

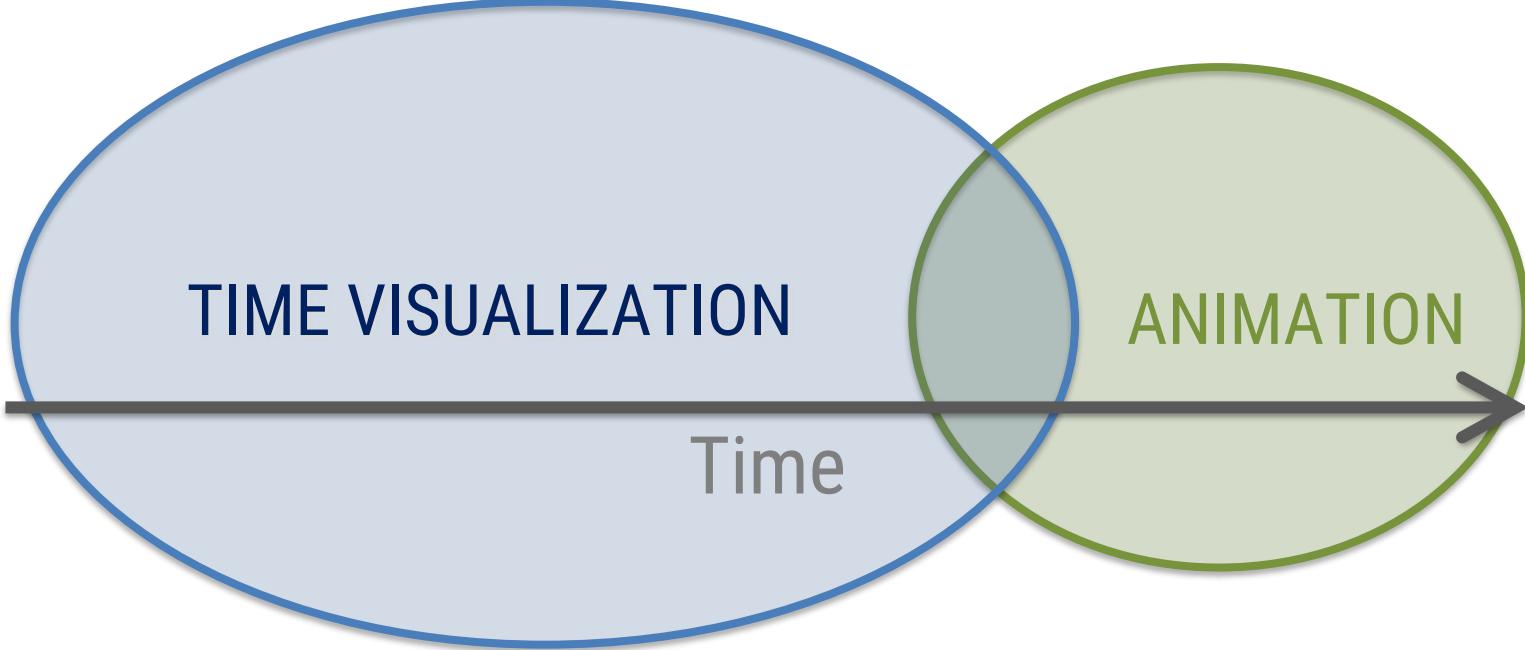
TIME AND ANIMATION

Petra Isenberg (&Pierre Dragicevic)

A Venn diagram consisting of two overlapping circles. The left circle is light blue with a dark blue outline and contains the text "TIME VISUALIZATION". The right circle is light green with a dark green outline and contains the text "ANIMATION". The two circles overlap significantly in the center.

TIME VISUALIZATION

ANIMATION



A Venn diagram consisting of two overlapping circles. The left circle is light blue and labeled "TIME VISUALIZATION". The right circle is light green and labeled "ANIMATION". The overlapping area is shaded grey and contains the word "Time". A horizontal arrow points from the center of the "ANIMATION" circle towards the right.

TIME VISUALIZATION

Time

ANIMATION

VISUALIZATION OF TIME

TIME

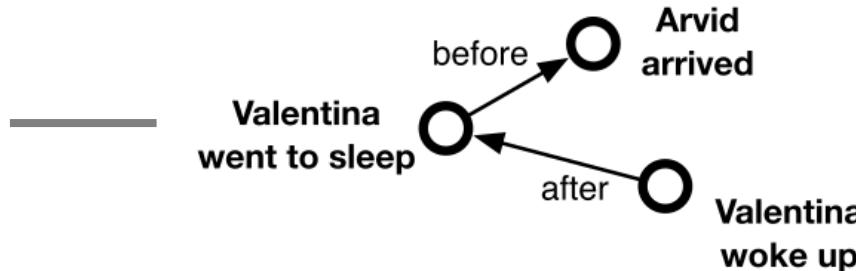
- Is just another data dimension
- Why bother?

TIME

- Is just another data dimension
- Why bother?
- What data type is it?
 - Nominal?
 - Ordinal?
 - Quantitative?

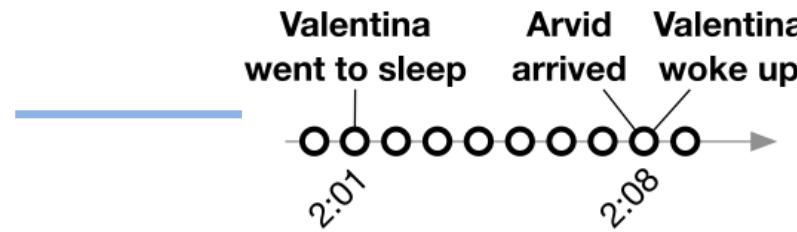
TIME

- **Ordinal**



- **Quantitative**

- Discrete



- Continuous



[Aigner et al, 2011](#)

TIME

	Quantitative	Ordinal	Nominal
More Accurate	Position 	Position 	Position
	Length 	Density 	Hue
	Angle 	Saturation 	Density
	Slope 	Hue 	Saturation
	Area 	Length 	Shape
	Density 	Angle 	Length
	Saturation 	Slope 	Angle
	Hue 	Area 	Slope
Less Accurate	Shape 	Shape 	Area

[Joe Parry, 2007](#). Adapted from [Mackinlay, 1986](#)

TIME

- Periodicity
 - Natural: days, seasons
 - Social: working hours, holidays
 - Biological: circadian, etc.
- Has many subdivisions (units)
 - Years, months, days, weeks, H, M, S
- Has a specific meaning
 - Not captured by data type
 - Associations, conventions
 - Pervasive in the real-world
 - Time visualizations often considered as a separate type

VISUALIZING TIME

as a time point



VISUALIZING TIME

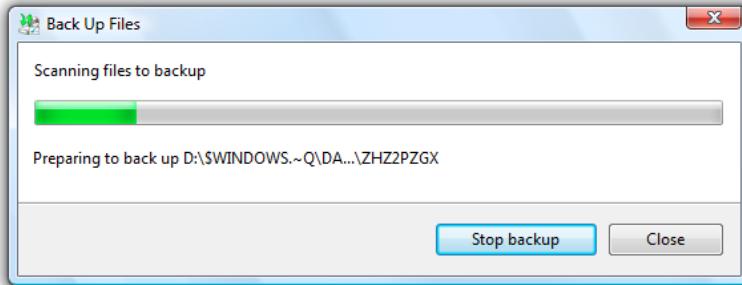


as a time period



VISUALIZING TIME

as a duration

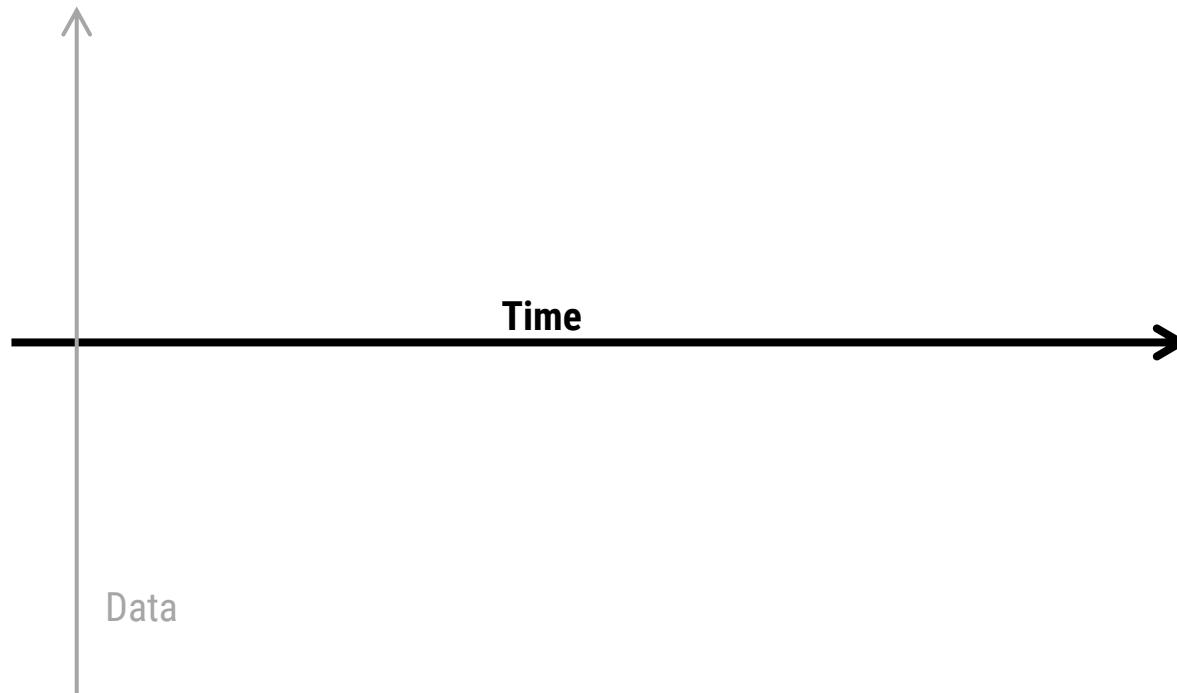


VISUALIZING TIME

PLUS DATA

MAPPING TIME TO SPACE

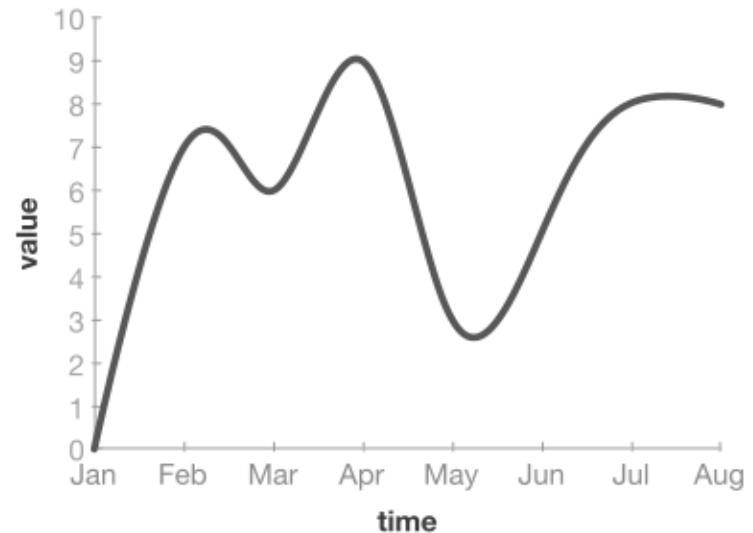
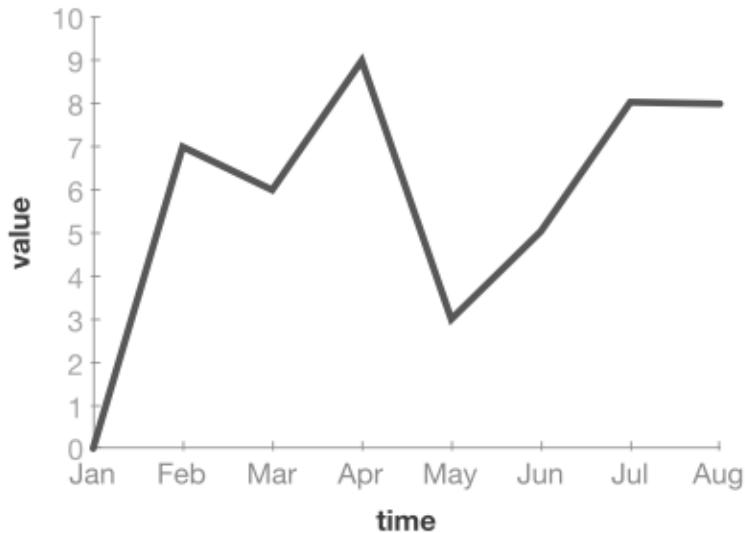
MAPPING TIME TO AN AXIS



TIME-SERIES DATA

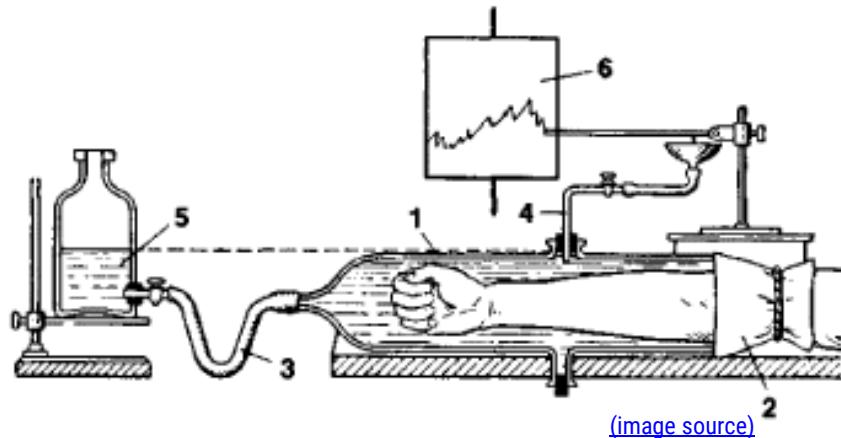
- From a Statistics Book:
 - A set of observations x_t , each one being recorded at a specific time t
- From Wikipedia:
 - A sequence of data points, measured typically at successive time instants spaced at uniform time intervals

LINE CHARTS



LINE CHARTS

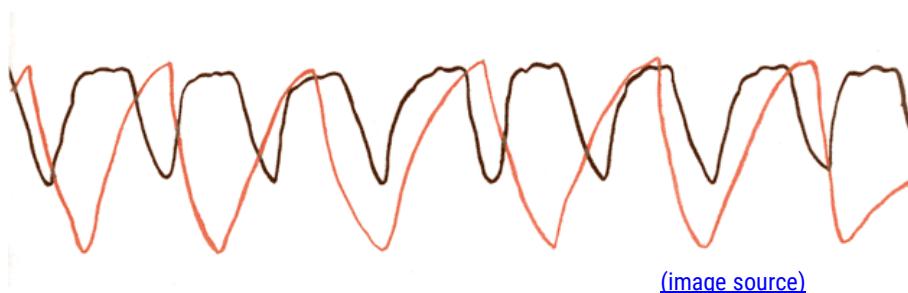
Marey's Physiological Recordings



[\(image source\)](#)



Plethysmograph
Étienne-Jules Marey, 1876

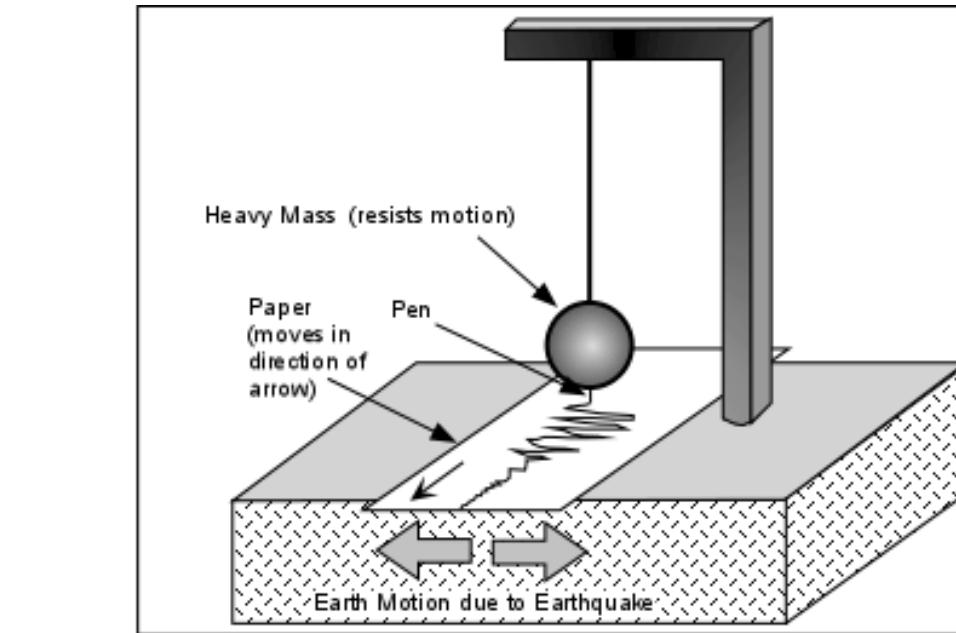


[\(image source\)](#)

Pneumogram
Étienne-Jules Marey, 1876

LINE CHARTS

Pendulum Seismometer



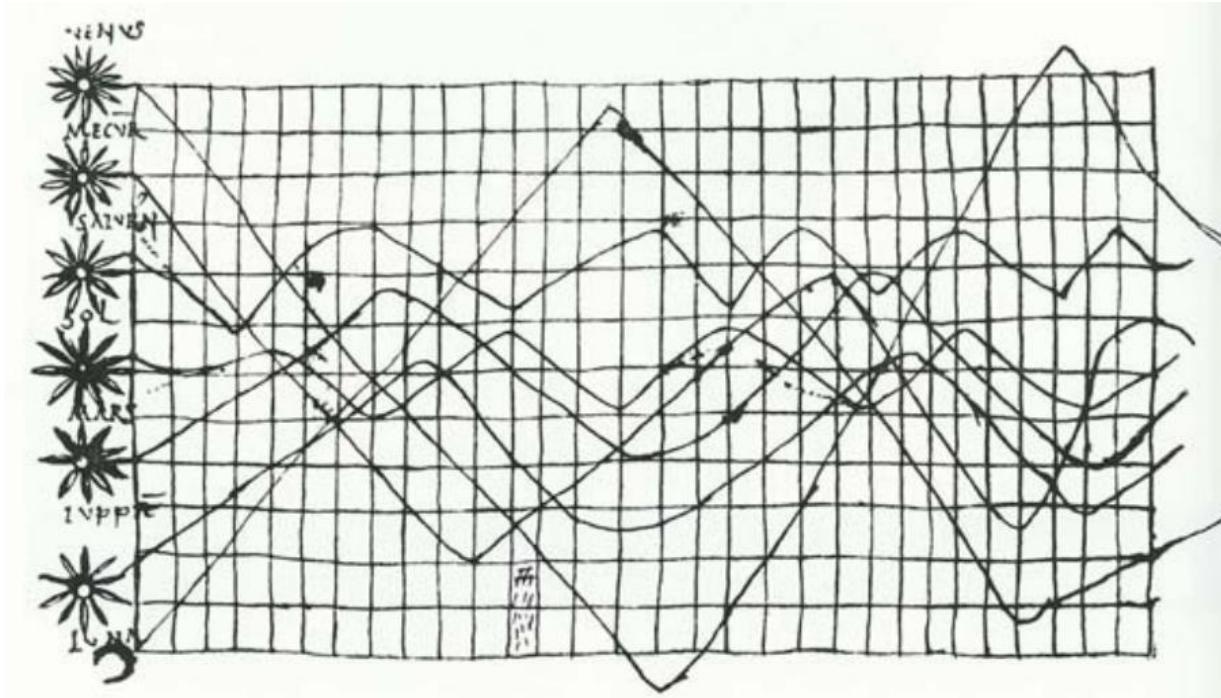
[\(image source\)](#)

Andrea Bina, 1751

Possibly also 17th century [\(source\)](#)

LINE CHARTS

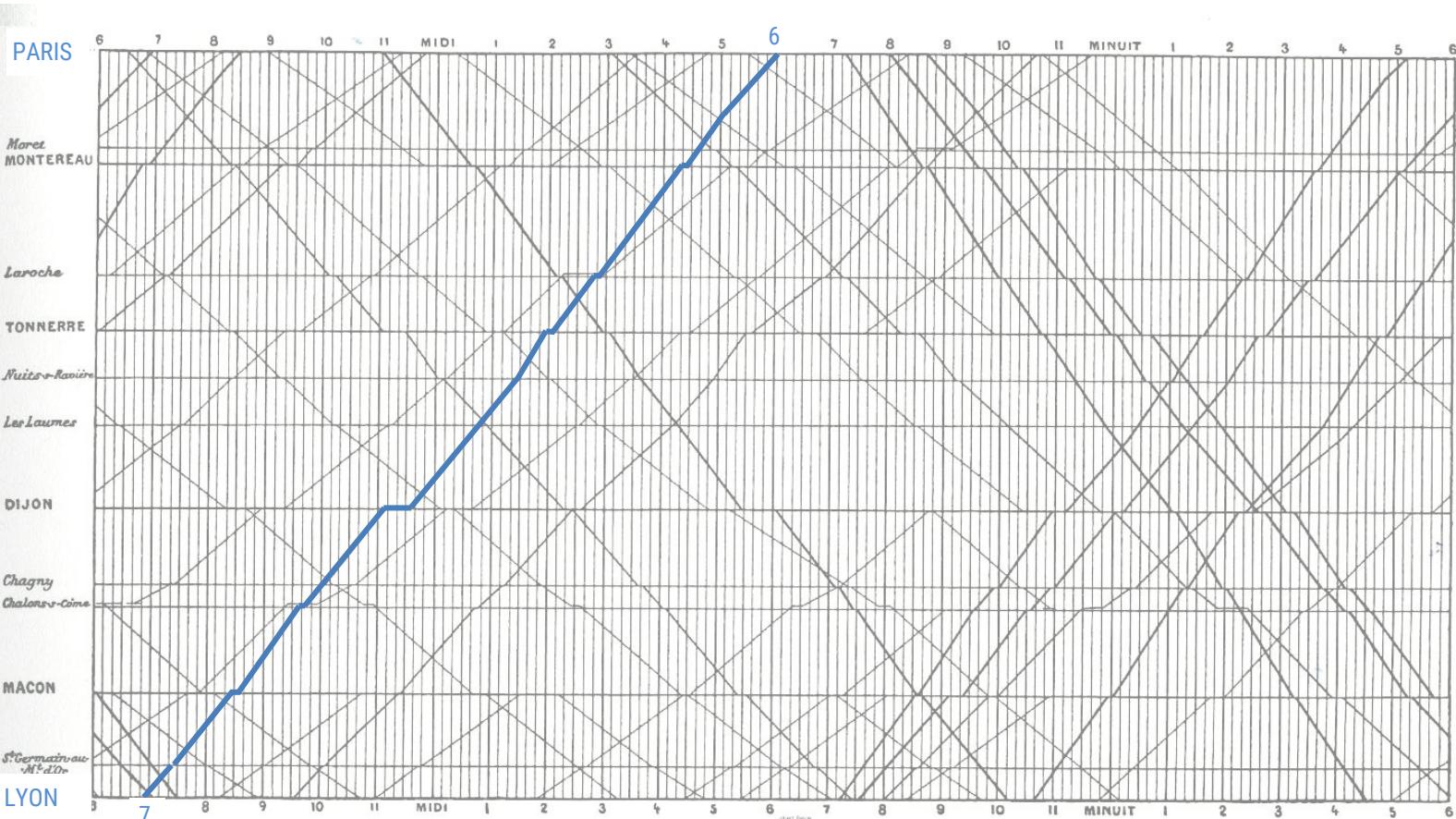
Inclinations of planetary orbits



Macrobius, 10th or 11th century
cited in [Kendall, 1990](#)

LINE CHARTS

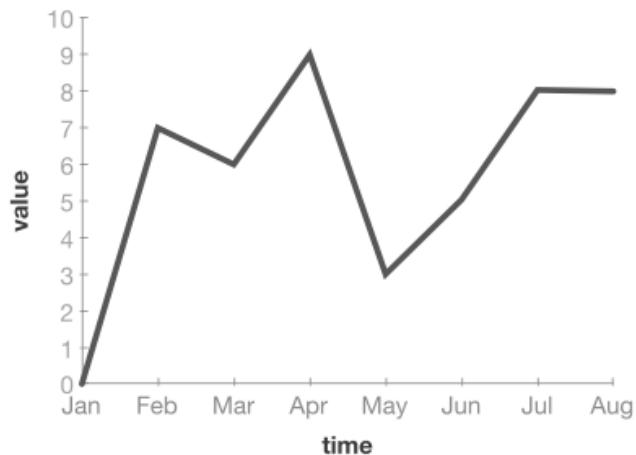
Marey's Train Schedule



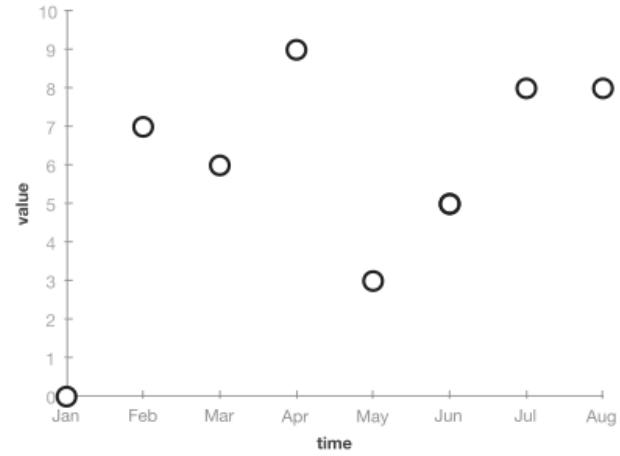
Étienne-Jules Marey, 1885, cited in [Tufte, 1983](#)

OTHER CHARTS

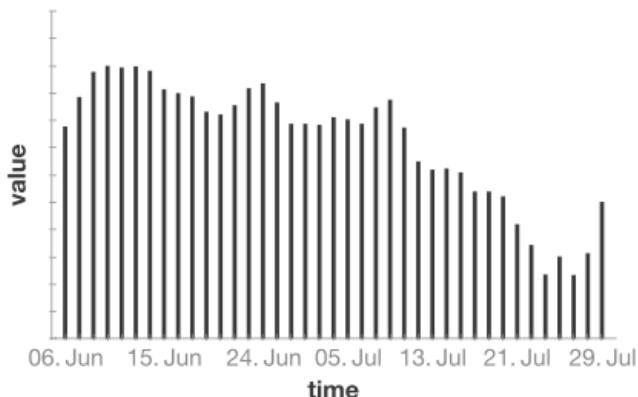
Line Plots



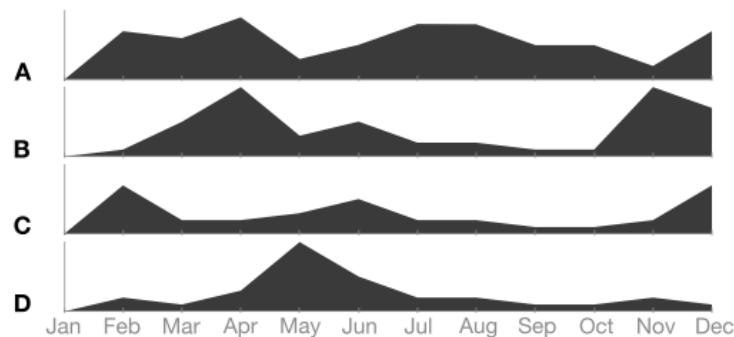
Point Plots



Bar Charts

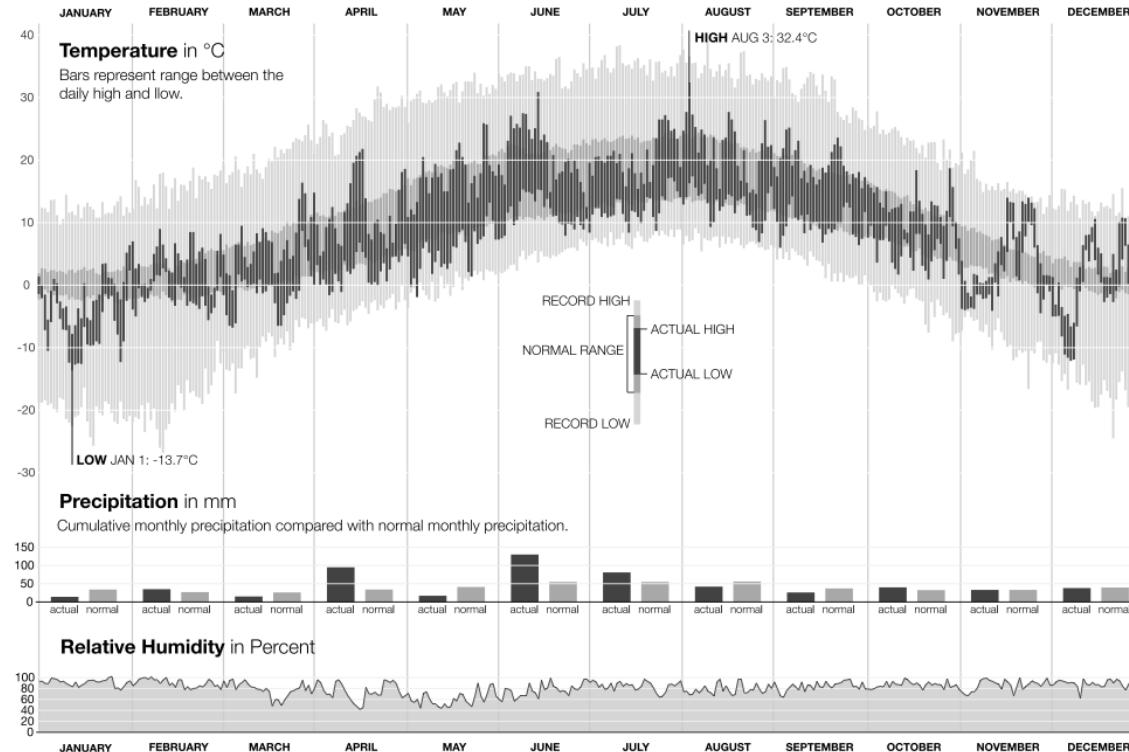


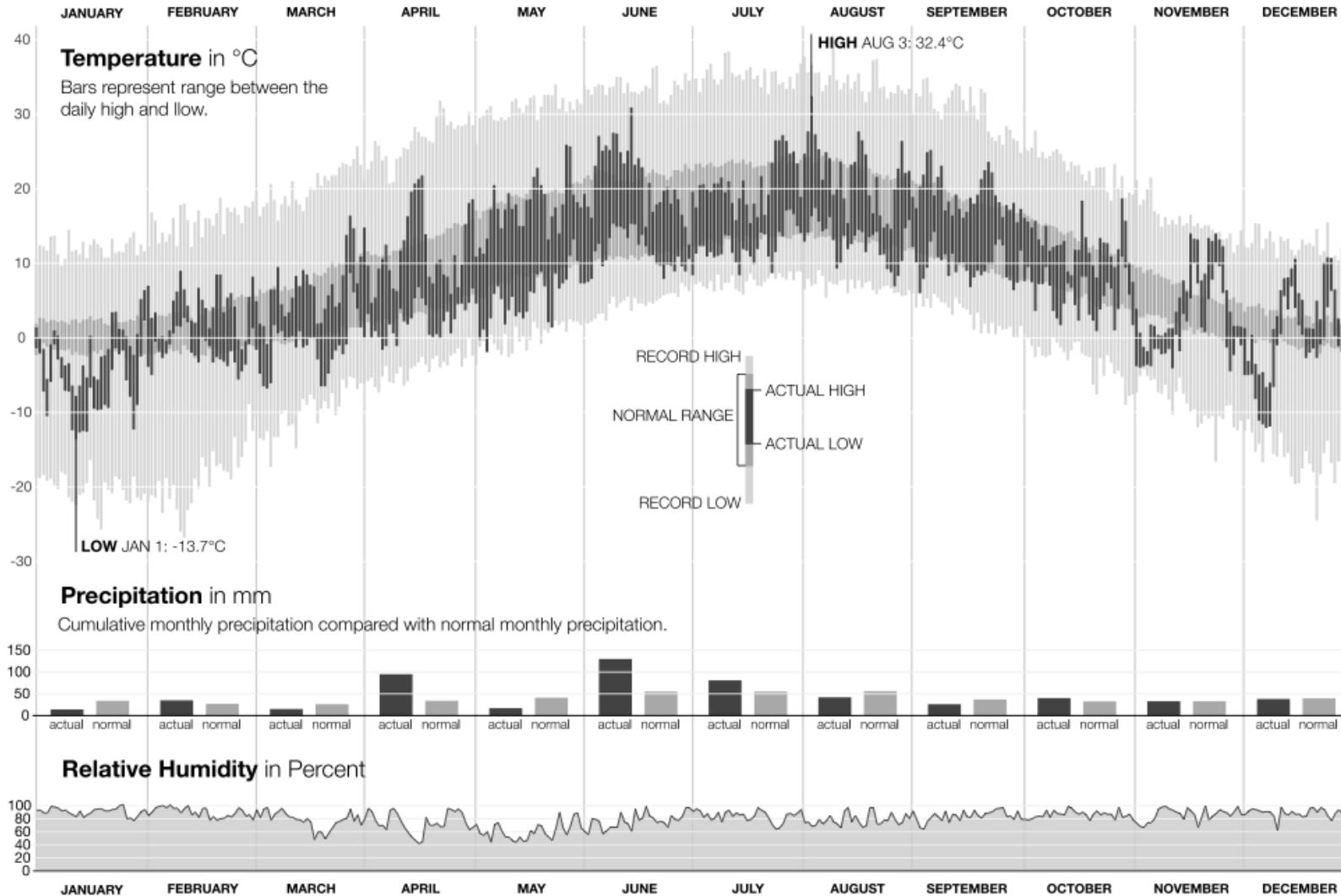
Silhouette Graphs



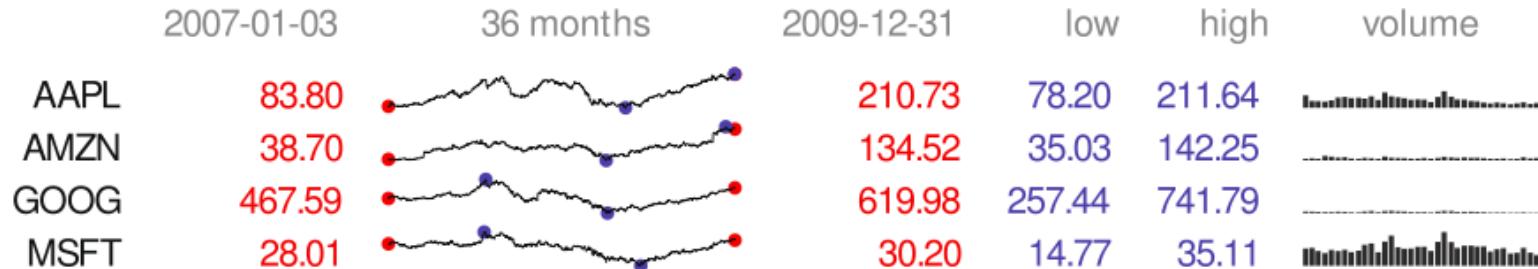
OTHER CHARTS

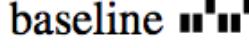
Combination - New York Times Weather Chart





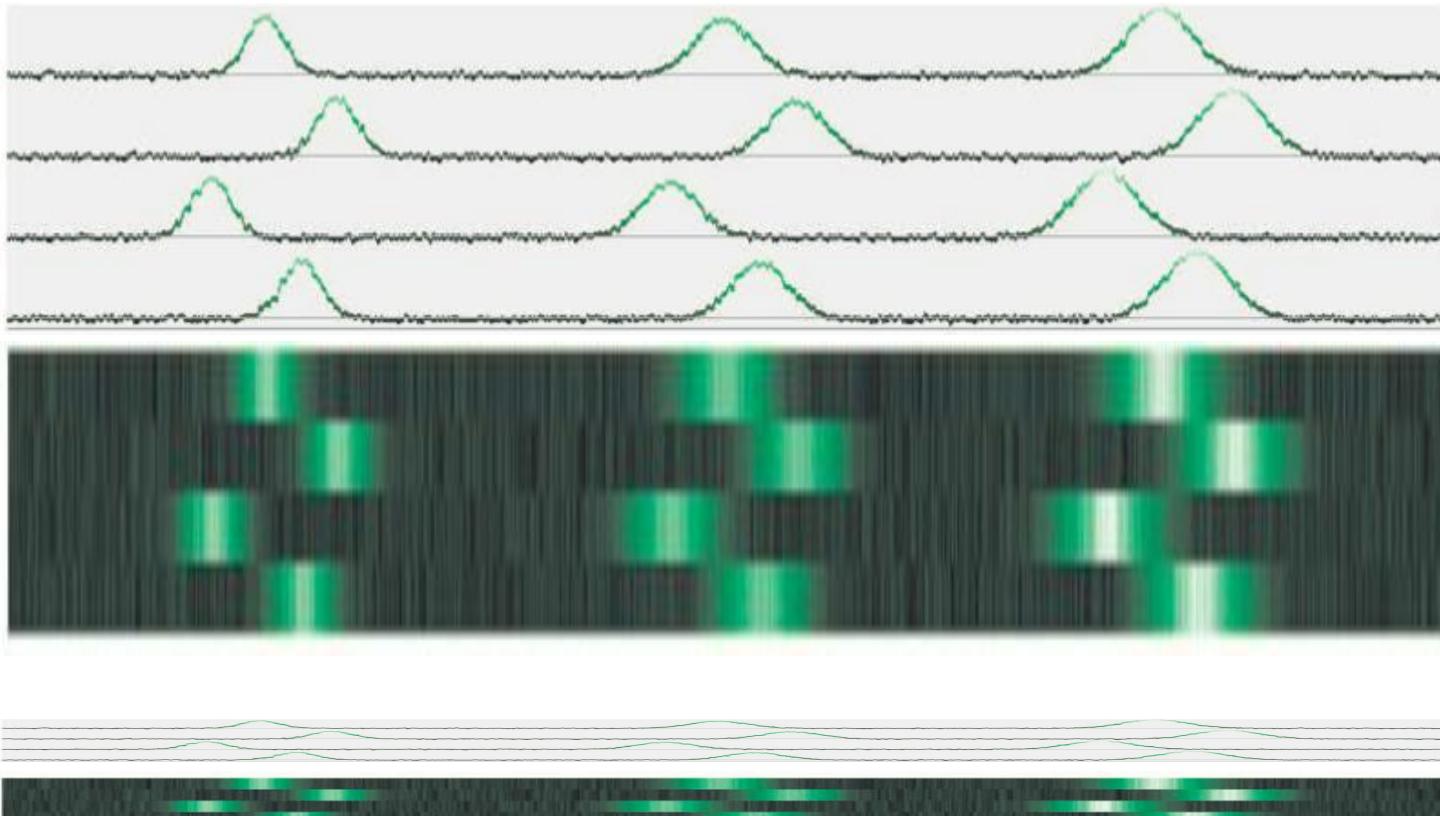
SPARKLINES



Usually, miniaturized versions of line plots  (\rightarrow p. 153) and bar graphs  (\rightarrow p. 154) are employed to represent data. For the special case of binary or three-valued data, special bar graphs can be applied that use ticks extending up and down a horizontal baseline . One use for this kind of data are wins and losses of sports teams where the history of a whole season can be presented using very little space. For line plots, the first and last value can be emphasized by colored dots (•) and printing the values themselves textually

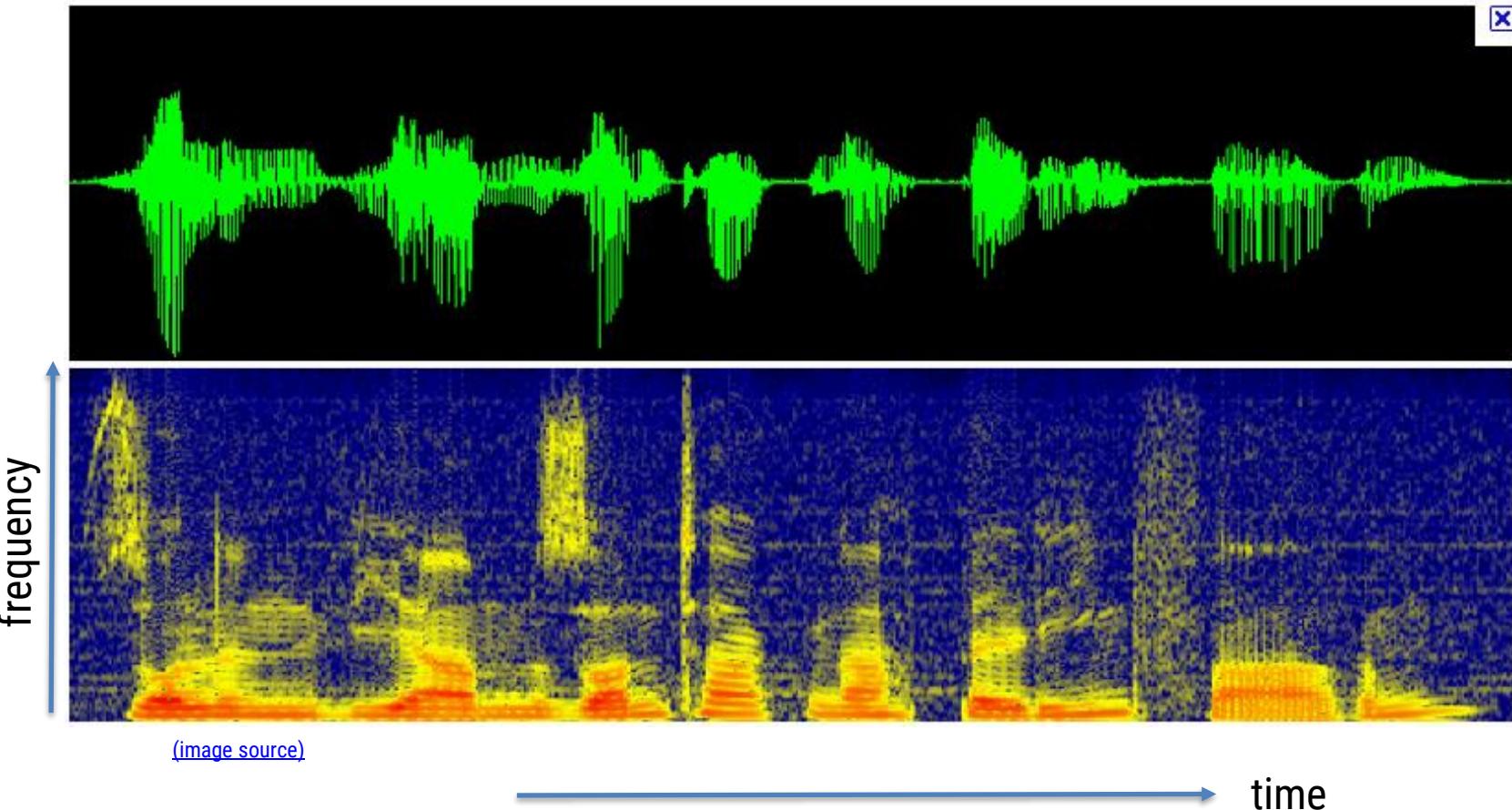
COLOR ENCODING

Strip Plots

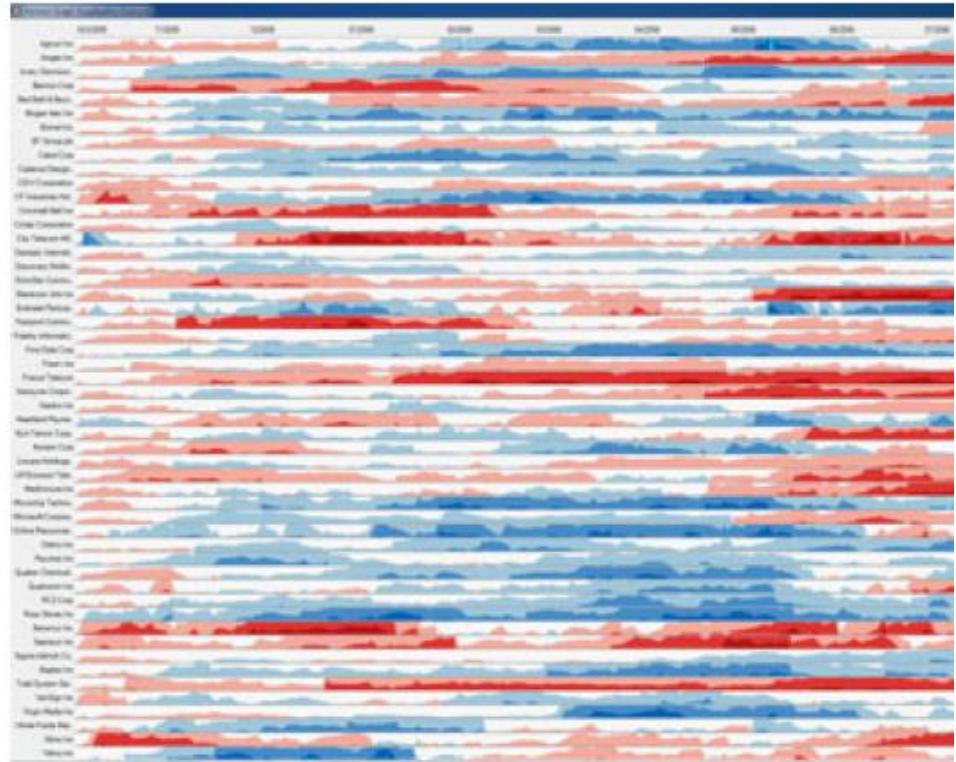
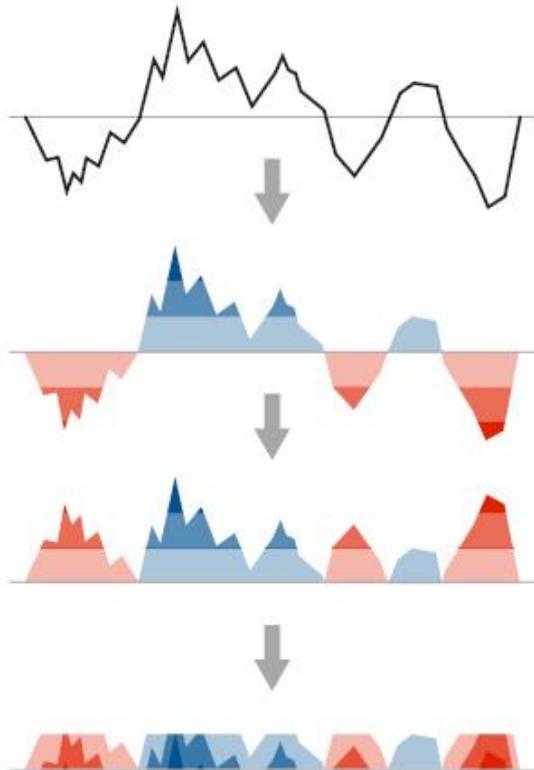


