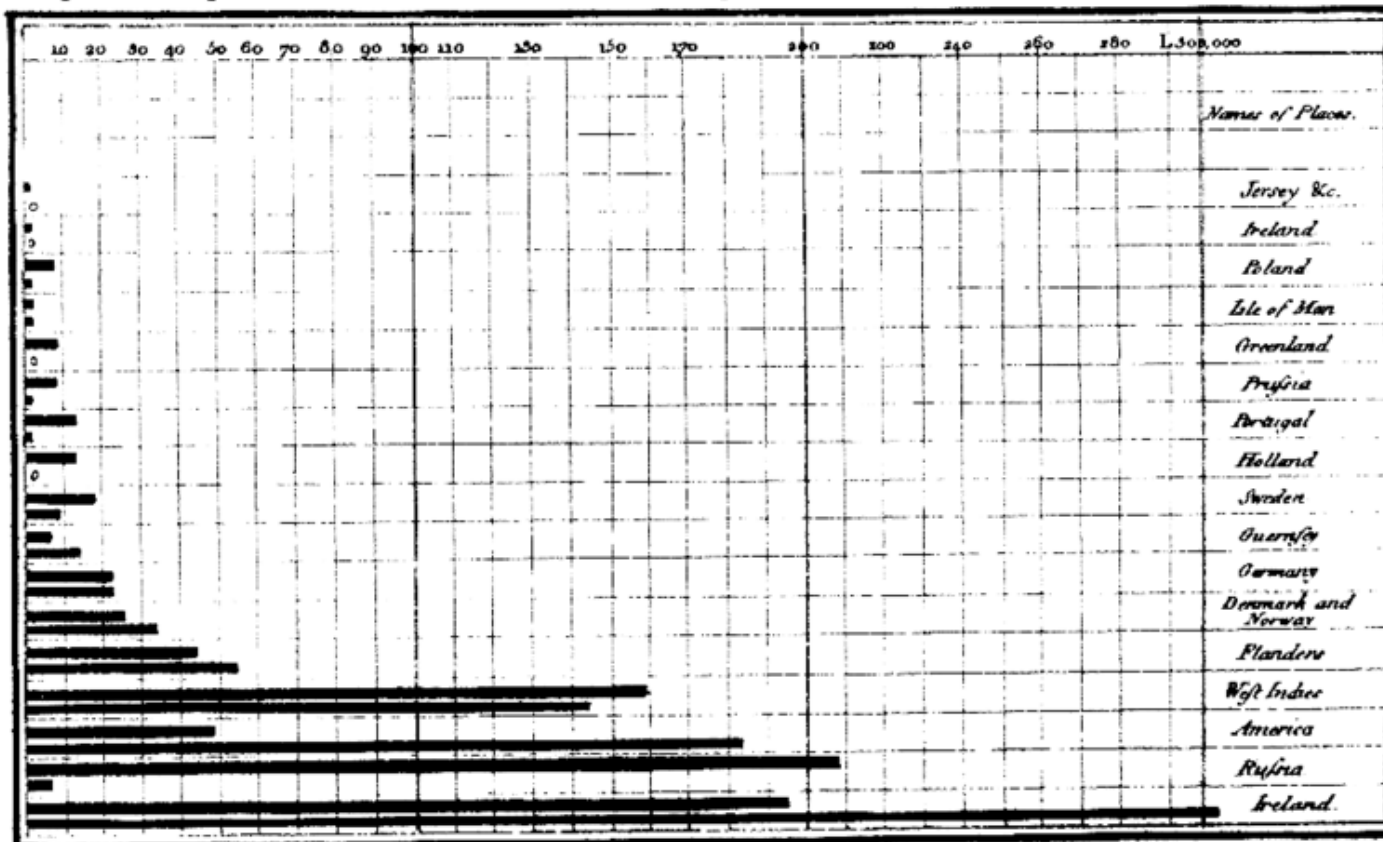
Neale sculpt 352, Strand, London.

Exports and Imports to and from Denmark & Norway from 1700 to 1780

William Playfair, Commercial and Political Atlas, 1786

Information is multivariate

Exports and imports of SCOTLAND to and from different parts for one Year from Christmas 1780 to Christmas 1781.



The Upright divisions are Ten Thousand Pounds each. The Black Lines are Exports the Ribbed lines Imports.

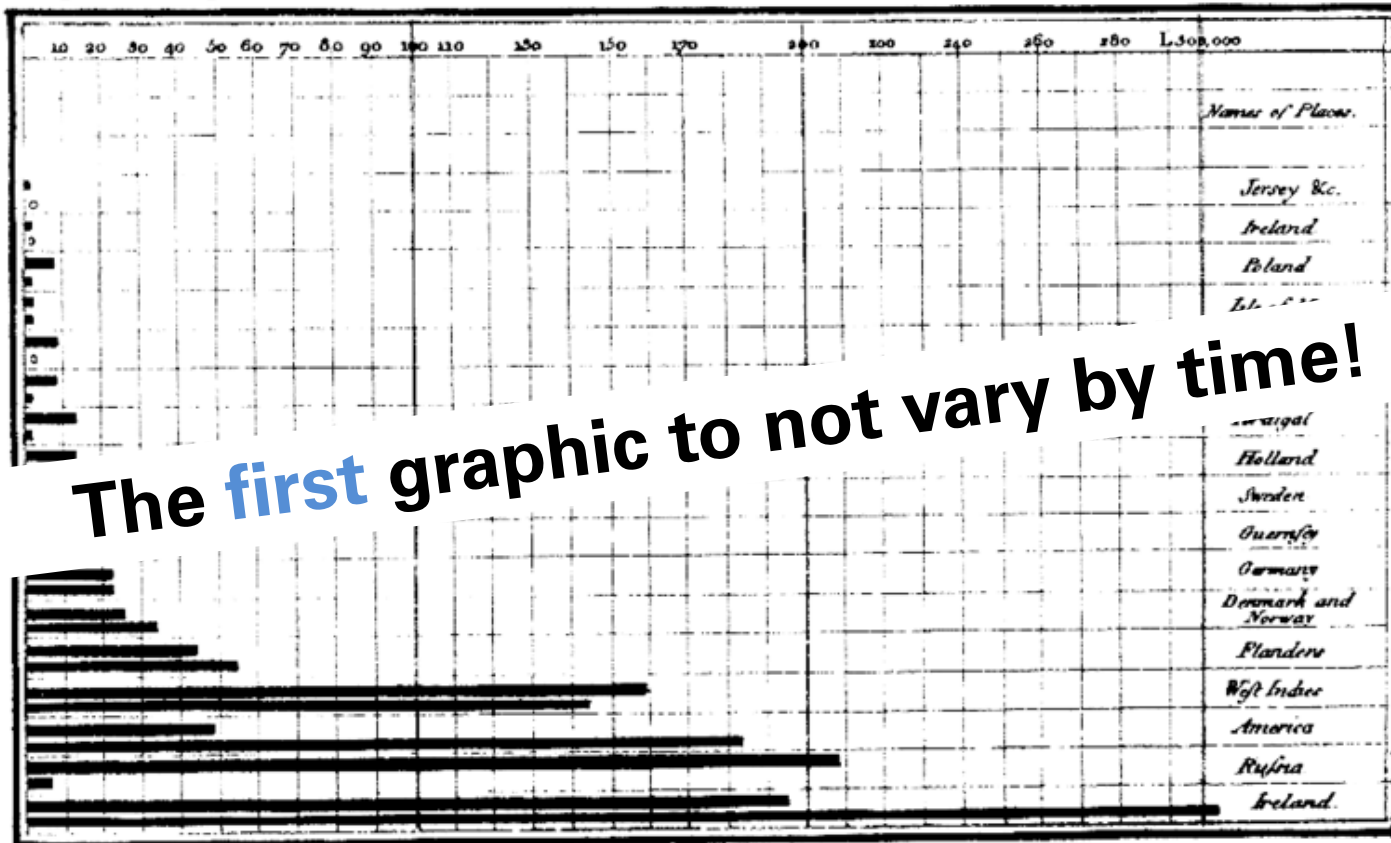
Published in the Act done June 9th 1781 by W^m Playfair

