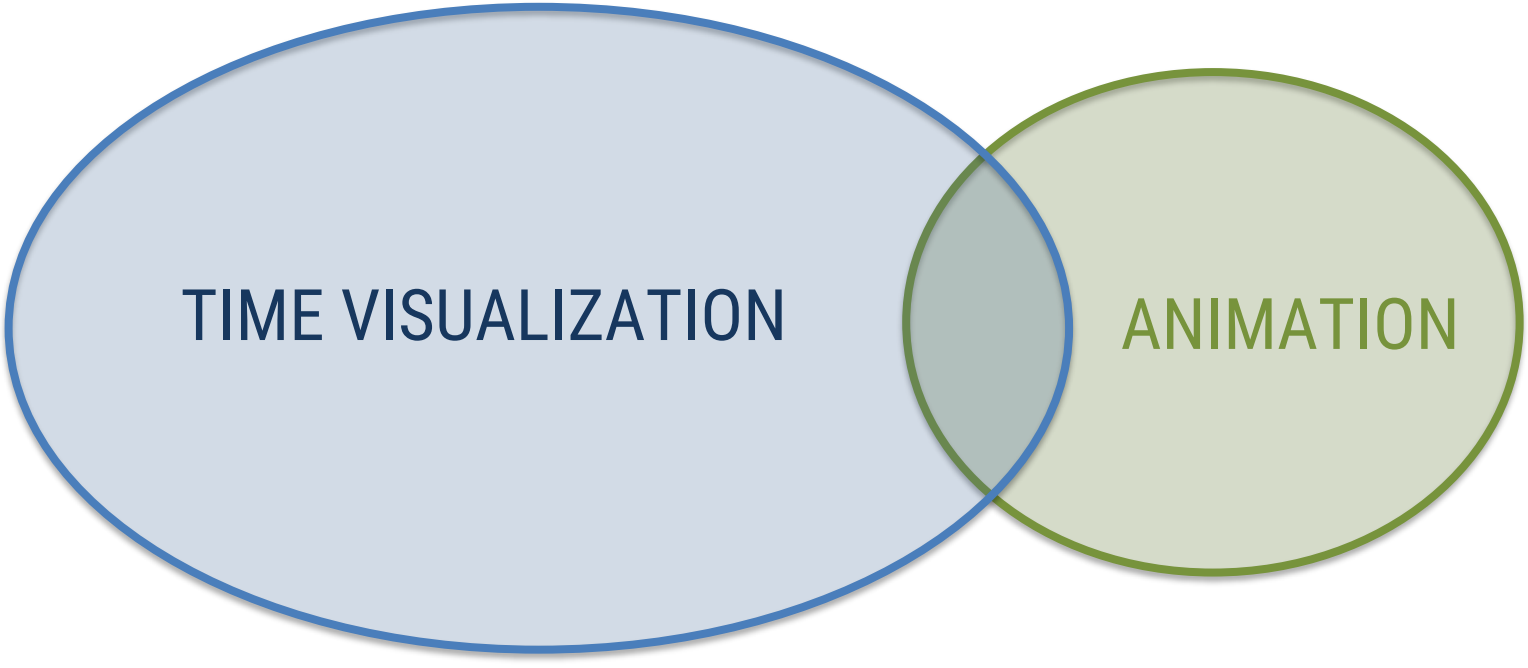
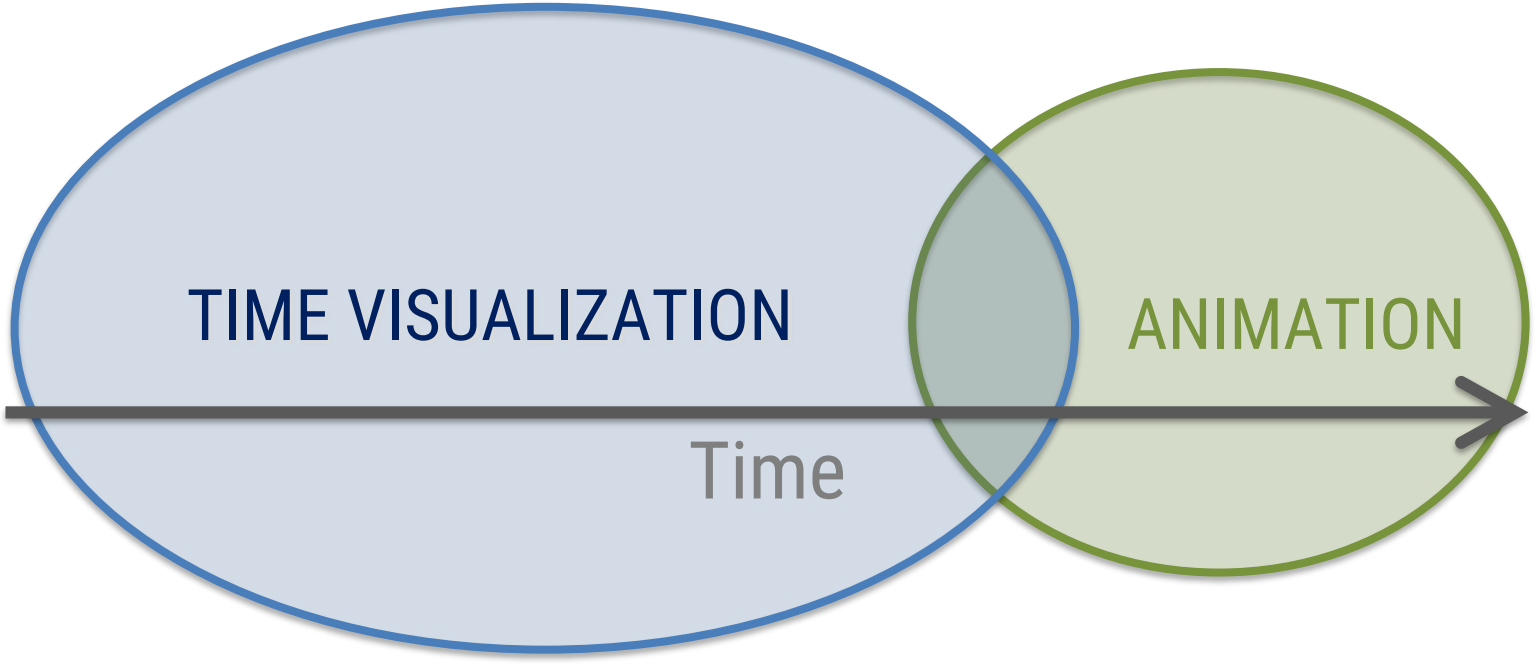
TIME AND ANIMATION

Petra Isenberg (&Pierre Dragicevic)

informatics mathematics
Inria


TIME VISUALIZATION
ANIMATION


TIME VISUALIZATION
ANIMATION
Time

VISUALIZATION OF TIME

TIME

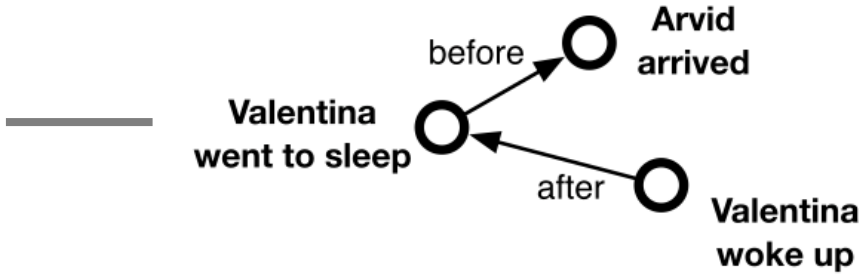
- Is just another data dimension
- Why bother?

TIME

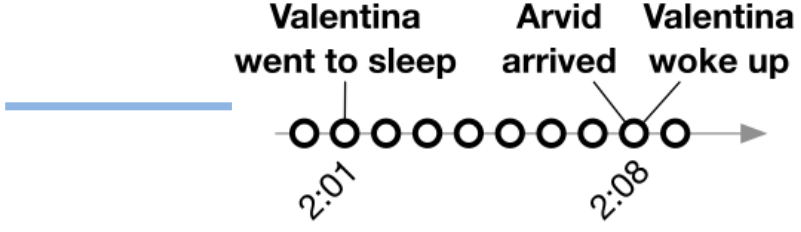
- Is just another data dimension
- Why bother?
- What data type is it?
  - Nominal?
  - Ordinal?
  - Quantitative?

TIME

- **Ordinal**



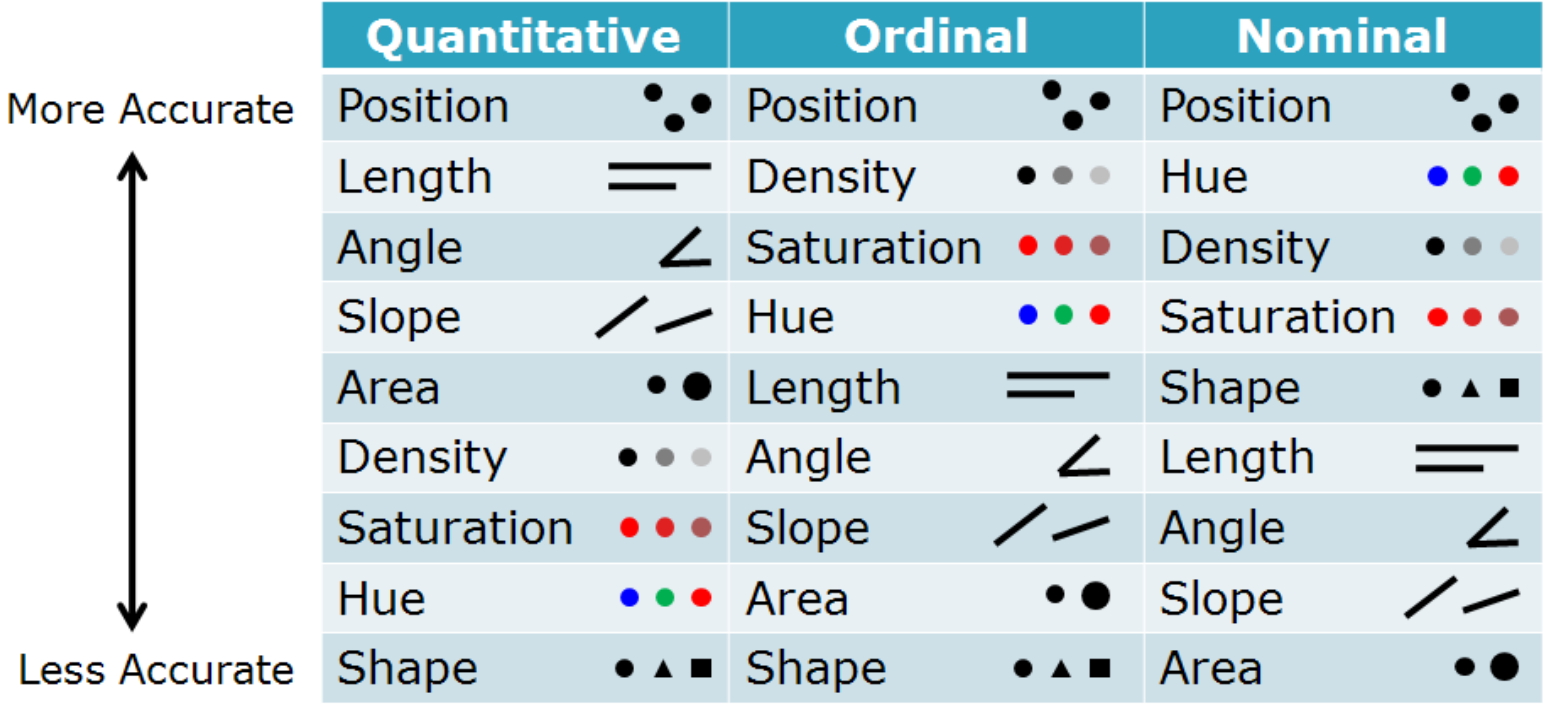
- **Quantitative**
  - Discrete



  - Continuous

[Aigner et al, 2011]

TIME



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

TIME

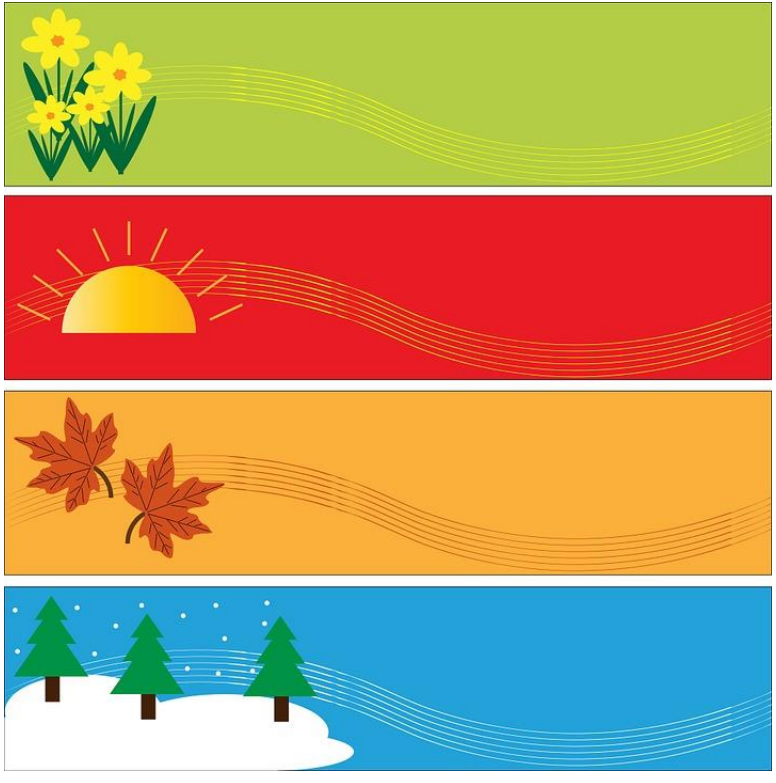
Shneiderman:

- 1-dimensional data
- 2-dimensional data
- 3-dimensional data
- **temporal data**
- multi-dimensional data
- tree data
- network data

VISUALIZING TIME

as a time point

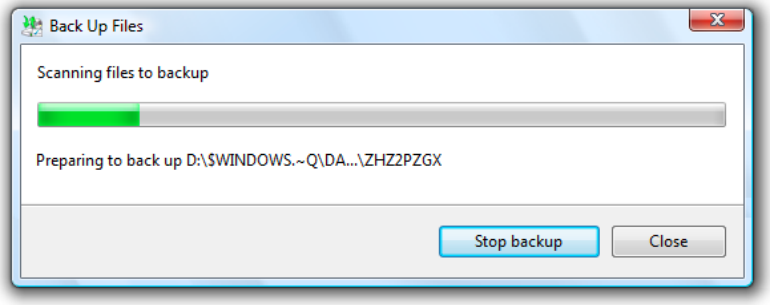
VISUALIZING TIME



as a time period

VISUALIZING TIME

as a duration

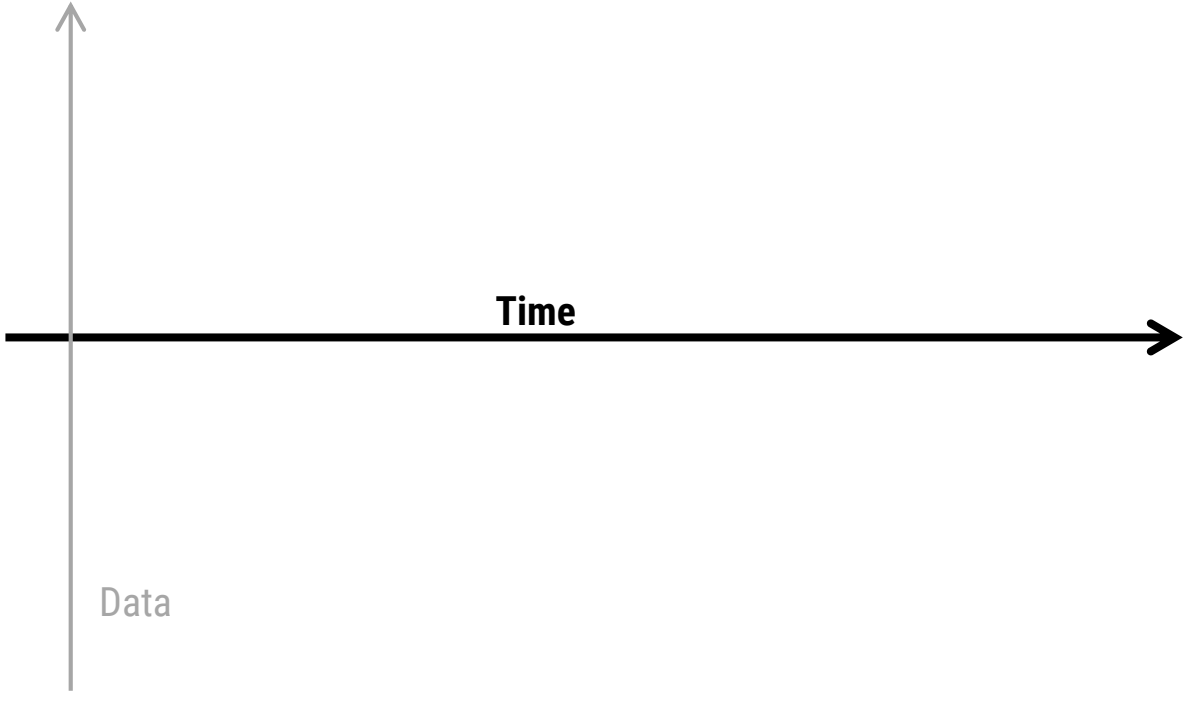


VISUALIZING TIME

PLUS DATA

MAPPING TIME TO SPACE

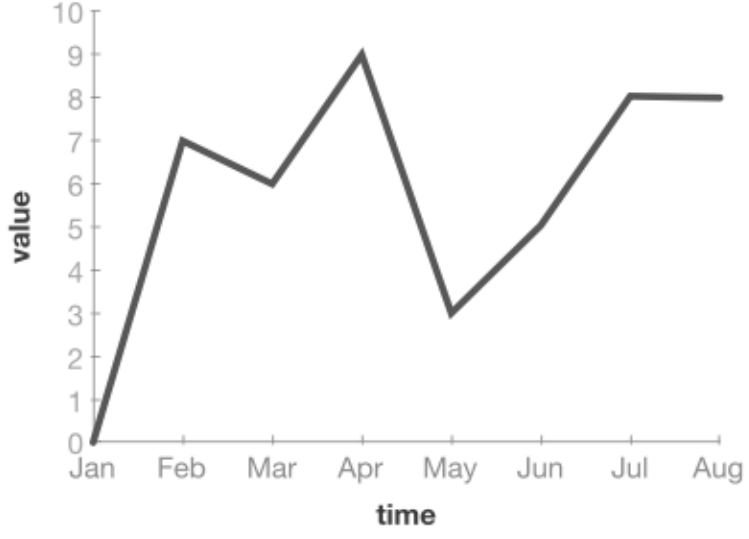
MAPPING TIME TO AN AXIS

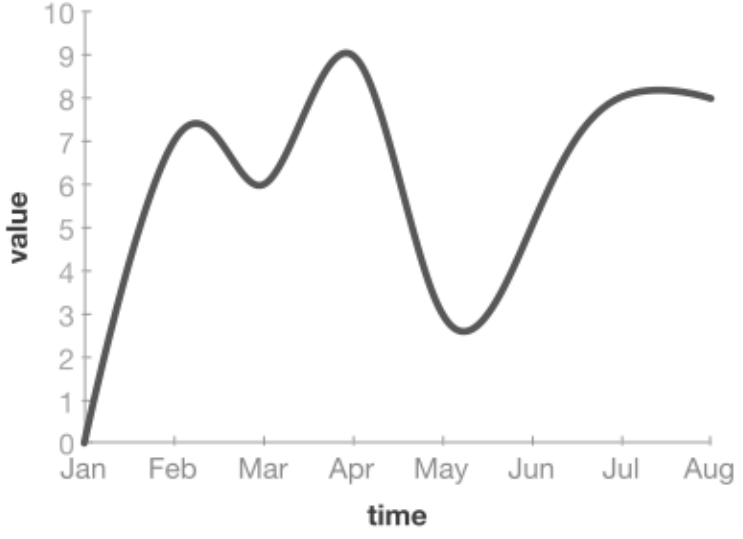


TIME-SERIES DATA

- 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

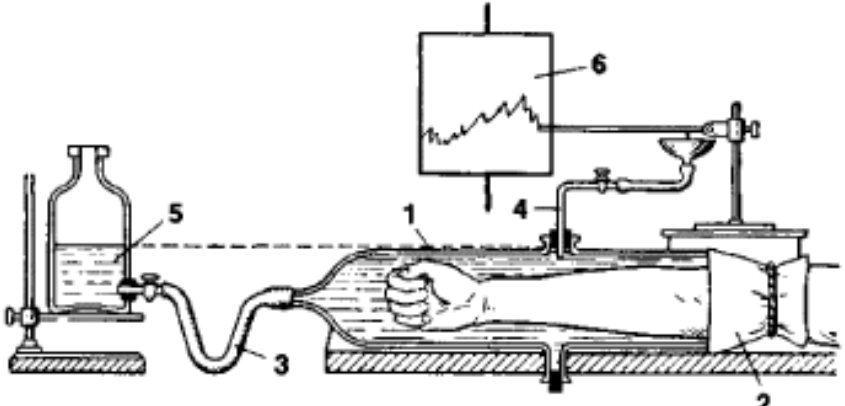




Aigner et al, 2011

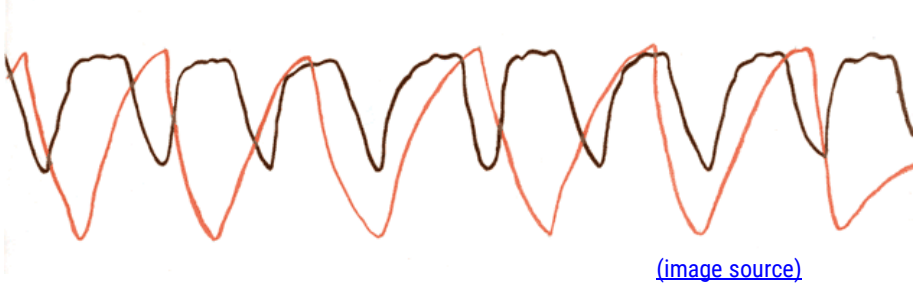
LINE CHARTS

Marey's Physiological Recordings



(image source)

Plethysmograph
Étienne-Jules Marey, 1876

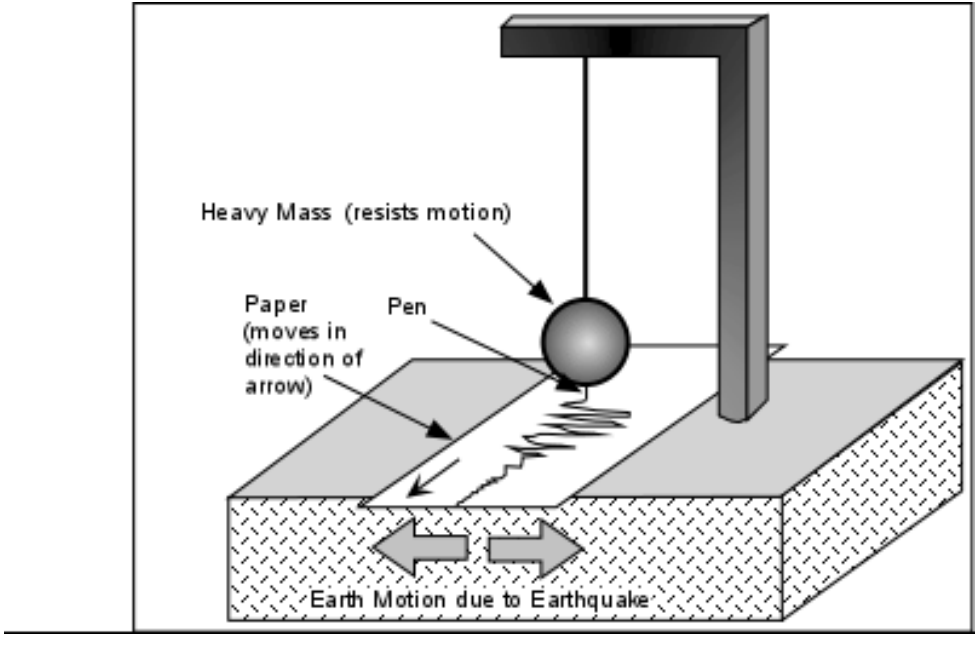


(image source)

Pneumogram
Étienne-Jules Marey, 1876

LINE CHARTS

Pendulum Seismometer

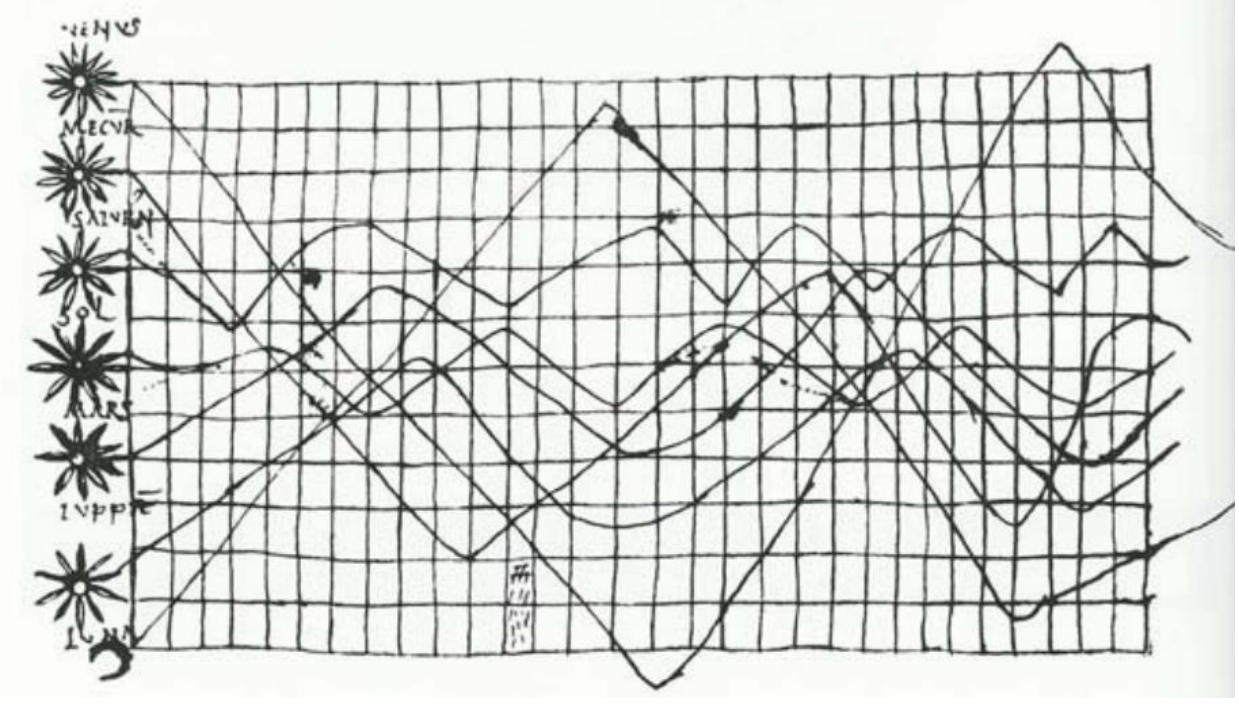


(image source)