COLOR ENCODING

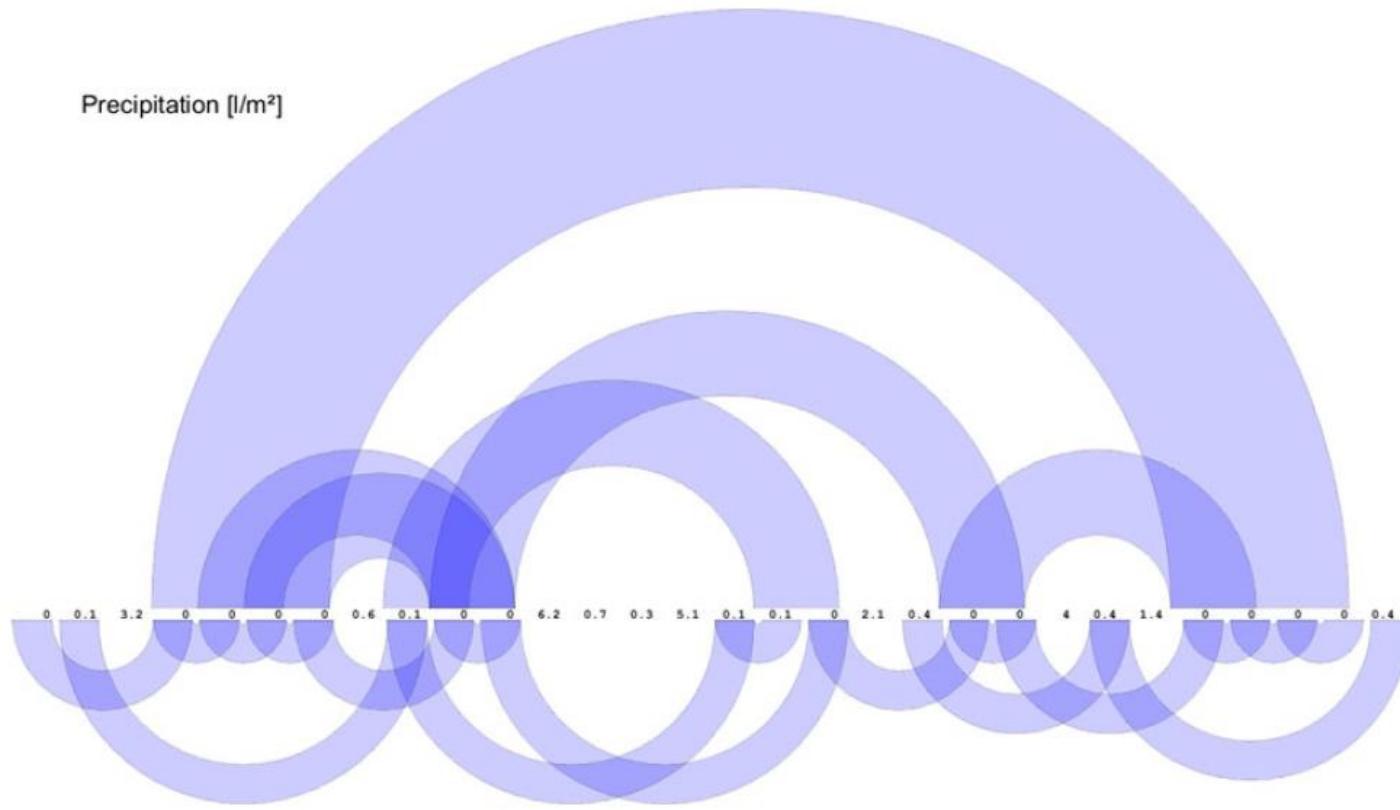
FFT Spectrum



HORIZON GRAPHS

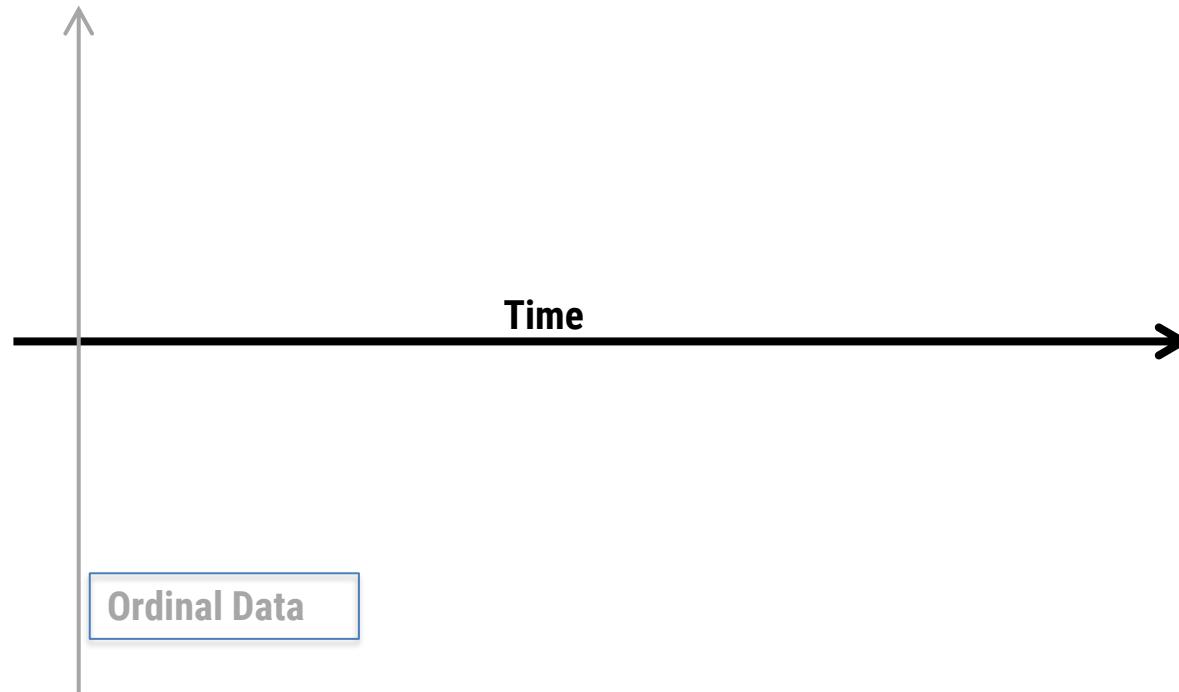


ARC DIAGRAMS

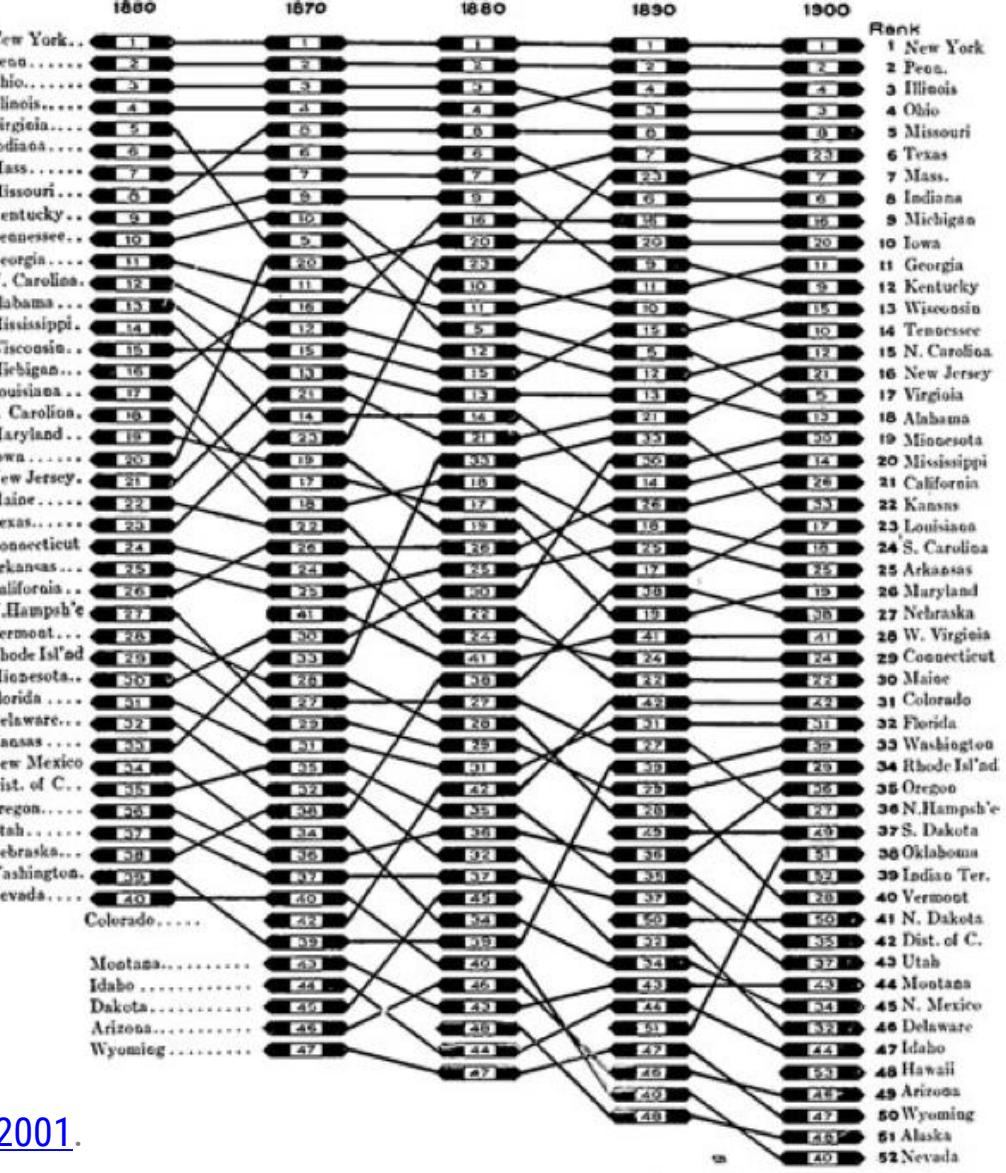


Wattenberg, 2002

OTHER DATA TYPES



RANK CHART

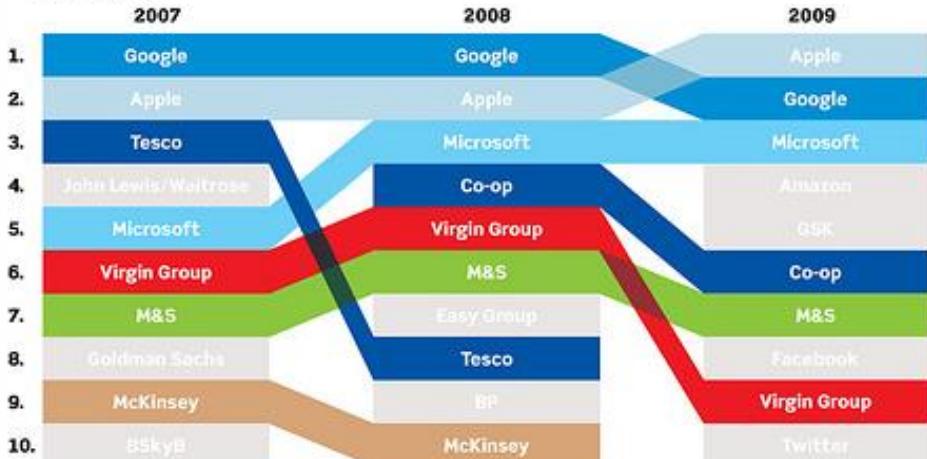


Brinton, 1914. Cited in Aigner et al, 2001.

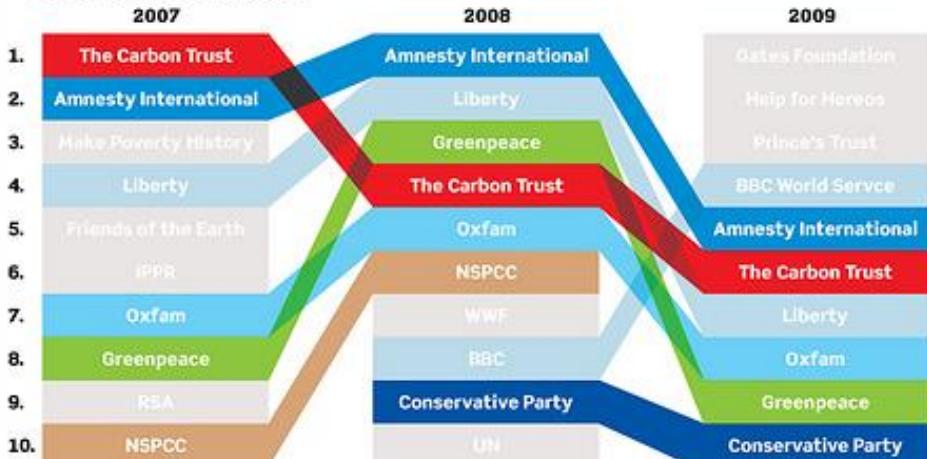
RANK CHART

MOST HIGHLY-REGARDED BRANDS BY UK'S PROMINENT LEADERS

>BUSINESSES



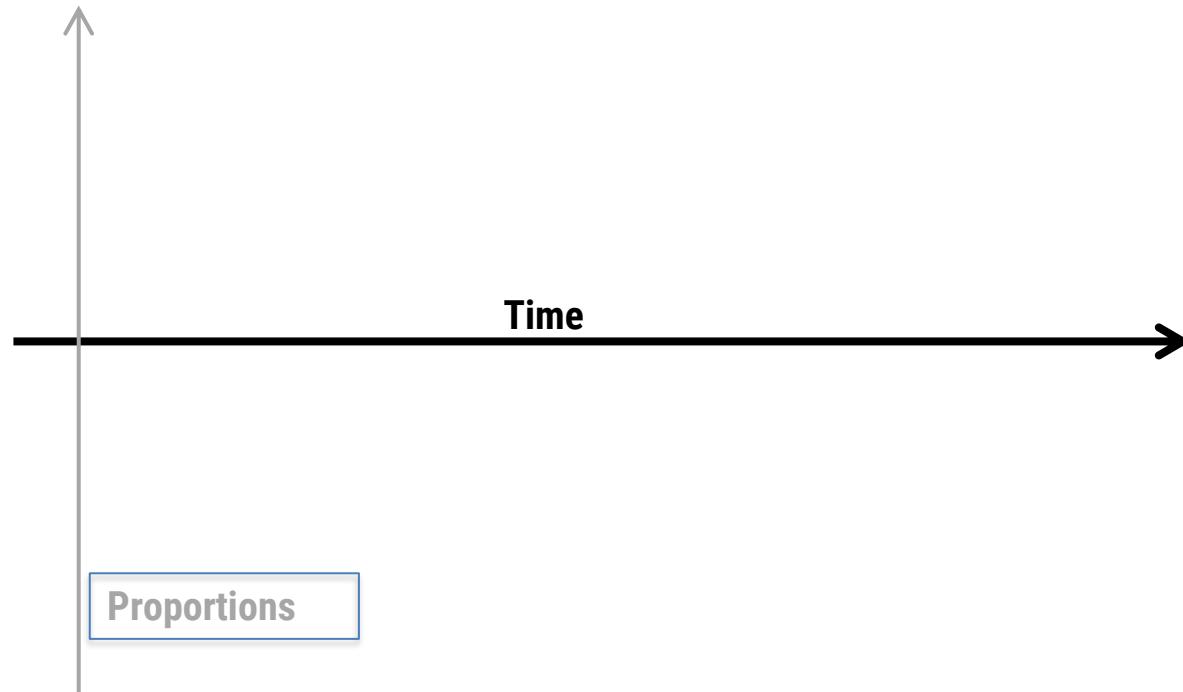
>NON-PROFIT ORGANISATIONS



[Hughes, 2009](#)

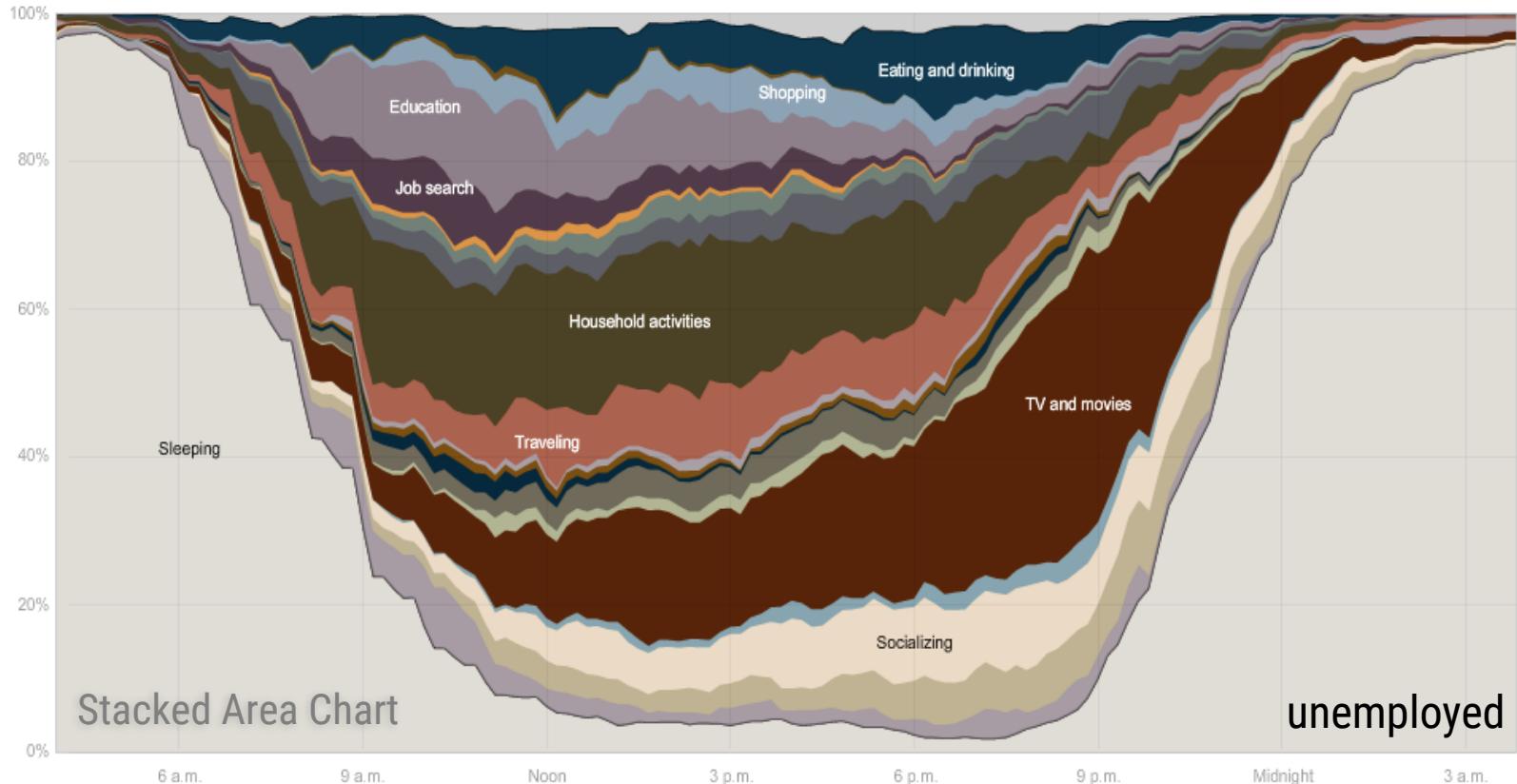
Chart showing the top ten brands' standing over the last three years

OTHER DATA TYPES



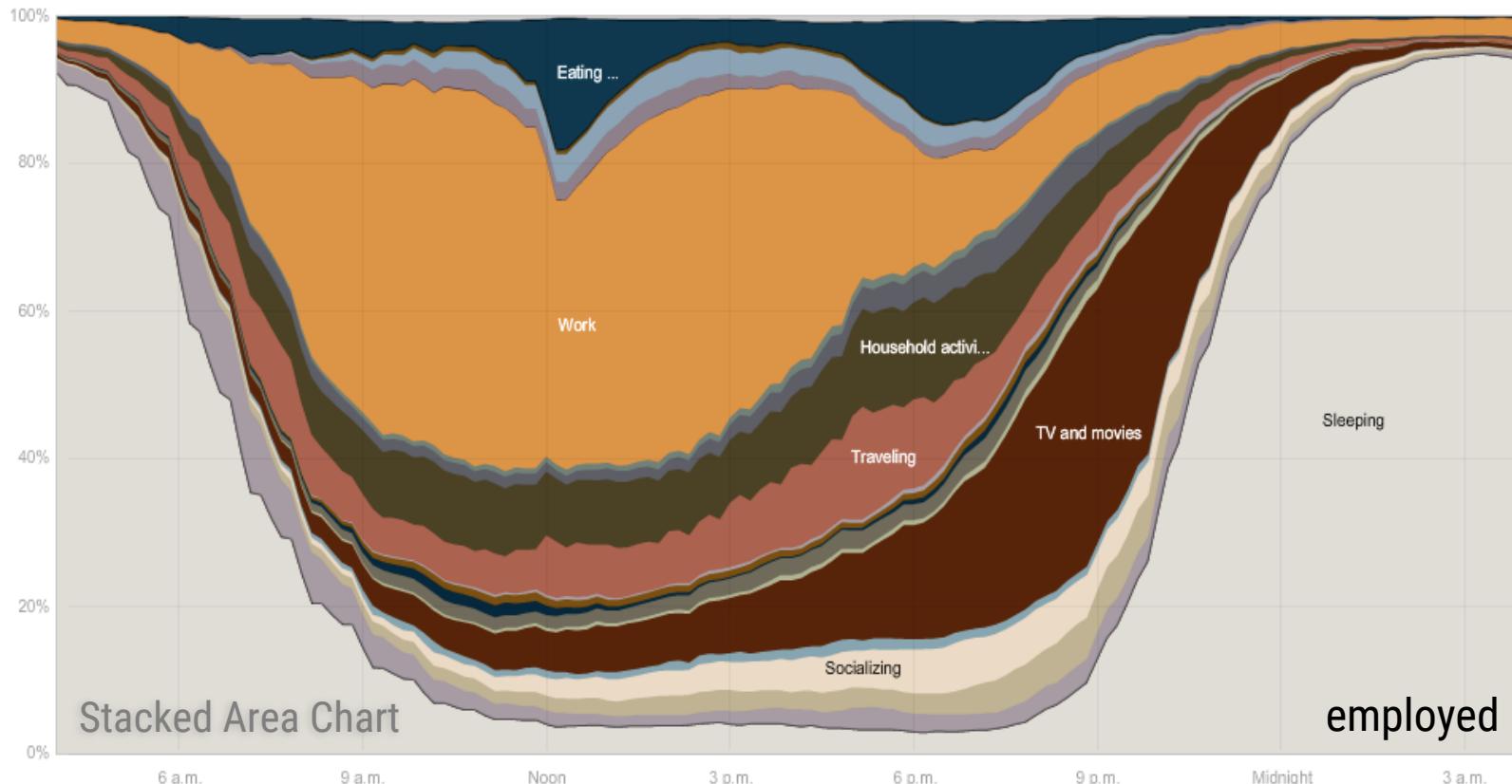
OTHER CHARTS

Stacked Graph
Area Chart
ThemeRiver
StreamGraph



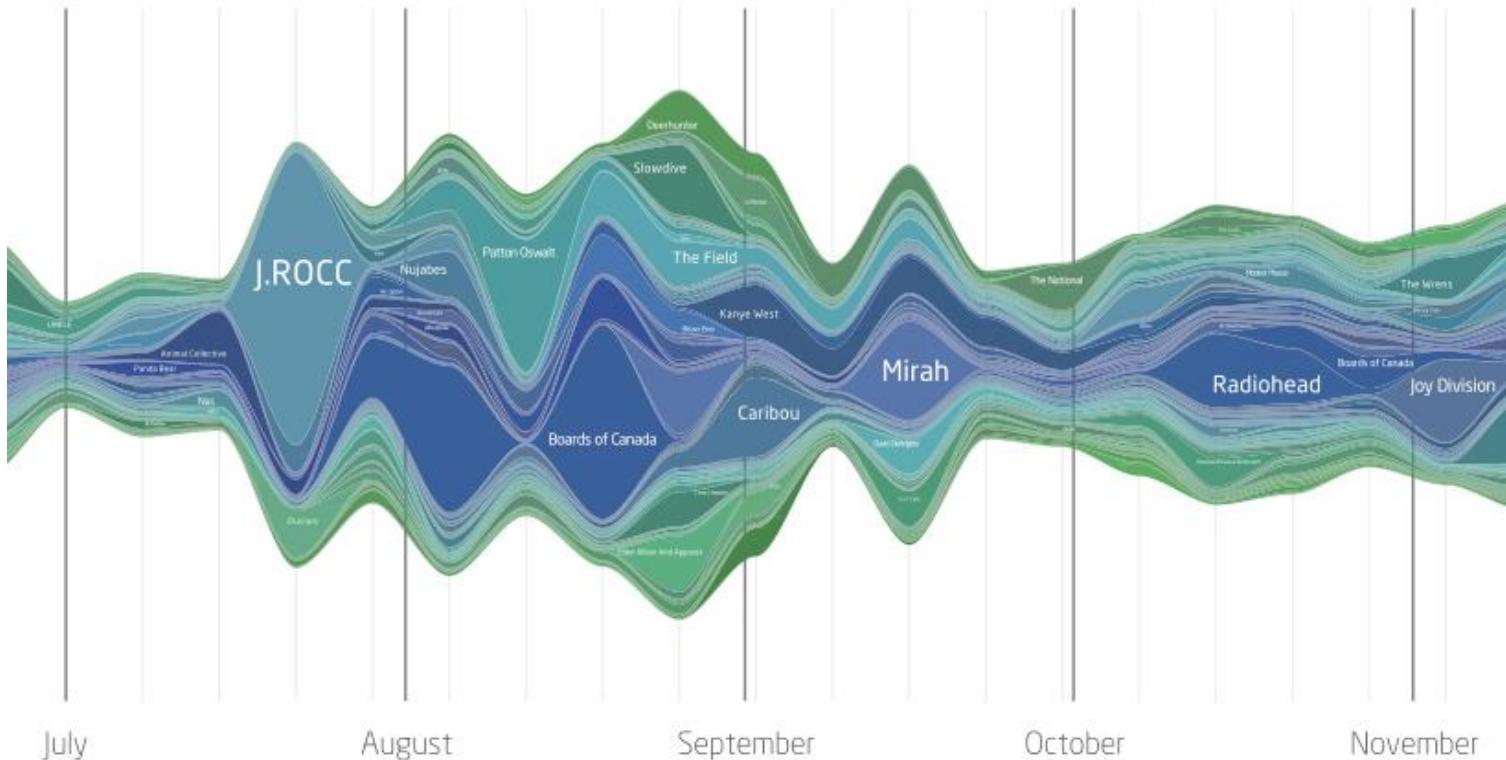
OTHER CHARTS

Stacked Graph
Area Chart
ThemeRiver
StreamGraph

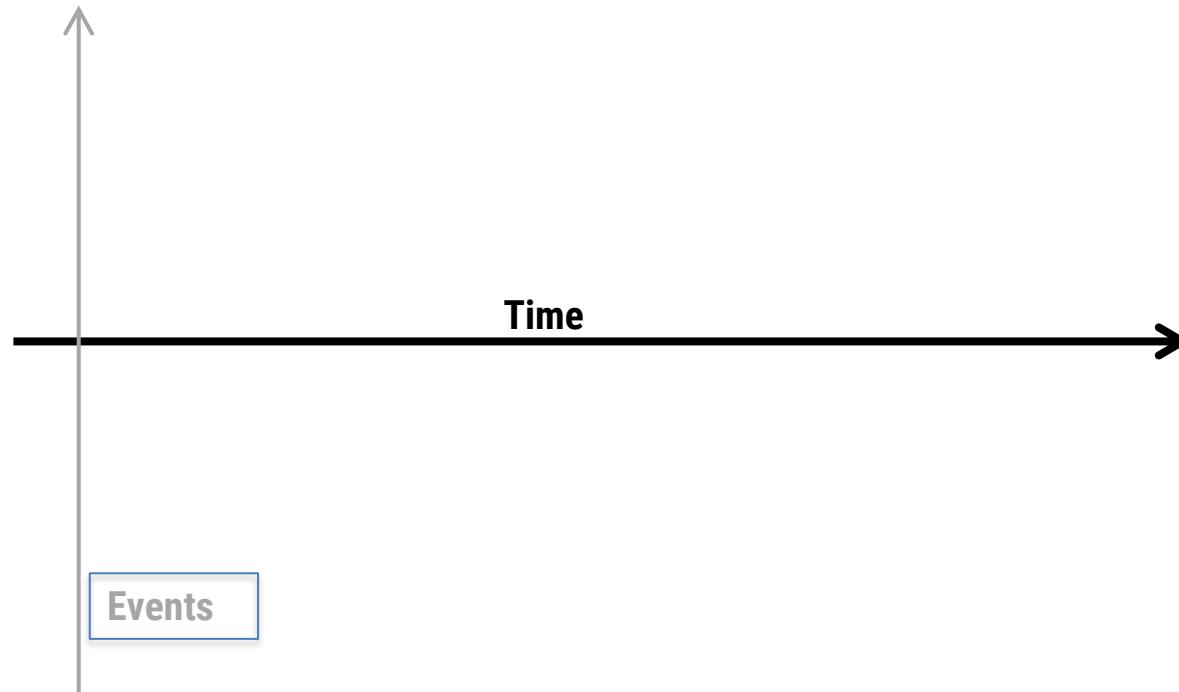


OTHER CHARTS

Stacked Area Chart



OTHER DATA TYPES

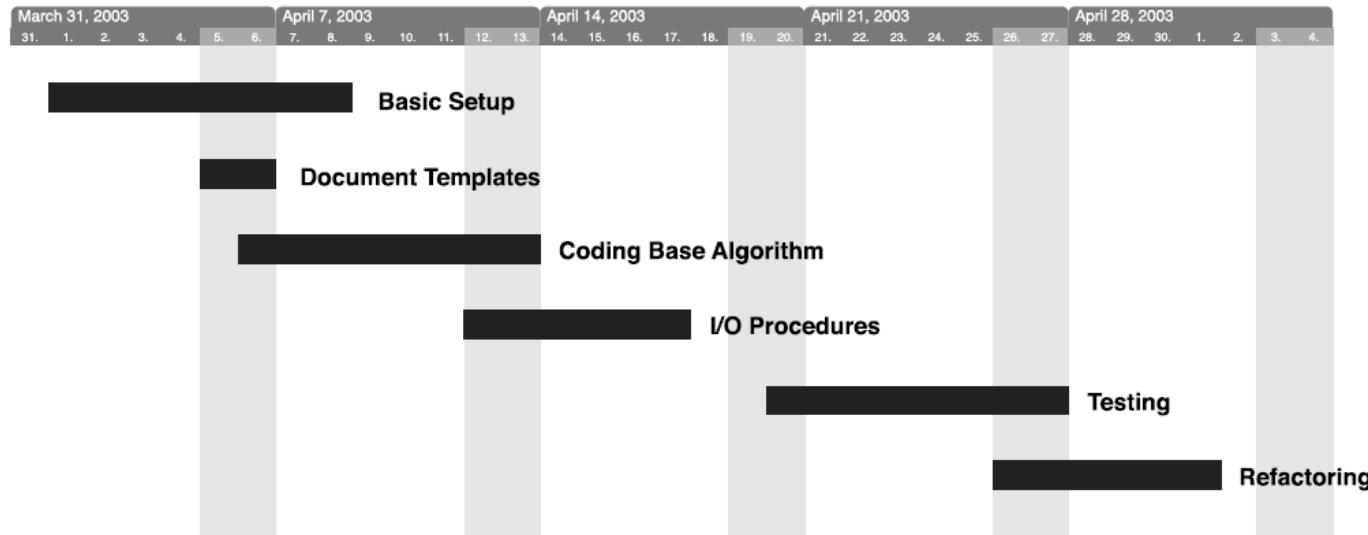


EVENTS

- Like *observations* in time-series:
 - Data points with a time stamp
- But:
 - Most often sparse and irregular
 - Data is mostly nominal
 - Can have a duration (start + end)
- Often, subjective / social data rather than physical measures