With imp^t 352 Strand, London.

Exports and Imports of Scotland to and from different parts
for one Year from Christmas 1780 to Christmas 1781
William Playfair, Commercial and Political Atlas, 1786

Information is multivariate

Exports and imports of SCOTLAND to and from different parts for one Year from Christmas 1780 to Christmas 1781.



The first graphic to not vary by time!

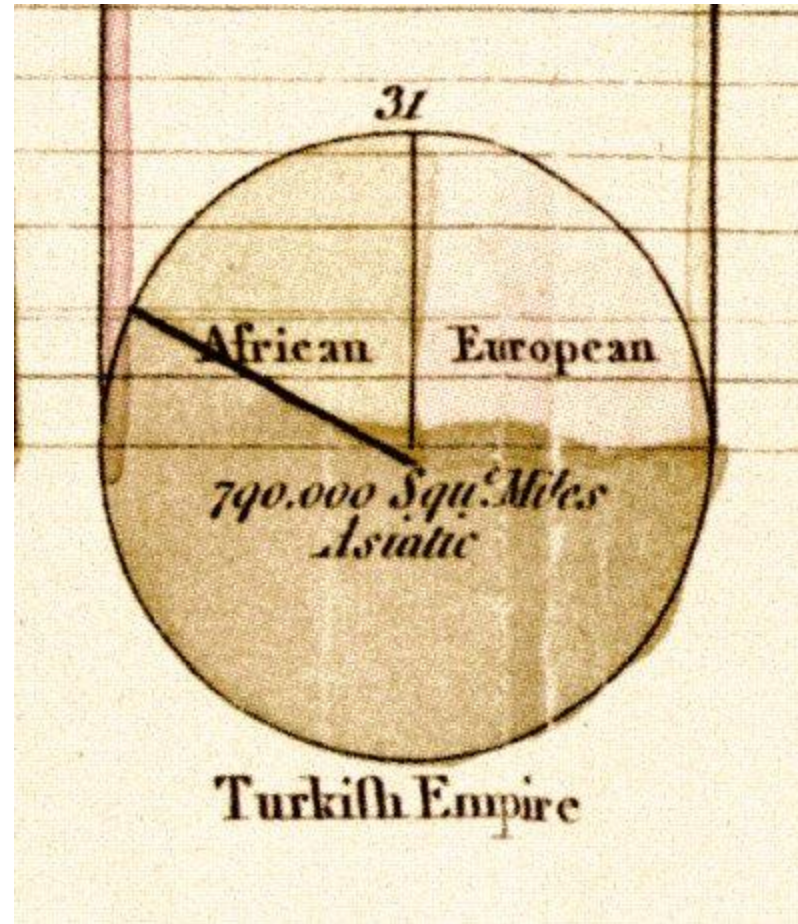
The Upright divisions are Ten Thousand Pounds each. The Black Lines are Exports the Ribbed lines Imports.

Published in the *Atlas* Volume 9th of 81 by W^m Playfair

High Street, Strand, London.

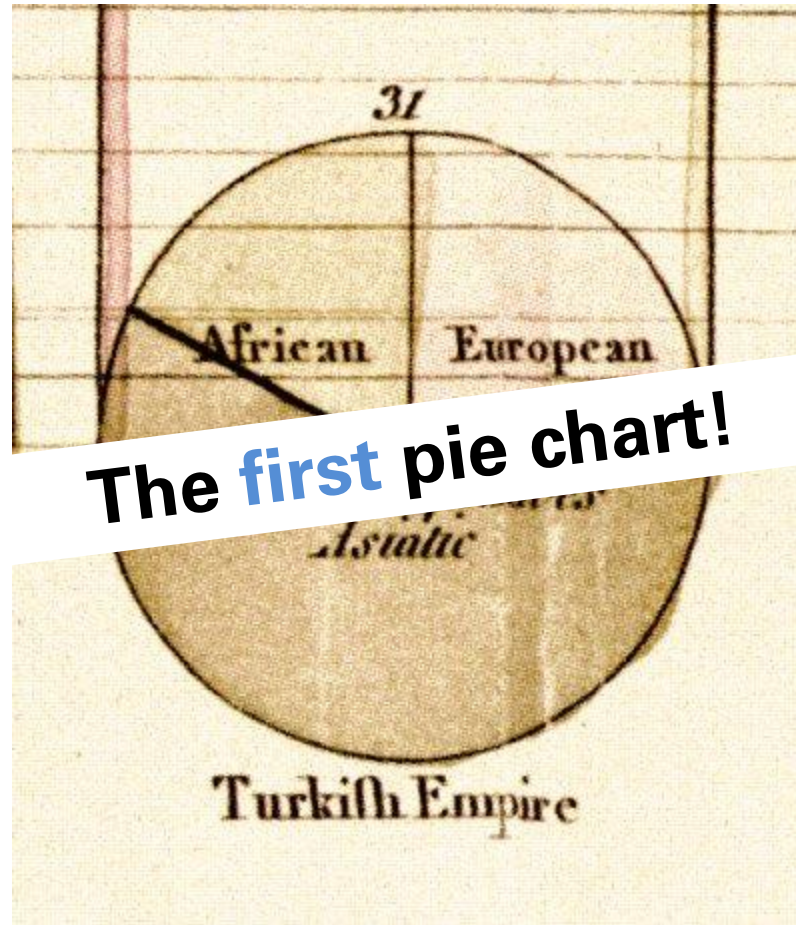
Exports and Imports of Scotland to and from different parts
for one Year from Christmas 1780 to Christmas 1781
William Playfair, Commercial and Political Atlas, 1786

Information is **multivariate**



Proportions of the Turkish Empire in 1789
William Playfair, Statistical Breviary, 1801

Information is **multivariate**



The first pie chart!

Proportions of the Turkish Empire in 1789
William Playfair, Statistical Breviary, 1801

Visualization reveals

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 Clegur, 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 Mohilew et en rejoignant vers Orscha et Witebsk, avaient toujours marché avec l'armée.

