01

Course Overview

Notice

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Bibliography

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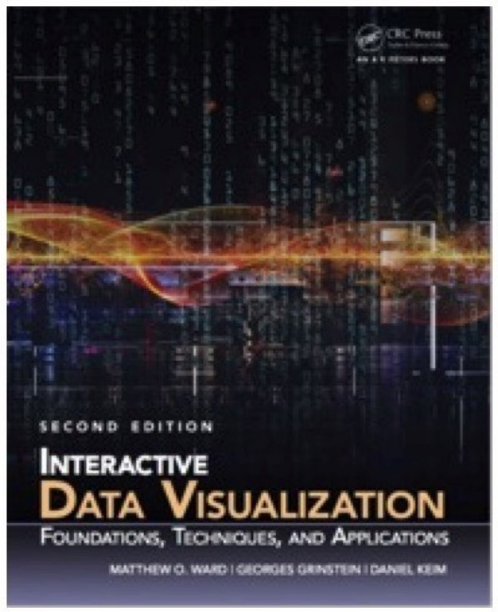

Interactive Data Visualization: Foundations, Techniques, and Applications
Matthew O. Ward, Georges Grinstein, Daniel Keim
2015, 2nd Edition
ISBN: 9781482257373
ISBN (e-Book): 9781482257397

Visualization Analysis & Design
Tamara Munzner
2015,
ISBN: 9781466508910
ISBN (e-Book): 9781498707763

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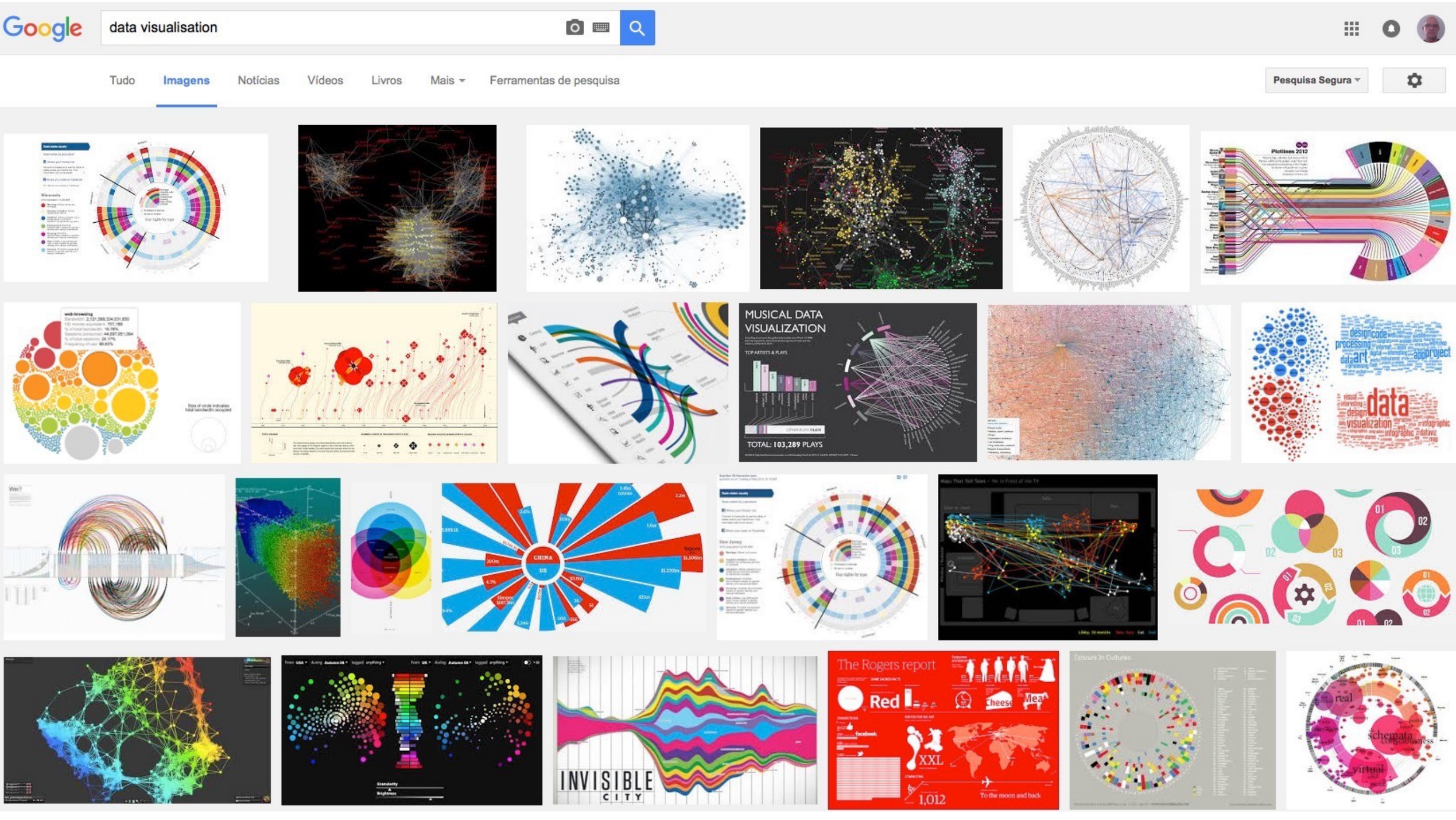

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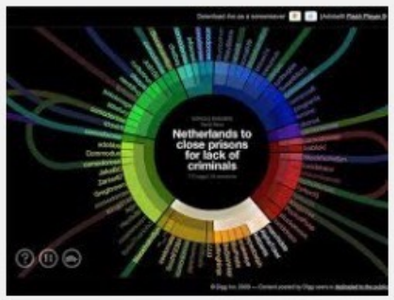

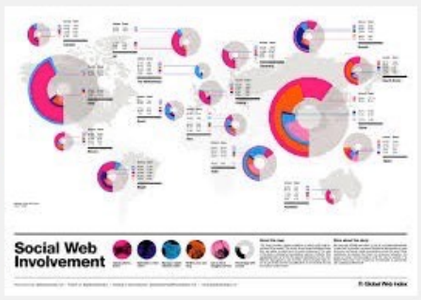

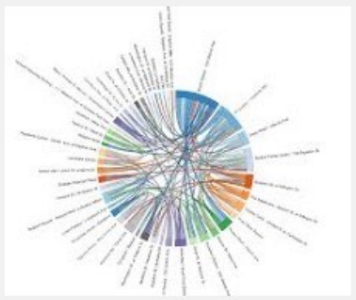



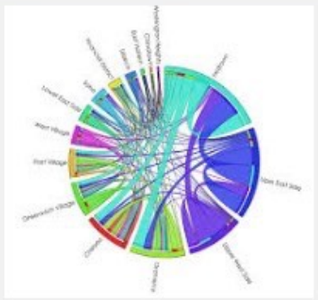


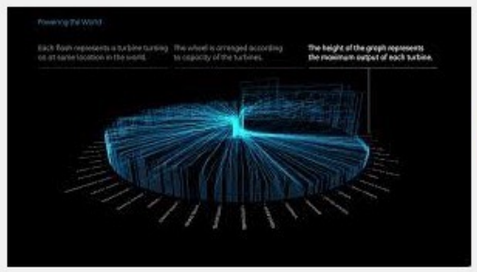


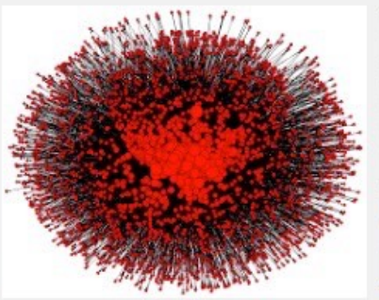
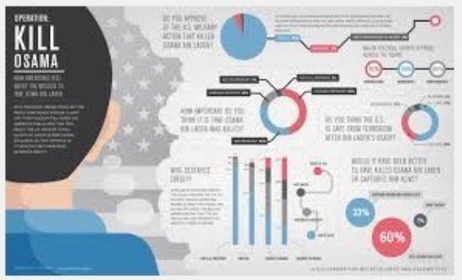

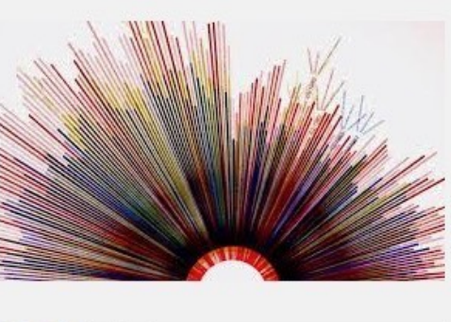
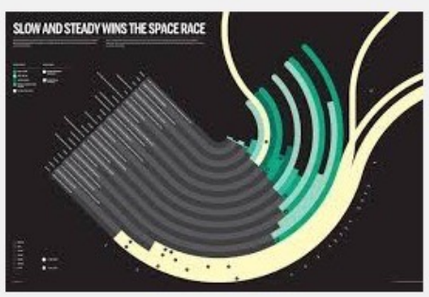

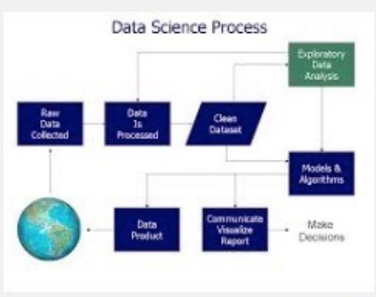


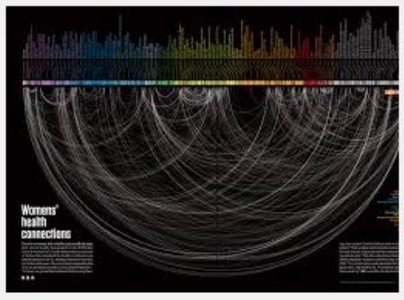

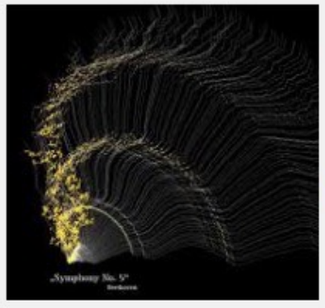
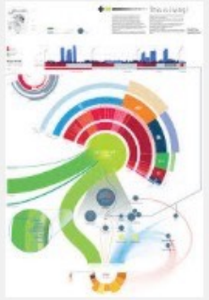
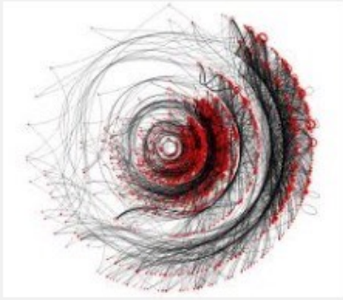
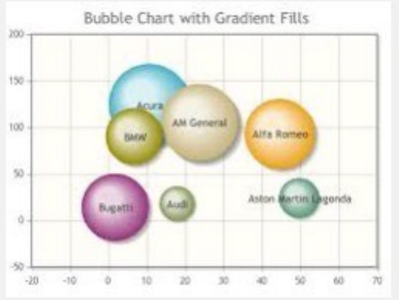

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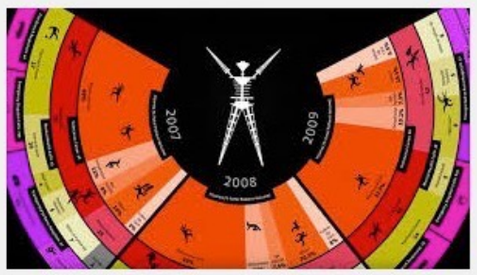


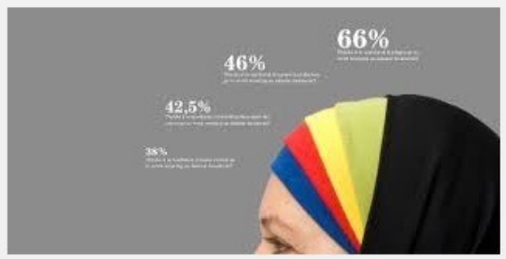

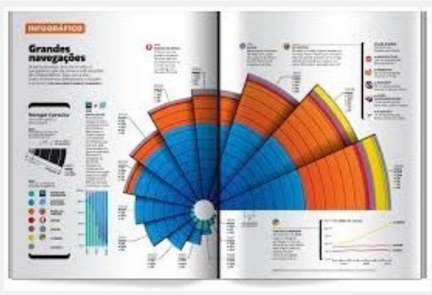

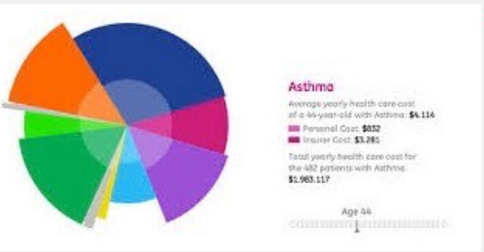

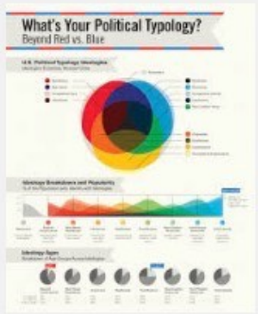

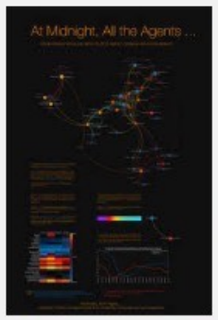

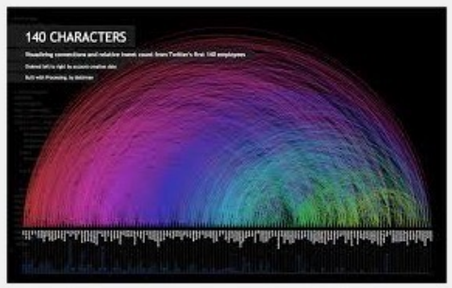

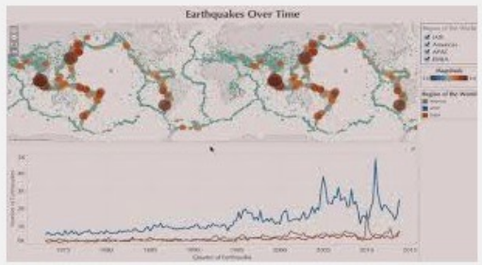


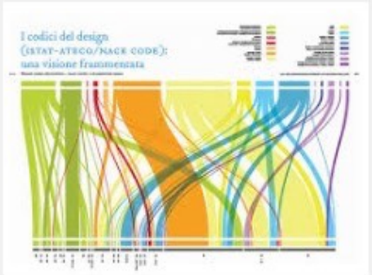

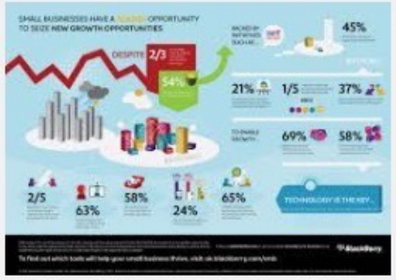

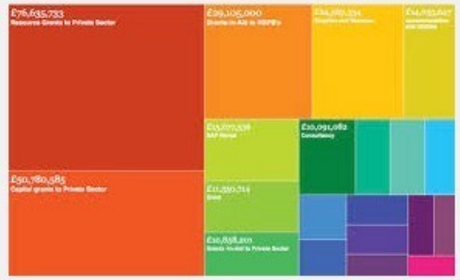
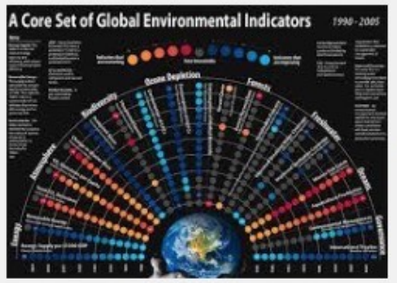

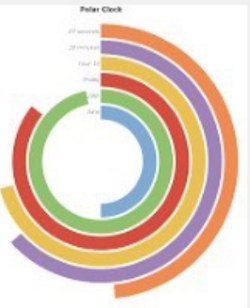

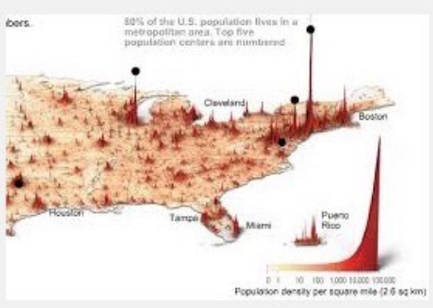


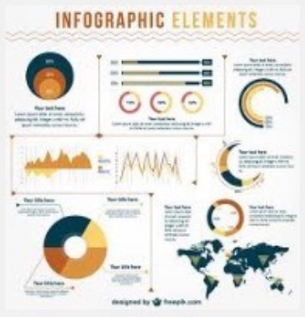

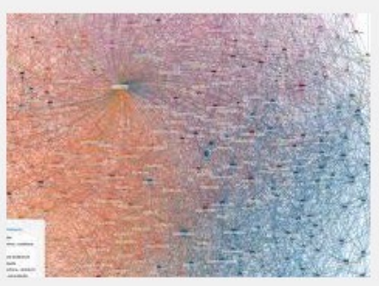


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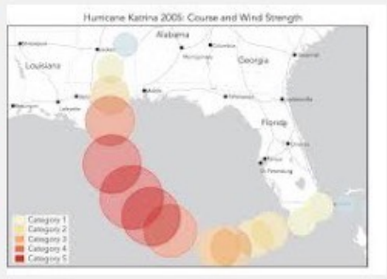


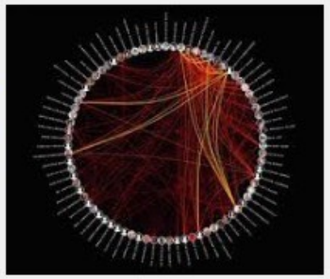
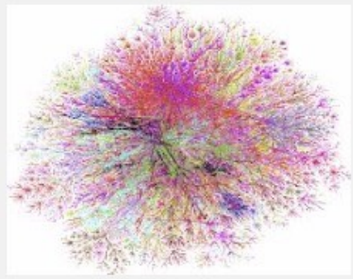
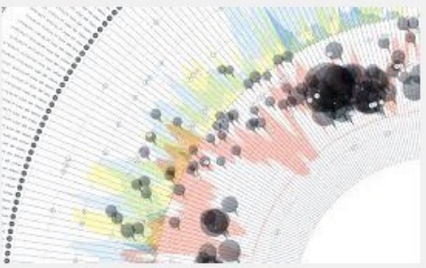
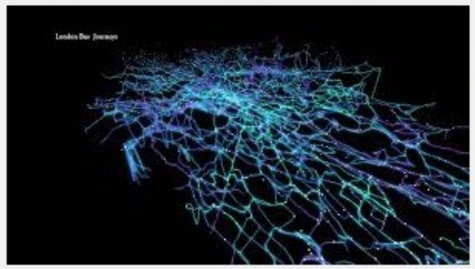

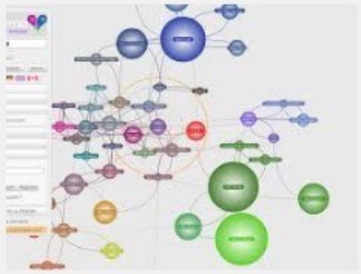
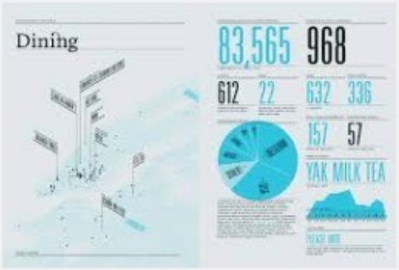

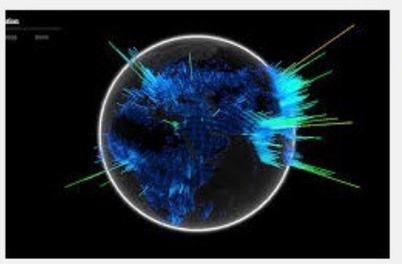




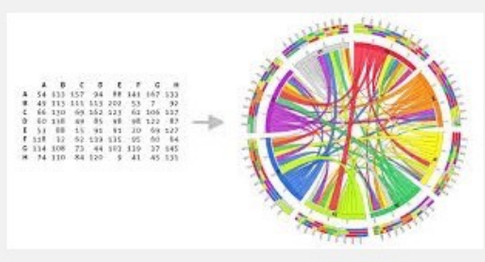
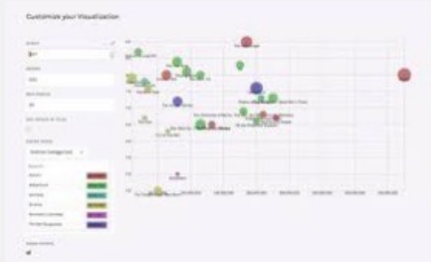
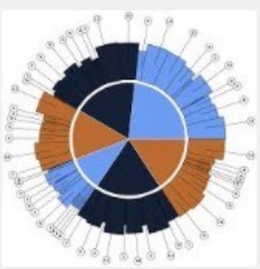
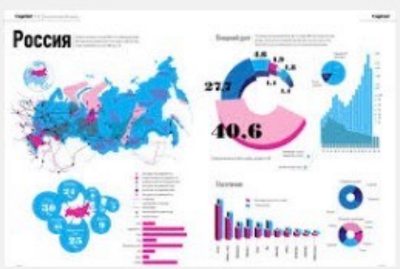

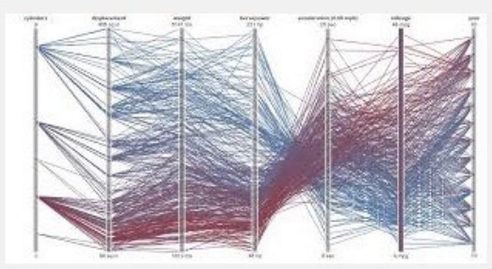

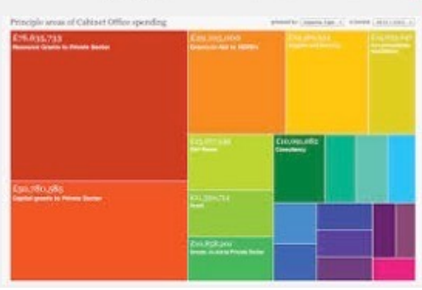


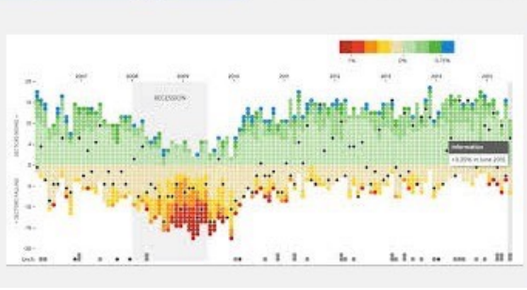

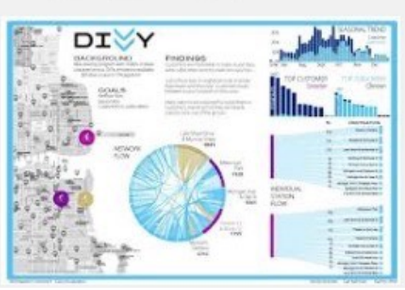


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  - **Human perceptual system makes parallel processing of pictures**
- **A picture can be independent of local language**

Visualization in everyday life

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- **How many different ways are there to show the same data? Which ones are best for particular circumstances?**
- **Why should we study visualization?**

What is the Goal of Data Visualization?

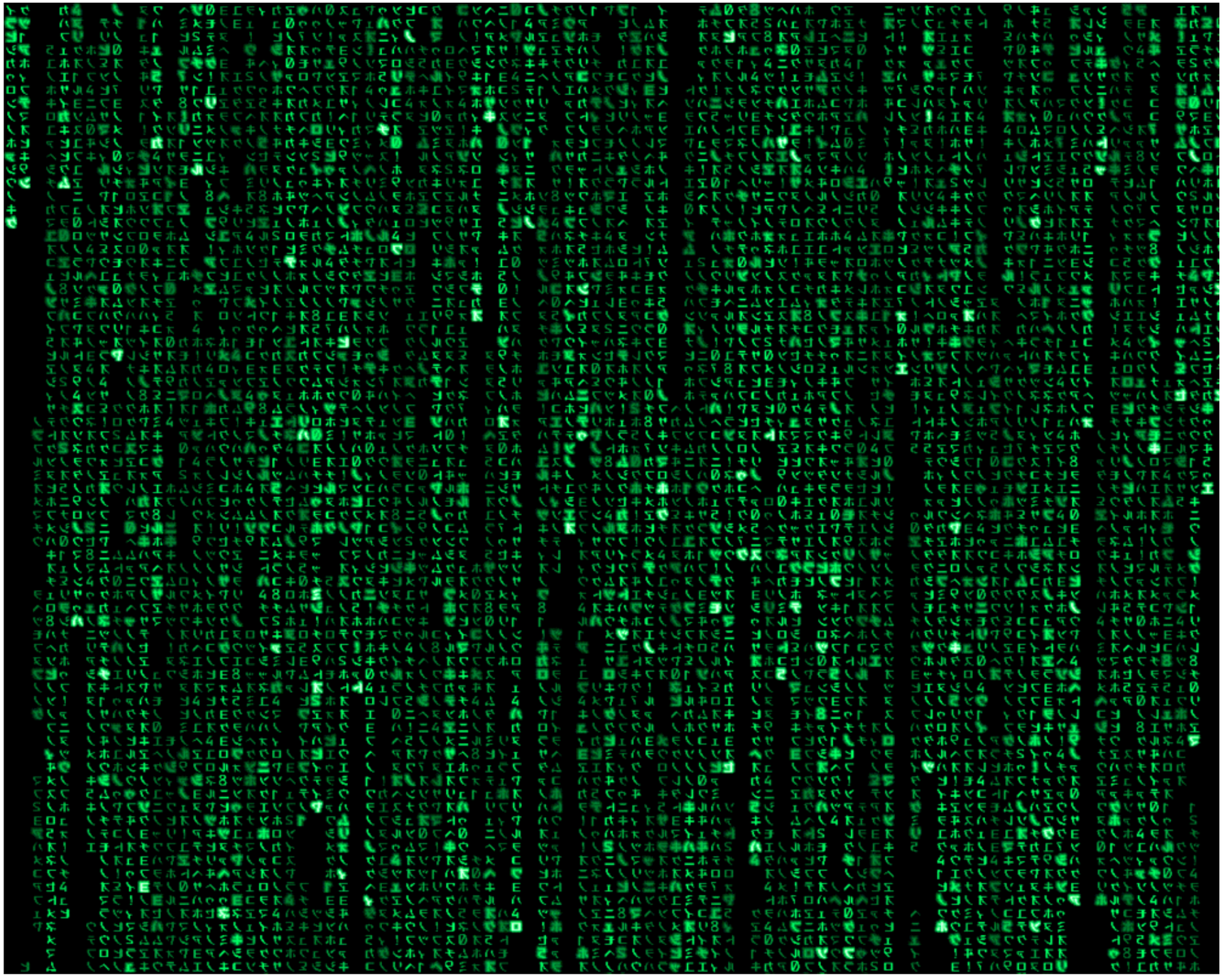
“Data visualization is not just about seeing data !

Is about UNDERSTANDING data,

and being able to make decisions based on the data”

by John C. Hart

What is the Goal of Data Visualization?



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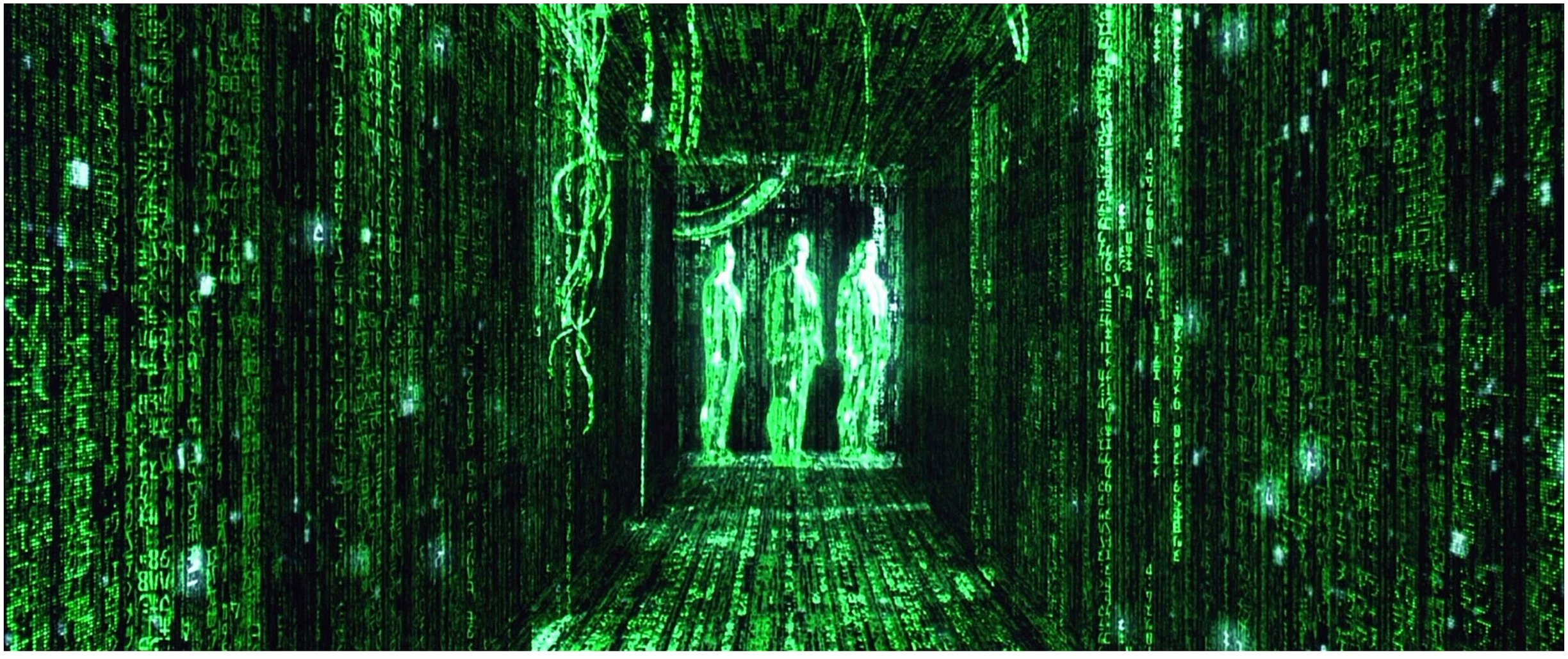

Landmarks of (Data) Visualization

Landmarks in Visualization

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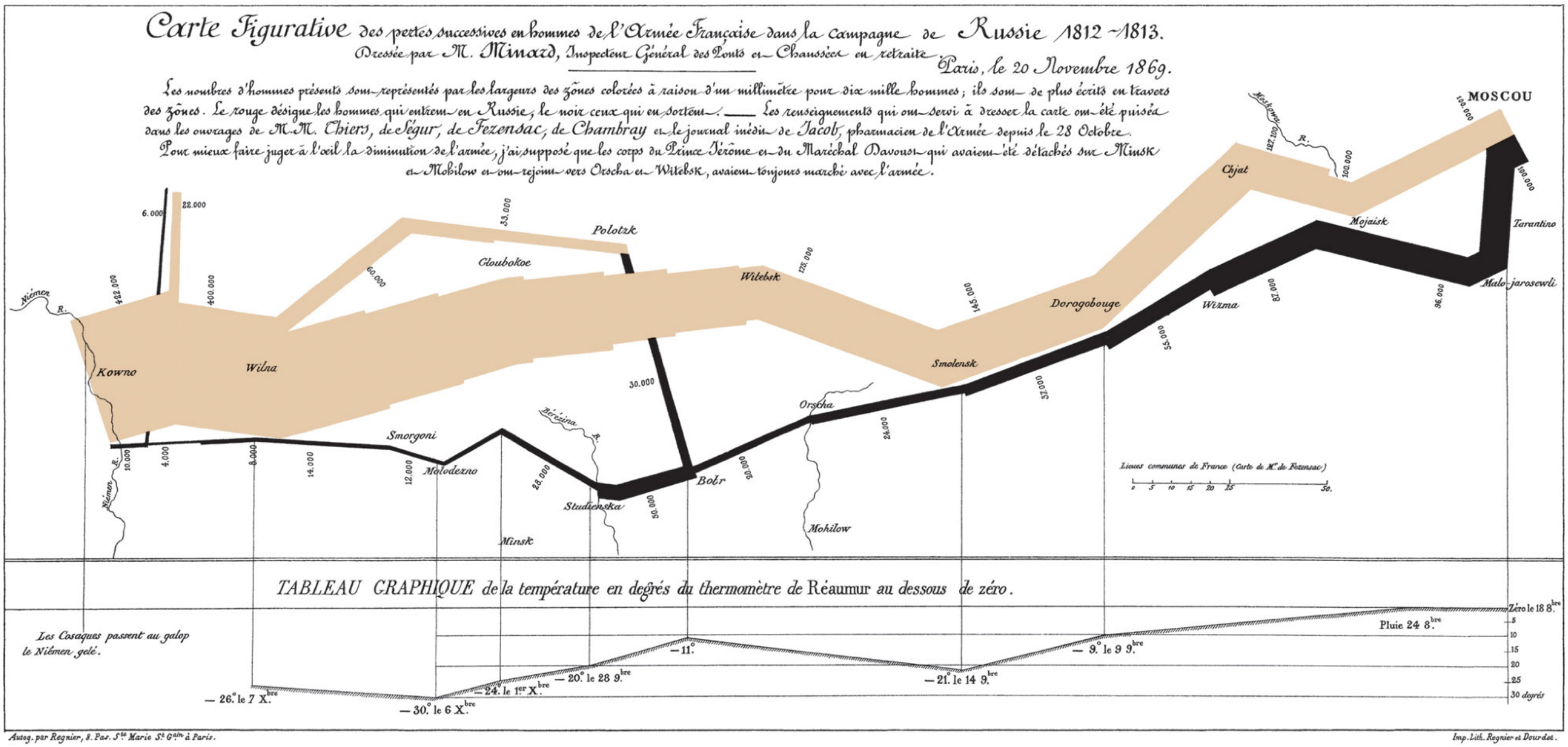