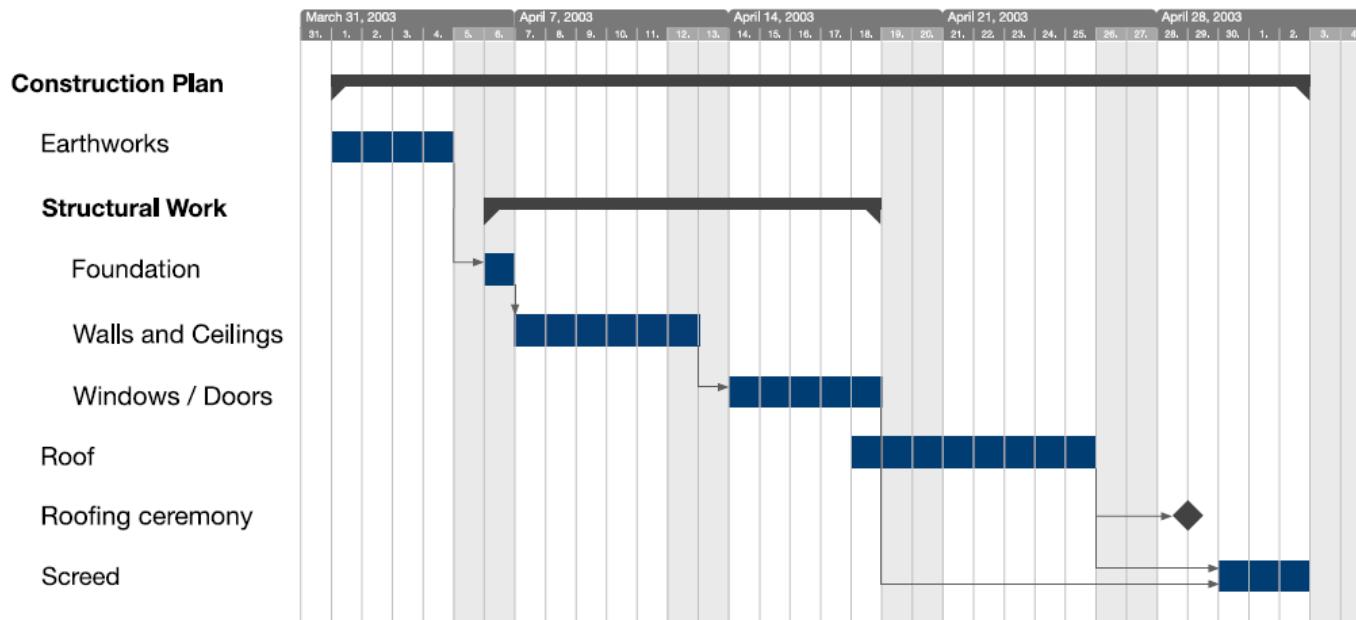
TIMELINES

Project Timeline



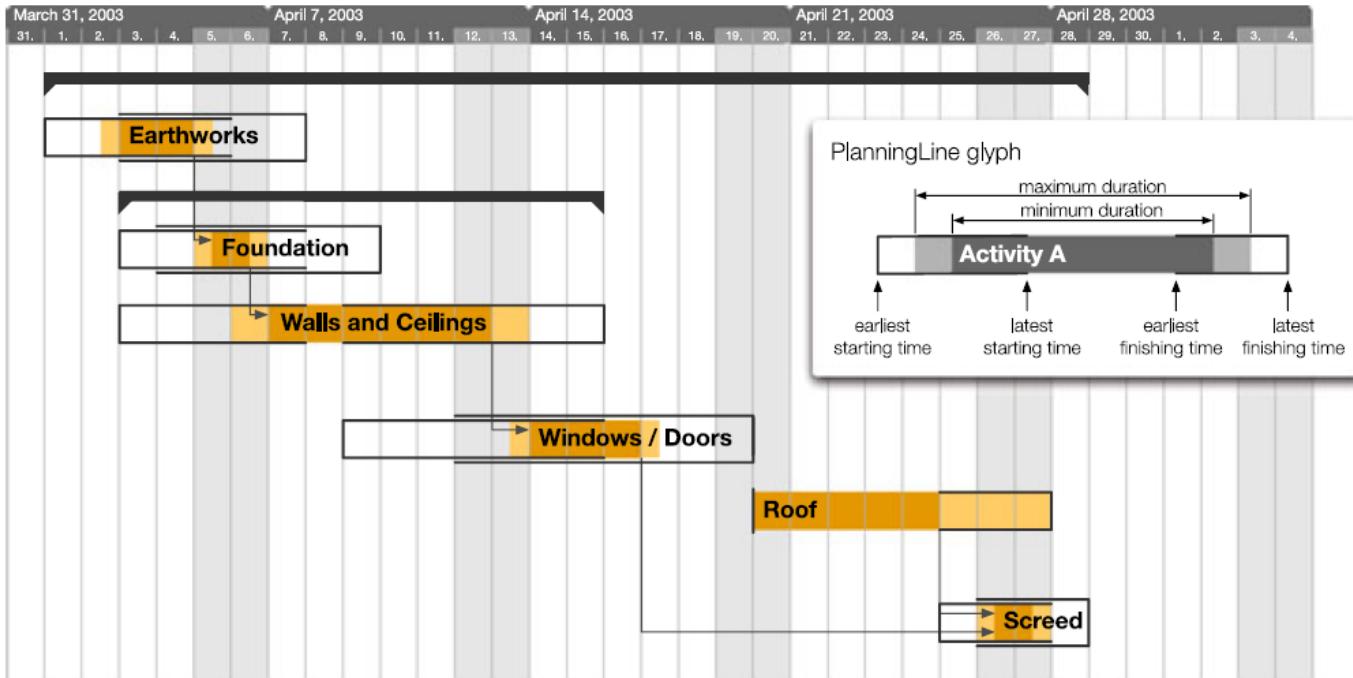
TIMELINES

Gantt Chart



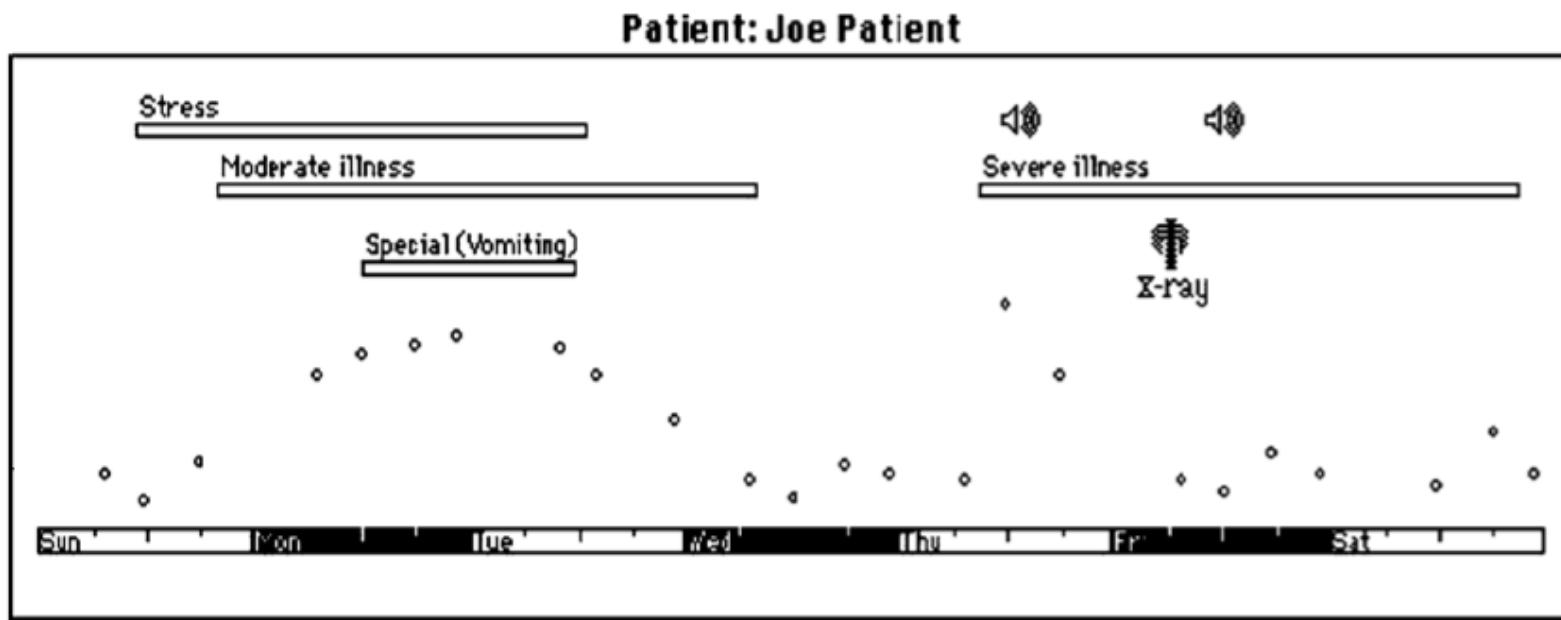
TIMELINES

Planning Lines



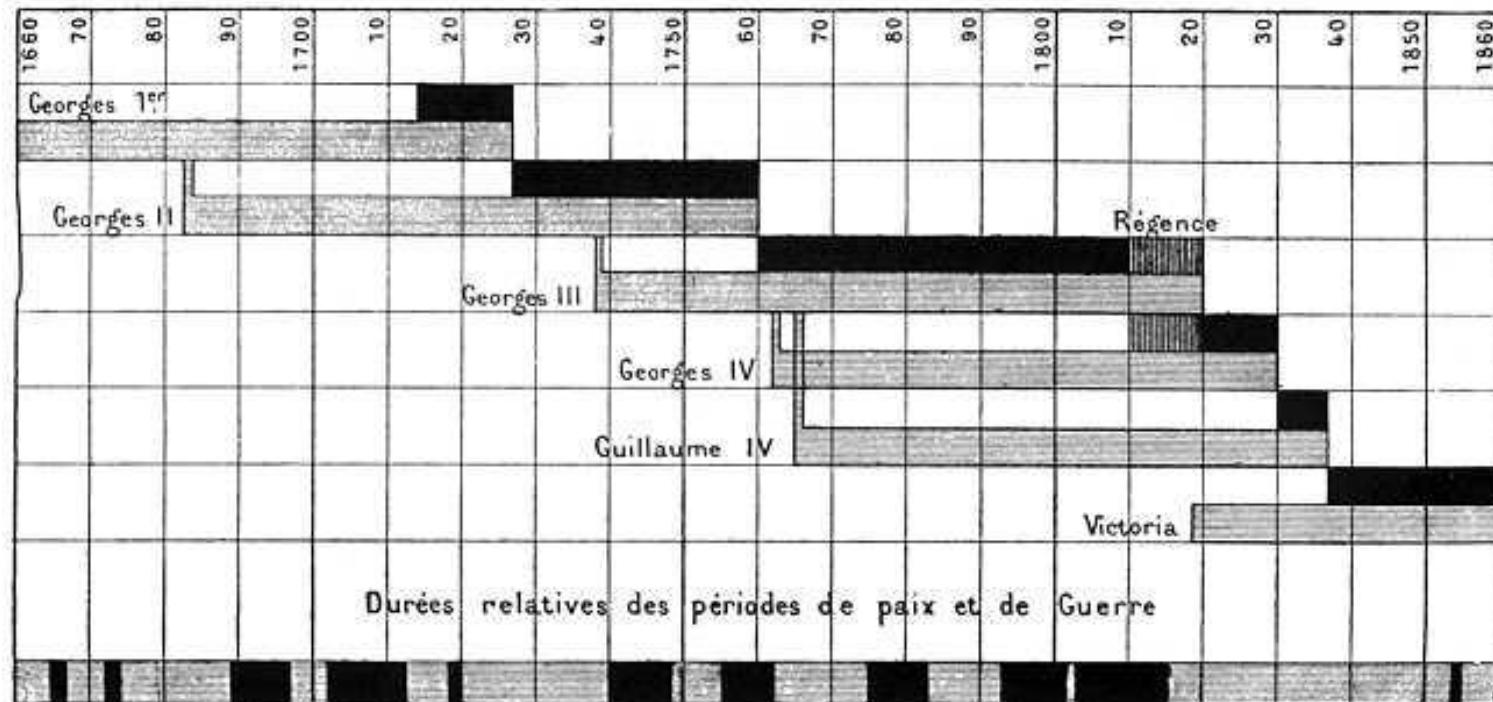
TIMELINES

Patient Data



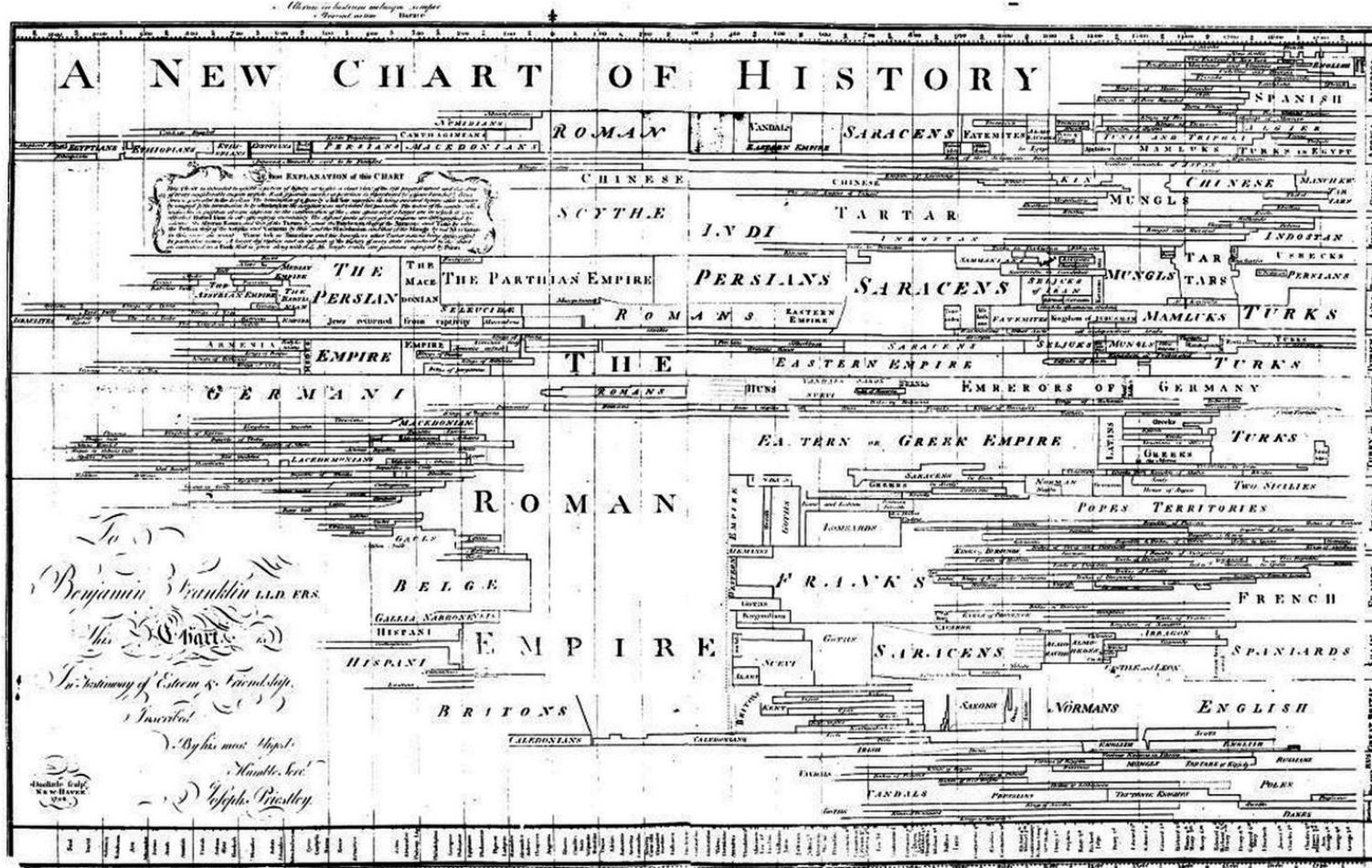
TIMELINES

Reigns of English Monarchs

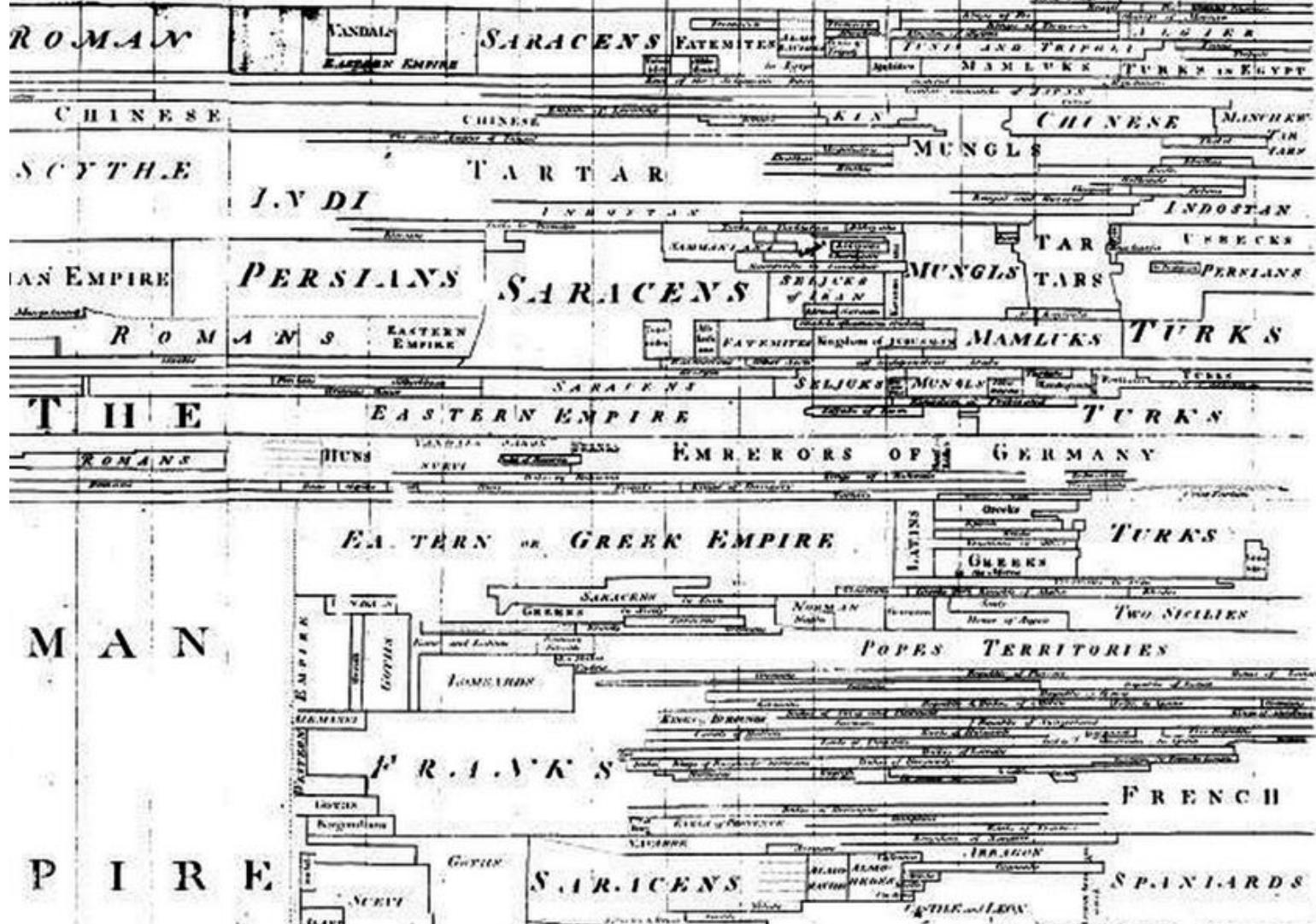


TIMELINES

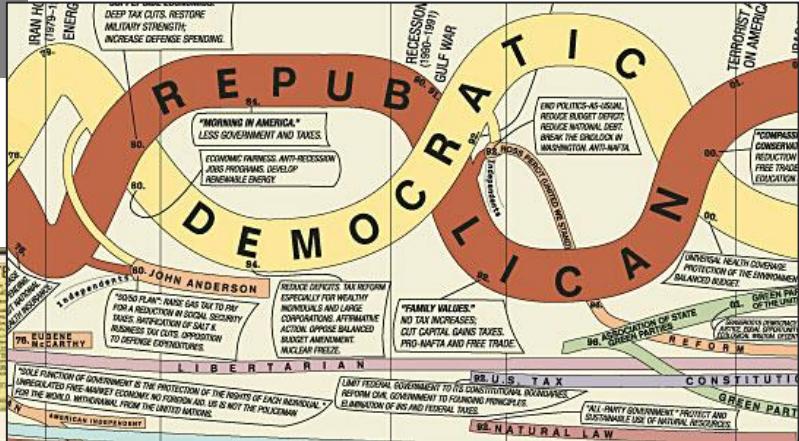
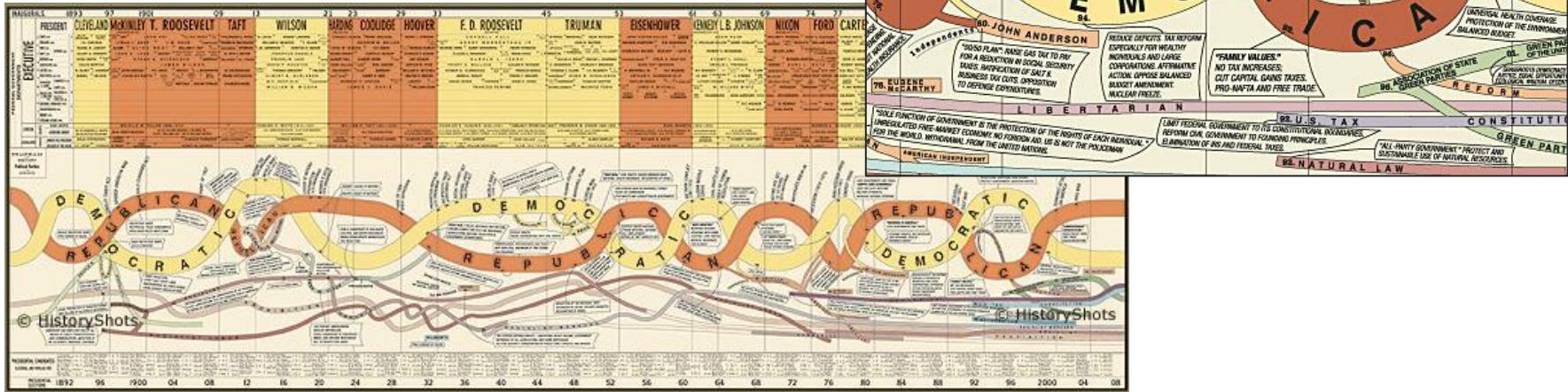
Joseph Priestley, 1769 ([source](#))



OF HISTORY

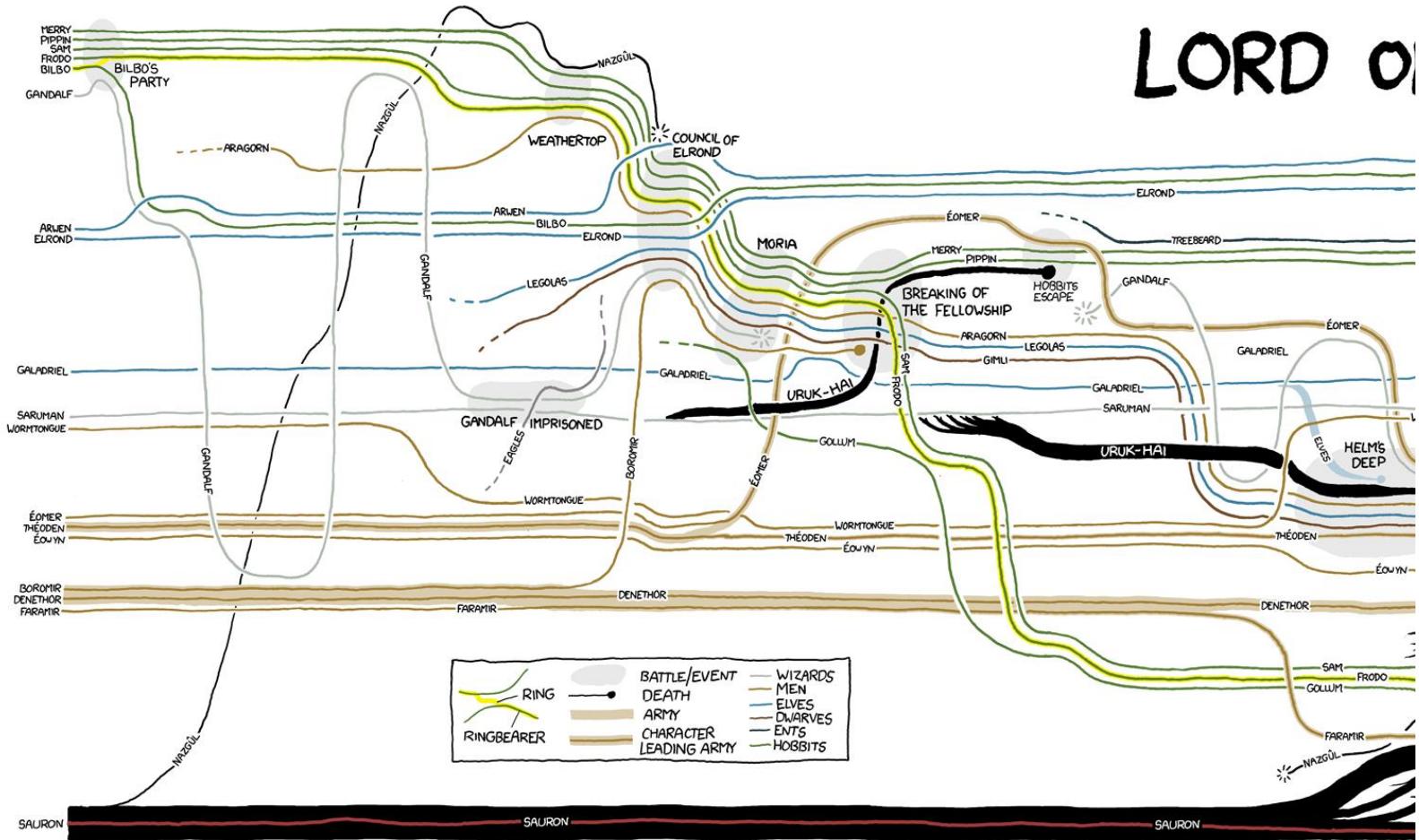
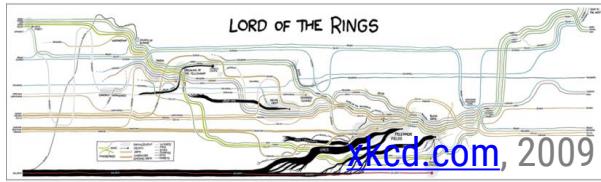


TIMELINES



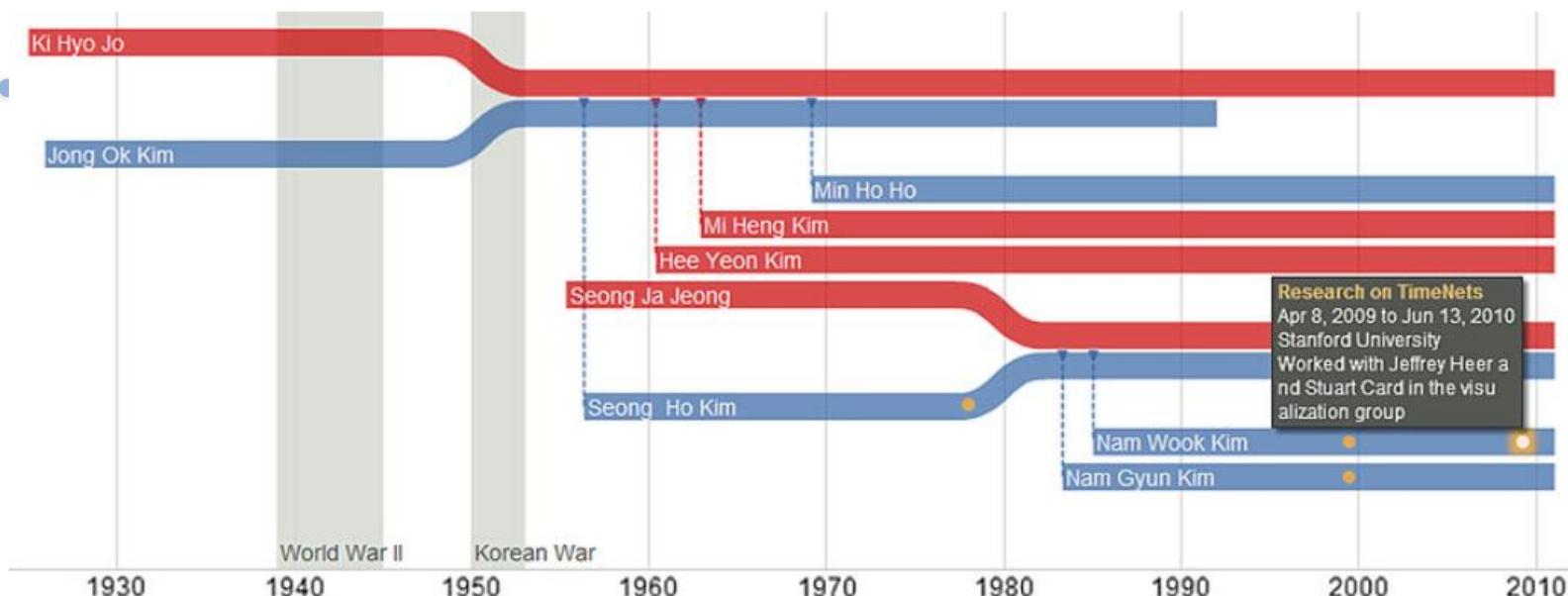
historyshots.com,
2005

TIMELINES

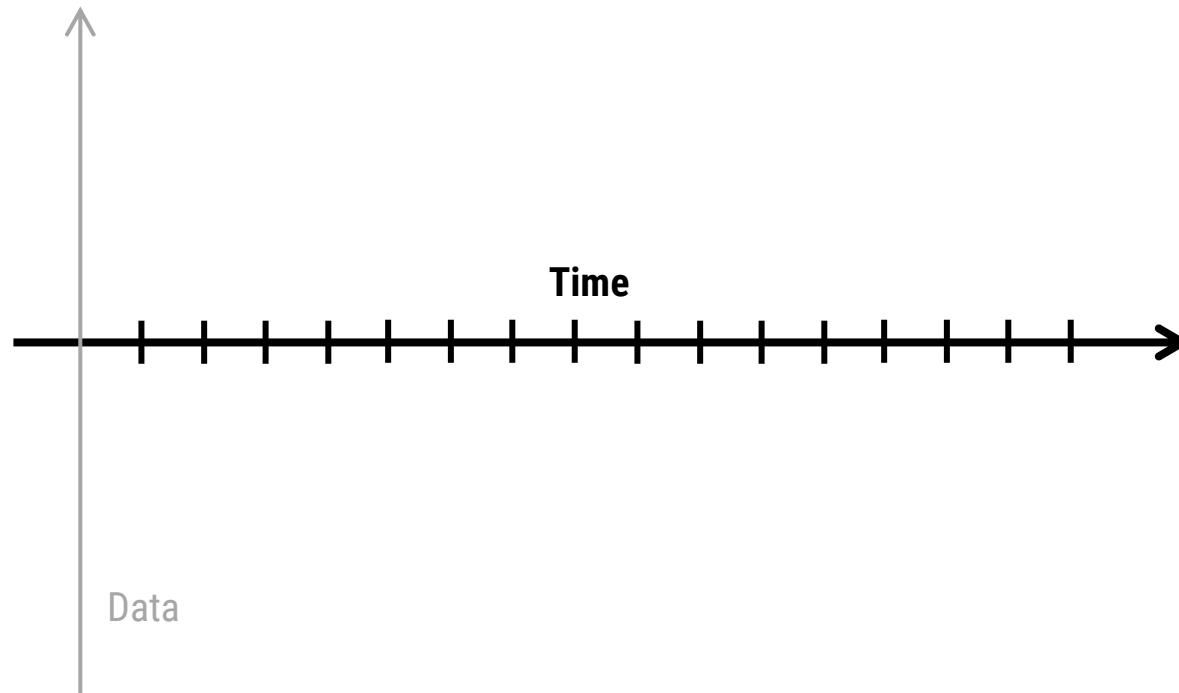


TIMELINES

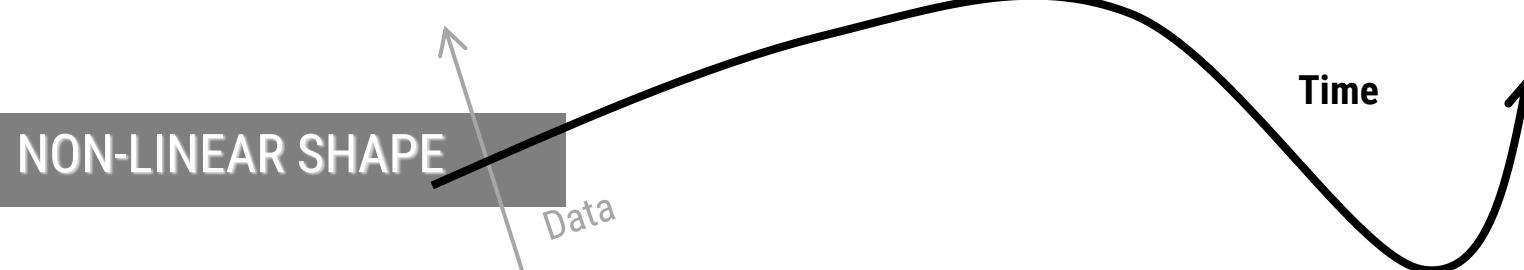
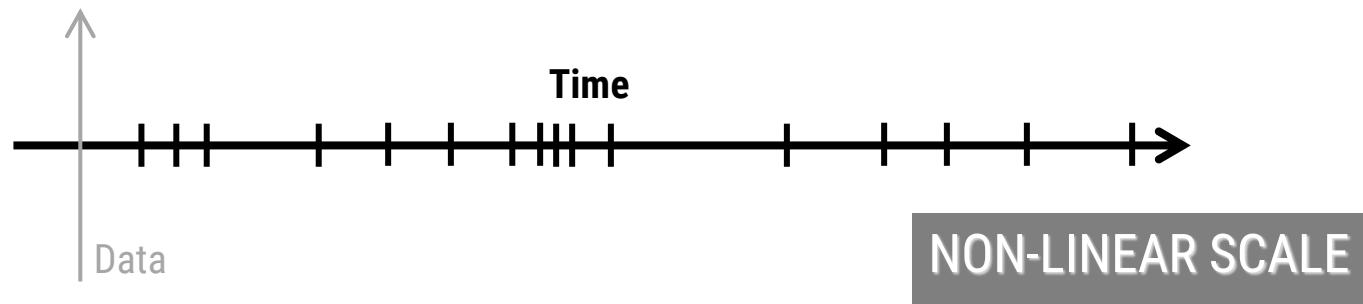
TimeNets



MAPPING TIME TO AN AXIS

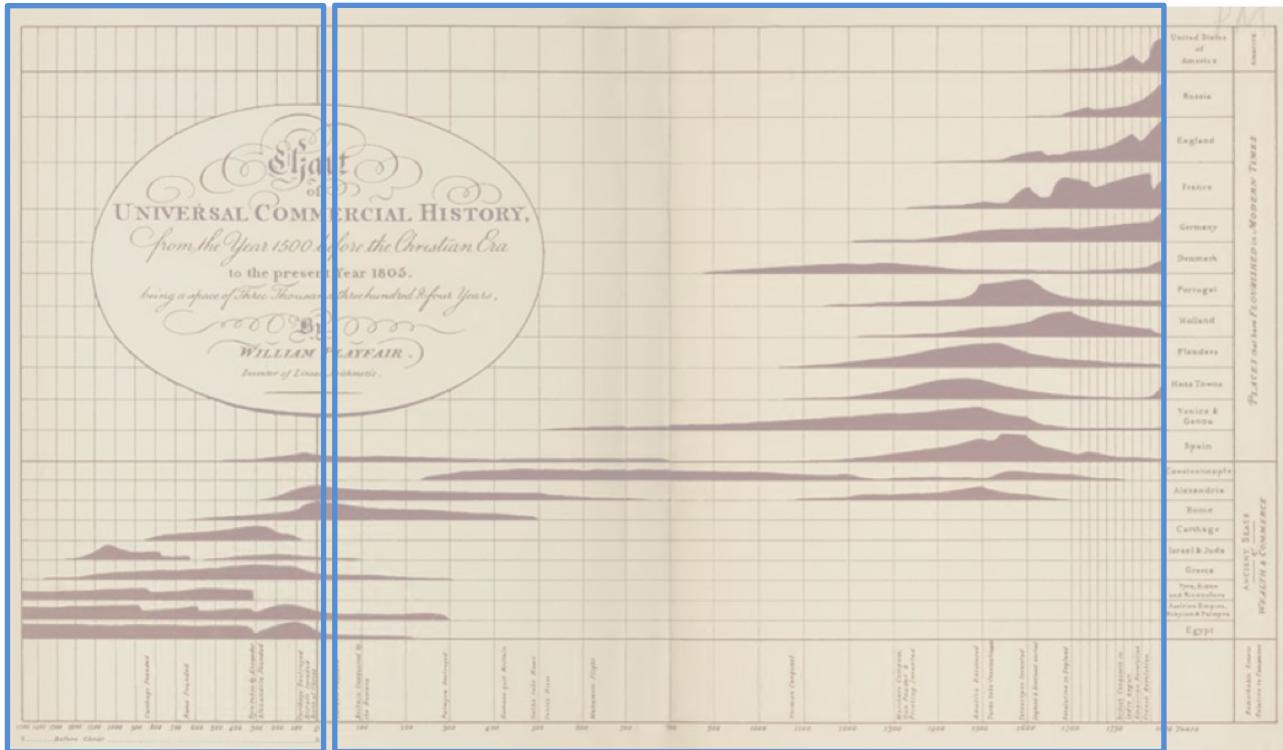


NON-LINEAR TIME AXES



NON-LINEAR TIME AXES

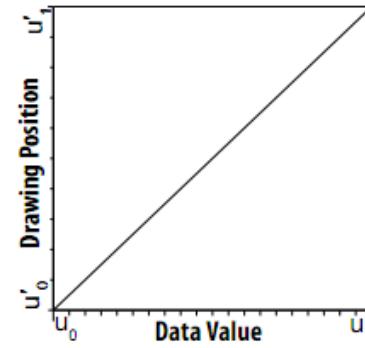
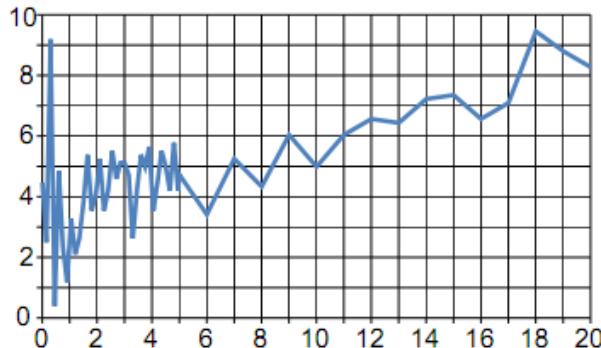
Dual-Scale Charts



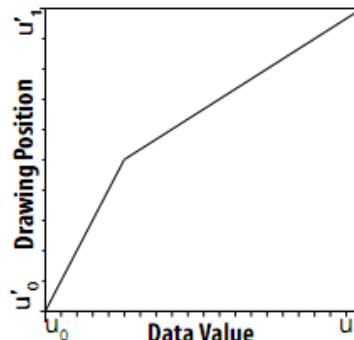
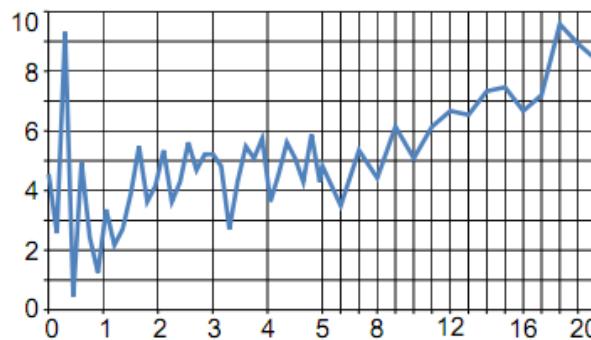
William Playfair, 1805. Cited in [Aigner et al, 2011](#).

NON-LINEAR TIME AXES

Dual-Scale Charts



Regular Chart

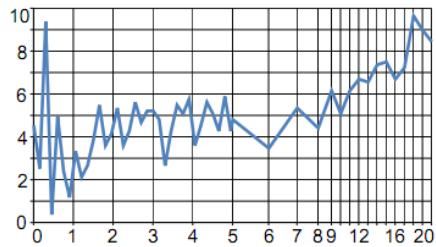


Bifocal Chart

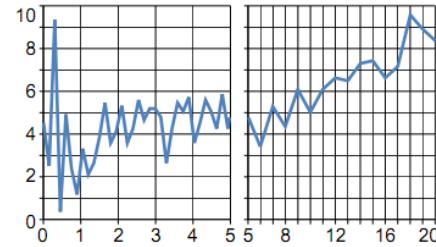
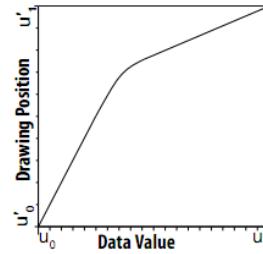
[Isenberg et al. 2011](#)

NON-LINEAR TIME AXES

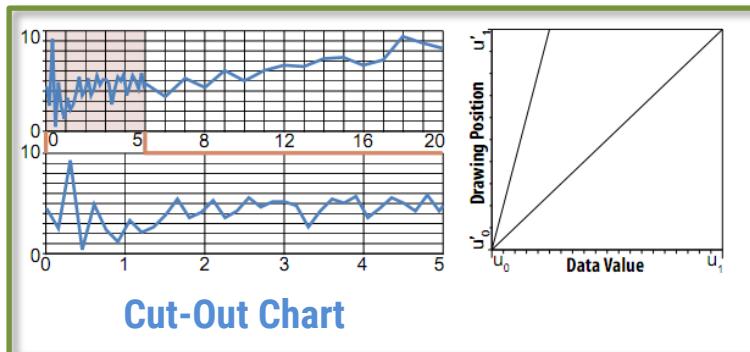
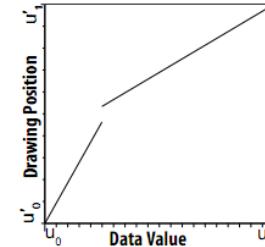
Other Types of Dual-Scale Charts



Lens Chart



Broken Chart



Cut-Out Chart

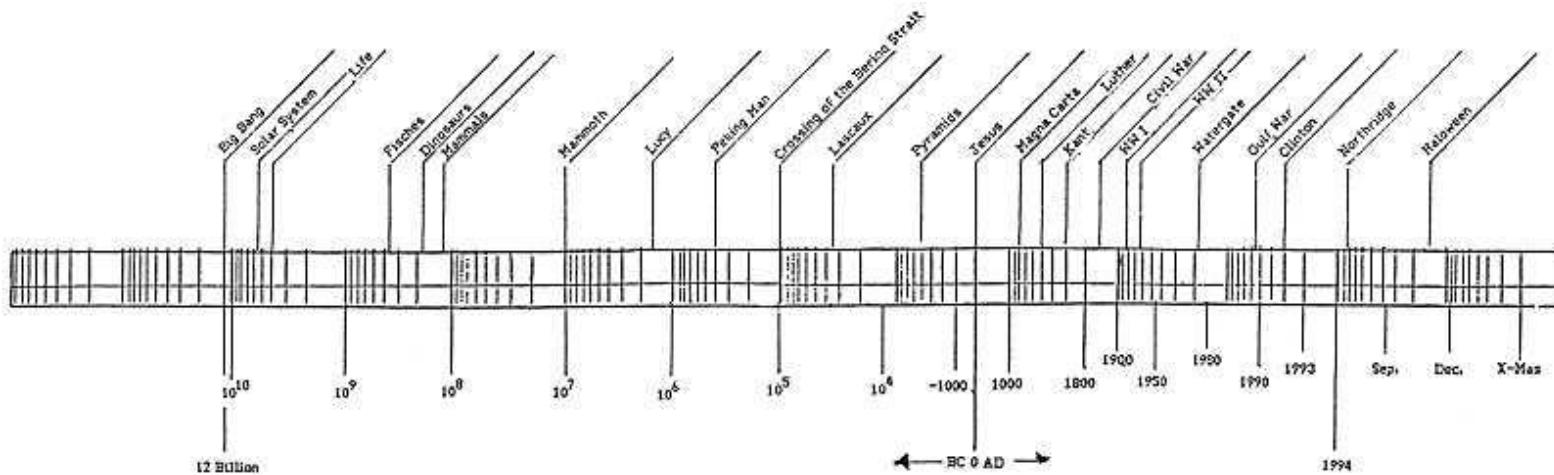


Superimposed Chart

[Isenberg et al, 2011](#)

NON-LINEAR TIME AXES

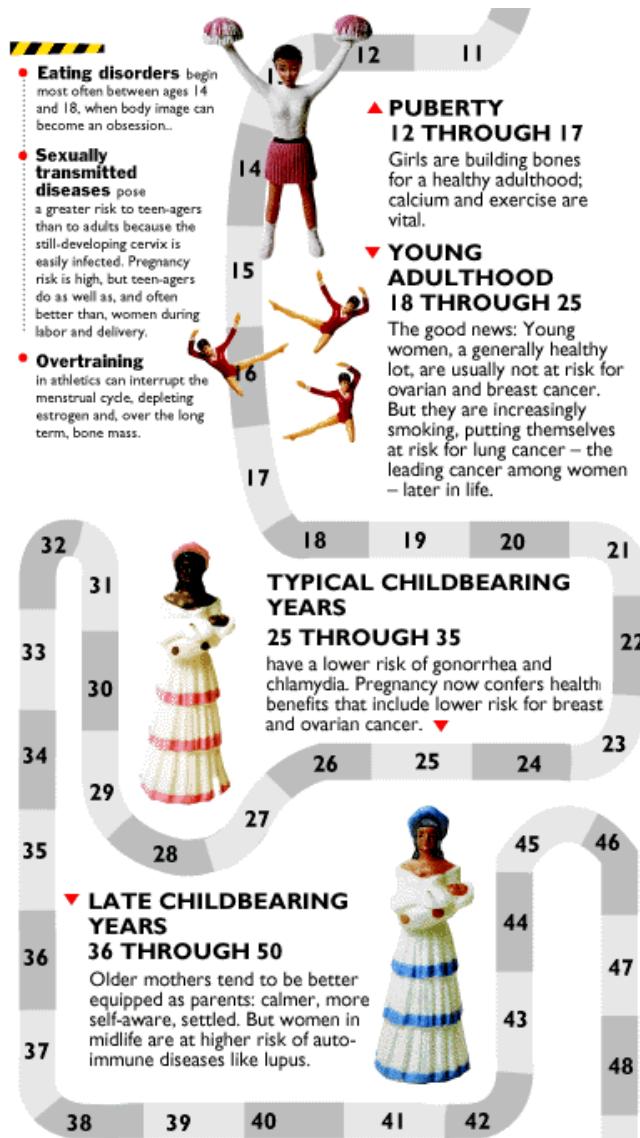
Logarithmic scale



NON-LINEAR

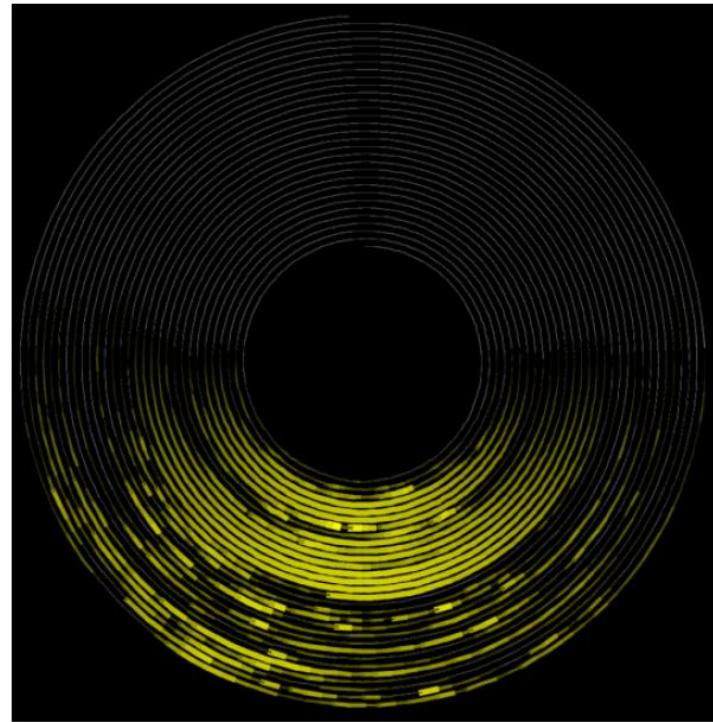
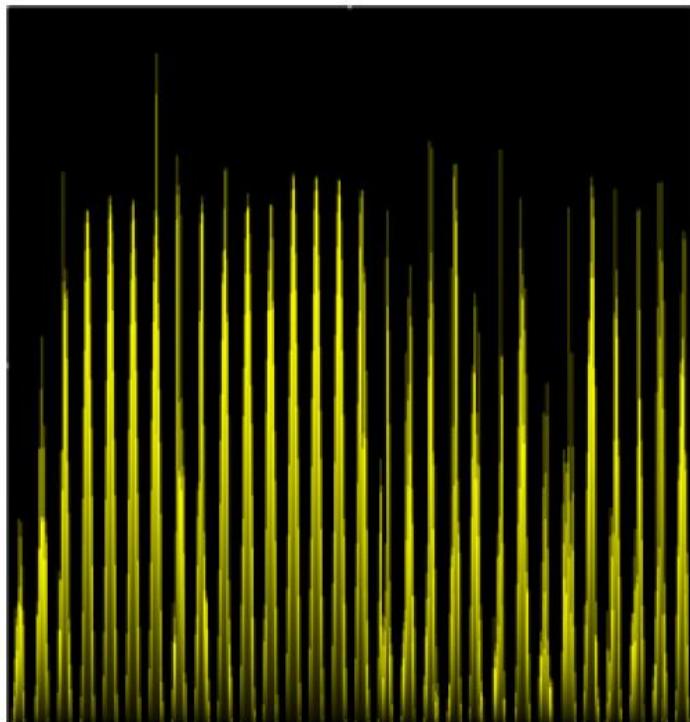
Curved

Megan Jaegerman, 1997



NON-LINEAR TIME AXES

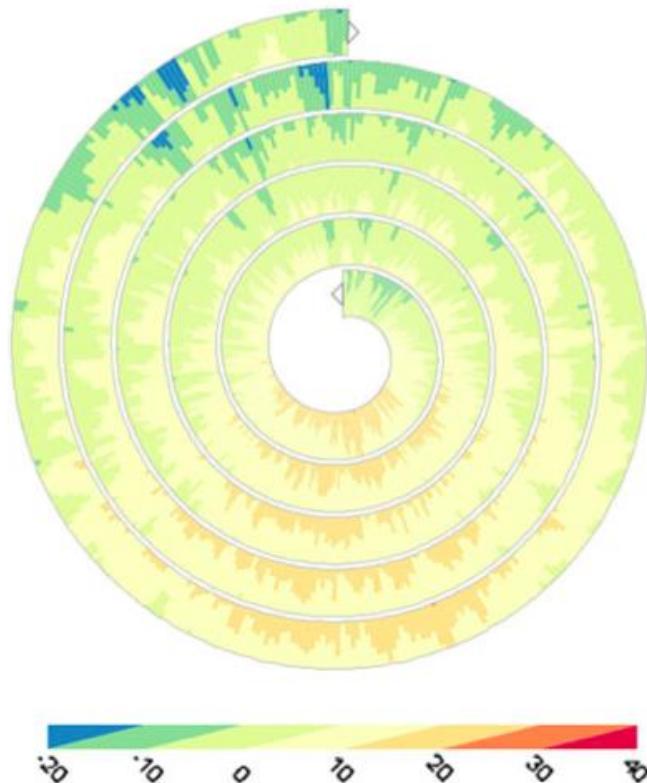
Spiral



[Webel et al, 2001](#)

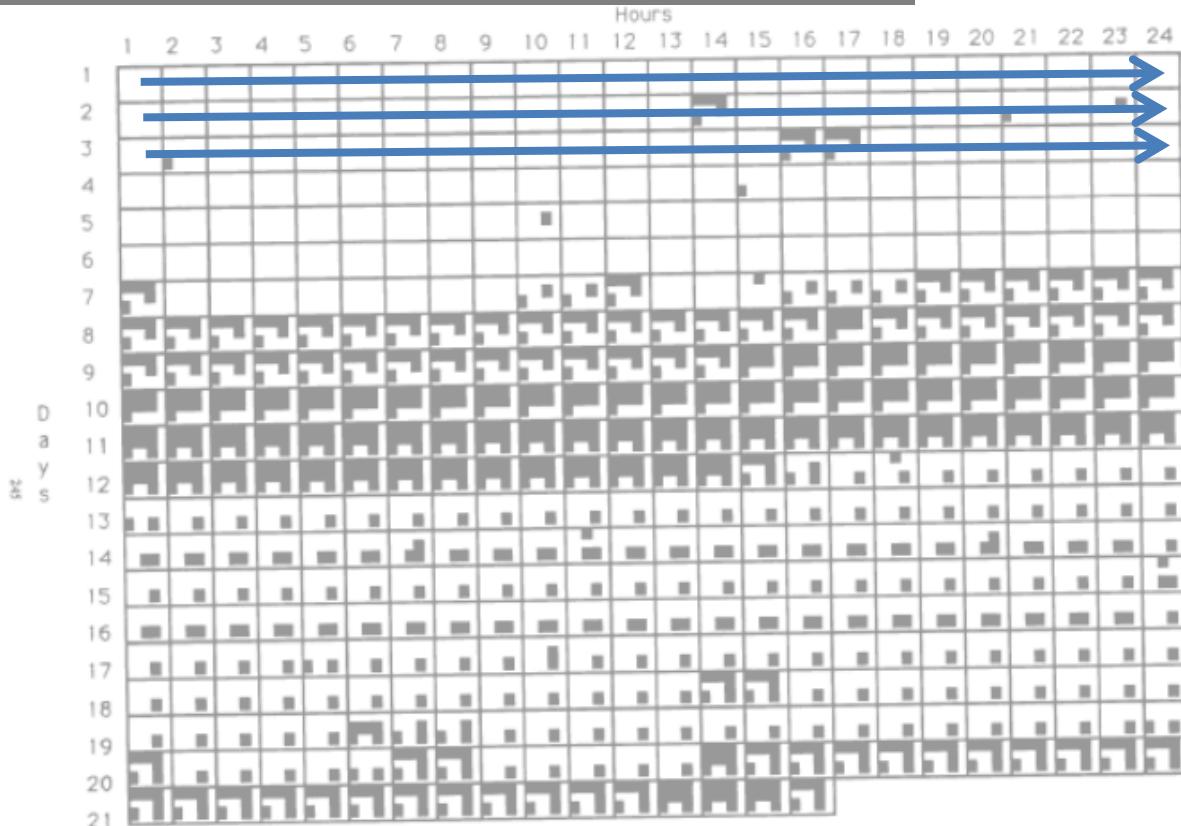
NON-LINEAR TIME AXES

Spiral



NON-LINEAR TIME AXES

Grid



Day by Hour: Thirteen Parameters of Magnetosphere and Solar Wind Data

NON-LINEAR TIME AXES

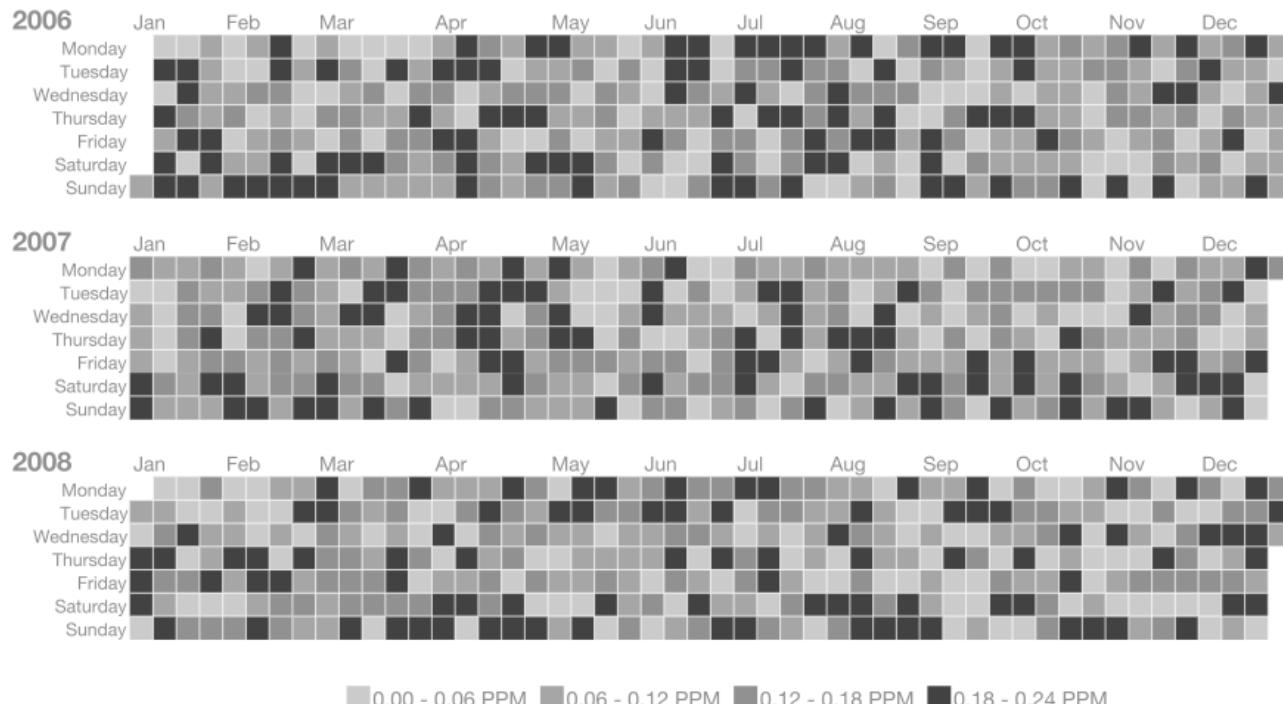
Grid - Calendar



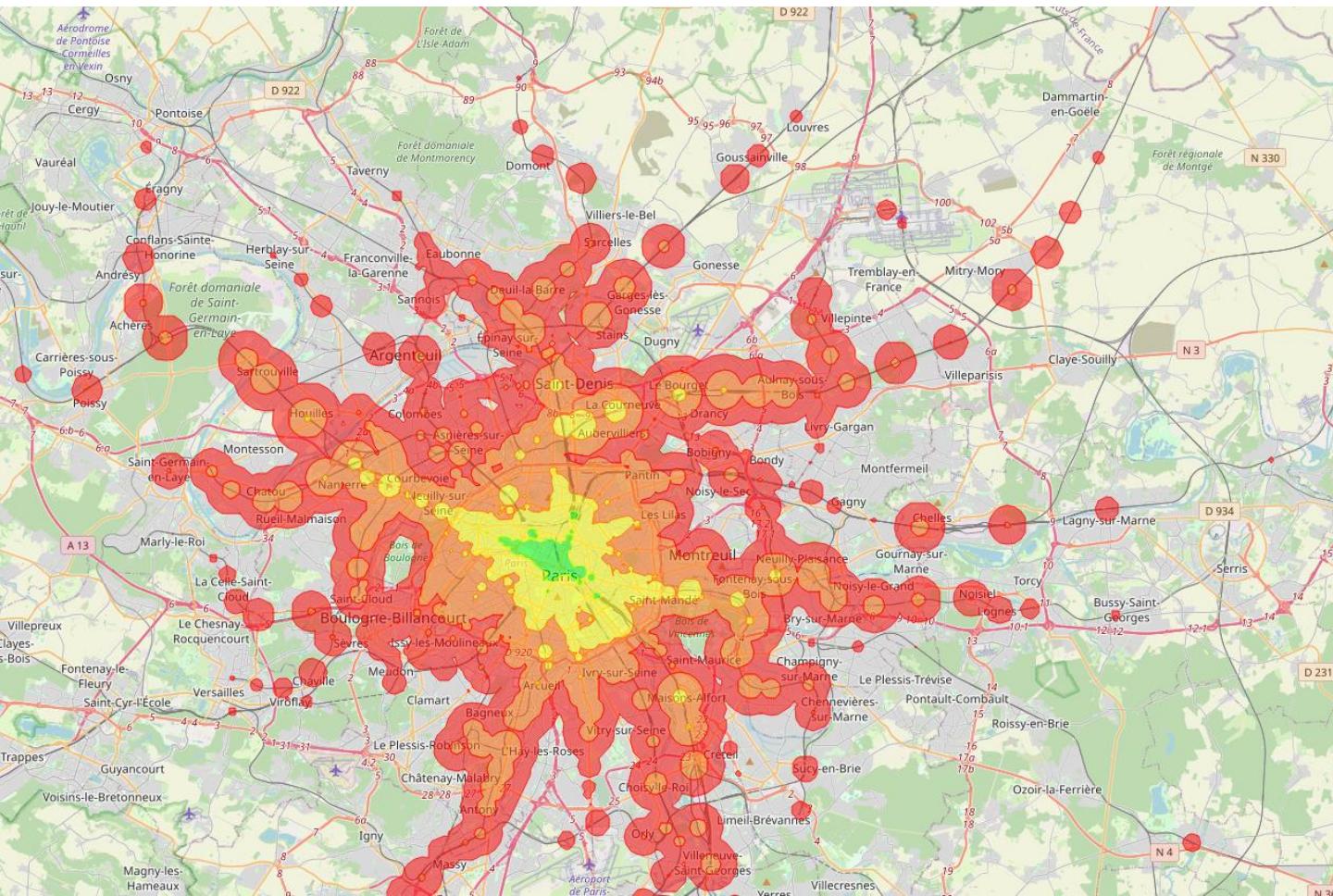
NON-LINEAR TIME AXES

Grid - Tile Map

Krems Ozone



ISOCHRONE MAPS



Cliquez quelque part en Île-de-France, pour lancer le calcul des courbes isochrones.