Andrea Bina, 1751
Possibly also 17th century (source)

LINE CHARTS

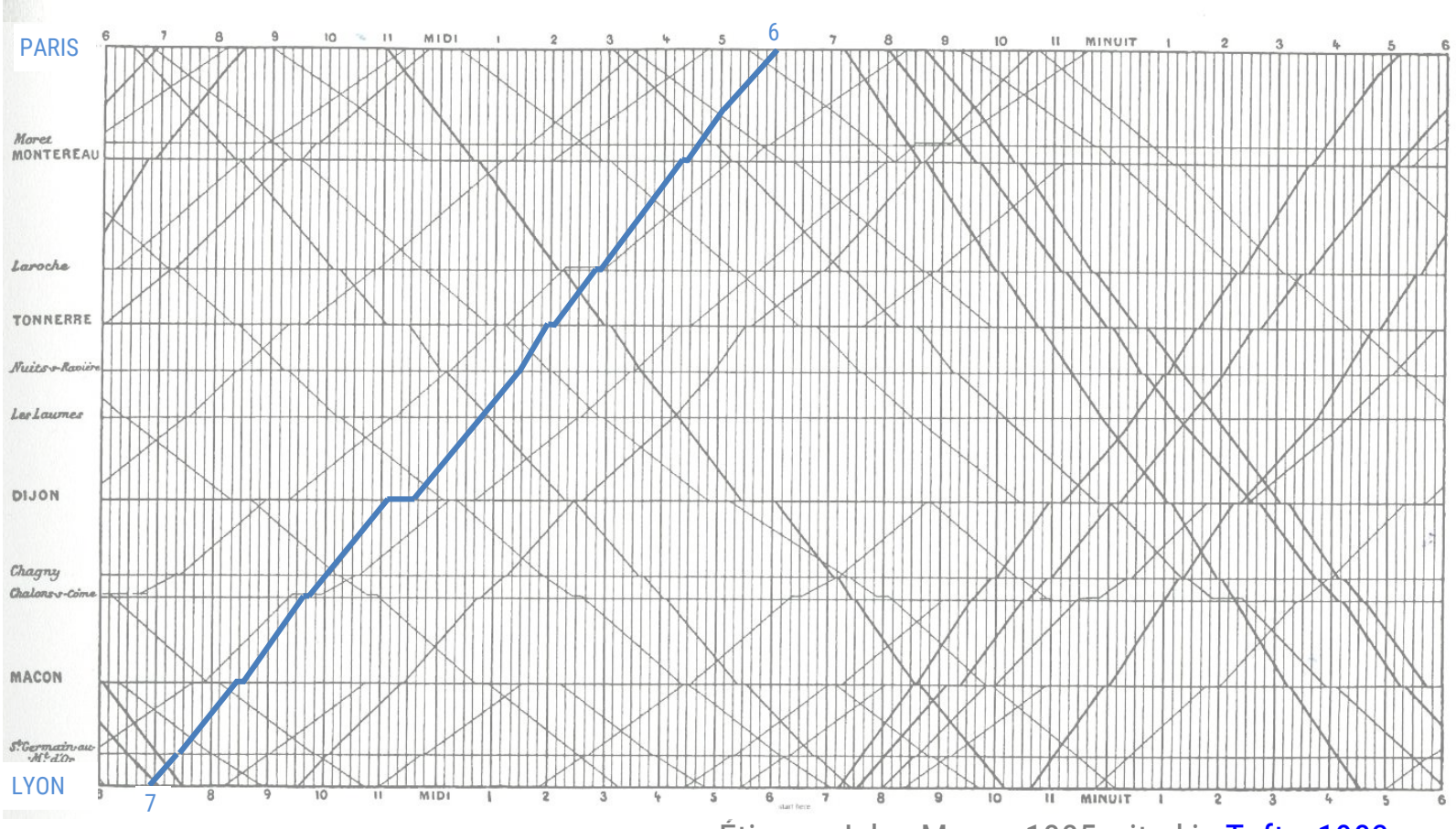
Inclinations of planetary orbits



Macrobius, 10th or 11th century
cited in Kendall, 1990

LINE CHARTS

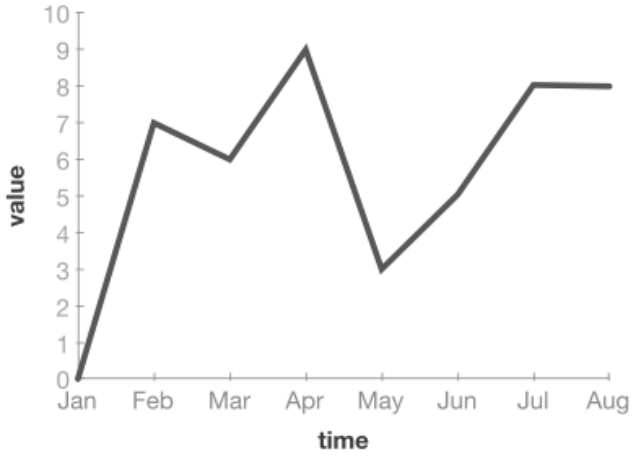
Marey's Train Schedule



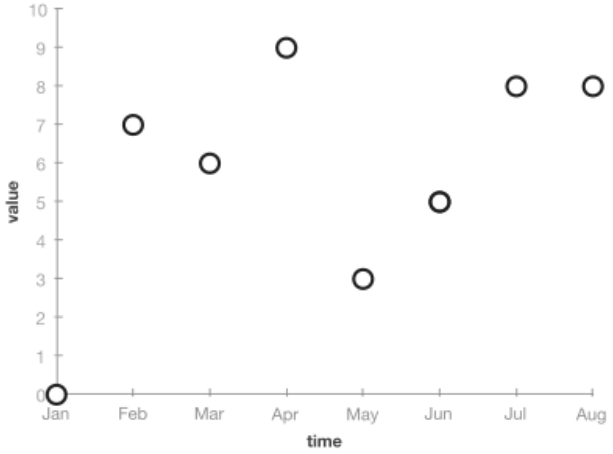
Étienne-Jules Marey, 1885, cited in Tufte, 1983

OTHER CHARTS

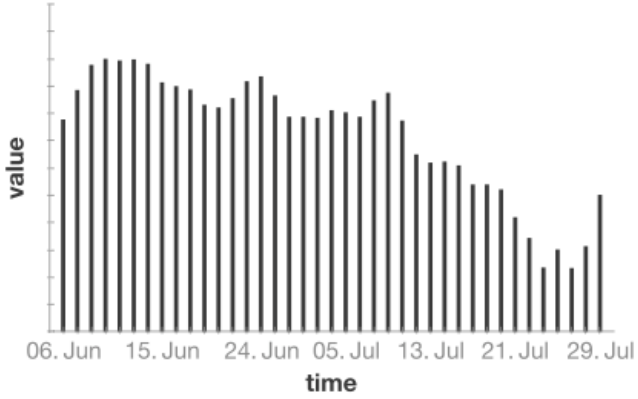
Line Plots



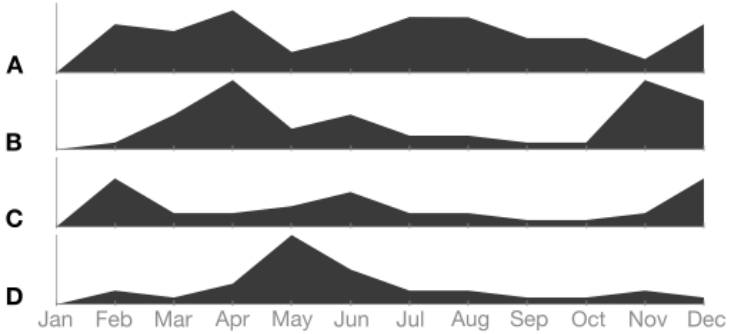
Point Plots



Bar Charts



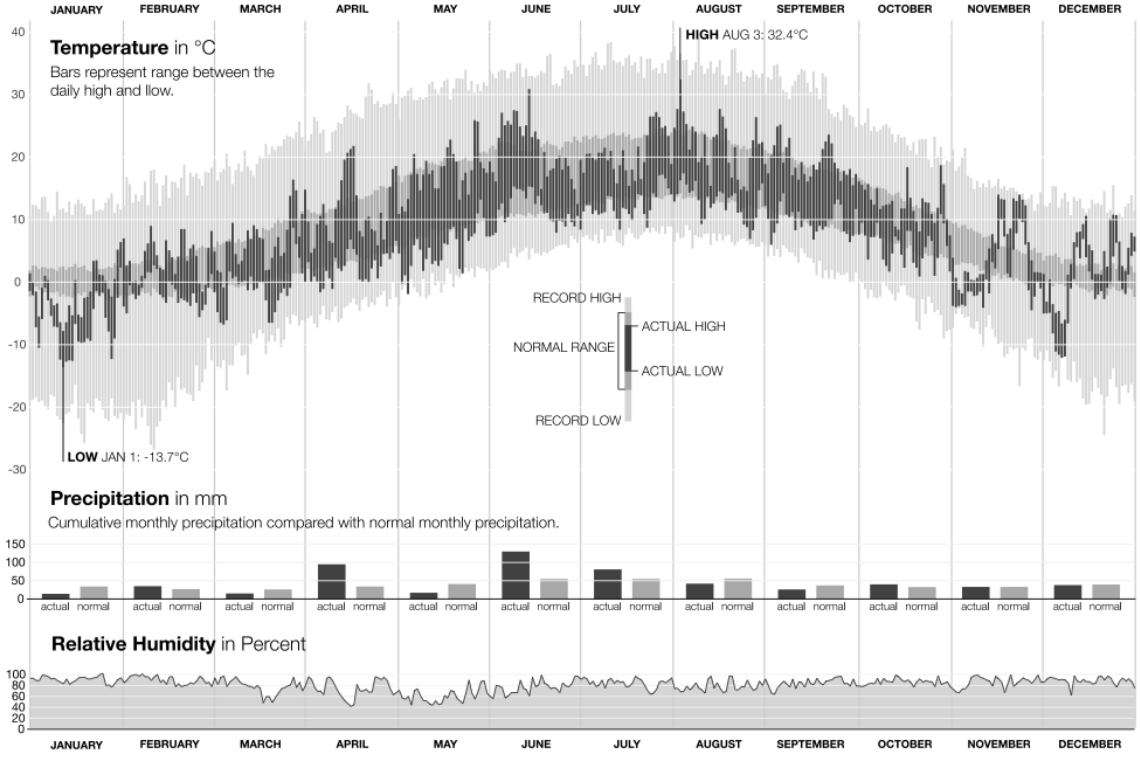
Silhouette Graphs



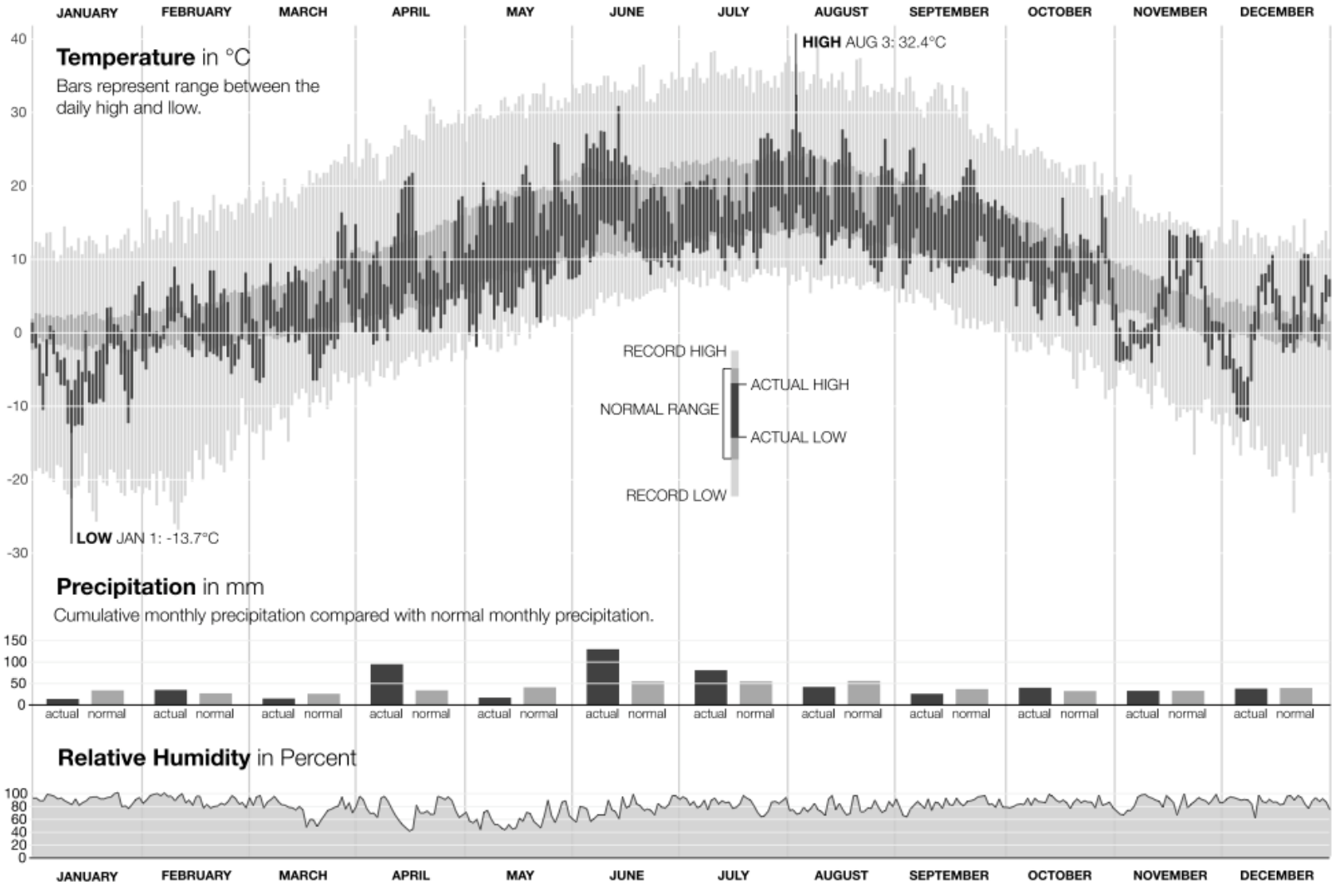
[Aigner et al, 2011](#)

OTHER CHARTS

Combination - New York Times Weather Chart

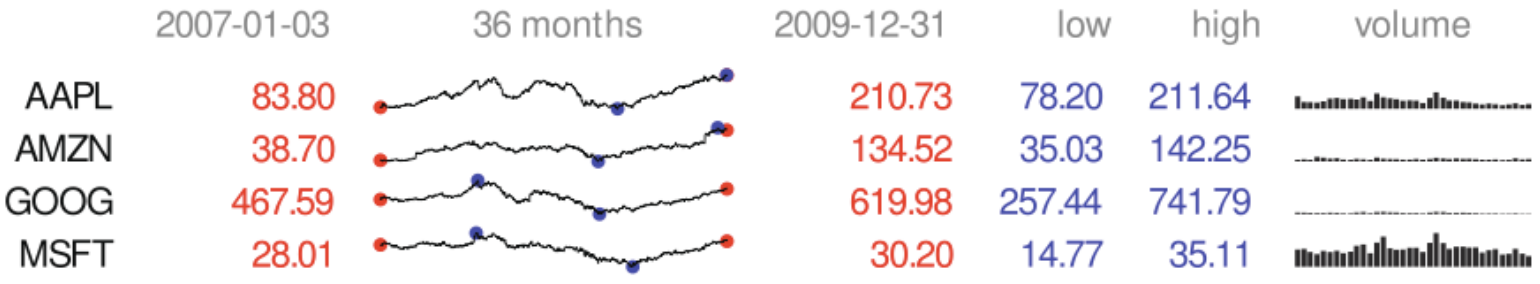


New York Times, 1980. Cited in [Tufte, 1983]


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
Temperature in °C
Bars represent range between the daily high and llow.
HIGH AUG 3: 32.4°C
LOW JAN 1: -13.7°C
RECORD HIGH
ACTUAL HIGH
NORMAL RANGE
ACTUAL LOW
RECORD LOW
Precipitation in mm
Cumulative monthly precipitation compared with normal monthly precipitation.
actual normal
Relative Humidity in Percent

OTHER CHARTS

Sparklines

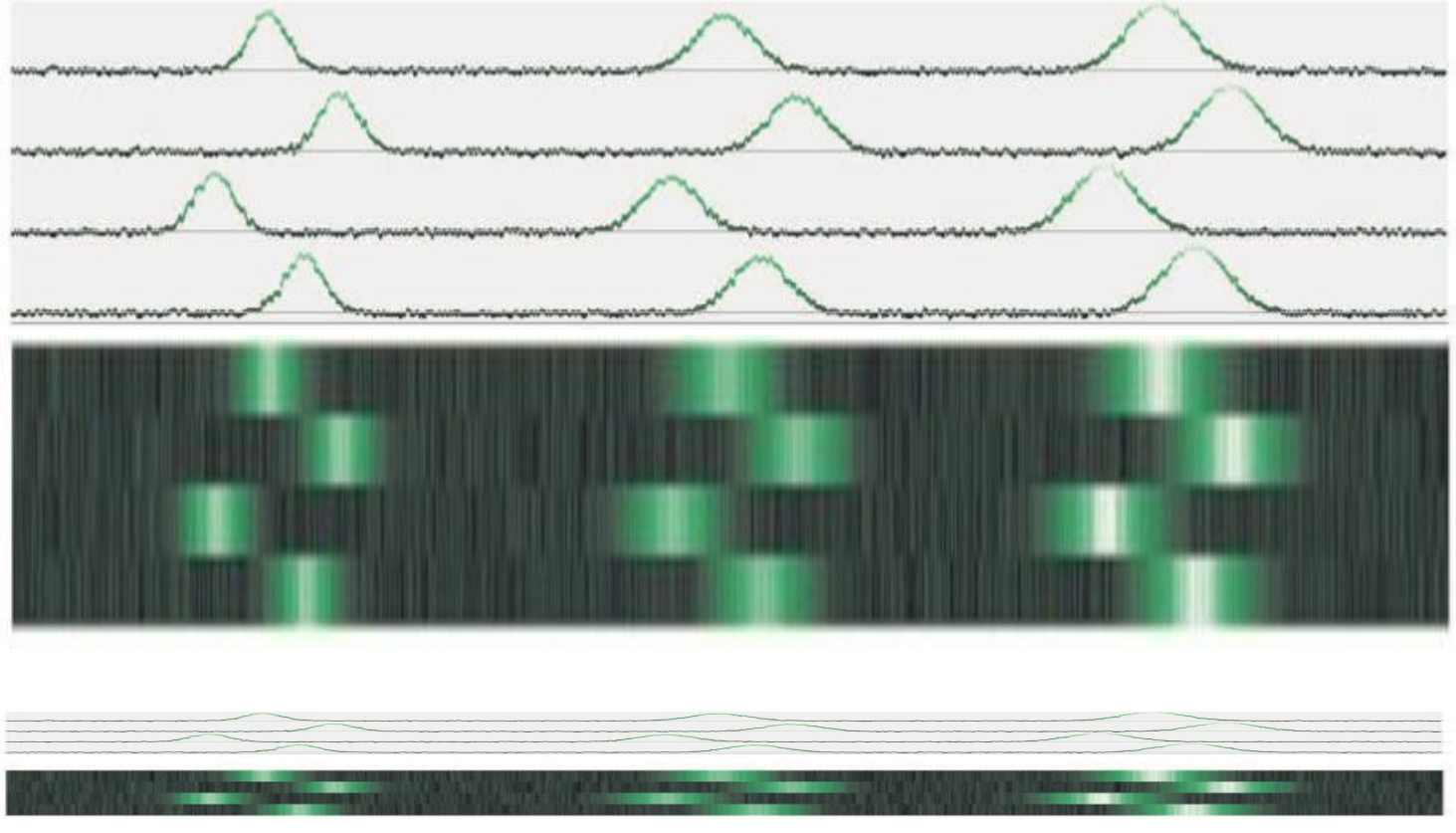


Usually, miniaturized versions of line plots  (↪ p. 153) and bar graphs  (↪ p. 154) are employed to represent data. For the special case of binary or three-valued data, special bar graphs can be applied that use ticks extending up and down a horizontal baseline  . One use for this kind of data are wins 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

Tufte, 2006. Cited in Aigner et al, 2011

OTHER CHARTS

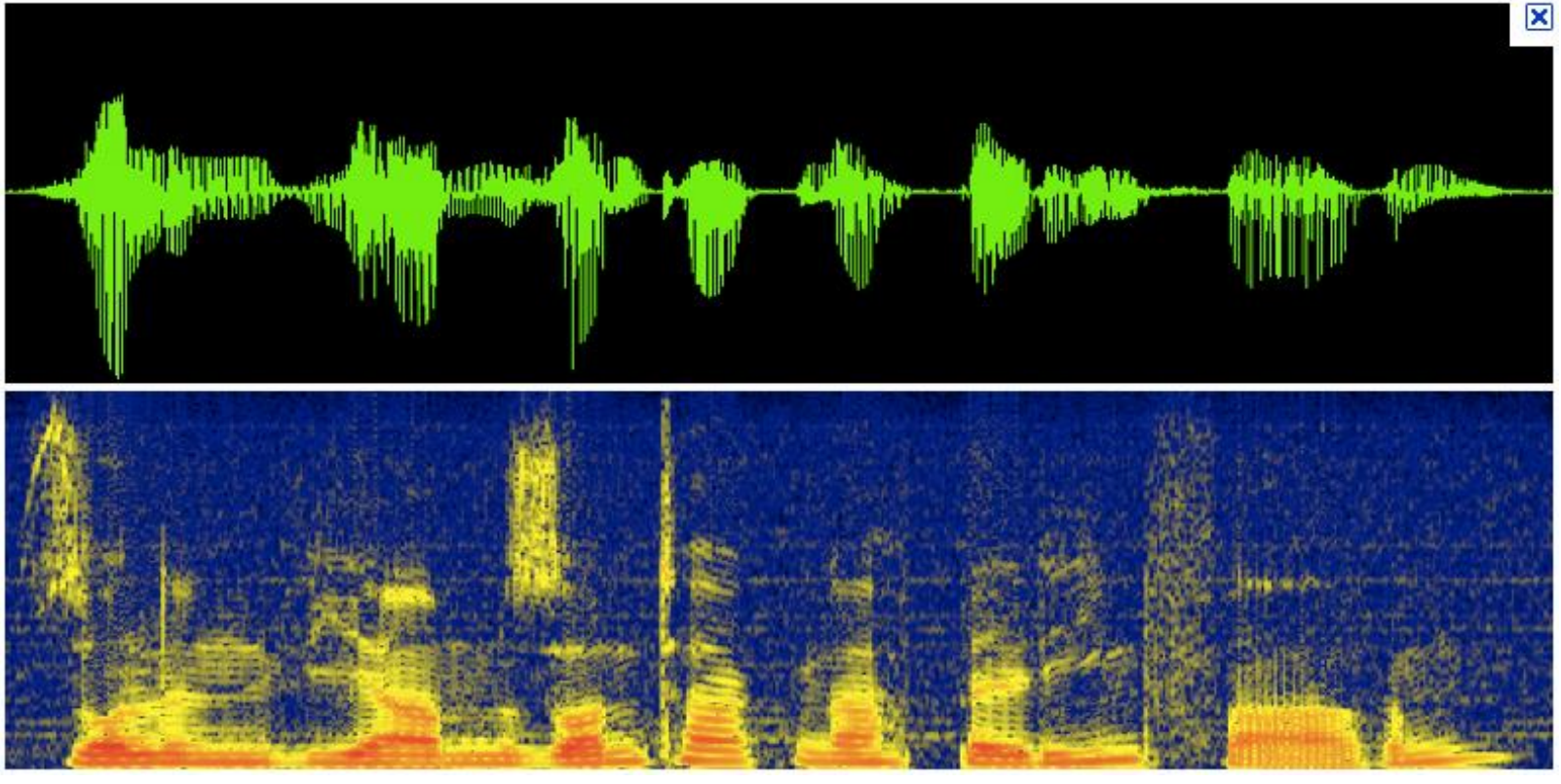
Color Encoding



Lam and Munzner ,2007

OTHER CHARTS

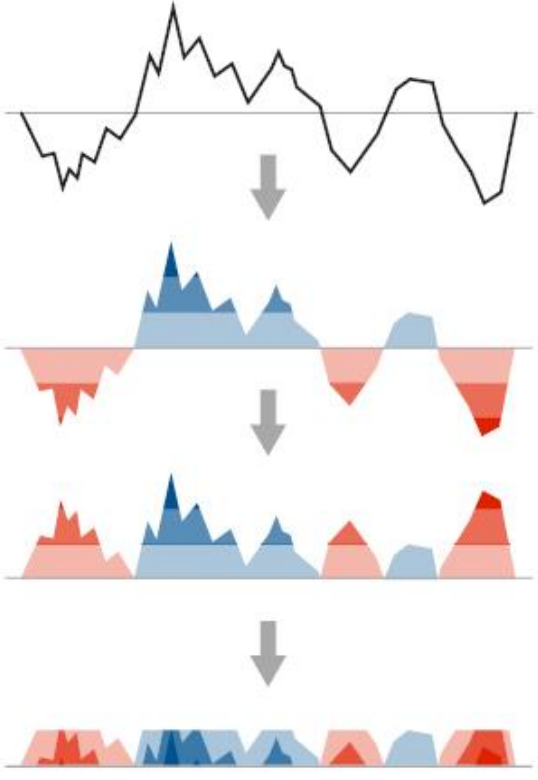
Color Encoding - FFT Spectrum

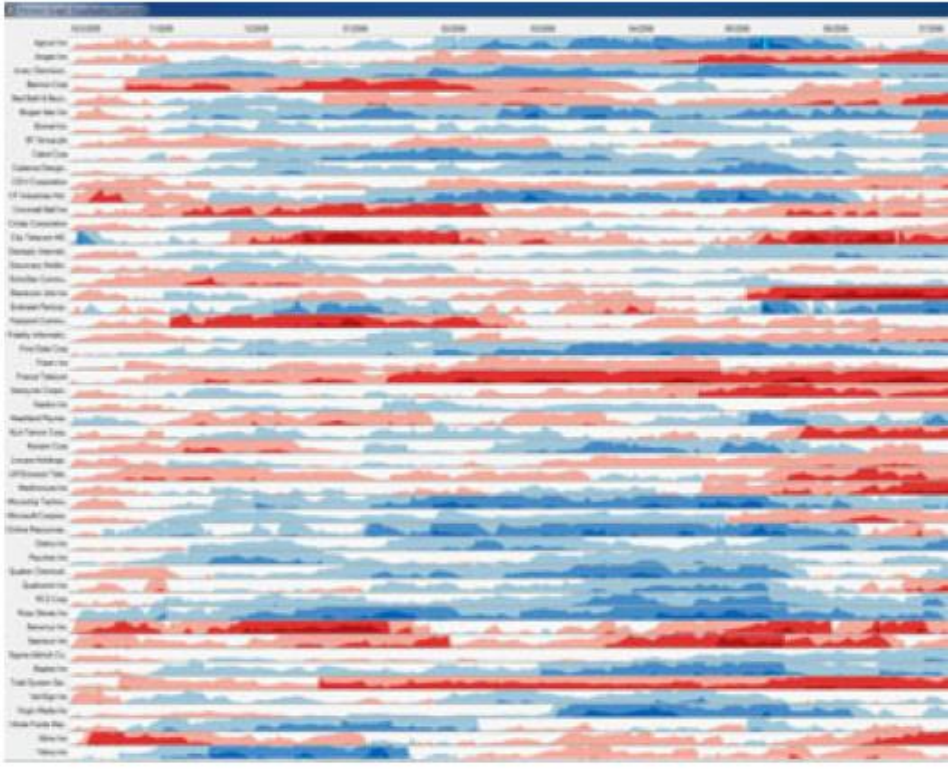


(image source)