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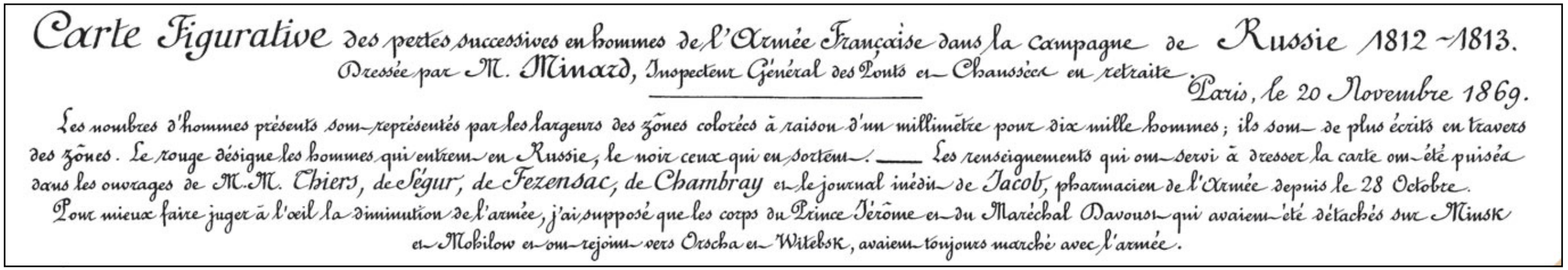

Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.
Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.
Paris, le 20 Novembre 1869.
Les nombres d'hommes présents sont représentés par les largeurs des zônes colorées à raison d'un millimètre pour dix mille hommes ; ils sont de plus écrits en travers des zônes. 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. Thiers, 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'oeil 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 Mobilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

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

- **Le nombre d'hommes présents sont représentés par les largeurs des zones colorés à raison d'un millimètre pour dix mille hommes au travers des zones.**
- **Le "rouge" désignent des hommes qui entrem en Russie, le noir ceux qui en sorte**

- **Les renseignements qui on servit ….. [References]**

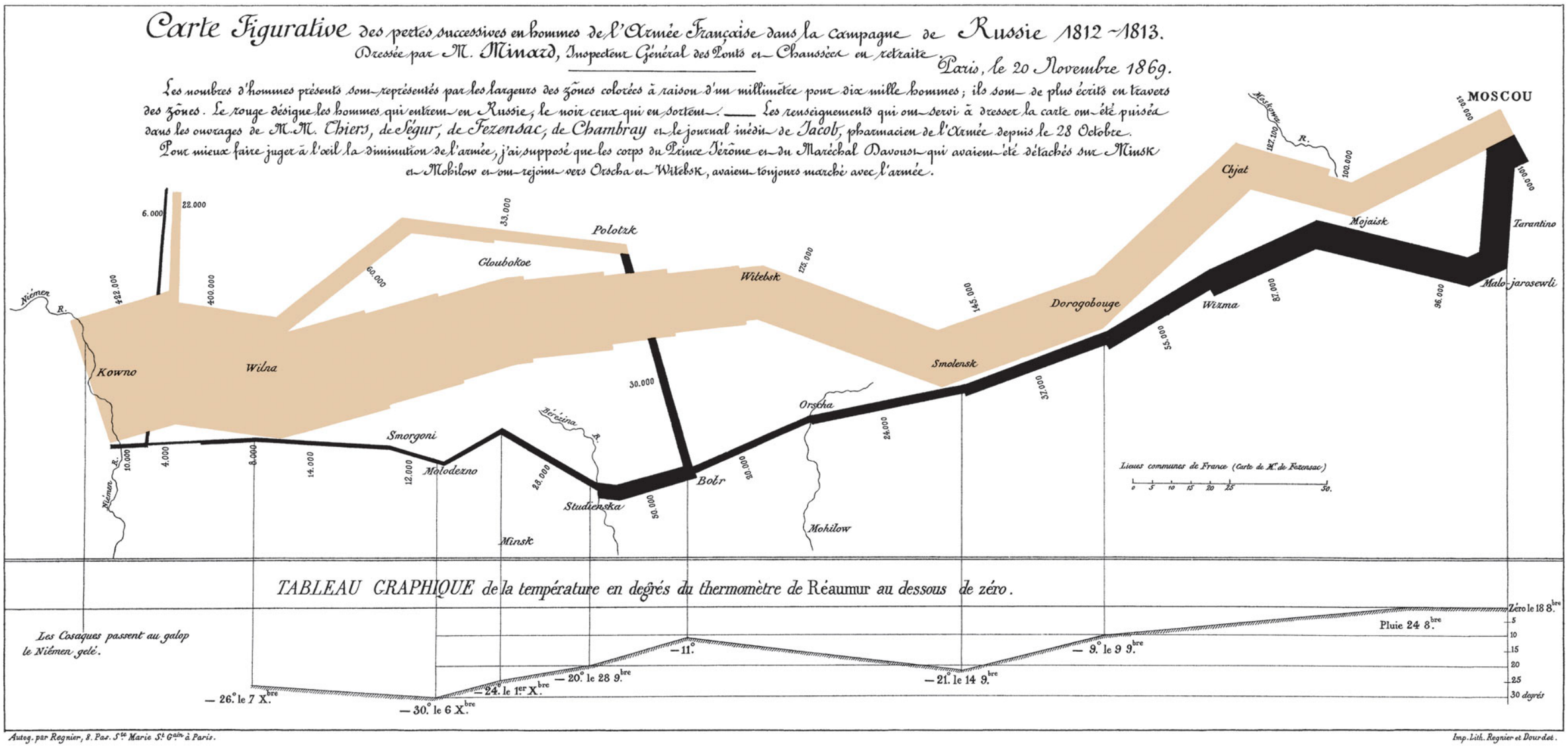
Estónia
Letónia
Lituânia
Bielorrússia
Narva
Gatchina
Гатчина
Cherepovets
Череповец
Veliky
Novgorod
Великий
Новгород
Saaremaa
Pärnu
Tartu
Pskov
Псков
Rybinsk
Рыбинск
Cēsis
Riga
Jūrmala
Tver
Тверь
Moscovo
Москва
Podolsk
Подольск
Vitebsk
Віцебск
Smolensk
Смоленск
Kaunas
Vilnius
Minsk
Мінск
Mahilyow
Магілёў
Labkovičy
Лабковічы
Tula
Тула
Briansk
Брянск
Oriol
Орёл
Białystok
Gomel
Гомель
Kursk
Курск
Voronej
Воронеж
Chernigov
Чернігів
Staryy Oskol
Старый Оскол
Lublin
Sumy

December

October

Landmarks in Visualization

- **Charles Minard's map of Napoleon's disastrous Russian campaign of 1812.**



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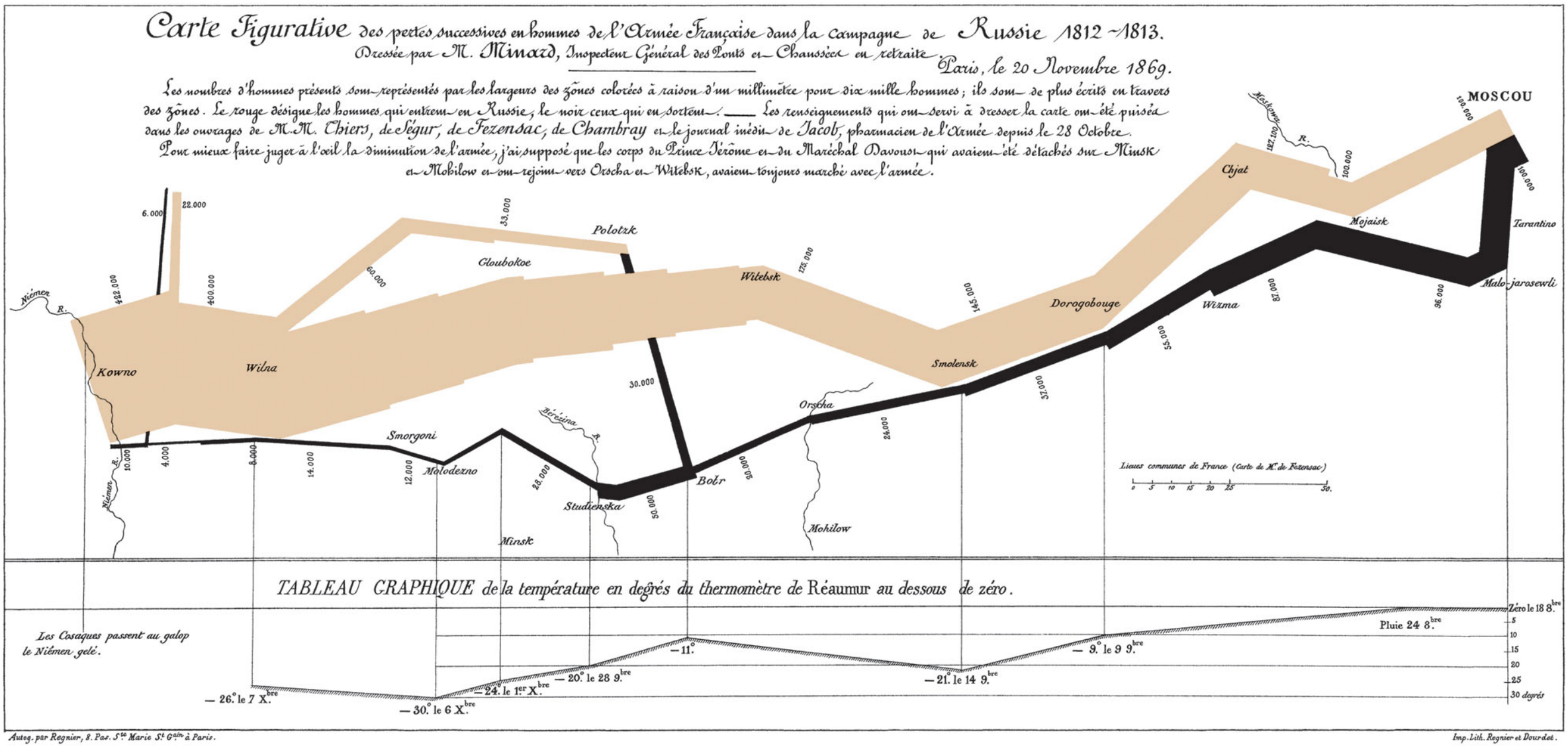

Six different sets of data: **geography**, the army's **course**, the army's **direction**; the **number of soldiers** remaining; **temperature**; **time**.

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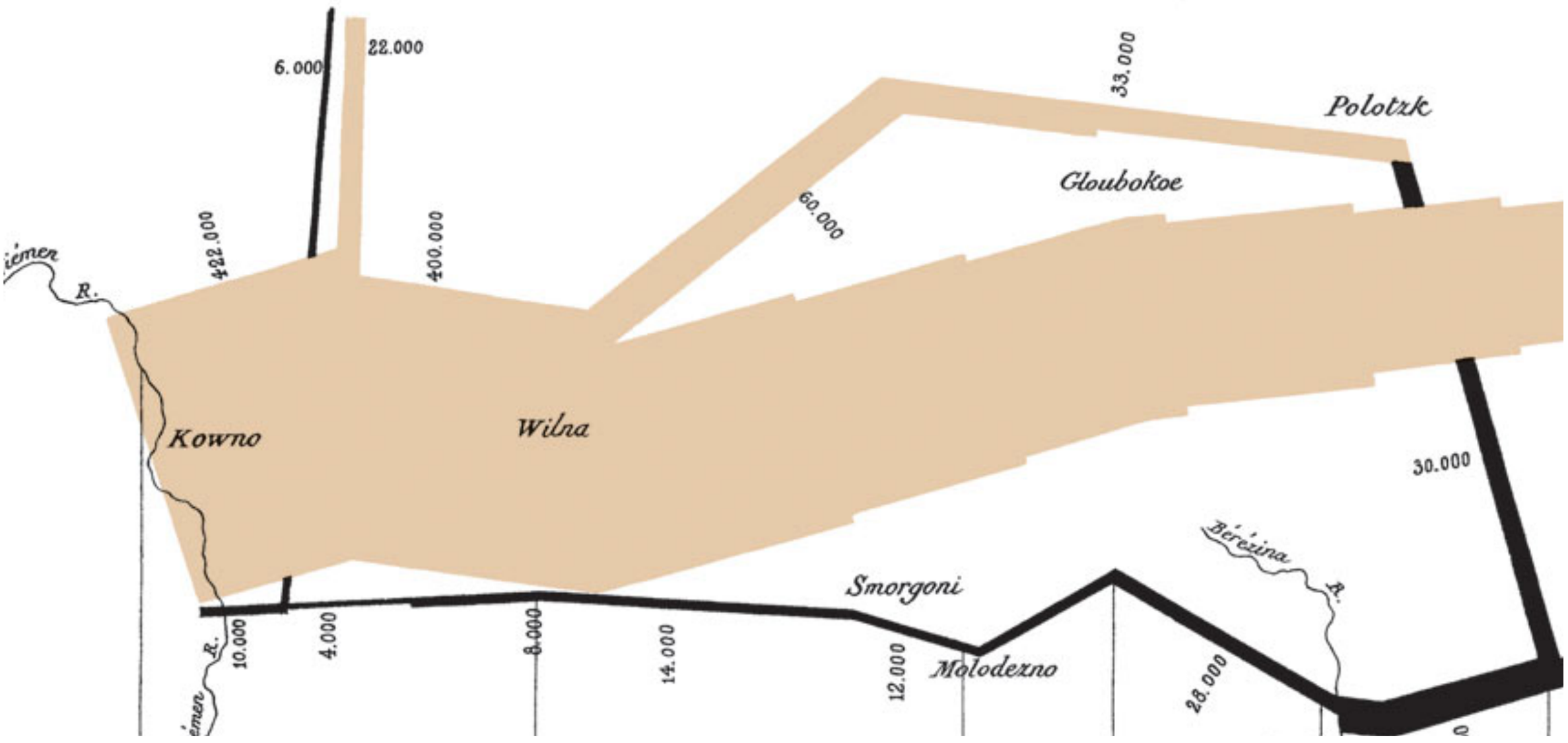

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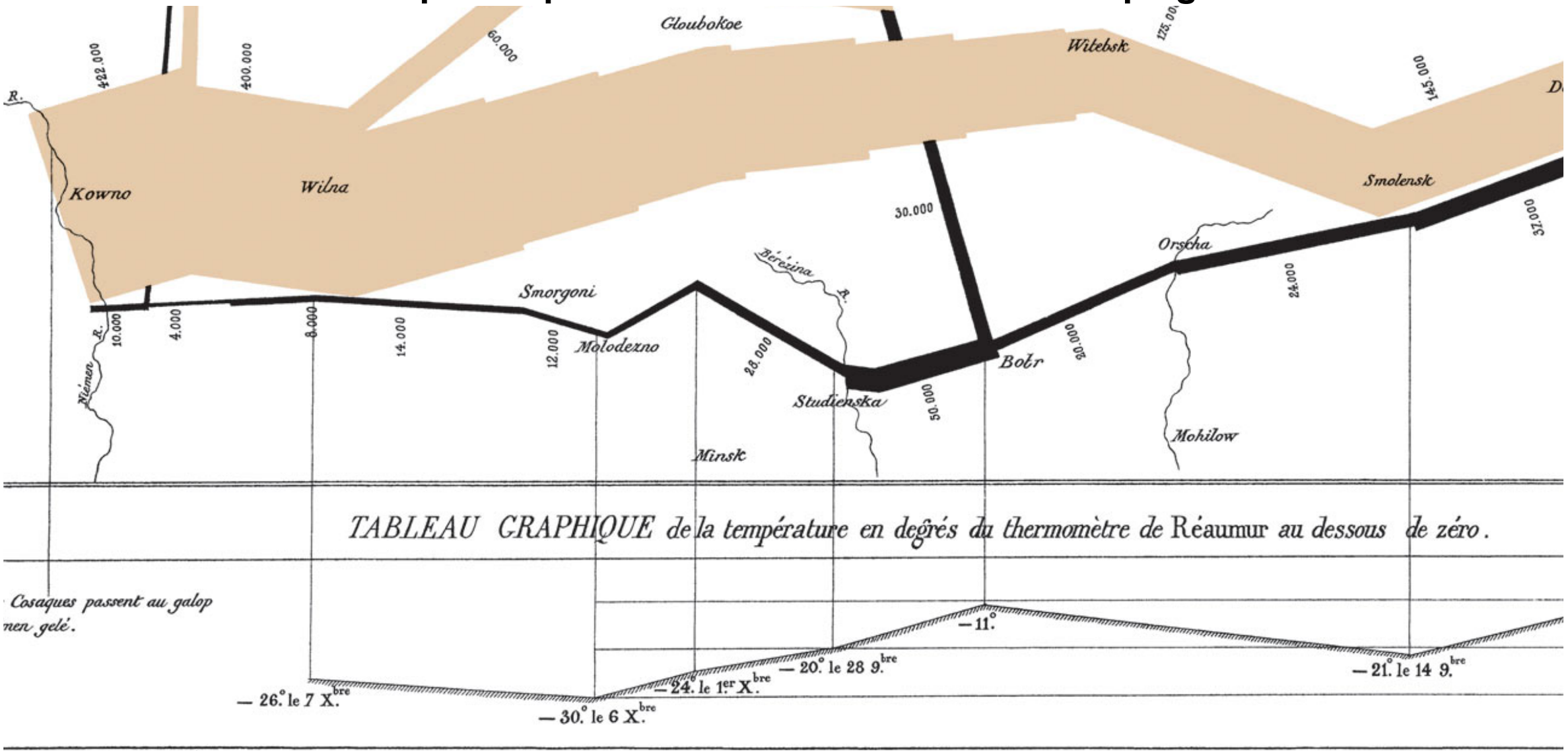

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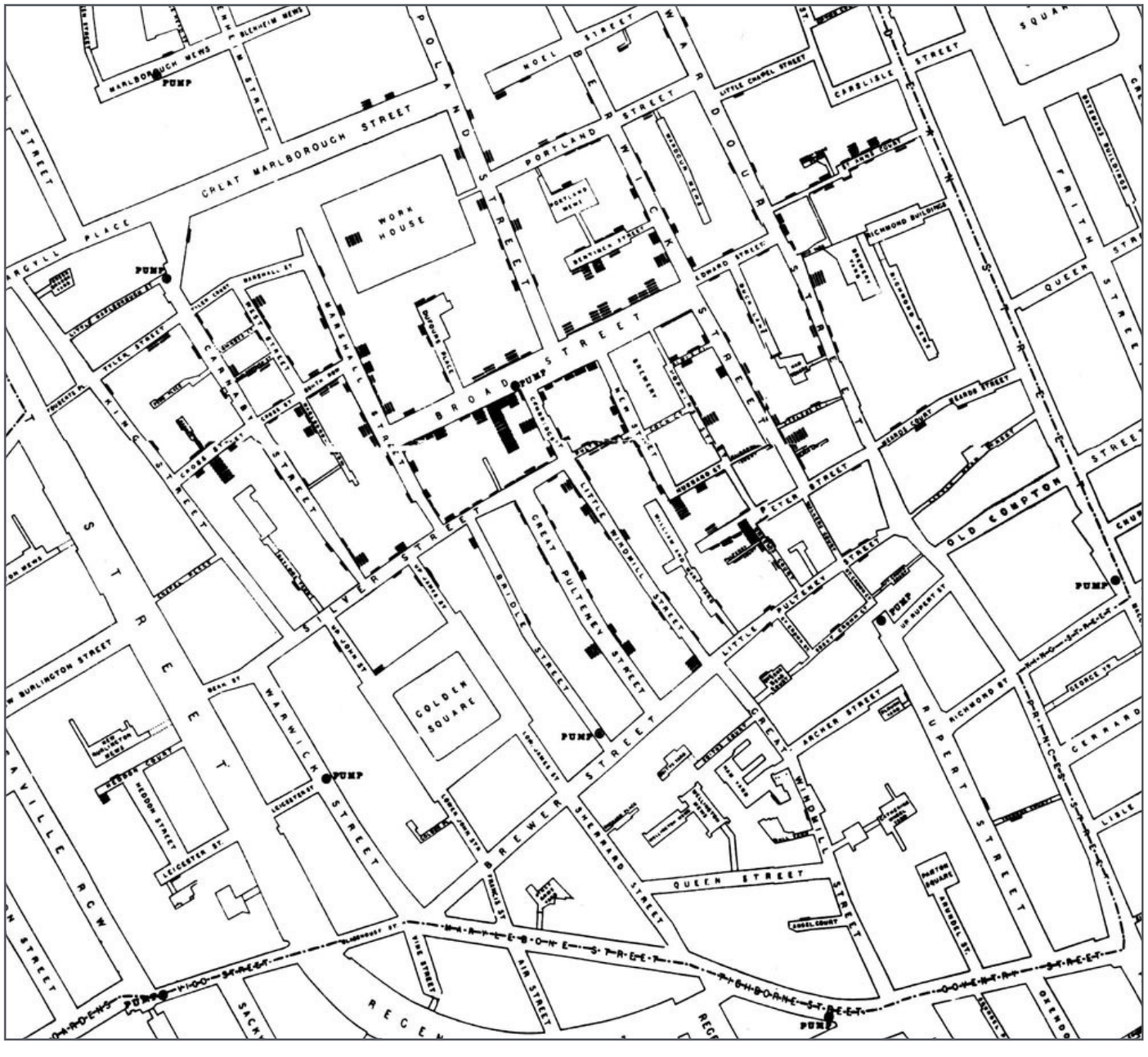

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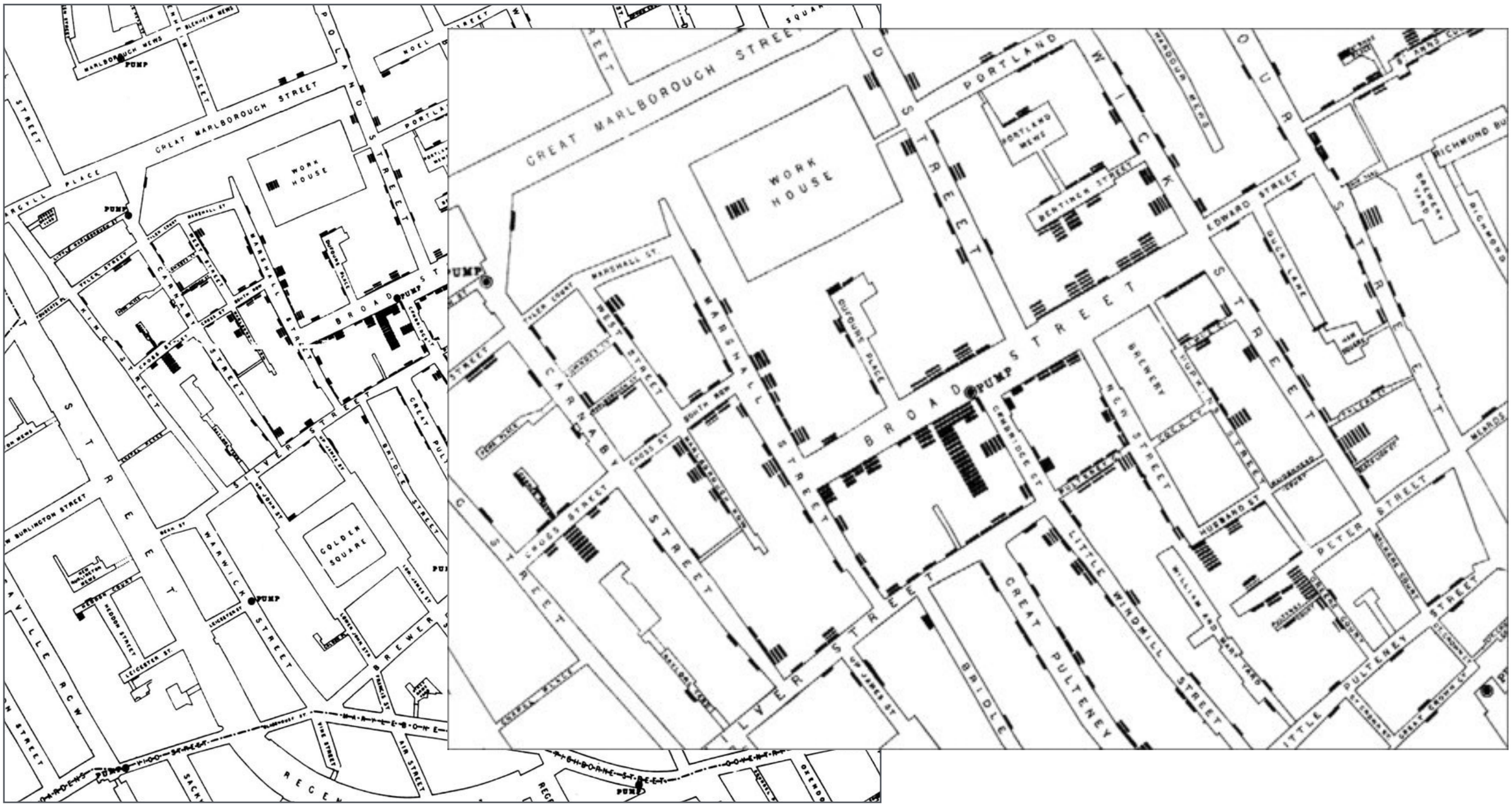

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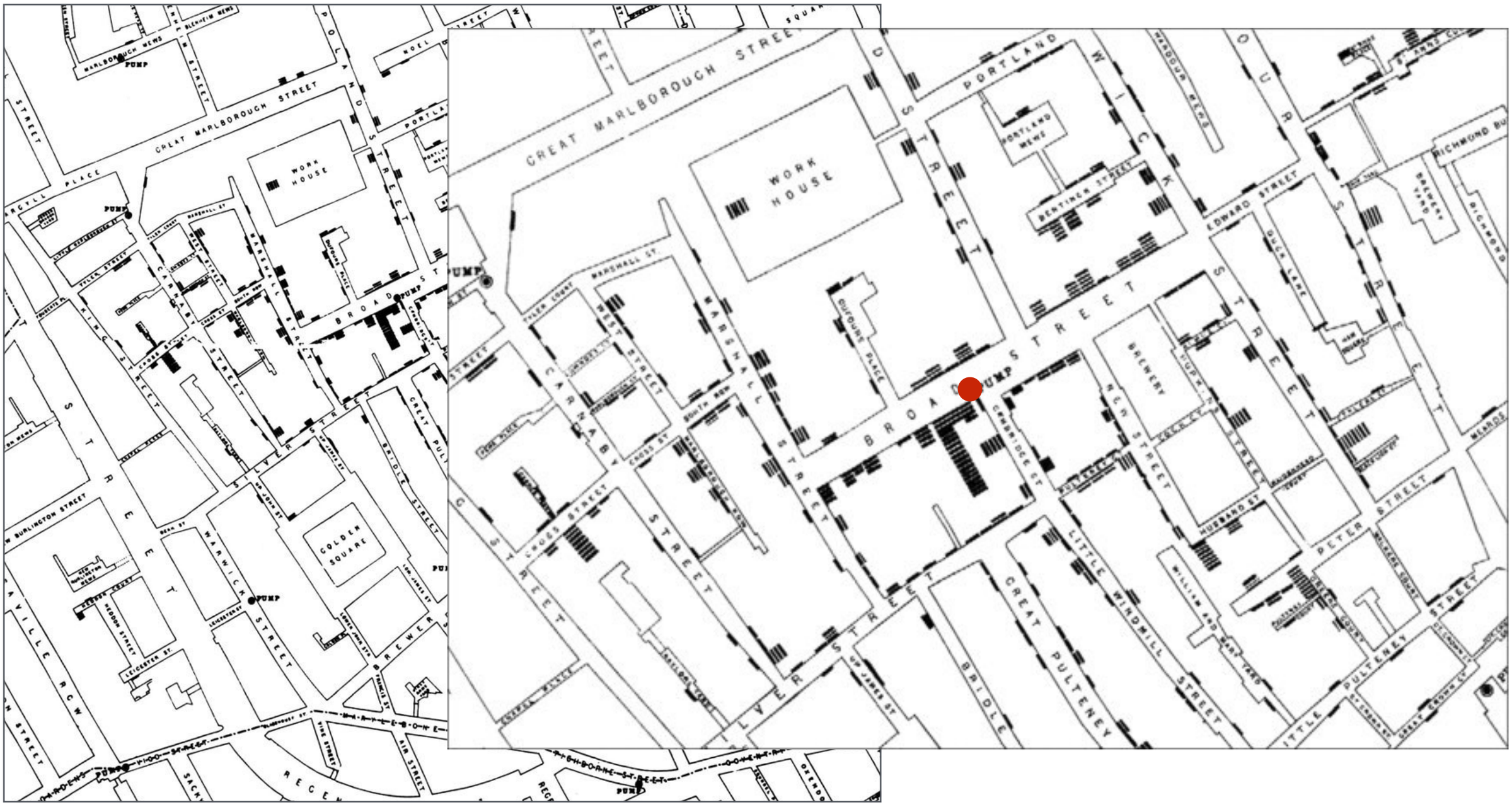