60min 45min 30min 15min

Comment ça marche?

Les différentes zones de couleur indiquent les temps de trajet estimés à partir du point d'origine. Par exemple, la zone orange est estimée accessible en 45 minutes, à partir du point d'origine.

Les temps de trajet sont calculés à l'aide d'un algorithme écrit à l'origine pour l'application Android [Métro 01](#).

Lignes prises en compte

M	14	11	7	1	3	7 ^{bs}	5	4	9	13	10
	3 ^{bs}	2	12	8	6						
RER	A	B	D	C	E						
T	7	2	3a	6	8	3b	4	1			
Bus	R	L	N	P	J	U	H	K			

Les Bus ne sont pas pris en compte! Cela pénalise les résultats en banlieue où le réseau Bus est plus dense que le réseau RER/Trains.

Approximations (et pistes d'amélioration)

Le moteur ne connaît pas les horaires temps réelles des trains. Il effectue des approximations sur :

- Les temps d'attente en gare
- Les temps d'arrêt à chaque station
- La vitesse des trains entre chaque station
- Votre vitesse de marche

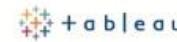
Les résultats sont en général proches de la réalité dans Paris, mais moins bons en banlieue. Le moteur considère par exemple que les RER et les Transiliens s'arrêtent à tous les arrêts de leur ligne (alors que ce n'est presque jamais le cas).

Une approximation est également faite sur la vitesse des

TimeSplines

Sketch-Based Authoring of Flexible and Idiosyncratic Timelines

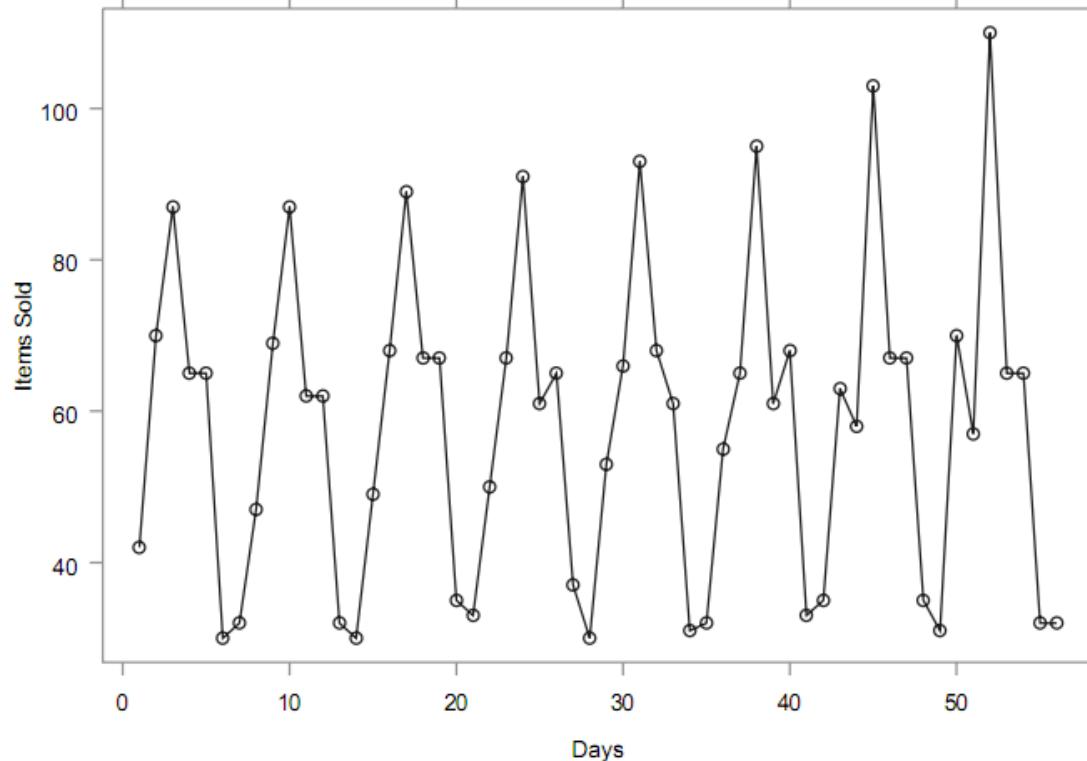
Anna Offenwanger, Matthew Brehmer, Fanny Chevalier, and Theophanis Tsandilas



<https://www.youtube.com/watch?v=vNWgwHK4ExY&t=167s>

NON-LINEAR TIME AXES

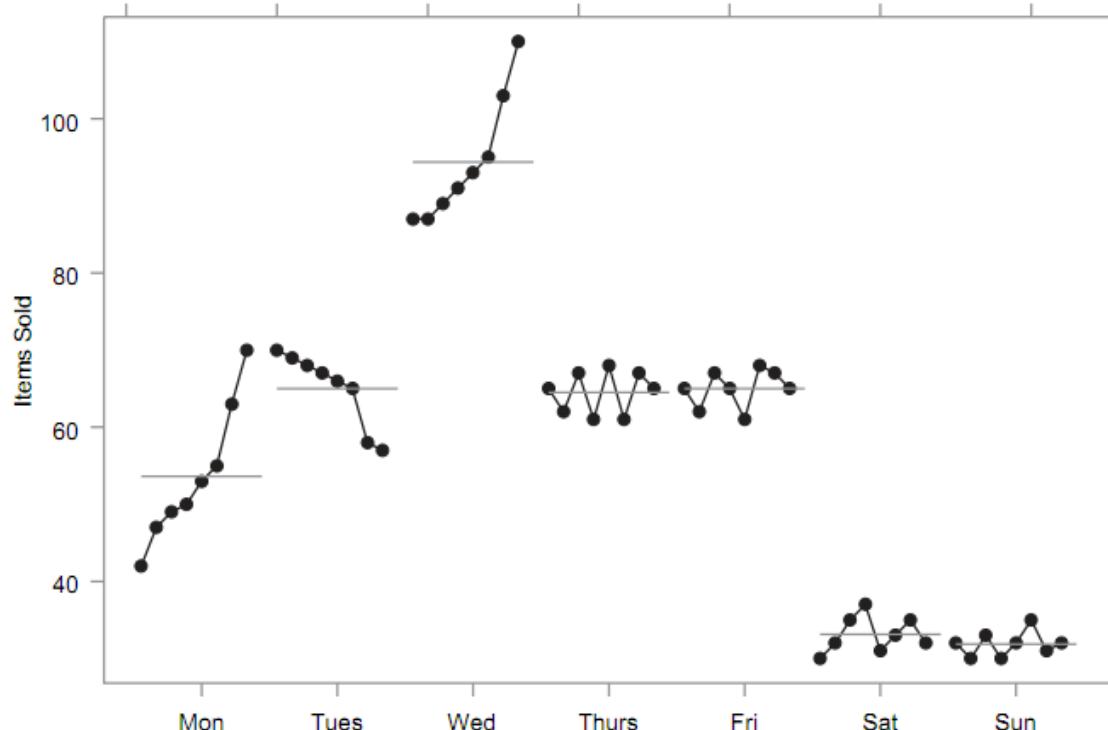
Cycle Plots



[Cleveland et al, 1978](#)

NON-LINEAR TIME AXES

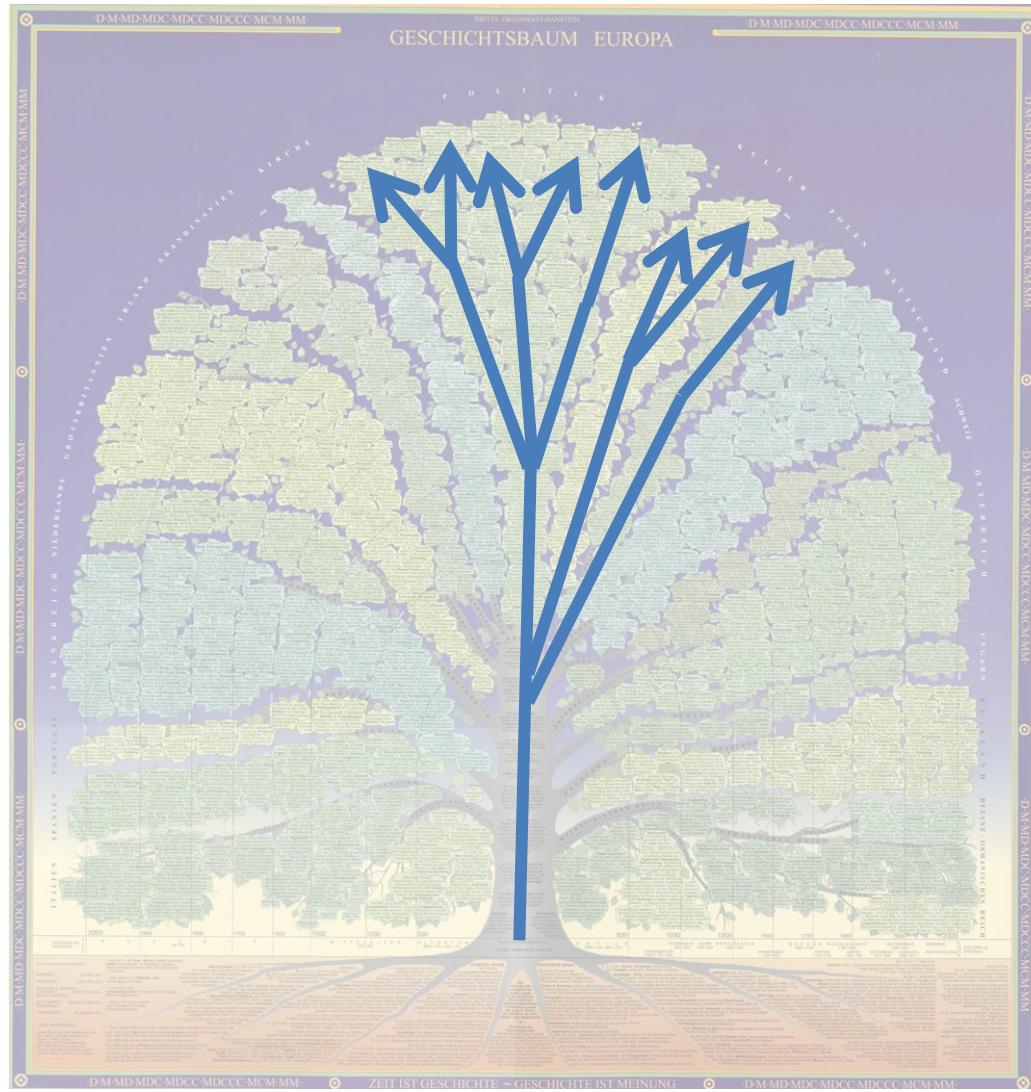
Cycle Plots



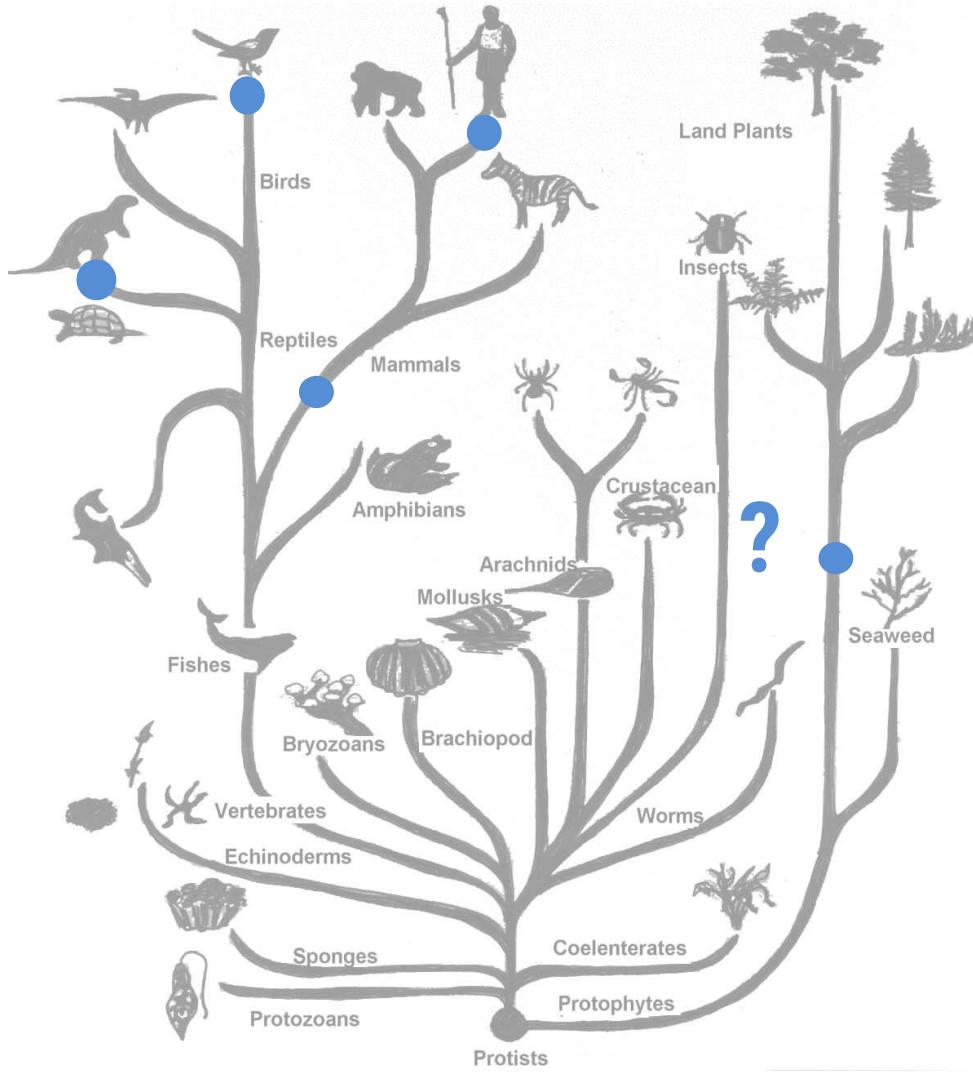
Trees



geschichtsbaum.de

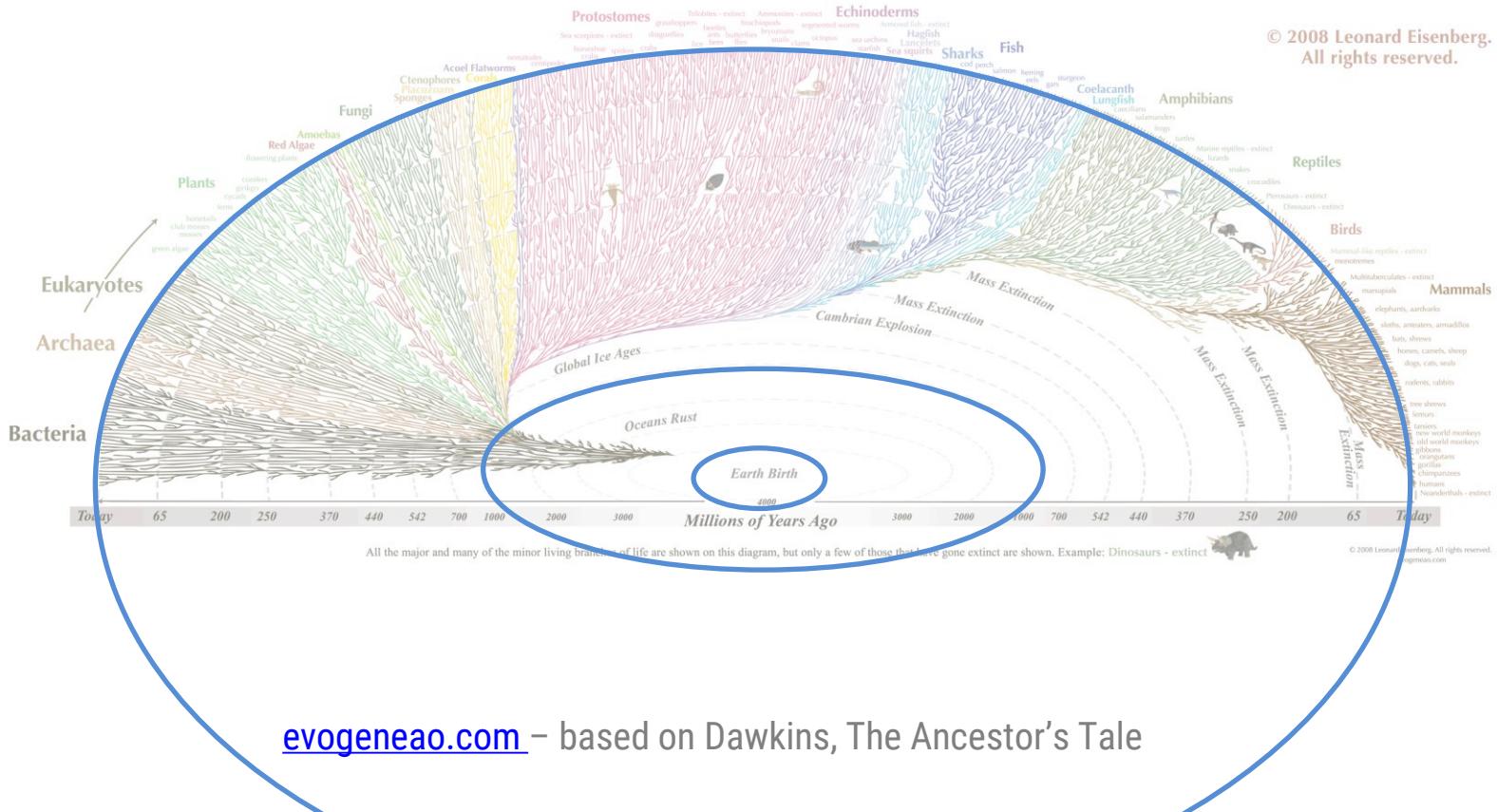


Phylogenetic Tree



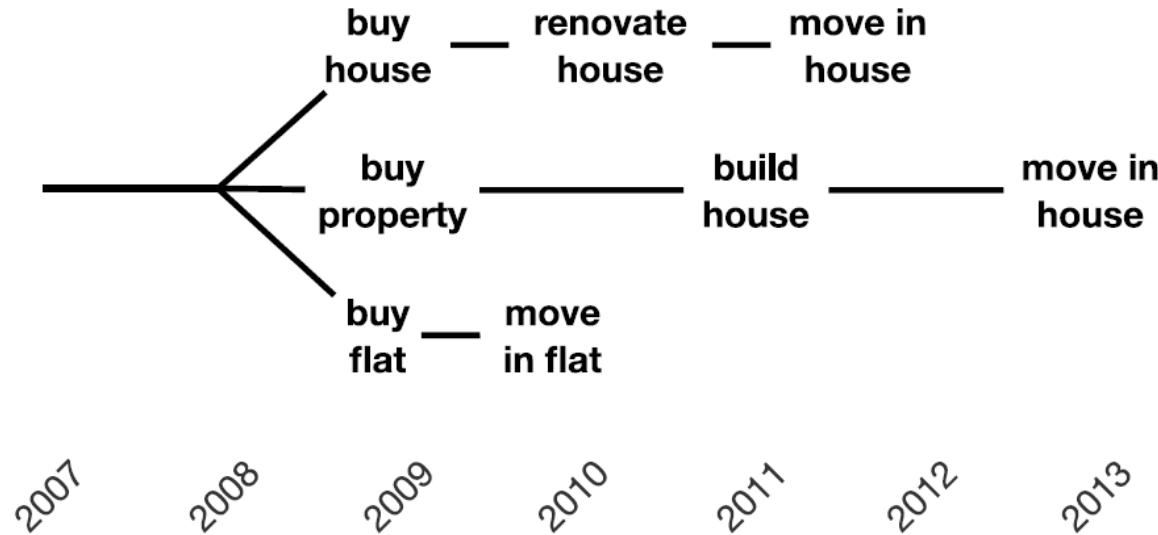
NON-LINEAR TIME AXES

Phylogenetic Tree

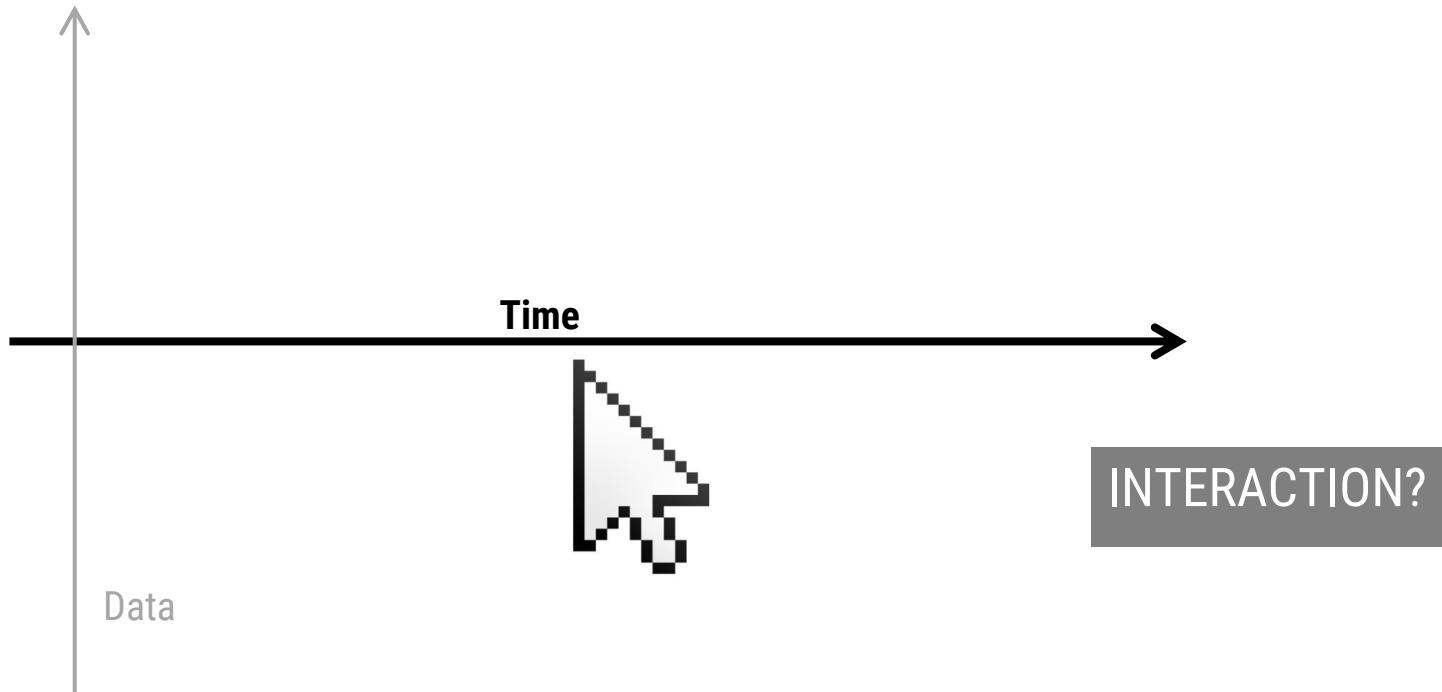


NON-LINEAR TIME AXES

Trees – Branching time

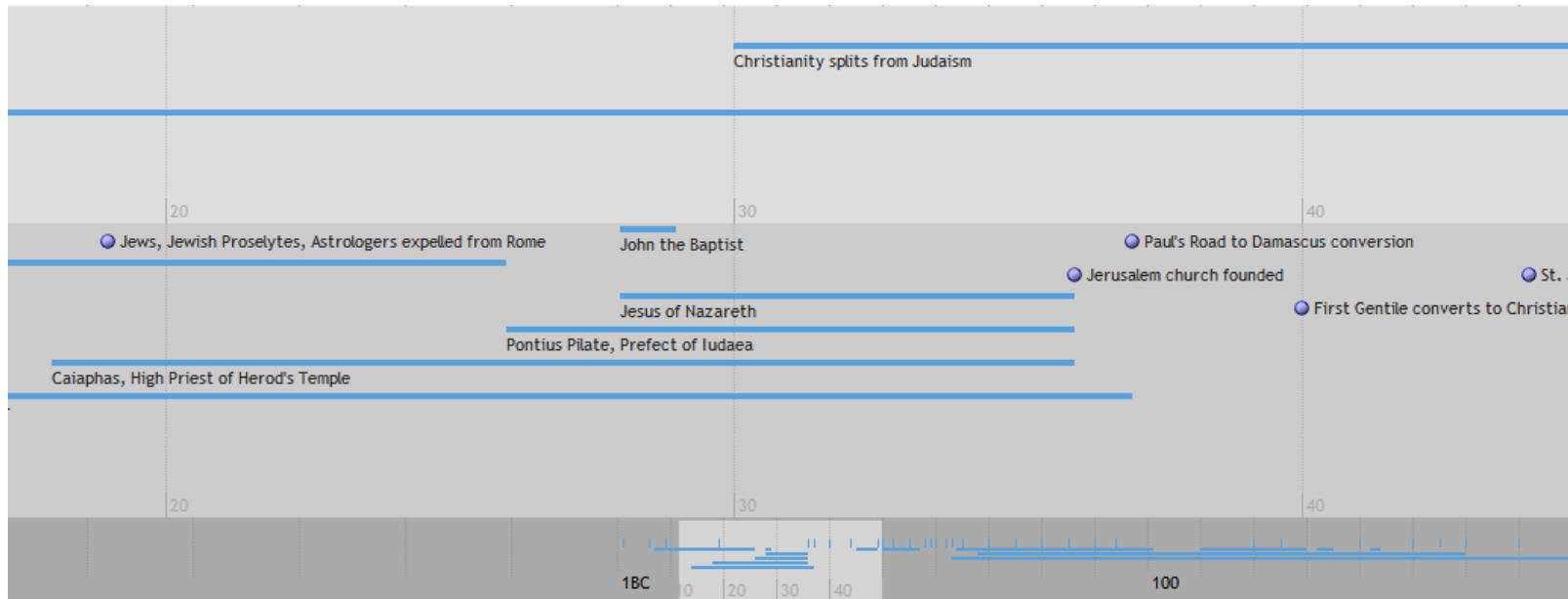


MAPPING TIME TO AN AXIS



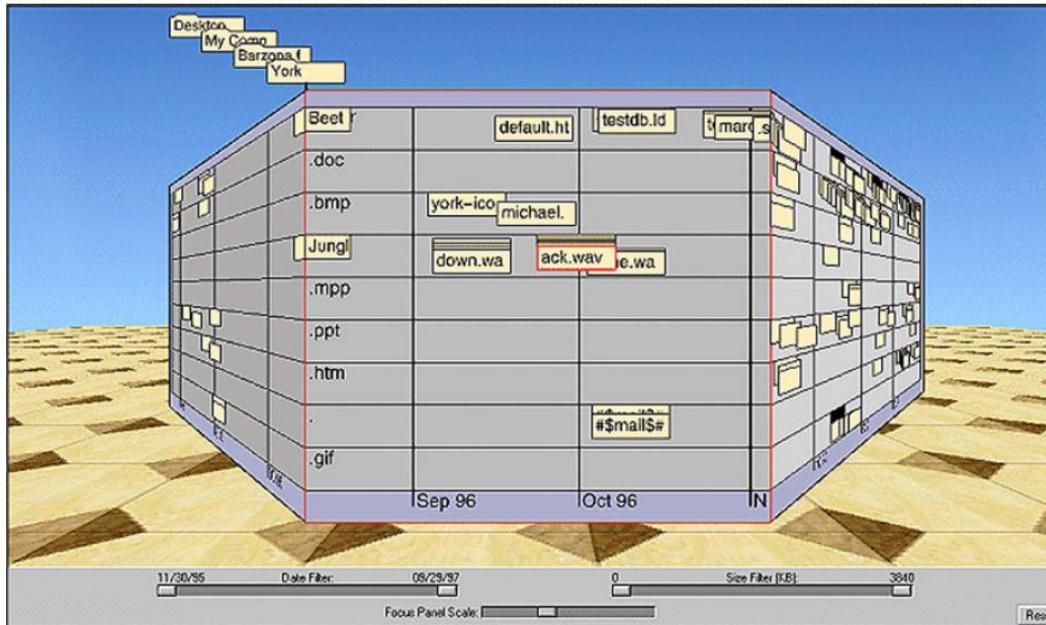
INTERACTION

Focus+Context - Simile Timeline



INTERACTION

Focus+Context - Perspective Wall

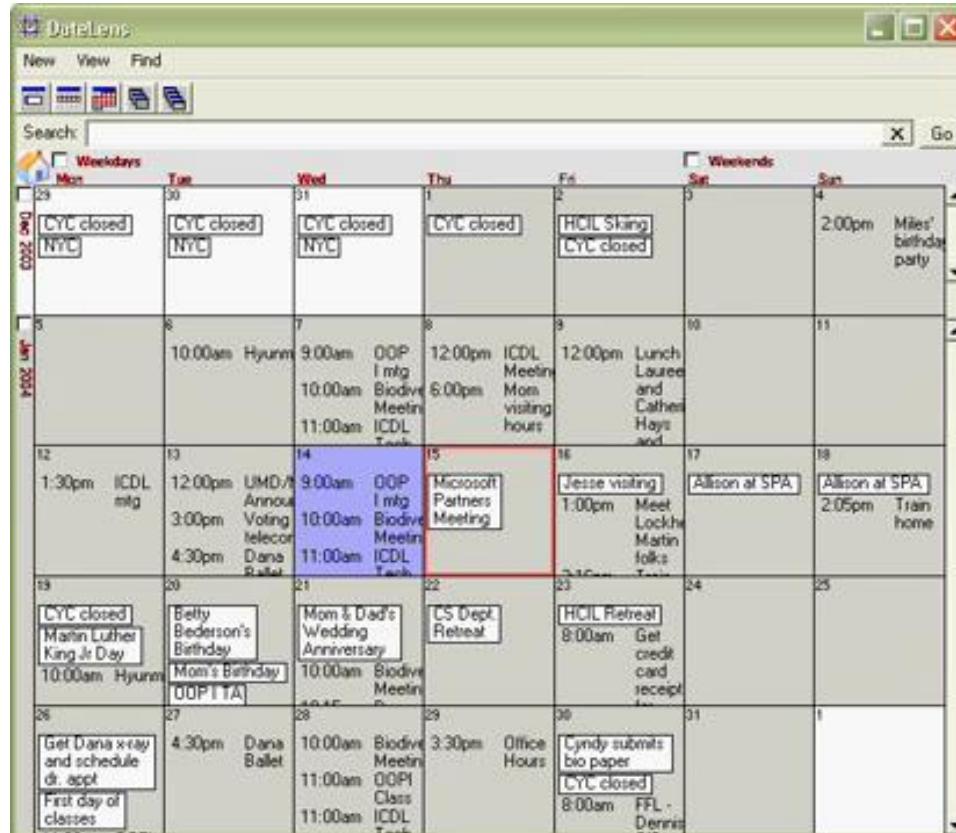
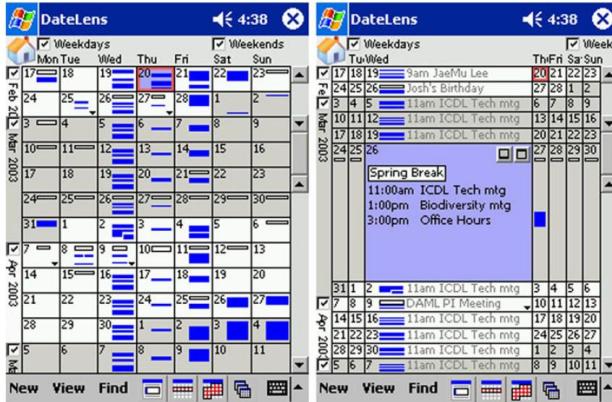




<https://www.youtube.com/watch?v=hYUZbrWtCZg>

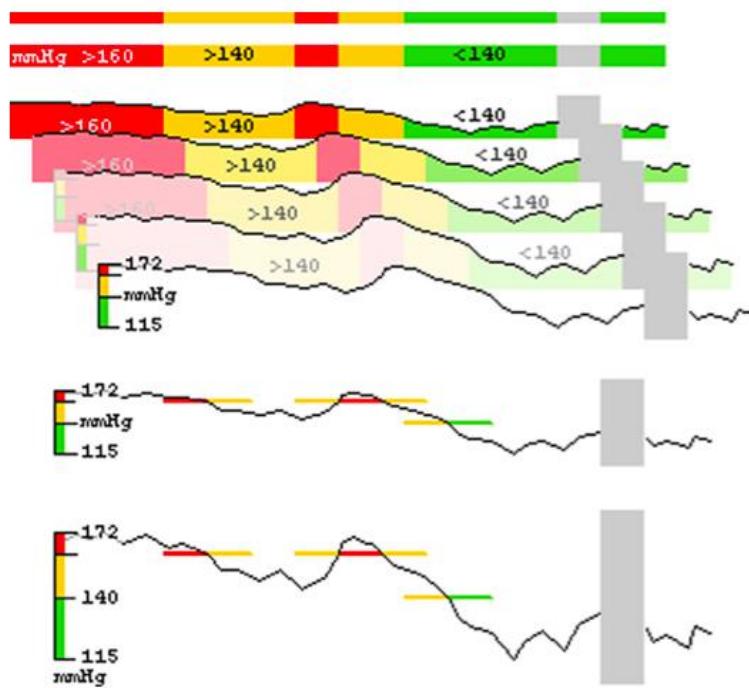
INTERACTION

Focus+Context - DateLens



INTERACTION

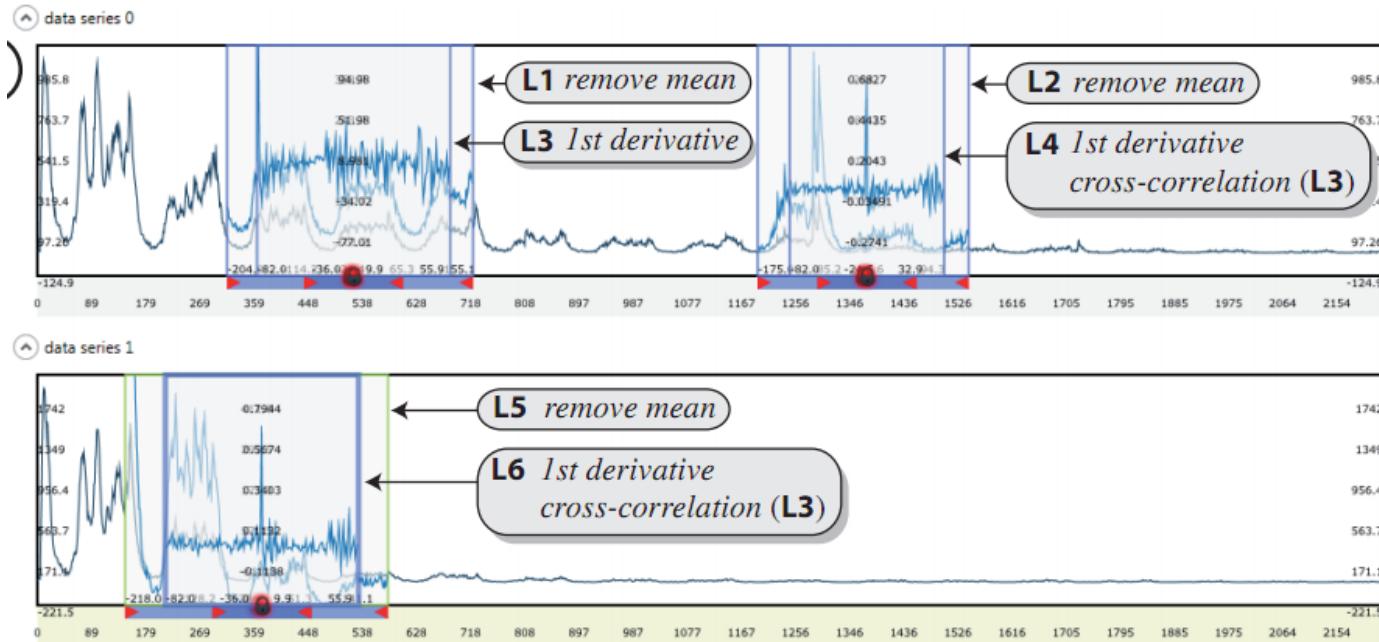
Semantic Zooming - Midgaard



[Schlechtweg and Miksch, 2004](#). Cited in [Aigner et al, 2011](#)