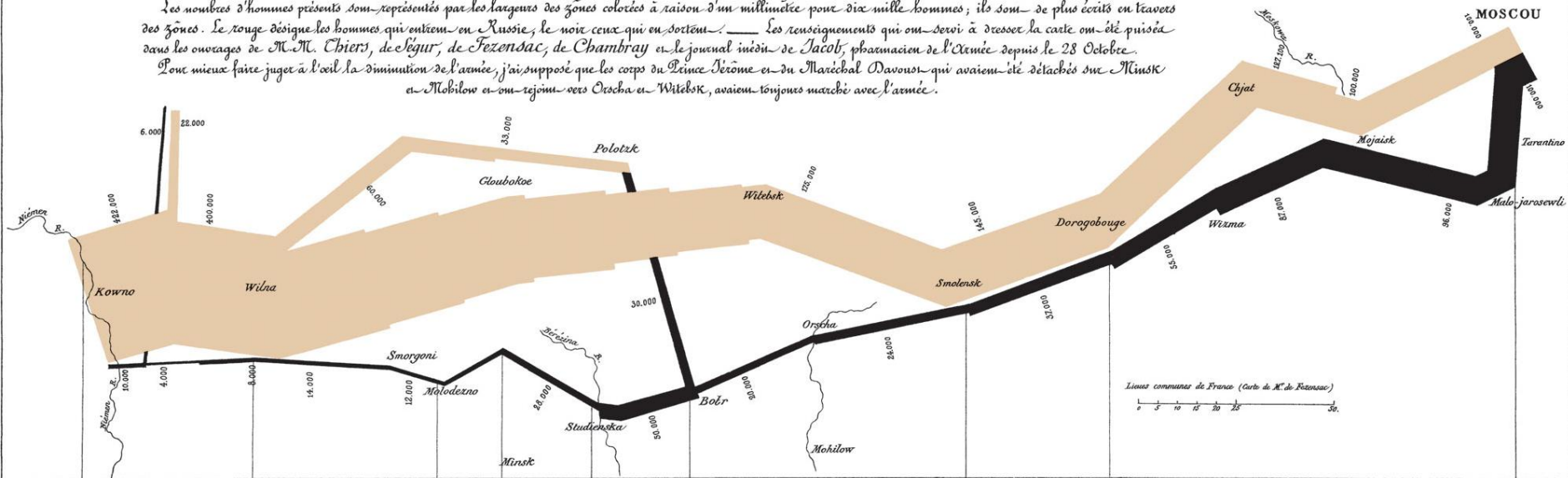
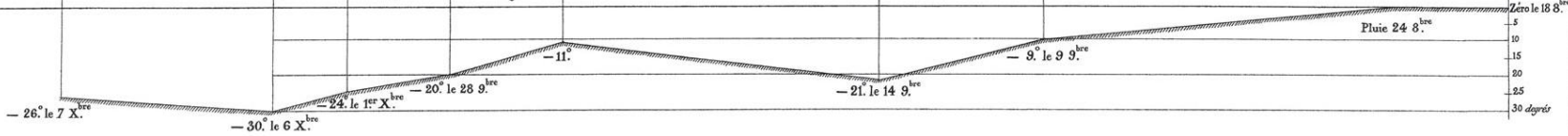
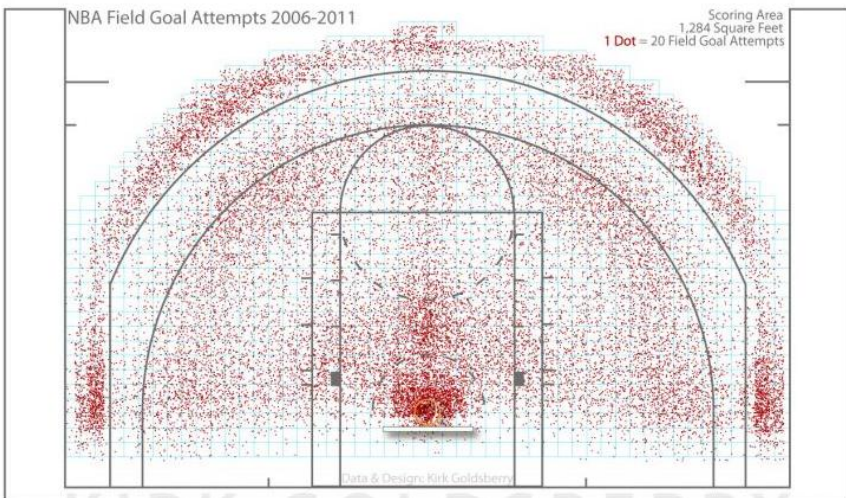


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.

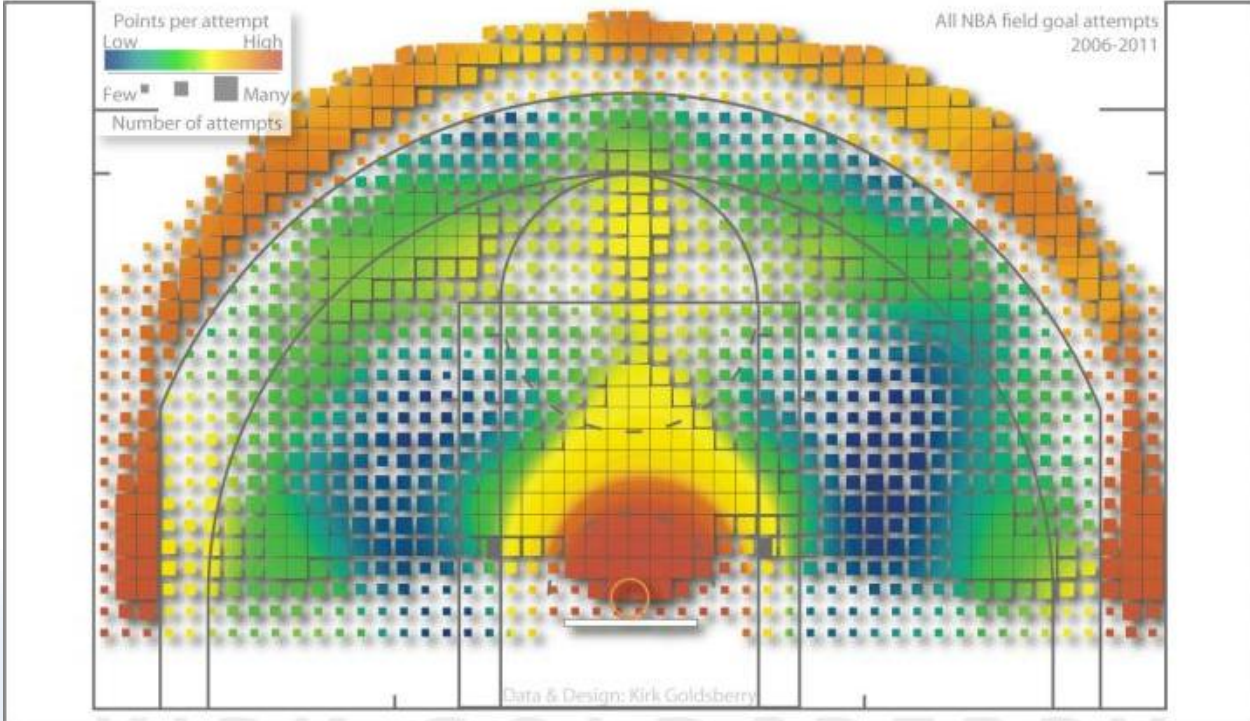


Figurative map of the successive losses of men in
The French Army in the Russian Campaign 1812 – 1813
Charles Minard, 1869