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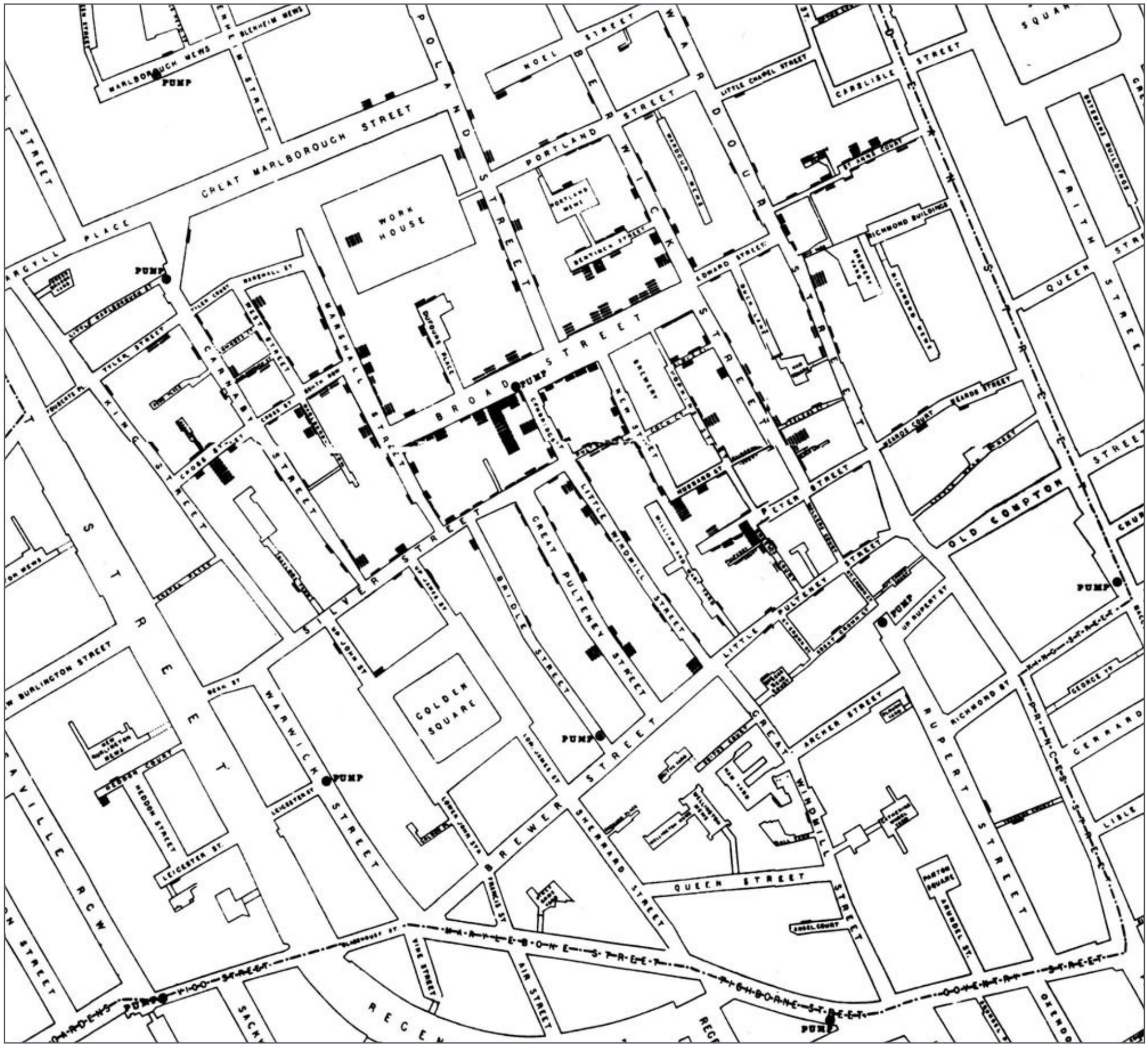
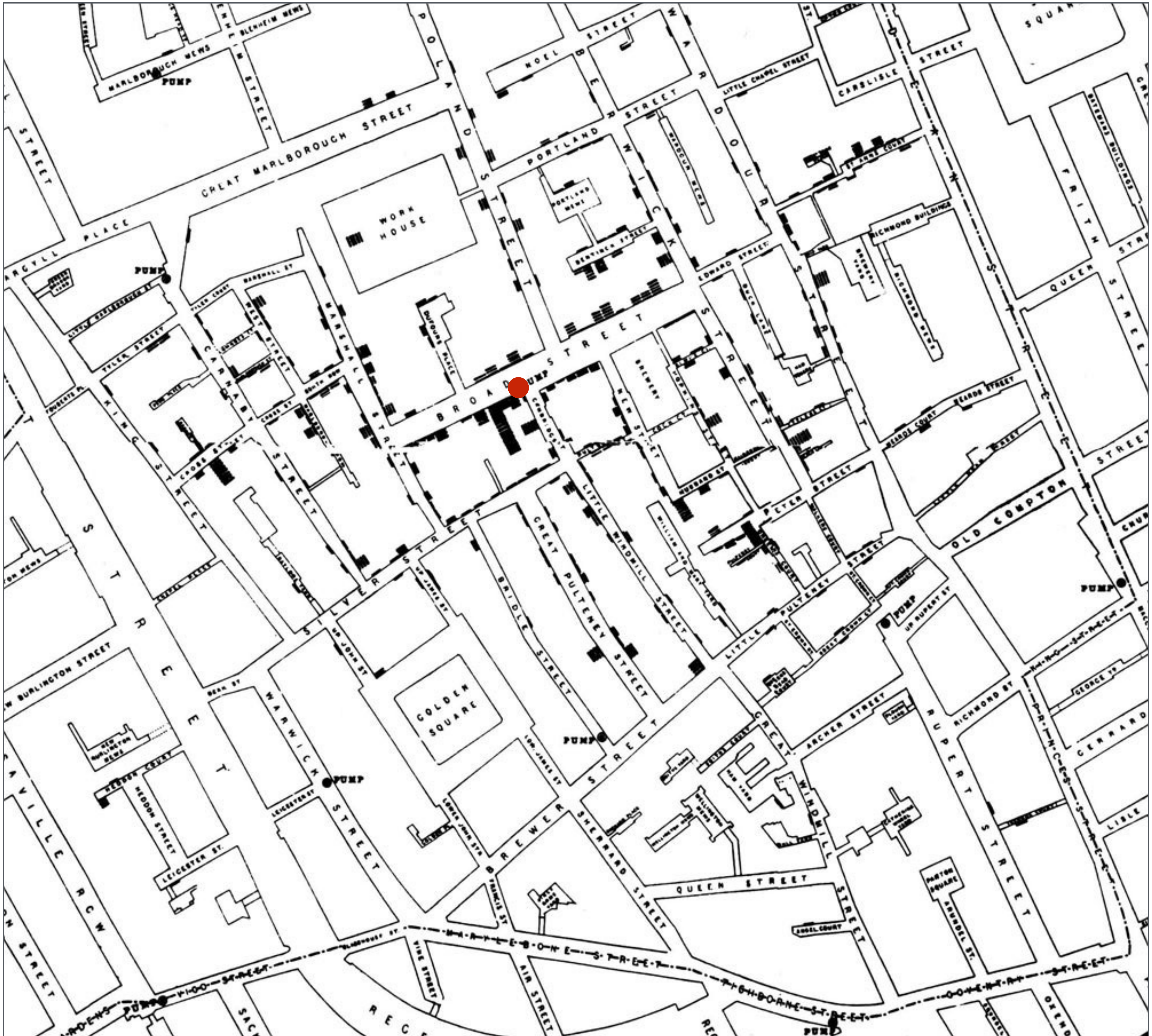

GREAT MARLBOROUGH STREET
PUMP
MARLBOROUGH MEWS
POLAND STREET
PORTLAND STREET
NOEL STREET
LITTLE CHAPEL STREET
CARLISLE STREET
ARGYLL PLACE
WORK HOUSE
PORTLAND MEWS
BERNERS STREET
RICHMOND BUILDINGS
EDWARD STREET
TYLER STREET
CARNABY STREET
MARSHALL ST
BROAD STREET
QUEEN STREET
OLD COMPTON
KING STREET
GREAT PULTENEY STREET
LITTLE WINDMILL STREET
BRIDLE STREET
GOLDEN SQUARE
WARWICK STREET
REWER STREET
SHERRARD STREET
ARCHER STREET
RUPERT STREET
PRINCES STREET
GERRARD
REGENT STREET
AVILLE ROW
LEICESTER ST.
HEDDON STREET
NEW BURLINGTON MEWS
SACKVILLE STREET
PIPER STREET
AIR STREET
ANGEL COURT
PHOTON SQUARE
ARUNDEL ST.
OXENDON



MARLBOROUGH MEWS
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WILLIAM AND MARY YARD
SILVER STREET
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TICHBORNE STREET
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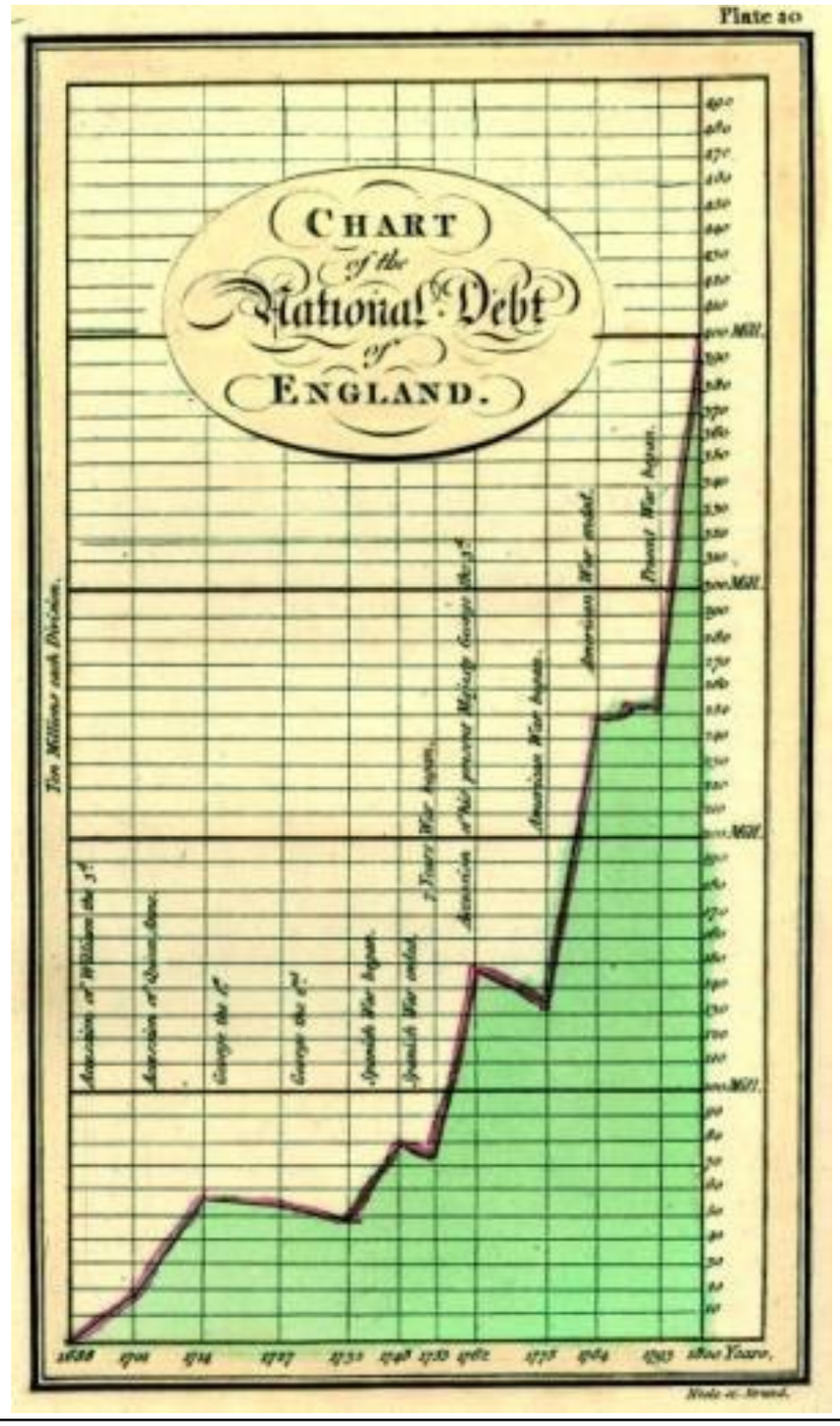
Early visualizations

- **William Playfair: Plot of National Debt over time**



William Playfair invented three types of diagrams: in 1786 the **line graph** and **bar chart** of economic data, and in 1801 the **pie chart**.

Early visualizations

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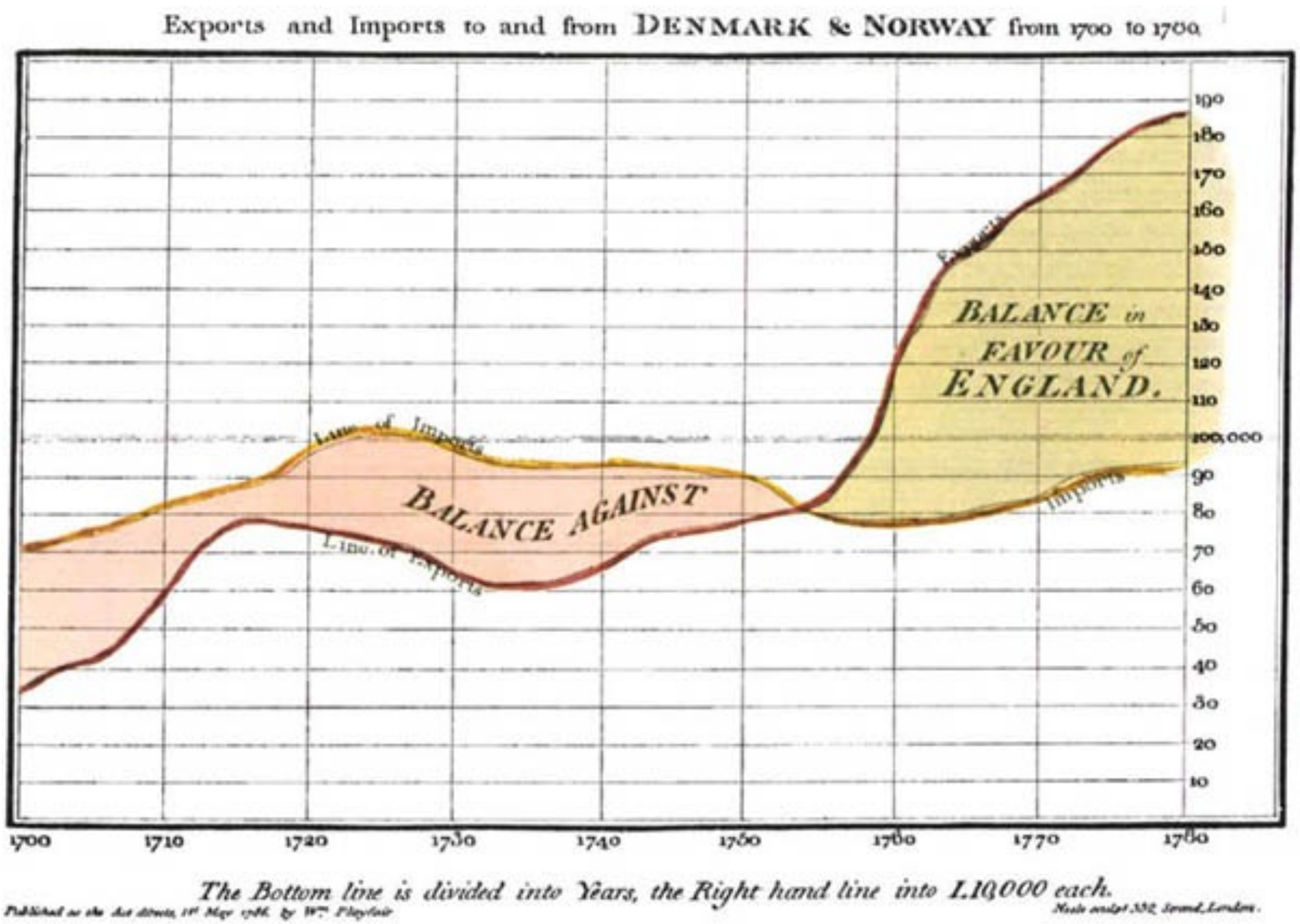
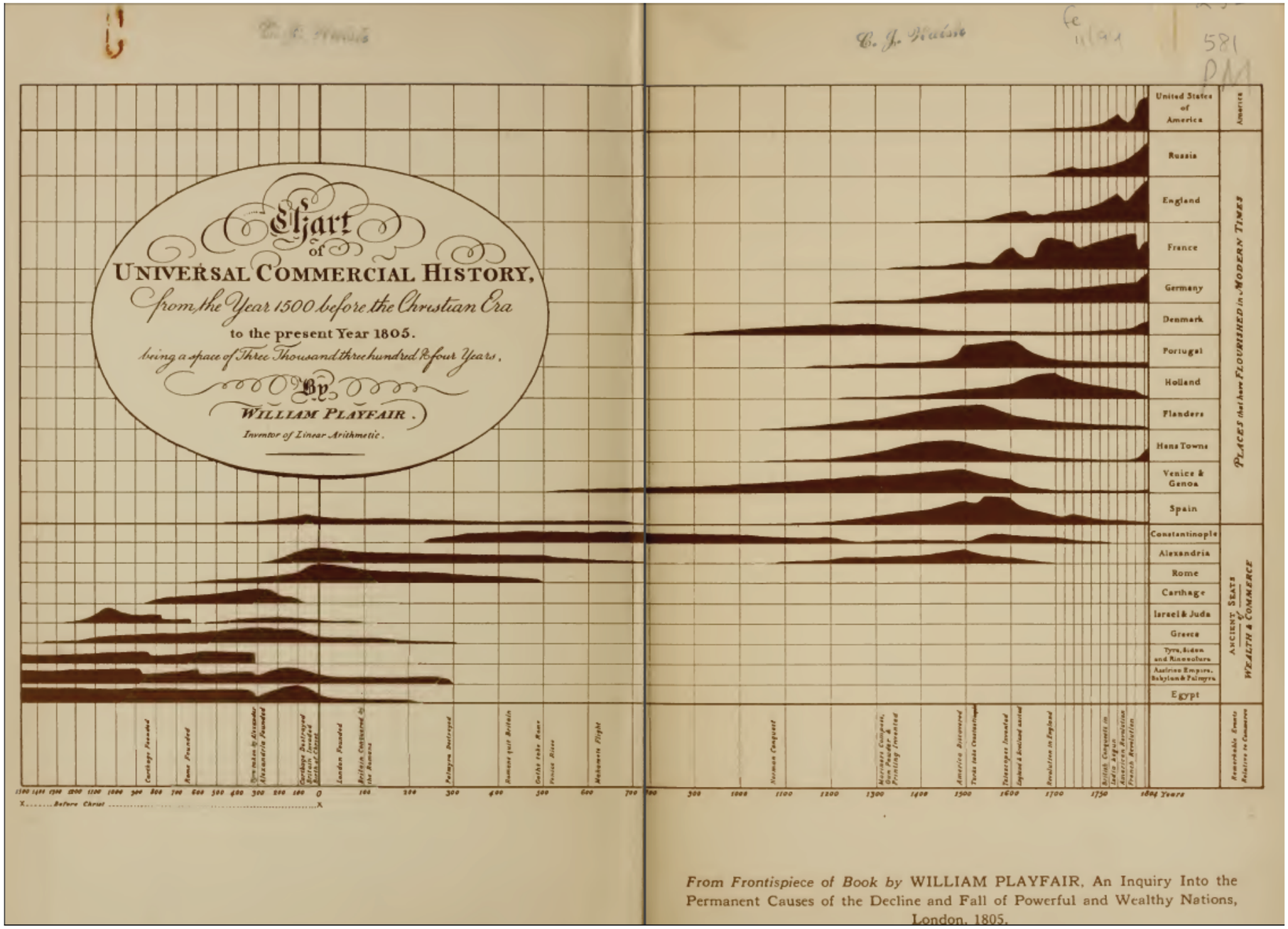
Early visualizations

- **William Playfair: Balance trade between England and Denmark (1786)**



Early visualizations

- **William Playfair: Universal Comercial History**



From Frontispiece of Book by WILLIAM PLAYFAIR, An Inquiry Into the Permanent Causes of the Decline and Fall of Powerful and Wealthy Nations, London, 1805.

What is the Goal of Data Visualization?

The (ultimate) goal of DV

"Data visualization is not just about seeing data !

Is about UNDERSTANDING data,

and being able to make decisions based on the data"

by John C. Hart

Early visualizations

- **Recommended readings:**
  - **(Matthew O. Ward et all, 2010) pages 6 - 15.**
  - **See the suggested links at the end.**

- **Some “Landmarks”:**
  - **Broad Street cholera outbreak, by John Snow, 1854.**
  - **Charles Minard's map of Napoleon's disastrous Russian campaign of 1812.**
  - **William Playfair founder of graphical methods of statistics.**
  - **Florence Nightingale’s “Rose” representing the causes of mortality in the army.**
  - **Periodic Table: Dmitri Mendeleev (1869); Julius Lothar Meyer (1870).**

Why (data) visualization is important?

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Anscombe's Quartet: Raw Data

1		2		3		4	
X	Y	X	Y	X	Y	X	Y
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89

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	X	Y	X	Y	X	Y	X	Y
	10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
	8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
	13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
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	5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89
Mean	9.0	7.5	9.0	7.5	9.0	7.5	9.0	7.5
Variance	10.0	3.75	10.0	3.75	10.0	3.75	10.0	3.75
Correlation	0.816		0.816		0.816		0.816	

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11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
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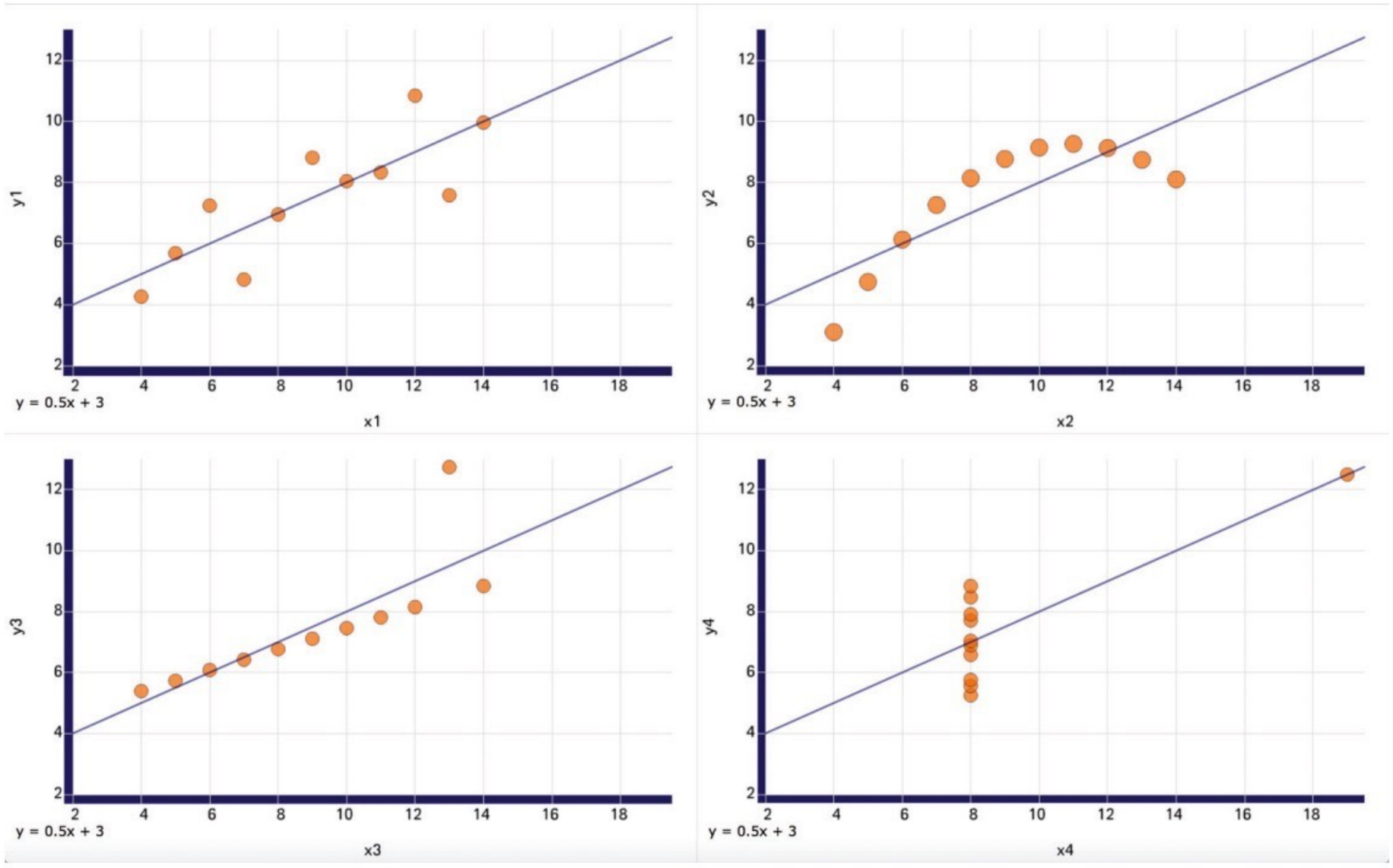
Variance	10.0	3.75	10.0	3.75	10.0	3.75	10.0	3.75
Correlation	0.816		0.816		0.816		0.816	

4 datasets
2 variables, 11 rows

Property	Value
Mean of X	9
Variance of X	11
Mean of Y	7.5
Variance of Y	4.1
Correlation	0.816
Linear Regression	y = 3.0 + 0.5x

F. J. Anscombe (1973)

Why (data) visualization is important?



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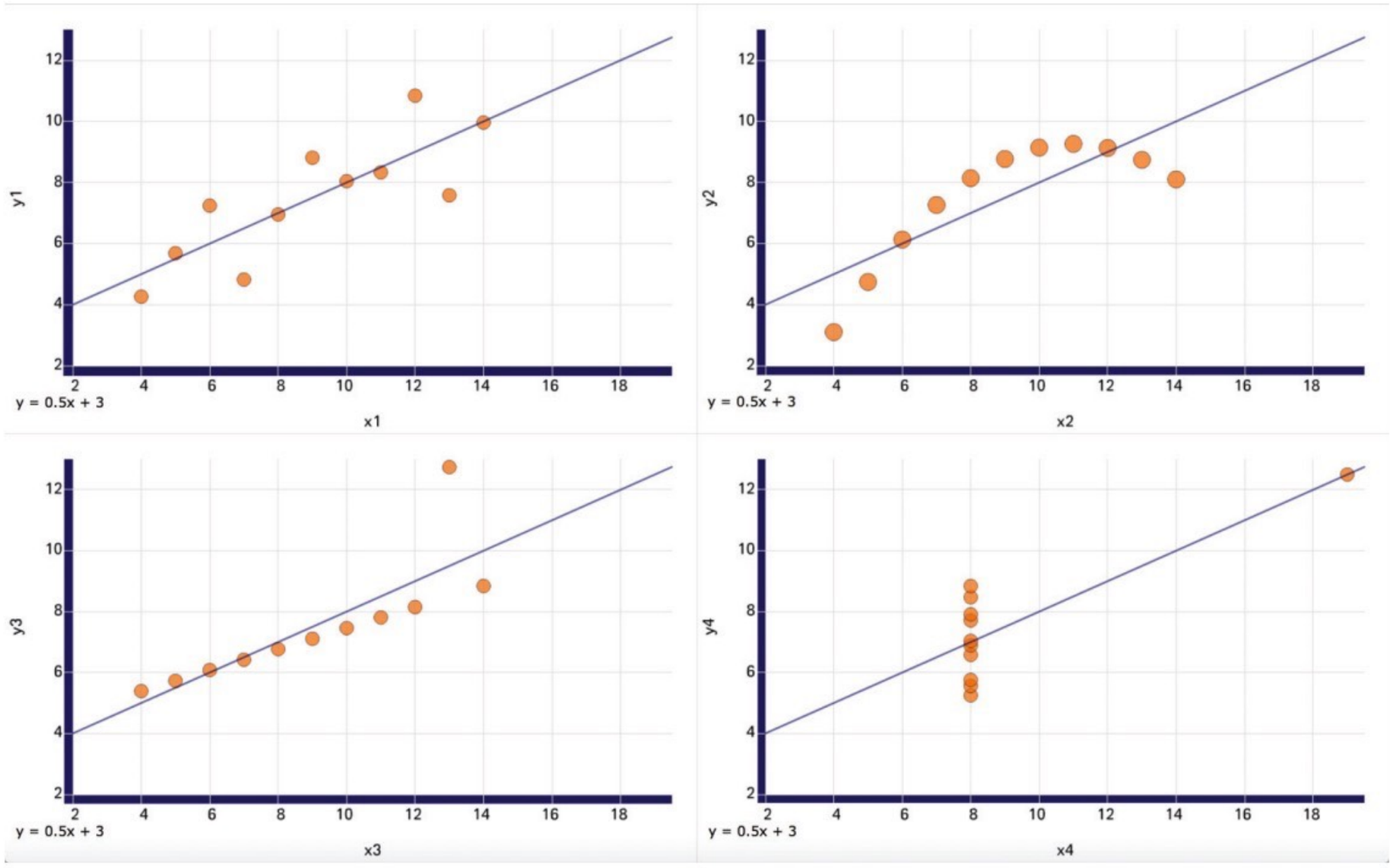

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Statistic is not enough !