INTERACTION

Magic Lenses - ChronoLenses



Exploratory Analysis of Time-series with ChronoLenses

Jian Zhao

Fanny Chevalier

Emmanuel Pietriga

Ravin Balakrishnan

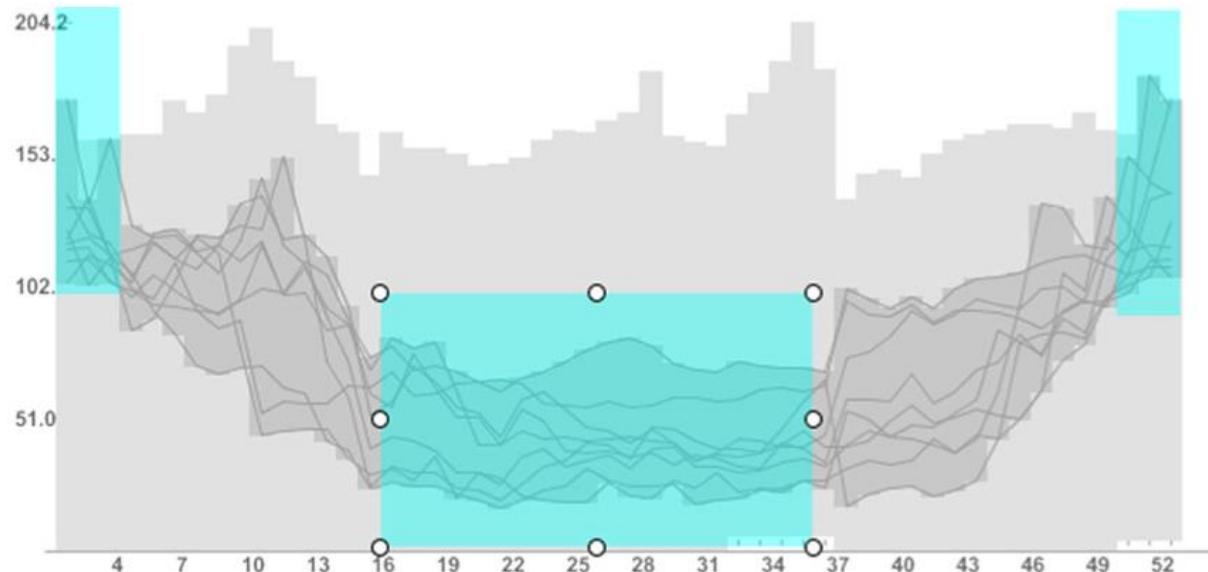


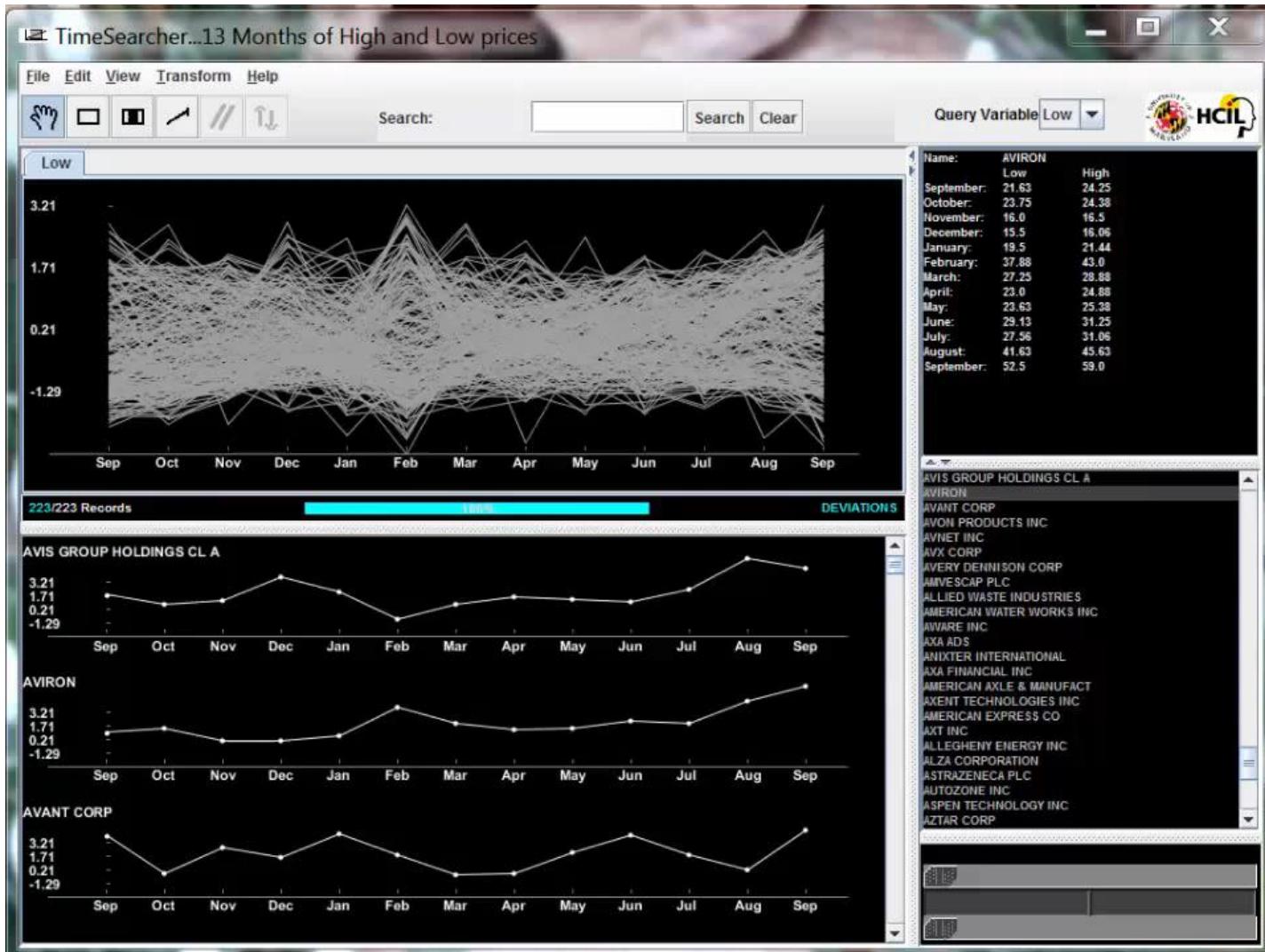
UNIVERSITY OF TORONTO
DEPARTMENT OF COMPUTER SCIENCE
DATA VISUALIZATION
GROUP



INTERACTION

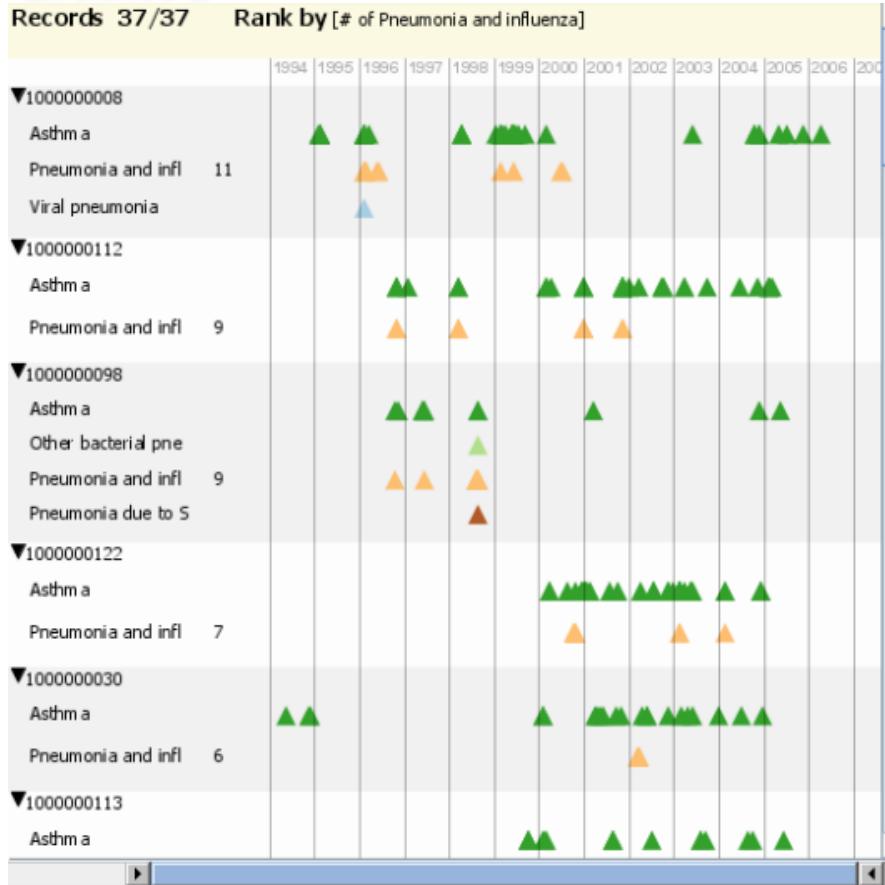
Dynamic queries - Time Searcher





INTERACTION

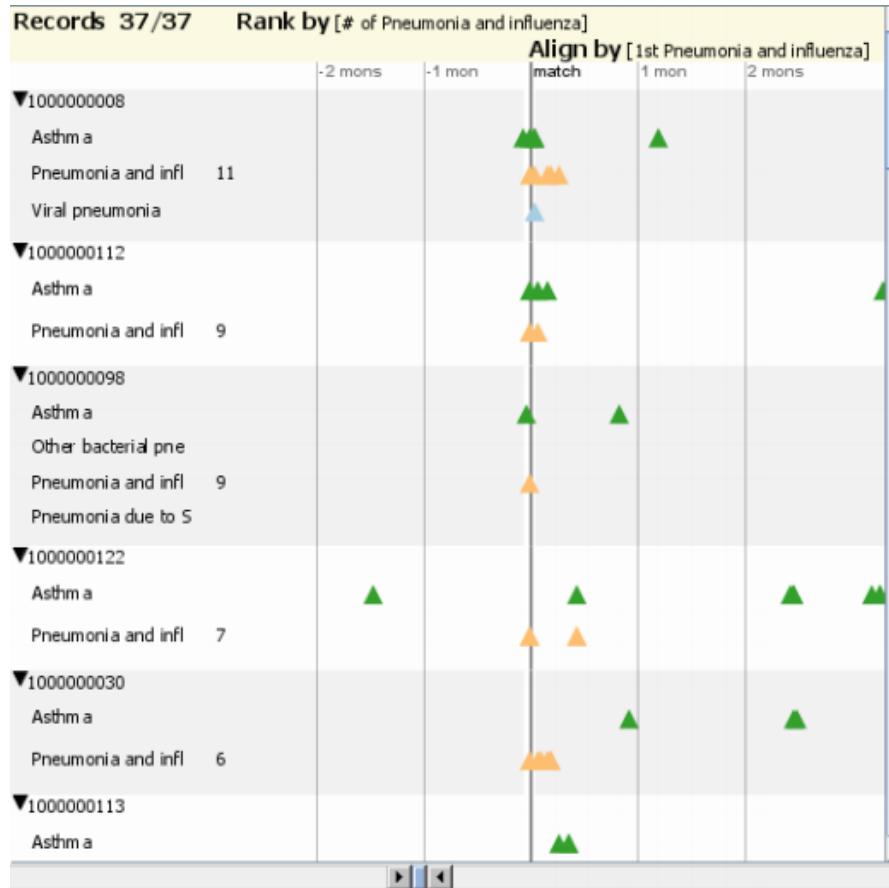
Temporal alignment – Lifelines 2



Wang et al,
2008

INTERACTION

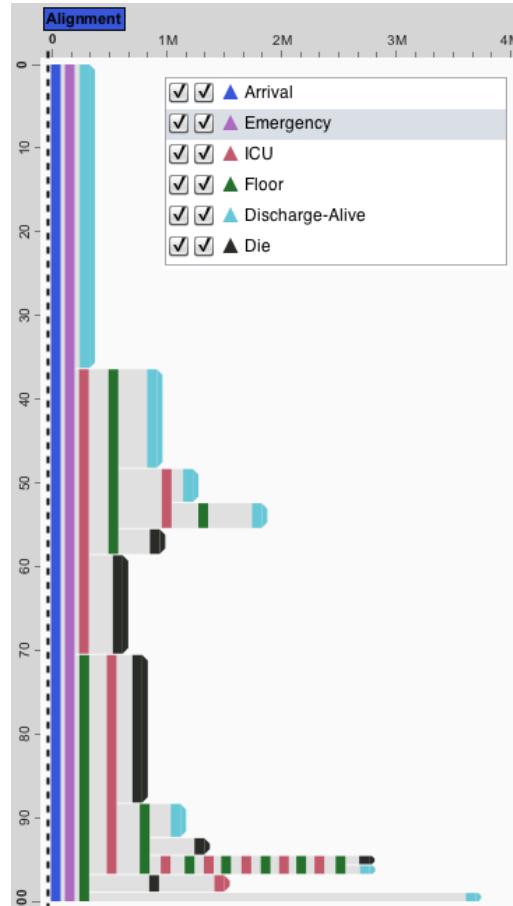
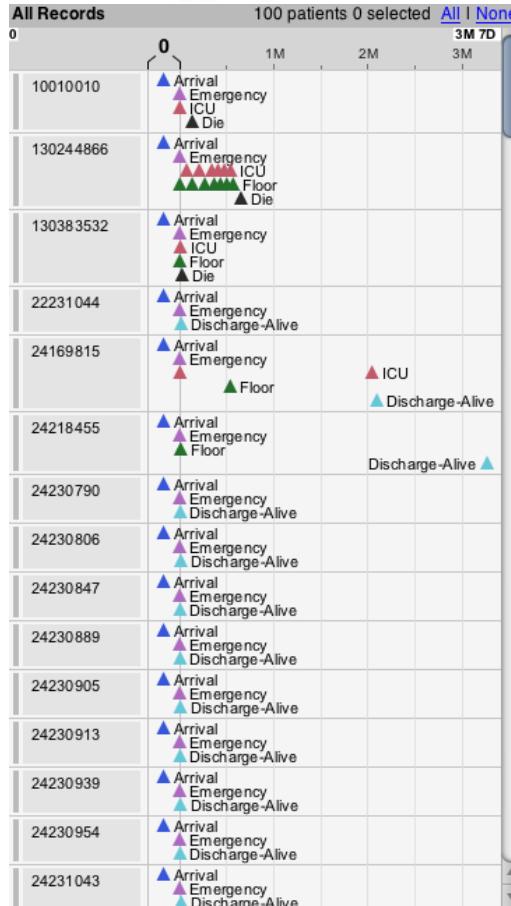
Temporal alignment – Lifelines 2



INTERACTION

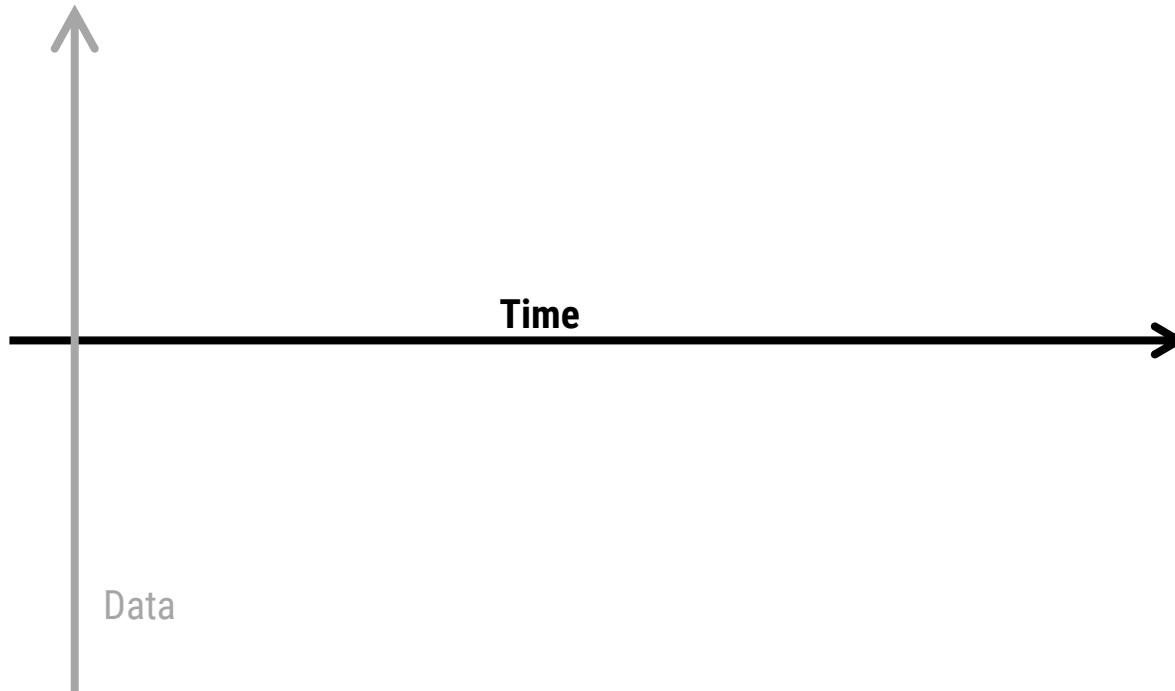
Wongsuphasawat et al.
2011

Temporal alignment + Aggregation – LifeFlow

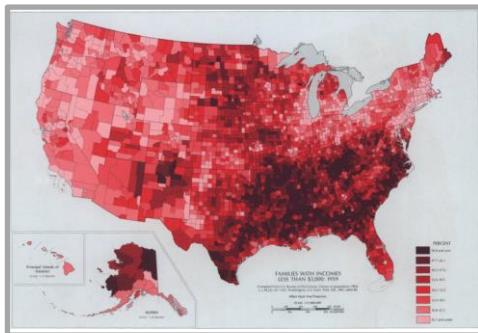


MAPPING TIME TO SPACE

MAPPING TIME TO AN AXIS



MAPPING TIME TO AN AXIS

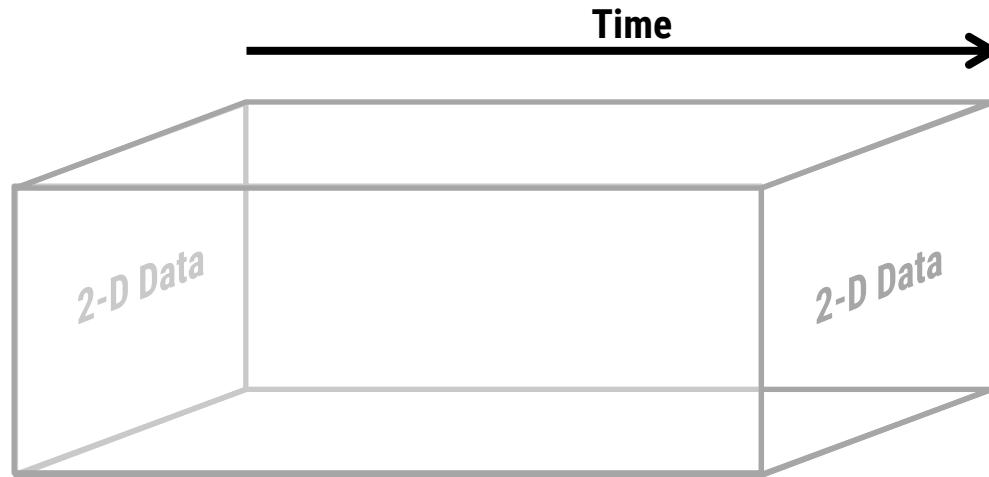


Time

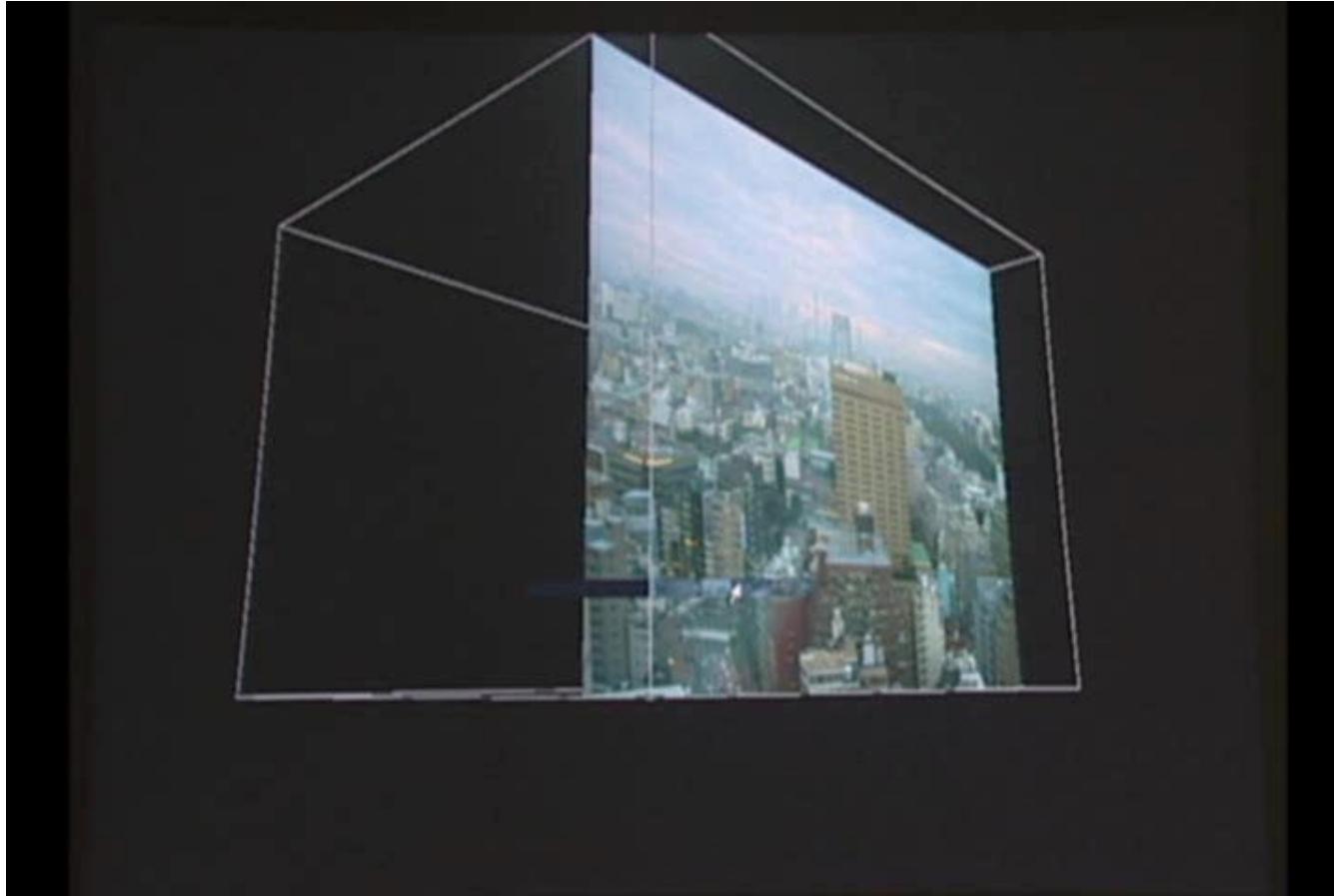
Data

2D + TIME

Space-Time Cube Model



2D + TIME



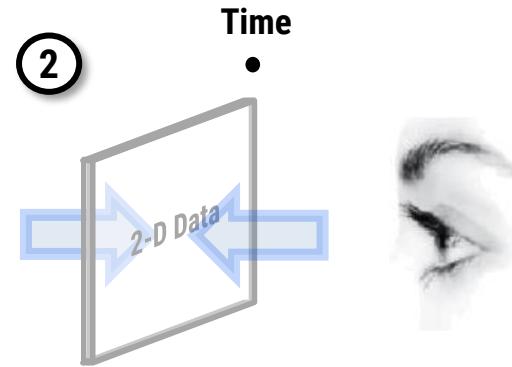
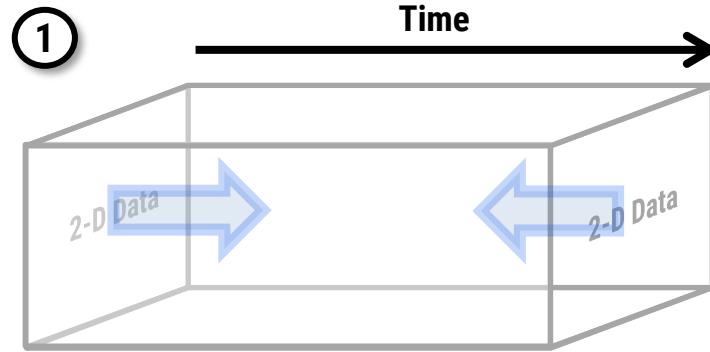
2D + TIME



[Cassinelli, 2005](#)

2D + TIME

Time Flattening



2D + TIME

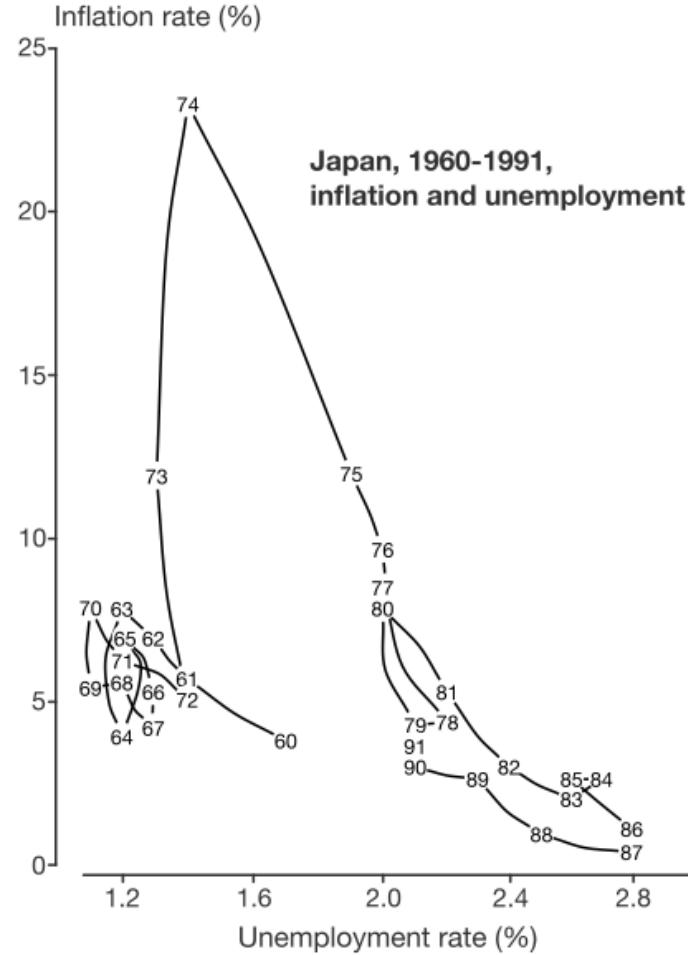
Long exposure photography



www.dlmument.com

2D + TIME

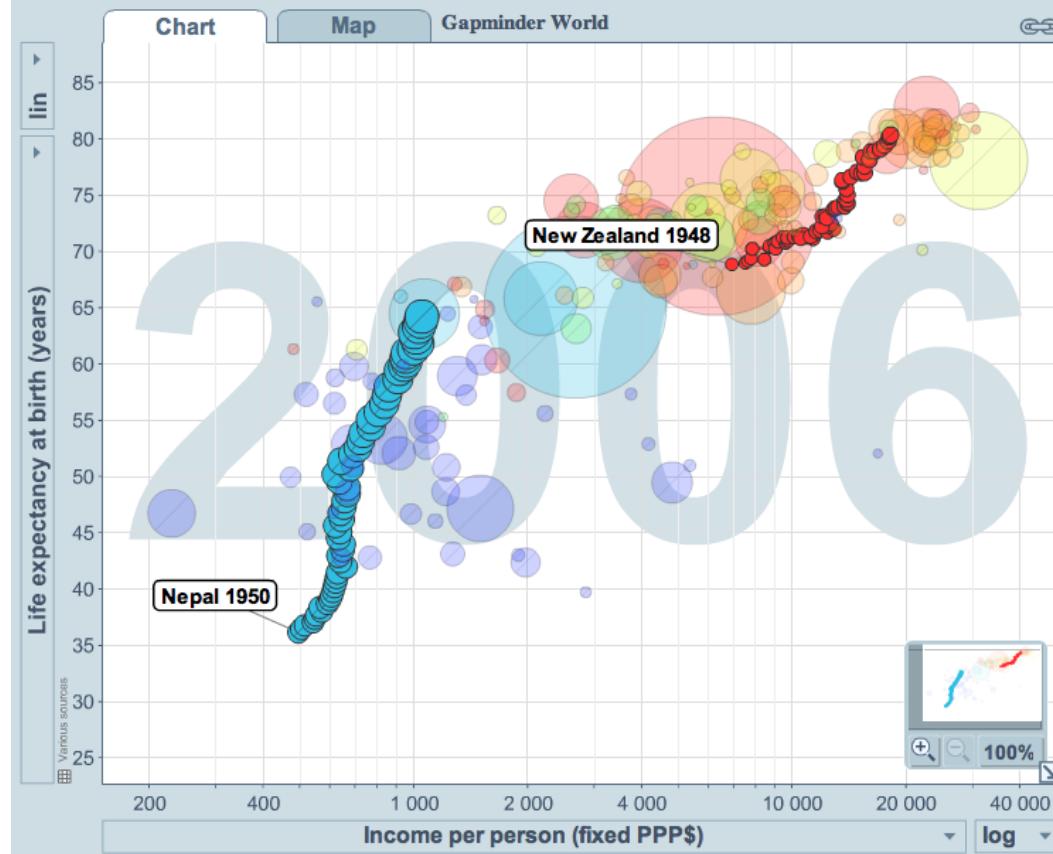
Phillips Curve



Tufte, 1997. Cited in [Aigner et al, 2001](#)

2D + TIME

Trails



2D + TIME

Napoleon's Russian Campaign of 1812

Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.
Dessiné par M. Minard, Inspecteur Général des Ponts et Chaussees en retraite. Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie; le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été pris dans les ouvrages de M. Chiers, de Léger, de Fezensac, de Chambray et le journal intérieur de Jacob, pharmacien de l'Armée depuis le 28 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Napoléon et du Maréchal Davout, qui avaient été détranchés sur Minsk et Malibow et en rejoignaient vers Orelka et Wilensk, avaient toujours marché avec l'armée.

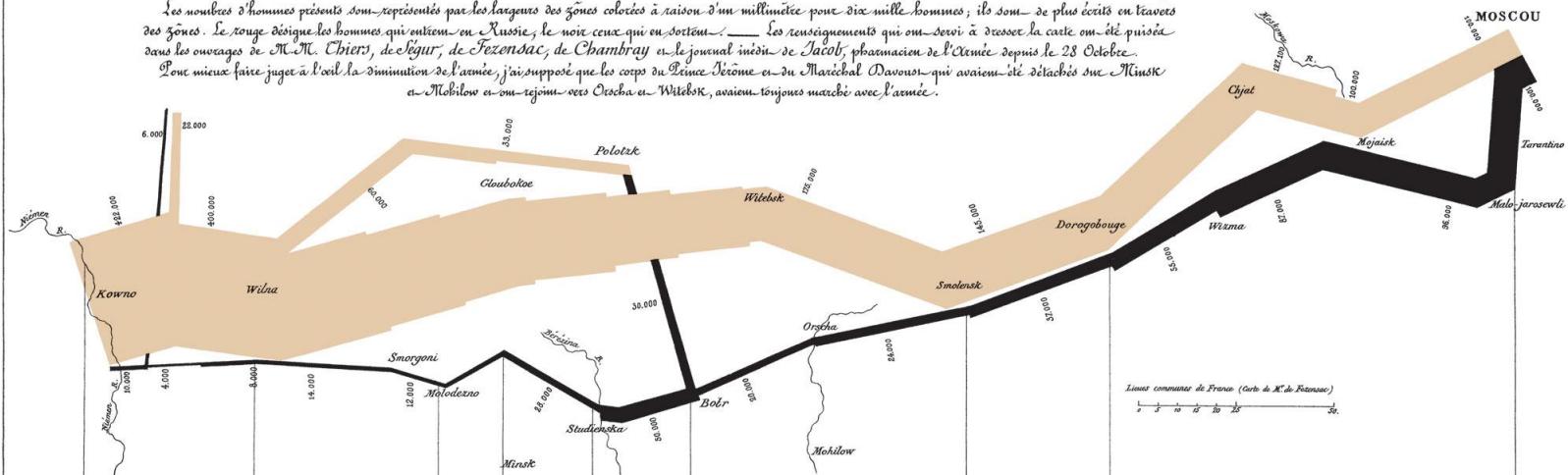
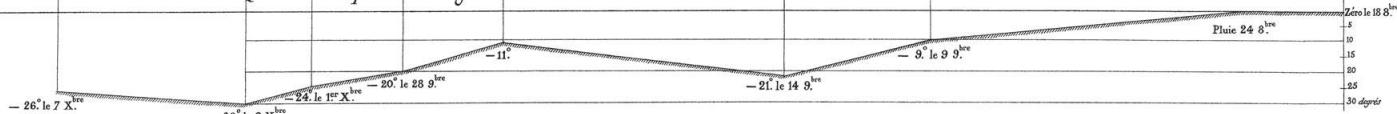


TABLEAU CRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.

Les Cosaques passent au galop
le Niemen gelé.



2D + TIME

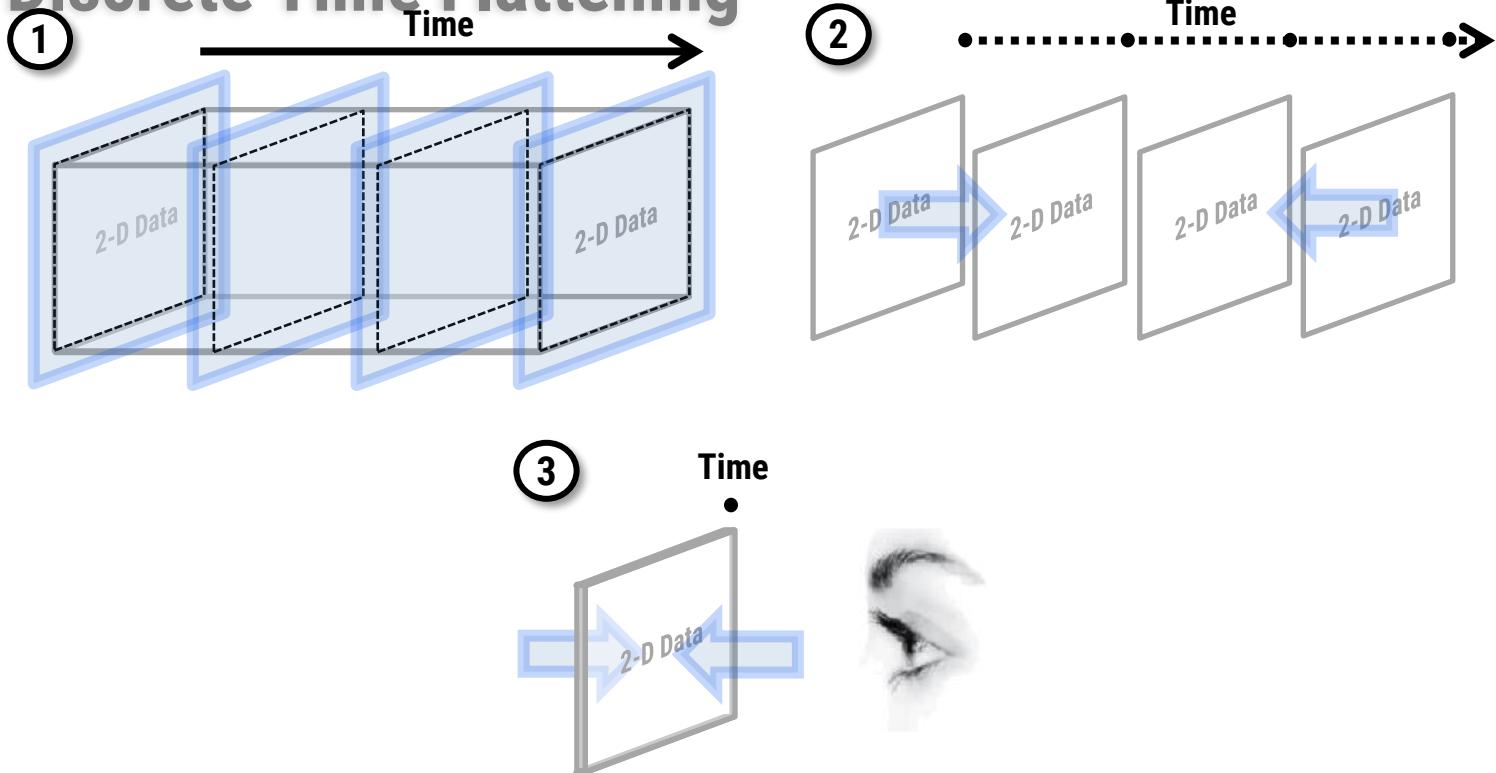
Flow Maps



Tobler, 1987
Adrienko, 2011

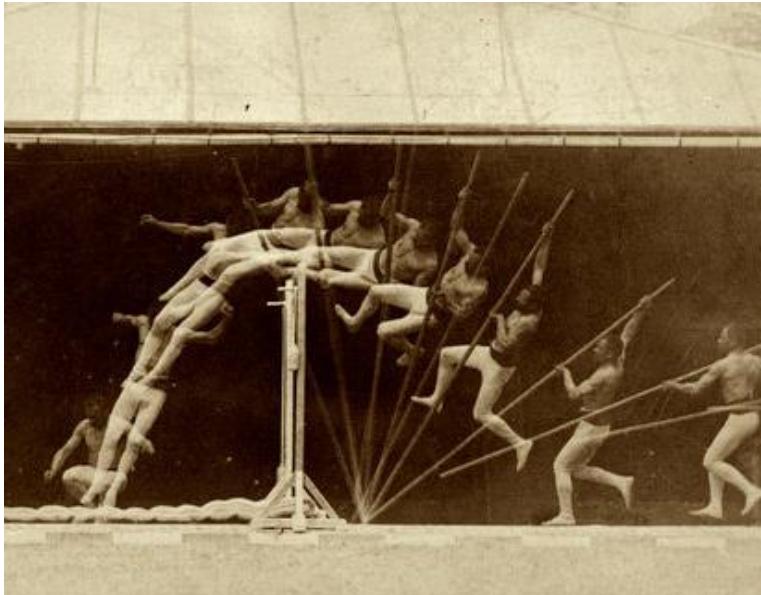
2D + TIME

Discrete Time Flattening



2D + TIME

Marey's Chronophotography Technique

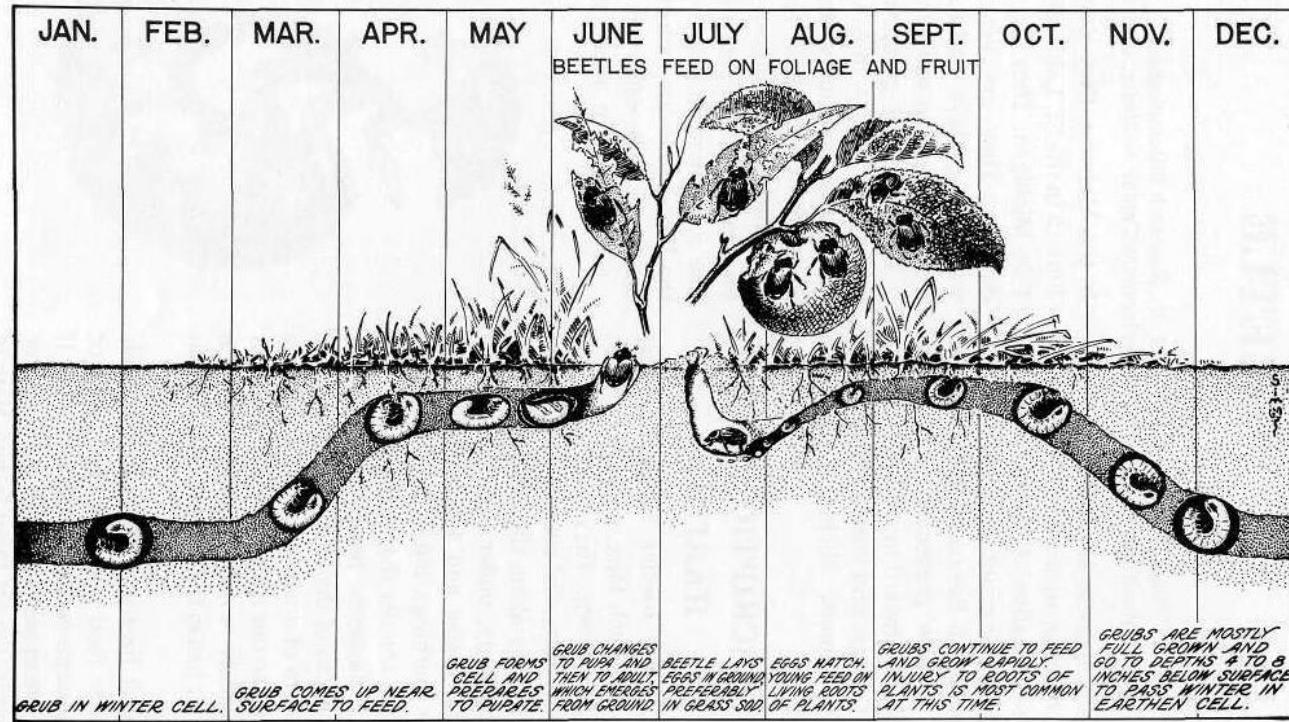


(image source)

Étienne-Jules Marey, 1880s ([source](#))

2D + TIME

Sequences



Seasonal life cycle of the Japanese beetle in the vicinity of Philadelphia.

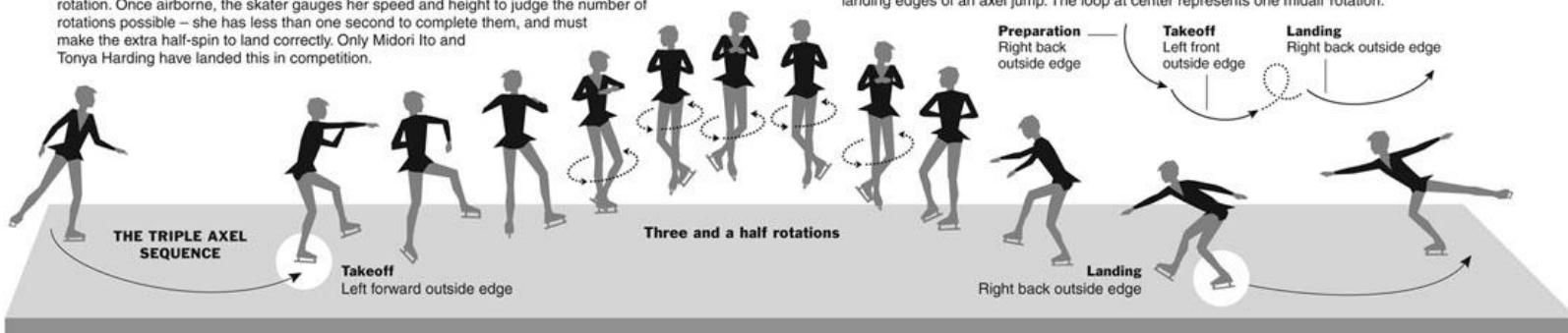
2D + TIME

Sequences

The Jumping Off Points: Moves That Will Be Made in the Free Skating Programs

TRIPLE AXEL: Add an extra half-spin

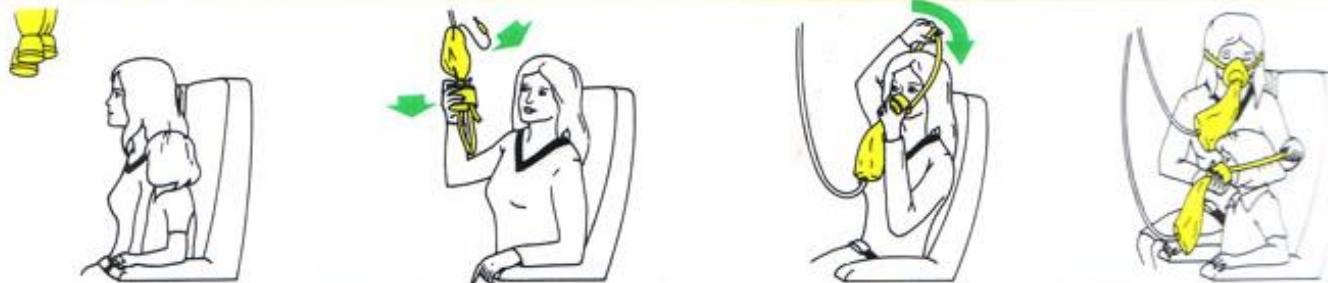
The Axel's forward takeoff and backward landing positions add an extra half-rotation to the jump, so skaters need maximum power on takeoff, and precise upper body control during rotation. Once airborne, the skater gauges her speed and height to judge the number of rotations possible – she has less than one second to complete them, and must make the extra half-spin to land correctly. Only Midori Ito and Tonya Harding have landed this in competition.



Megan Jaegerman. Cited in [Tufte, 2007](#)

2D + TIME

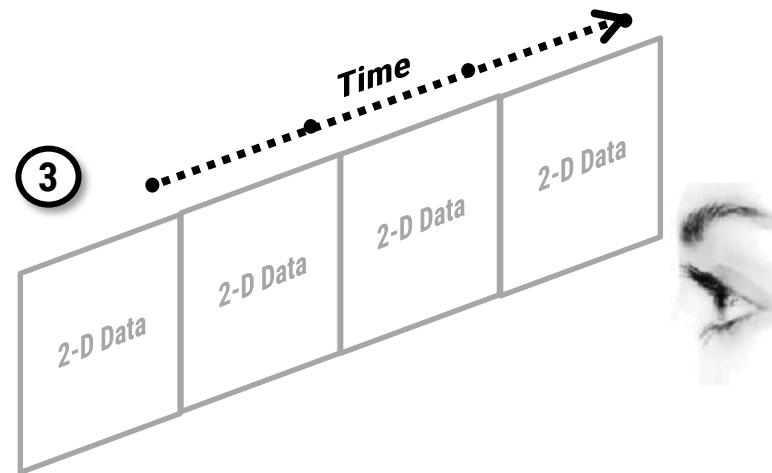
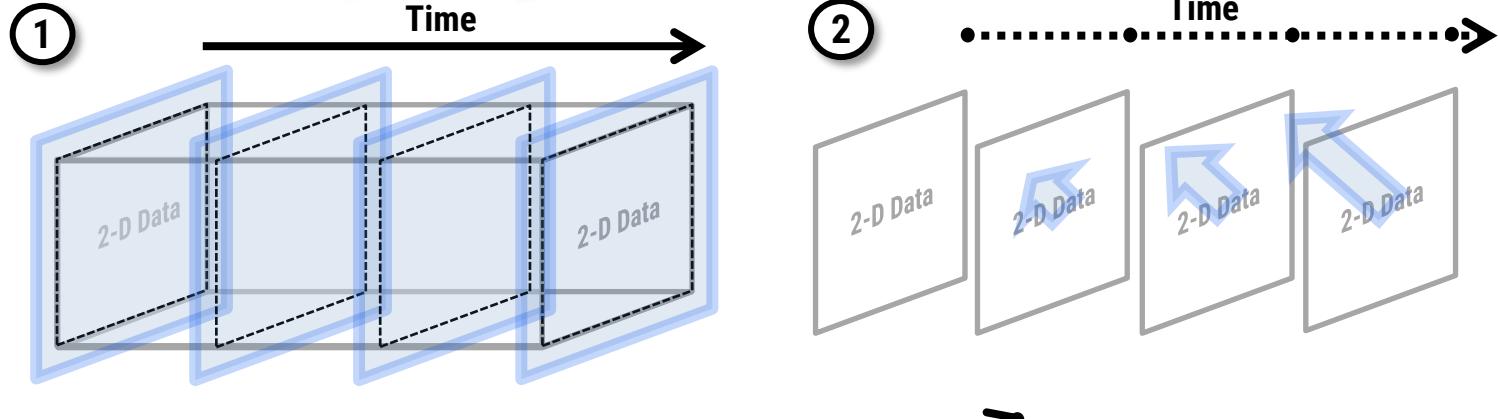
What about this?