Visualization reveals

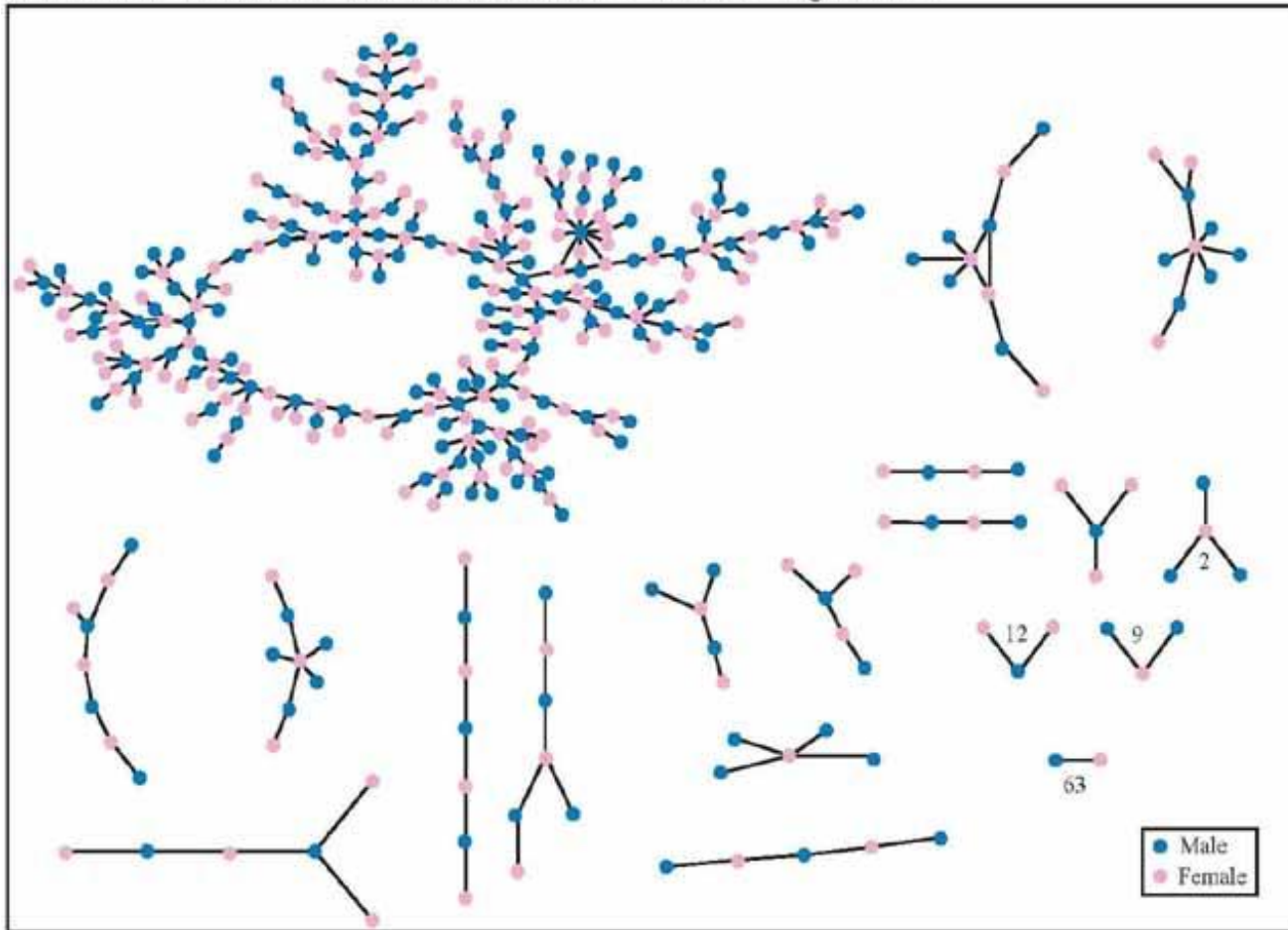


NBA Field Goal Attempts 2006-2011
Kirk Goldsberry



Visualization reveals

The Structure of Romantic and Sexual Relations at "Jefferson High School"

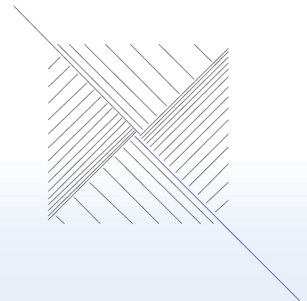


Each circle represents a student and lines connecting students represent romantic relations occurring within the 6 months preceding the interview. Numbers under the figure count the number of times that pattern was observed (i.e. we found 63 pairs unconnected to anyone else).

Chains of Affection: The Structure of Adolescent Romantic and Sexual Networks
Bearman PS, Moody J, Stovel K.

Graphical Excellence

The crossroads between “beautiful” and “informative.”