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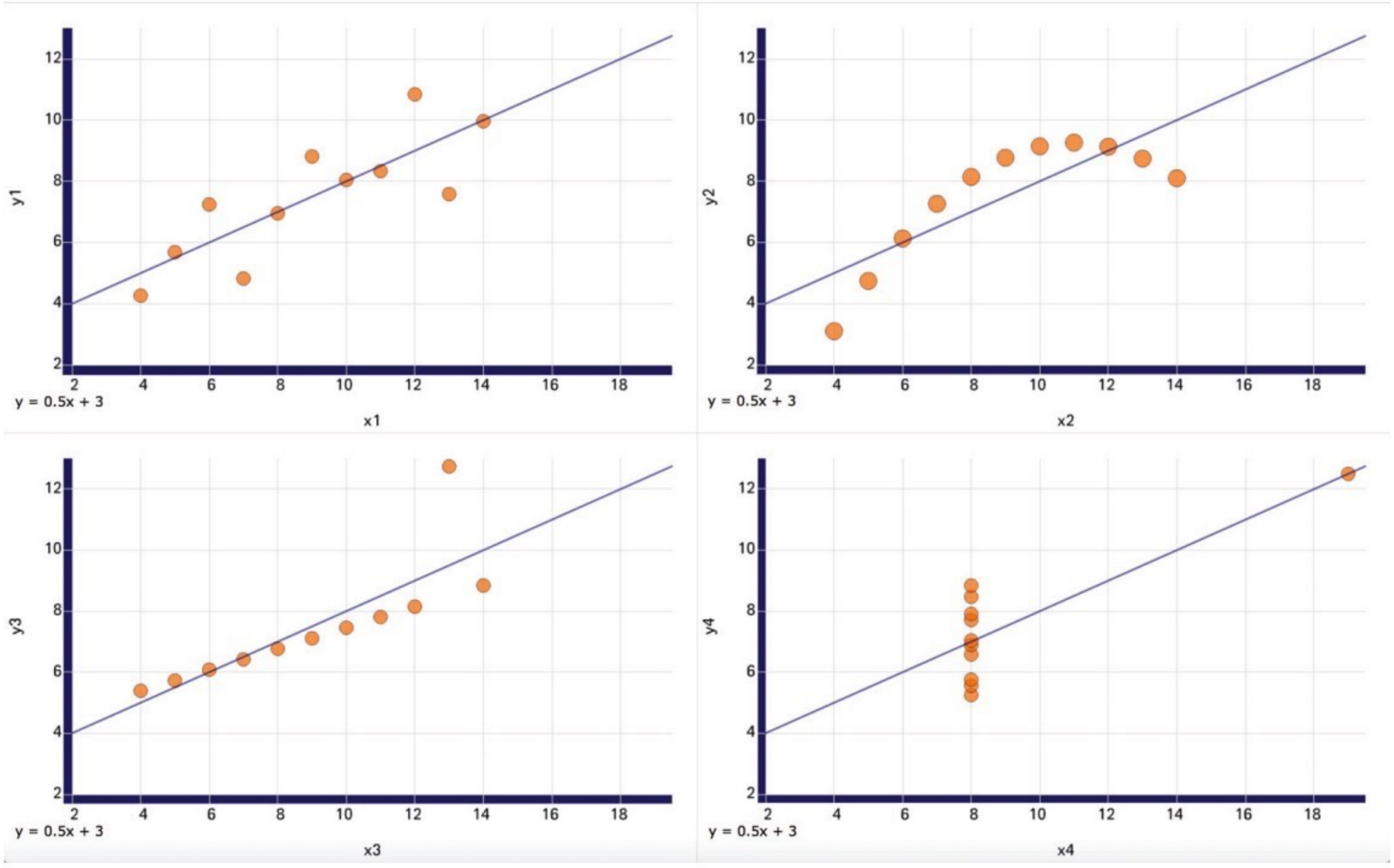

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- **Can the presentation of data impact the decision?**
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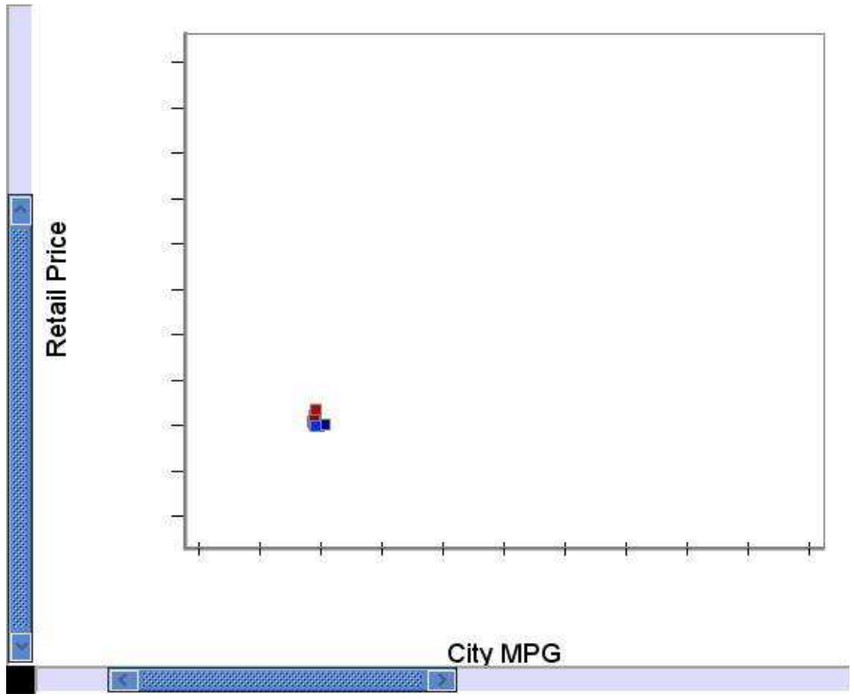

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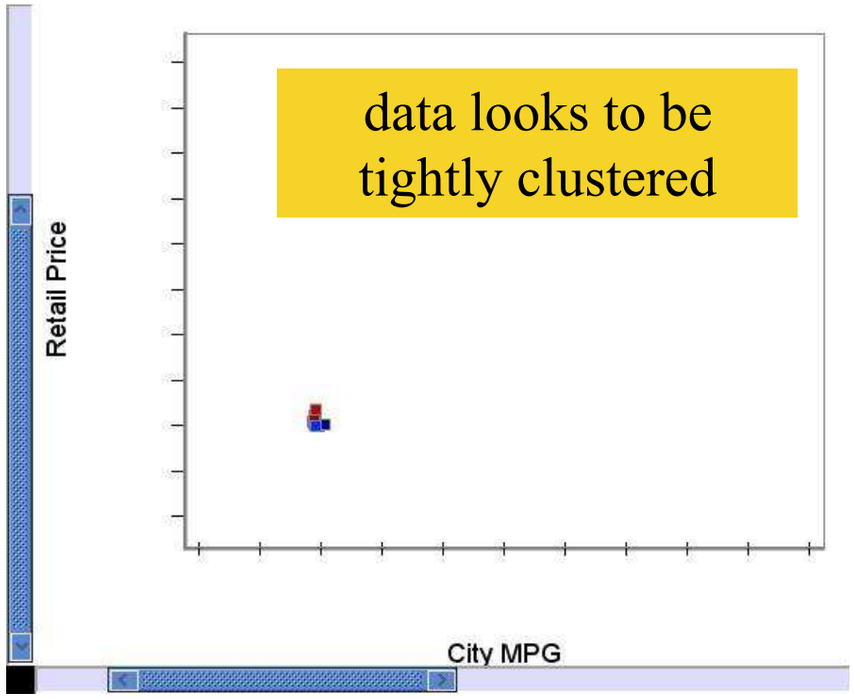

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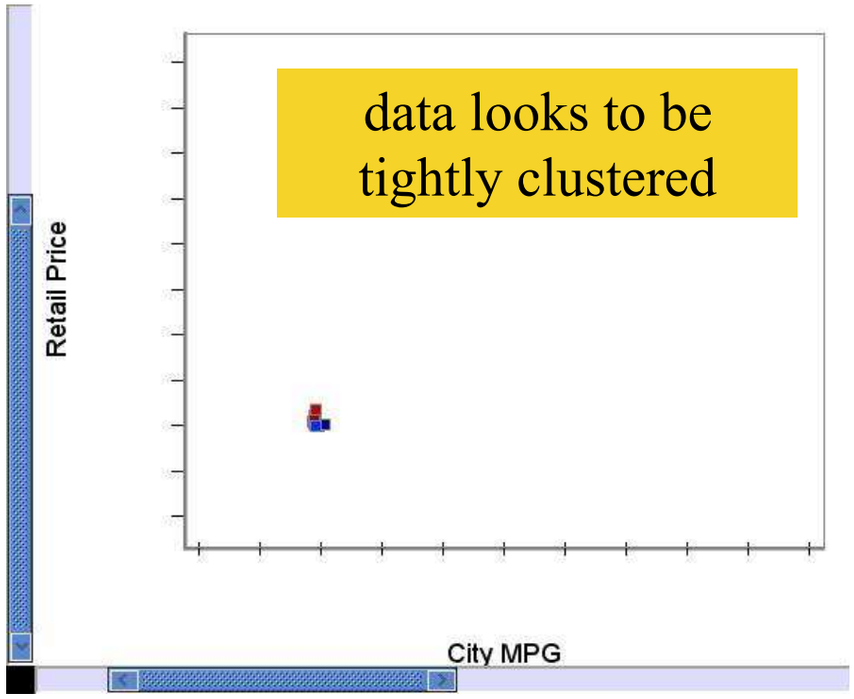

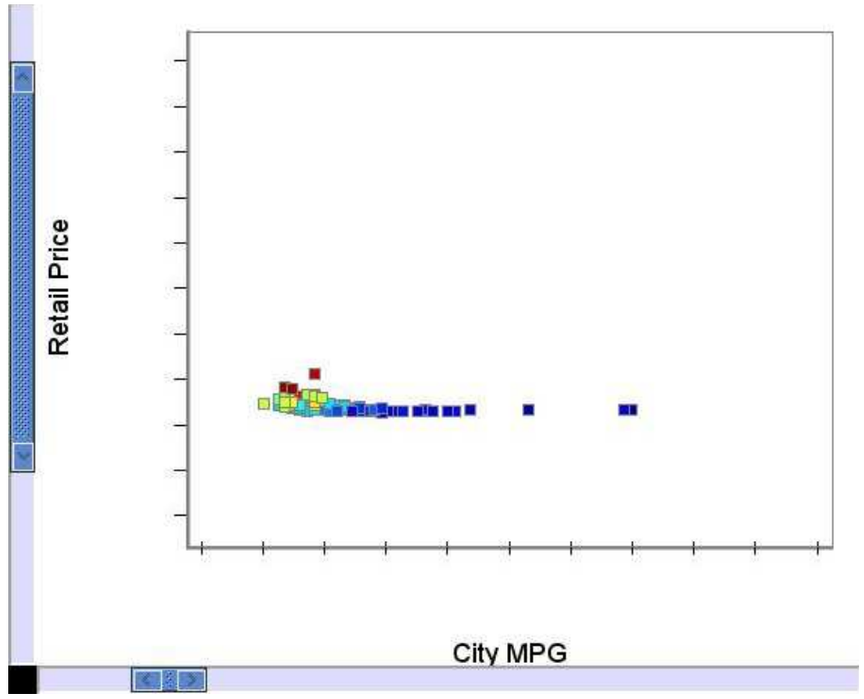

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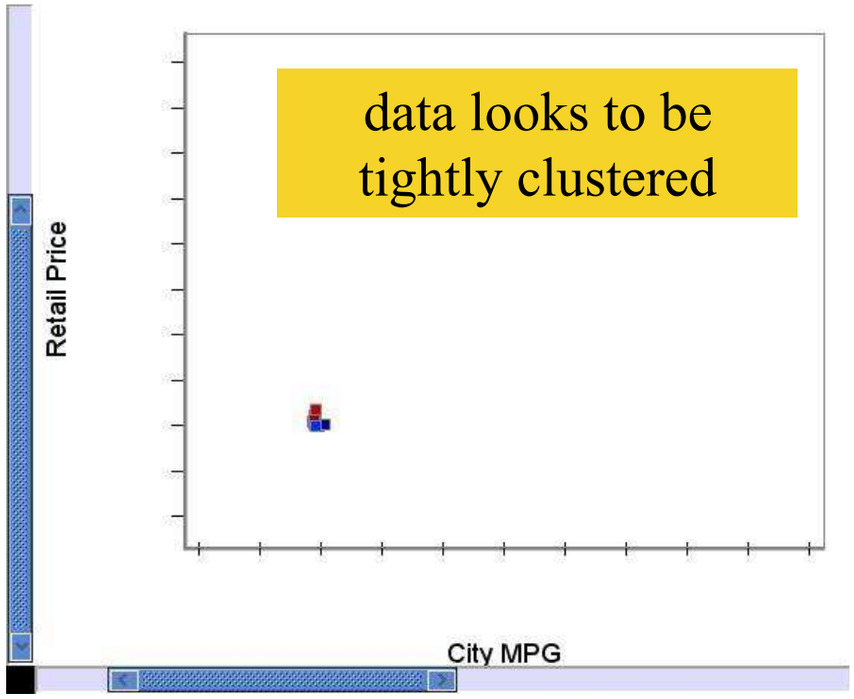

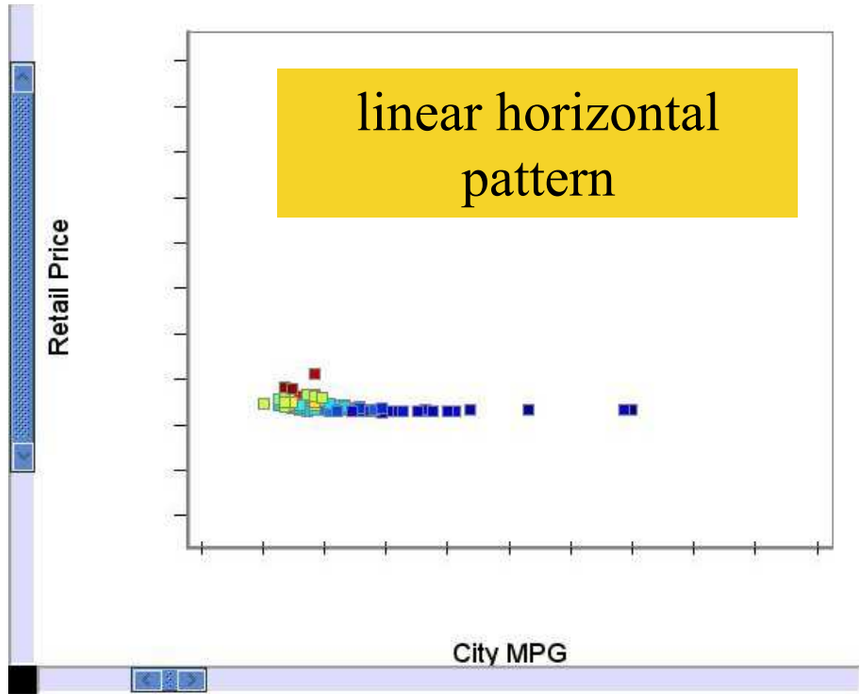

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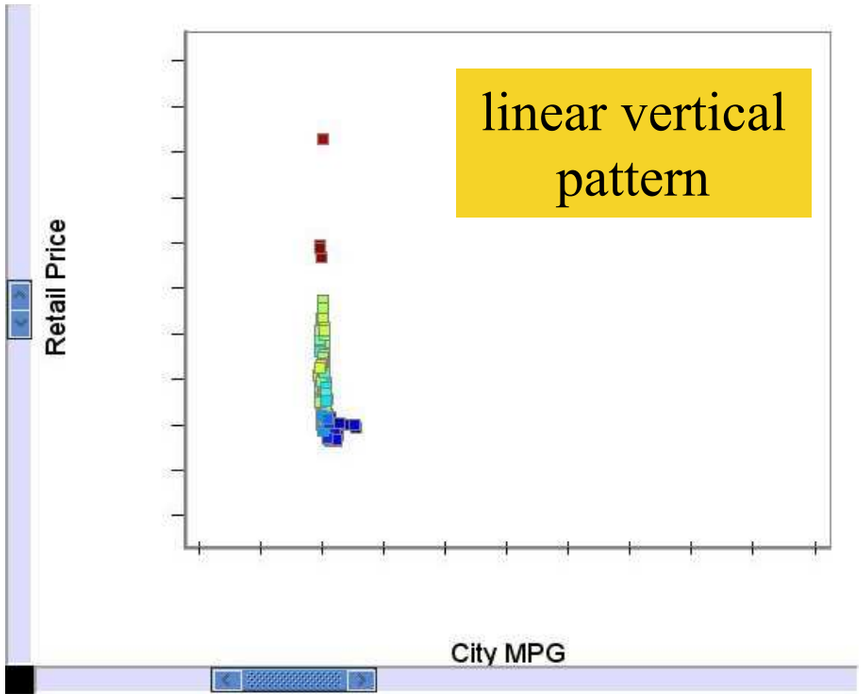

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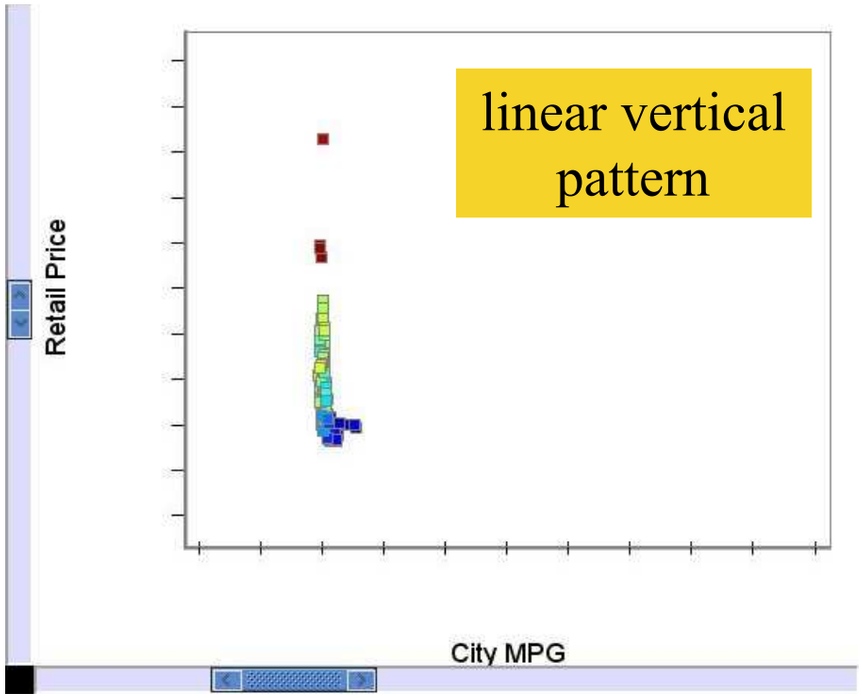
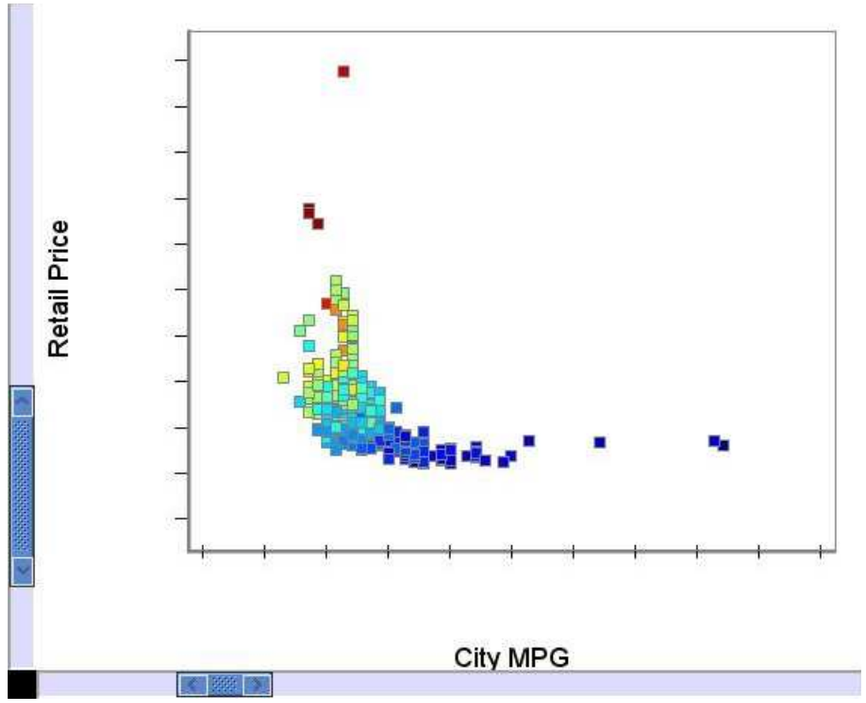
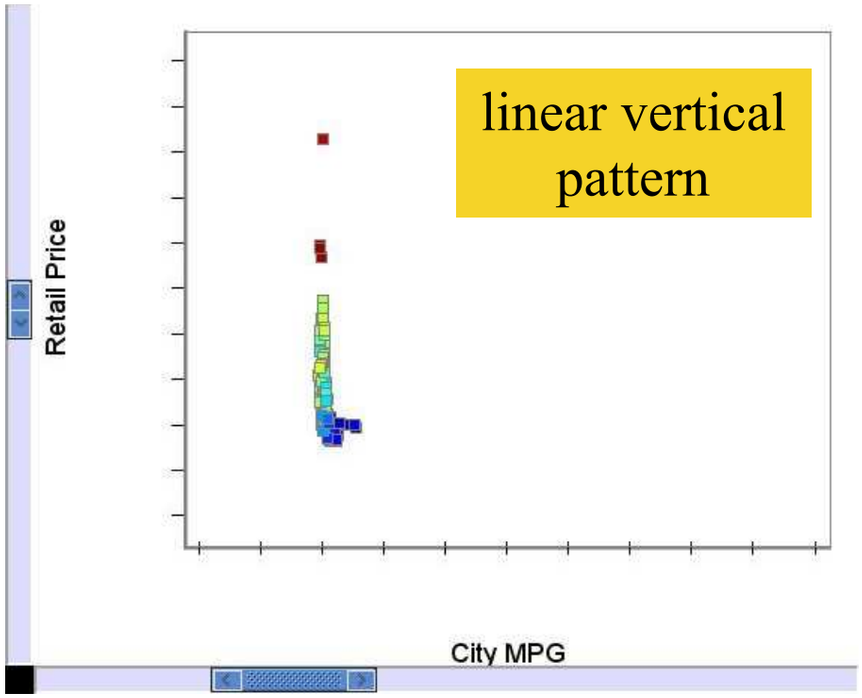
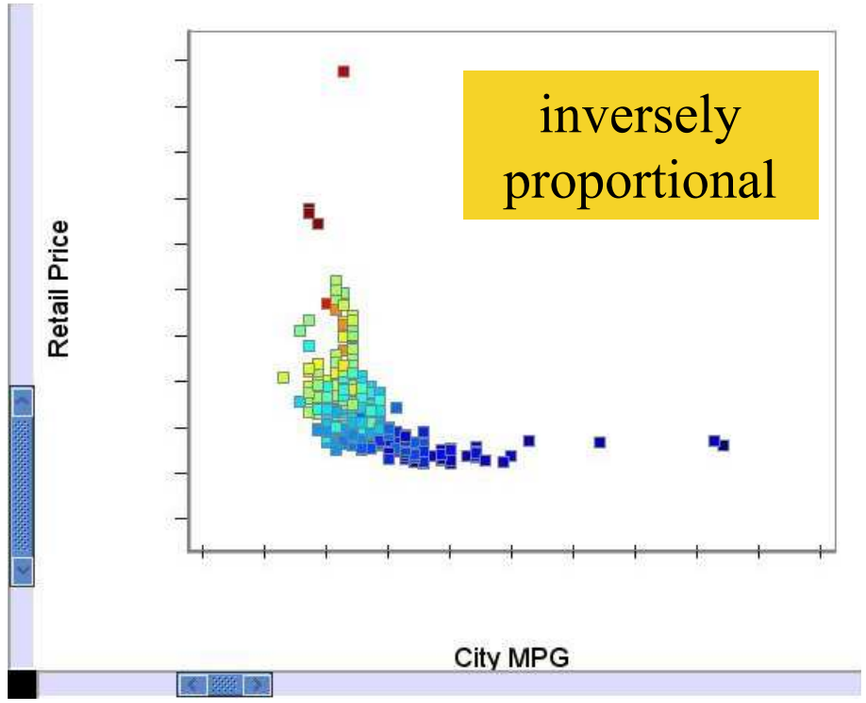




Why (data) visualization is important?

- **What is the effect of the presentation of the data on the decision making process?**
- **Can the presentation of data impact the decision?**
- **Can we say which presentations are better or more influential than others?**





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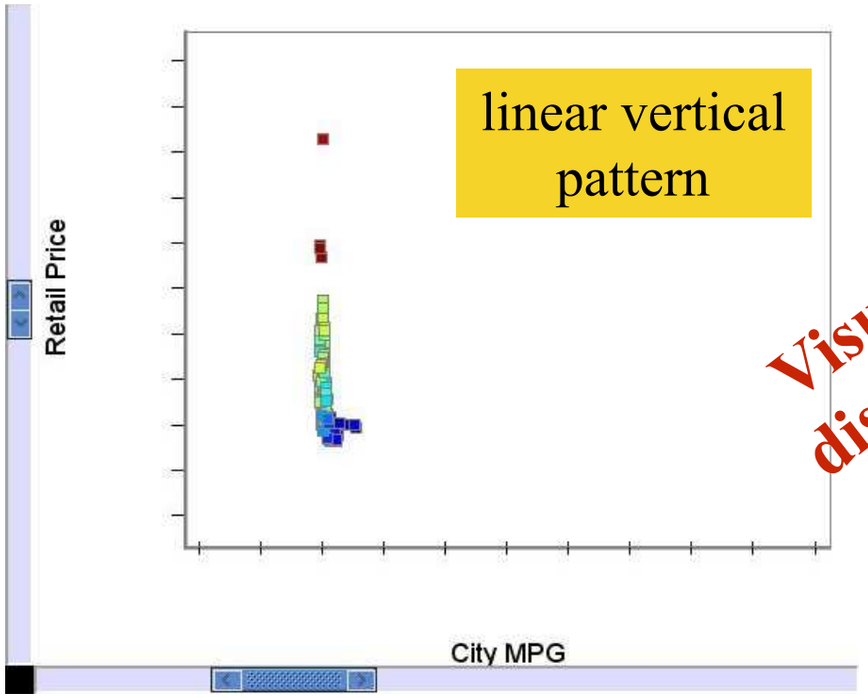
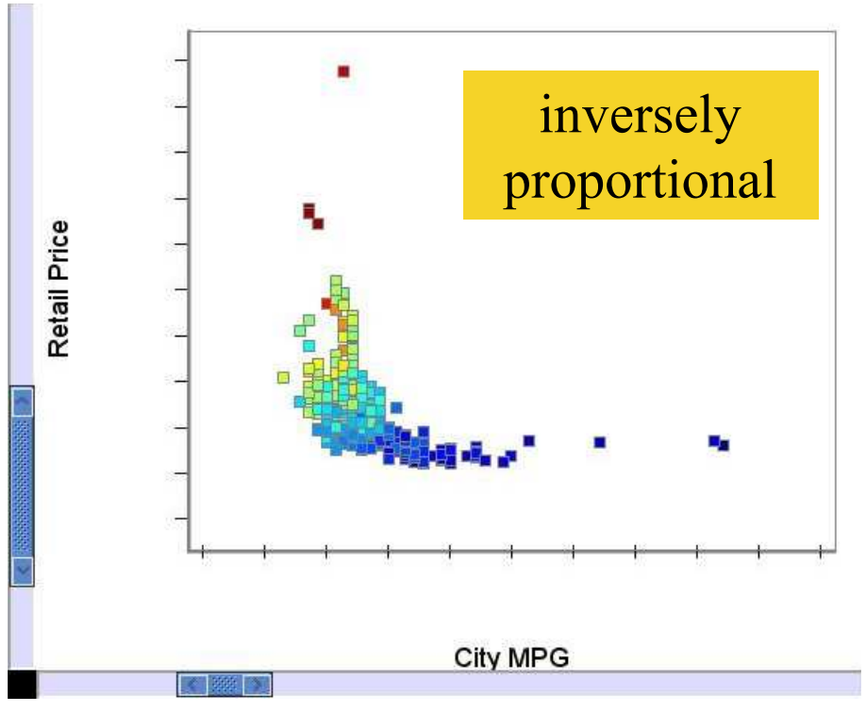


Visualization can distort the "truth"



Why (data) visualization is important?

- **What is the the role of human preferences and training in the visualization?**

> . Linda S. Elting, James M. Walker, Charles G. Martin, Scott B. Cantor, and Edward B. Rubenstein. "**Influence of Data Display Formats on Decisions** to Stop Clinical Trials." British Medical Journal 318 (1999)

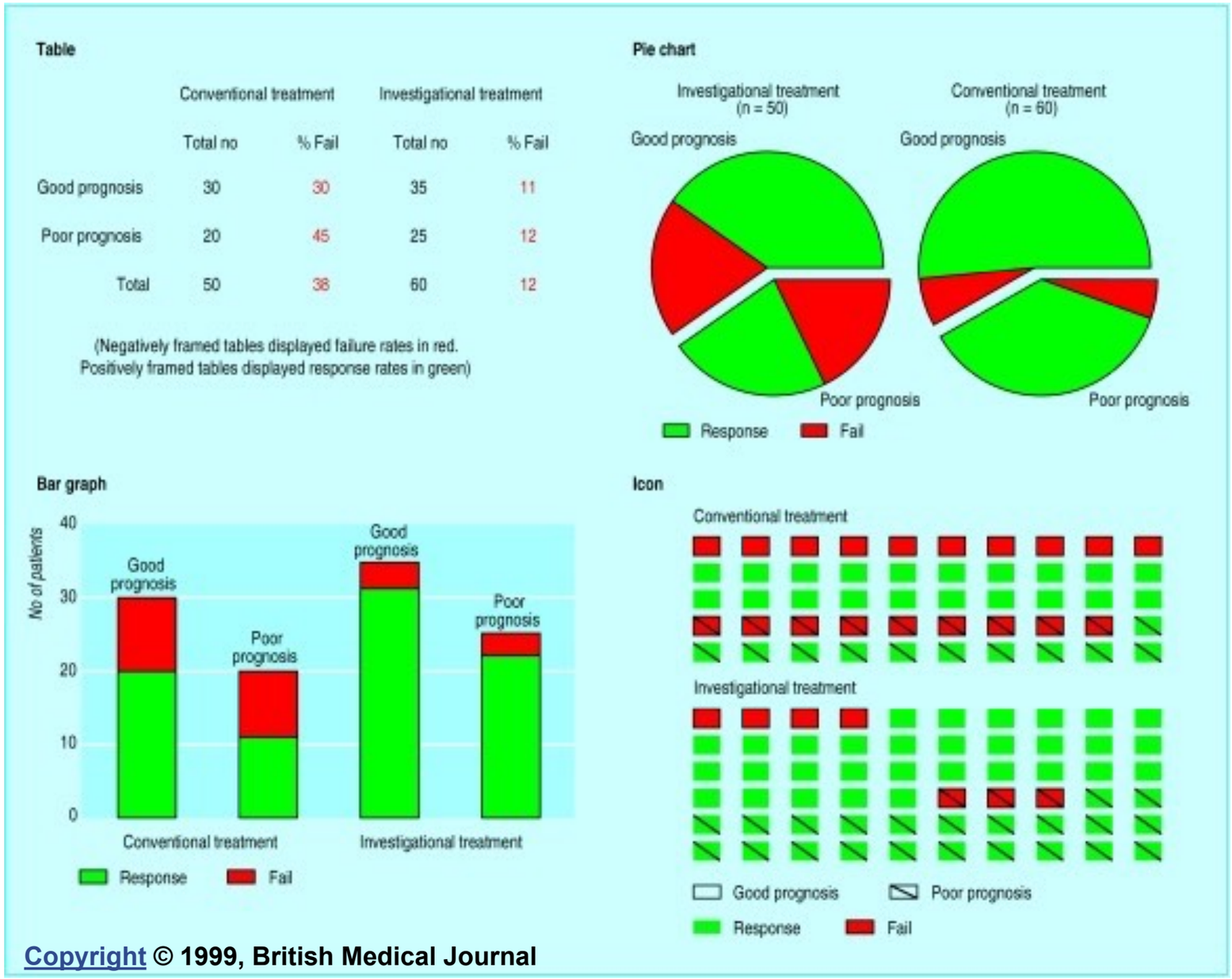
- **Hypothetical clinical trial:**
  - **Two treatments: 50 patients with conventional and 60 with investigational**
  - **Two populations: 65 with good prognosis and 45 with bad prognosis**
  - **Two outcomes for each treatment: Response (positive) vs Fail**
  - **34 clinicians**
  - **If a clinician sees that one treatment is better than the other, then he should stop the clinical treatment**

Why (data) visualization is important?

- **What is the the role of human preferences and training in the visualization?**

4 visualizations:
Table
Pie Chart
Bar Graph
Icon

Green - Response
Red - Fail



Why (data) visualization is important?

- **What is the the role of human preferences and training in the visualization?**
  - **PARTICIPANTS** were shown tables, pie charts, bar graphs, and icon displays containing hypothetical data from a clinical trial and were asked to decide whether to continue the trial or stop for an unplanned statistical analysis.
  - **MAIN MEASURE : Percentage of accurate decisions with each type of display**
  - **RESULTS:**
    - **More correct decisions were made with icon displays** (82%) than with tables (68%), pie charts (56%), and bar graphs (43%).
    - Most (21) clinicians preferred the table; Several were contemptuous of the icon display.

The visualization is key in presenting data but the user preferences are very involved

Why (data) visualization is important?

- **Tamara Munzner, 2015**

1.11 Why Are Most Designs Ineffective?

The most fundamental reason that vis design is a difficult enterprise is that the vast majority of the possibilities in the design space will be ineffective for any specific usage context. In some cases, a possible design is a poor match with the properties of the human perceptual and cognitive systems. In other cases, the design would be comprehensible by a human in some other setting, but it's a bad match with the intended task. Only a very small number of possibilities are in the set of reasonable choices, and of those only an even smaller fraction are excellent choices. Randomly choosing possibilities is a bad idea because the odds of finding a very good solution are very low.

Why (data) visualization is important?

- **Nowadays**
  - **Generating a lot of data and information**
  - **Need to process such information**
  - **Need to communicate increasing levels of information**

Visualization is a cornerstone of modern knowledge discovery tools. Applications often include one or more visualizations to provide different views of data to describe some patterns or structures.

We need to communicate information to people in a efficient and effective manner.

What is the Goal of Data Visualization?

The (ultimate) goal of DV

"Data visualization is not just about seeing data !