[\(image source\)](#)

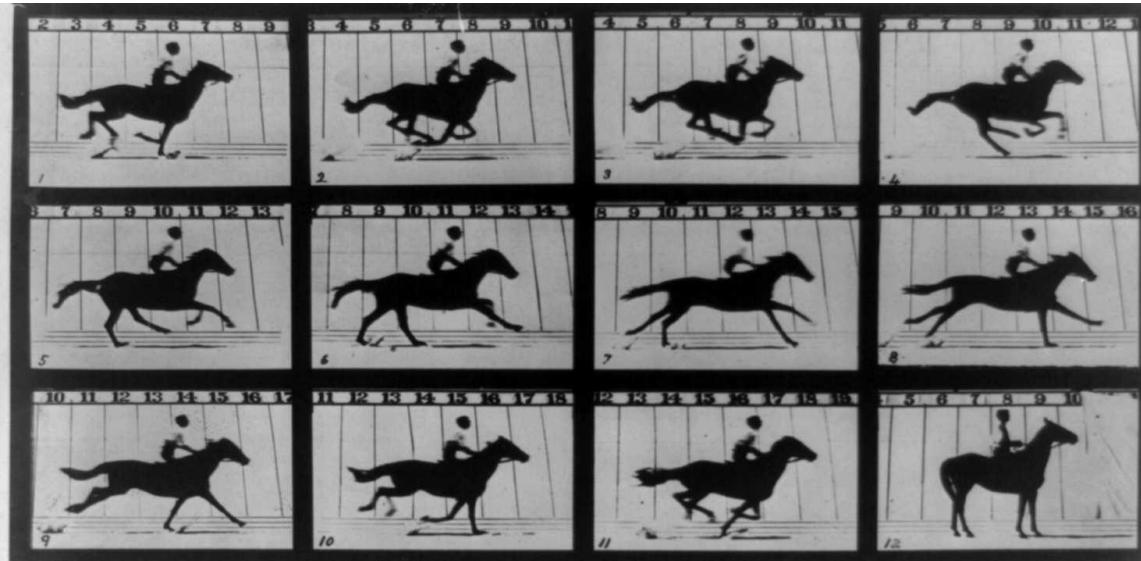
2D + TIME

Time Juxtaposing



2D + TIME

Muybridge's Chronophotography Technique



Copyright, 1878, by MUYBRIDGE.

MORSE'S Gallery, 417 Montgomery St., San Francisco.

THE HORSE IN MOTION.

Patent for apparatus applied for.

MUYBRIDGE.

AUTOMATIC ELECTRO-PHOTOGRAPHIC.

"SALLIE GARDNER," owned by LELAND STANFORD; ridden by G. DOMM, running at a 1.40 gait over the Palo Alto track, 19th June, 1878.

The negatives of these photographs were made at intervals of twenty-seven thousandths of a second, and they represent successive positions assumed during a single stride of the mare. The vertical lines were twenty-seven inches apart; the horizontal lines represent elevations of four inches each.

The negatives were each exposed during the two-thousandth part of a second, and are absolutely "untouched."

Eadweard J. Muybridge, 1878 ([source](#))

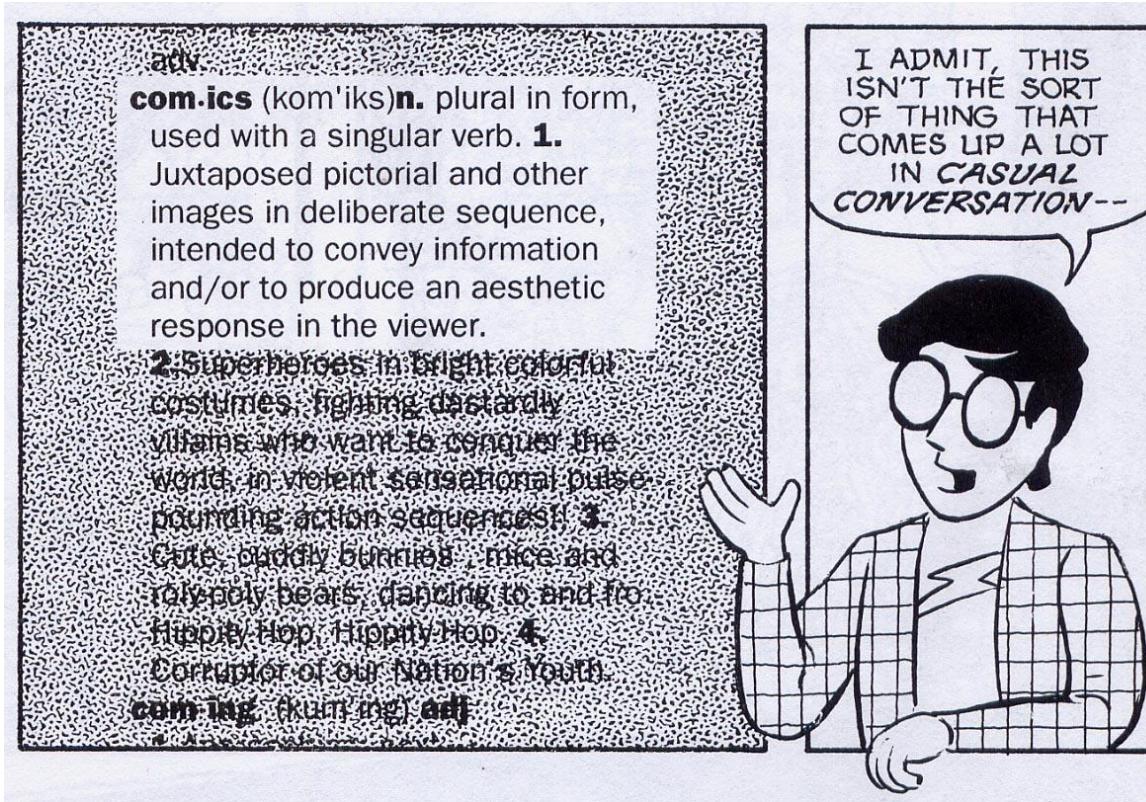
2D + TIME

Comics



2D + TIME

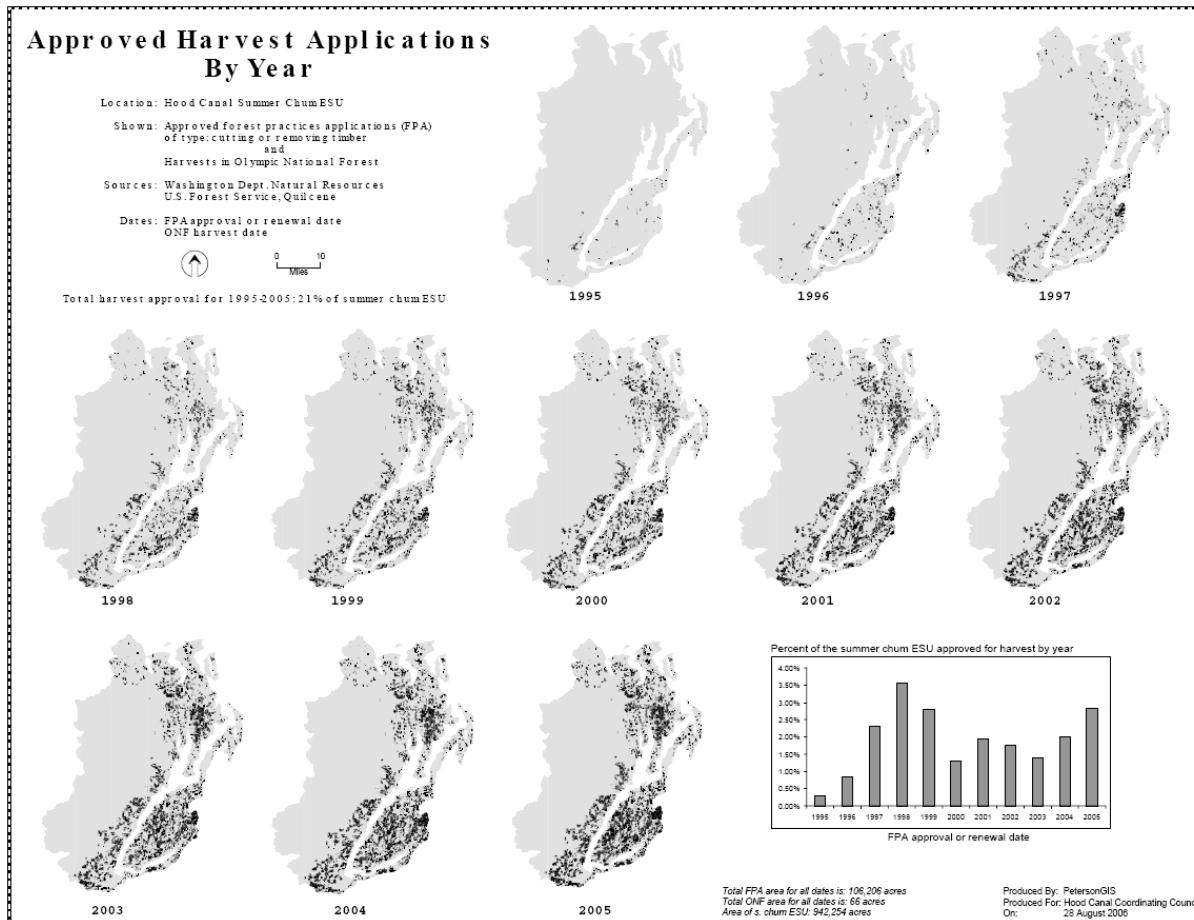
Comics



Understanding Comics: The invisible Art
Scott McCloud, 1993

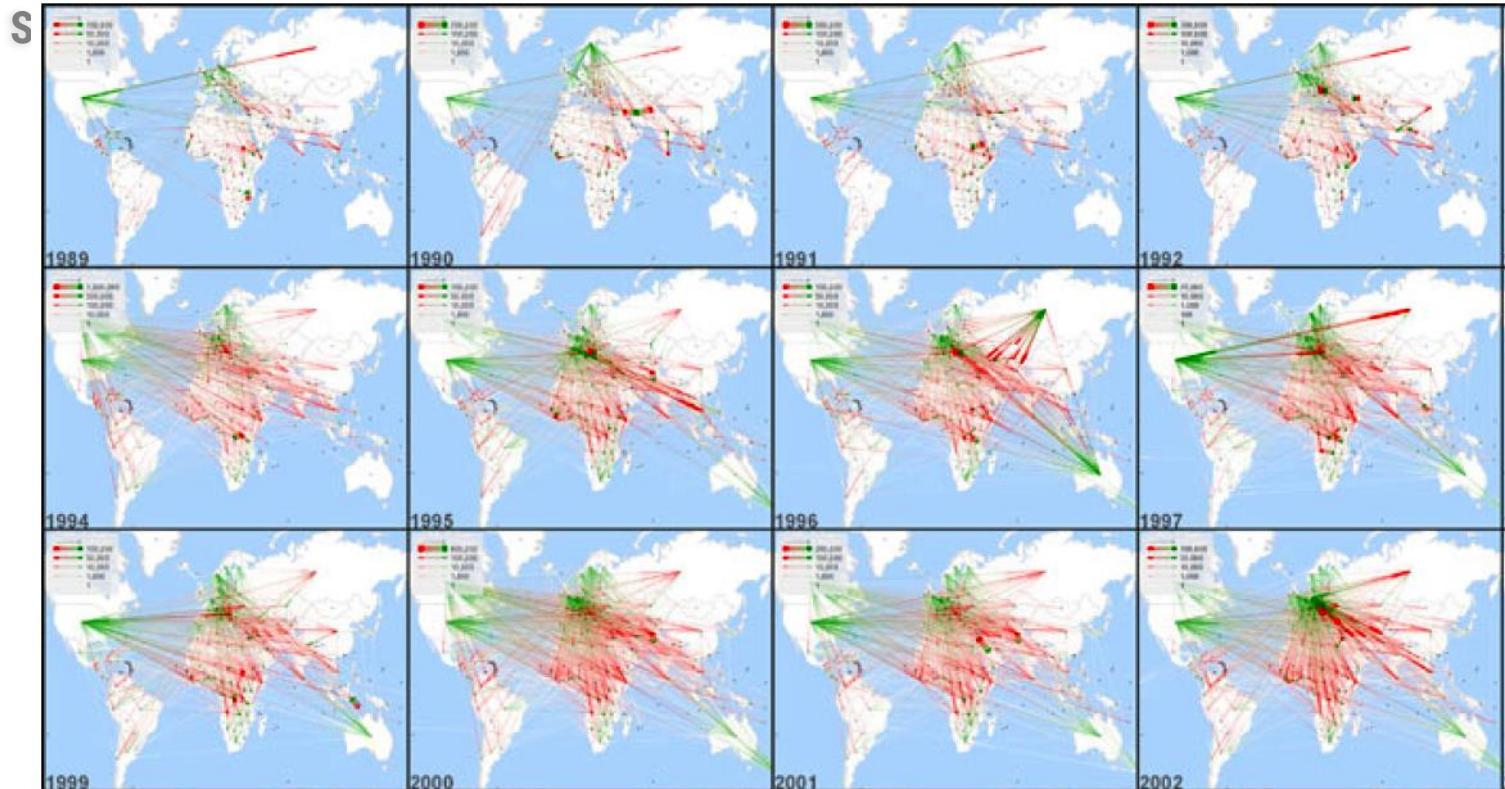
2D + TIME

Small Multiples



Tufte,
1983

2D + TIME

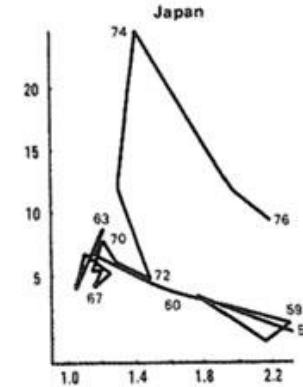
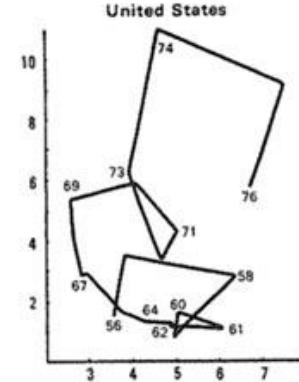
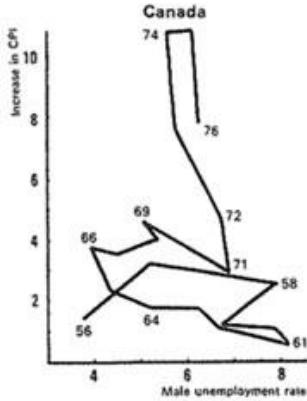


2D + TIME

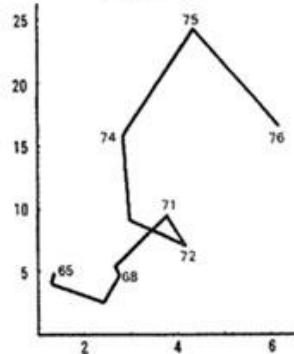
What about this?

Inflation and Unemployment Rates

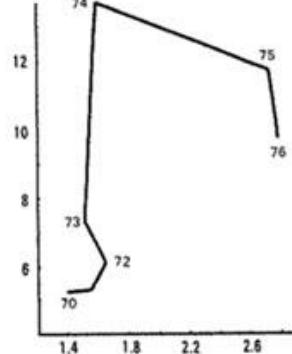
Per cent



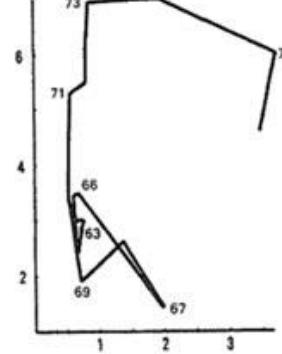
United Kingdom



France



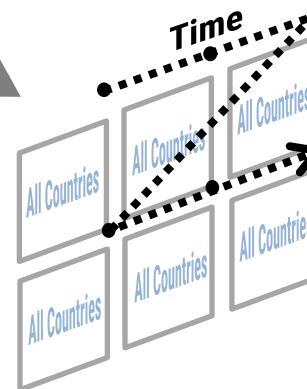
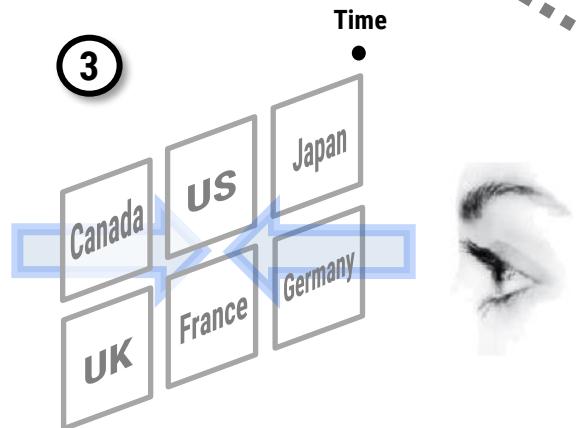
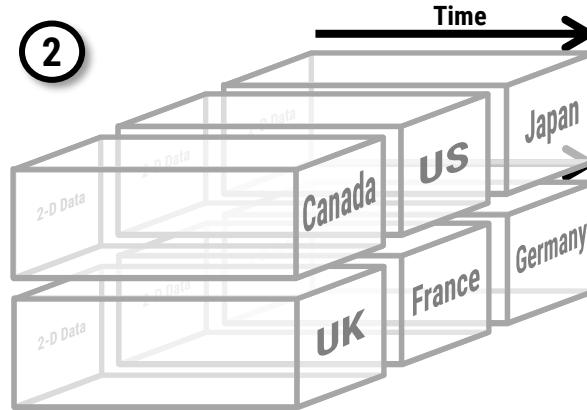
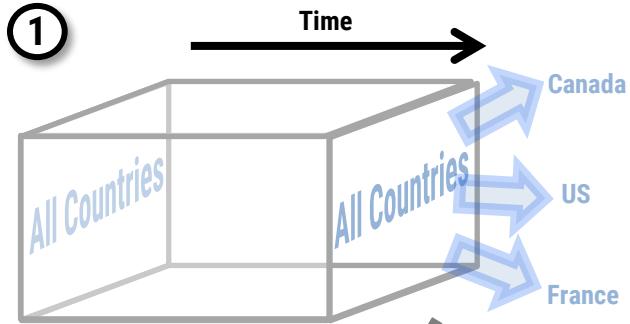
Germany



(image source)

2D + TIME

What about this?



2D + TIME

Side-By-Side Views

FE / trunk
build.xml

Activity Revisions Users Reports Source

107905 ▾ 107905 ▾ + Changeset Raw Annotation Highlighting ▾ Columns ▾ Reviews ▾

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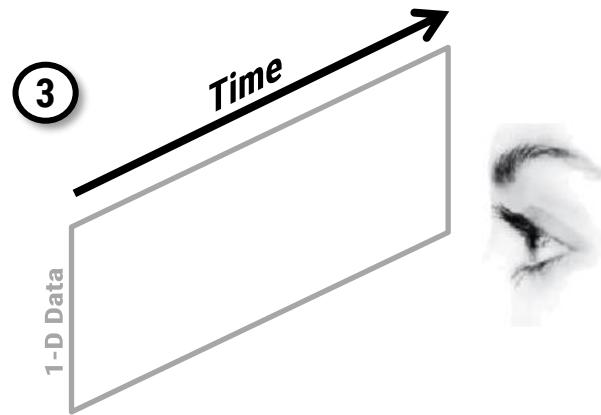
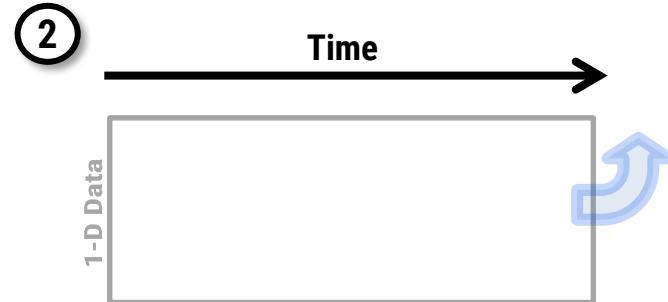
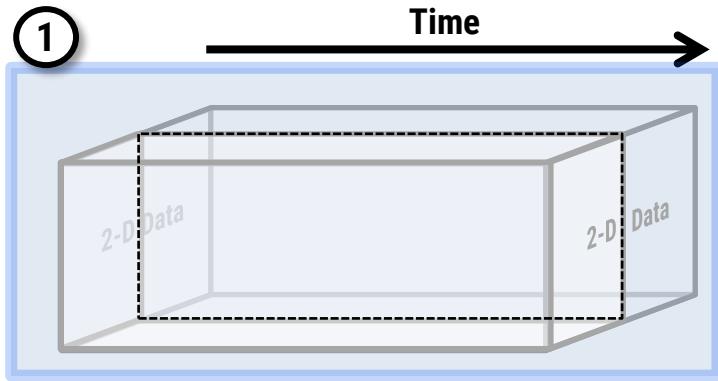
2D + TIME

Side-By-Side Views



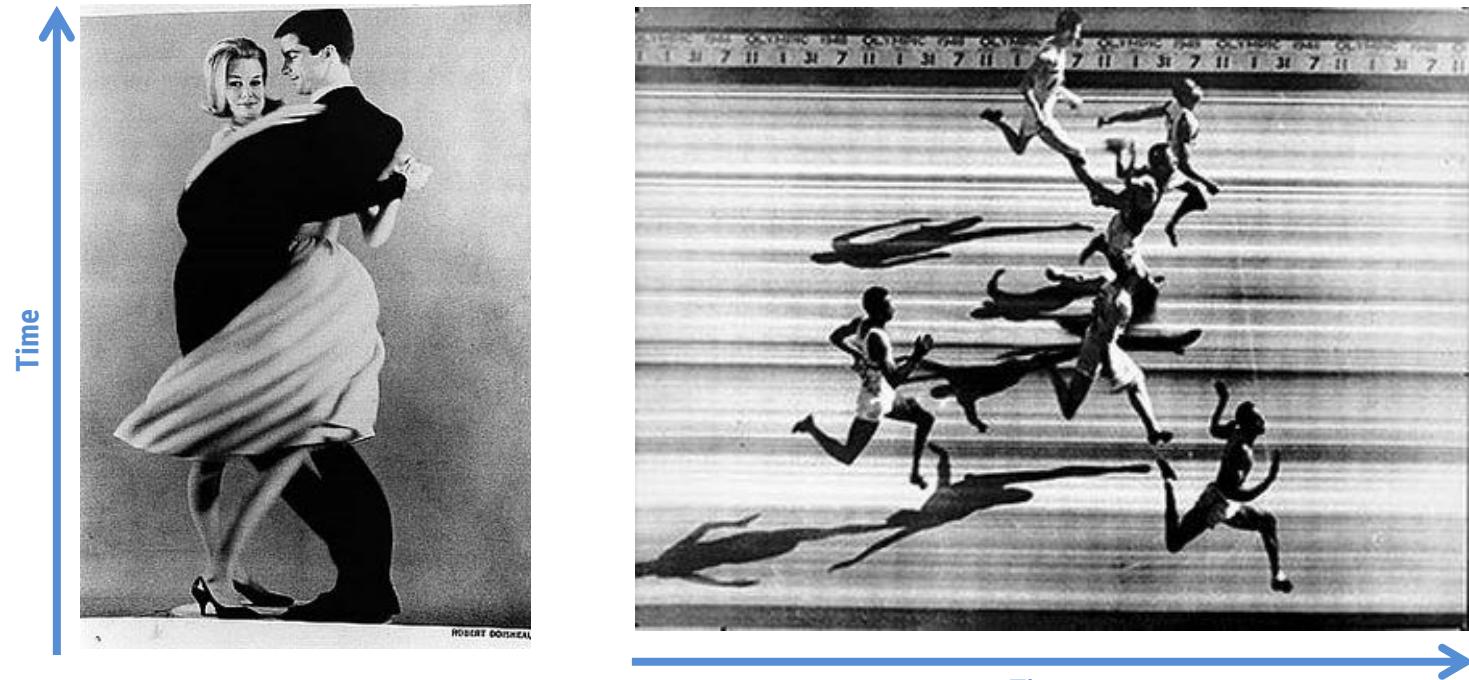
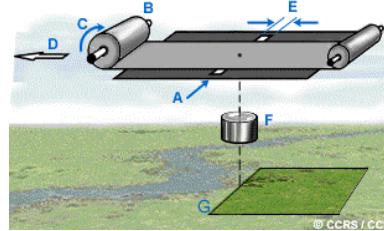
2D + TIME

Space Cutting



2D + TIME

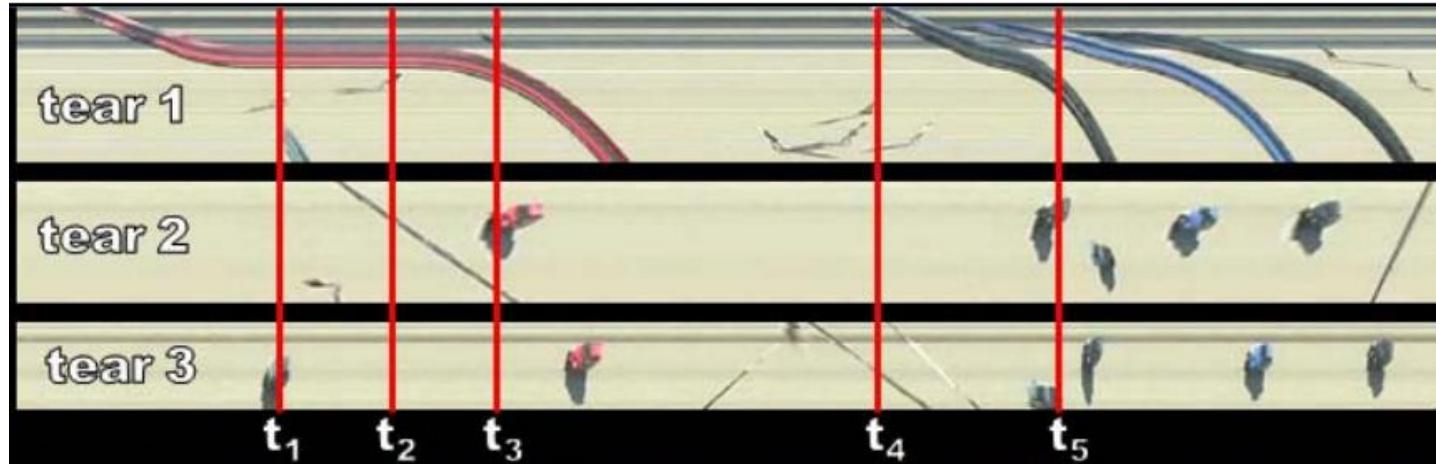
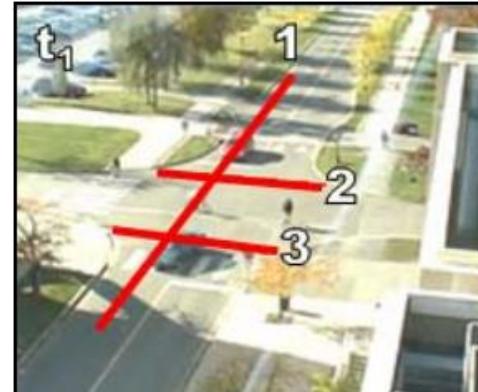
Slit-Scan Photography



[\(images source\)](#)

2D + TIME

Slit-Tear Exploration of Videos



Exploring Video Streams using Slit-Tear Visualizations

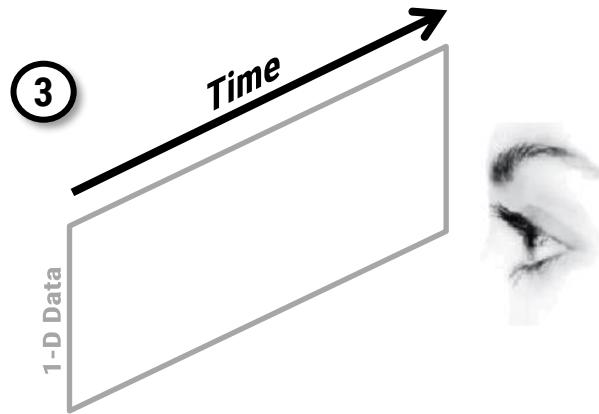
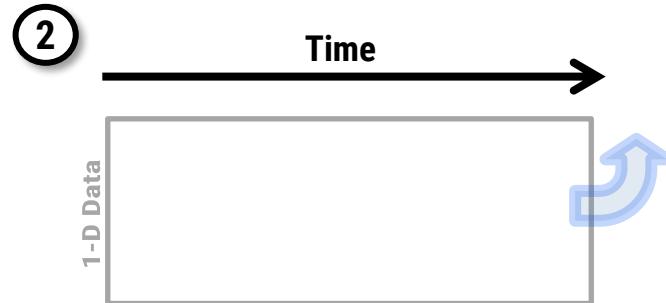
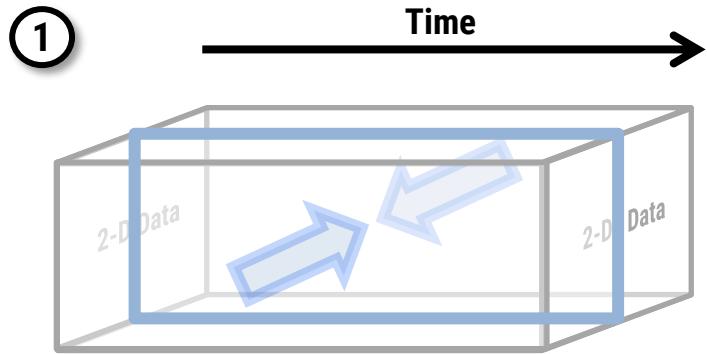
Anthony Tang, *University of British Columbia*

Saul Greenberg, *University of Calgary*

Sidney Fels, *University of British Columbia*

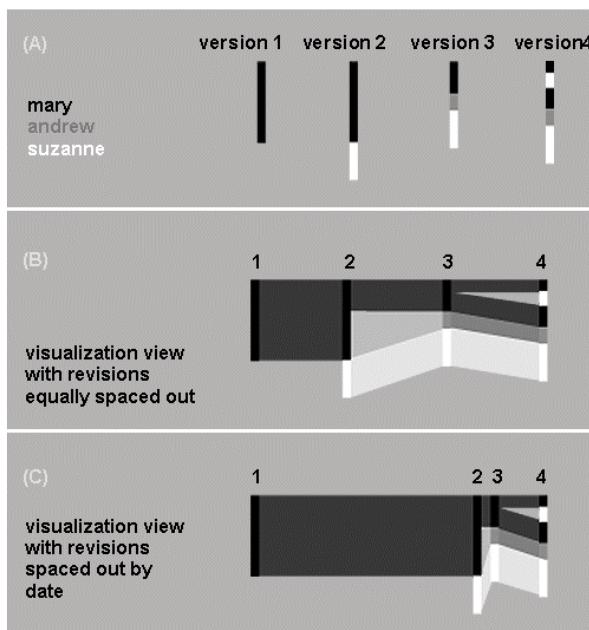
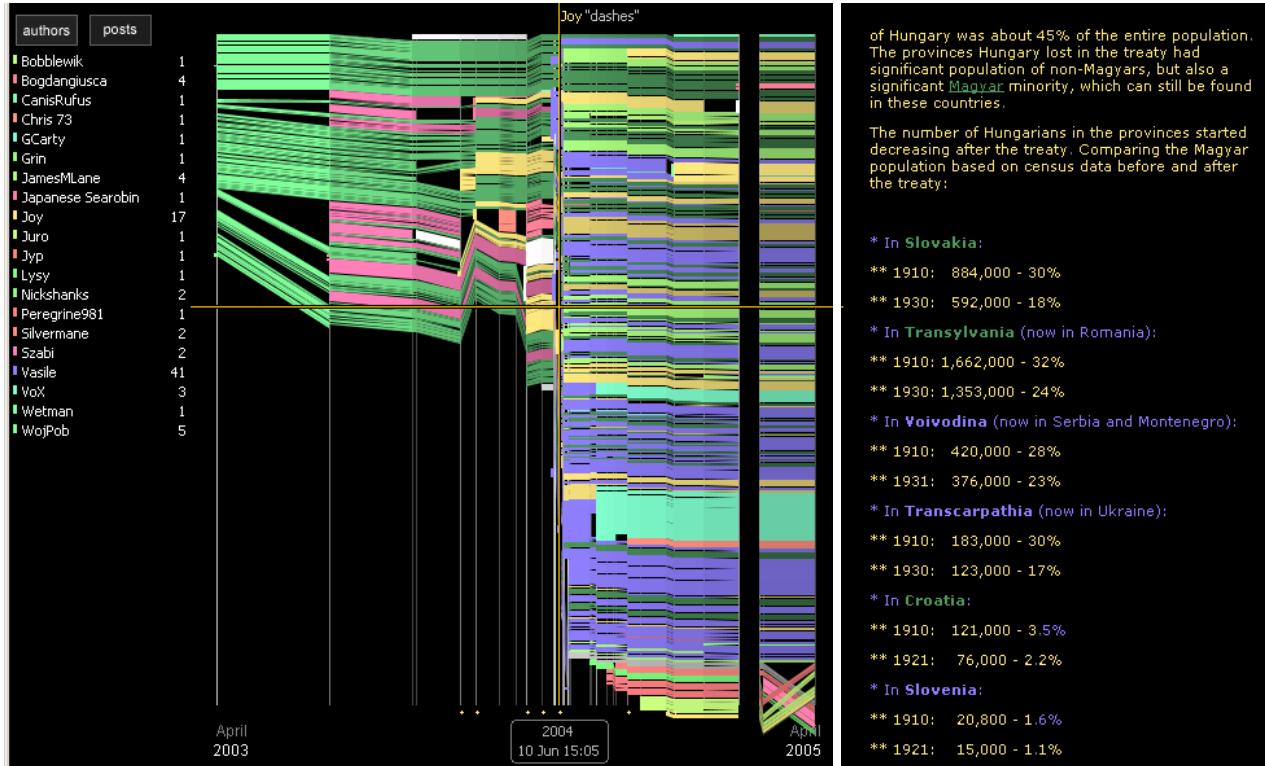
2D + TIME

Space Flattening



2D + TIME

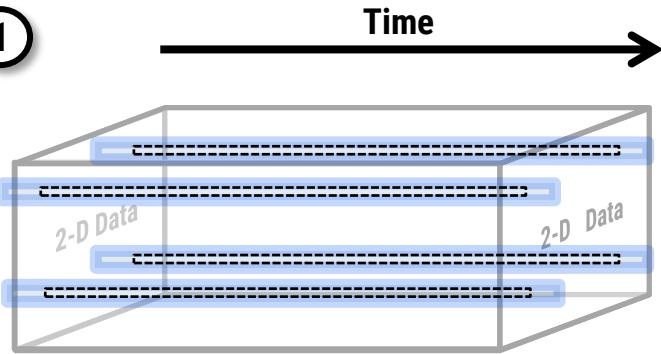
History Flow



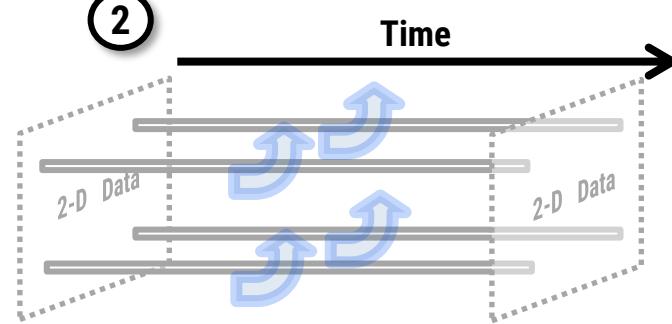
2D + TIME

Sampling

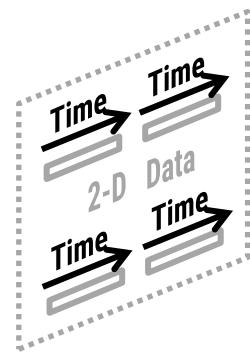
①



②

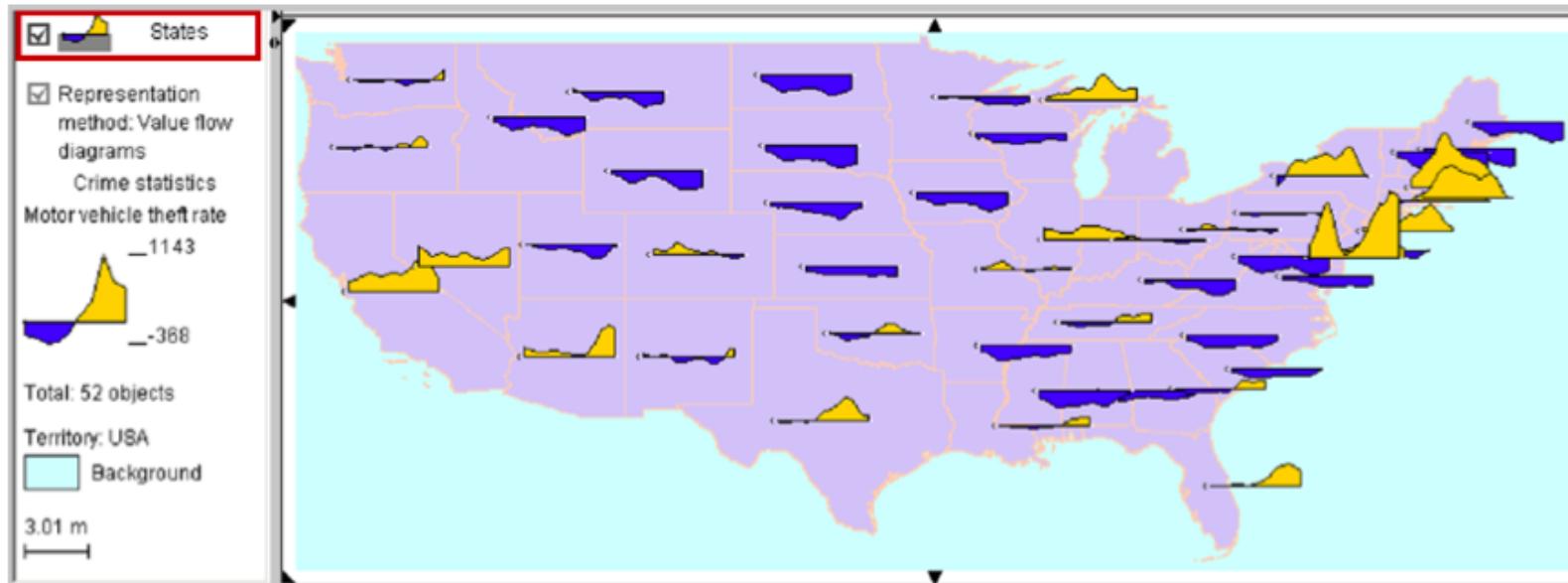


③



2D + TIME

Multiple Silhouette Graphs



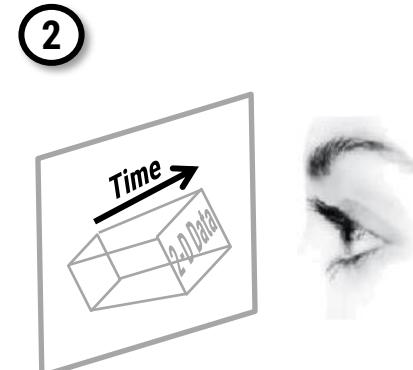
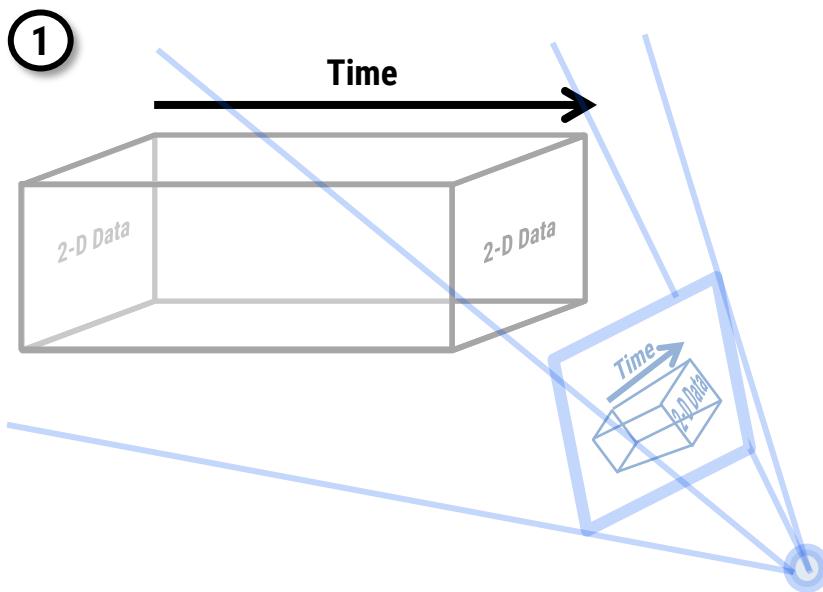
2D + TIME