OTHER CHARTS

Horizon Graphs

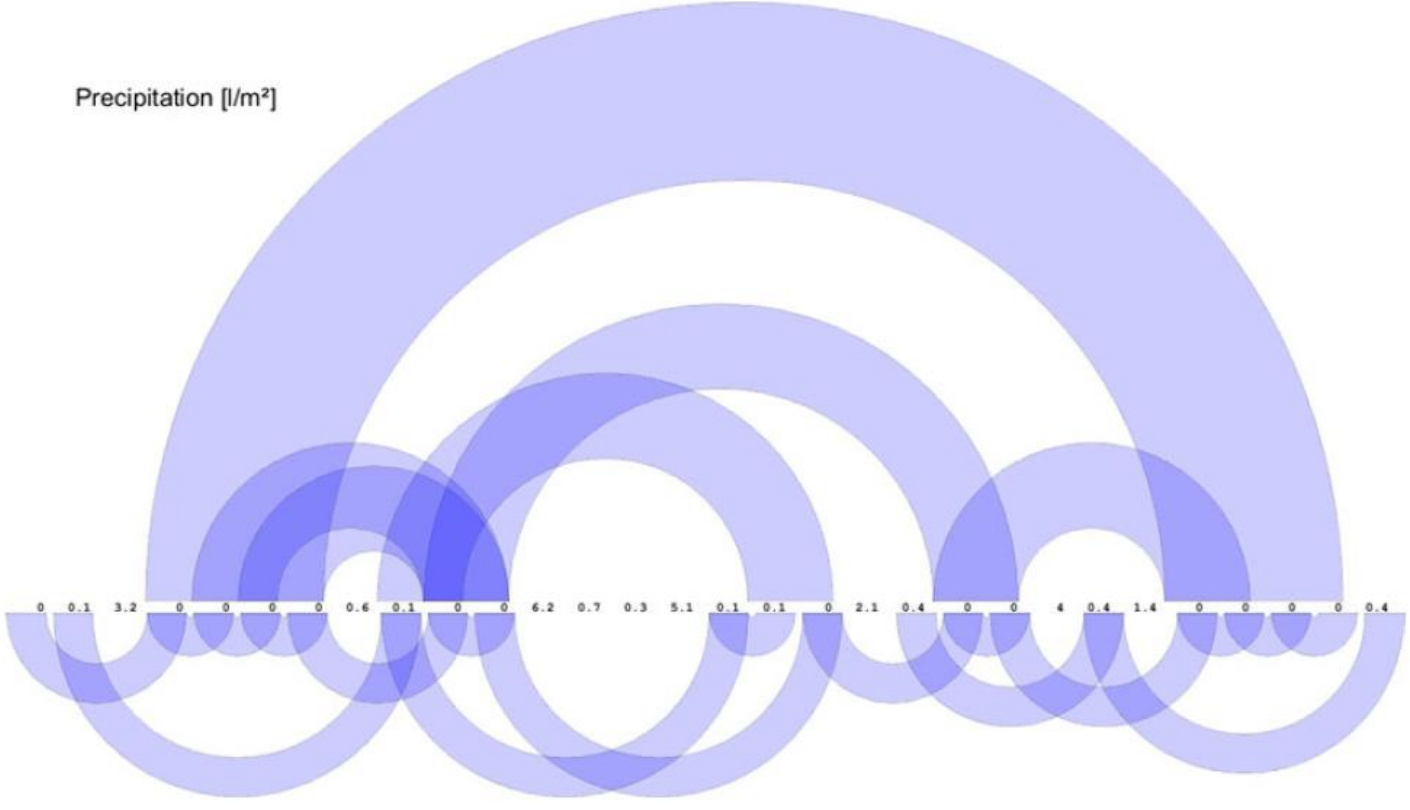




Reijner, 2008. Cited in Aigner et al, 2011

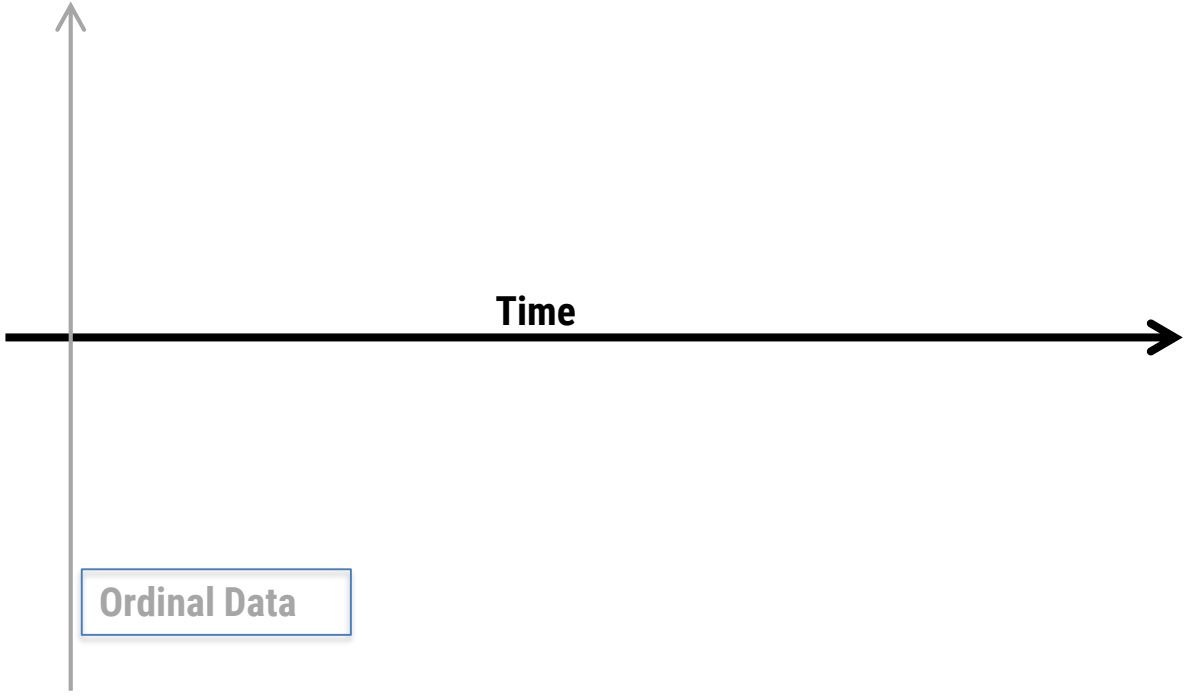
OTHER CHARTS

Arc Diagrams



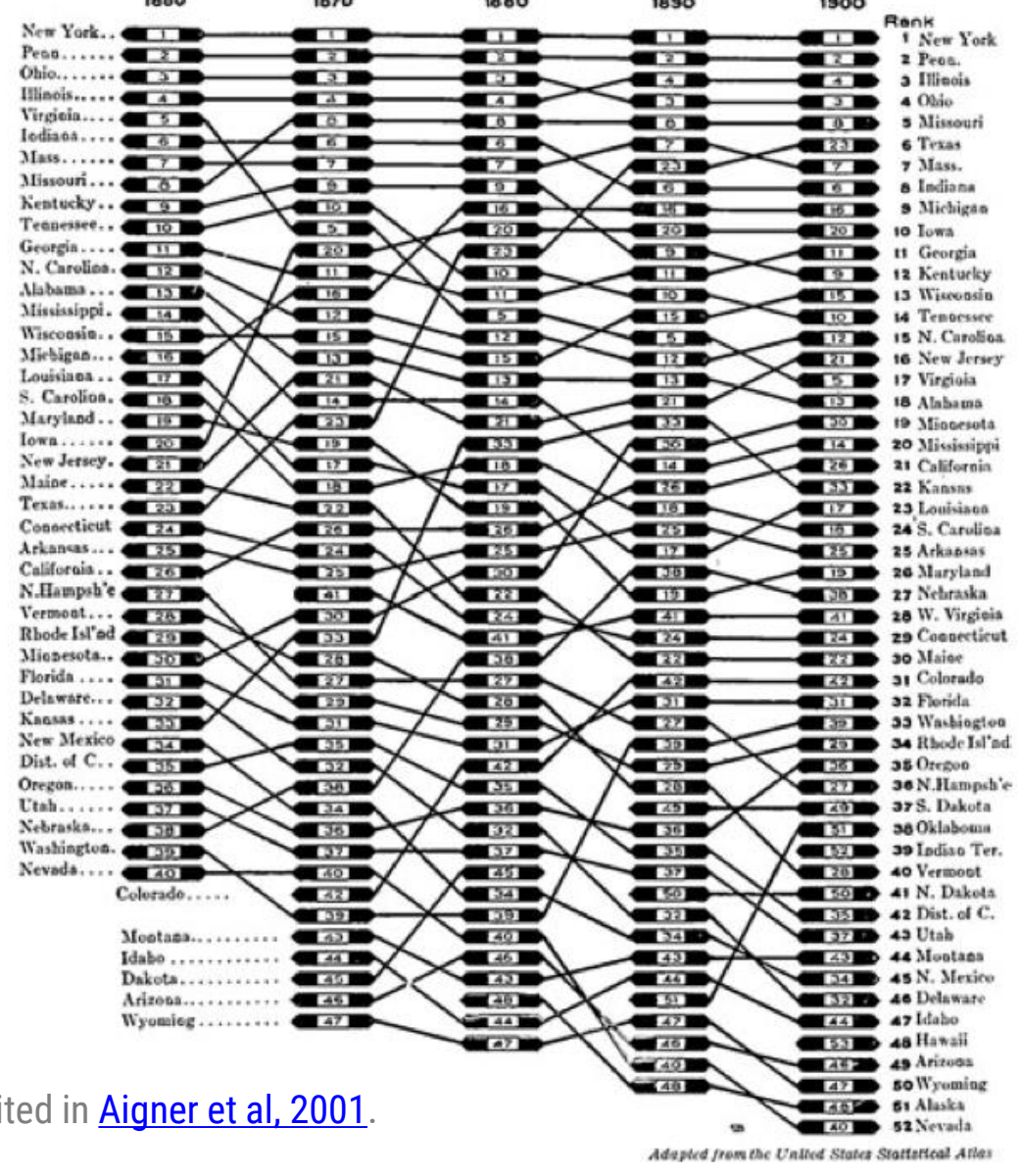
Wattenberg, 2002

OTHER DATA TYPES



OTHER

Rank Chart



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

OTHER

Rank Chart

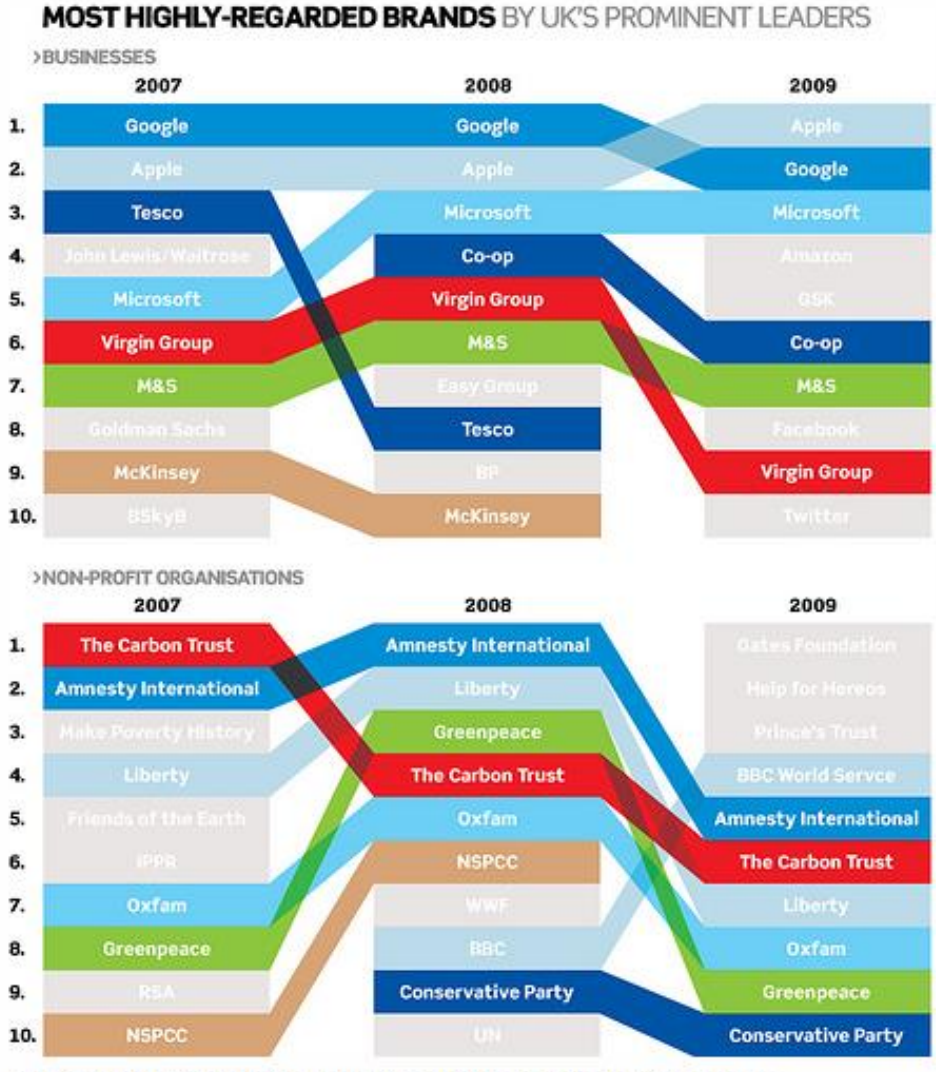
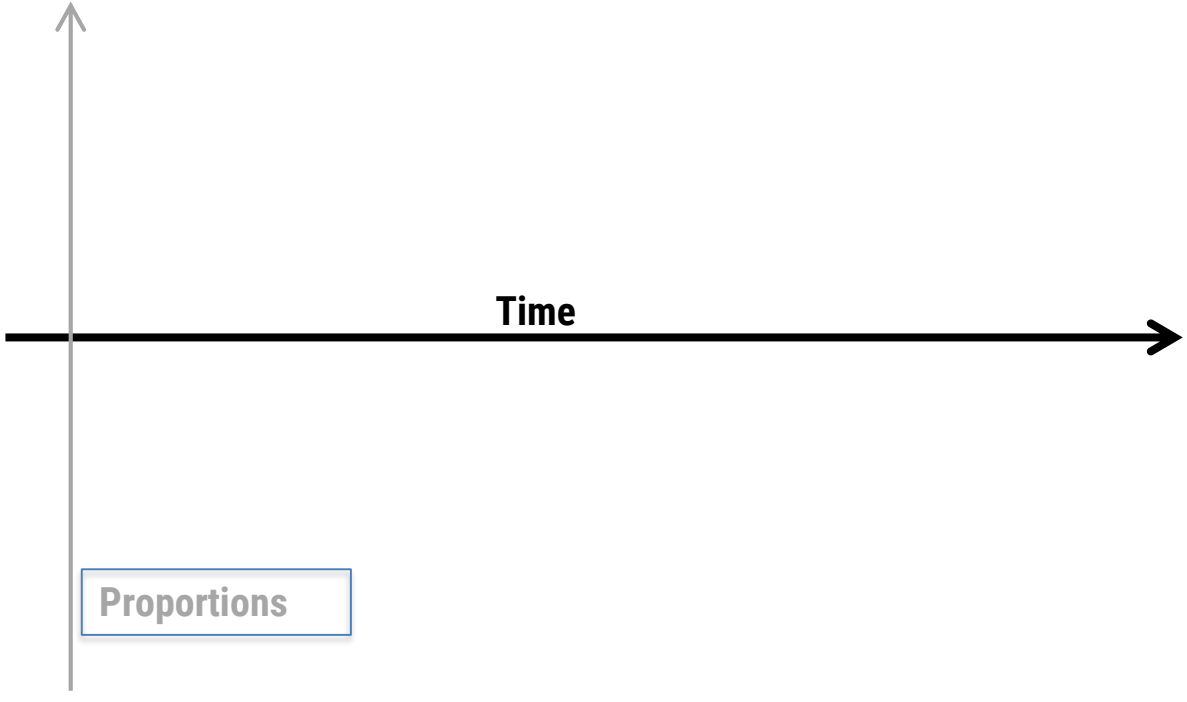


Chart showing the top ten brands' standing over the last three years

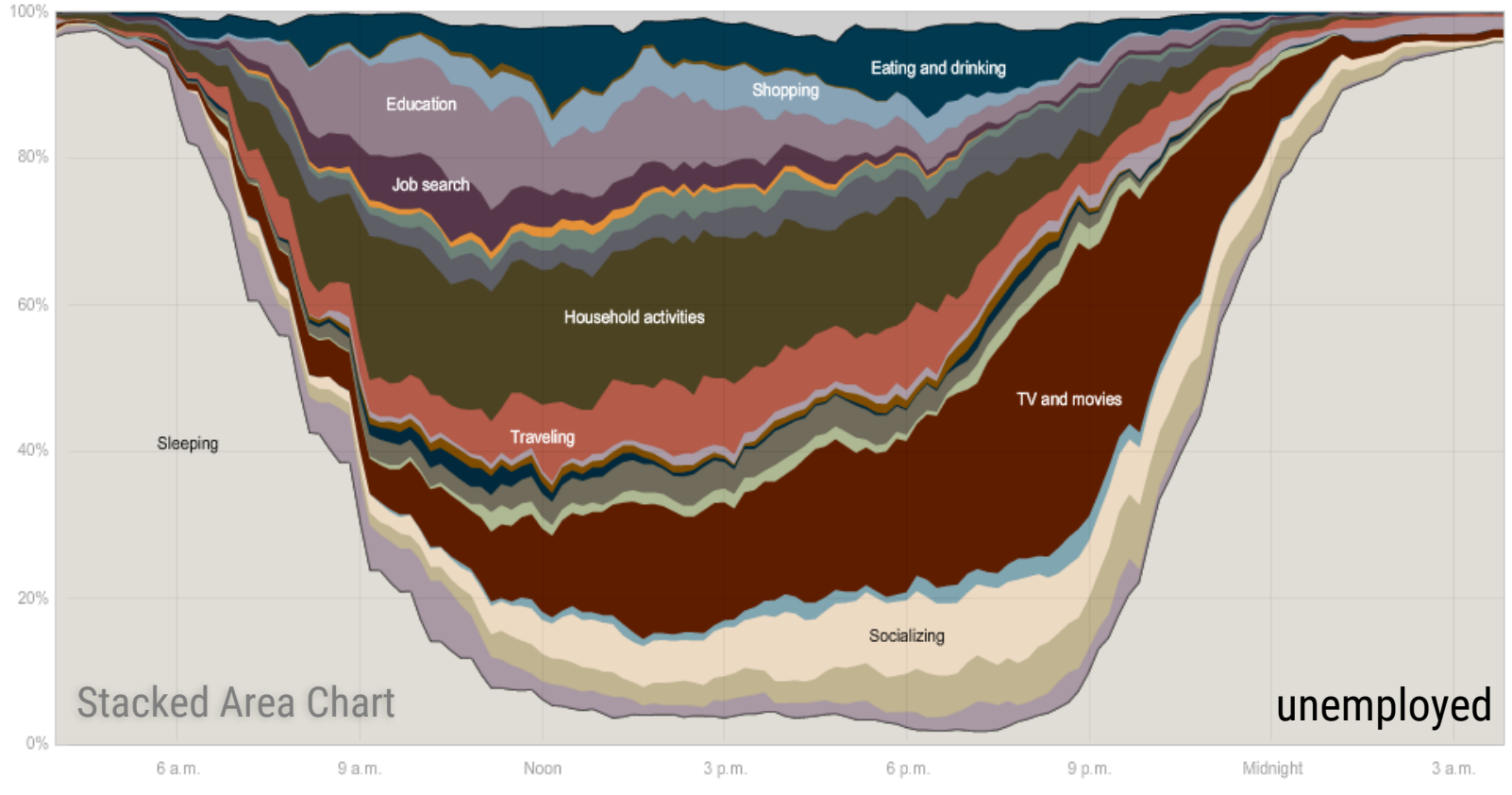
Hughes, 2009

OTHER DATA TYPES



OTHER CHARTS

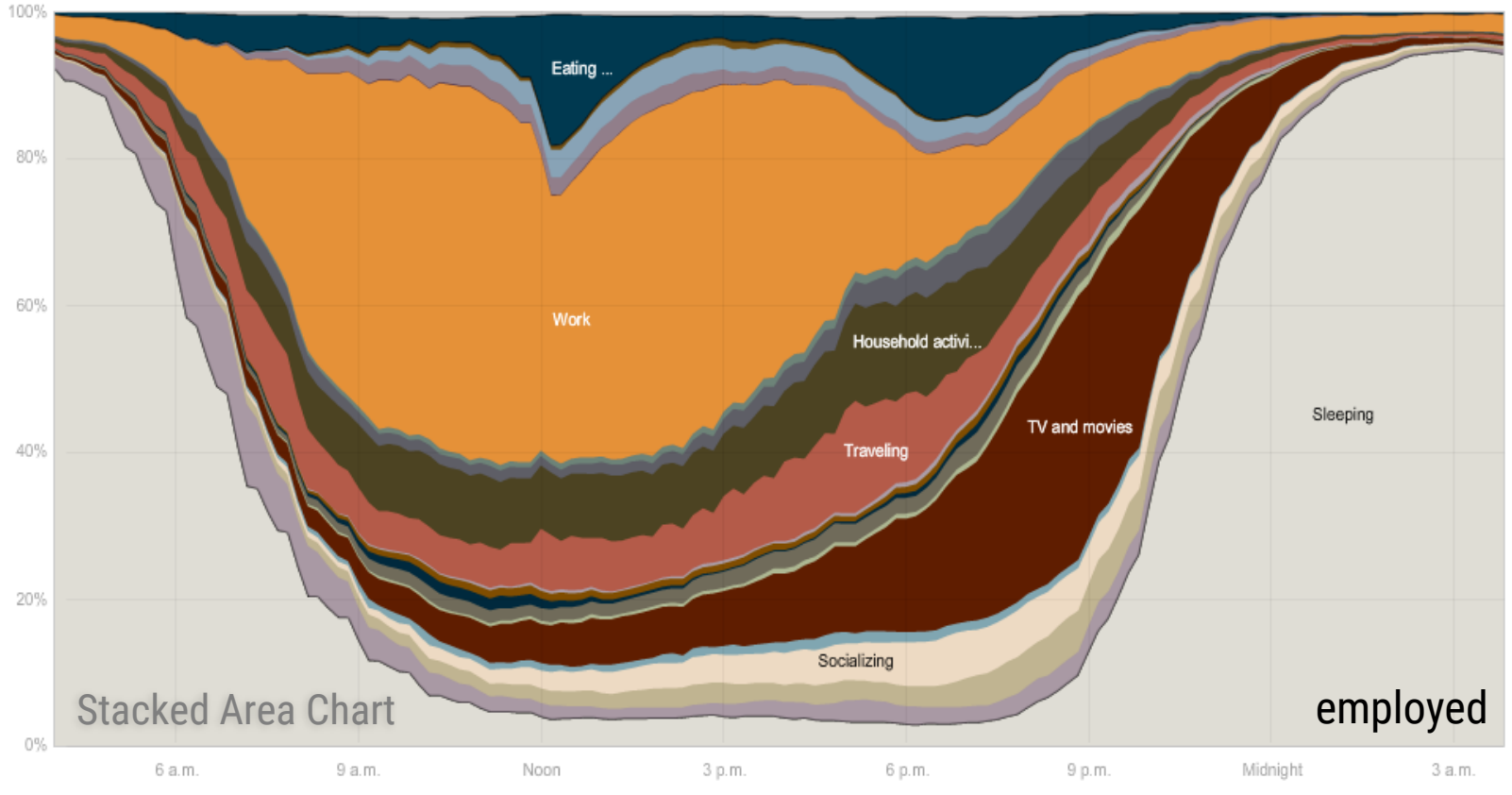
Stacked Graph
Area Chart
ThemeRiver
StreamGraph