Is about UNDERSTANDING data,

and being able to make decisions based on the data"

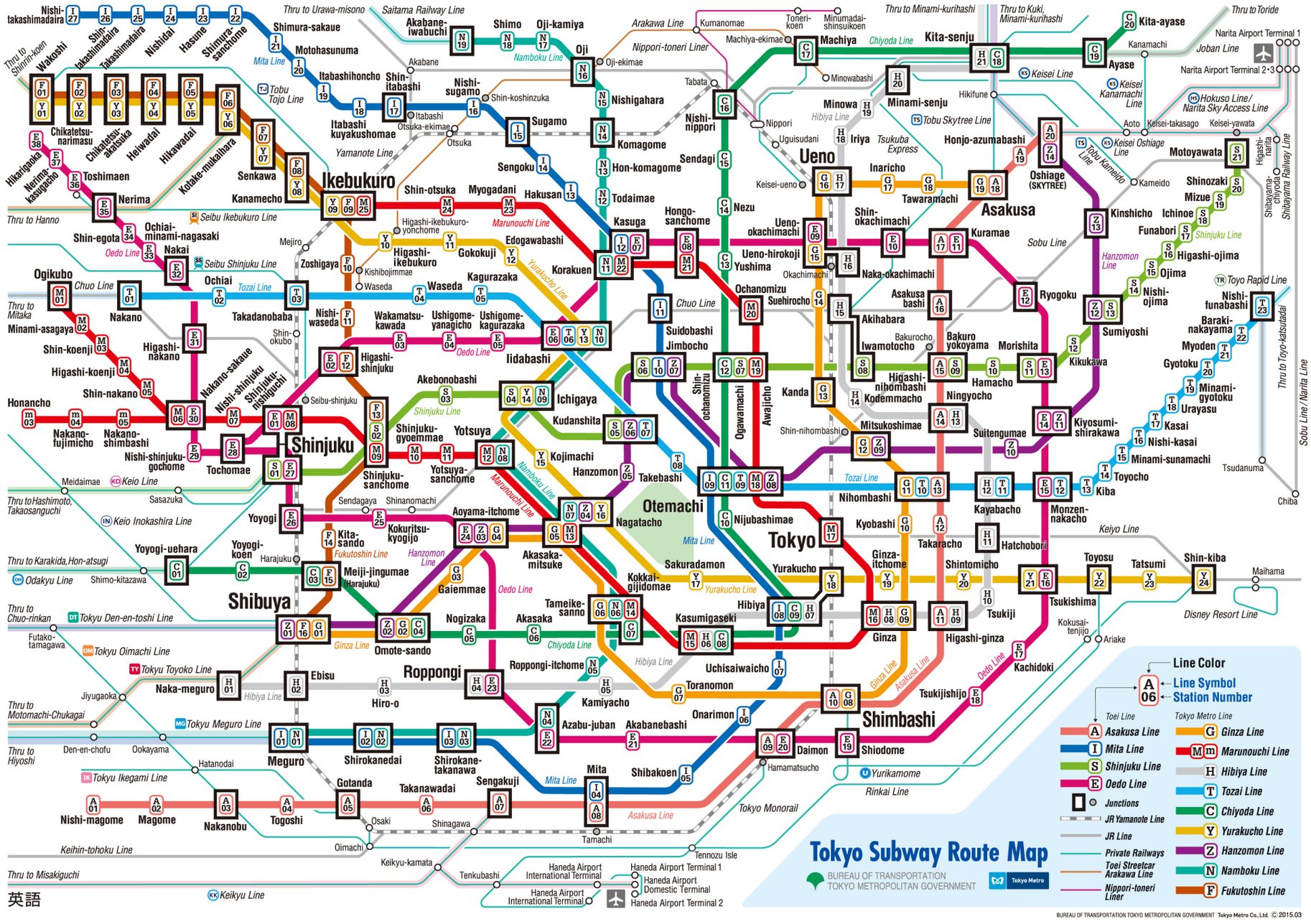
by John C. Hart

(Data) Visualization today

Visualization today

- **Qualitative versus Quantitive**

Tokyo



英語

Visualization today

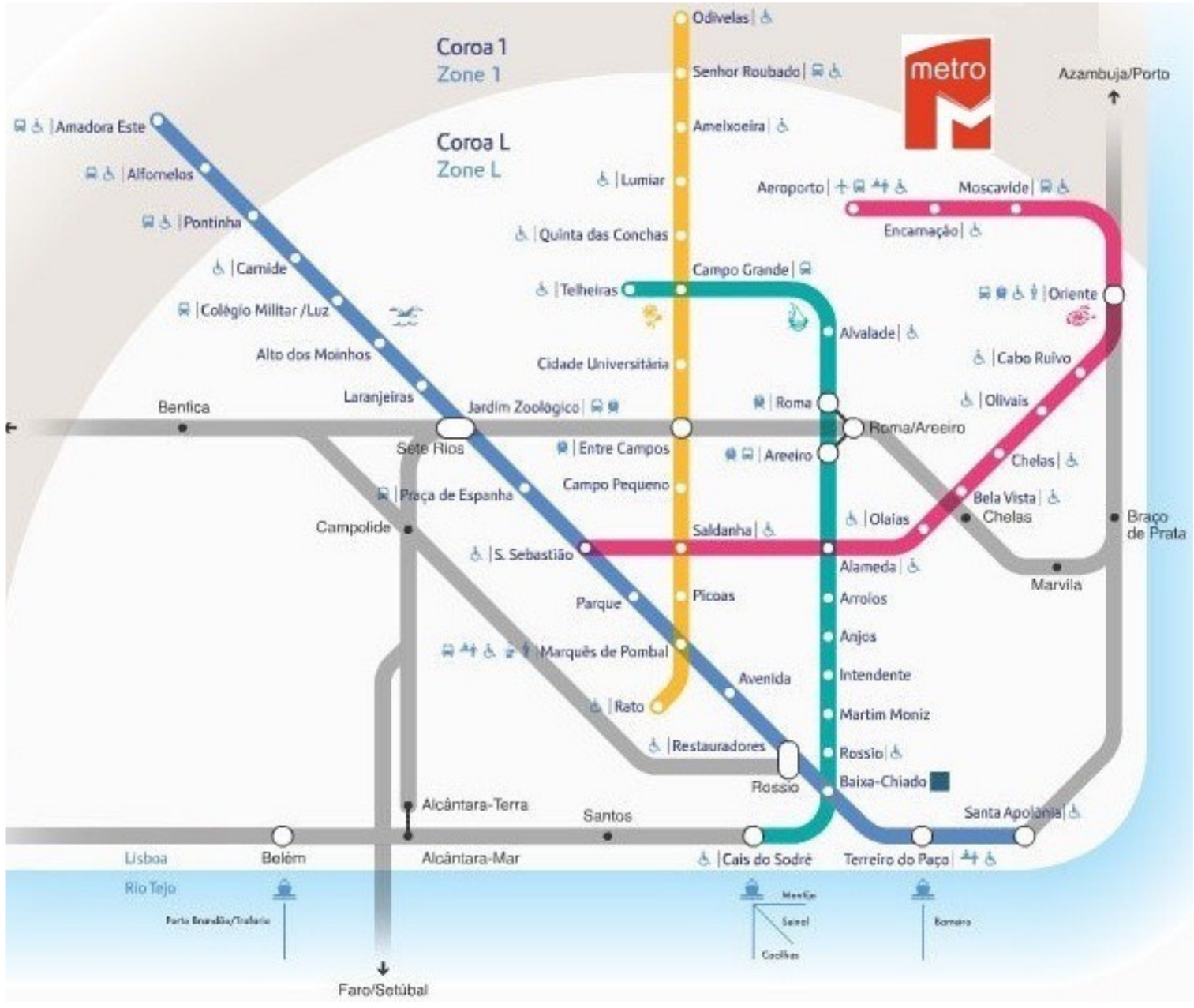
- **Qualitative versus Quantitive**

Paris

Visualization today

- **Qualitative versus Quantitive**

Lisbon

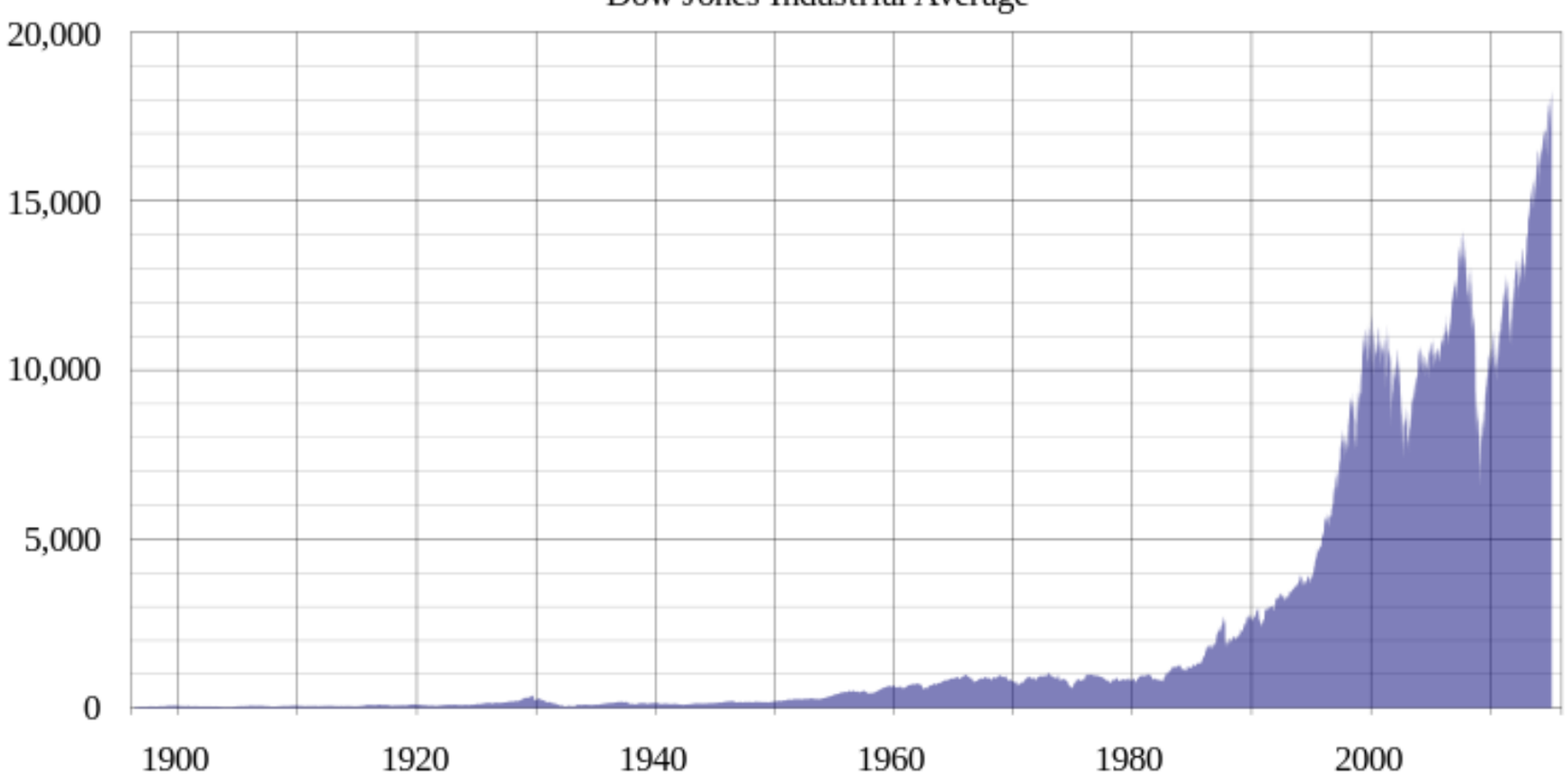


Visualization today

- **Precision versus Imprecision**

$11,956,584,748,608.58

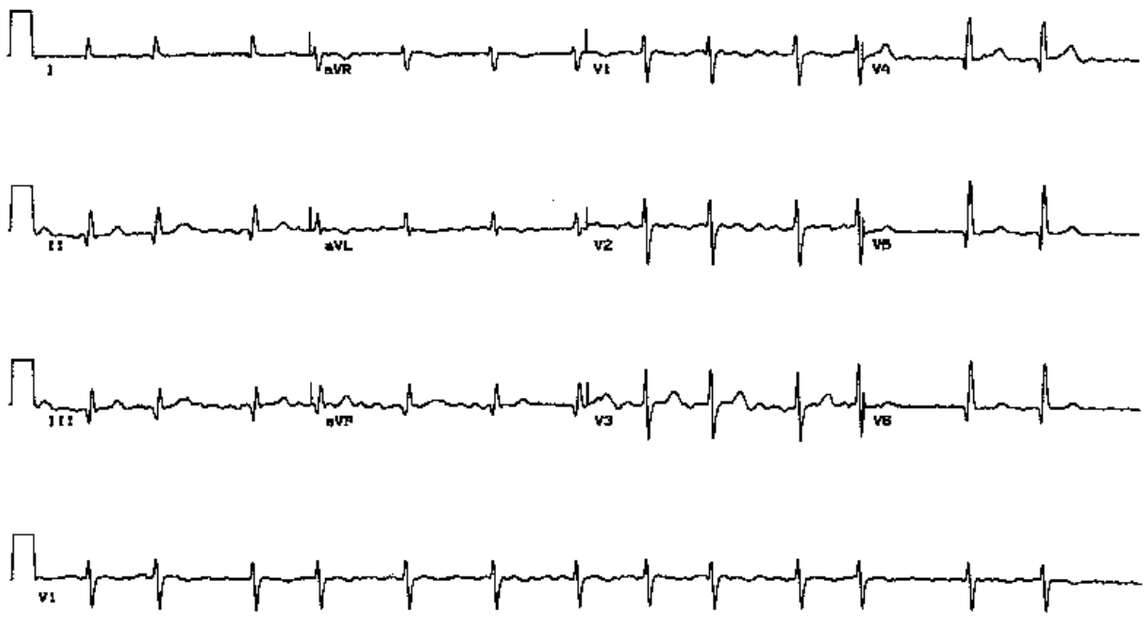
US National public debt at January 22, 2006



Visualization today

- **Precision versus Imprecision**

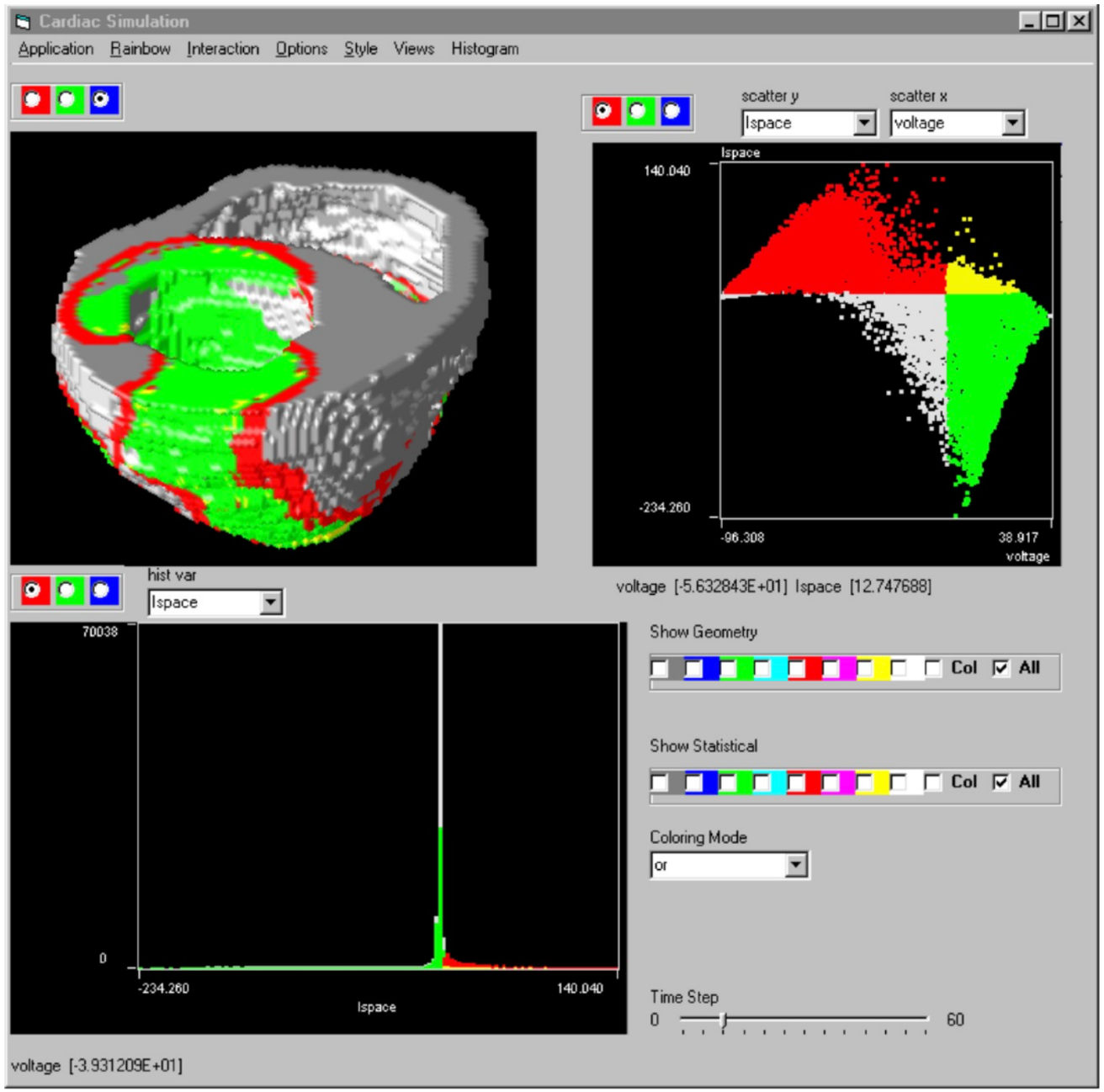
A 79 year old man with 5 hours of chest pain



A 53 year old man with Ischaemic Heart Disease

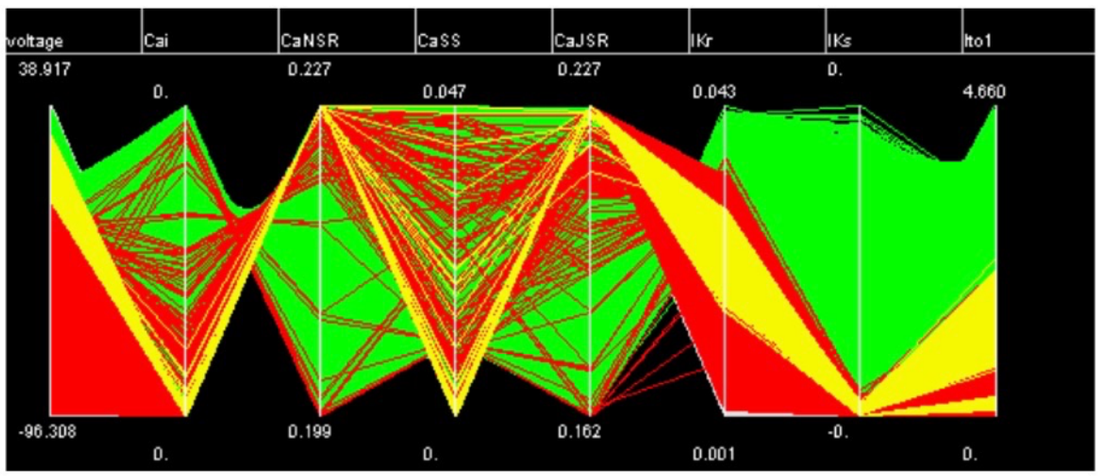
Visualization today

- **Single visualization versus Multiple visualization**



Heart 3D Model
Additional parameters

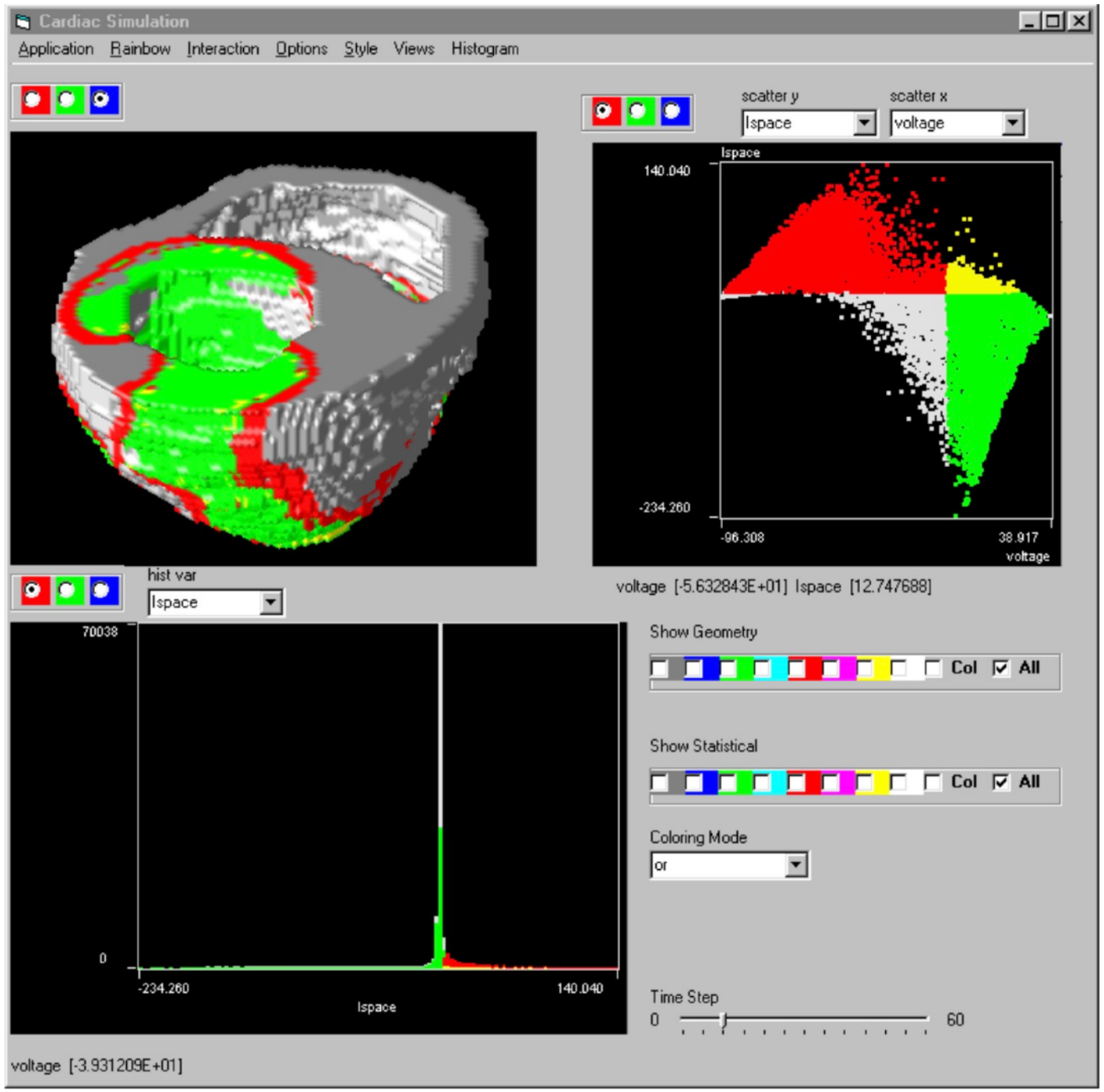
Linked parallel coordinates presentation



D. L. Gresh, B. E. Rogowitz, R. L. Winslow, D. F. Scollan, and C. K. Yung. “WEAVE: A System for Visually Linking 3D and Statistical Visualizations, Applied to Cardiac Simulation and Measurement Data.”

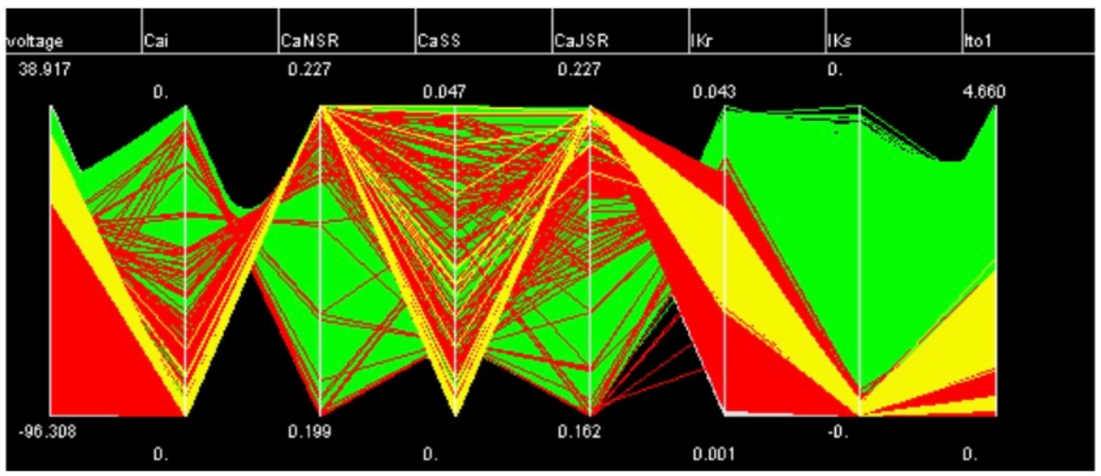
Visualization today

- **Static versus Interactive**



In an **interactive** visualization the user can query the display and thus interact with the application display directly rather than menus

Linked parallel coordinates presentation

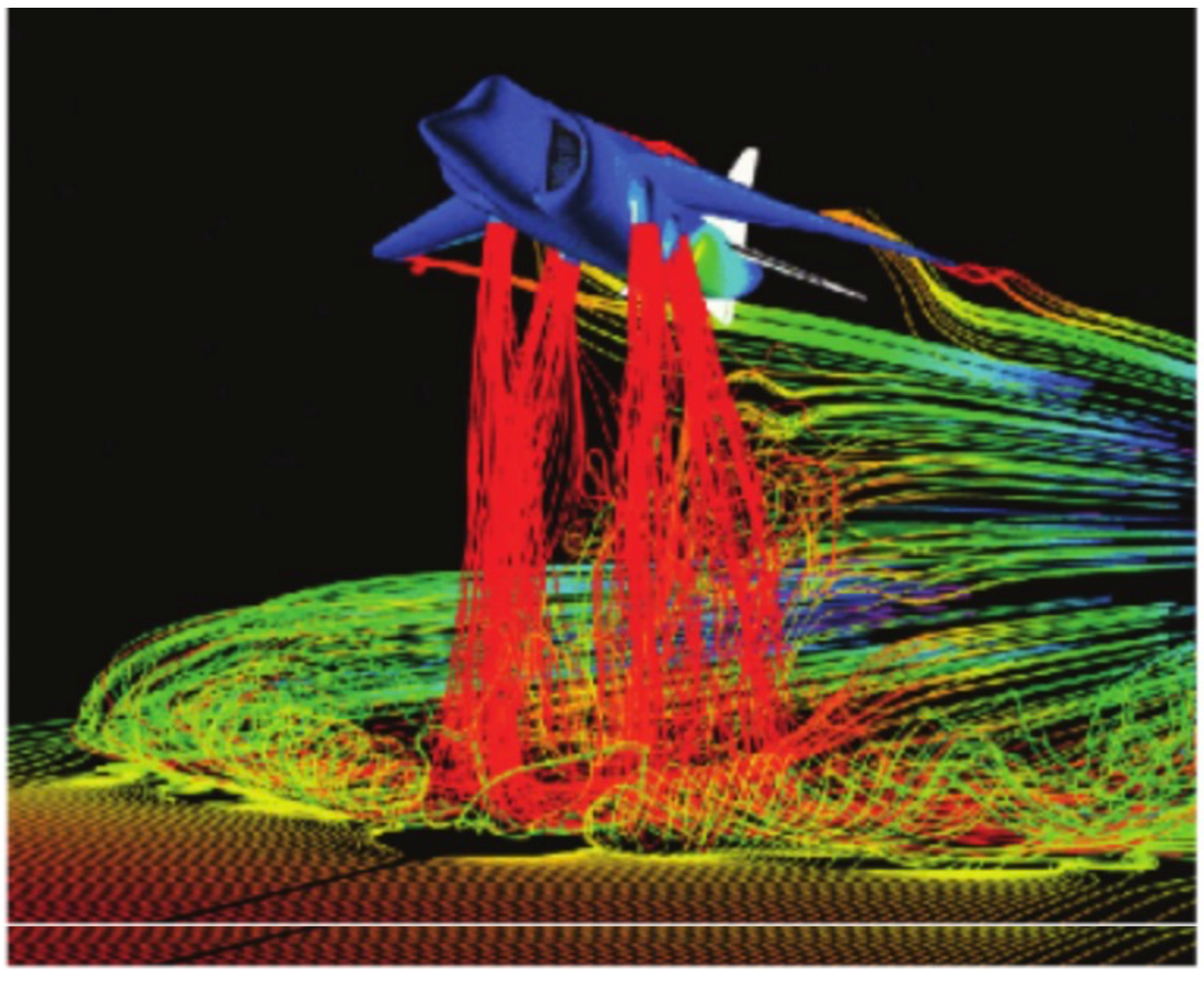


D. L. Gresh, B. E. Rogowitz, R. L. Winslow, D. F. Scollan, and C. K. Yung. “WEAVE: A System for Visually Linking 3D and Statistical Visualizations, Applied to Cardiac Simulation and Measurement Data.”

Visualization today

- **Abstraction versus “real images”**

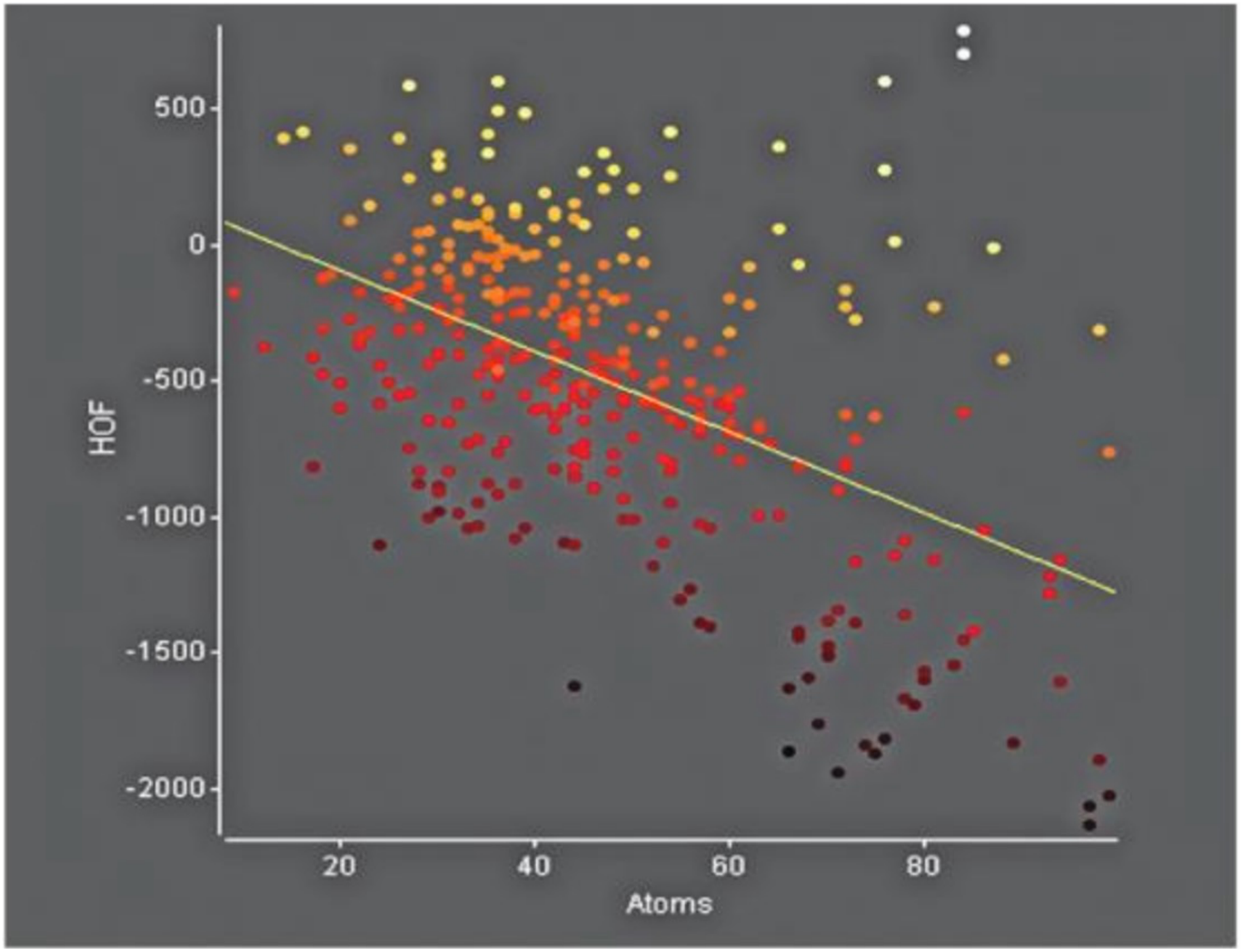
Blood vessel configuration of the head and Brain (http://www.bodyworlds.com/)



Simulation visualization of the air generated by a Harriet Jet (http://quest.nasa.gov/aero/background/tools/)

Visualization today

- **Abstraction versus "real images"**



Mechanism of action for yeast (image generated by UMass Lowell UVP Software)

x-coordinate: number of atoms;
y-coordinate: heat information;

$y = mx + b$; m = -12.5 and b = 50

Color of each point: Gibs energy

Visualization provides **visual representation of objects** that may include data, algorithms, results of computations, process and many other components of the application

The ability to provide rich descriptions of data is one of the strengths of visualization

Visualization today

- **Recommended readings:**
  - **(Matthew O. Ward et all, 2010) pages 15 - 21.**
  - **See the suggested links at the end.**

- **Some Highlights**
  - **Qualitative versus Quantitative**
  - **Precision versus Imprecision**
  - **Single visualization versus Multiple visualization**
  - **Static versus Interactive**
  - **Abstraction versus “real images”**

Modes of Visualization

Modes of Visualization

John C. Hart

Interactive Visualization

- Used for discovery
- Intended for a single investigator or collaborators
- Rerenders based on input
- Prototype quality

Presentation Visualization

- Used for communication
- Intended for large group or mass audience
- Does not support user input
- Highly polished

Interactive Storytelling

- Presentations via interative webpages

6

Modes of Visualization

Modes of Visualization

John C. Hart

Visualization Mode	User Interaction	Graphics Rendering	Target	Medium
Interactive Visualization	User controls everything, including dataset	Real-time rendering	Individual or collaborators	Software or internet
Interactive Storytelling	User can filter or inspect details of preset datasets	Real-time rendering	Mass audience	Internet or kiosk
Presentation Visualization	User only observes	Precomputed rendering	Colleagues, mass audience	Slide shows, video

What is Data Visualization?