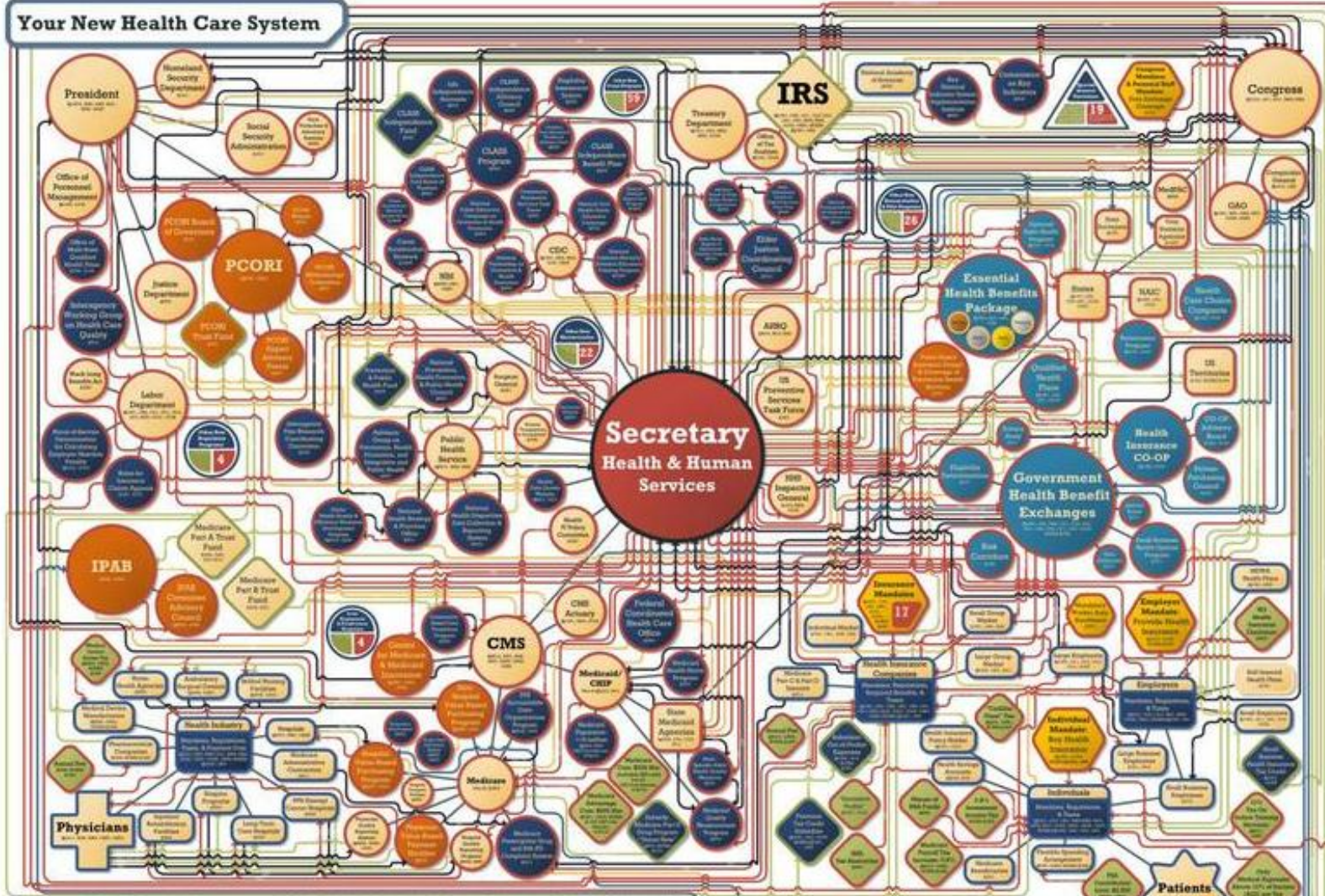
Ugly

Beautiful

Informative

Unreadable

Your New Health Care System



New Government

- Raising Potential
- Involvement in Health Insurance Market
- Other Expansions
- Represents Bundles of Additional Entities
- Mandates
- Taxes & Monetary Fees/Penalties/Cuts
- Trust Funds (Raising Potential)
- Other New Trust Funds/Monetary Benefits

Expanded Government

- Government with Expanded Authority/Responsibility
- Government Financed Entry with New Inflows/Outflows
- State/Territory with Expanded Authority/Responsibility

Private

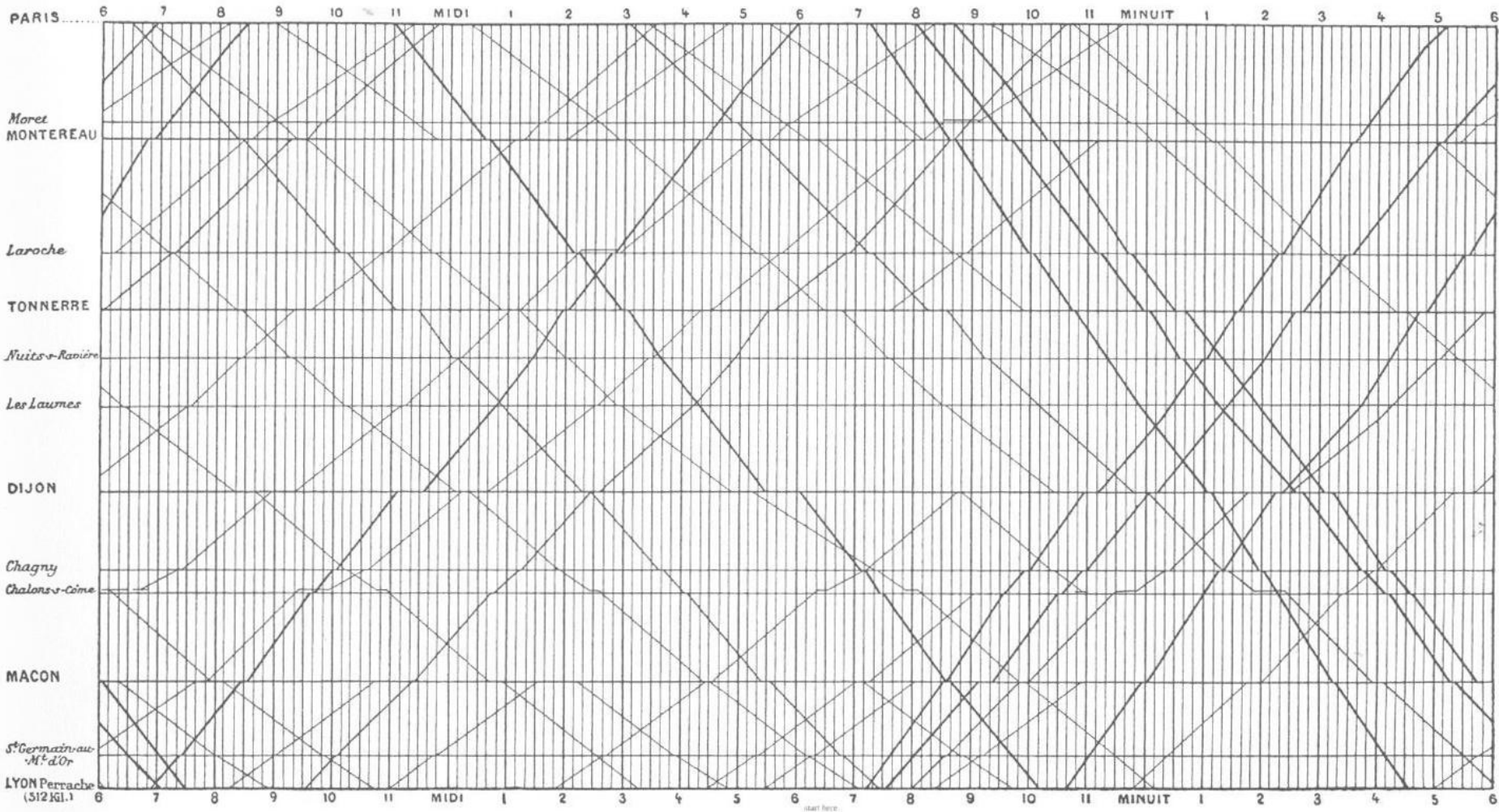
- Private Equity with New Mandates/Regulations/Responsibilities
- Exchange
- Private Entity
- Special Interest Provision