New York Times, 2009

OTHER CHARTS

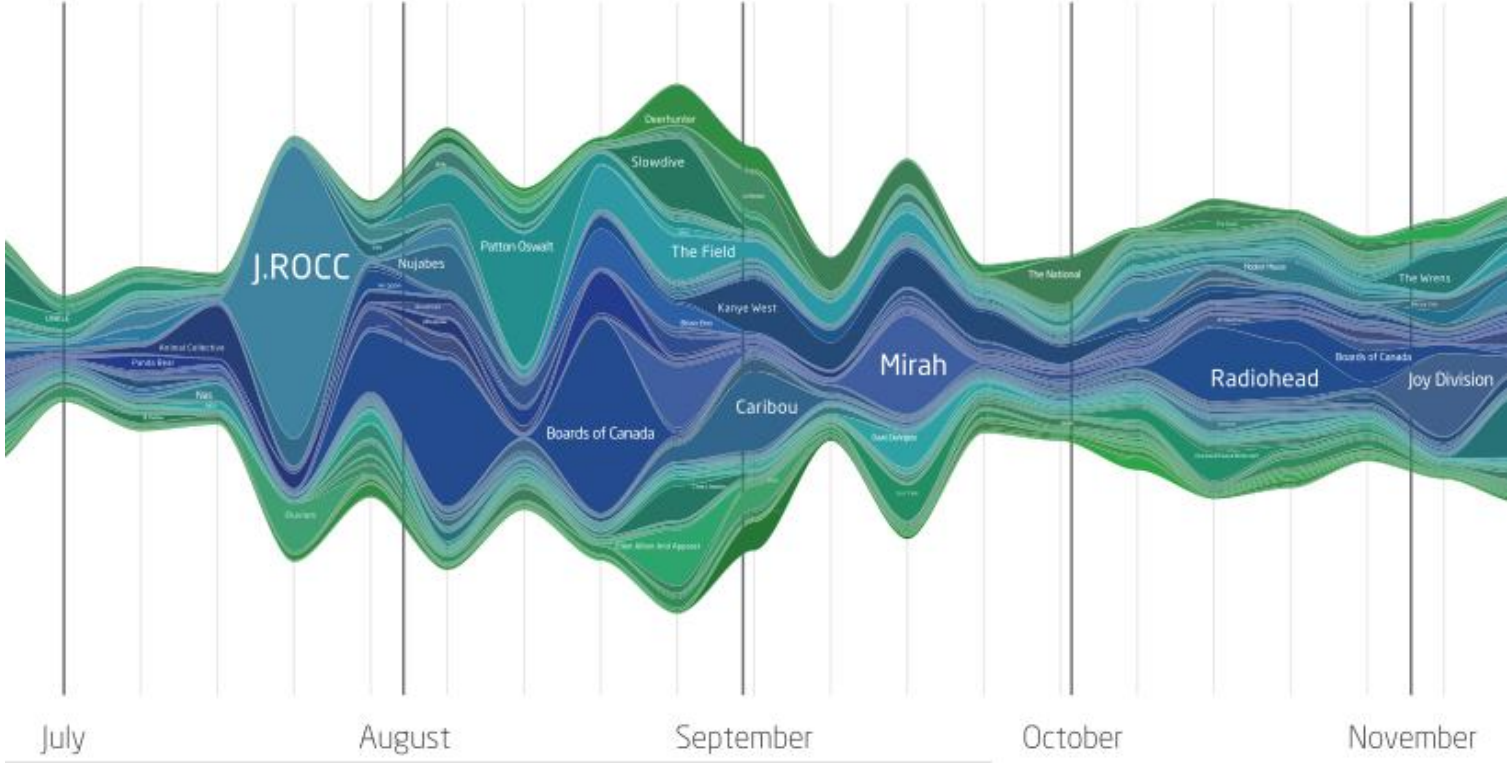
Stacked Graph
Area Chart
ThemeRiver
StreamGraph



New York Times, 2009

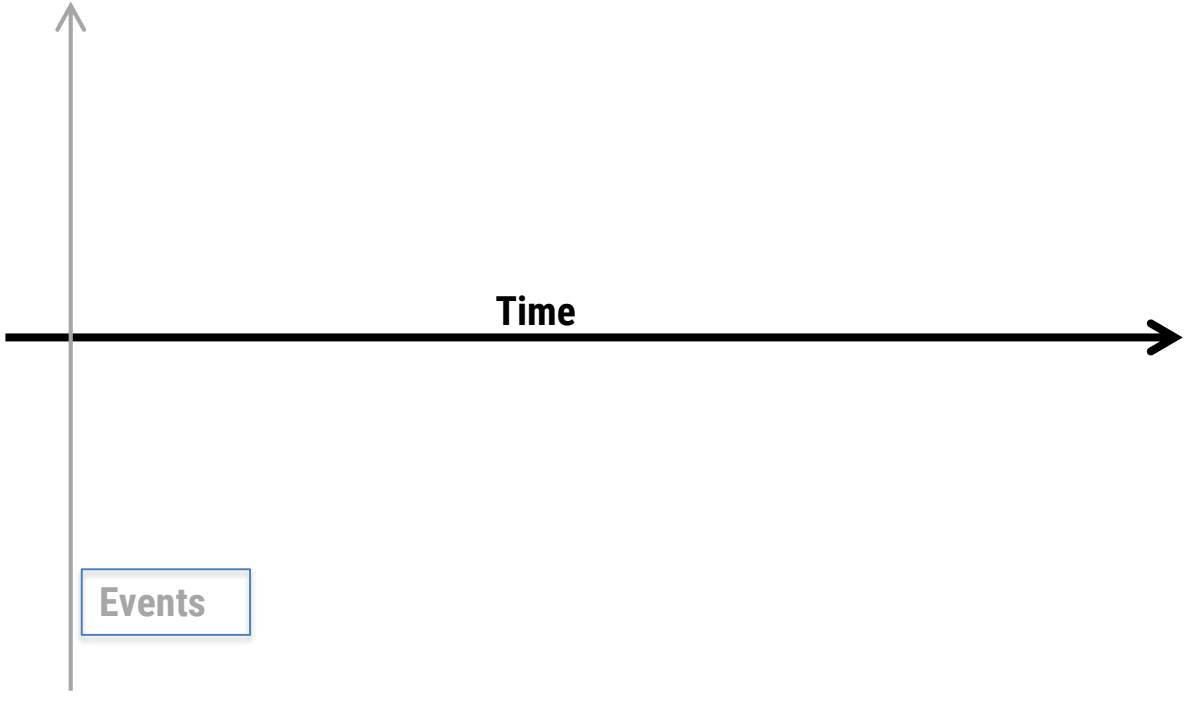
OTHER CHARTS

Stacked Area Chart



lastgraph.areacode.org

OTHER DATA TYPES

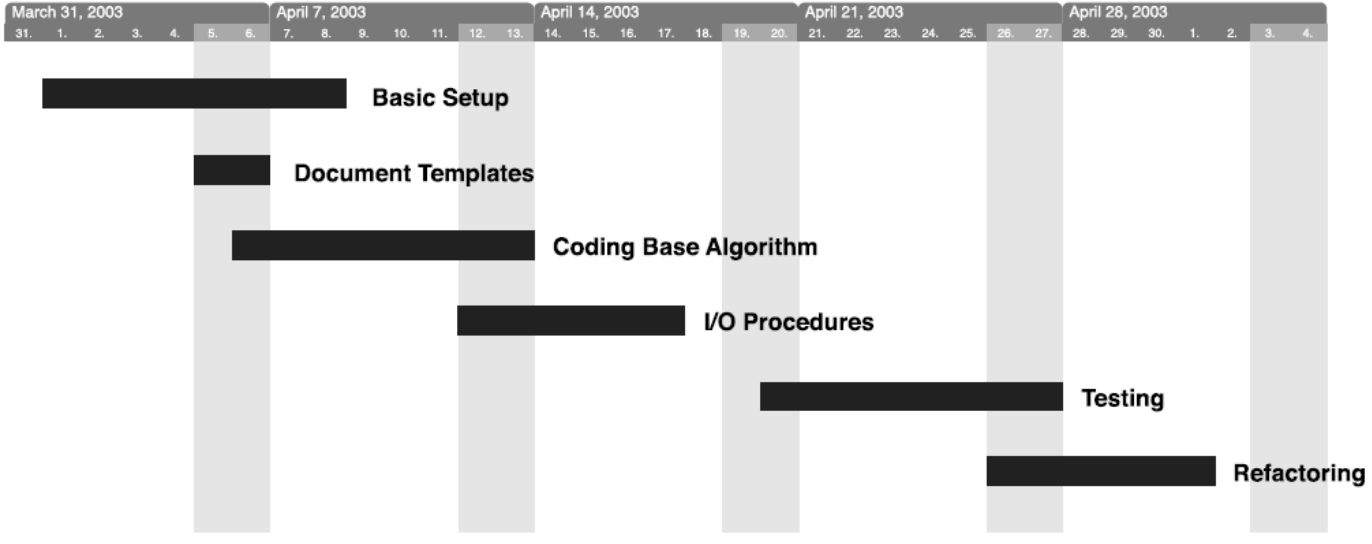


EVENTS

- 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

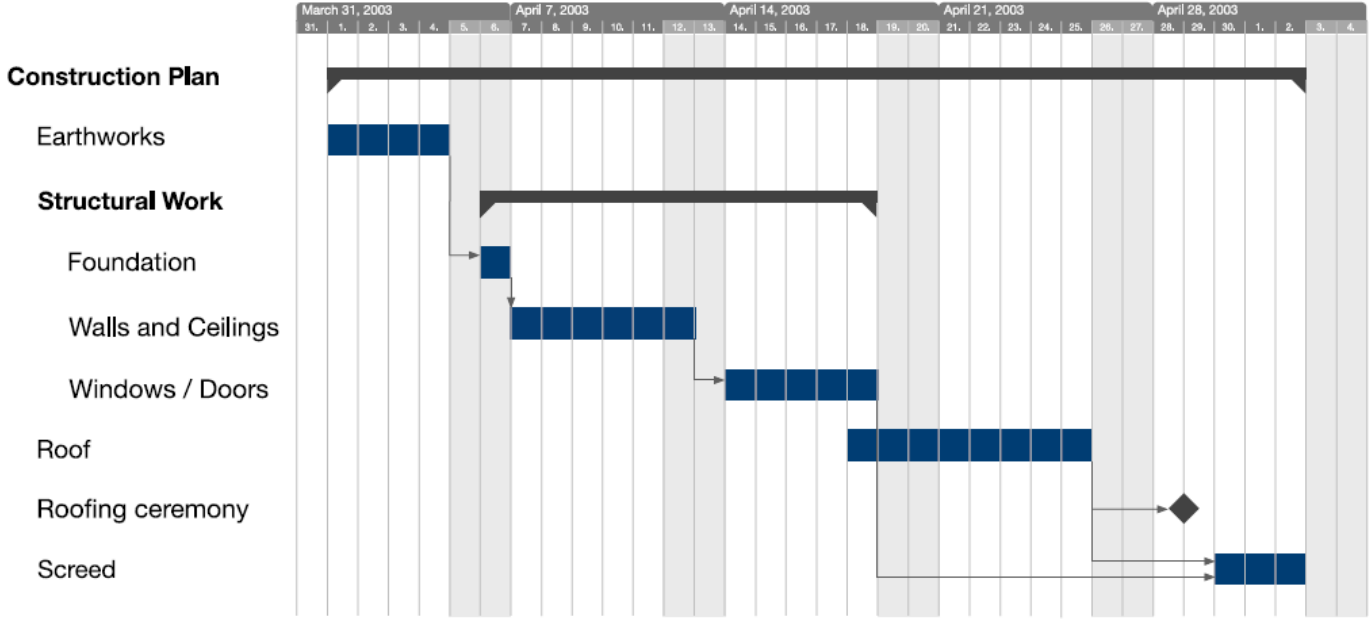
Project Timeline



Aigner et al, 2011

TIMELINES

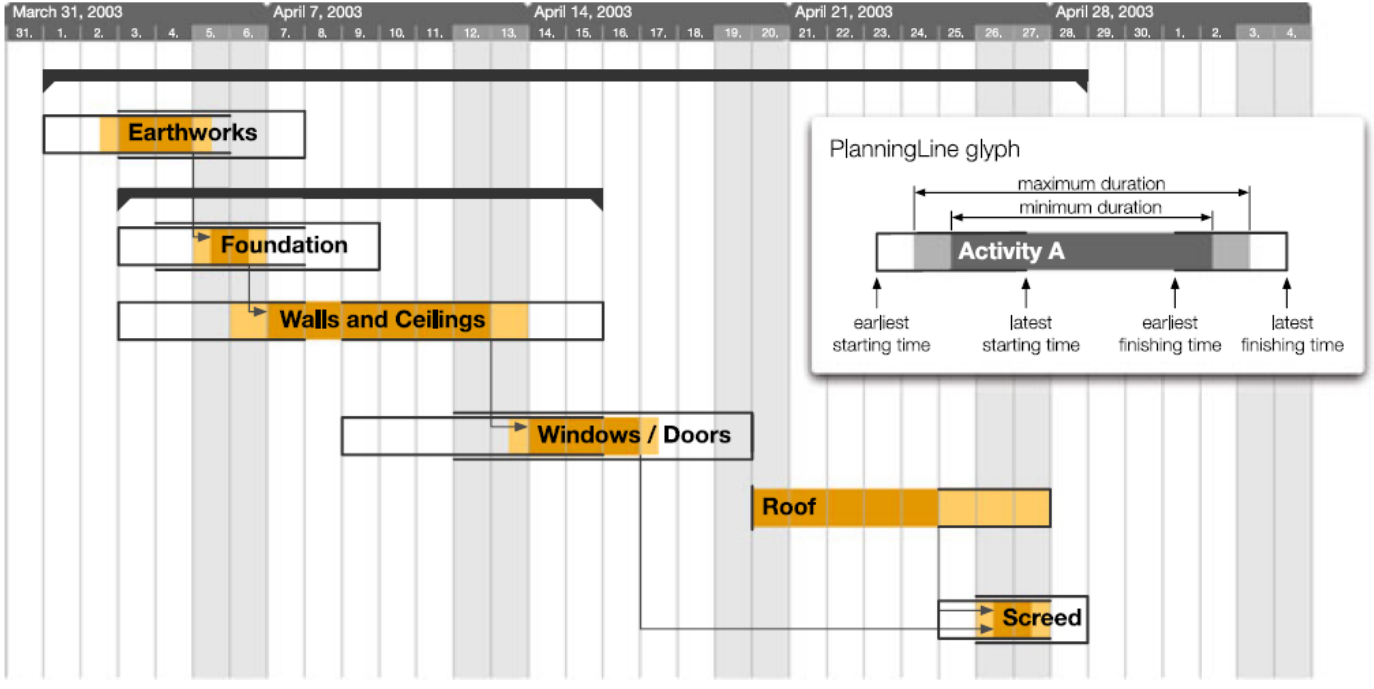
Gantt Chart



Gantt, 1913. Cited in [Aigner et al, 2011]

TIMELINES

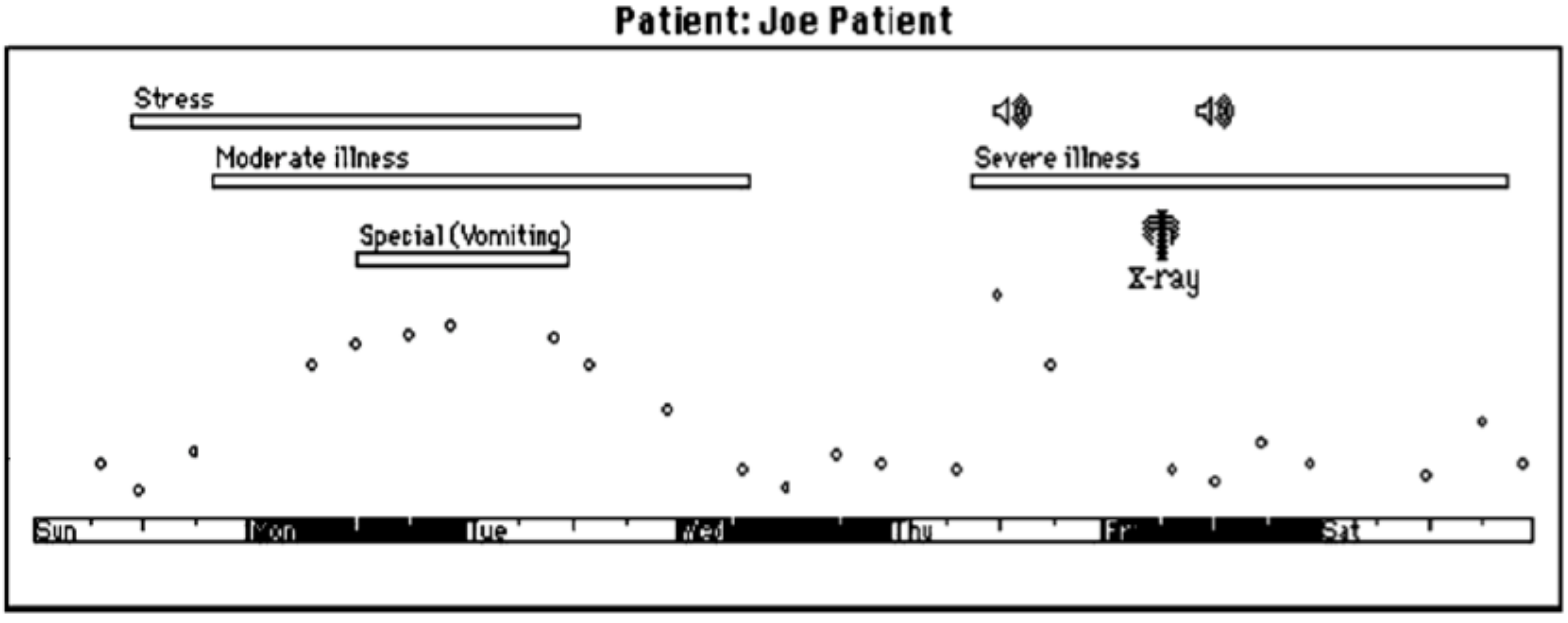
Planning Lines



Aigner et al, 2005

TIMELINES

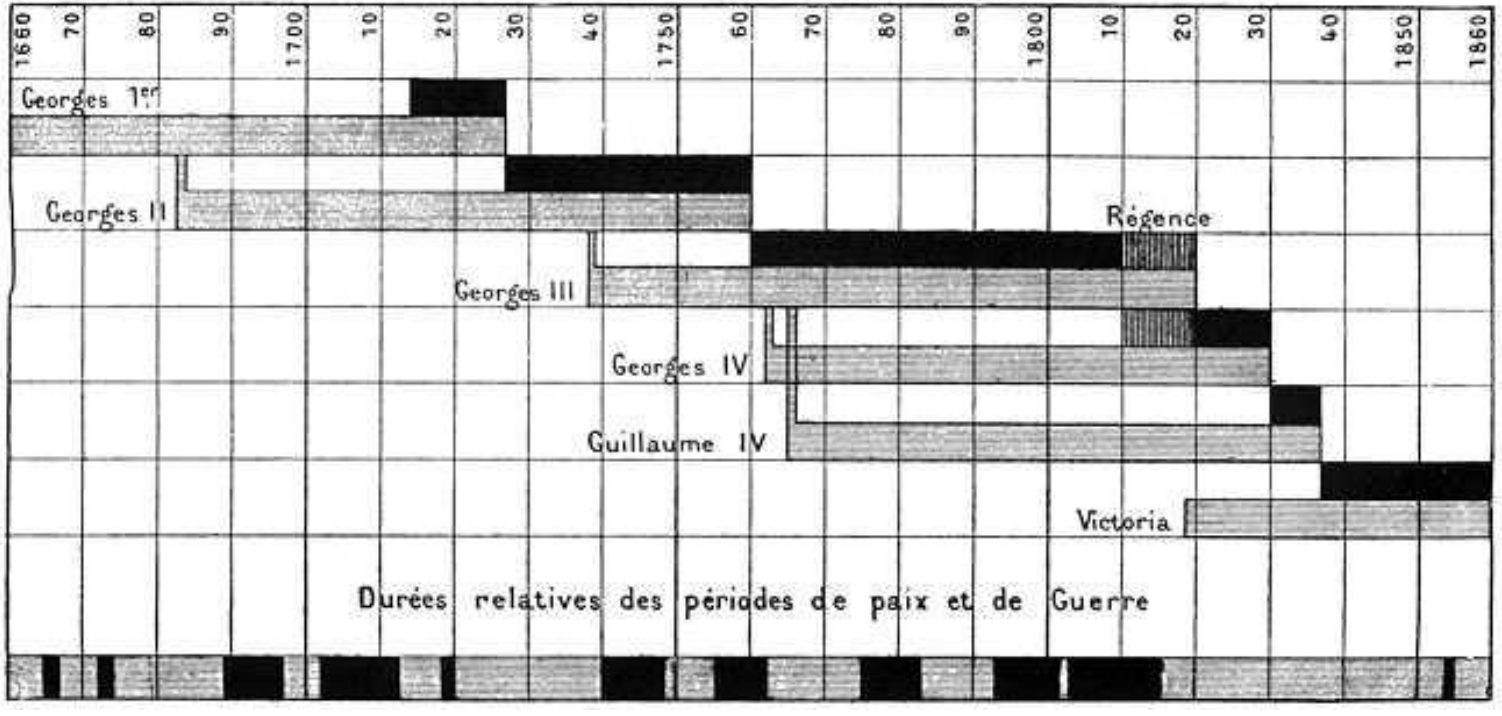
Patient Data



Aigner et al, 2011

TIMELINES

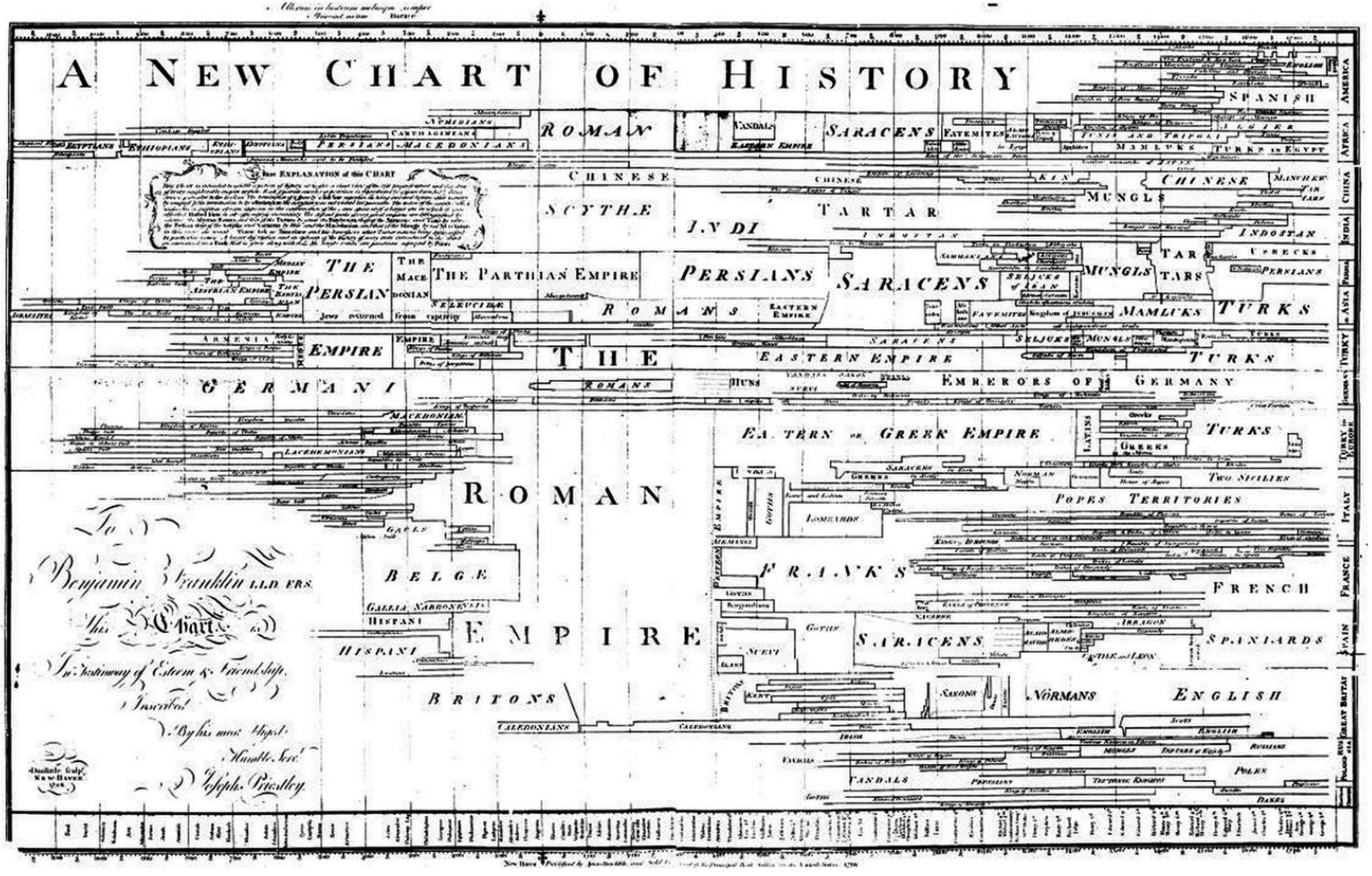
Reigns of English Monarchs

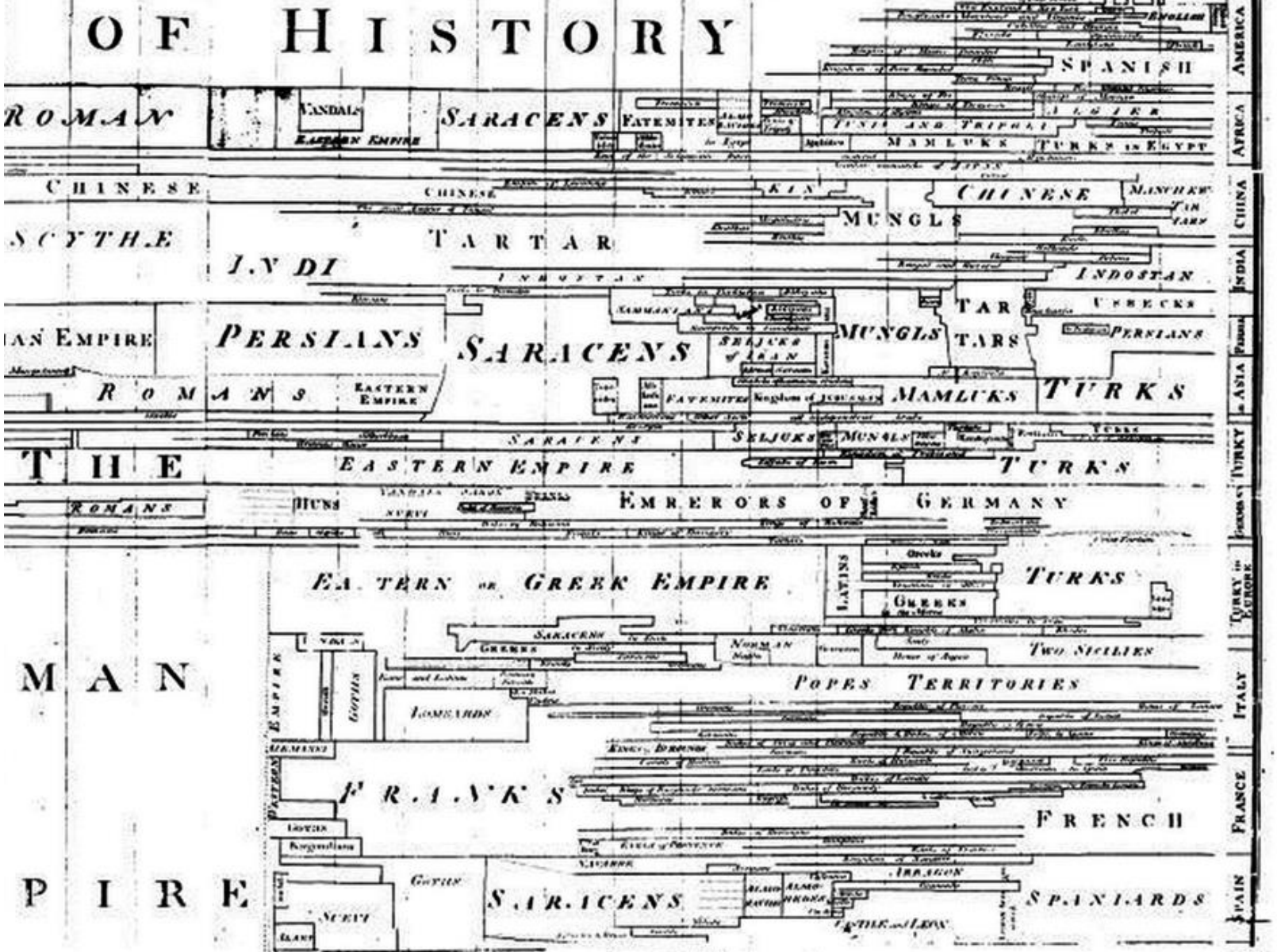


Étienne-Jules Marey, 1885 (source)