“Data visualization is not just about seeing data !

Is about UNDERSTANDING data,

and being able to make decisions based on the data”

by John C. Hart

Visualization today: IEEE - VIS

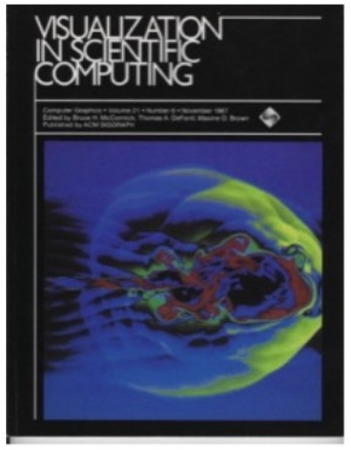
- **IEEE - VIS conference is a major venue for visualization from 1987 !**
  - **IEEE Visual Analytics Science and Technology (VAST)**
  - **IEEE Information Visualization (InfoVis)**
  - **IEEE Scientific Visualization (SciVis)**

- **http://www.aviz.fr/~bbach/vis25timeline/**

Visualization today: VIS 25 TIMELINE

1987

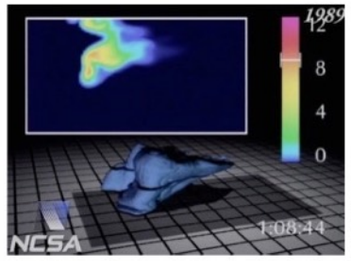
+ Add Visualization



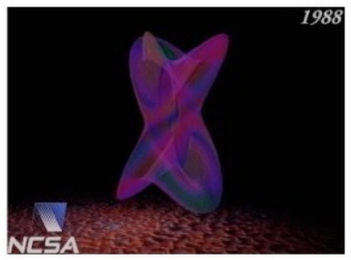
Visualization in Scientific Computing
B.H. McCormick, T.A Defanti, M.D Brown

1988

+ Add Visualization



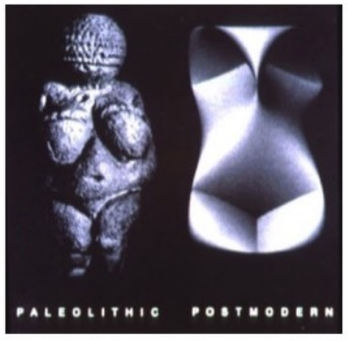
Thunderstorm
Donna National Center for Supercomputing Applications (NCSA)



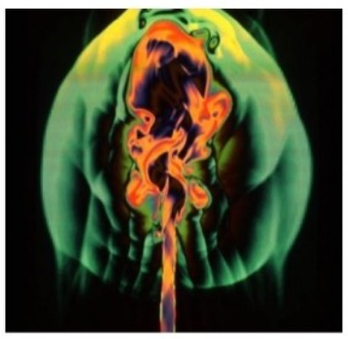
Venus
D. Cox, G. Francis, R. Idaszak (NCSA)

1989

+ Add Visualization



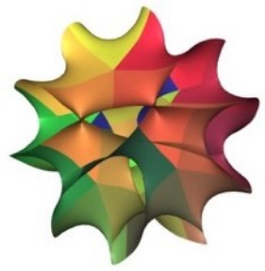
Donna Cox's Capstone talk at IEEE Visualization 1990
Donna Cox



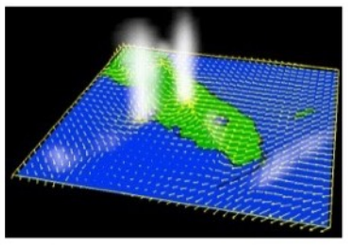
Donna Cox's Capstone talk at IEEE Visualization 1990
National Center for Supercomputing Applications (NCSA)

1990

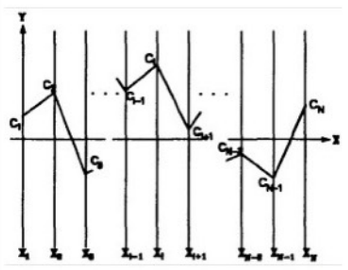
+ Add Visualization



Techniques for Visualizing Fermat's Last Theorem
A. Hanson, P. A. Heng, B. C. Kaplan



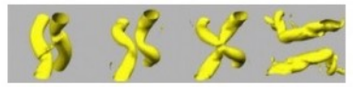
The Vis5D system for easy interactive visualization
W. Hibbard, D. Santek



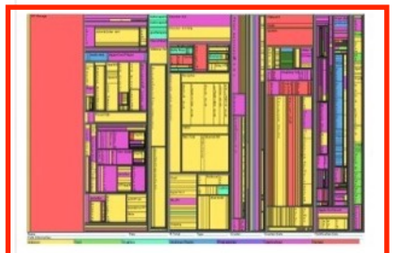
Parallel coordinates: a tool for visualizing multi-dimensional geometry
A. Inselberg, B. Dimsdale

1991

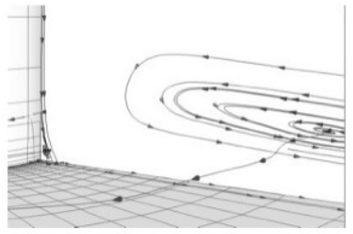
+ Add Visualization



Visualizing causal effects in 4D space-time vector fields
D. Silver, M. Gao, N. Zabusky



Tree-maps: A Space-filling Approach to the Visualzaition of Hierarchical Information Structures
B. Johnon, B. Shneiderman



A Tool for Visualizing the Topology of Three-dimensional Vector Fields
A. Globus, C. Levit, T. Lasinki

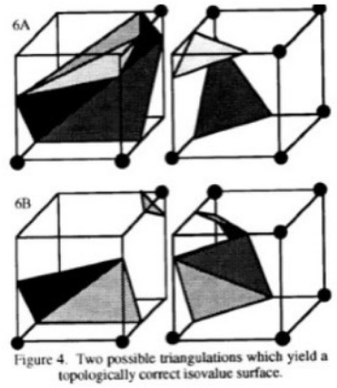


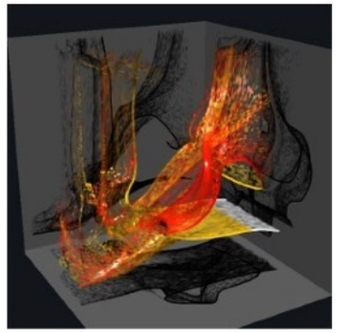
Figure 4. Two possible triangulations which yield a topologically correct isovalue surface.

The Symptotic Decider: Resolving the Ambiguity in Marching Cubes
G. M. Nielson, B. Hamann

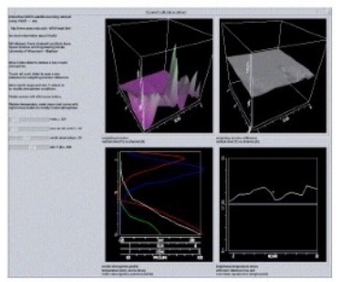
Visualization today: VIS 25 TIMELINE

1992

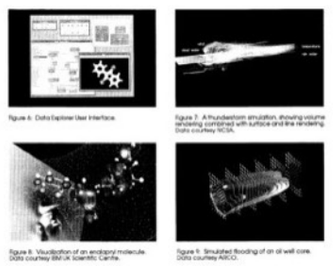
+ Add Visualization



Rendering Surface Particles
J. J. van Wijk



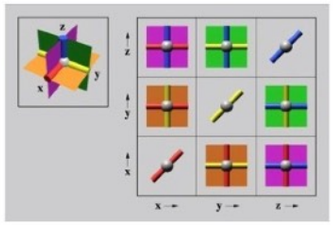
Display of scientific data structures for algorithm visualization
W. Hibbard, C. R. Dyer, B. E. Paul



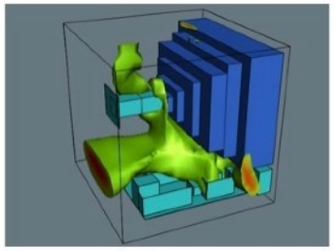
An architecture for a Scientific Visualization System
B. Lucas, G. Abram, N. Collins, D.A. Eppstein, D.L. Gresh, K.P. McAuliffe

1993

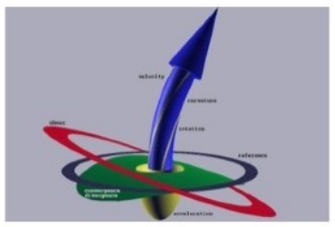
+ Add Visualization



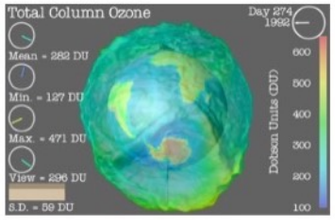
HyperSlice - Visualization of Scalar Functions of Many Variables
J. J. van Wijk, R. van Liere



Implicit Stream Surfaces
J. J. van Wijk

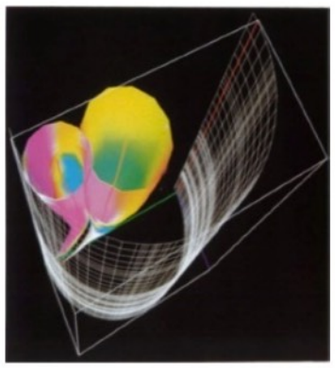


A Probe for Local Flow Field Visualization
W. C. de Leeuw, J. J. van Wijk

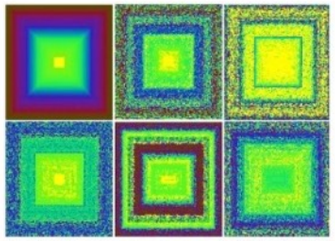


Visualization of Stratospheric Ozone Depletion and the Polar Vortex
L. Treinish

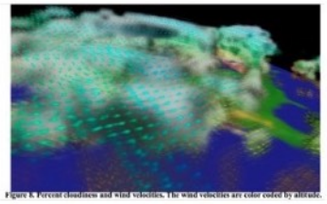
Cave picture
Electronic Visualization Laboratory (EVL)



Cloud Tracing in Convection-Diffusion Systems
K-L Ma, P. J. Smith



Visual Feedback in Querying Large Databases
D. A. Keim, H.-P. Kriegel and T. Seidl

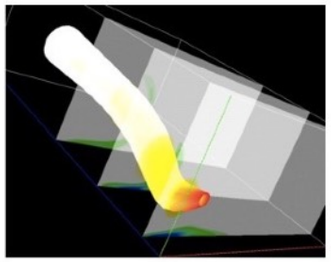


Texture Splats for 3D Scalar and Vector Fields Visualizations
R. Crawfis, N. Max

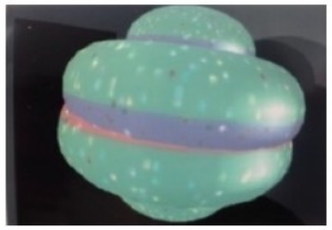
Visualization today: VIS 25 TIMELINE

1994

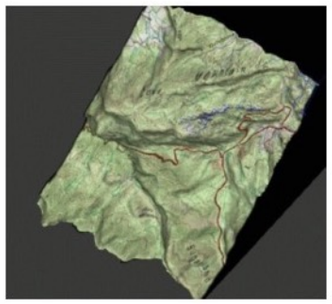
+ Add Visualization



3D Visualization of Unsteady 2D Airplane Wake Vortices
K-L. Ma



Virtual Reality Performance for Virtual Geometry
R.A. Cross and A.J. Hanson



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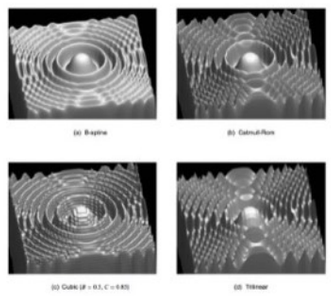

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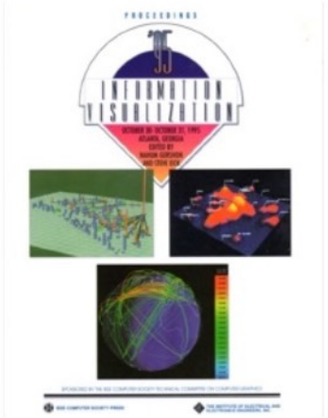

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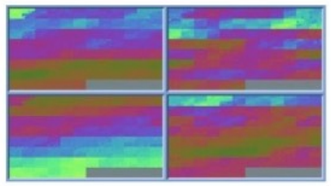

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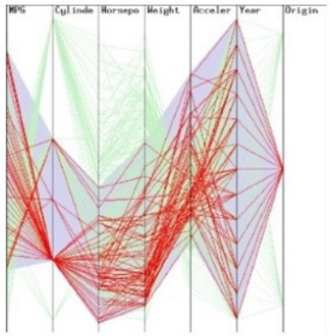

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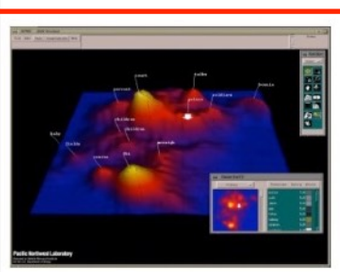

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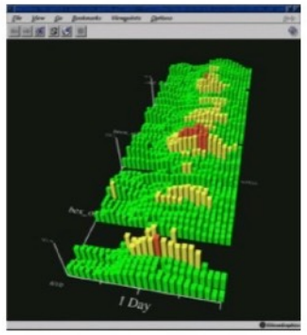

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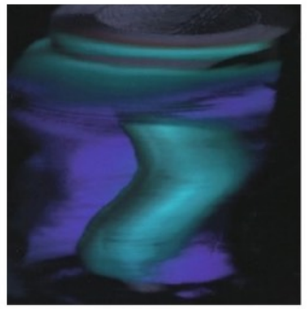

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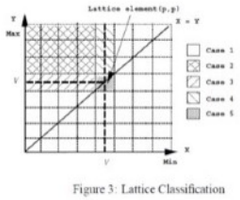

Figure 3: Lattice Classification

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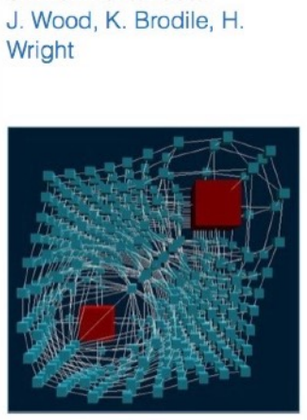

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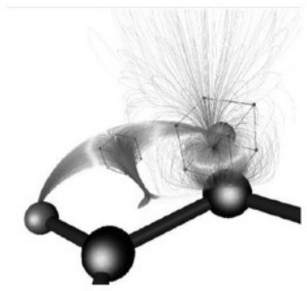

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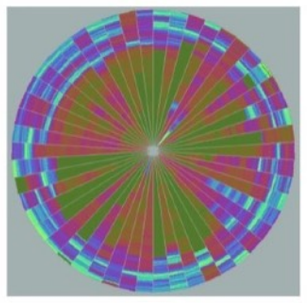

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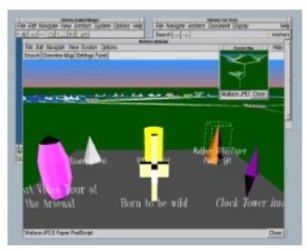

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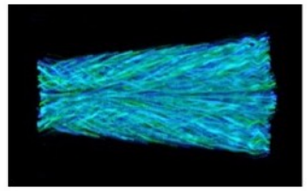

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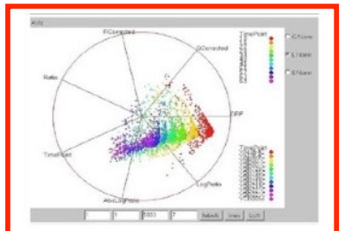

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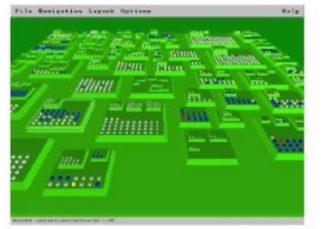

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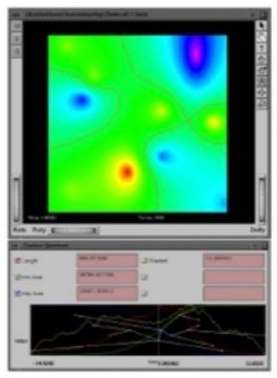

Figure 5: A 2D scalar field (top) with the associated contour spectrum with superimposed *contour tree* (bottom).

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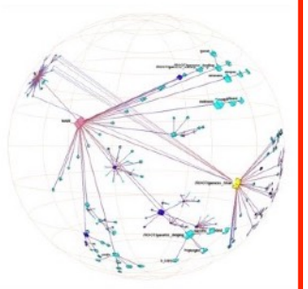

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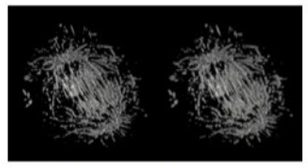

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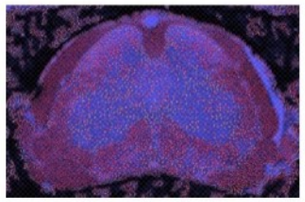

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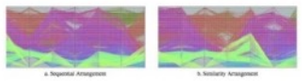

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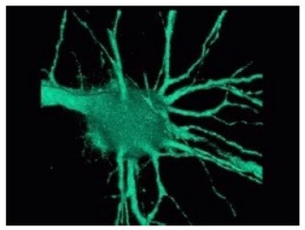

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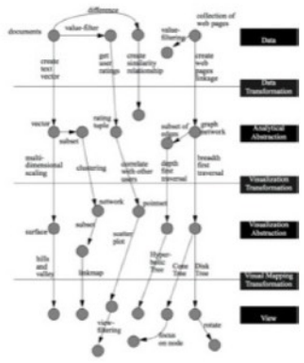

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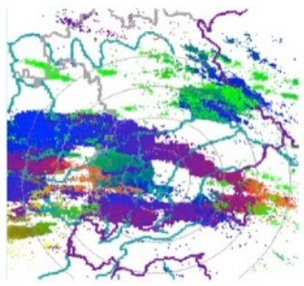

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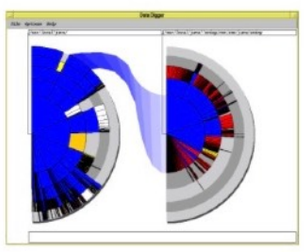

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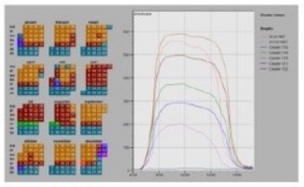

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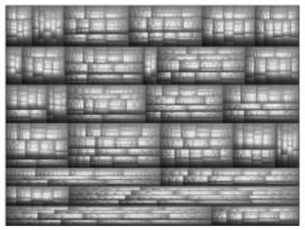

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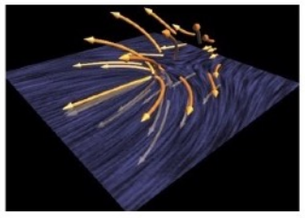

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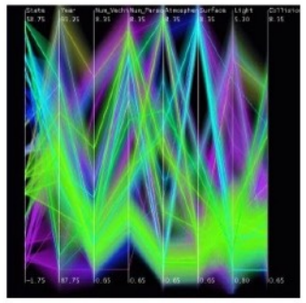

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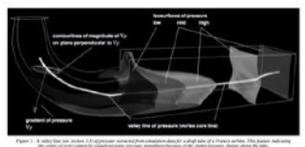

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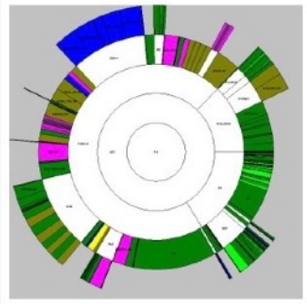

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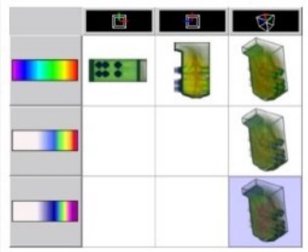

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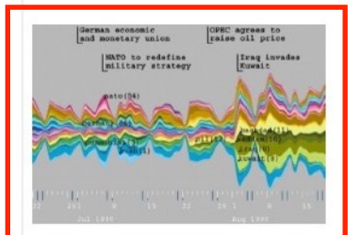

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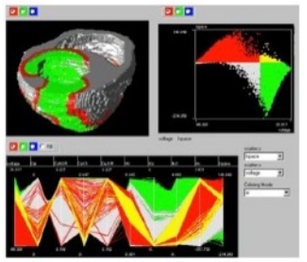

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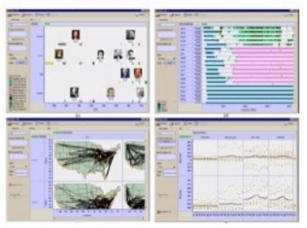

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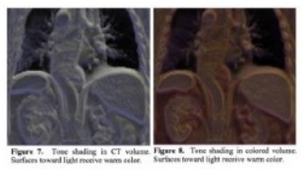

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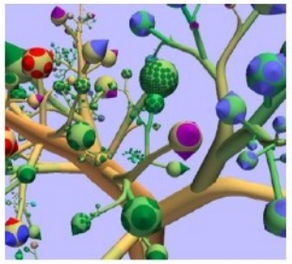

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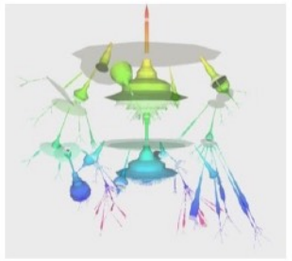

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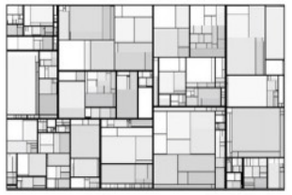

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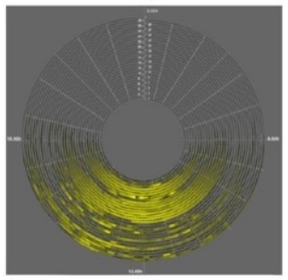

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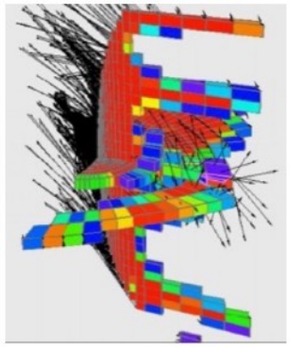

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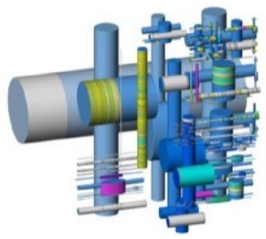

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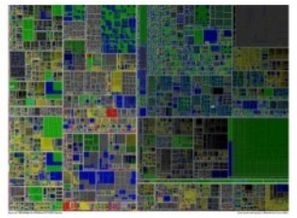

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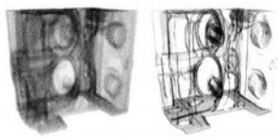

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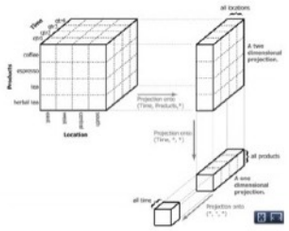

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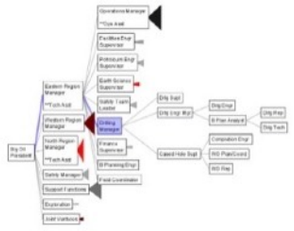

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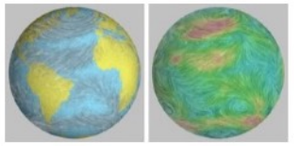
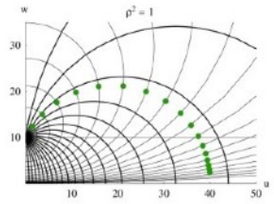


Image Based Flow Visualization for Curved Surfaces
J. J. van Wijk



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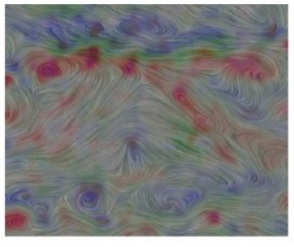
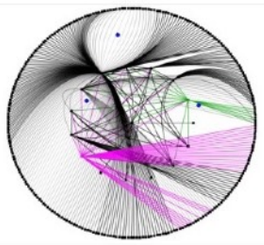
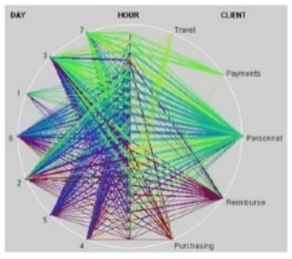
Smooth and efficient zooming and panning
J. J. van Wijk, W. A. A. Nuij



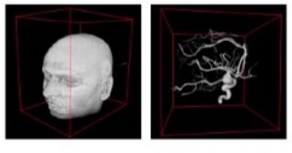
Effectively Visualizing Multi-Valued Flow Data Using Color and Texture
T. Urness, V. Interrante, I. Marusic, E. Longmire, B. Ganapathisubramani



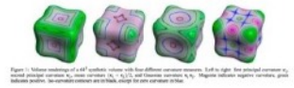
EdgeLens: An Interactive Method for Managing Edge Congestion in Graphs
N. Wong, S. Carpendale, S. Greenberg



Interactive-Poster: Business Impact Visualization
F. Casati, U. Dayal, M. C. Hao, D. A. Keim, J. Schneidewind



Acceleration Techniques for GPU-BAsed Volume Rendering
J. Kruger, R. Westermann



Curvature-Based Transfer Functions for Direct Volume Rendering: Methods and Applications
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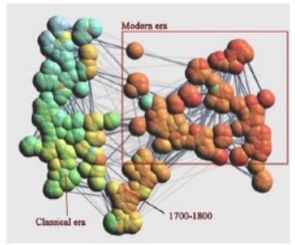
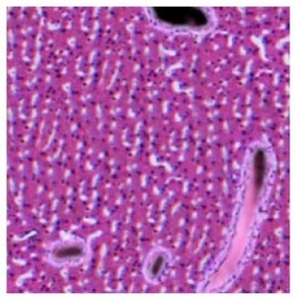
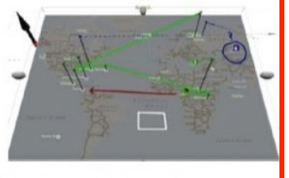


Interactive Visualization of Small World Graphs
F. van Ham, J. J. van Wijk

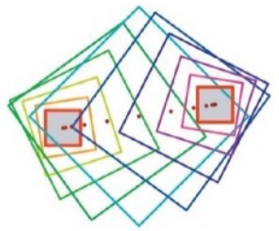


Enhancing volumetric datasets with sub-resolution detail using texture synthesis
L. Wang, K. Mueller



GeoTime Information Visualization
T. Kapler and W. Wright

RecMap: Rectangular Map Approximations
R. Heilmann, D. A. Keim, C. Panse and M. Sips



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A Model for Smooth Viewing and Navigationof Large 2D Information Spaces
J. J. van Wijk and W. A.A. Nuij

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Knowledge Precepts for Design and Evaluation of Information Visualizations
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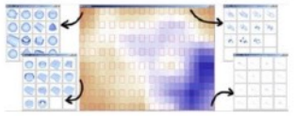
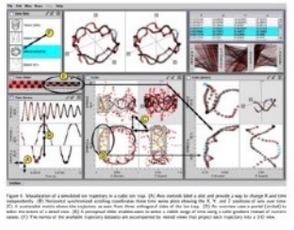
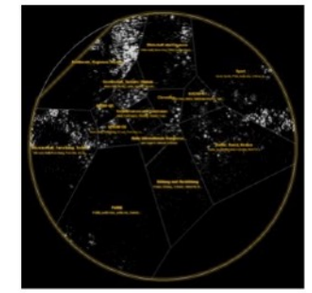


2D Maps for Visual Analysis and Retrieval in Large Multi-Feature 3D Model Databases
B. Bustos, D. A. Keim, C. Panse, T. Schreck



Building Highly-Coordinated Visualizations in Improvise
C. Weaver

The InfoVis Tookkit
J-D. Fekete



Evaluating a System for Interactive Exploration of Large, Hierarchically Structured Document Repositories
M. Granitzer, W. Kienreich, V. Sabol, K.Andrews, W. Klieber

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Visualization of the Genus of Knots
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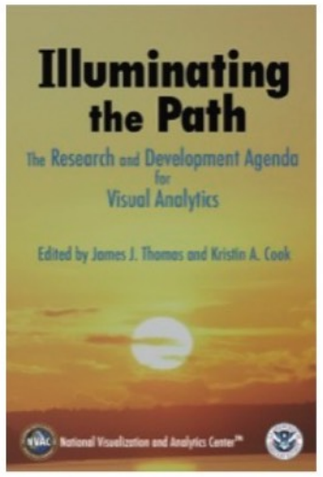
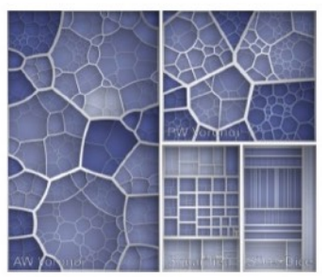


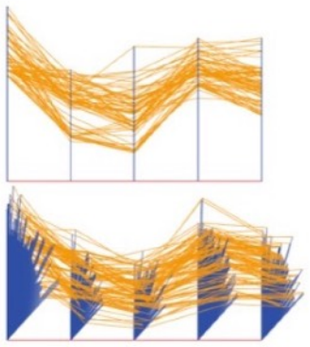
Illuminating the Path
J. J. Thomas, Kristin A. Cook

Baby Names, Visualization, and Social Data Analysis
M. Wattenberg

Vizster: Visualizing Online Social Networks
J. Heer, D. Boyd



Voronoi treemaps
M. Balzer, O. Deussen



An Interactive 3D Integration of Parallel Coordinates and Star Glyphs
E. Fanea, S. Carpendale, T. Isenberg

The Value of Visualization

Jarke J. van Wijk*
Dept. Mathematics and Computer Science
Technische Universiteit Eindhoven

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The Value of Visualization
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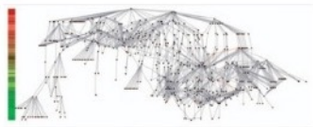
Dig-CoLa: directed graph layout through constrained energy minimization
T. Dwyer, Y. Kohen



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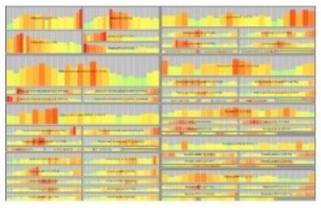
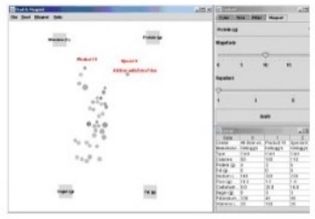
Drawing Directed Graphs using Quadratic Programming
T. Dwyer, Y. Kohen, K. Marriott



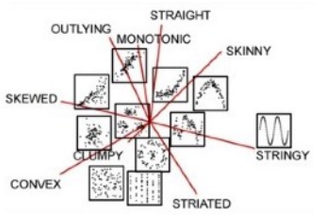
Importance-Driven Visualization Layouts for Large Time Series Data
M. C. Hao, D. A. Keim, U. Dayal, T. Schreck



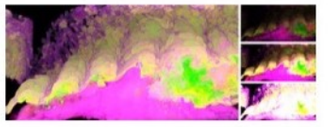
Dust & Magnet: Multivariate Information Visualization using a Magnet Metaphor
J. S. Yi, R. Melton, J. Stasko, J. Jacko

- Retrieve Value
- Filter
- Compute Derived Value
- Find Extremum
- Sort
- Determine Range
- Characterize Distribution
- Find Anomalies
- Cluster
- Correlate

Low-level Components of Analytic Activity in Information Visualization
R. Amar, J. Eagan, J. Stasko



Graph-Theoretic Scagnostics
L. Wilkinson, A. Anand, R. Grossman



High Dynamic Range Volume Visualization
X. Yuan, M.X. Nguyen, B. Chen, D. H. Porter

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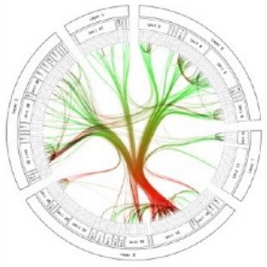

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Hierarchical Edge Bundles: Visualization of Adjacency Relations in Hierarchical Data
D. Holten

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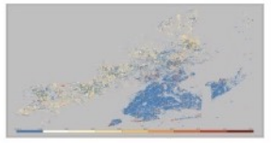
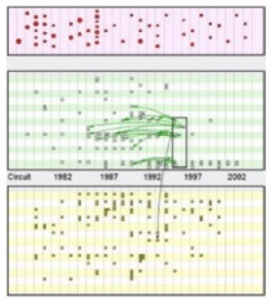
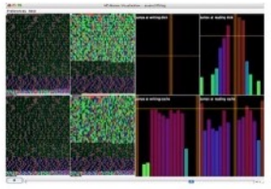


Visualization of Geo-spatial Point Sets via Global Shape Transformation and Local Pixel Placement
C. Panse, M. Sips, D. A. Keim and S. C. North

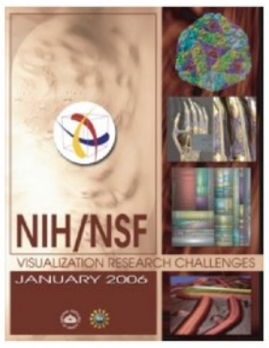
Jim Thomas presentations with images from the 2004 - 2006 time frame -> founding of VAST symposium during IEEE VIS week.
J. Thomas



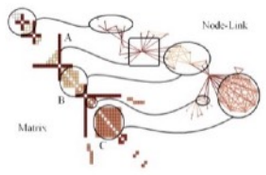
Network Visualization by Semantic Substrates
B. Shneiderman, A. Aris



Interactive Poster: Exploring Block Access Patterns of Native XML Storage
H. Janetzko, D. A. Keim, M. Kramis, F. Mansmann, M. Waldvogel



Visualization Research Challanges (NIH/NSF)
C. Johnson, R. Moorhead, T. Munzner, H. Pfister, P.