New Relationships

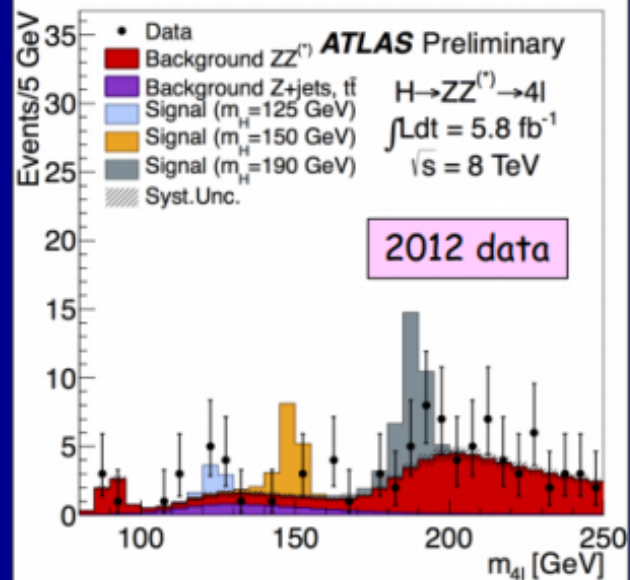
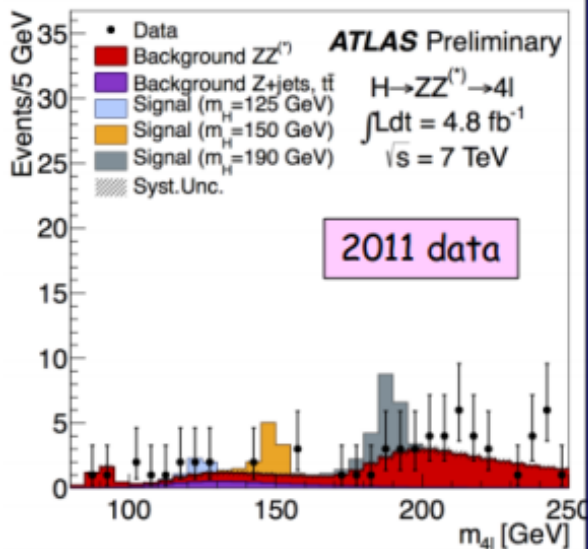
- Regulations/Requirements/Mandates
- Reporting Requirements
- Oversight
- Money Flows
- Consultation/Advisory/Safe Sharing
- Interstitial Connections (Includes Enabling)

ACA: Affordable Care Act
 HHS: Department of Health and Human Services
 IRS: Internal Revenue Service
 DOJ: Department of Justice
 ADOJ: Assistant Attorney General
 CHIP: Children's Health Insurance Program
 CMS: Centers for Medicare & Medicaid Services
 CBO: Congressional Budget Office
 GAO: Government Accountability Office
 HIE: Health Information Exchange
 ICD-9: International Classification of Diseases, 9th Revision
 ICD-10: International Classification of Diseases, 10th Revision
 Medicare: Social Security Administration
 Medicaid: Social Security Administration
 CHIP: Children's Health Insurance Program
 ACA: Affordable Care Act
 HHS: Department of Health and Human Services
 IRS: Internal Revenue Service
 DOJ: Department of Justice
 ADOJ: Assistant Attorney General
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 CMS: Centers for Medicare & Medicaid Services
 CBO: Congressional Budget Office
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 Medicaid: Social Security Administration
 CHIP: Children's Health Insurance Program

Patient Protection & Affordable Care Act, P.L. 111-148
Health Care & Education Reconciliation Act, P.L. 111-354
 Prepared by: Joint Economic Committee, Republican Staff
 Congressman Kevin Brady, Senior House Republican
 Senator Sam Brownback, Ranking Member

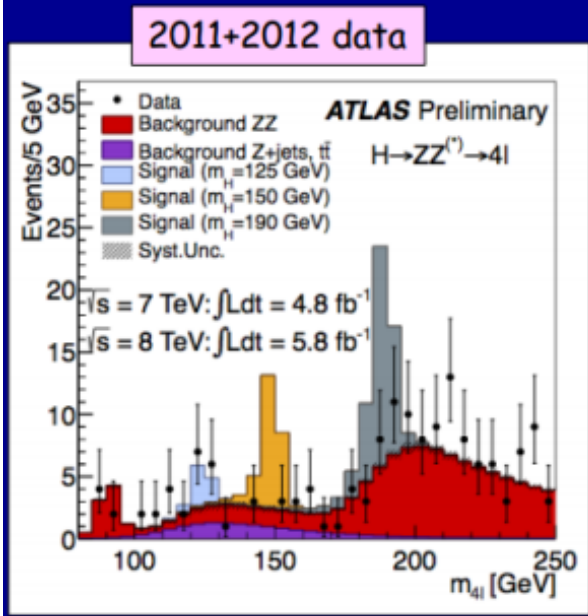






The low-mass region

$m_{4l} < 160 \text{ GeV}$:
 Observed: 39
 Expected: 34 ± 3

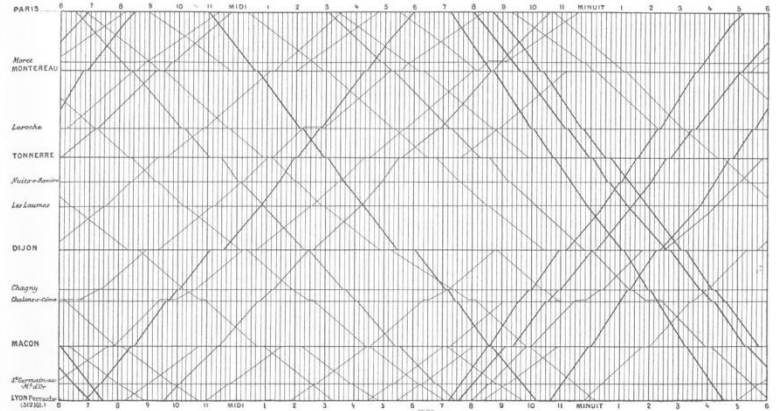
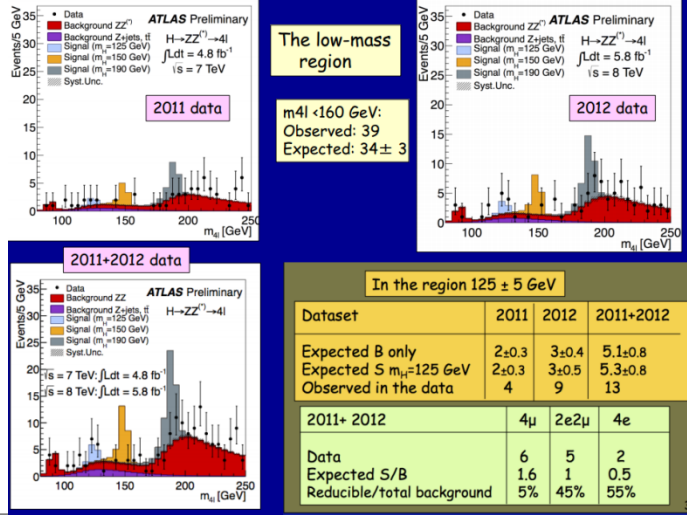


In the region $125 \pm 5 \text{ GeV}$

Dataset	2011	2012	2011+2012
Expected B only	2 ± 0.3	3 ± 0.4	5.1 ± 0.8
Expected S $m_H=125 \text{ GeV}$	2 ± 0.3	3 ± 0.5	5.3 ± 0.8
Observed in the data	4	9	13
2011+ 2012	4μ	$2e2\mu$	$4e$
Data	6	5	2
Expected S/B	1.6	1	0.5
Reducible/total background	5%	45%	55%