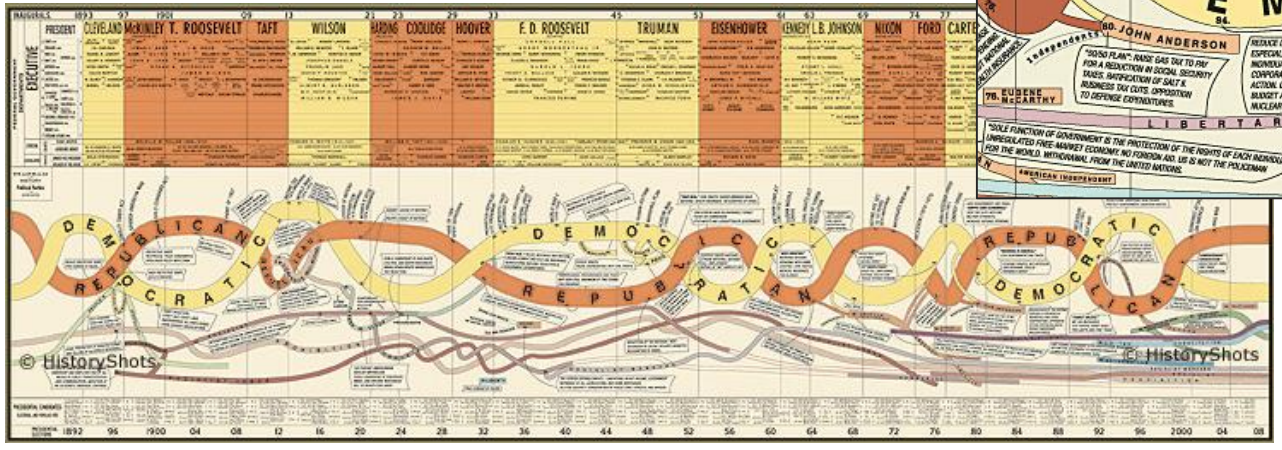
TIMELINES

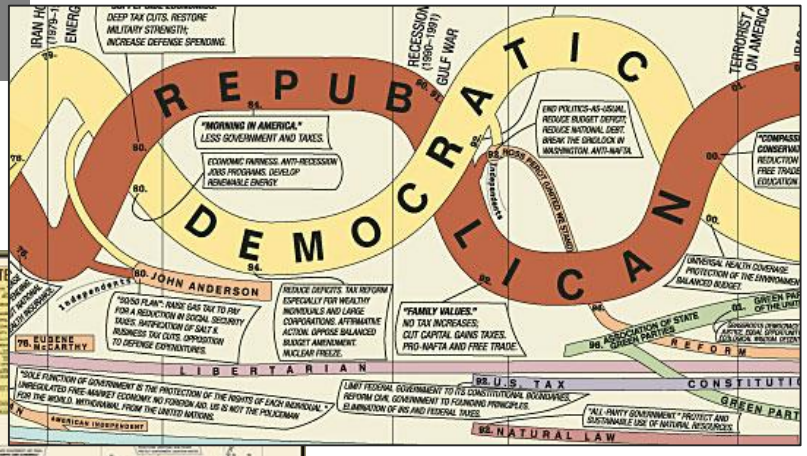
Joseph Priestley, 1769 (source)




OF HISTORY
ROMAN
VANDALS
EASTERN EMPIRE
SARACENS
FATEMITES
SPANISH
MAMLUKS
TURKS in EGYPT
CHINESE
CHINESE
KIN
MUNGLS
CHINESE
MANCHEW TAR TARY
SCYTHE
TARTAR
INDI
INDOSTAN
INDOSTAN
TAR
USBECKS
PERSIANS
SARACENS
MUNGLS
TARS
PERSIANS
ROMANS
EASTERN EMPIRE
FATEMITES
MAMLUKS
TURKS
SARACENS
SELJUKS
MUNGLS
TURKS
EASTERN EMPIRE
ROMANS
HUNS
EMPERORS OF GERMANY
EASTERN or GREEK EMPIRE
LATINS
GREEKS
TURKS
SARACENS
GREEKS
NORMAN
TWO SICILIES
POPES TERRITORIES
LOMBARDS
FRANKS
FRENCH
GOTHS
SUEVI
SARACENS
ARRAGON
SPANIARDS
AMERICA
AFRICA
CHINA
INDIA
PERSIA
ASIA
TURKY
TURKY in EUROPE
ITALY
FRANCE
SPAIN

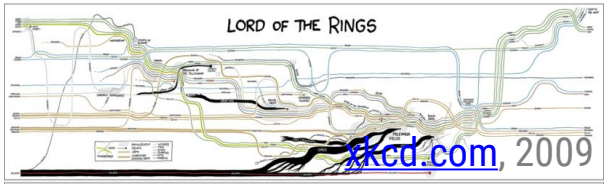
TIMELINES





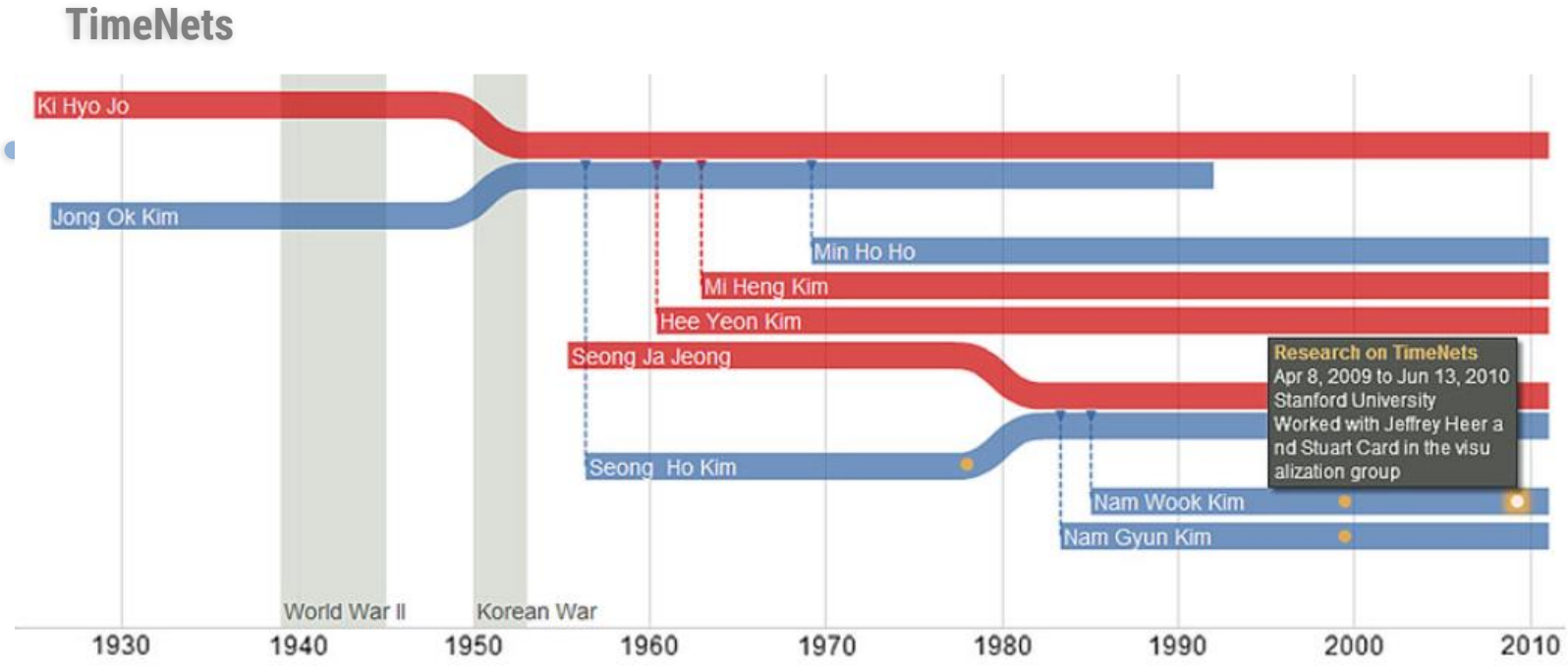
historyshots.com, 2005

TIMELINES



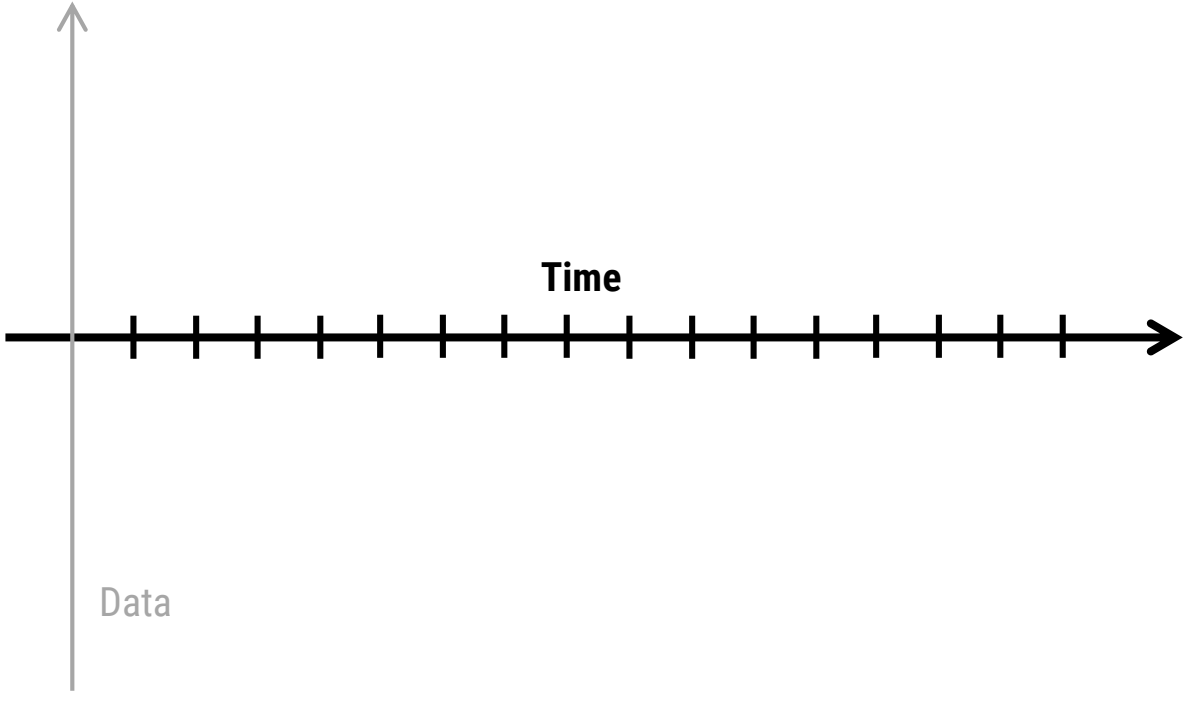
xkcd.com, 2009

TIMELINES

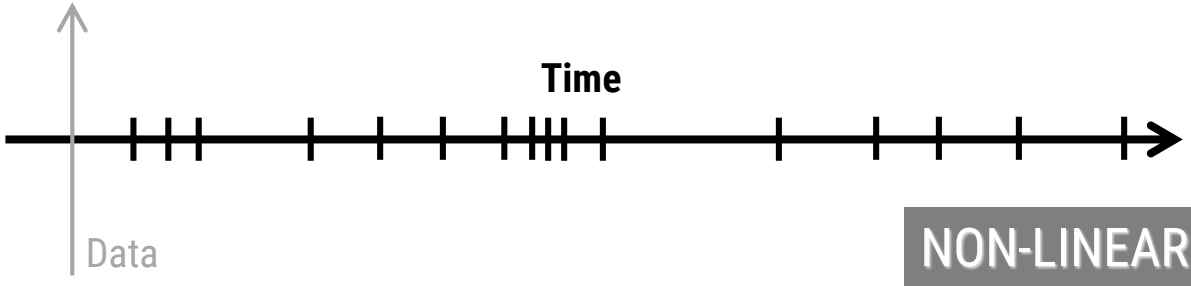


Kim et al, 2010

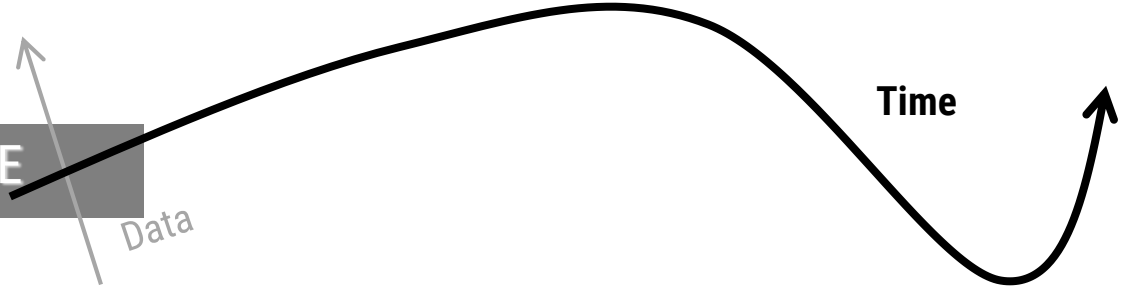
MAPPING TIME TO AN AXIS



NON-LINEAR TIME AXES



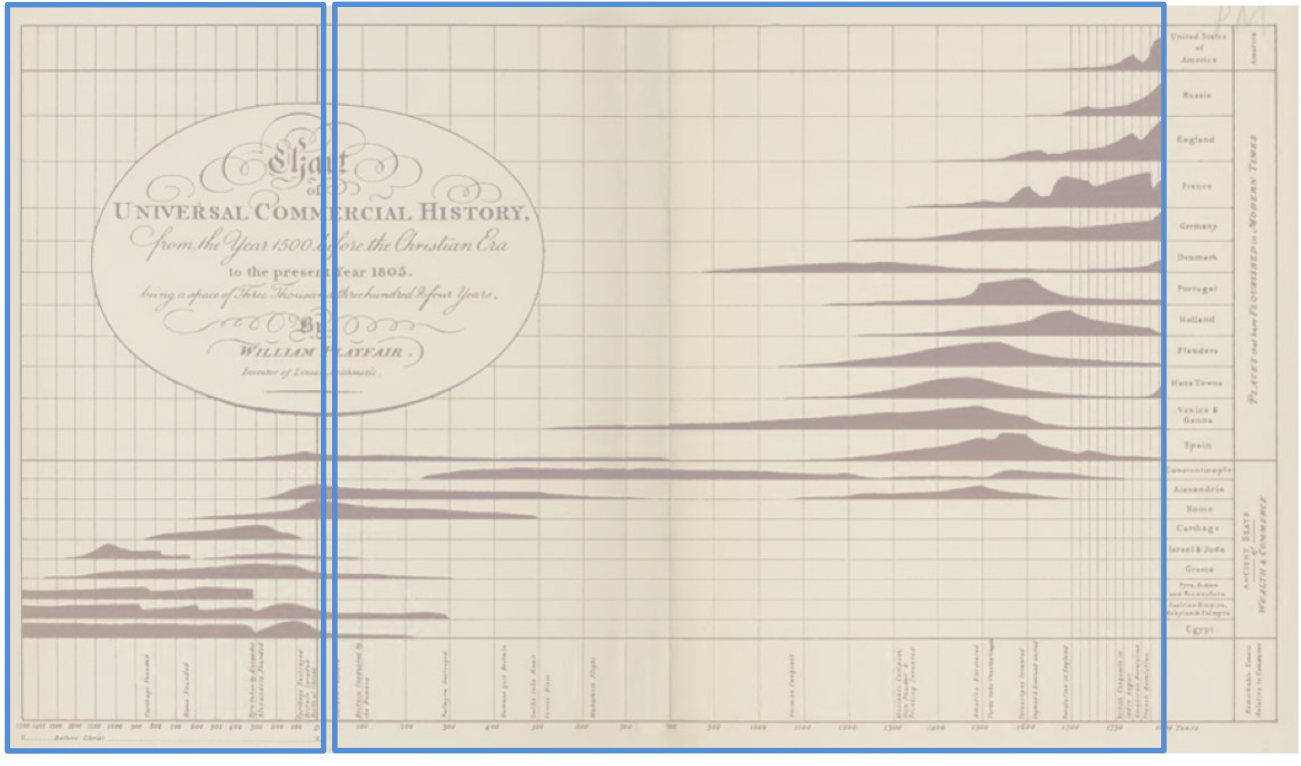
NON-LINEAR SCALE



NON-LINEAR SHAPE

NON-LINEAR TIME AXES

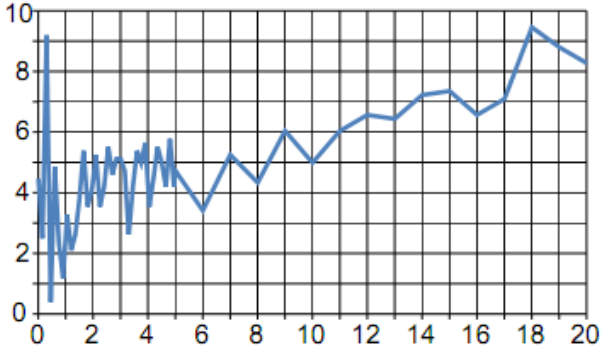
Dual-Scale Charts

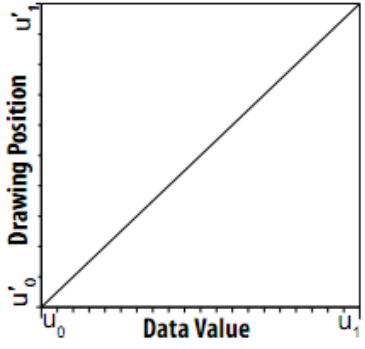


William Playfair, 1805. Cited in [Aigner et al, 2011](#).

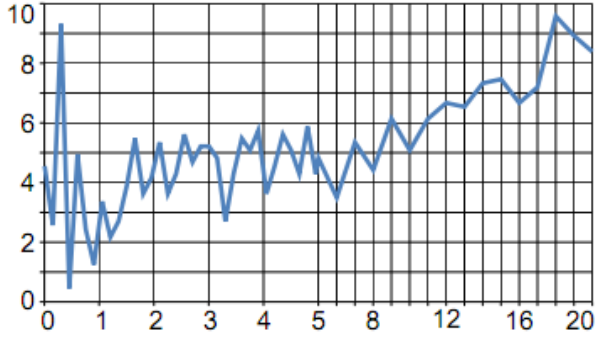
NON-LINEAR TIME AXES

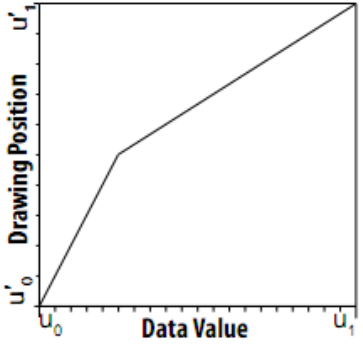
Dual-Scale Charts





Regular Chart



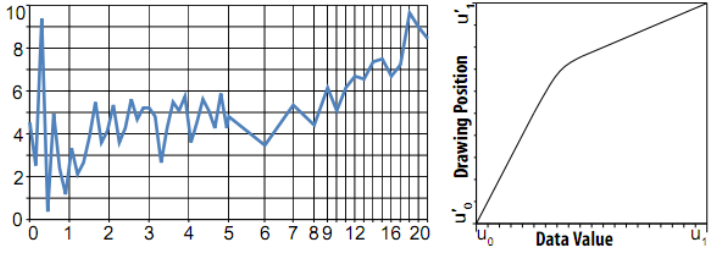


Bifocal Chart

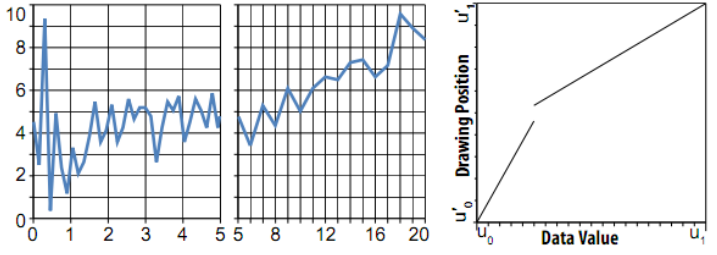
[Isenberg et al, 2011]

NON-LINEAR TIME AXES

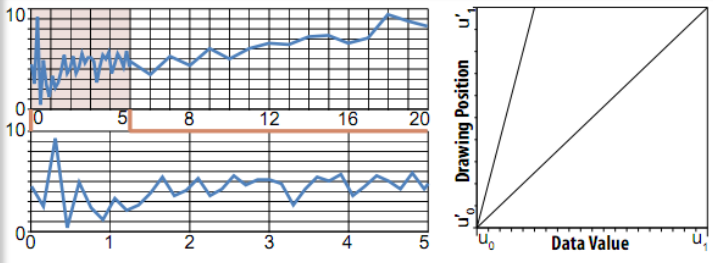
Other Types of Dual-Scale Charts



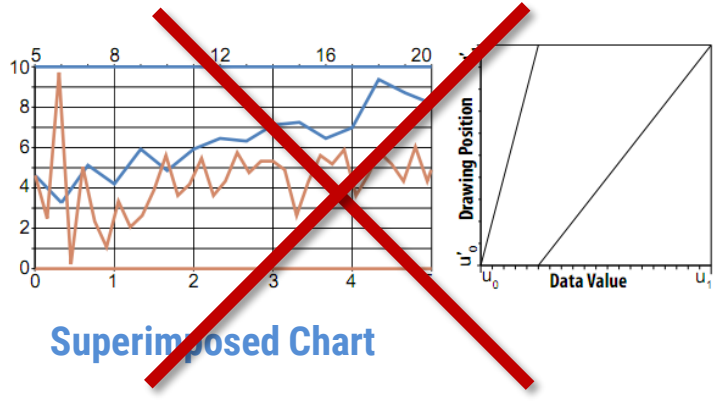
Lens Chart



Broken Chart



Cut-Out Chart

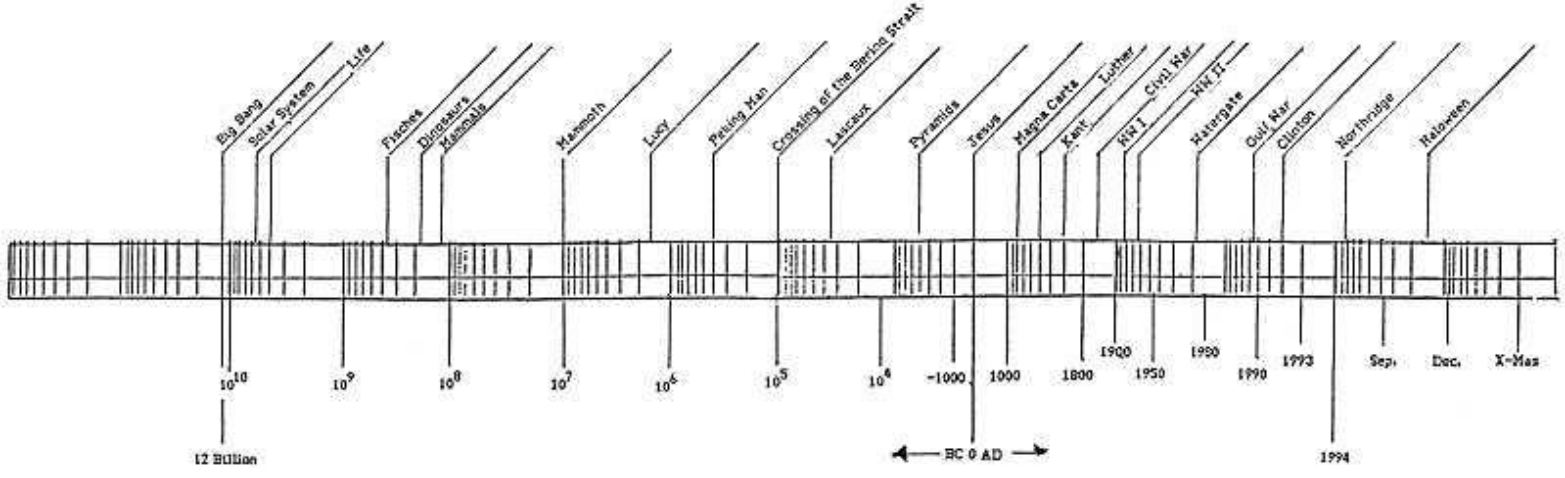


Superimposed Chart

[Isenberg et al, 2011]