MatrixExplorer: a Dual-Representation System to Explore Social Networks
N. Henry, J-D. Fekete

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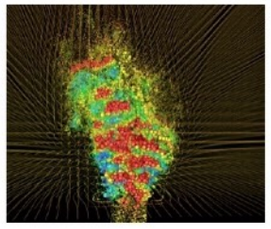
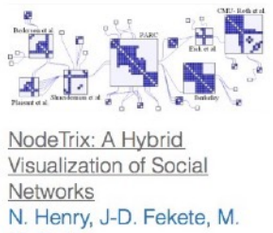
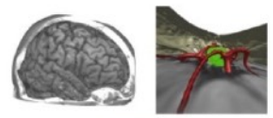
Many Eyes: A Site for Visualization at Internet Scale
F. B. Viegas, M. Wattenberg, F. van Ham, J. Kriss, M. McKeon



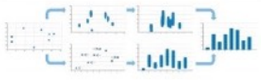
Time Dependent Processing in a Parallel Pipeline Architecture
J. Biddiscombe, B. Geveci, K. Martin, K. Moreland, D. Thompson



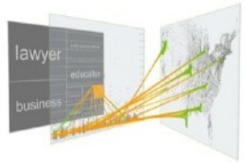
NodeTrix: A Hybrid Visualization of Social Networks
N. Henry, J-D. Fekete, M. McGuffin



High-Quality Multimodal Volume Rendering for Preoperative Planning of Neurosurgical Interventions
J. Beyer, M. Hadwiger, S. Wolfsberger, K. Buehler



Animated Transitions in Statistical Data Graphics
J. Heer, G. Robertson



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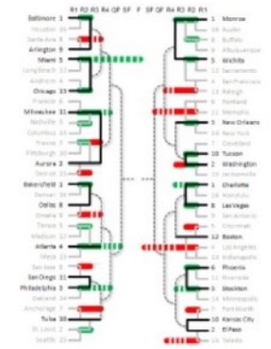
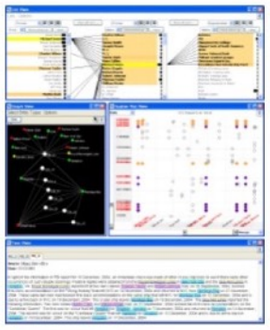
Visualizing the History of Living Spaces
Y. A. Ivanov C. R. Wren, A. Sorokin, I. Kaur

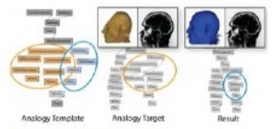


AdaptiviTree: Adaptive Tree Visualization for Tournament-Style Brackets
D. Tan, G. Smith, B. Lee, G. Robertson



Jigsaw: Supporting Investigative Analysis through Interactive Visualization
J. Stasko, C. Gorg, Z. Liu, K. Singhal

Interactive Tree Comparison for Co-located Collaborative Information Visualization
P. Isenberg, S. Carpendale



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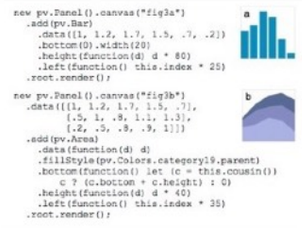
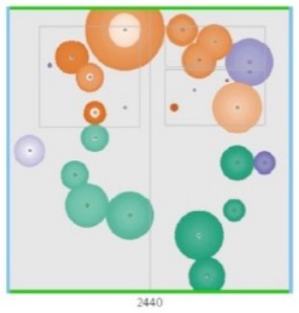
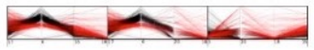


Protovis: A Graphical Toolkit for Visualization
M. Bostock, J. Heer

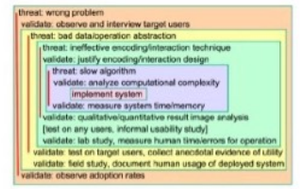
Participatory Visualization with Wordle
F.B. Viegas, M. Wattenberg, J. Feinberg



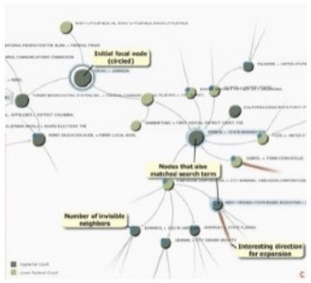
Spatiotemporal Analysis of Sensor Logs using Growth Ring Maps
P. Bak, F. Mansmann, H. Janetzko, D. A. Keim



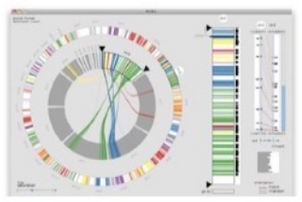
Combining automated analysis and visualization techniques for effective exploration of high-dimensional data
A. Tatu, G. Albuquerque, M. Eisemann, J. Schneidewind, H. Theisel, M. Magnor, D. A. Keim



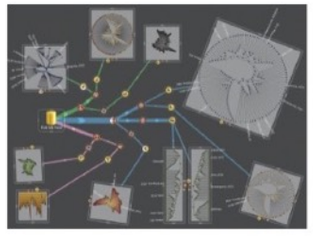
A Nested Model for Information Visualization and Design
T. Munzner



"Search, Show Context, Expand on Demand": Supporting Large Graph Exploration with Degree-of-Interest
F. van Ham, A. Perer



MizBee: A Multiscale Synteny Browser.
M. Meyer, T. Munzner, H. Pfister



Lark: Coordinating Co-located Collaboration with Information Visualization
M. Tobiasz, P. Isenberg, S. Carpendale

Visual Opinion Analysis of Customer Feedback Data
D. Oelke, M. C. Hao, C. Rohrdantz, D. A. Keim, U. Dayal, L.-E. Haug, H. Janetzko

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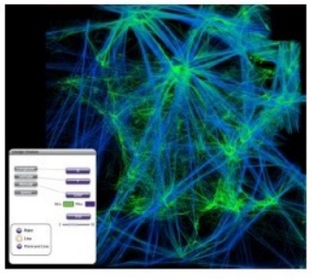
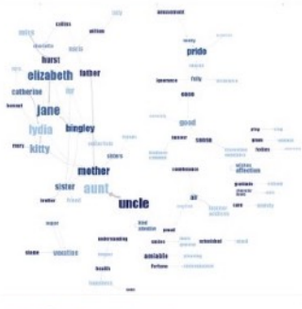
S. Johansson, J. Johnansson



FromDaDy: spreading data across views to support iterative exploration of aircraft trajectories.
C. Hurter, B. Tissoires, S. Conversy



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Mapping Text with Phrase Nets
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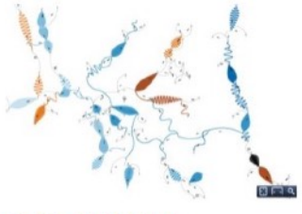

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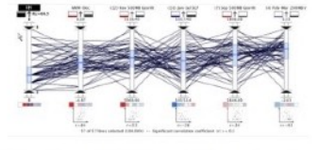
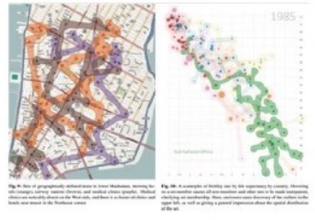


Guided Analysis of Hurricane Trends Using Statistical Processes Integrated with Interactive Parallel Coordinates
C. Steed, J.E. Swan II, T.J. Jankun-Kelly, P. Fitzpatrick



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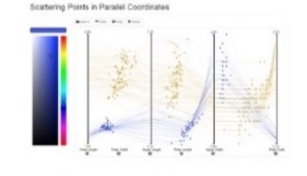

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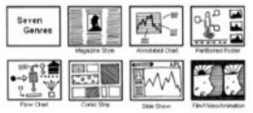

Narrative Visualization: Telling Stories with Data
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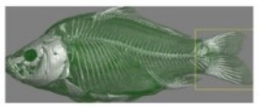
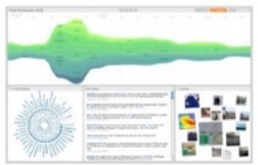


VDVR: Verifiable Volume Visualization of Projection-Based Data
Z. Zheng, W. Xu, and K. Mueller



A Visual Backchannel for Large-Scale Events
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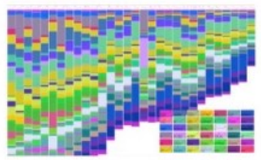
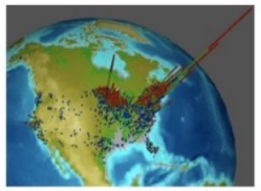


Visual Market Sector Analysis for Financial Time Series Data
H. Ziegler, M. Jenny, T. Gruse, D. A. Keim



Stacking Graphic Elements to Avoid Over-Plotting
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Behaviorism: A Framework For Dynamic Data Visualization
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J. Waser, R. Fuchs, H. Ribicic, B. Schindler, G. Boschl, e. Groller

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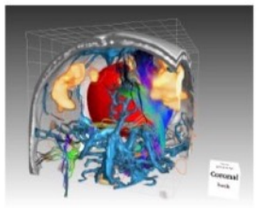

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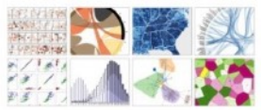

D3 Data-Driven Documents
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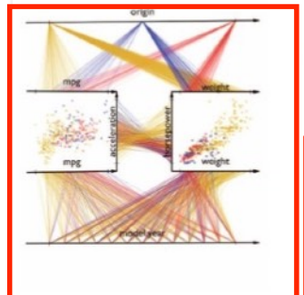
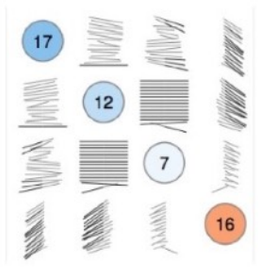
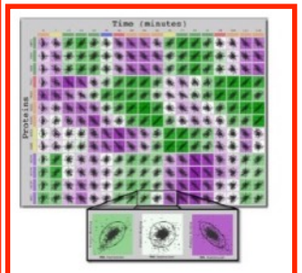


Flexible Linked Axes for Multivariate Data Visualization
J. H. T. Claessen, J. J. van Wijk

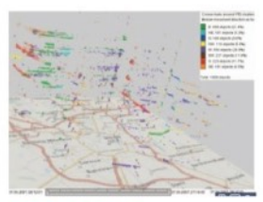
Visual Thinking In Action: Visualizations As Used On Whiteboards
J. Walny, S. Carpendale, N. Henry Riche, G. Venolia, P. Fawcett



Asymmetric Relations in Longitudinal Social Networks
U. Brandes, B. Nick



Visualizing Global Correlation in Large-Scale Molecular Biological Data
A.N.M. Choudhury, K. Potter, T-M. Rhyne, Y. Livnat, C. Johnson, O. Alter



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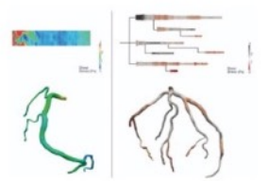

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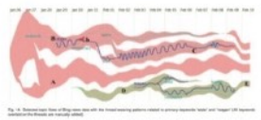
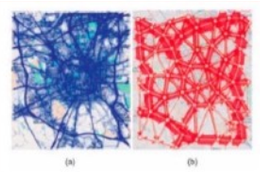
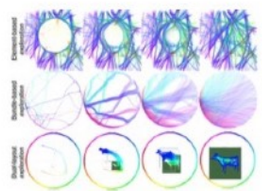


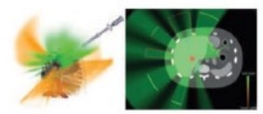
TextFlow: Towards Better Understanding of Evolving Topics in Text
W. Cui, S. Liu, L. Tan, C. Shi, Y. Song, Z. Gao, H. Qu, X. Tong



Spatial Generalization and Aggregation of Massive Movement Data
N. Adrienko, G. Adrienko



MoleView: An Attribute and Structure-Based Semantic Lens for Large Element-Based Plots.
C. Hurter, O. Ersoy, A. Telea.



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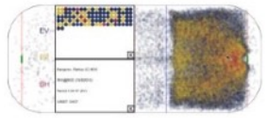
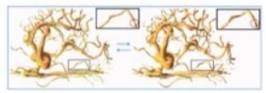
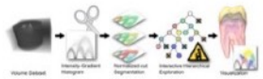


SnapShot: Visualization to Propel Ice Hockey Analytics
H. Pileggi, C. D. Stolper, J. M. Boyle, J. T. Stasko



Fuzzy Volume Rendering
N. Fout, K-L. Ma

Understanding Pen and Touch Interaction for Data Exploration on Interactive Whiteboards
J. Walny, B. Lee, P. Johns, N. Henry Riche, S. Carpendale



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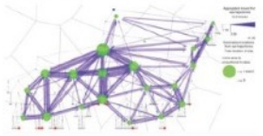

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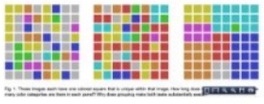

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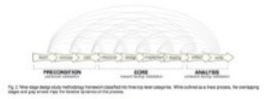

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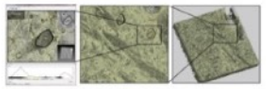

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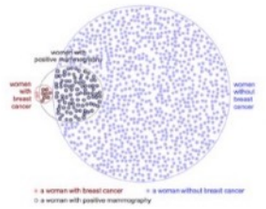

Assessing the Effect of Visualizations on Bayesian Reasoning through Crowdsourcing
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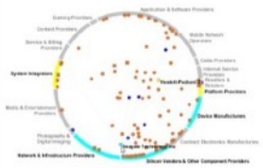
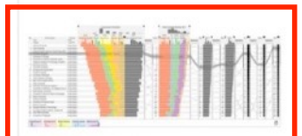


Understanding Interfirm Relationships in Business Ecosystems with Interactive Visualization
R. C. Basole, T. Clear, M. Hu, H. Mehrotra, and J. Stasko



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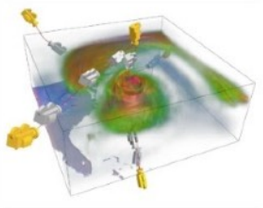

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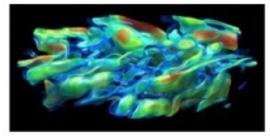
W-H. Hsu, Y. Zhang, K-L. Ma



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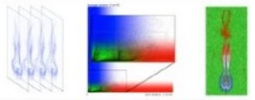
Y. Zhang, K-L. Ma



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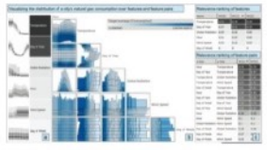

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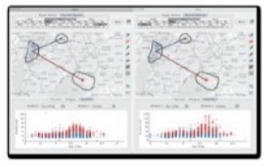
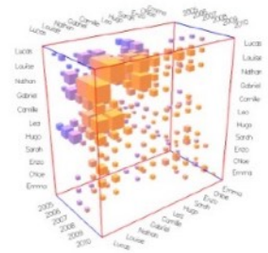
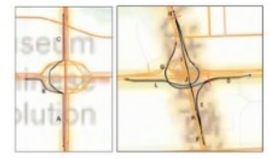


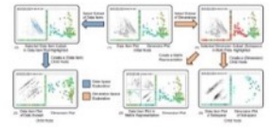
Visual Exploration of Big Spatio-Temporal Urban Data: A Study of New York City Taxi Trips
N. Ferreira, J. Poco, H. T. Vo, J. Freire, C. T. Silva



Visualizing Dynamic Networks with Matrix Cubes
B. Bach, E. Pietriga, J-D. Fekete



Visual Traffic Jam Analysis Based on Trajectory Data
Z. Wang, M. Lu, X. Yuan, J. Zhang, and H. van de Wetering



Dimension Projection Matrix/Tree: Interactive Subspace Visual Exploration and Analysis of High Dimensional Data
X. Yuan, D. Ren, Z. Wang, C. Guo

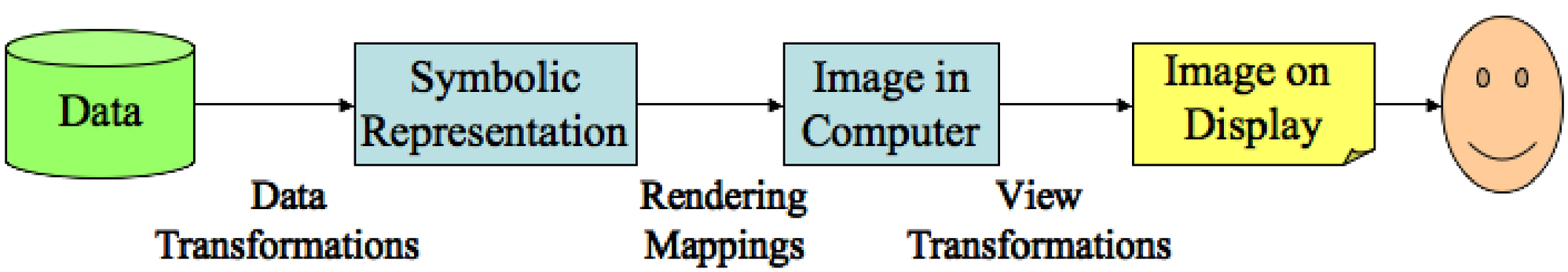
(Data) Visualization and other fields

Visualization and other fields

- **Visualization emerges as a sub-field of Computer Graphics, and is now a new field that encompasses aspects from *human-computer interaction*, *perceptual psychology*, *databases*, *statistics*, *data mining*, and *computer graphics*, and others.**
- ***Computer graphics* focus on graphical objects and the organization (and implementation) of graphical primitives.**
- **Visualization is the application of graphics to display data by mapping data to graphical primitives and rendering the display.**
- **In Computer Graphics the visual realism is often one major concern. In Visualization the focus is on finding an effective communication of information.**

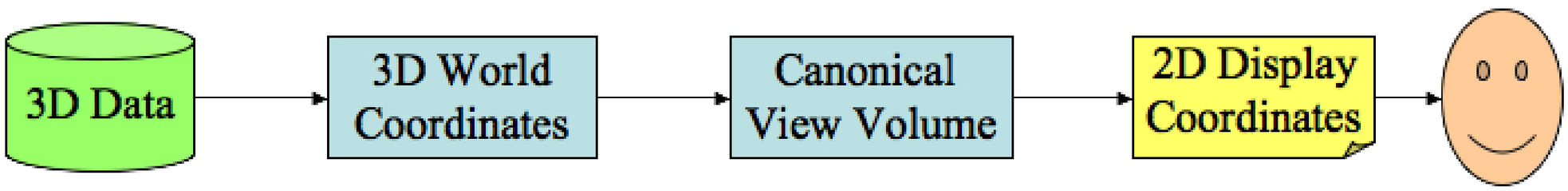
Visualization Process

- **What is involved in the Visualization process?**
  - **Type of data available for display**
  - **Type of the information the Viewer hopes to extract from (exploration; confirm hypotheses) or convey with the display (present results)**



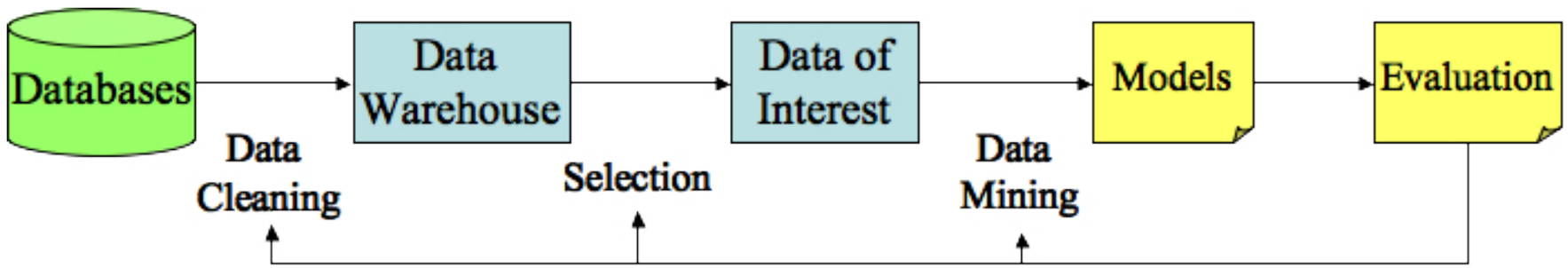
Visualization Process: computer graphics pipeline

- **For computer graphics the stages are:**
  - **Modeling: 3D model**
  - **Viewing: virtual camera**
  - **Clipping: bounds of the desired image**
  - **Hidden surface removal & Projection: mapping to a 2D system**
  - **Rendering: color, illumination, etc.**



Visualization Process: the knowledge discovery pipeline

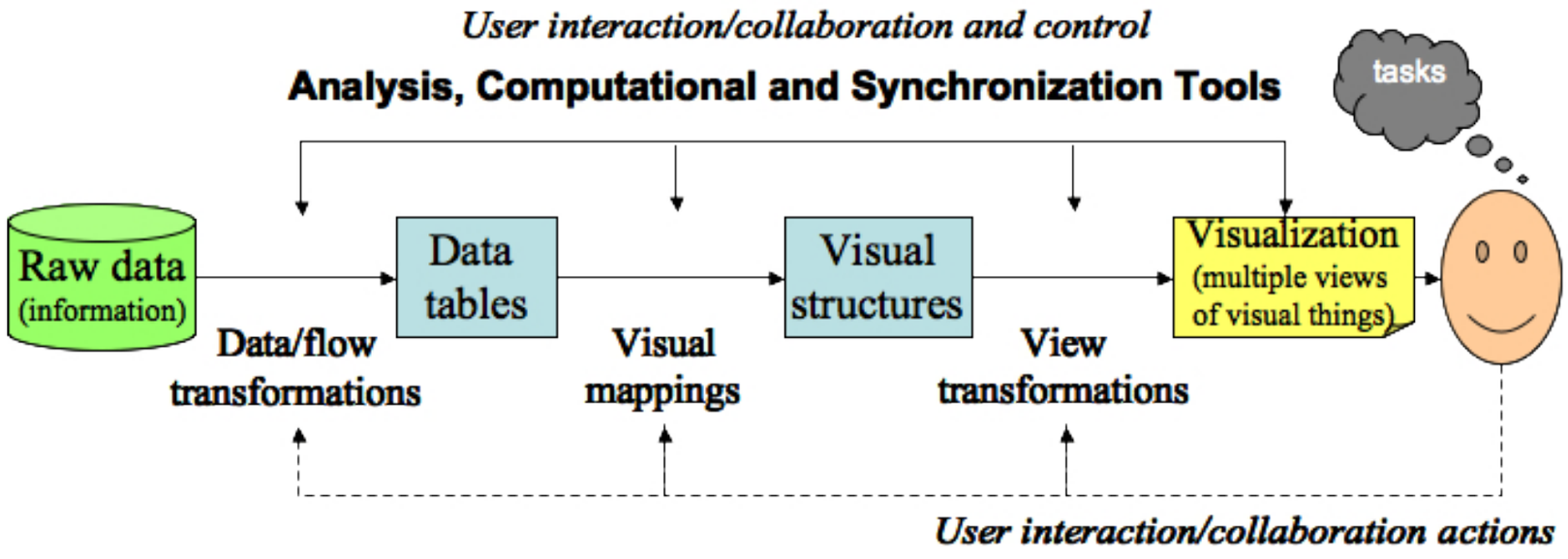
- **For knowledge discovery the stages are:**
  - **Data:**
  - **Data integration, cleaning, warehousing and selection:**
  - **Data mining:**
  - **Patter evaluation**
  - **Rendering or visualization:**



(*) Interactive visualization can be used at every step of KD pipeline

Visualization Process: visualization pipeline

- **For visualization the stages are:**
  - **Modeling: the data to be visualized**
  - **Data Selection: similar to clipping**
  - **Data to visual mappings: the heart of the visualization is mapping data values to graphical entities or their attributes; may involve scaling, shifting, filtering, interpolating, or subsampling.**
  - **Scene parameter setting: (ex: color mapping)**
  - **Rendering or generation of the visualization**



Visualization Process: visualization pipeline

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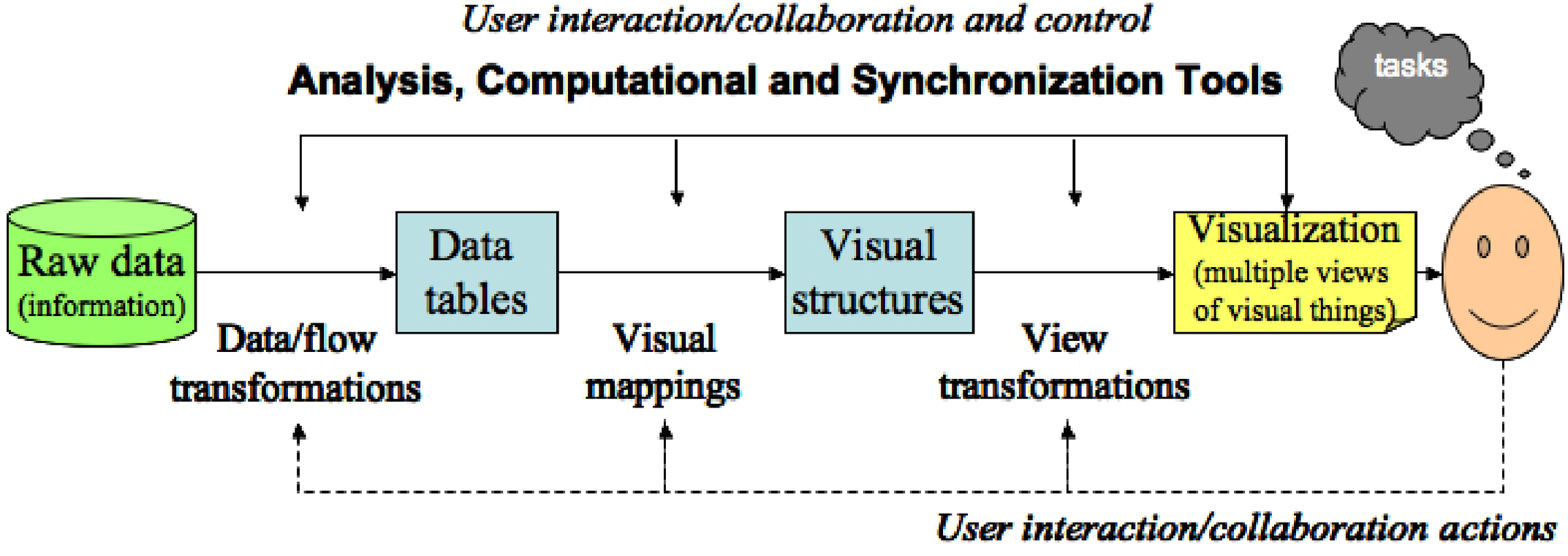
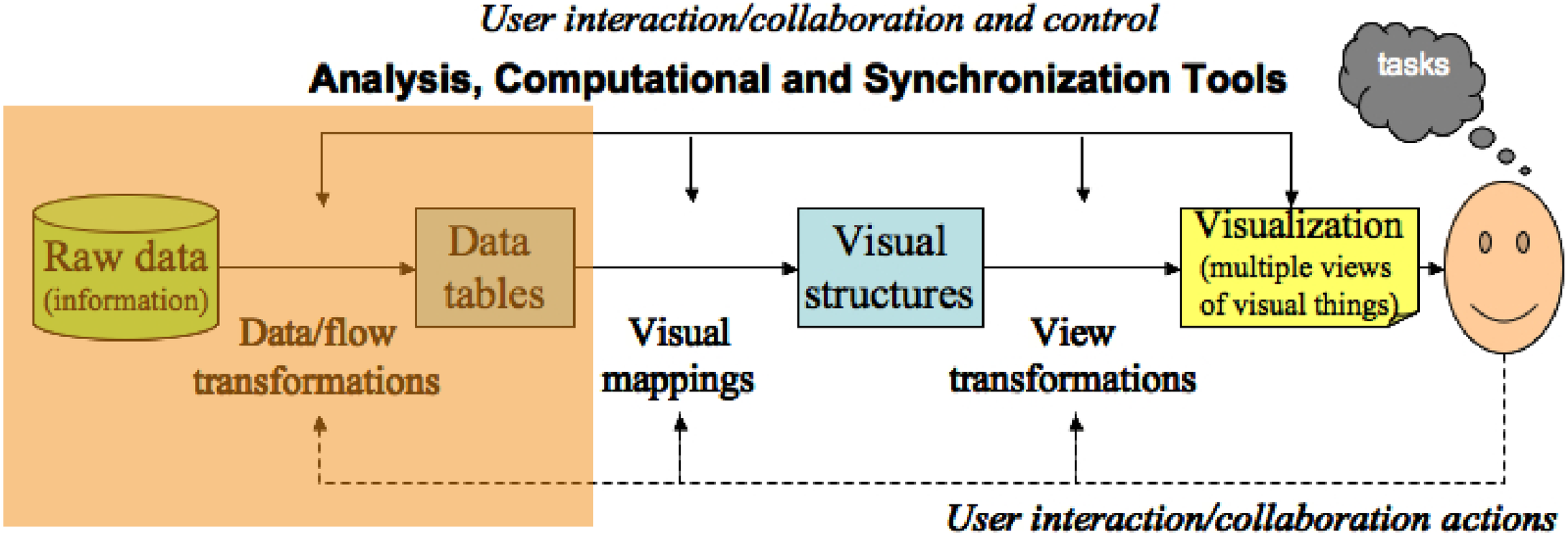
  - **Type of data available for display**
  - **Type of the information the Viewer hopes to extract from (exploration; confirm hypotheses) or convey with the display (present results)**



Visualization Process: visualization pipeline

- **What is involved in the Visualization process?**
  - **Type of data available for display**
  - **Type of the information the Viewer hopes to extract from (exploration; confirm hypotheses) or convey with the display (present results)**



Visualization Process: visualization pipeline

- **What is involved in the Visualization process?**
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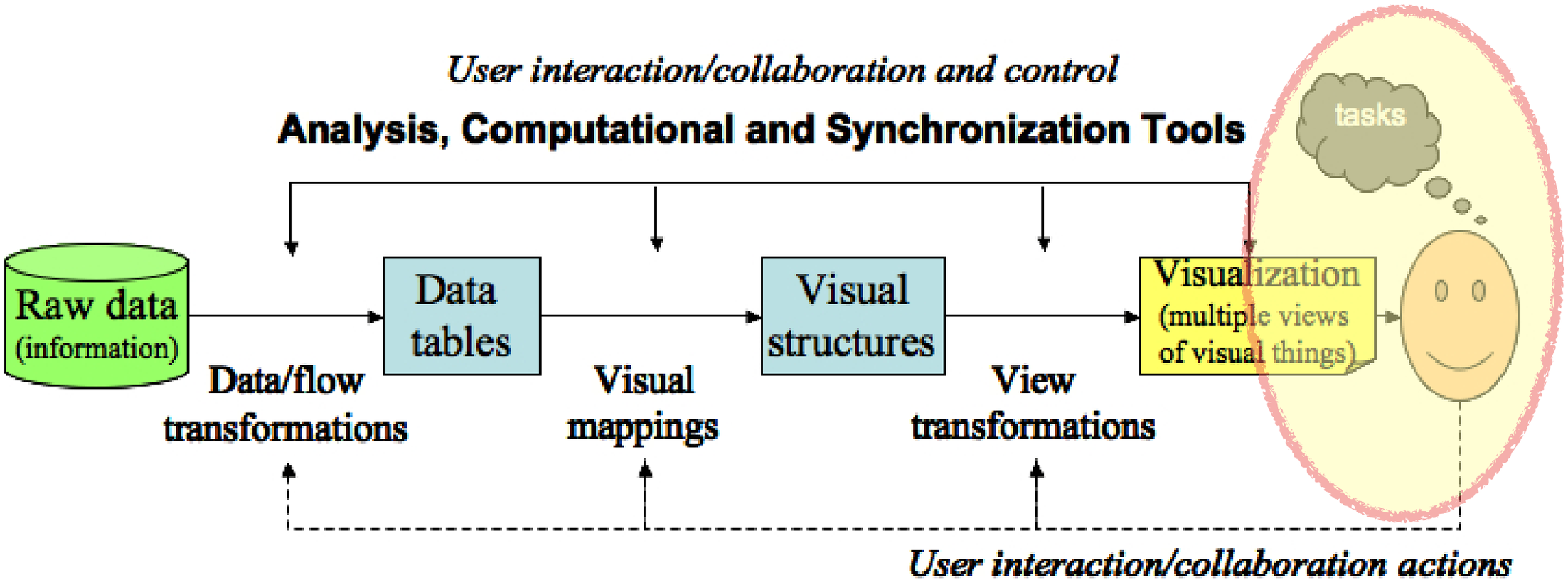
  - **Type of the information the Viewer hopes to extract from (exploration; confirm hypotheses) or convey with the display (present results)**



Further Reading and Summary

Q&A

Further Reading

- **Recommend Readings**
  - Interactive Data Visualization: Foundations, Techniques, and Applications, Matthew O. Ward et all, 2015, pages 1 - 38.
- **Supplemental readings:**
  - Cholera map's John Snow:
    - https://en.wikipedia.org/wiki/1854_Broad_Street_cholera_outbreak
  - Napoleon
    - https://en.wikipedia.org/wiki/Charles_Joseph_Minard
  - William Playfair:
    - https://en.wikipedia.org/wiki/William_Playfair
  - Florence Nightingale:
    - https://pt.wikipedia.org/wiki/Florence_Nightingale
  - Periodic table:
    - https://en.wikipedia.org/wiki/Periodic_table

Check - vis25timeline

What you should know

- **What is Visualization.**
  - grocking the data => take decisions
- **Data Visualization can be extremely powerful**
  - Uncover new patterns; confirm hypothesis;
- **Why Visualization is important.**
  - Stats not enough; communication needs; exploratory needs
- **Key aspects of today Visualizations.**
  - Interactions; visual abstractions; multiple (linked) visualizations.
- **The general steps of a Visualization Process**
  - **Raw data -> data -> viz structures -> images -> perception + feedback**
- **The role of Perception.**
  - The role and the importance of the user.