Planning Polygons



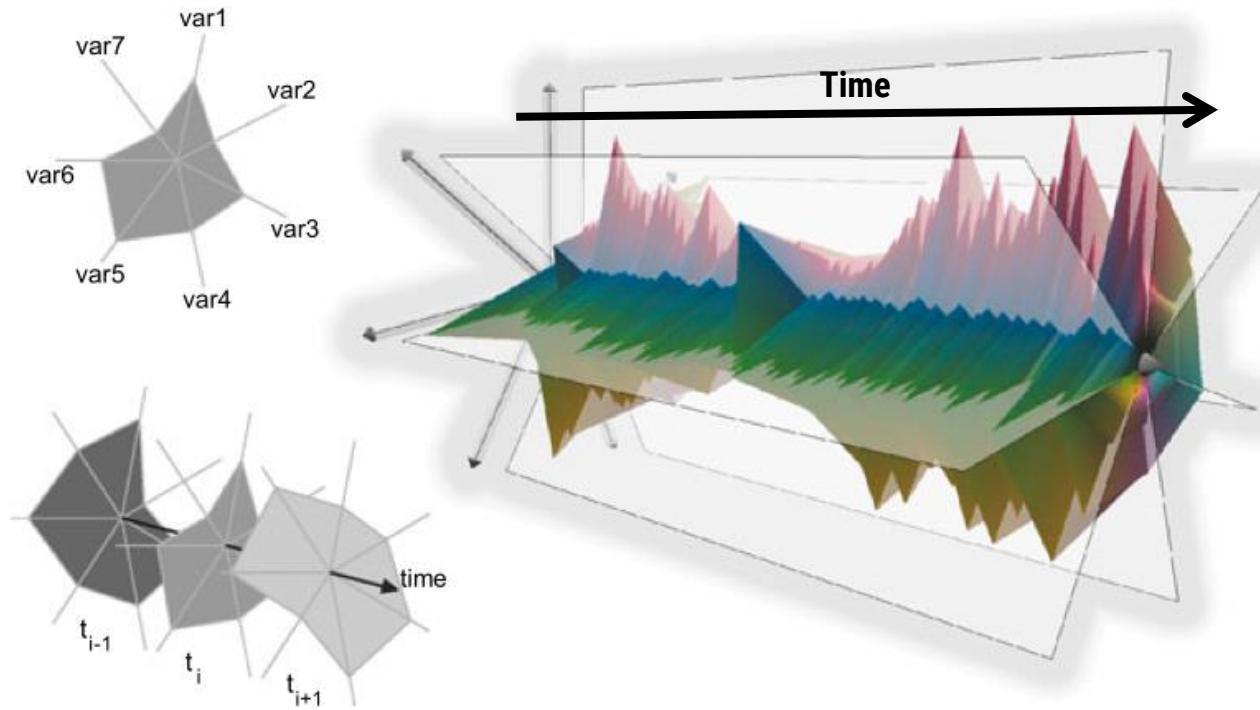
2D + TIME

3D Rendering



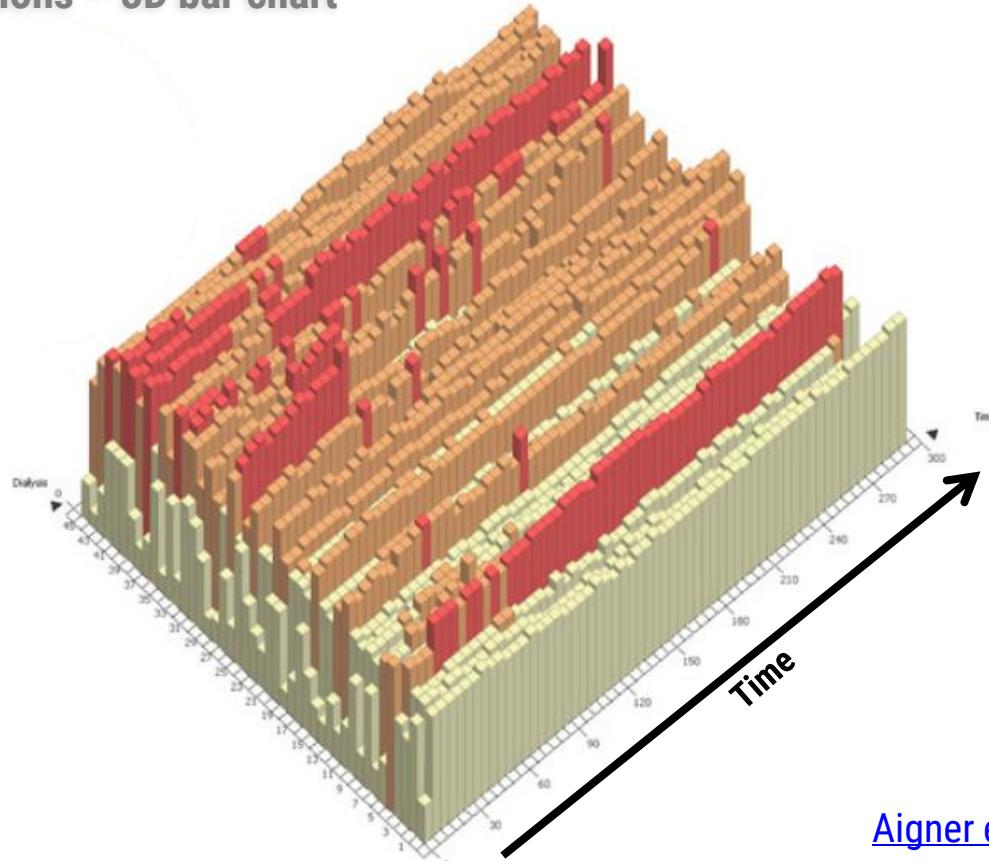
2D + TIME

3D visualizations - Kiviat Tube



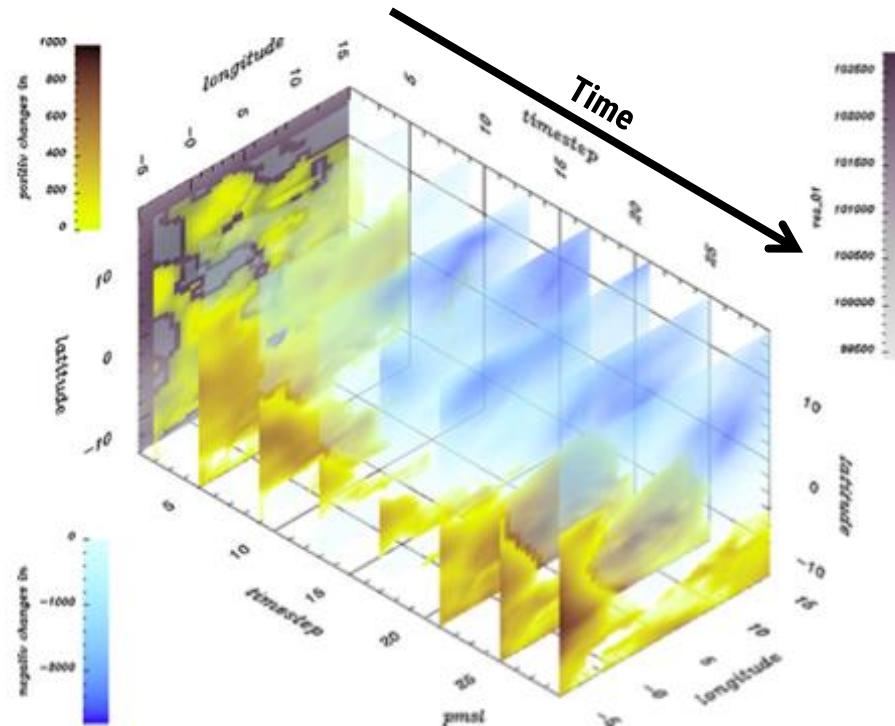
2D + TIME

3D visualizations – 3D bar chart



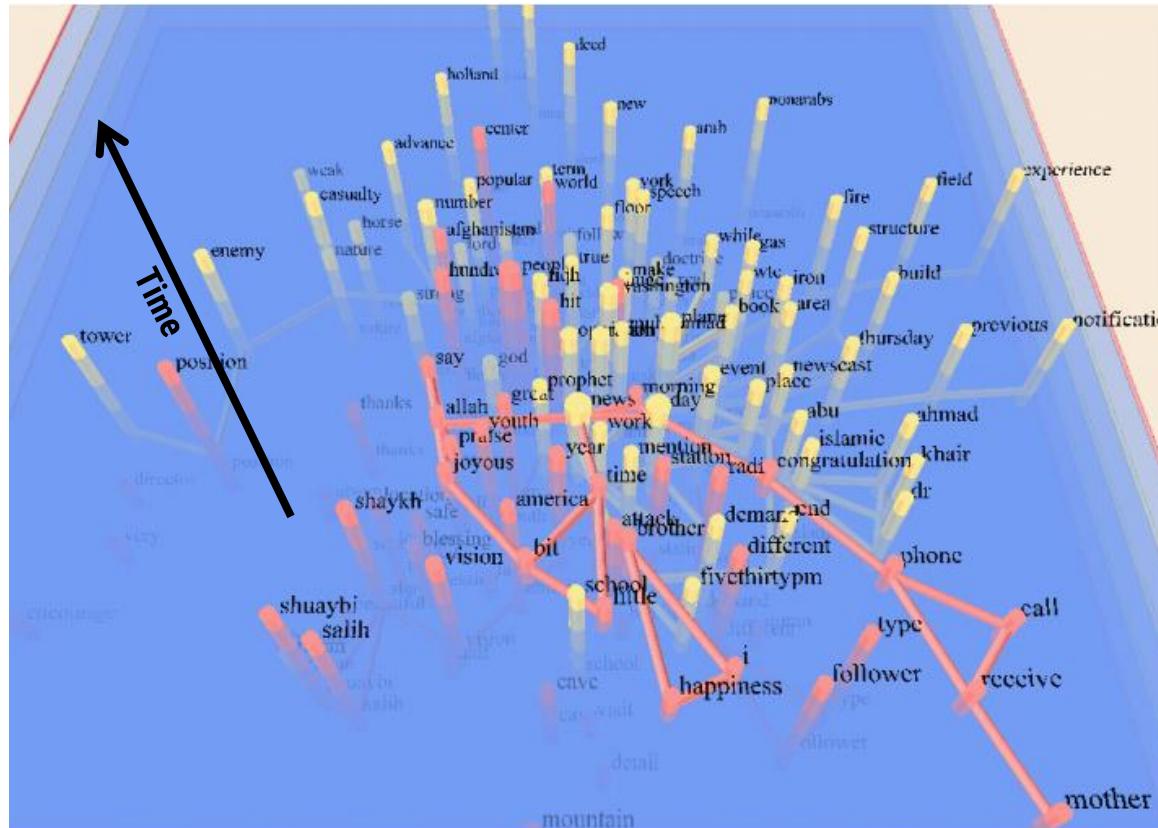
2D + TIME

3D visualizations – Climate data



2D + TIME

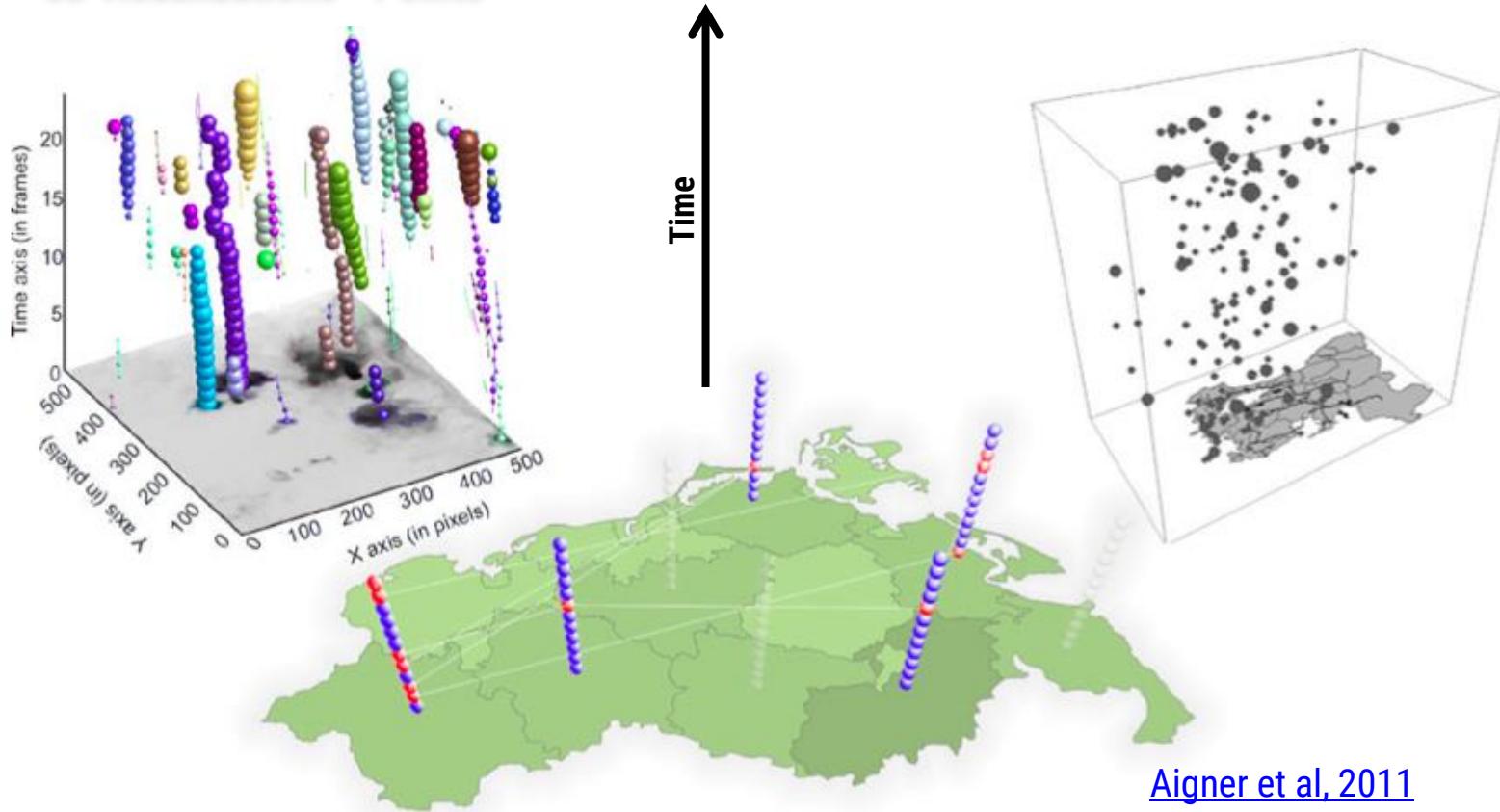
3D visualizations – Time-evolving graphs



Brandes and Corman, 2002

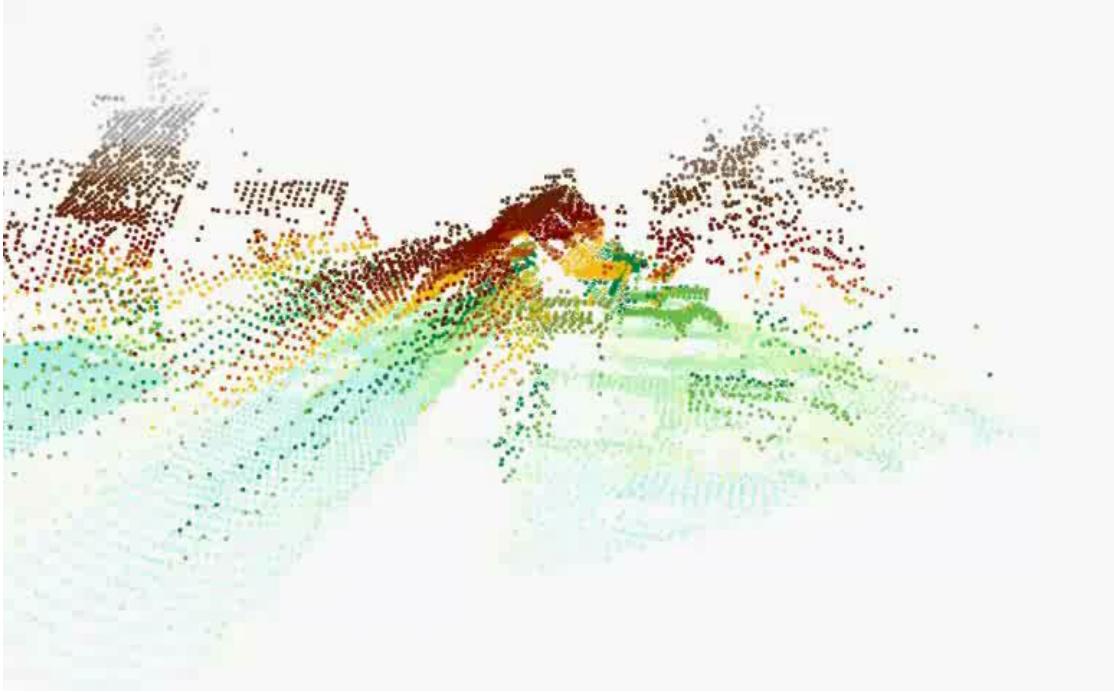
2D + TIME

3D visualizations - Points



2D + TIME

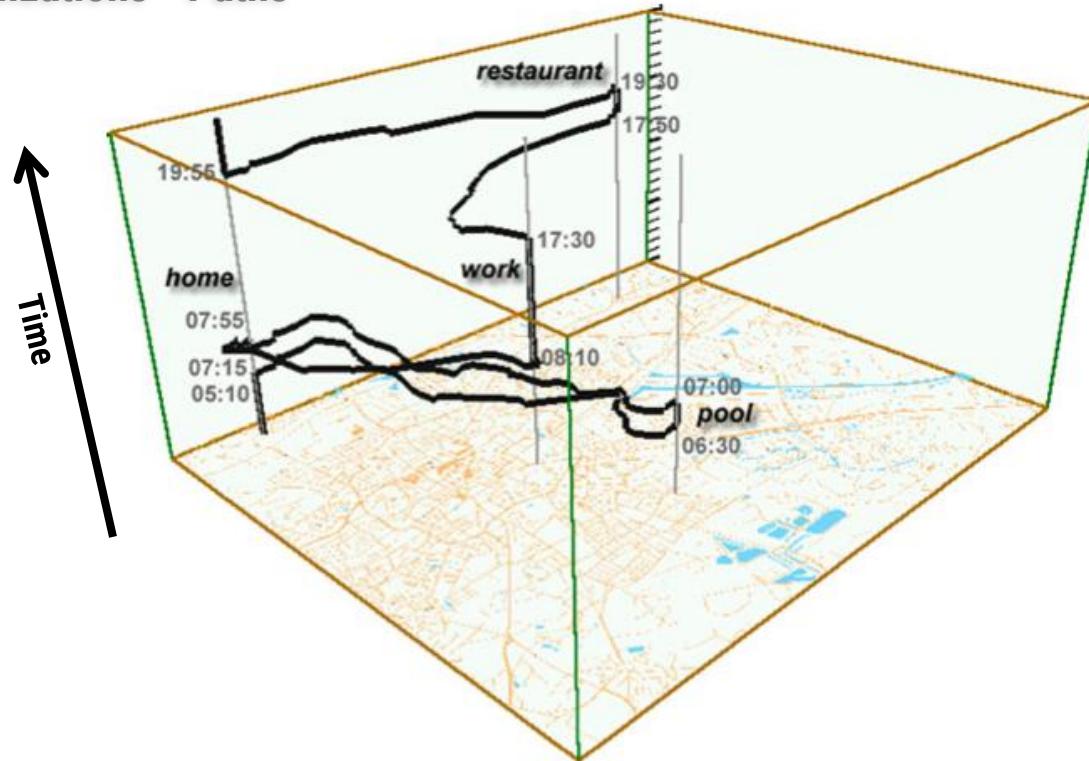
3D visualizations - Points



[\(video source\)](#)

2D + TIME

3D visualizations - Paths

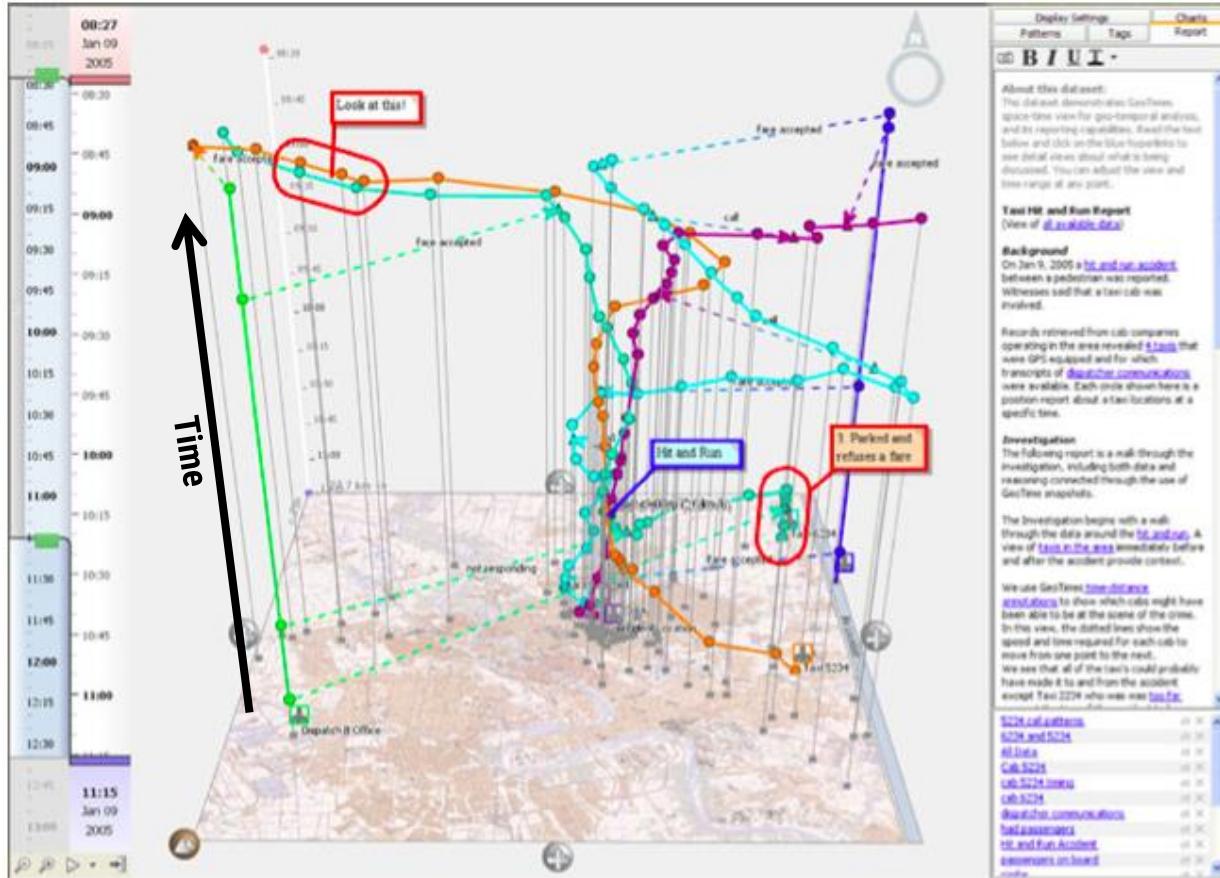


[Kraak, 2003](#). Cited in [Aigner et al, 2011](#)

2D + TIME

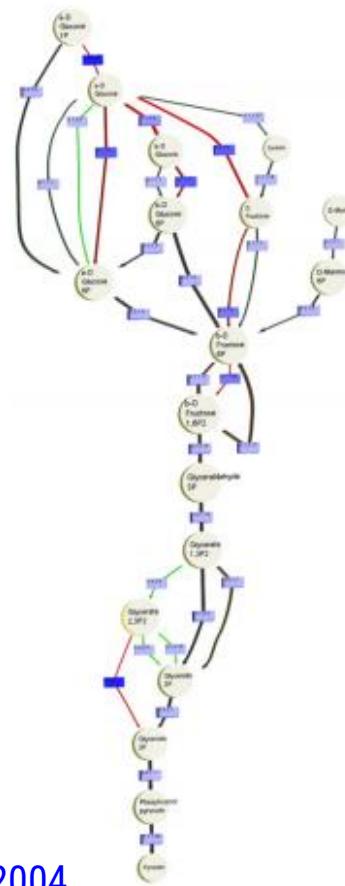
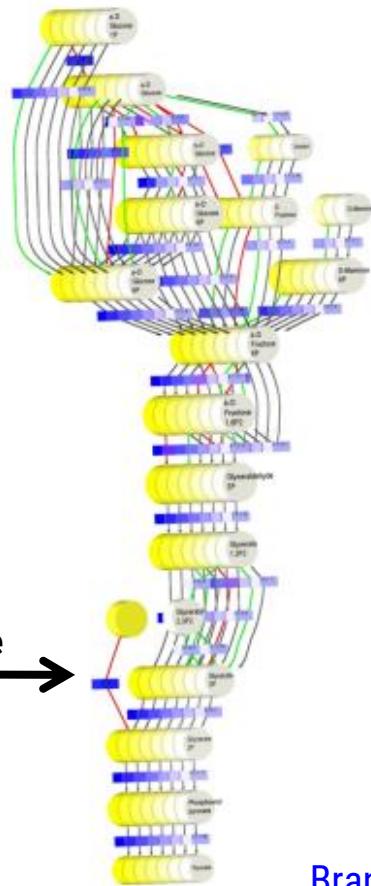
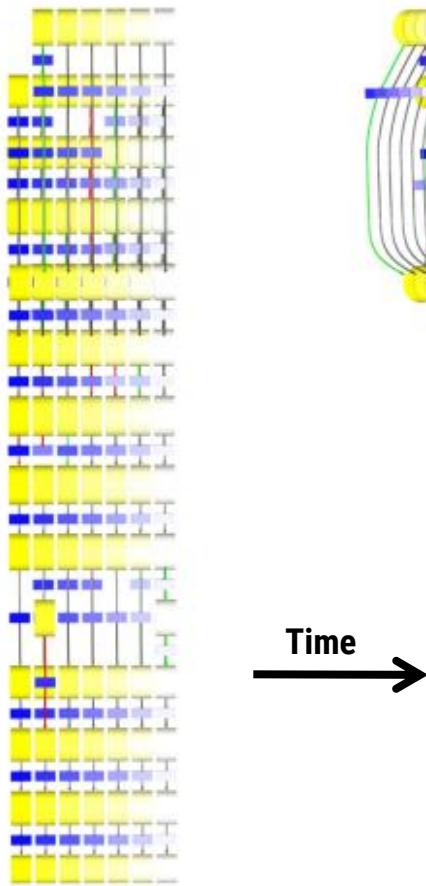
3D visualizations - GeoTime

geotime.com



2D + TIME

3D visualizations – Time-evolving graphs

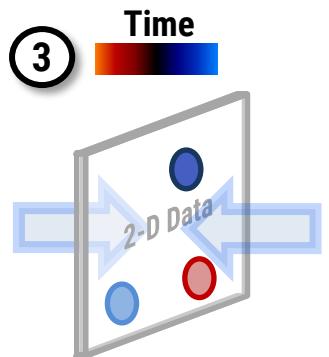
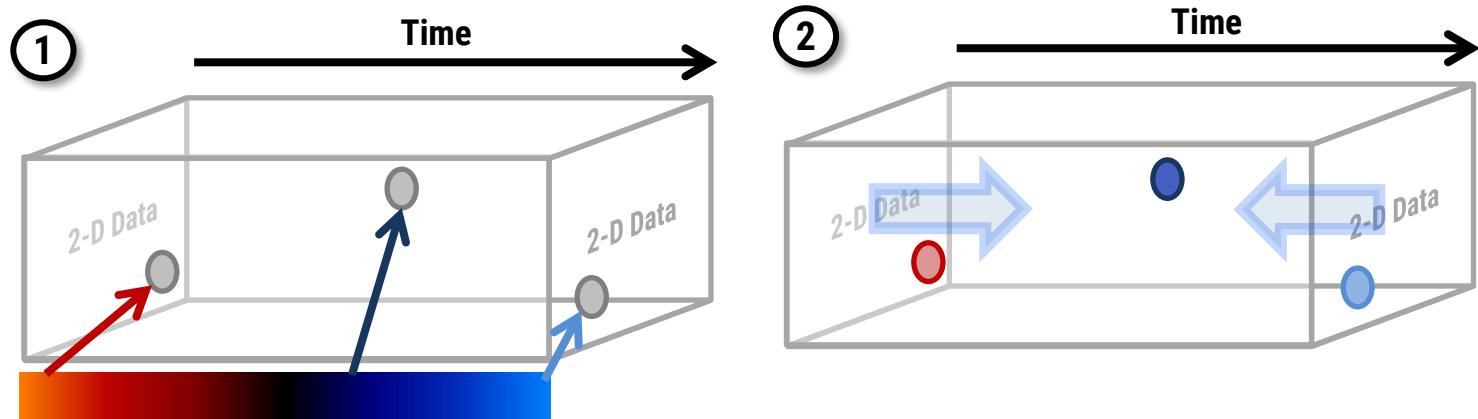


Brandes et al., 2004

MAPPING TIME TO SPACE

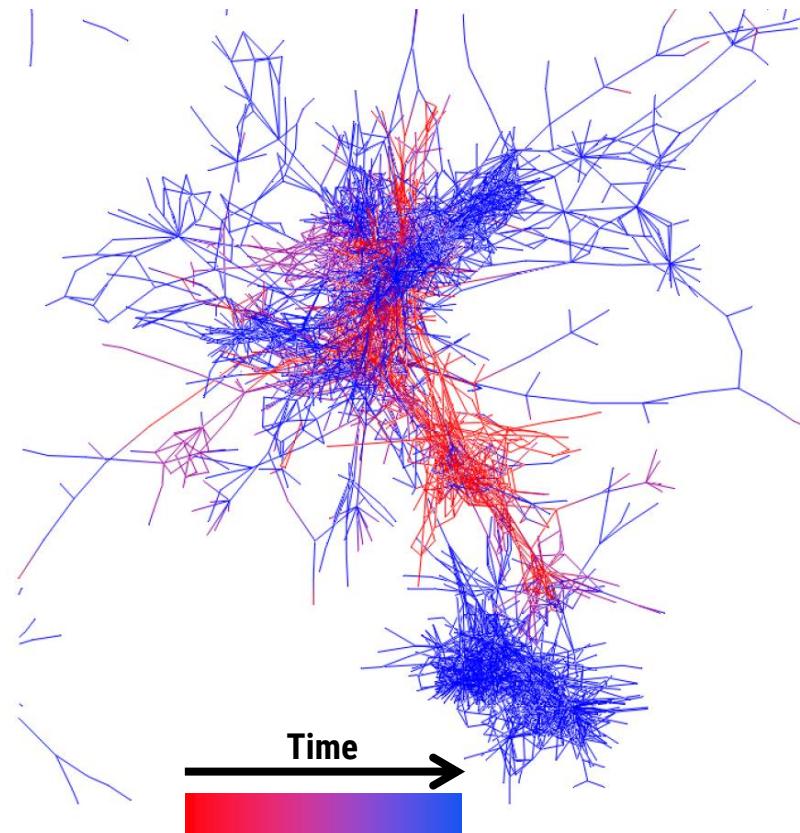
2D + TIME

Colored Time Flattening



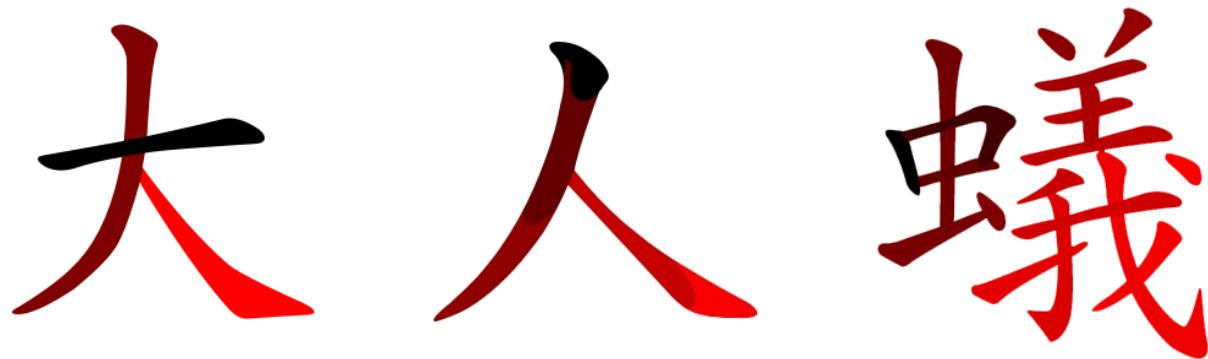
2D + TIME

Using Color – GEOVOL

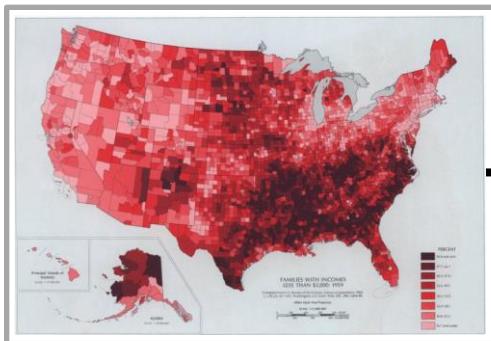


2D + TIME

Using Color – Stroke Order



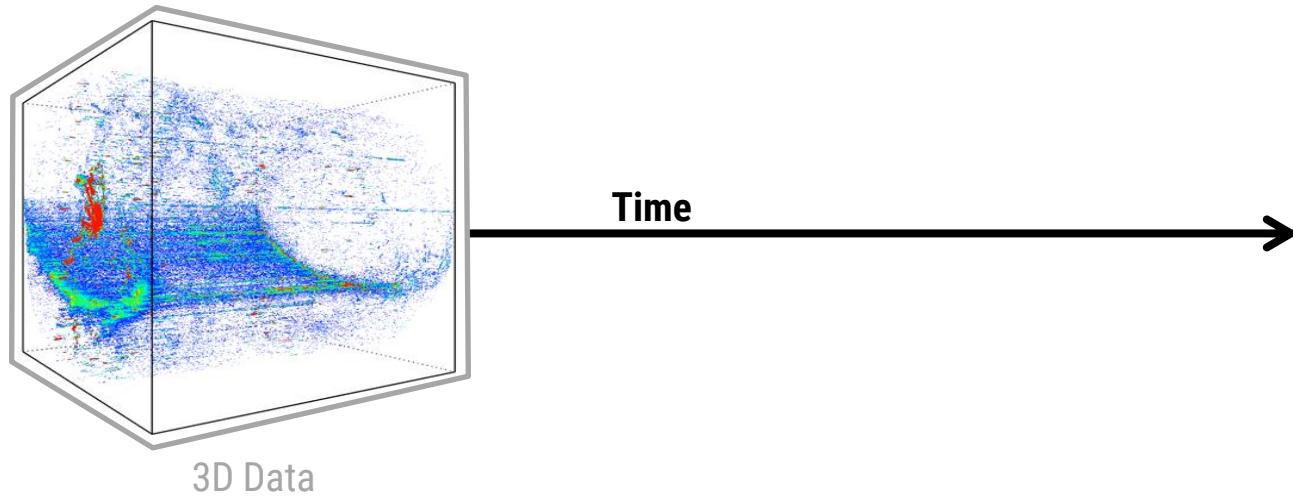
MAPPING TIME TO AN AXIS



Time

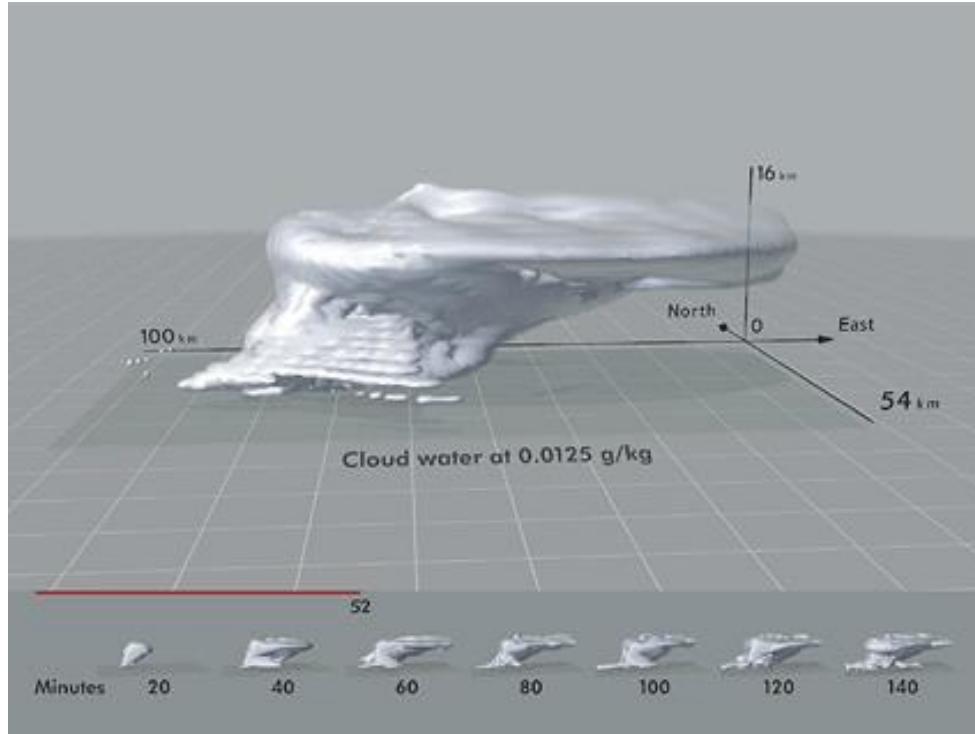
2D Data

MAPPING TIME TO AN AXIS



3D + TIME

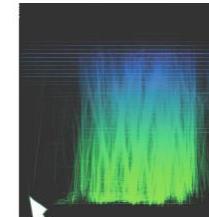
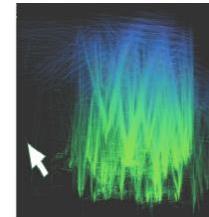
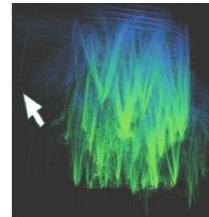
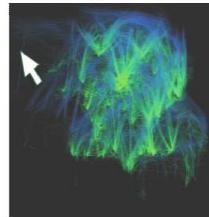
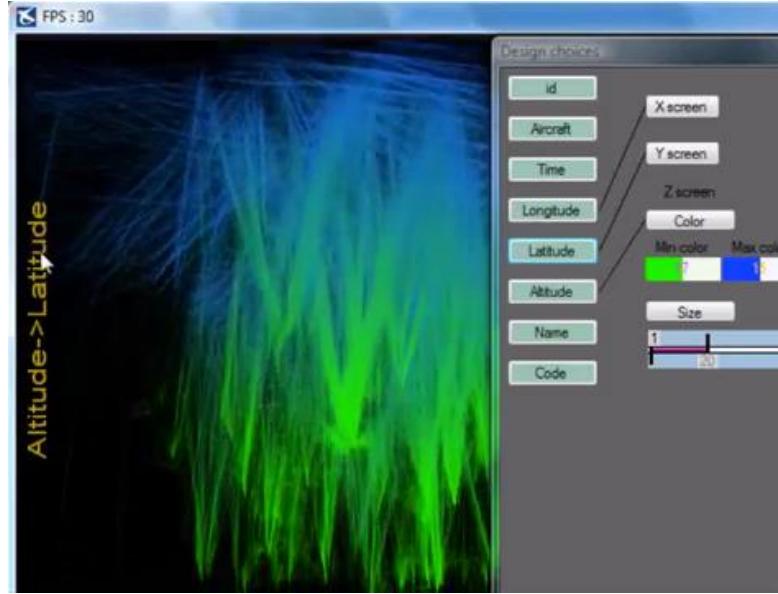
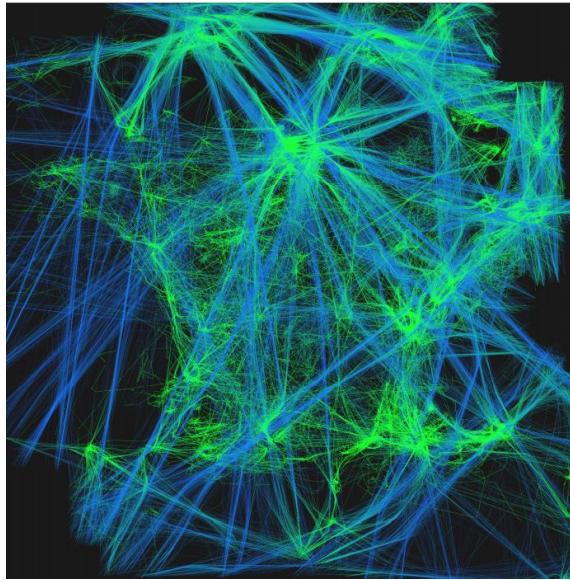
Slicing + Juxtaposing – 3D Small Multiples



[Tufte and Bushell, 2005](#)

3D + TIME

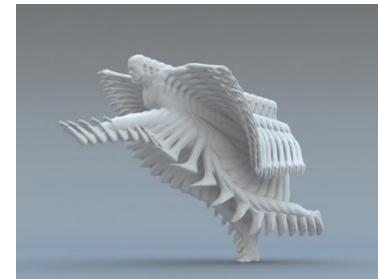
Flattening - FromDaDy



[Hurter et al, 2009](#)

3D + TIME

Slicing & Flattening - Peter Jansen's Sculptures



Peter Jansen. humanmotions.com

TIME VISUALIZATION

What's Missing?

Animations

ANIMATION

ANIMATION

- **Static Visual Content**
 - **Visual content that is fixed over time**

ANIMATION

- **Static Visual Content**
 - **Visual content that is fixed over time**
- **Dynamic Visual Content**
 - **Visual content that changes over time**

ANIMATION

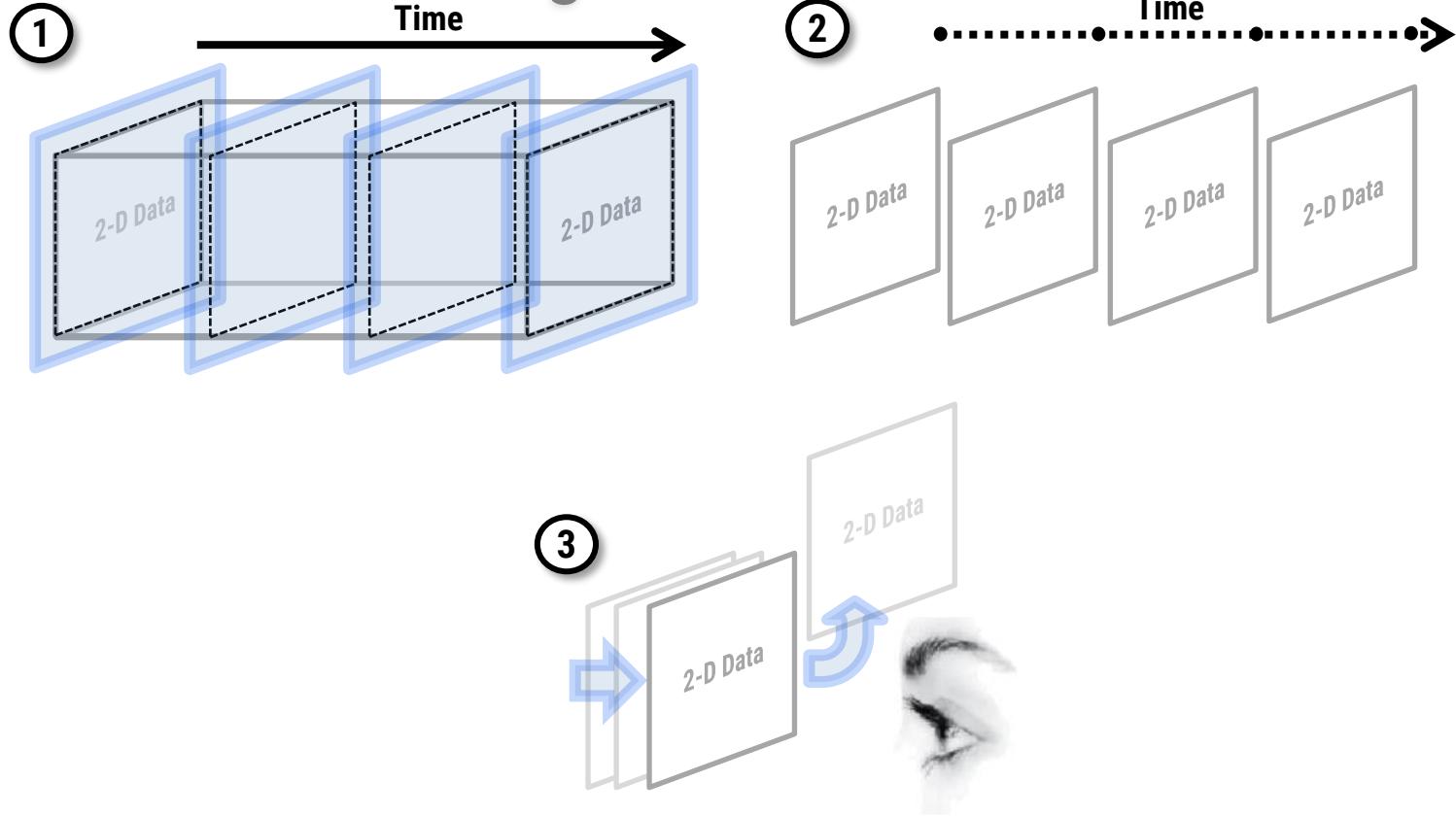
- **Static Visual Content**
 - **Visual content that is fixed over time**
- **Dynamic Visual Content**
 - **Visual content that changes over time**
- **Interactive Visual Content**
 - **Visual content that changes over time**
 - **Under the user's influence**

ANIMATION

- Static Visual Content
 - Visual content that is fixed over time
- Dynamic Visual Content
 - Visual content that changes over time
- Interactive Visual Content
 - Visual content that changes over time
 - Under the user's influence
- Animation
 - Visual content that changes over time
 - Outside the user's influence

2D + TIME

Animated Time Cutting



2D + TIME

Movies and Cartoons



Eadweard J. Muybridge, 1879

2D + TIME

Zoopraxiscope



[\(image source\)](#)

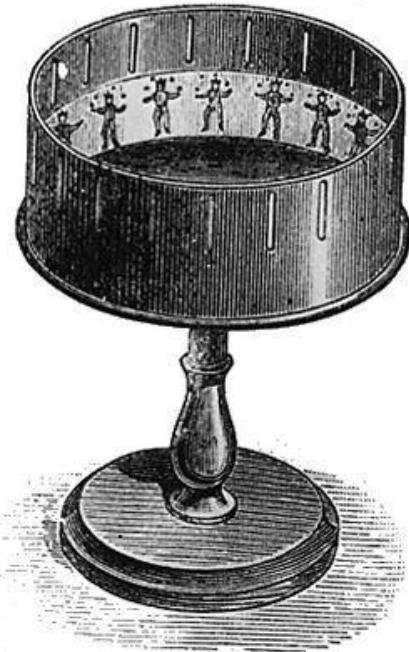


[\(image source\)](#)

Eadweard J. Muybridge, 1879

2D + TIME

Zoetrope



William G. Horner, 1833
also Ting Huan, 180 AD
([source](#))

2D + TIME

Animation – Gap Minder



(image source)

gapminder.org

154

2D + TIME

Animation – Gap Minder



[\(video source\)](#)

2D + TIME

Animation vs. Other Approaches



[\(image source\)](#)

2D + TIME

Animation vs. Other Approaches

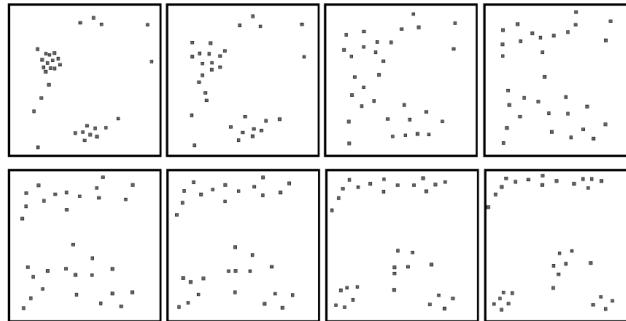


[\(image source\)](#)

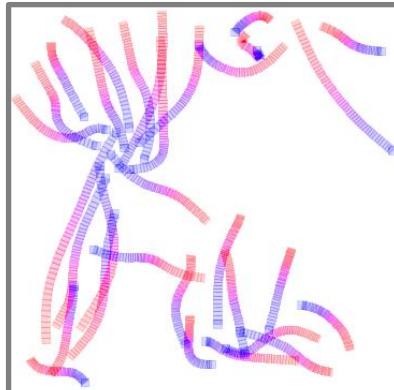
2D + TIME

Animation vs. Other Approaches

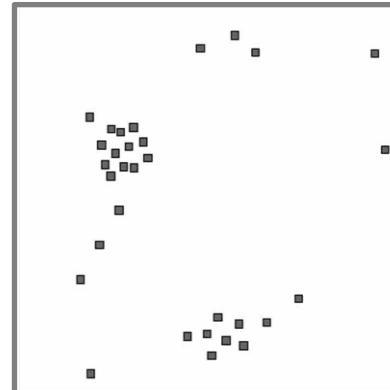
Small Multiples



Trails (Coloring + Flattening)