NON-LINEAR TIME AXES

Logarithmic scale



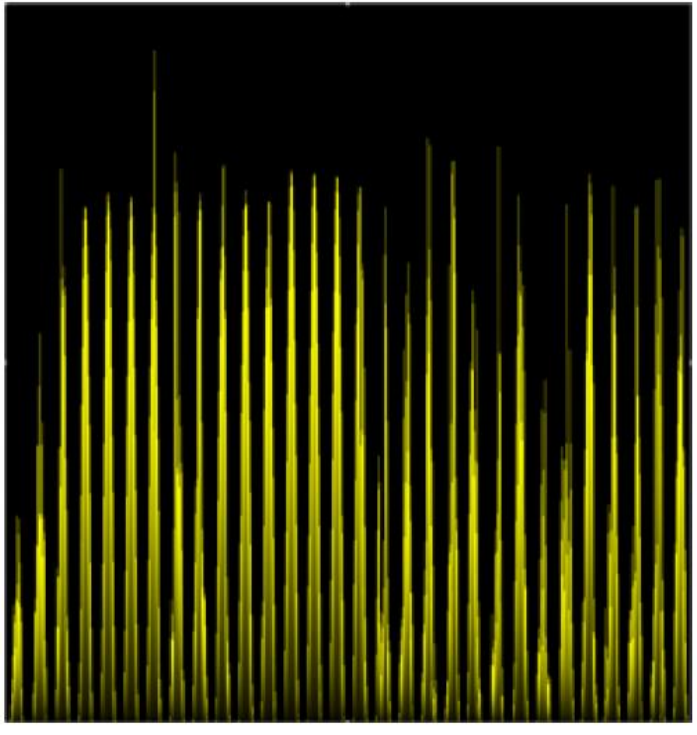
Heinz von Foerster, 1994 (source)

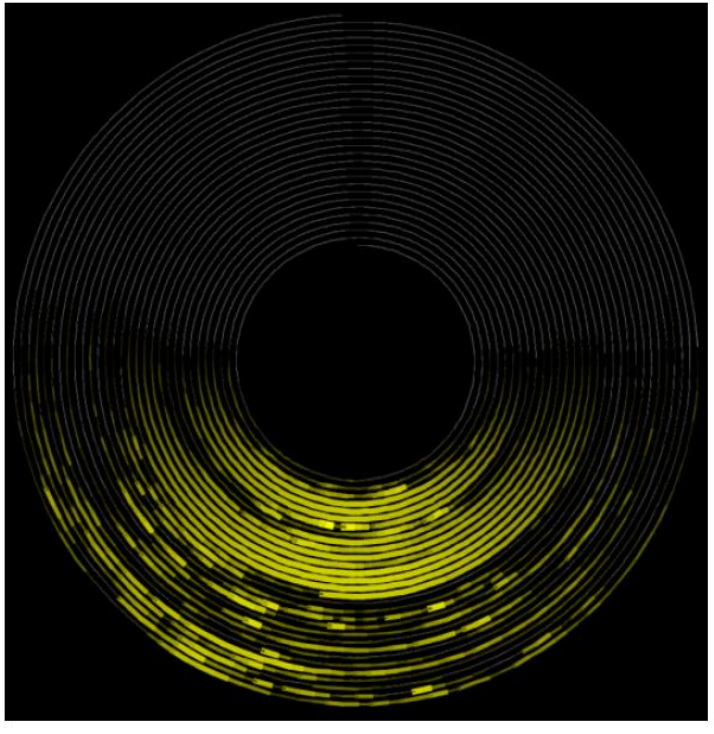
NON-LINEAR

Curved

[Megan Jaegerman, 1997]

NON-LINEAR TIME AXES

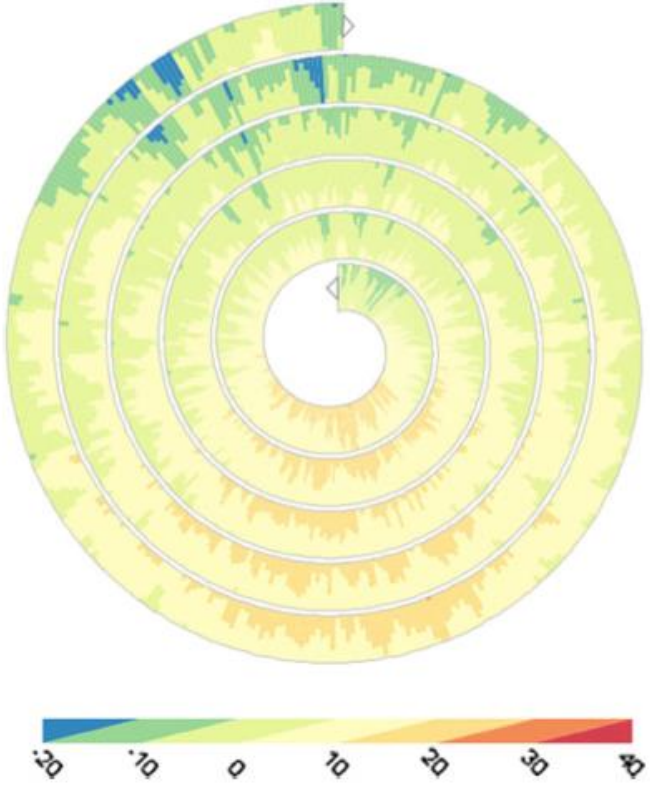




Webel et al, 2001

NON-LINEAR TIME AXES

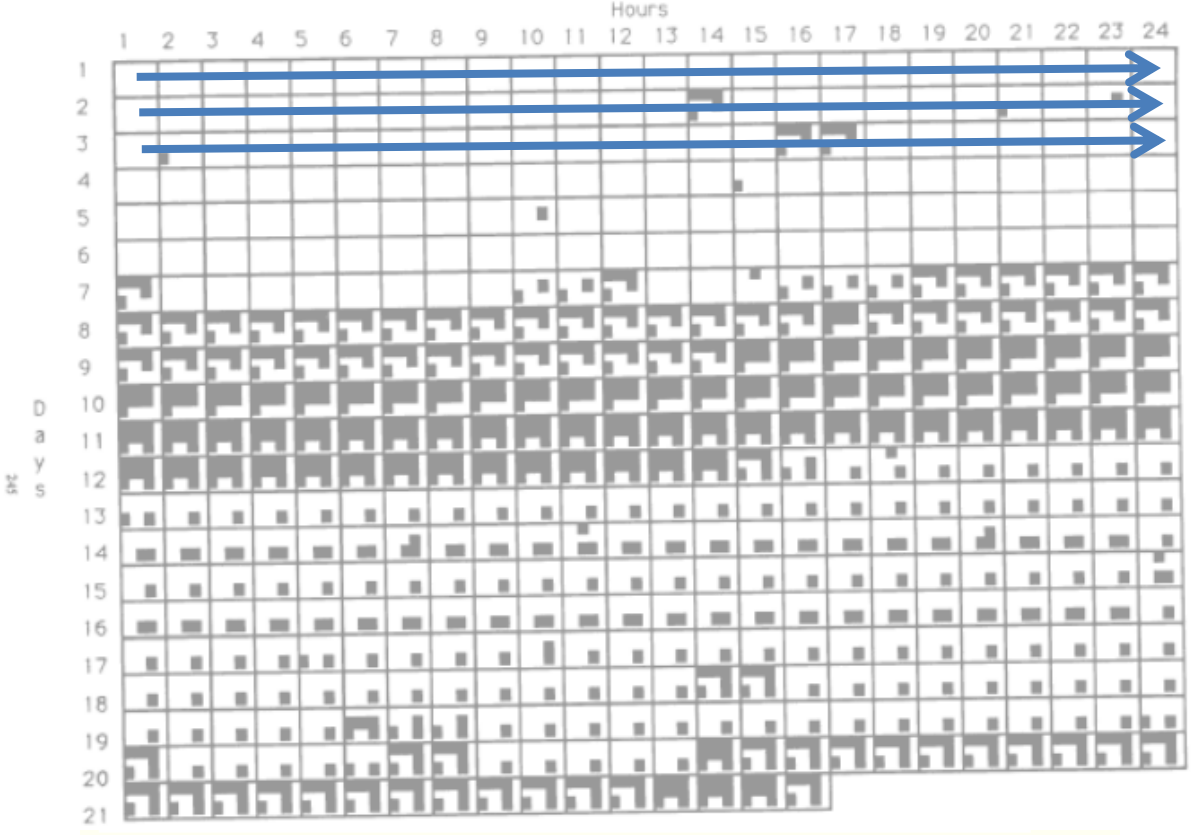
Spiral



Aigner et al, 2011

NON-LINEAR TIME AXES

Grid



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

Beddow, 1990

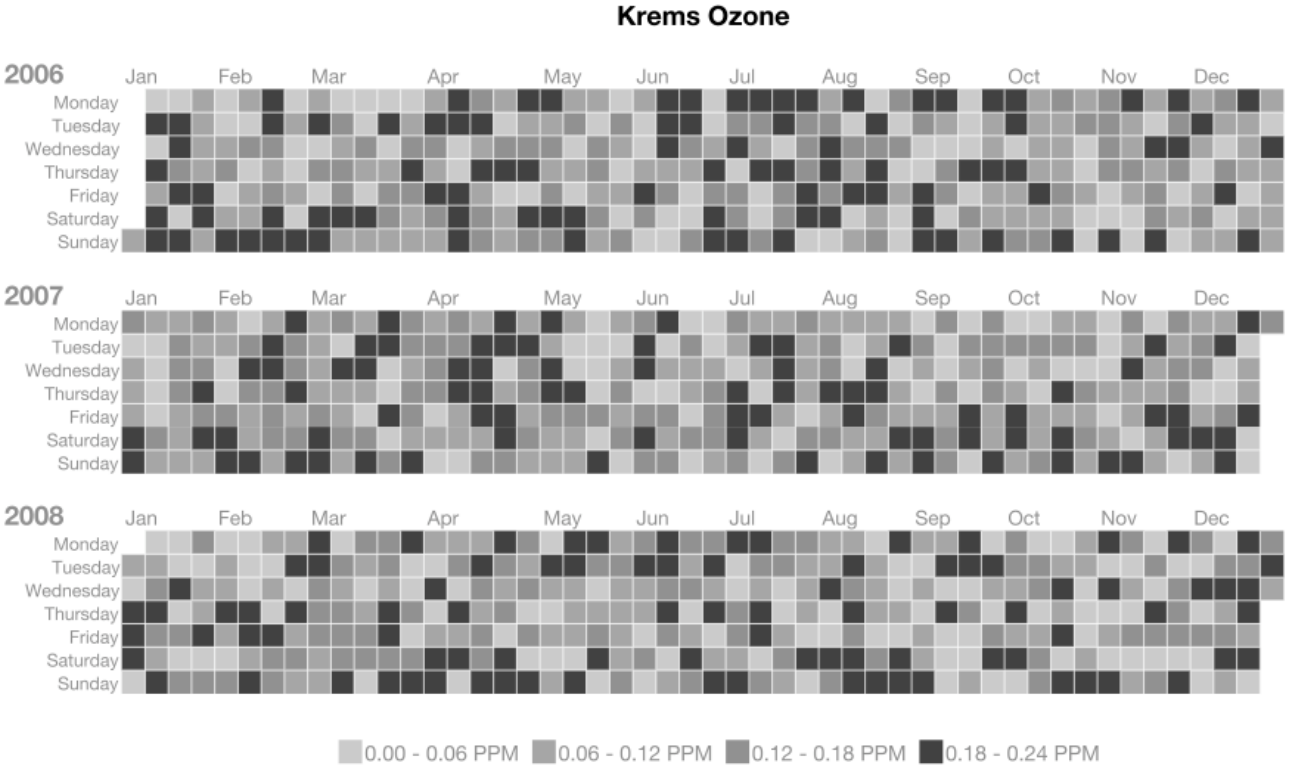
NON-LINEAR TIME AXES

Grid - Calendar

[Tom Haynes, 2010]

NON-LINEAR TIME AXES

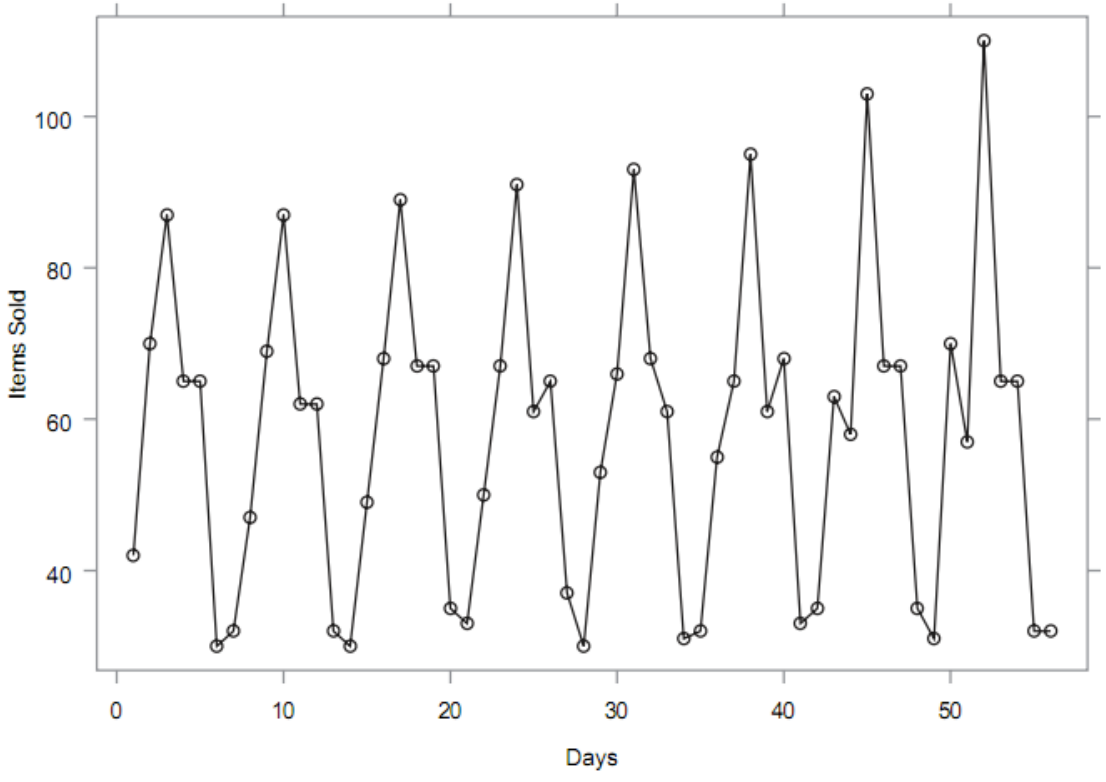
Grid - Tile Map



Mintz et al, 1997. Cited in [Aigner et al, 2011](#).