Further Reading and Summary

Q&A

Course Organization and Overview

Syllabus

Introduction to Data Visualization

What Is Visualization?
Relationship between Visualization and Other Fields.
The Visualization Process.
Data Foundations.
Human Perception and Information Processing.
Semiology of Graphical Symbols.
The Visual Variables.

Visualization Techniques

Visualization Techniques for Spatial Data
Visualization Techniques for Geospatial Data
Visualization Techniques for Time-Oriented Data
Visualization Techniques for Multivariate Data
Visualization Techniques for Trees, Graphs, and Networks
Text and Document Visualization

Interaction Concepts and Techniques

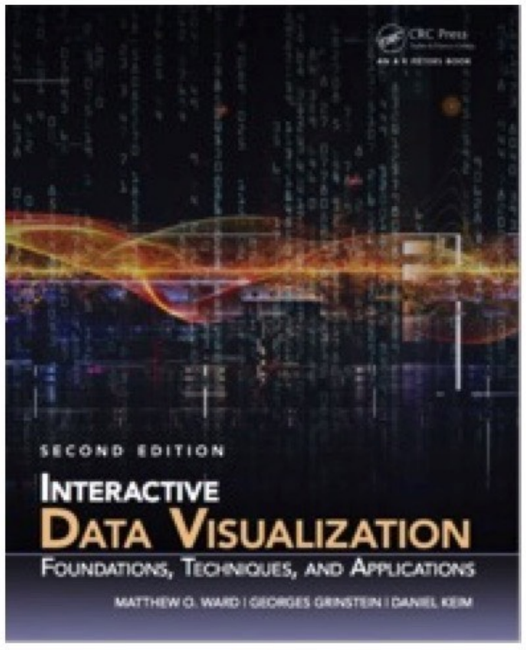
Interaction Operators, Operands and Spaces (screen, object, data, attributes)
Visualization Structure Space (Components of the Data Visualization)
Animating Transformations
Interaction Control
Designing Effective Visualizations
Comparing and Evaluating Visualization Techniques

Visualization Systems

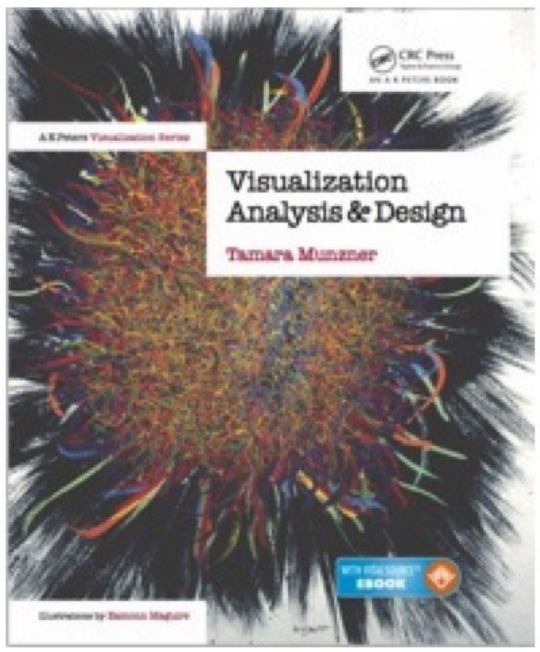
Systems Based on Data Type
Systems Based on Analysis Type
Text Analysis and Visualization
Modern Integrated Visualization Systems
Toolkits

Research Directions in Visualization

Bibliography

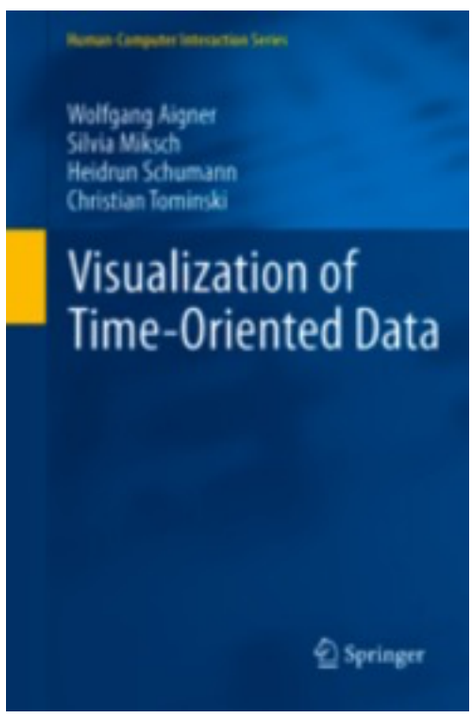


Interactive Data Visualization: Foundations, Techniques, and Applications
Matthew O. Ward, Georges Grinstein, Daniel Keim
2015, 2nd Edition
ISBN: 9781482257373
ISBN (e-Book): 9781482257397

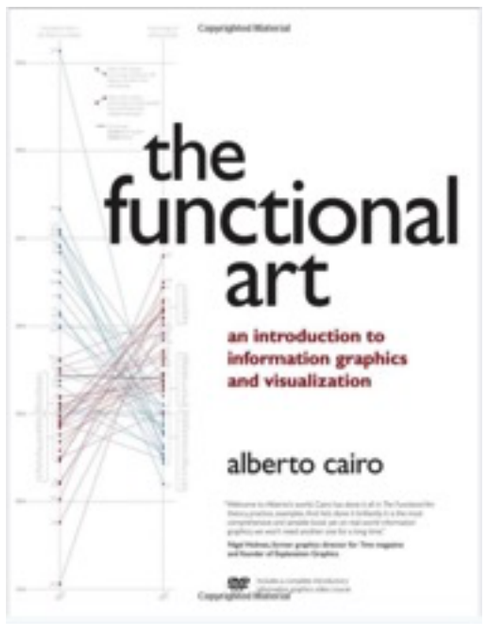


Visualization Analysis & Design
Tamara Munzner
2015,
ISBN: 9781466508910
ISBN (e-Book): 9781498707763

Bibliography



Visualization of Time-Oriented Data
Wolfgang Aigner, Silvia Miksch Heidrun Schumann, Christian Tominski



The Functional Art: An introduction to information graphics and visualization
Alberto Cairo

Bibliography

http://www.tableau.com

Weekly routine

- **Lectures - 1 x 2 h**

- **The lab sessions - 1 x 2 h**
  - **Demoing and Training**
  - **Project developing**

- **The recommended readings**

- **The recommended actions**

- **Meetings for student support if required**

Evaluation rules

- **Two mid-term written individual tests (25% each)**
- **One project (for team of two students), with several phases:**
  - **Specification**
  - **Paper (20%)**
  - **Code/implementation (30%)**
  - **(*) an oral discussion will be required to validate the project components**
- **Course approval requires the following minimal grades:**
  - **(mean (Test1; Test2) >= 10) AND (Test1 >= 8) AND (Test2 >= 8)**
  - **(mean(Paper;Code&Implementation) >= 10) AND**
- **Final exam may replace mean (Test1; Test2) if project is approved.**

Web Site: http://vid.ssdi.di.fct.unl.pt

IDV 17/18
Interactive Data Visualization

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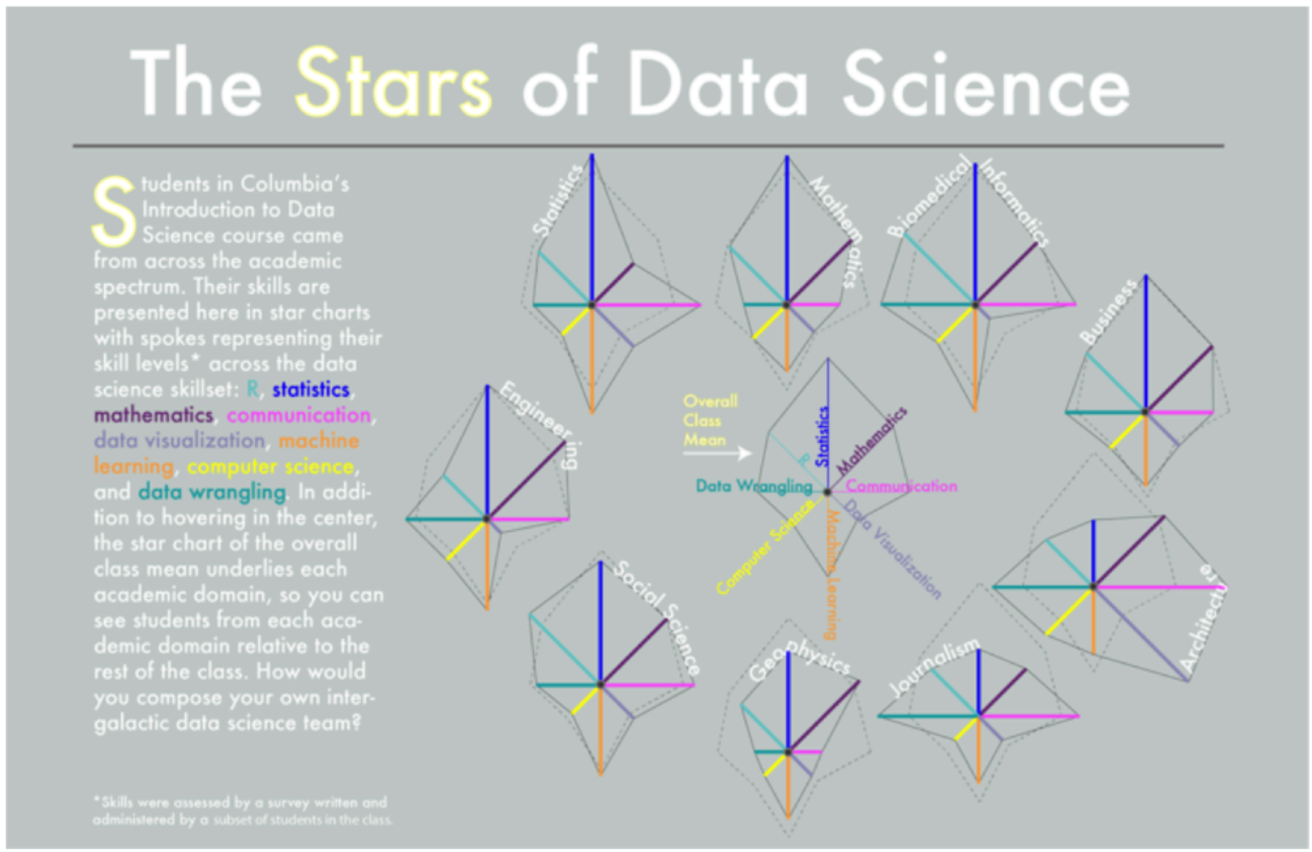
Notice
March 2018
VID RSS Feed

Visualization and Data Science

05 52 03 52 18 à30 10:43 Filed in: Notice

(Interactive Data) Visualization is a major component of Data Science. In the Columbia's Introduction to Data Science the student have different backgrounds. This image shows the students skills according 8 axes of competencies. See more here.



The IDV site is up and running

05 52 03 52 18 à20 10:43 Filed in: Notice

The site of Interactive Data Visualisation is up and running. This site is public and will be the most important communication channel with the students.

VID - Visualização Interactiva de Dados

Web Site: News

IDV 17/18
Interactive Data Visualization

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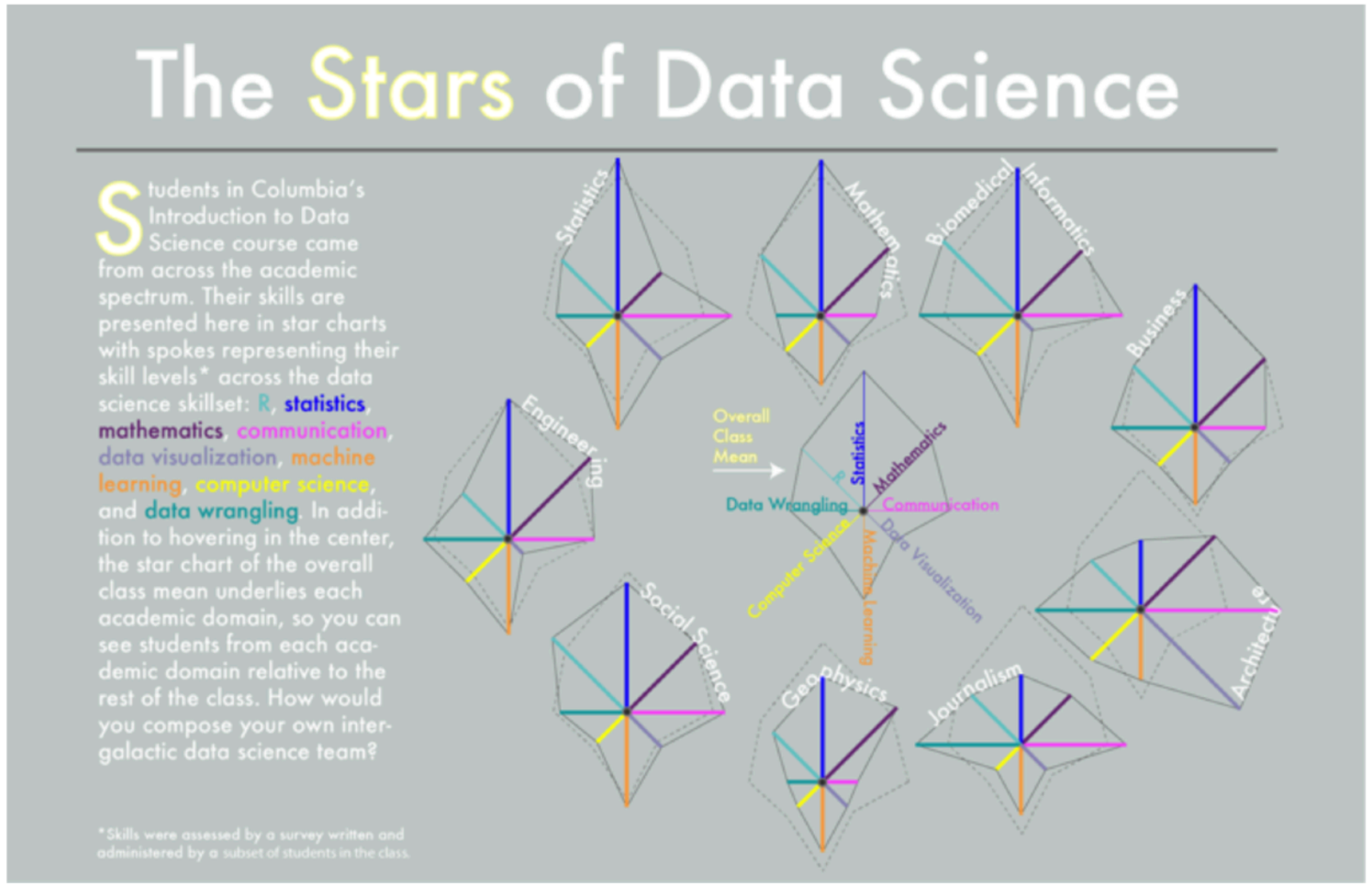

Web Site: Information

IDV 17/18
Interactive Data Visualization

FACULDADE DE CIÊNCIAS E TECNOLOGIA
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Interactive Data Visualisation (**IDV**) is a 6 ECTS curricular unit of the set of specialization units offered to the students of 4th or 5th year of Mestrado Integrado em Engenharia Informática (MIEI), and to students of Mestrado em Análise e Engenharia de Big Data (MAEDBD). Interactive Data Visualization presents the theoretical basis and practices for the design, use and evaluation of modern systems for Interactive Data Visualisation.

This course is provided by Departamento de Informática (DI) da Faculdade de Ciências e Tecnologia (FCT) da Universidade Nova de Lisboa (UNL).

Objectives:
Knowledge:

- What is Information Visualization, Data Visualisation (DV) and the different purposes of DV.
- The role of interactivity in DV and the general interaction patterns.
- The concept of Visual Variable and the practical consequence in the design of Interactive Data Visualization (IDV).
- The classification of data for DV purposes and the impact on IDV.
- For each type of data the most relevant available techniques.
- Due to its wide applicability, some deep understanding on Visualization Techniques for multivariate Data time oriented data and Geospatial Data.
- The main components of general IDV systems and the principal characteristics required on modern IDV systems.
- The available approaches to Compare and Evaluate Visualization Techniques and Systems.
- The actual trends in IDV and their role in more general systems and applications.

Application:

- Choose the visual variables and visualization techniques for a given data set and purposes.
- Use a given an existing IDV system to explore one or more data sets.
- Based on existing frameworks and platforms, design and build an IDV system appropriate for a class of data sets and a class of exploration and visualization tasks.
- Setup an experimental environment to evaluate a DV technique. Analyze the data gathered in the experimentation.

Soft-Skills:

- Understand the multidisciplinary nature of the area and the relationship with other areas.
- Explore the experimental nature for design IDV systems.

Prerequisites:
None

Teacher
Prof. João Moura Pires (jmp@fct.unl.pt) at office P3/2 and Tel: 10746.

Interactive Data Visualisation (**IDV**) is a 6 ECTS curricular unit of the set of specialization units offered to the students of 4th or 5th year of Mestrado Integrado em Engenharia Informática (MIEI), and to students of Mestrado em Análise e Engenharia de Big Data (MAEDBD). Interactive Data Visualization presents the theoretical basis and practices for the design, use and evaluation of modern systems for Interactive Data Visualisation.

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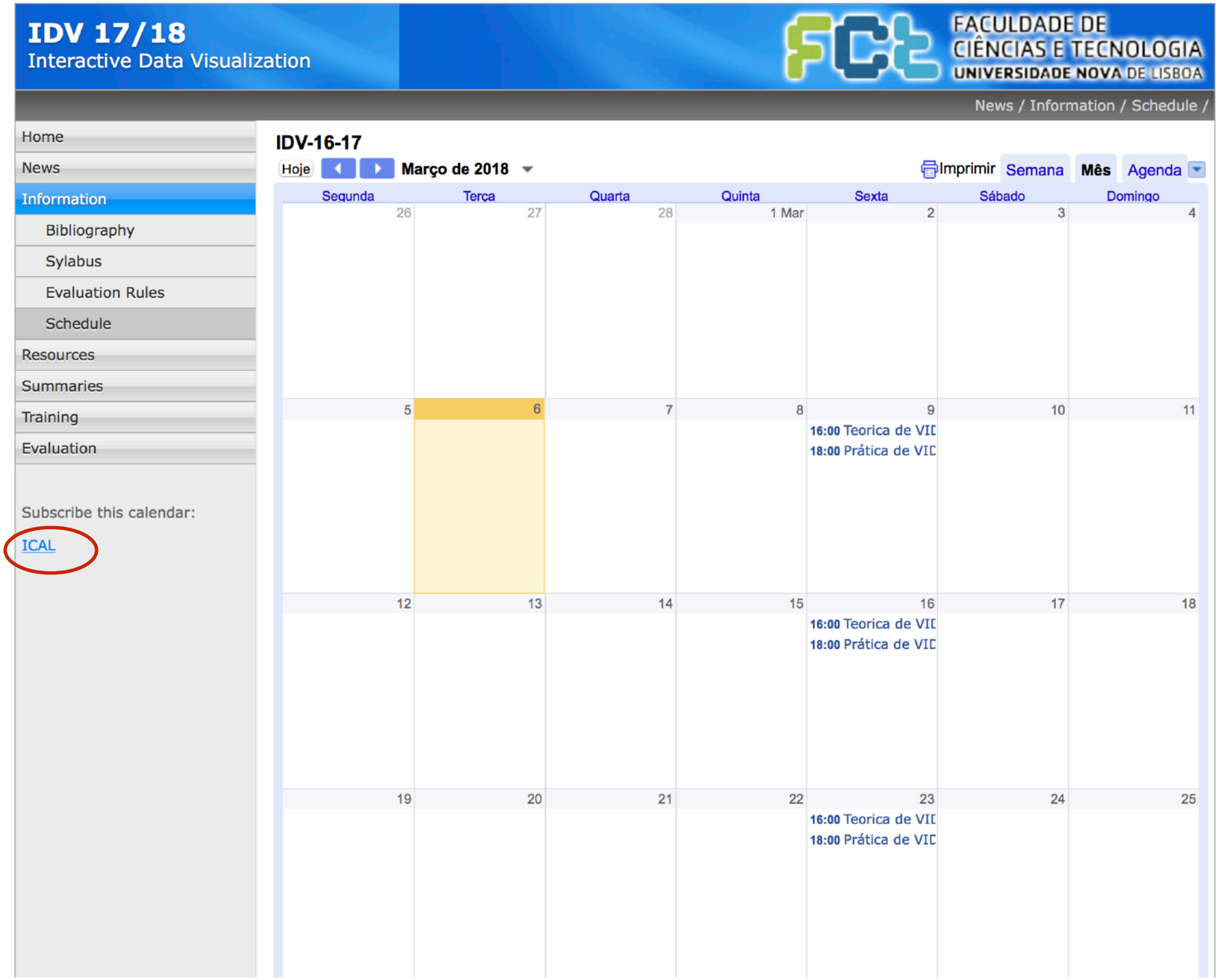
Web Site: Information / Schedule



Web Site: Resources / Lectures

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Material used by the teacher during the lectures.

IDV-01-COURSE OVERVIEW [PDF]
What we mean by "Interactive Data Visualization"? What is Visualization? Why Visualization is important? Early Visualizations; Visualization today; Visualization and other fields. Visualization Process; The role of Perception. Course Organization and Overview: Syllabus; Bibliography; Evaluation rules; important dates, etc

João Moura Pires STAResearch.NET Contact Me

Web Site: Resources / Papers

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Recommended papers.

Some suggested by the students

POLARIS: A SYSTEM FOR QUERY, ANALYSIS, AND VISUALIZATION OF MULTIDIMENSIONAL DATABASES
By Chris Stolte, Diane Tang, and Pat Hanrahan

A FEATURE-INTEGRATION THEORY OF ATTENTION
By Annem. Treisman and Garrygelade.

VISUAL SEARCH AND ATTENTION: A SIGNAL DETECTION THEORY APPROACH
By Preeti Verghese

THE STRUCTURE OF THE INFORMATION VISUALIZATION DESIGN SPACE
By Stuart K. Card and Jock Mackinlay

AN OPERATOR INTERACTION FRAMEWORK FOR VISUALIZATION SYSTEMS
By Ed Huai-hsin Chi, John T. Riedl

TOUR THROUGH THE VISUALIZATION ZOO
A survey of powerful visualization techniques, from the obvious to the obscure, by Jeffrey Heer, Michael Bostock, and Vadim Ogievetsky

TREE VISUALIZATION WITH TREE-MAPS: 2-D SPACE-FILLING APPROACH
By Ben Shneiderman

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In this area we will share some useful links. Please contribute with your suggestions

From the main bibliography

- The companion web site of "**Interactive Data Visualization: Foundations, Techniques, and Applications**": http://www.idvbook.com
- The companion web site of "**Visualization Analysis and Design**": http://www.cs.ubc.ca/~tmm/vadbook/
- The companion web site of "**The Functional Art: An introduction to information graphics and visualization**": http://www.thefunctionalart.com
- The companion web site of "**Visualization of Time-Oriented Data**": http://www.timeviz.net

Tools

- Data-Driven Documents: http://d3js.org

Recommended

- Revive 25 Years of Visualization Research in the VIS25 timeline: http://www.aviz.fr/~bbach/vis25timeline/

Surveys

- The 14 best data visualization tools: http://thenextweb.com/dd/2015/04/21/the-14-best-data-visualization-tools/
- Datavisualization.ch Selected Tools: http://selection.datavisualization.ch

Recommended by the students

- Color encyclopedia : Information and conversion: http://www.colorhexa.com/ (recommended by Nuno Martins)
- Javascript library help you to select appropriate color maps https://github.com/gka/chroma.js (recommended by Ricardo Silva)

Recommended by the students 16/17

- Visualização dos "inner workings" de uma rede de convulsão: http://scs.ryerson.ca/~aharley/vis/conv/ (Relacionado com a forma como o olho funciona (feature maps)).
- Graphlab, framework para visualização de dados, processamento em escala e machine learning em python. https://turi.com/products/create/ (Há licenças gratuitas para estudantes).
- To find datasets: https://www.kaggle.com/datasets (suggested by Sara Rosa and João Monteiro)

Propose useful stuff

Web Site: Summaries

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Lectures

RSS Feed

[T01]: Course overview

09 Mar 2018, 04:10 PM Filed in: Lectures

What we mean by "Interactive Data Visualization"? What is Visualization? Why Visualization is important? Early Visualizations; Visualization today; Visualization and other fields. Visualization Process; The role of Perception.

Course Organization and Overview: Syllabus; Bibliography; Evaluation rules; important dates, etc..

Recommended Readings: (i) Interactive Data Visualization: Foundations, Techniques, and Applications, Matthew O. Ward et all, 2010, pages 1 - 33.

Recommended Activities: (ii) Visit the various sections of this site; **(iii)** instal Tableau software on your computer. Follow the link http://www.tableau.com/academic/students.

To Know:

- What is Visualization.
- The main "applications" of Visualization.
- Why Visualization is important.
- Key aspects of today Visualizations.
- Some important landmarks of early visualizations. For each one why is a landmark.
- The relation between Visualization and computer graphics. The differences between them.
- The relation of Visualization with other fields.
- The general steps of a Visualization Process
- The role of Perception.
- The role and the importance of the user.

João Moura Pires STAResearch.NET Contact Me

Web Site: Evaluation section

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  - Subjects

This area is dedicated in general to the evaluation process and more specifically to the team-work projects, namely important dates, and detailed instructions about the **registration of teams** and **registration of subjects**, **report delivering** and **team-work discussion** .

Important Dates

- **Team registration**: until **March 30th**
- **Subject specification**: until **April 16th**
- **Paper**: until **May 18th**
- **Code and Implementation**: until **June 8th**
- **Oral discussions**: from **June 11th up to June 15th,** with previous appointment

Instructions

Team registration

The students have to create **teams with 2 students** and make a **team registration**. The team registration process requires to fill-up a google sheet already shared with you.

Subject definition

A registered team must register its subject choice for the Practical team-Work. The purpose of subject registration is to provide the teacher with a clear description of the chosen subject, the functional scope of the implementation, the proposed architecture and the technologies used, to get a teacher's approval, and from that point you should keep your subject registration updated as you start the development. By doing that you keep an appropriate live summary of your project for you, for your colleague and for the teacher. You may **update** your subject registration **as many times you want**. Please make your subject registration as clear and complete as possible. Consider the following recommendations:

Abstract; should be a short paragraph which describes the goal of your system and its most important features.

Description: you should describe: (i) the scope of your project; (ii) the proposed architecture and approach.
In order to present the scope you should identify the inputs, the main concerns about the data or the data model, the functionalities and eventually the outputs.
With the respect with the architecture you should describe the main components, how their purpose, how they exchange information and the technology you intend to use and their role.

Tasks: you should keep a list of tasks, as detailed as possible, in order to plan your work and check the feasibility of your approach. By doing this you will have to think in a very concrete way of how to address the all project and consequently you check if the previous description is sound. Also you break your original problem into many small problems that you can distribute the by the team members.

References: the text books, the papers, the sites you use during the design and the implementation of your project

Software: list of software you will use in the development of your project

Development: you can use this section for further details and eventually to indicate a URL where the teacher can check your system.

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Important Dates

Week	Subjects	Event
1	Overview	
2	Introduction to Data Visualization	
3		Team registration
4		March 30 => Wednesday, March 28
5		
6	Visualization Techniques	
7		**Test 1**
8		
9		
10	Advanced Topics: Evaluation; Research directions	**Paper**
11		
12		
13	Students Support	
14		**Test 2; Code and Implementation**
15	Oral Sessions	**Oral Sessions**

Important Dates

- **Team registration up to March 30th (week 04)**
- **Project Specification: Up to April 16th (week 07)**
- **Test 1: April 20th (week 07) - During the Lecture; The lab session will be important**
- **Paper : Up to May 18th (week 11)**
- **Test 2: June 8th (week 14) - During the Lecture; The lab session will for teams support**
- **Project Code: Up to June (week 14)**
- **Project Oral discussion: 11 to 15 June (week 15)**

Further Reading and Summary

Further Reading

- **Recommend Readings**
  - Interactive Data Visualization: Foundations, Techniques, and Applications, Matthew O. Ward et all, 2015, pages 1 - 38.
- **Supplemental readings:**
  - Cholera map's John Snow:
    - https://en.wikipedia.org/wiki/1854_Broad_Street_cholera_outbreak
  - Napoleon
    - https://en.wikipedia.org/wiki/Charles_Joseph_Minard
  - William Playfair:
    - https://en.wikipedia.org/wiki/William_Playfair
  - Florence Nightingale:
    - https://pt.wikipedia.org/wiki/Florence_Nightingale
  - Periodic table:
    - https://en.wikipedia.org/wiki/Periodic_table

Check - vis25timeline

What you should know

- **What is Visualization.**
  - grocking the data => take decisions
- **Data Visualization can be extremely powerful**
  - Uncover new patterns; confirm hypothesis;
- **Why Visualization is important.**
  - Stats not enough; communication needs; exploratory needs
- **Key aspects of today Visualizations.**
  - Interactions; visual abstractions; multiple (linked) visualizations.
- **The general steps of a Visualization Process**
  - **Raw data -> data -> viz structures -> images -> perception + feedback**
- **The role of Perception.**
  - The role and the importance of the user.

Recommended Actions

- **Read the available information on the Web Site**
- **Update your calendar (or subscribe the calendar)**
  - **VID RSS Feed**
- **Find a partner for your team work**
  - **Make the registration until March 30th**
- **Check the Summaries section and follow its recommendations**
- **Install Tableau software**
  - **http://www.tableau.com/academic/students**