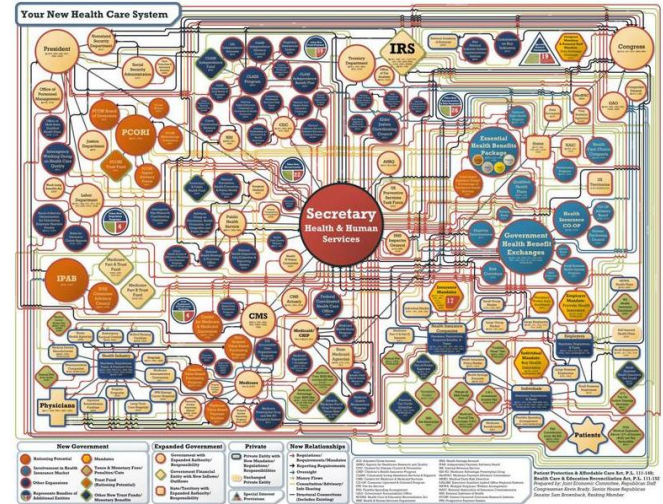
Ugly

Beautiful



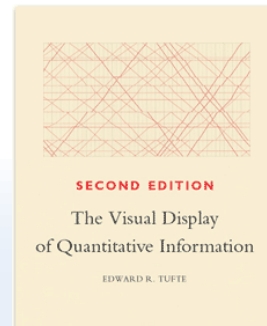
Informative

Unreadable



Graphical Excellence

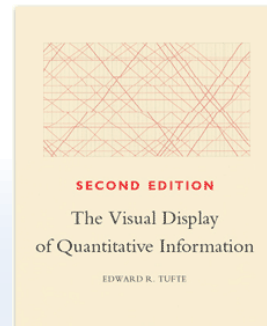
“Complex ideas communicated with clarity, precision, and efficiency.”



Graphical Excellence

“Complex ideas communicated with clarity, precision, and efficiency.”

- Show the data



Graphical Excellence

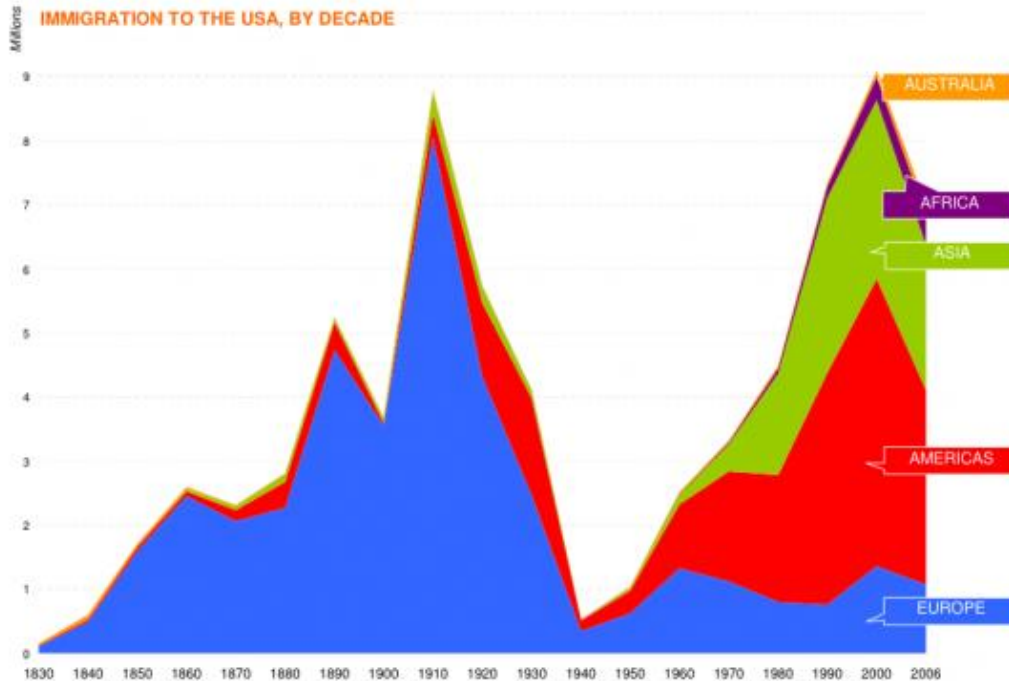
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- Show the data
- Induce the viewer to think of substance, not methodology

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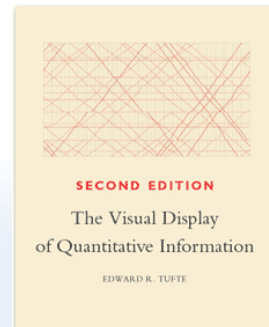
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Graphical Excellence

“Complex ideas communicated with clarity, precision, and efficiency.”

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- Avoid distorting the data



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Graphical Excellence

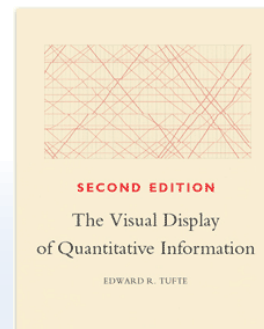
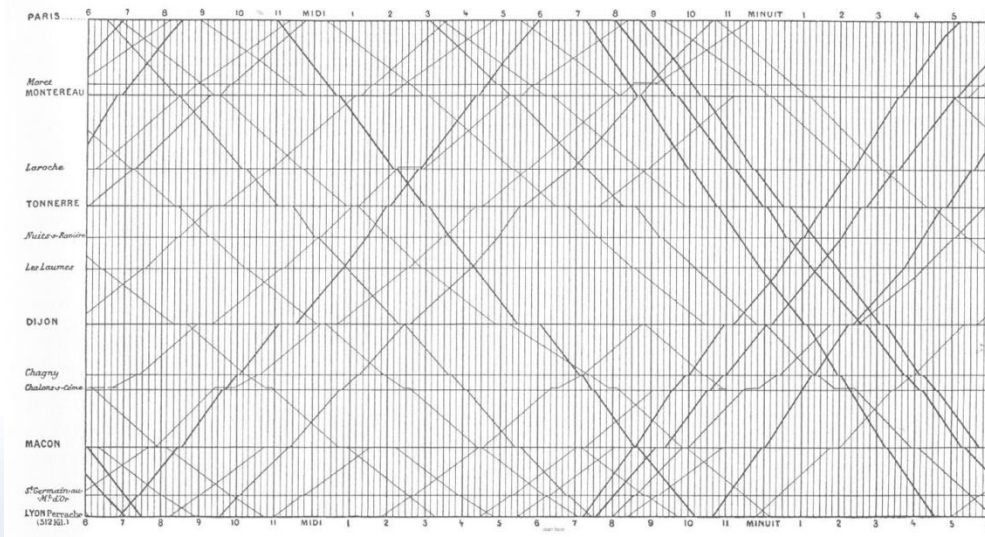
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- Avoid distorting the data
- Present many numbers in a small place
- Make large data sets coherent