NON-LINEAR TIME AXES

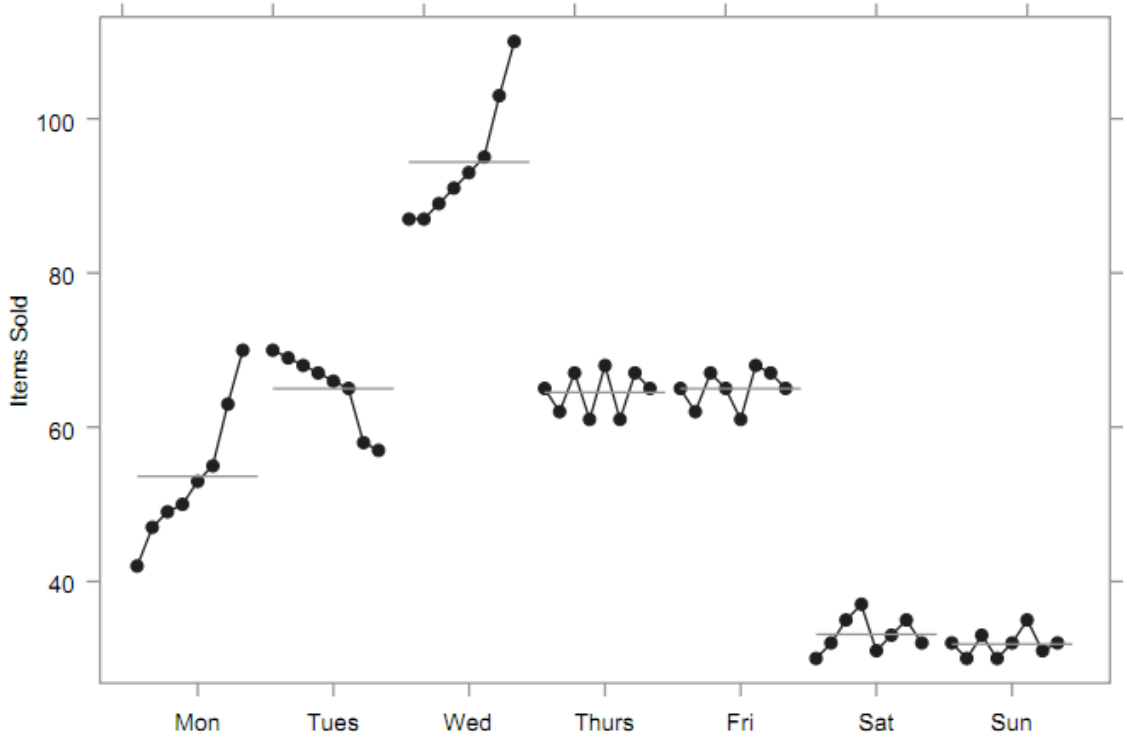
Cycle Plots



Cleveland et al, 1978

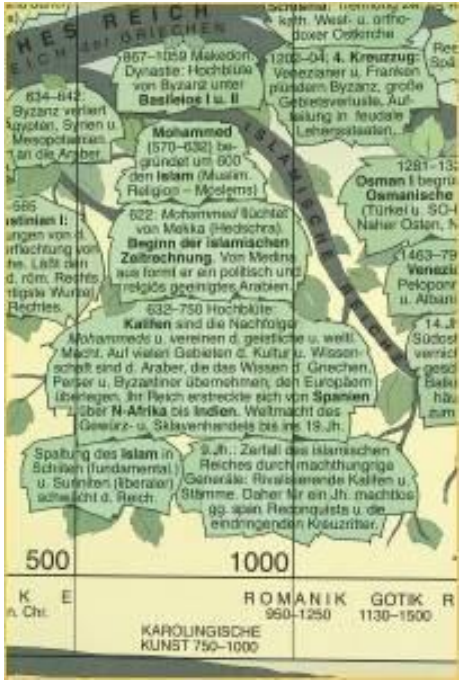
NON-LINEAR TIME AXES

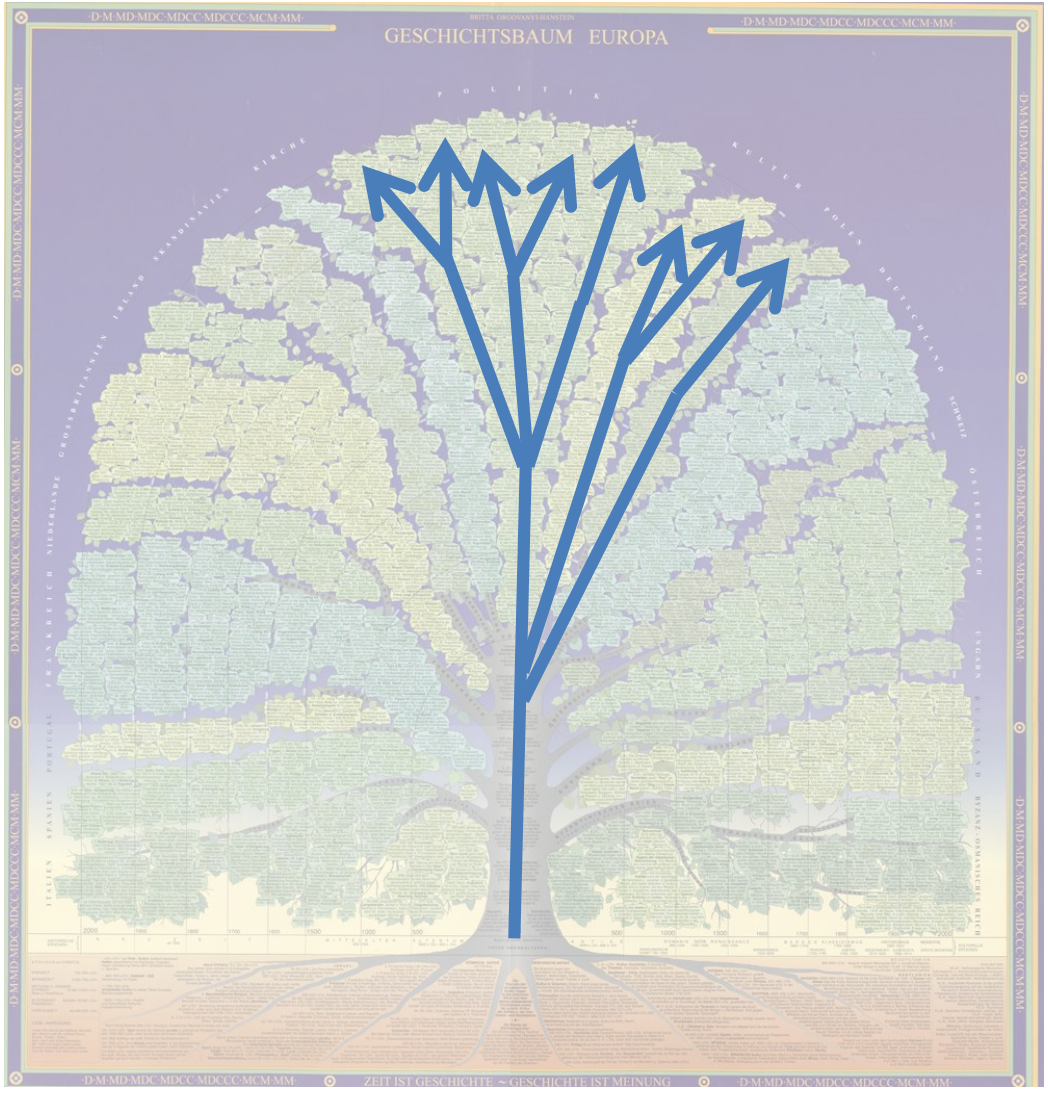
Cycle Plots



Cleveland et al, 1978

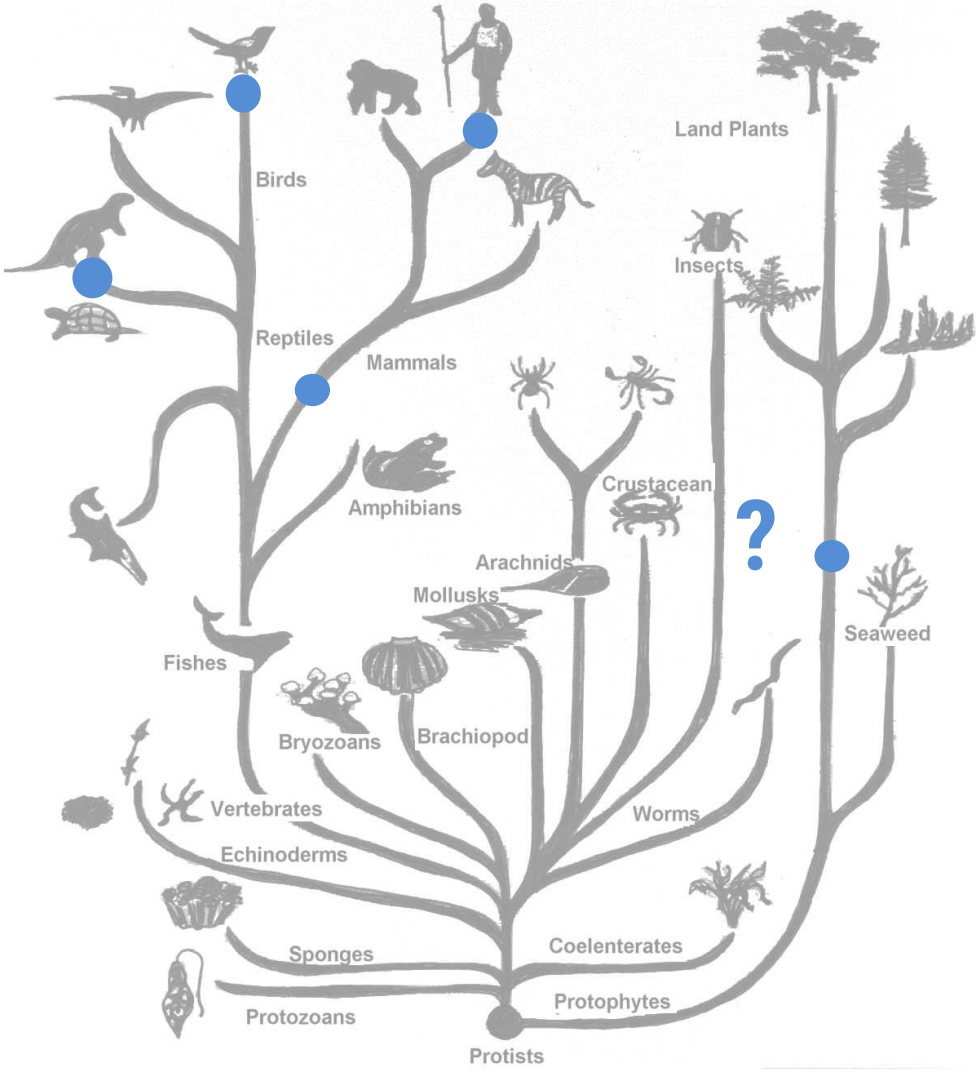
Trees





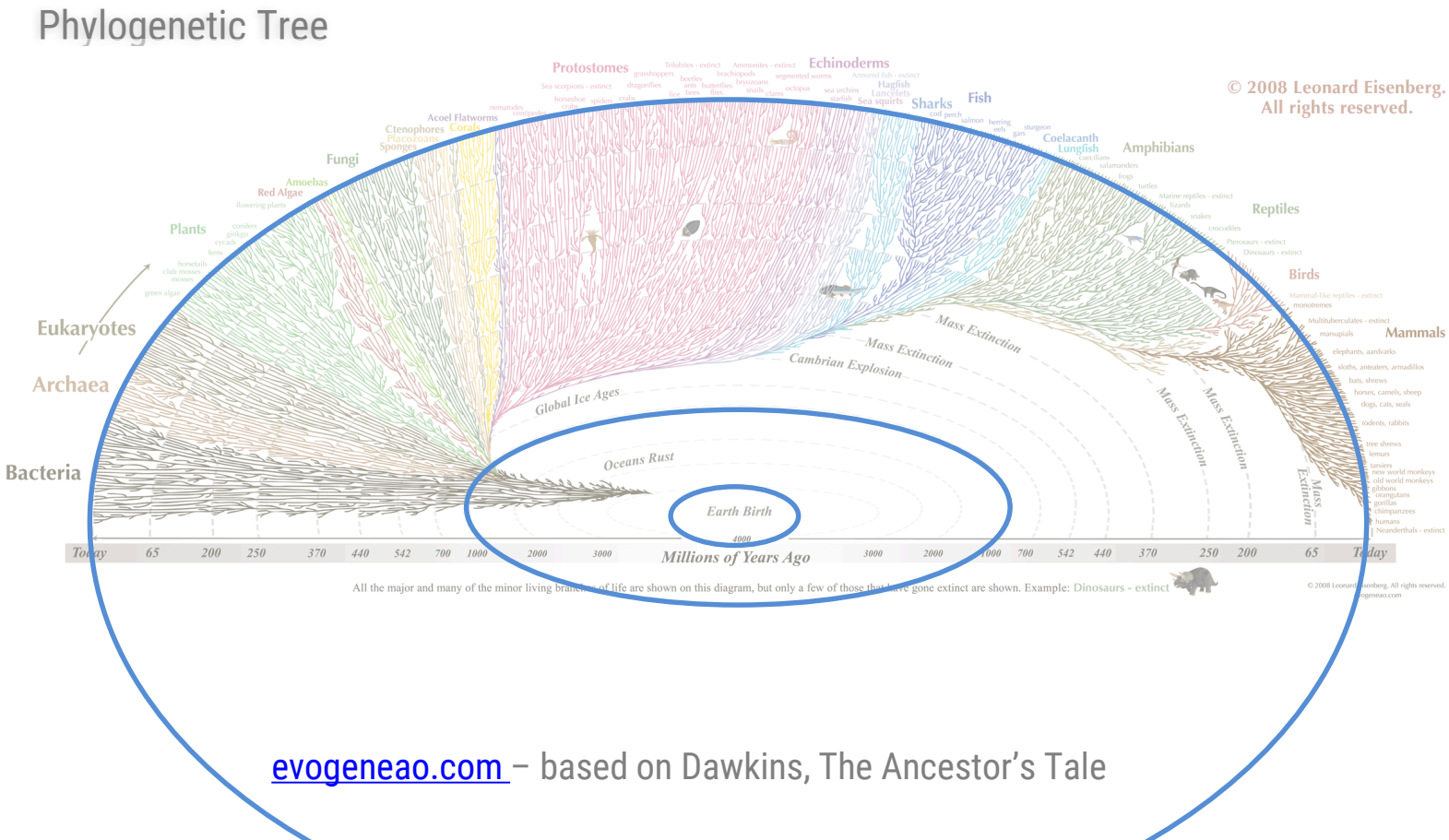
geschichtsbaum.de

Phylogenetic Tree



anonymous

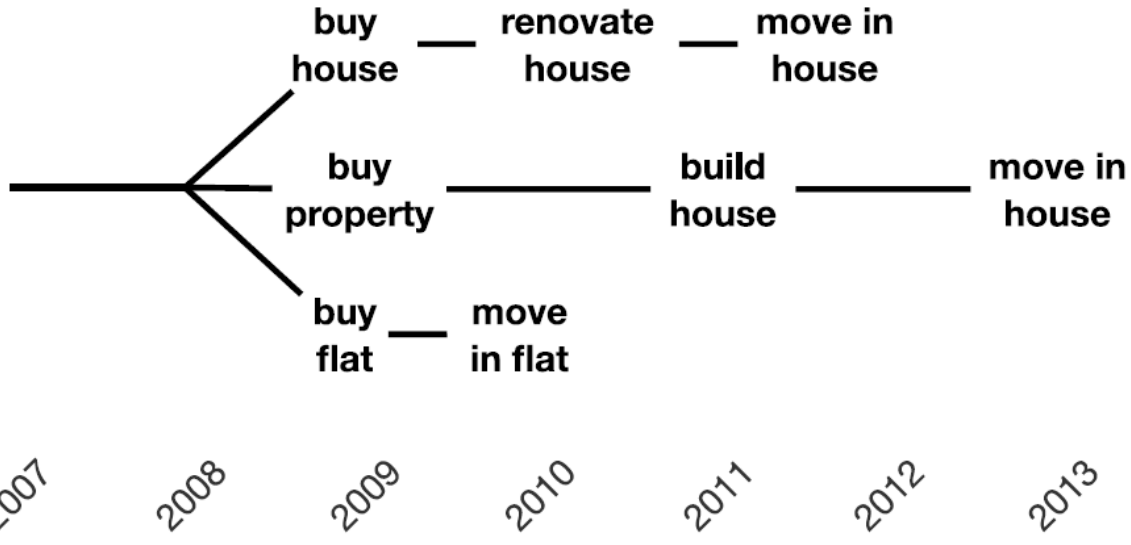
NON-LINEAR TIME AXES



evogeneao.com – based on Dawkins, The Ancestor's Tale

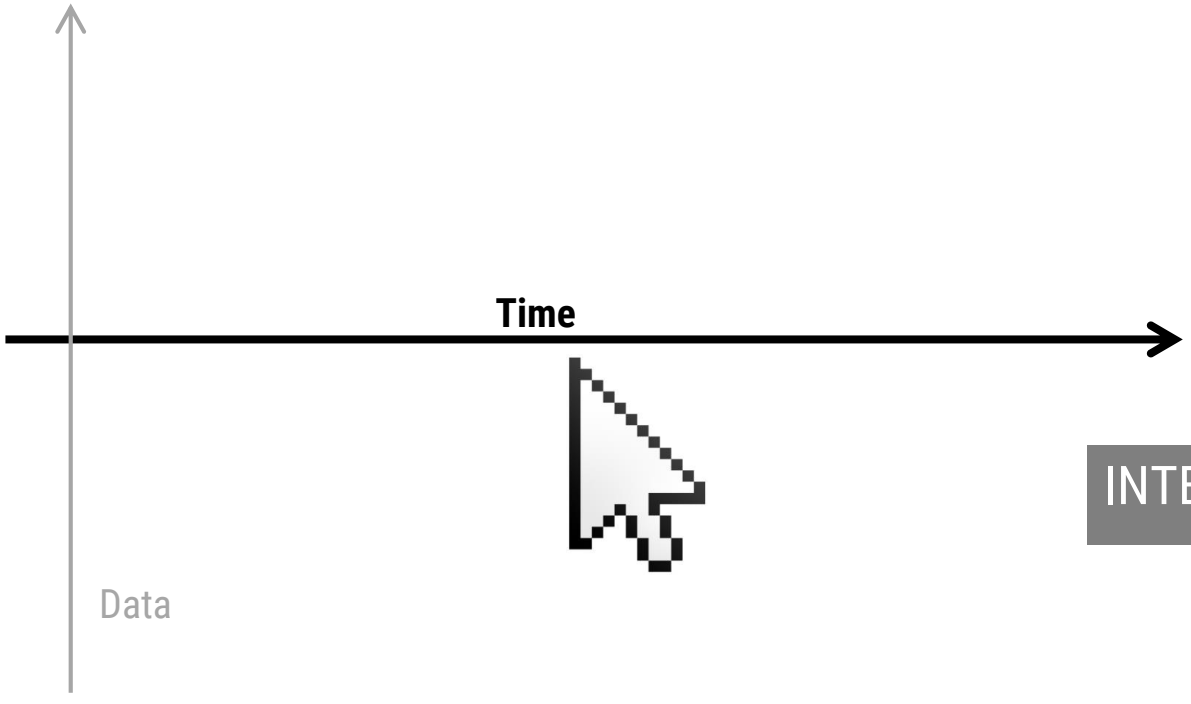
NON-LINEAR TIME AXES

Trees – Branching time



Aigner et al, 2011.

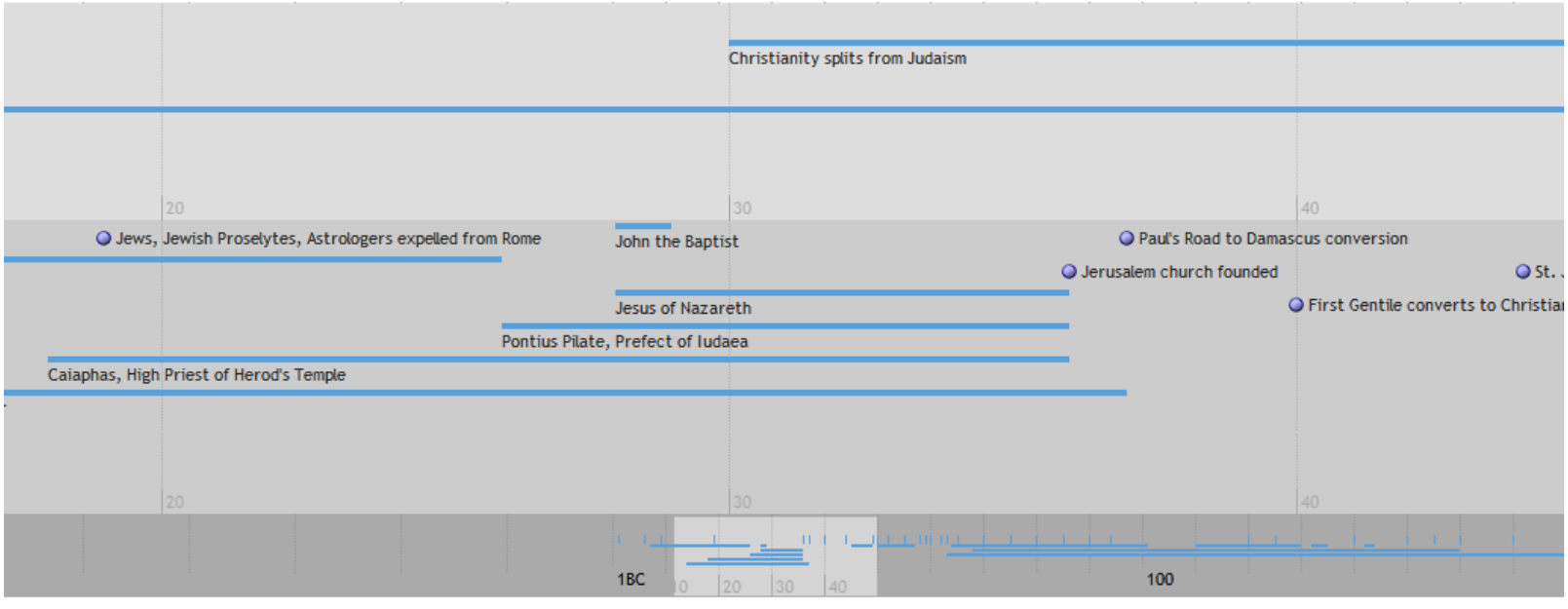
MAPPING TIME TO AN AXIS



INTERACTION?

INTERACTION

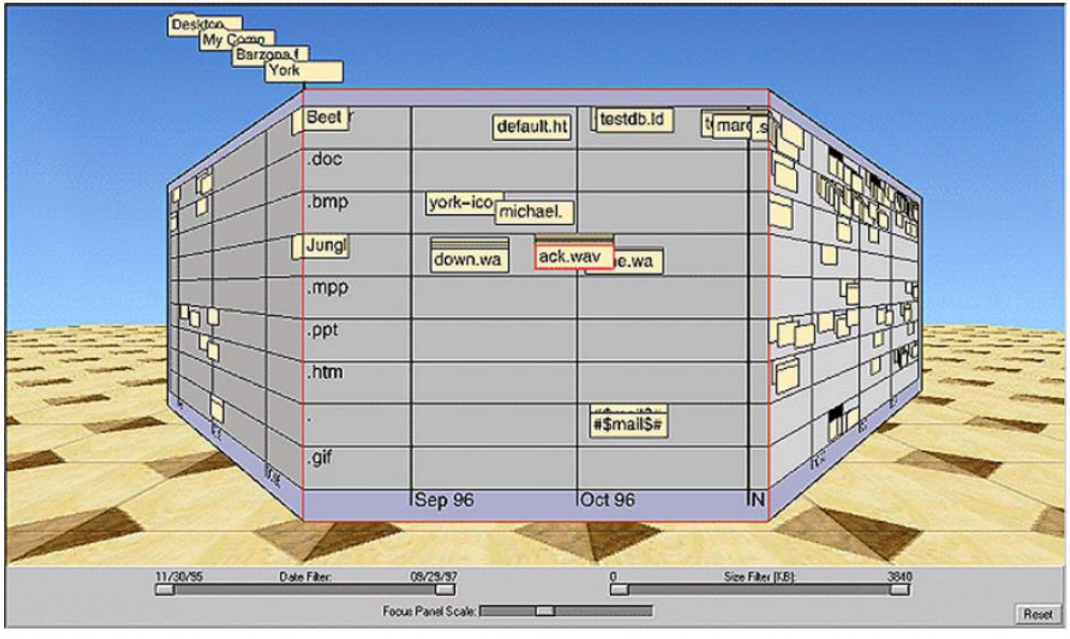
Focus+Context - Simile Timeline



simile-widgets.org

INTERACTION

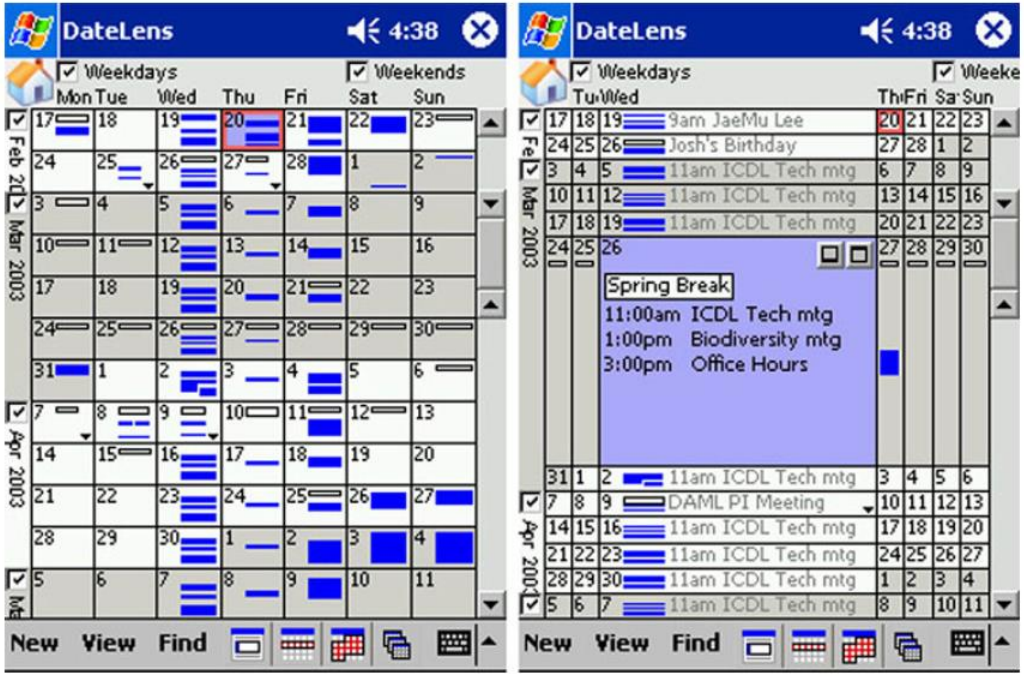
Focus+Context - Perspective Wall



[Mackinlay, 1991]

INTERACTION

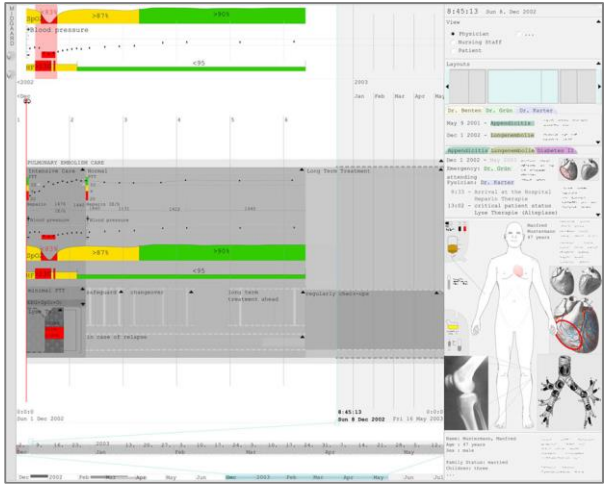
Focus+Context - DateLens

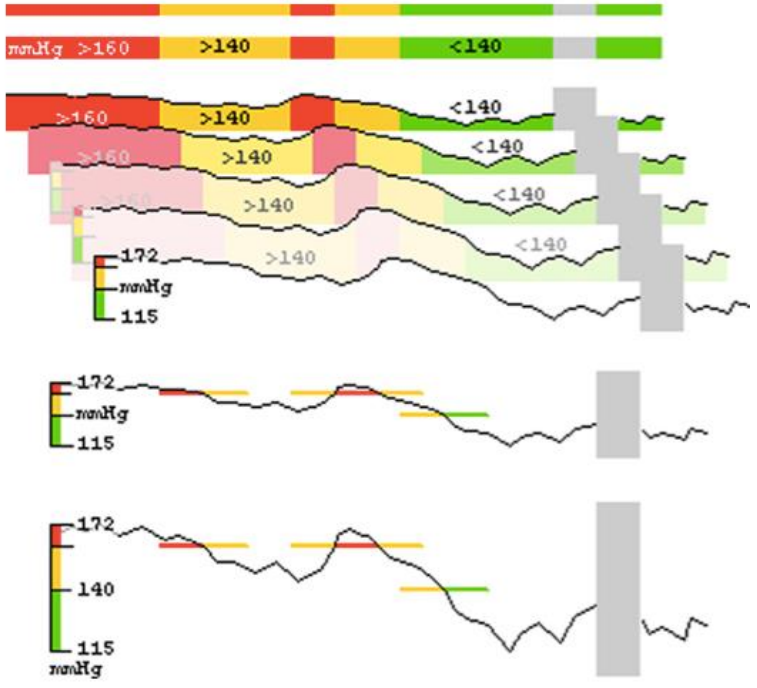


Bederson et al, 2004

INTERACTION

Semantic Zooming - Midgaard

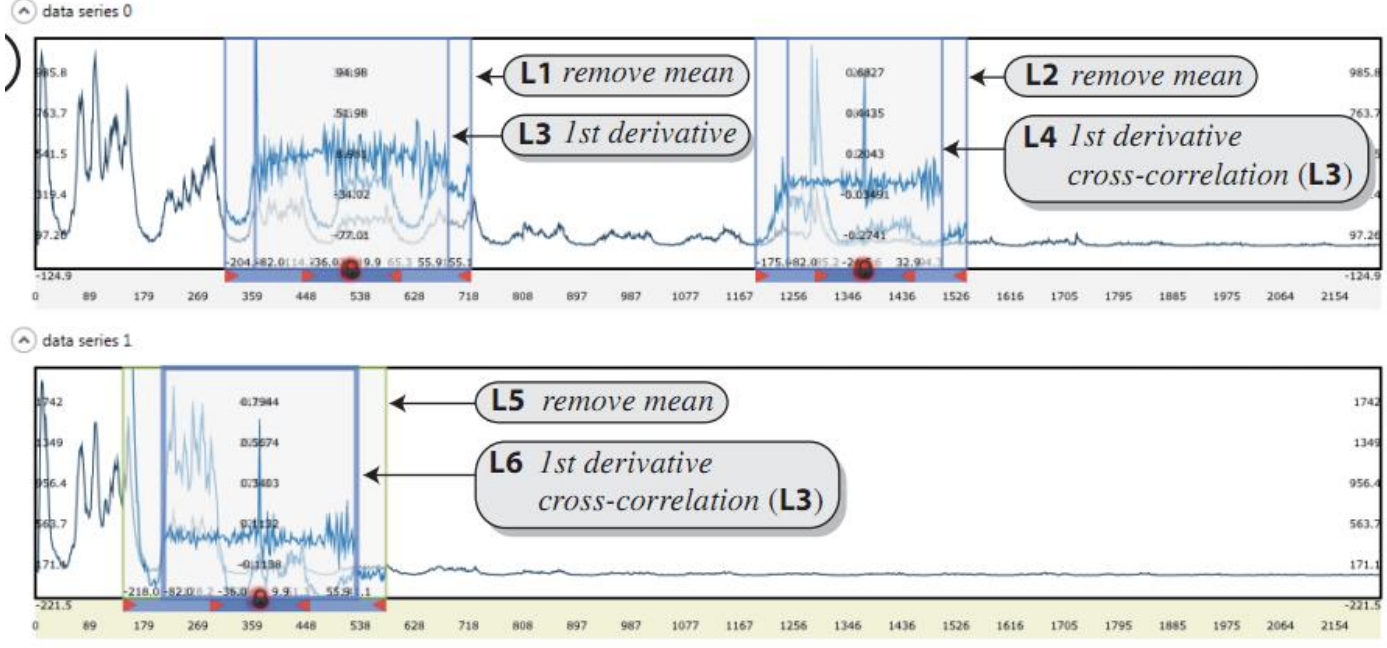




Schlechtweg and Miksch, 2004. Cited in Aigner et al, 2011

INTERACTION

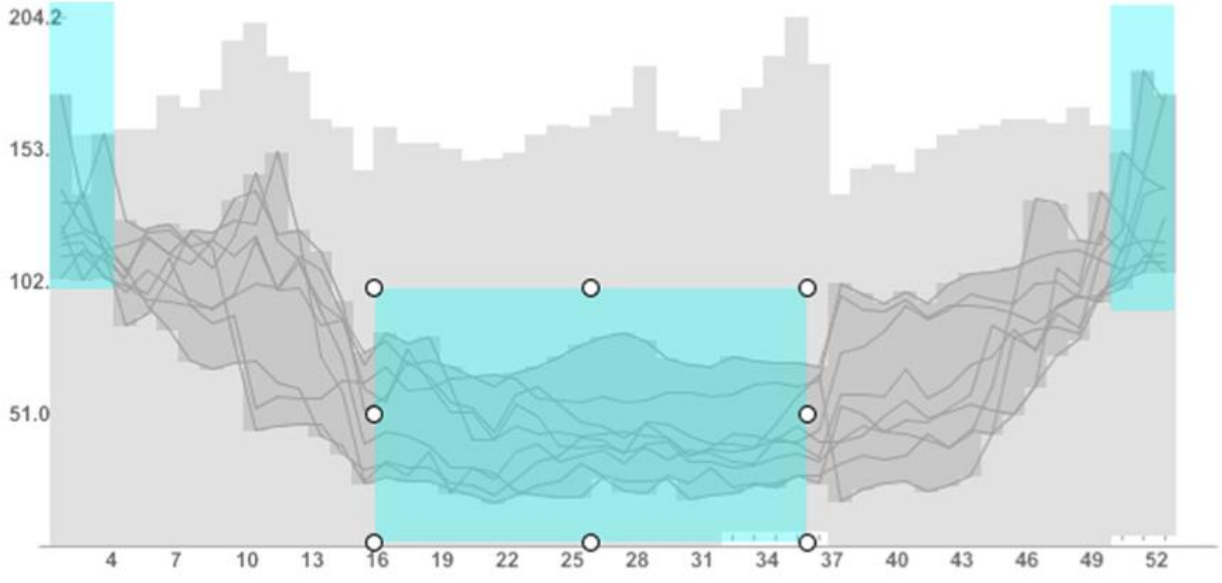
Magic Lenses - ChronoLenses



Zhao et al, 2011

INTERACTION

Dynamic queries - Time Searcher

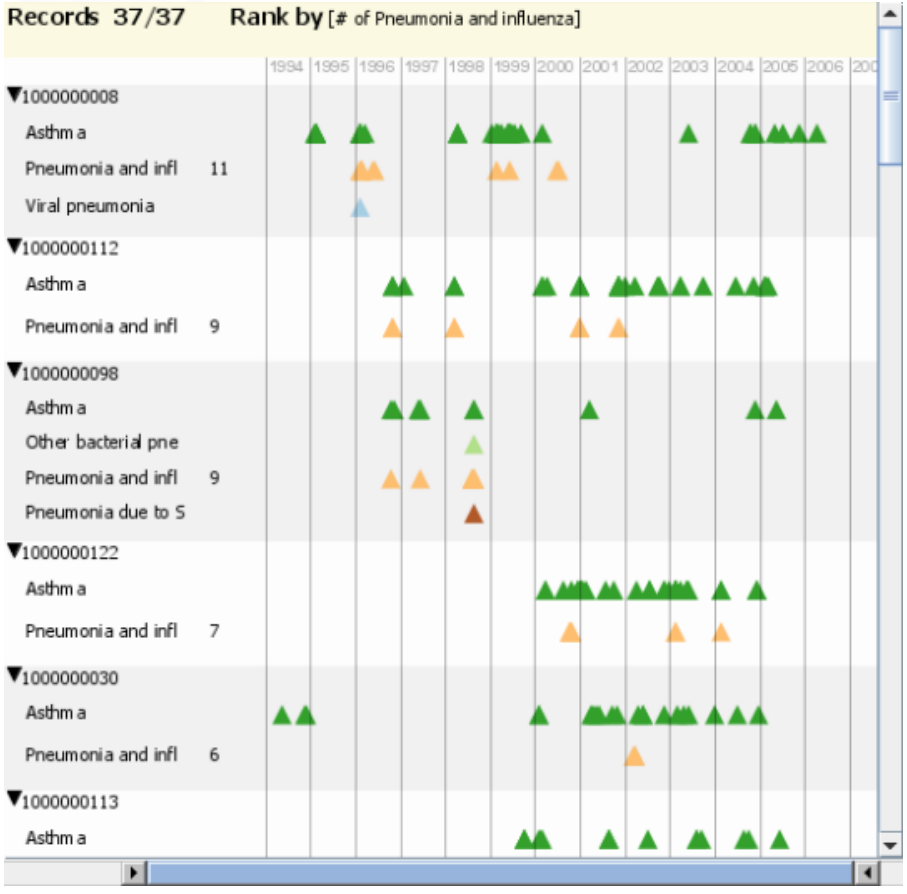


Hochheiser and Shneiderman, 2003


TimeSearcher...13 Months of High and Low prices
File Edit View Transform Help
Search:
Search
Clear
Query Variable
Low
HCIL
Low
3.21
1.71
0.21
-1.29
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
223/223 Records
DEVIATIONS
Name: AVIRON
Low High
September: 21.63 24.25
October: 23.75 24.38
November: 16.0 16.5
December: 15.5 16.06
January: 19.5 21.44
February: 37.88 43.0
March: 27.25 28.88
April: 23.0 24.88
May: 23.63 25.38
June: 29.13 31.25
July: 27.56 31.06
August: 41.63 45.63
September: 52.5 59.0
AVIS GROUP HOLDINGS CL A
AVIRON
AVANT CORP
AVON PRODUCTS INC
AVNET INC
AVX CORP
AVERY DENNISON CORP
AMVESCAP PLC
ALLIED WASTE INDUSTRIES
AMERICAN WATER WORKS INC
AWARE INC
AXA ADS
ANIXTER INTERNATIONAL
AXA FINANCIAL INC
AMERICAN AXLE & MANUFACT
AXENT TECHNOLOGIES INC
AMERICAN EXPRESS CO
AXT INC
ALLEGHENY ENERGY INC
ALZA CORPORATION
ASTRAZENECA PLC
AUTOZONE INC
ASPEN TECHNOLOGY INC
AZTAR CORP
AVIS GROUP HOLDINGS CL A
AVIRON
AVANT CORP