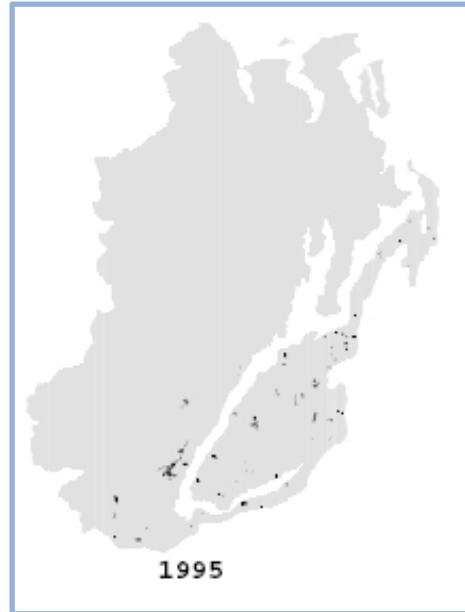


Animation



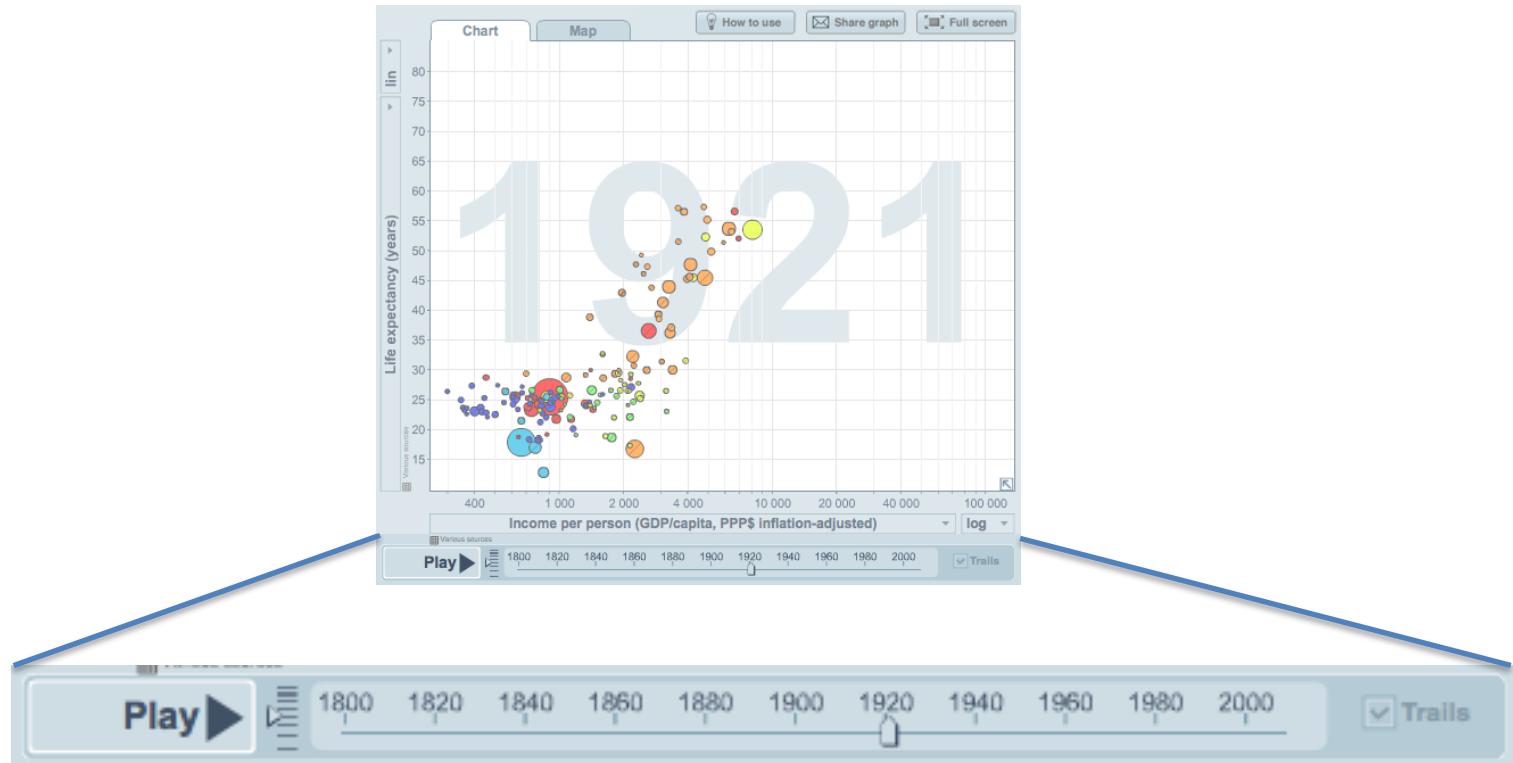
2D + TIME

Animation vs. Other Approaches

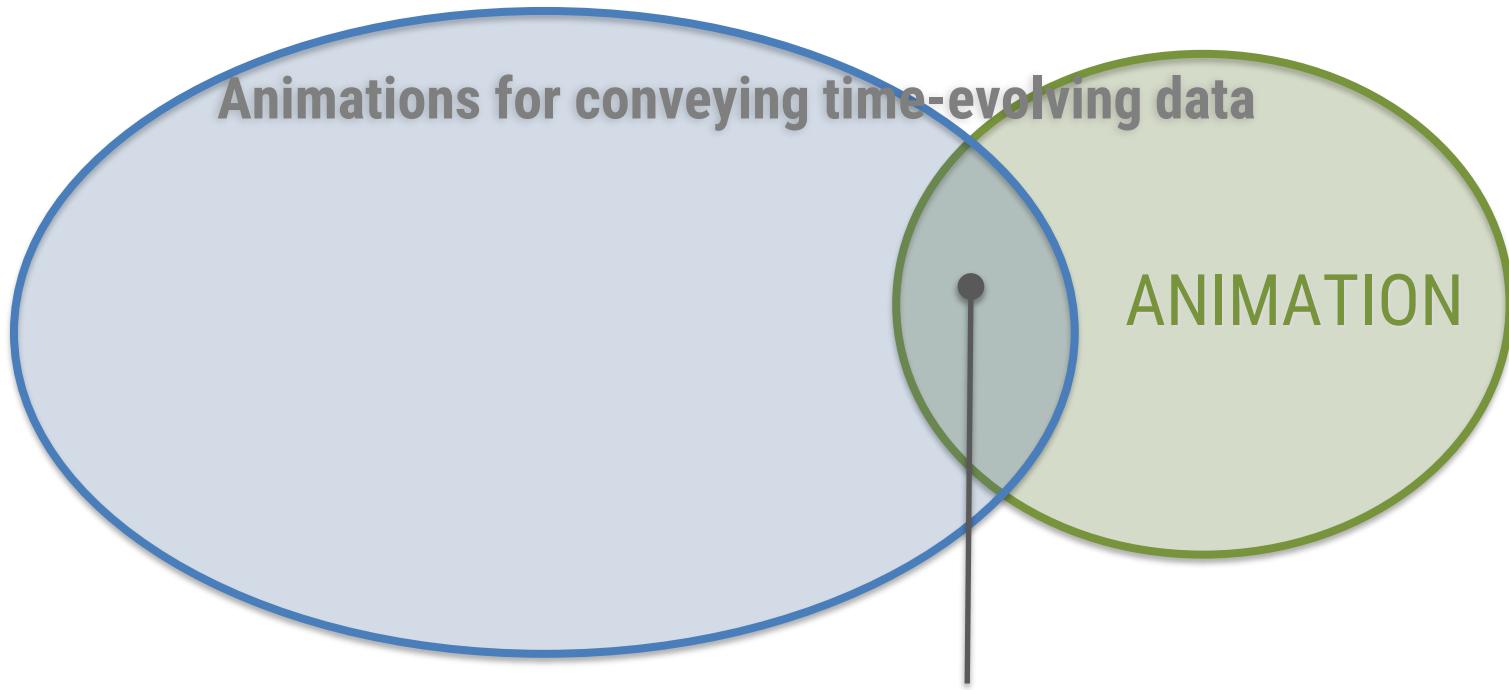


2D + TIME

Time Slider – GapMinder



TIME VISUALIZATION



ANIMATIONS

- For conveying time-evolving data

ANIMATIONS

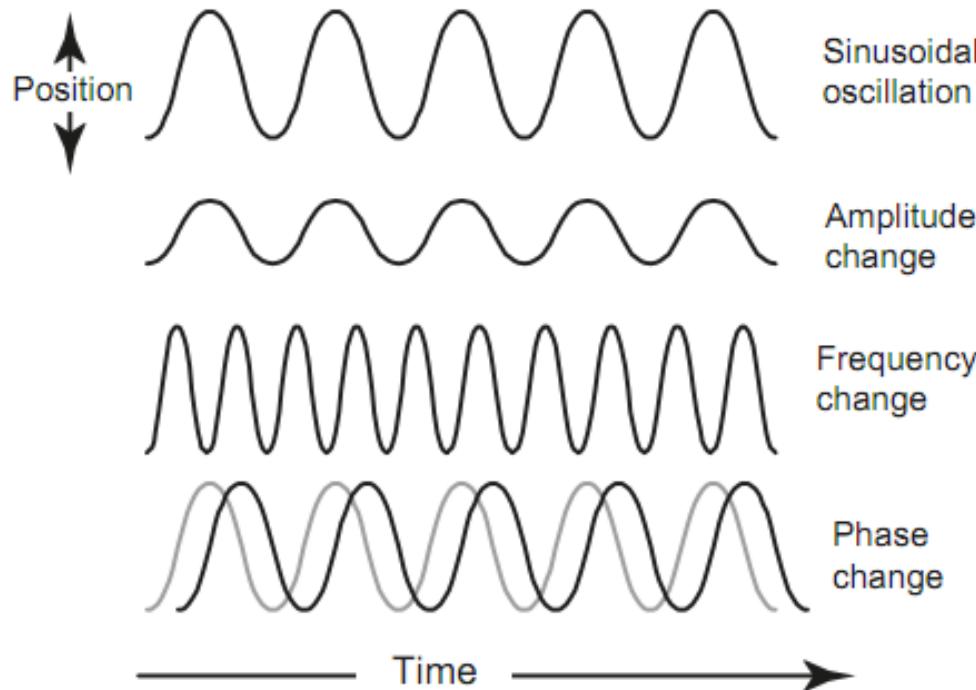
- For conveying time-evolving data
- For capturing users' attention
- As an information channel
- For explaining transitions

ANIMATIONS

- For conveying time-evolving data
- For capturing users' attention
- As an information channel
- For explaining transitions

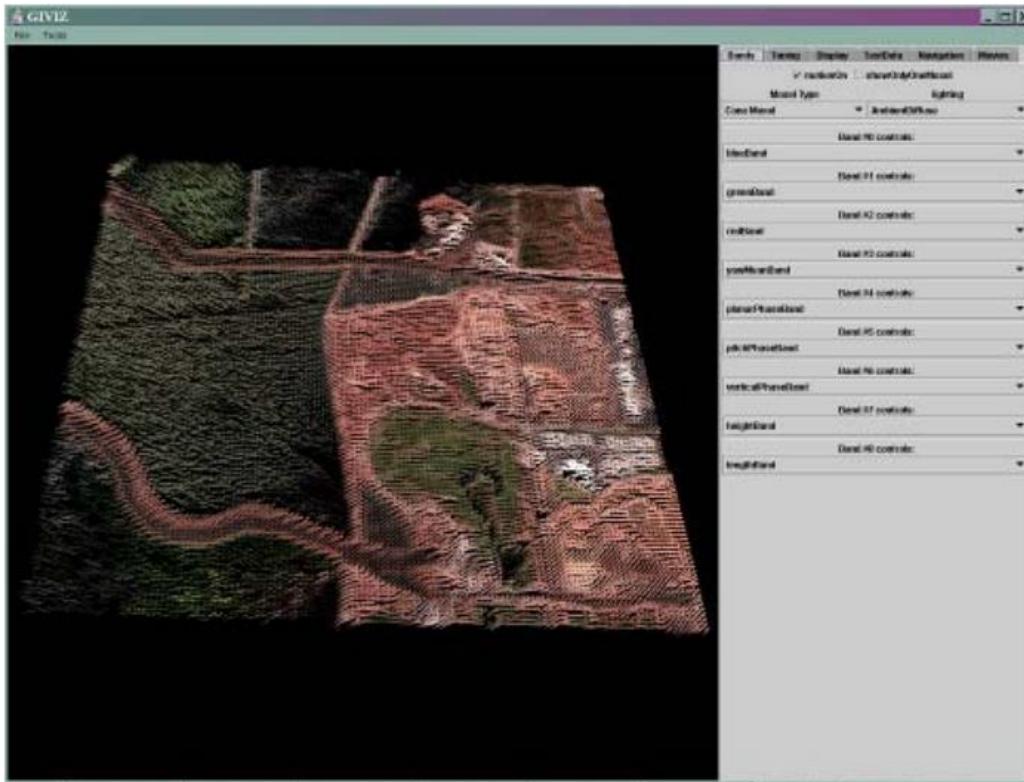
ANIMATIONS

Motion primitives as visual variables



ANIMATIONS

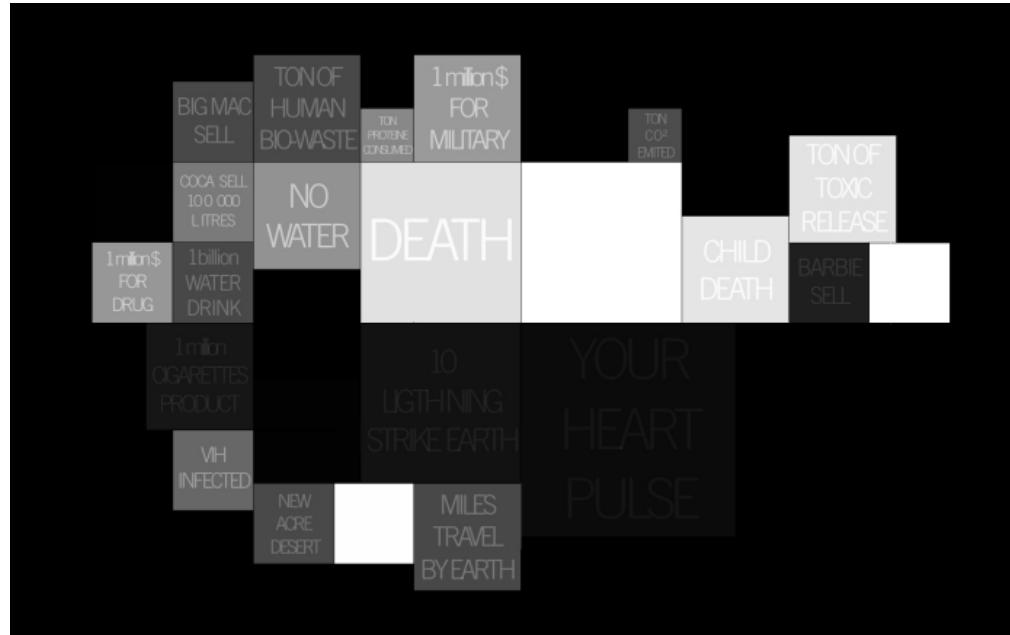
Motion primitives as visual variables



[Ware and Bobrow, 2006](#). Also see Bartram.

ANIMATIONS

Rhythm as a visual variable



LINK

ANIMATIONS

- For conveying time-evolving data
- For capturing users' attention
- As an information channel
- For explaining transitions

ANIMATED TRANSITIONS

Change Blindness Demo



ANIMATED TRANSITIONS

Change Blindness Demo



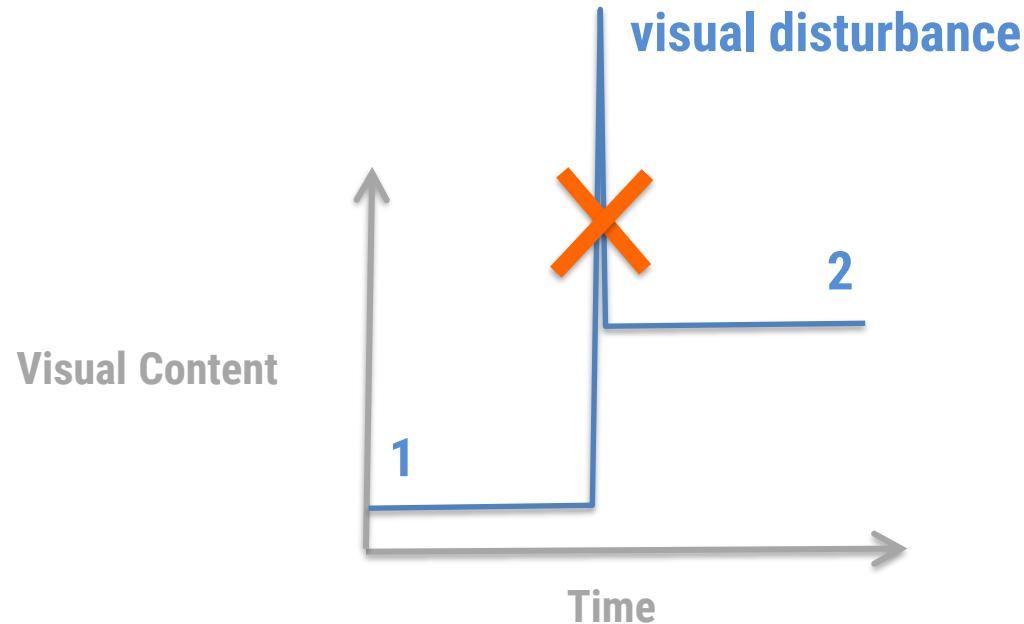
ANIMATED TRANSITIONS

Change Blindness Demo – Try again



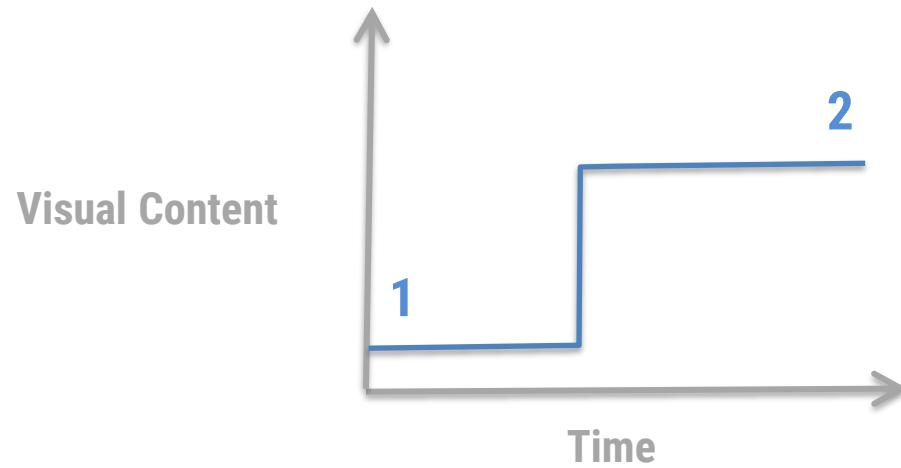
ANIMATED TRANSITIONS

Understanding Visual Transitions



ANIMATED TRANSITIONS

Understanding Visual Transitions



ANIMATED TRANSITIONS

How many words were inserted?

Hervey de Saint Denys has recently started to be known for his introspective studies on dreams. He wrote down his dreams on a daily basis from the age of 13. In 1867, he anonymously published *Les rêves et les moyens de les diriger* (Dreams and the Ways to Direct Them). In this book, he proposed techniques to control dreams, and he described dreams in which the "dreamer is perfectly aware he is dreaming". This particular state of consciousness later came to be called lucid dreaming.

ANIMATED TRANSITIONS

How many words were inserted? Try Again

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ANIMATED TRANSITIONS

What has changed?

Hervey de Saint Denys devoted himself to the study of Chinese, and in 1851 published his *Recherches sur l'agriculture et l'horticulture des Chinois*, in which he dealt with the plants and animals that might be acclimatized in the West. He translated Chinese texts as well as some Chinese stories not of classical interest but valuable for the light they throw on oriental custom. He also translated some works from the Spanish, and wrote a history of the Spanish drama.

Hervey de Saint Denys has recently started to be known for his introspective studies on dreams. He wrote down his dreams on a daily basis from the age of 13. In 1867, he anonymously published *Les rêves et les moyens de les diriger; observations pratiques* (Dreams and the Ways to Direct Them:Practical Observations). In

ANIMATED TRANSITIONS

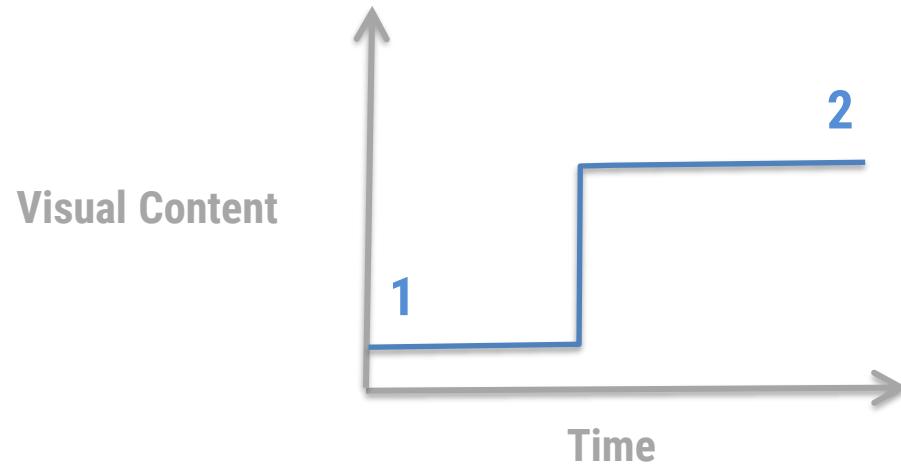
What has changed? Try Again

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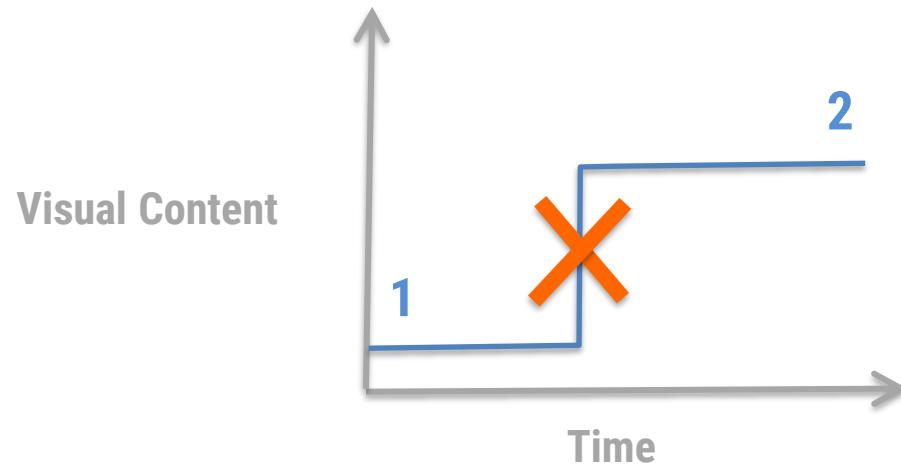
ANIMATED TRANSITIONS

Understanding Visual Transitions



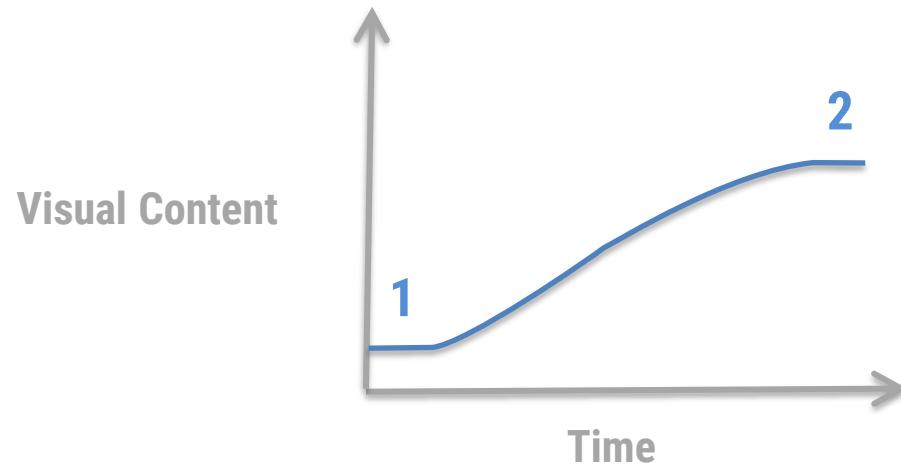
ANIMATED TRANSITIONS

Understanding Visual Transitions



ANIMATED TRANSITIONS

Understanding Visual Transitions



ANIMATED TRANSITIONS

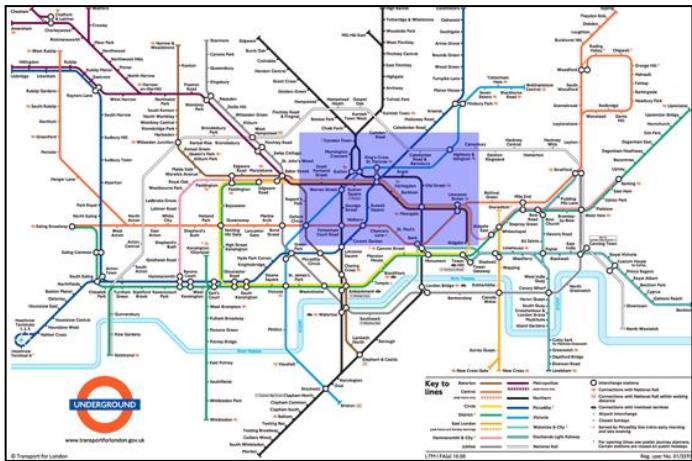
Help when scrolling documents

The supporting power being estimated at 2500 pounds, and the united weights of the party amounting only to about 1200, there was left a surplus of 1300, of which again 1200 was exhausted by ballast, arranged in bags of different sizes, with their respective weights marked upon them -- by cordage, barometers, telescopes, barrels containing provision for a fortnight, water-casks, cloaks, carpet-bags, and various other indispensable matters, including a coffee-warmer, contrived for warming coffee by means of slack-lime, so as to dispense altogether with fire, if it should be judged prudent to do so. All these articles, with the exception of the ballast, and a few trifles, were suspended from the hoop overhead. The car is much smaller and lighter, in proportion, than the one appended to the model. It is formed of a light wicker, and is wonderfully strong for so frail looking a machine. Its rim is about 4 feet deep. The rudder is also very much larger, in proportion, than that of the model; and the screw is considerably smaller. The balloon is furnished besides with a grapnel, and a guide-rope, which latter is of the most indispensable importance. A few words, in explanation, will here be necessary for such of our readers as are not conversant with the details of aerostation.

As soon as the balloon quits the earth, it is subjected to the influence of many circumstances tending to create a difference in its weight; augmenting or diminishing its ascending power. For example, there may be a deposition of dew upon the silk, to the extent, even, of several hundred pounds; ballast has

ANIMATED TRANSITIONS

Help when panning and zooming



Shanmugasundaram & Irani, 2008

ANIMATED TRANSITIONS

Help when navigating document revisions

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(cur) = difference from current version, (prev) = difference from preceding version,

m = minor edit, → = section edit, ← = automatic edit summary

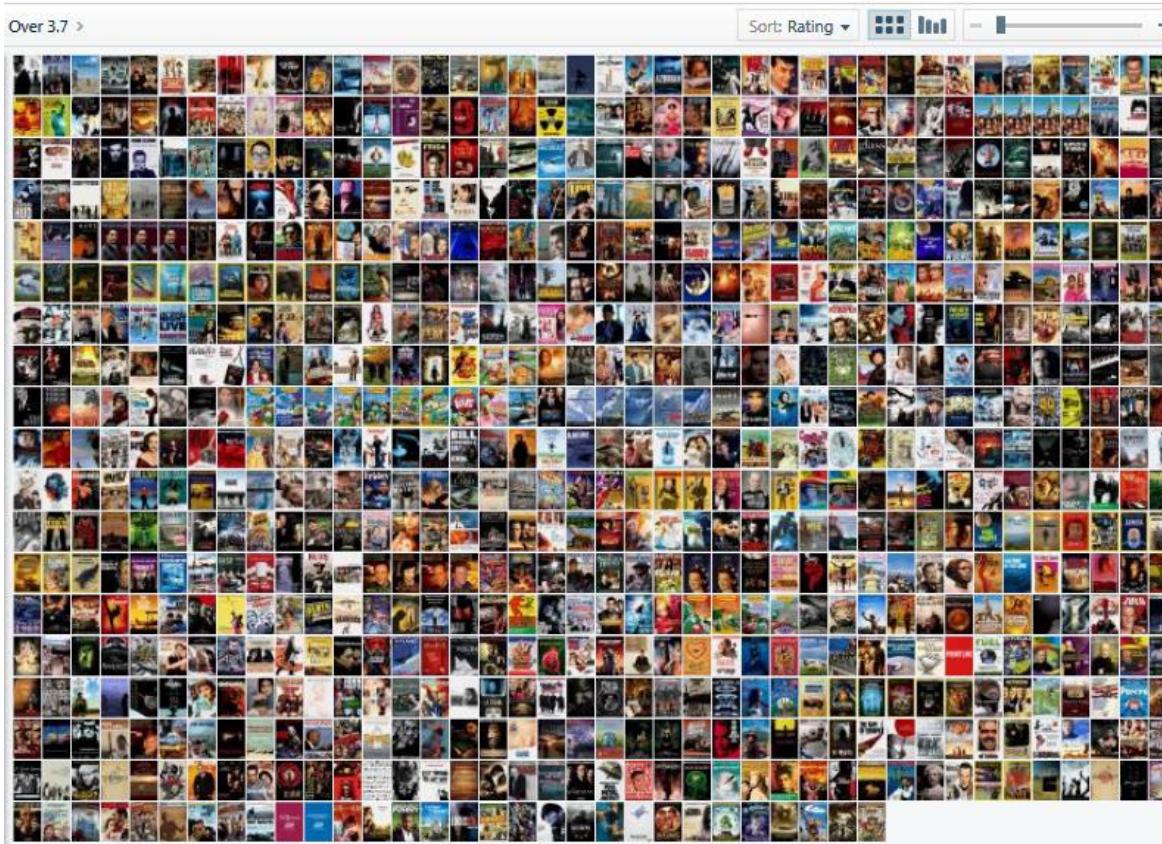
(latest | earliest) View (newer 50 | older 50) (20 | 50 | 100 | 250 | 500)

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- (cur) (prev) [21:05, 6 December 2009](#) 94.74.138.66 (talk) (16,058 bytes) ([undo](#))
- (cur) (prev) [19:15, 17 November 2009](#) 72.48.156.2 (talk) (16,056 bytes) ([→Introduction](#)) ([undo](#))
- (cur) (prev) [11:33, 17 November 2009](#) 192.248.16.90 (talk) (15,551 bytes) ([→See also](#)) ([undo](#))
- (cur) (prev) [22:06, 9 November 2009](#) The Thing That Should Not Be (talk | contribs) **m** (15,522 bytes)
(Reverted edits by 189.72.213.11 (talk) to last revision by ClueBot (Report Mistake) (HG)) ([undo](#))
- (cur) (prev) [22:06, 9 November 2009](#) 189.72.213.11 (talk) (15,764 bytes) ([→Usability](#)) ([undo](#))
- (cur) (prev) [11:24, 9 November 2009](#) ClueBot (talk | contribs) **m** (15,522 bytes) (*Reverting possible vandalism by 41.220.224.134 to version by Lester. False positive? Report it. Thanks, ClueBot. (819644) (Bot)*) ([undo](#))
- (cur) (prev) [11:24, 9 November 2009](#) 41.220.224.134 (talk) (15,405 bytes) (*Reverting to previous version*) ([undo](#))

ANIMATED TRANSITIONS

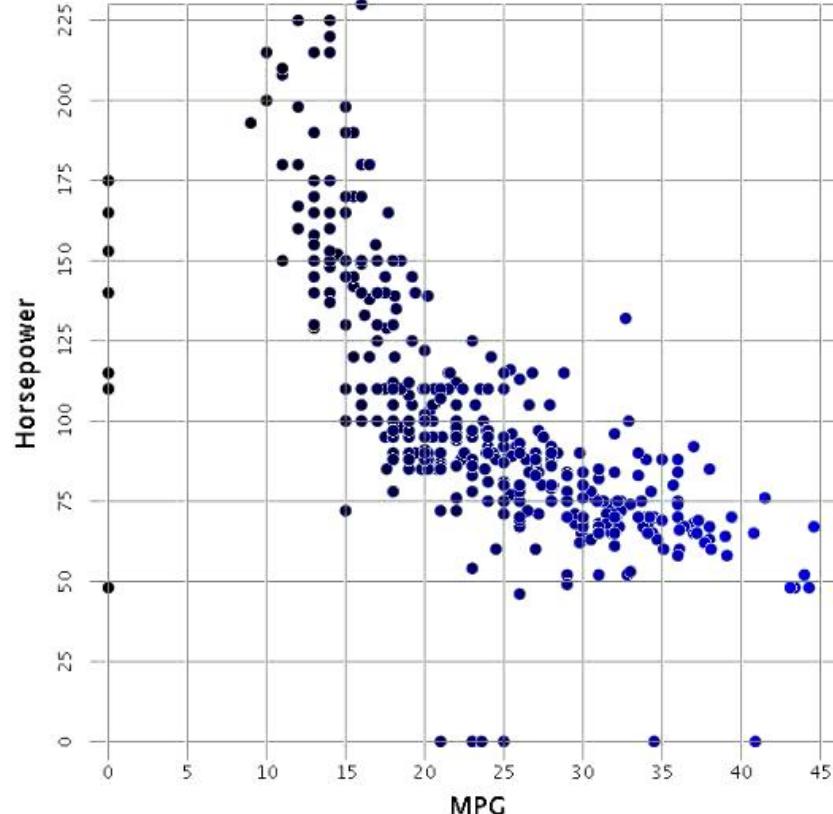
In faceted browsing - Pivot



[Microsoft
Pivot](#)

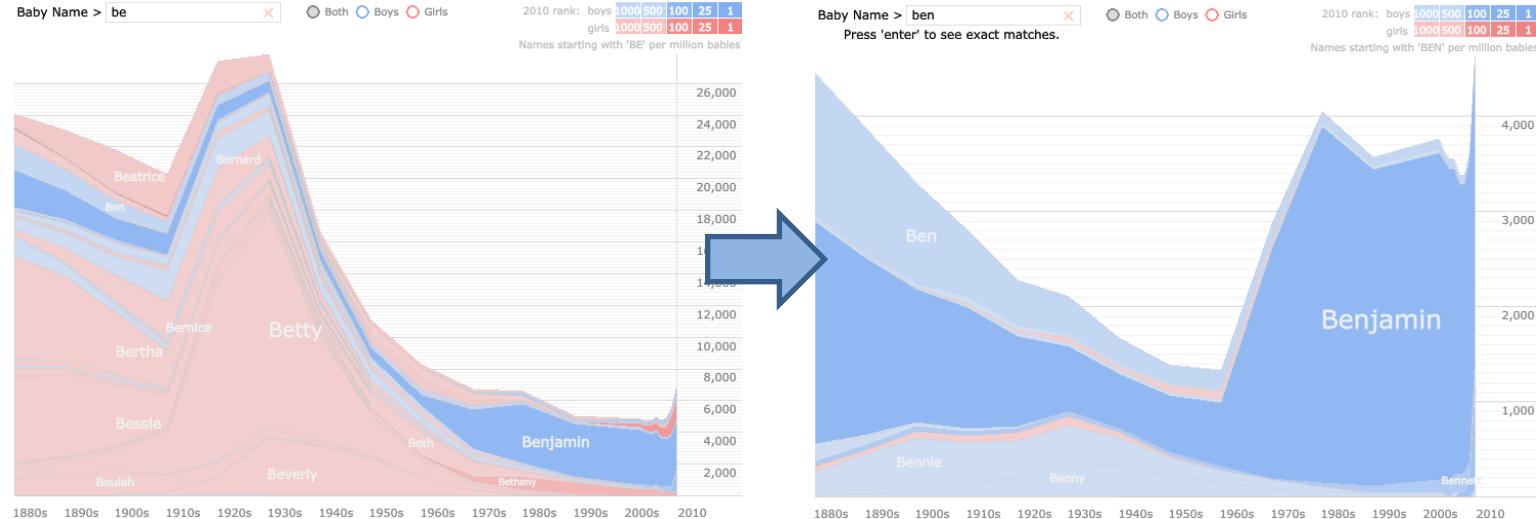
ANIMATED TRANSITIONS

In multidimensional exploration - ScatterDice



ANIMATED TRANSITIONS

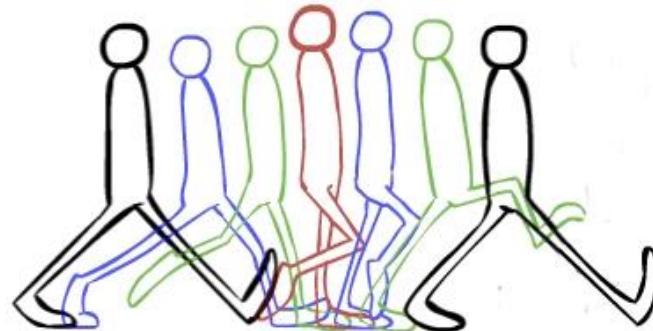
In charts – Baby Name Voyager



ANIMATED TRANSITIONS

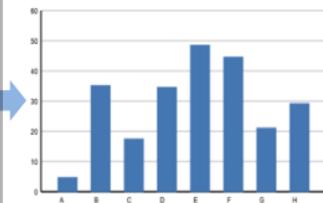
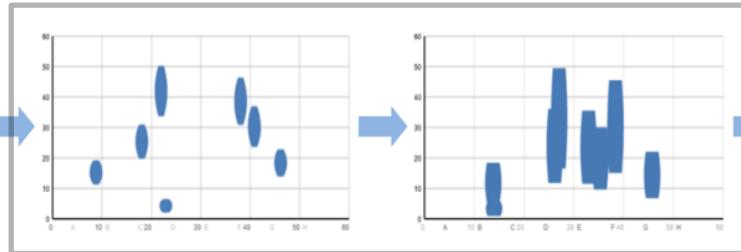
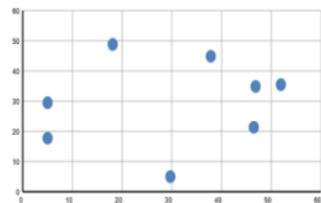
How to design them?

1. Interpolation problem: what to show in-between
2. Pacing problem: when to show it

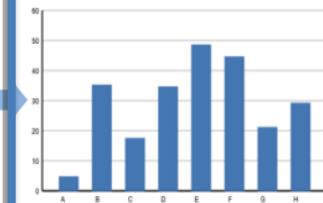
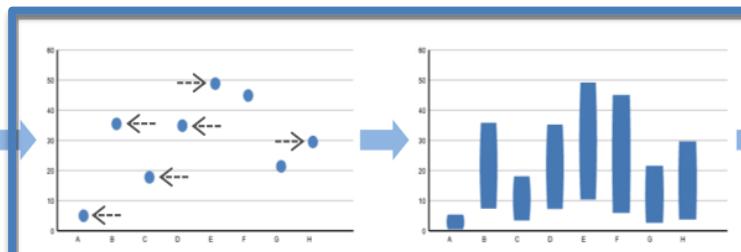
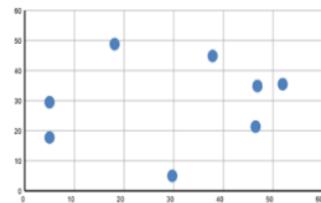


ANIMATED TRANSITIONS

Designing Animated Transitions



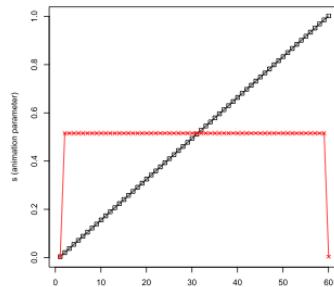
Direct Interpolation



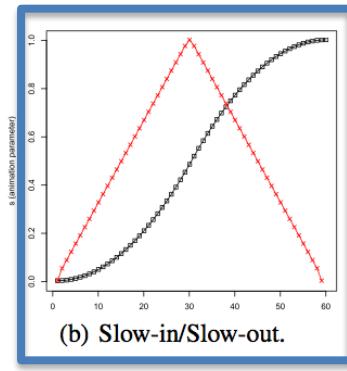
Staged Animation

ANIMATED TRANSITIONS

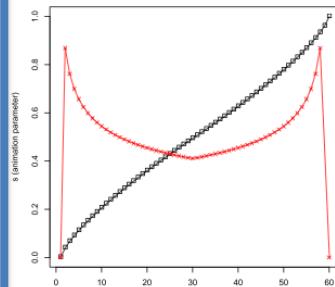
Designing Animated Transitions



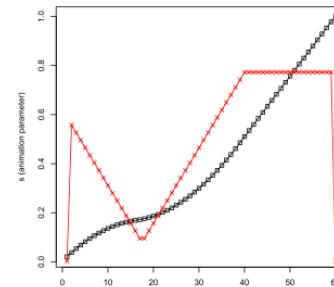
(a) Constant rate.



(b) Slow-in/Slow-out.



(c) Fast-in/Fast-out.

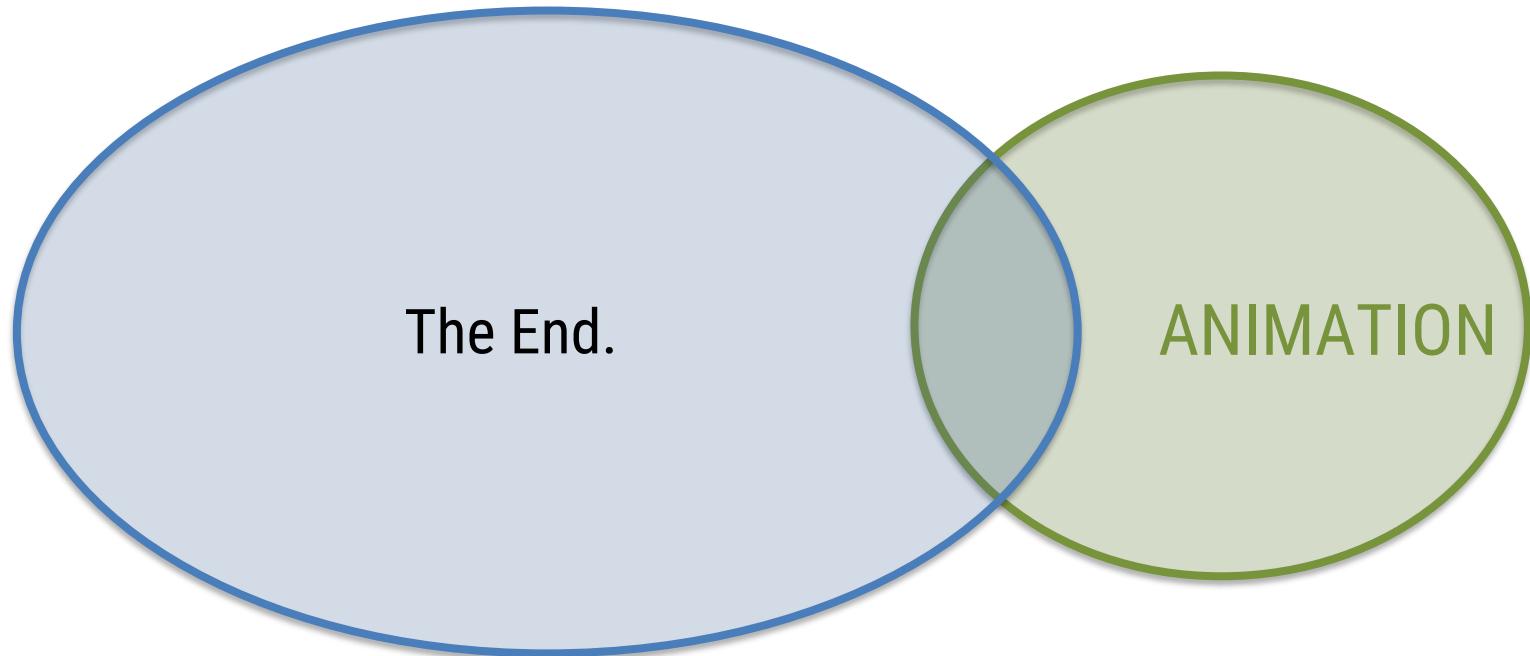


(d) Adaptive rate (frame 18).

ANIMATED TRANSITIONS

Use them!

TIME VISUALIZATION



ACKNOWLEDGMENT

Slides in were inspired and adapted from slides by

- Pierre Dragicevic (Inria)