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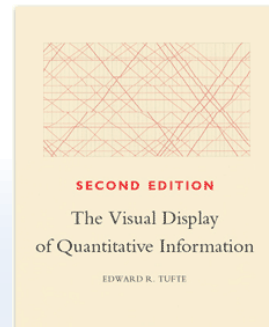
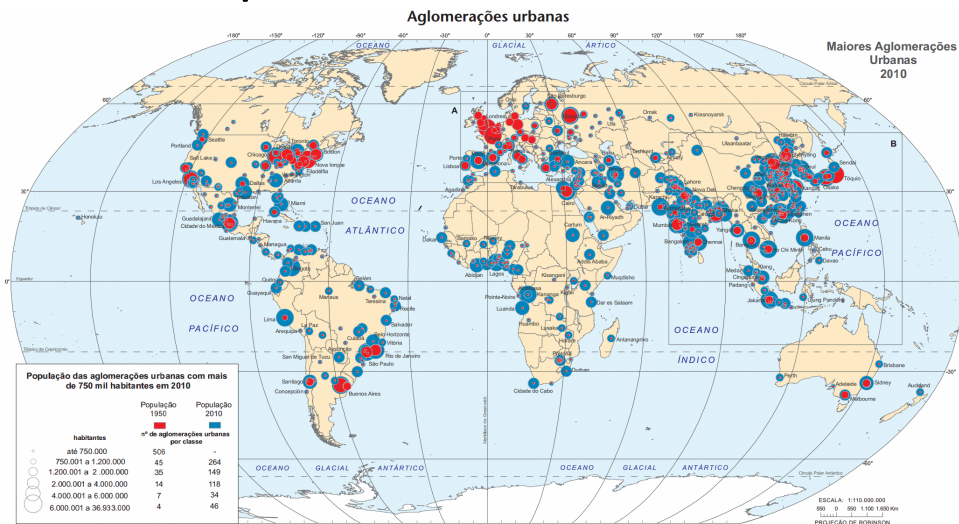
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- Encourage the eye to compare data
- Reveal the data at multiple levels of detail

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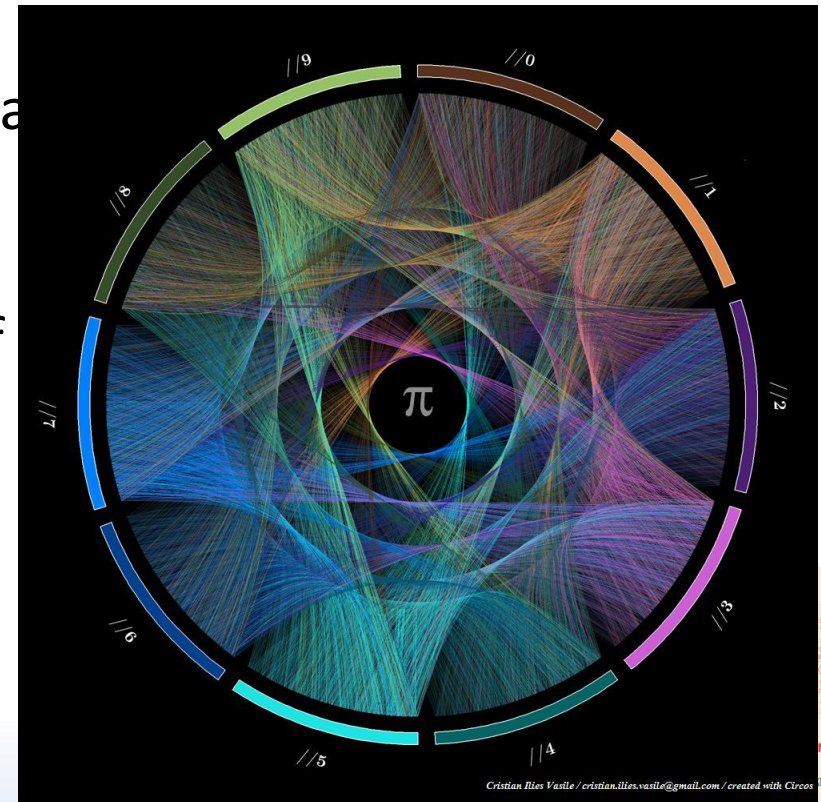
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- Serve a reasonably clear purpose

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Cristian Ilies Vasile / cristian.ilies.vasile@gmail.com / created with Circos

Journal of Quantitative Information Science

EDWARD R. TUFT

Graphical Excellence

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In 1854, the Soho district in London suffered a terrible cholera outbreak

Date	Deaths from Cholera in Soho
31 Aug 1854	[Start of outbreak cases]
2 Sept 1854	127
10 Sept 1854	500

In some parts of the city the mortality rate reached as high as 12.8%.



John Snow, 1854



John Snow, 1854

Context adds value to data.
Knowing how to apply it is key.



The Shapes of Stories by Kurt Vonnegut

Kurt Vonnegut gained worldwide fame and adoration through the publication of his novels, including *Slaughterhouse-Five*, *Cat's Cradle*, *Breakfast of Champions*, and more.

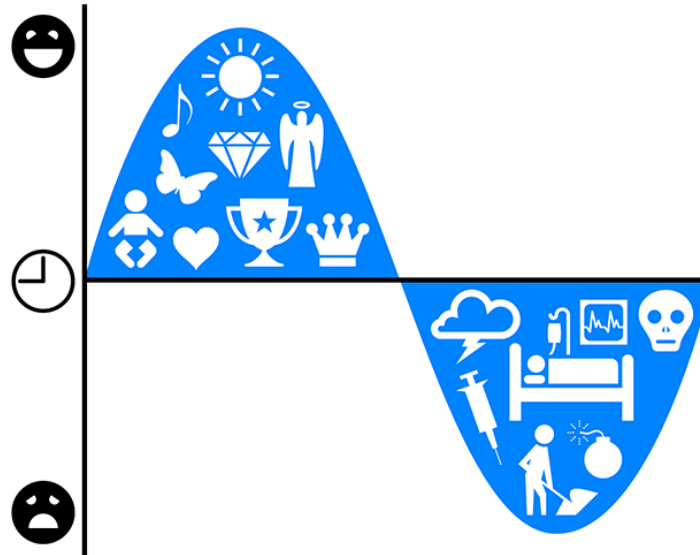
But it was his rejected master's thesis in anthropology that he called his prettiest contribution to his culture.

The basic idea of his thesis was that a story's main character has ups and downs that can be graphed to reveal the story's shape.

The shape of a society's stories, he said, is at least as interesting as the shape of its pots or spearheads. Let's have a look.

Designer: Maya Eilam, www.mayaeilam.com

Sources: *A Man without a Country* and *Palm Sunday* by Kurt Vonnegut



<http://www.youtube.com/watch?v=oP3c1h8v2ZQ>

HOMEWORK

(This is on Collab)

Search the Internet for two visualizations that you believe exemplify “Graphical Excellence.” Write a short response about what, in your Opinion, makes them excellent.