INTERACTION

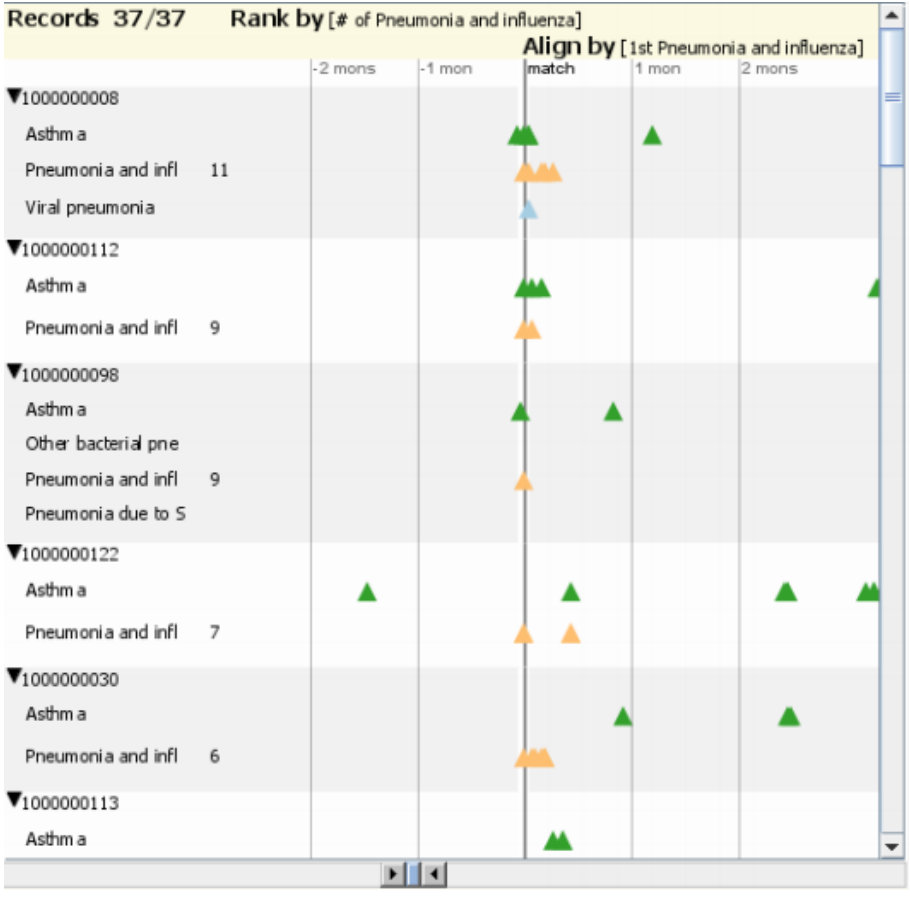
Temporal alignment – Lifelines 2



[Wang et al, 2008]

INTERACTION

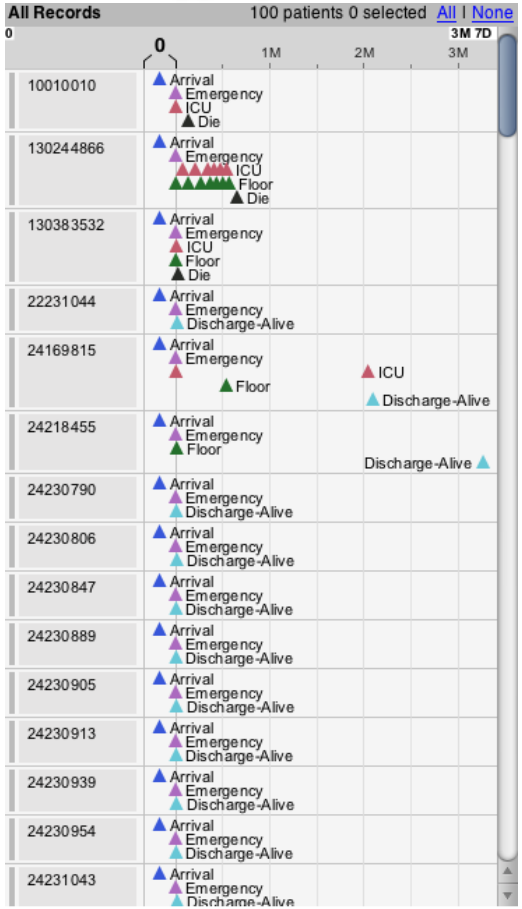
Temporal alignment – Lifelines 2

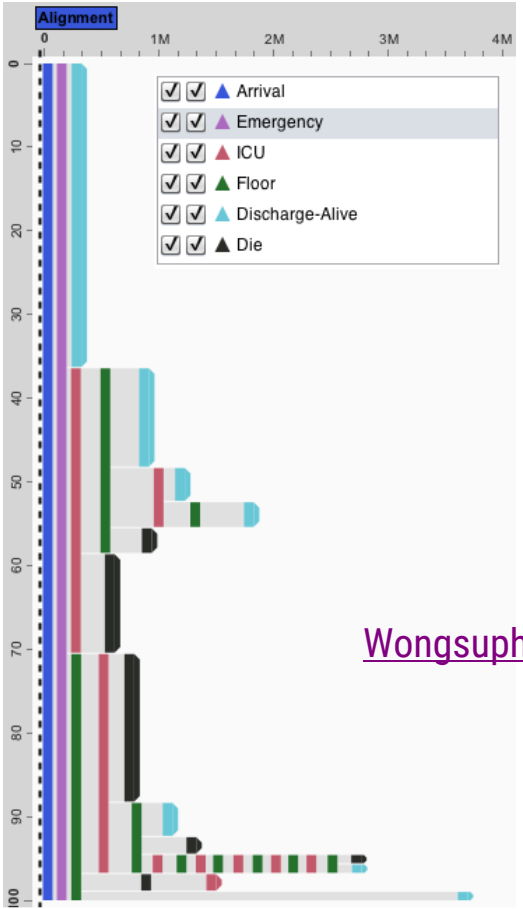


[Wang et al, 2008]

INTERACTION

Temporal alignment + Aggregation – LifeFlow

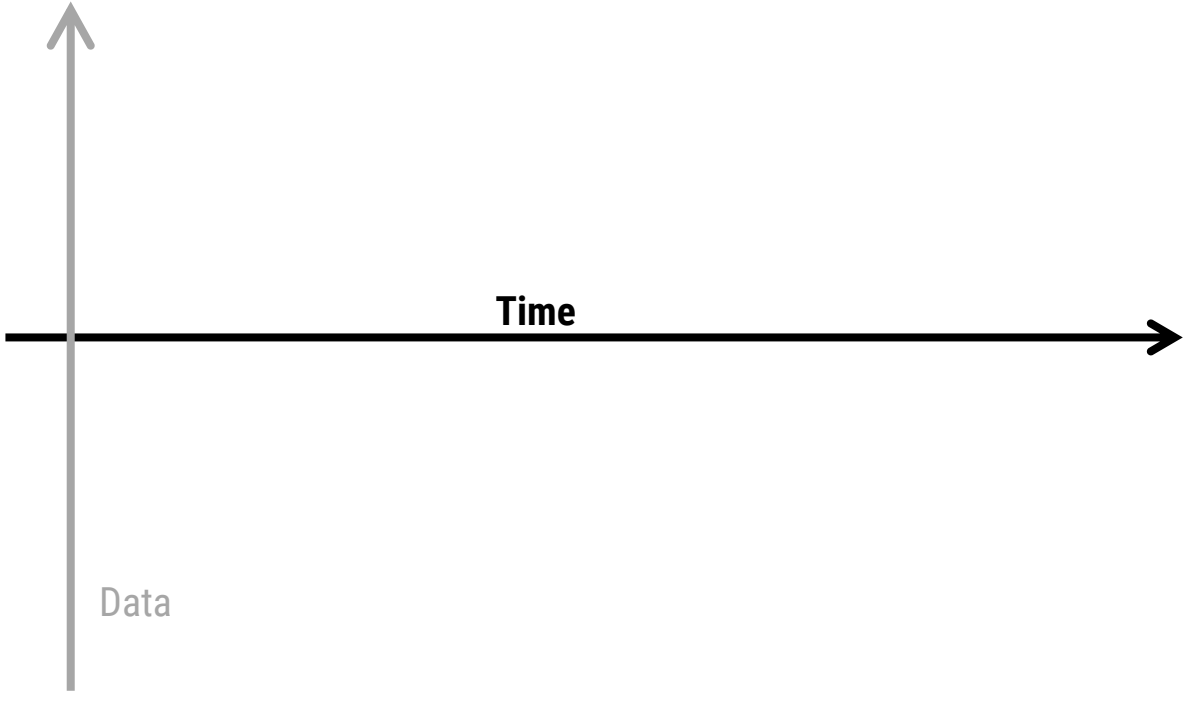




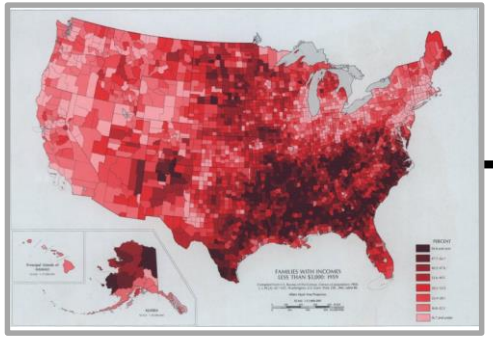
Wongsuphasawat et al, 2011

MAPPING TIME TO SPACE

MAPPING TIME TO AN AXIS



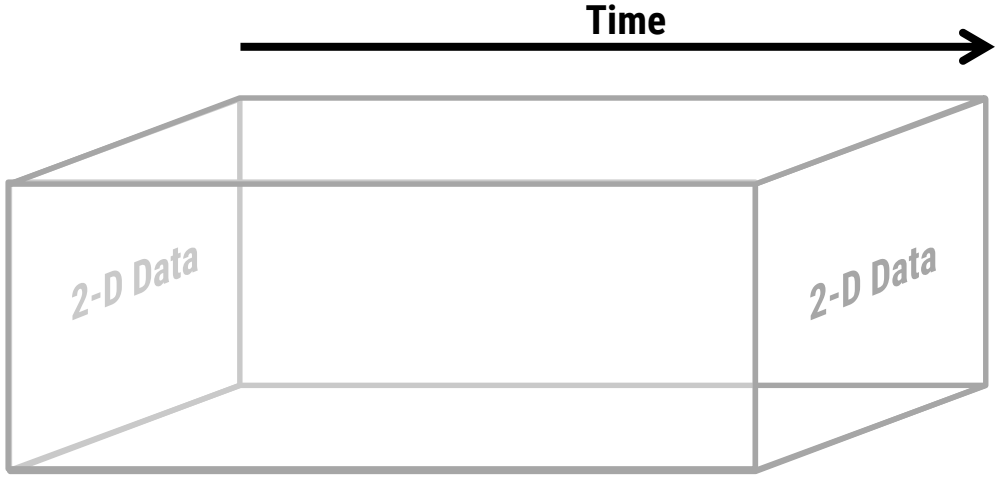
MAPPING TIME TO AN AXIS



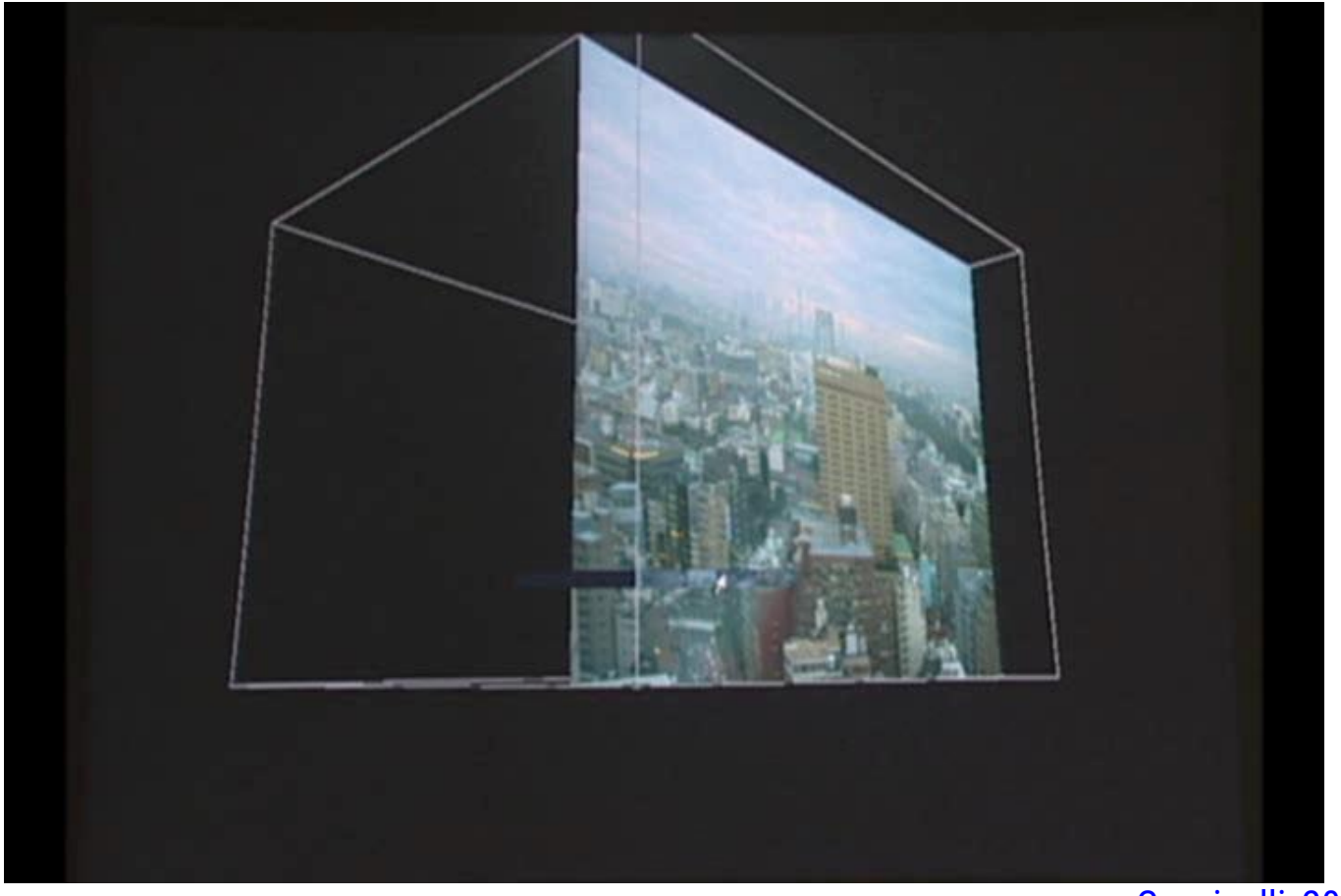
Data

2D + TIME

Space-Time Cube Model



2D + TIME



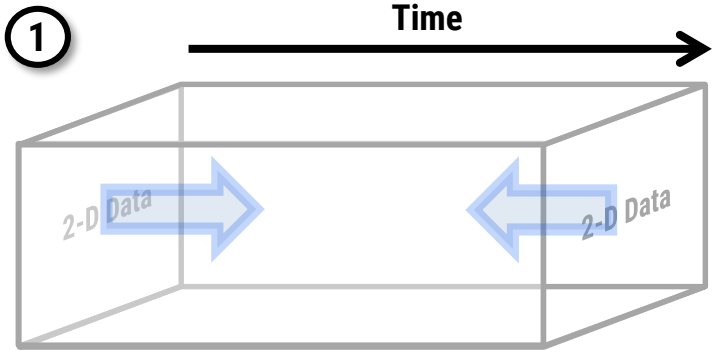
Cassinelli, 2005

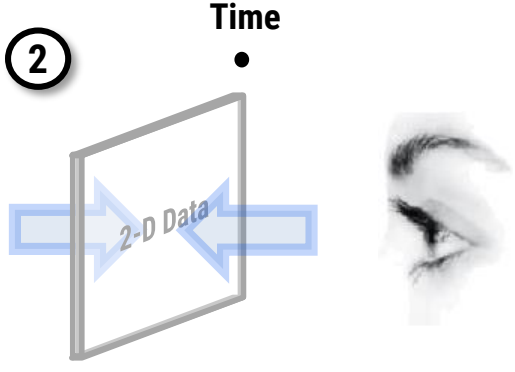
2D + TIME

Cassinelli, 2005

2D + TIME

Time Flattening



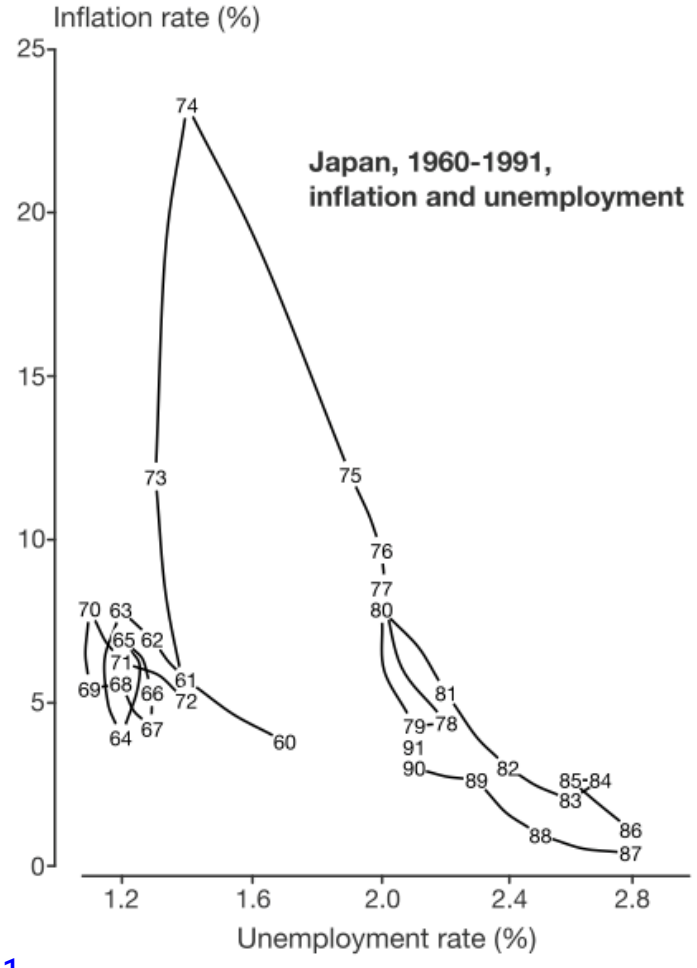


2D + TIME

Long exposure photography

2D + TIME

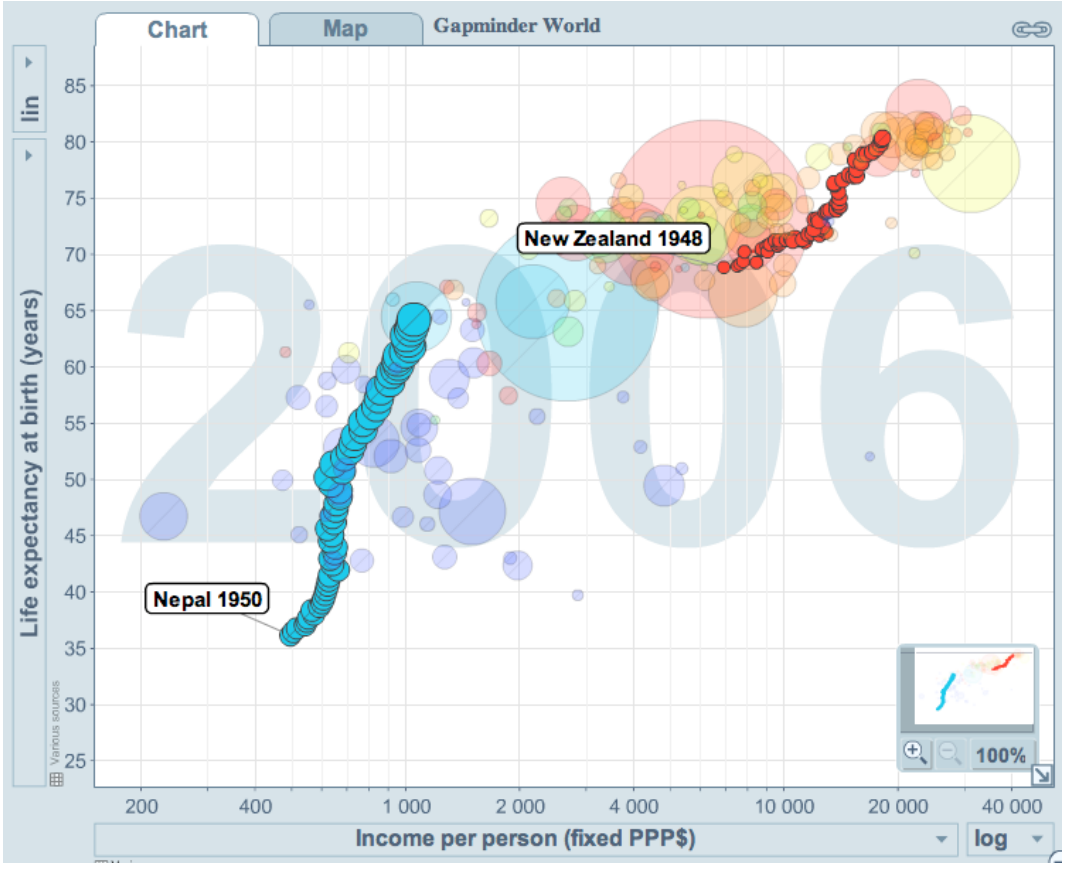
Phillips Curve



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

2D + TIME

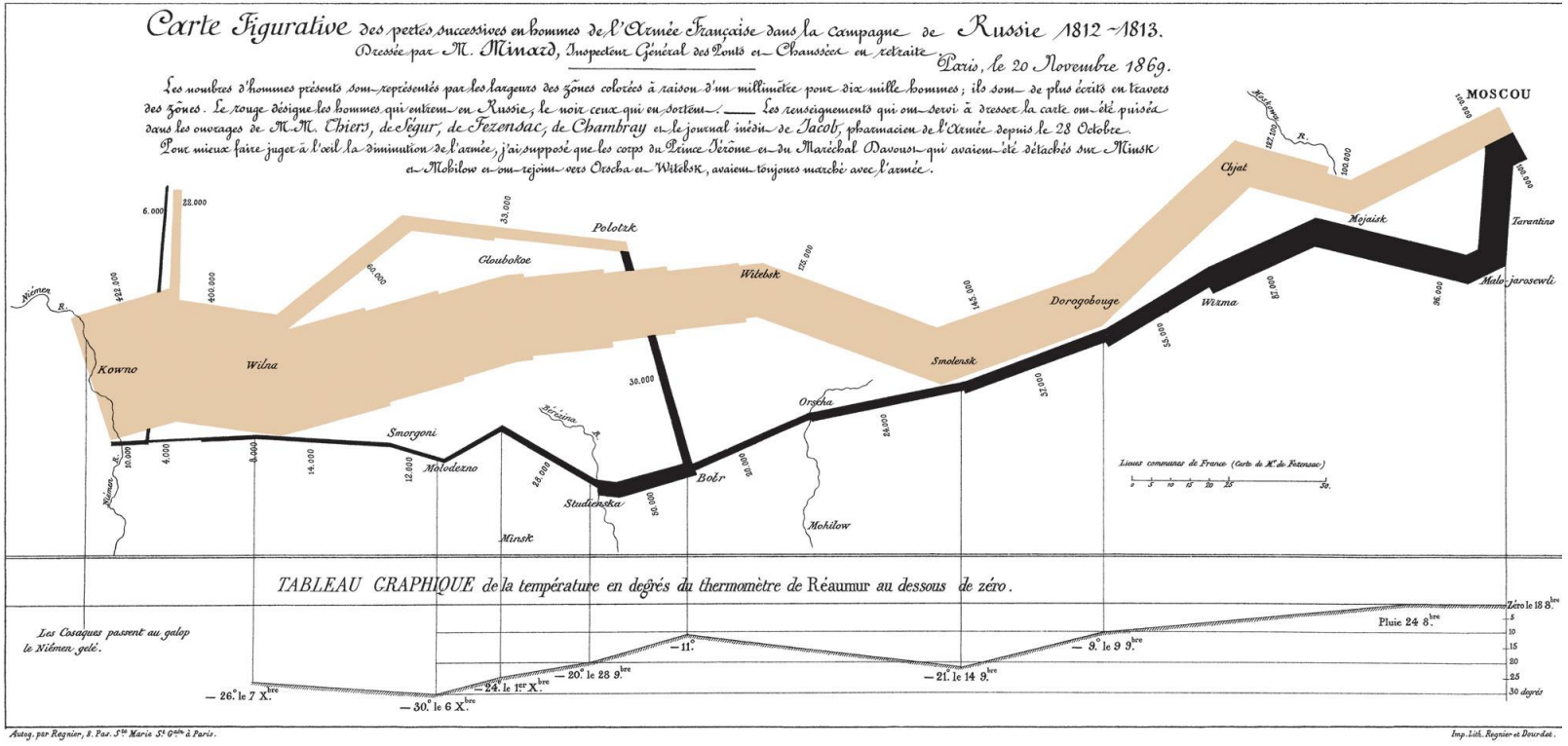
Trails



gapminder.org

2D + TIME

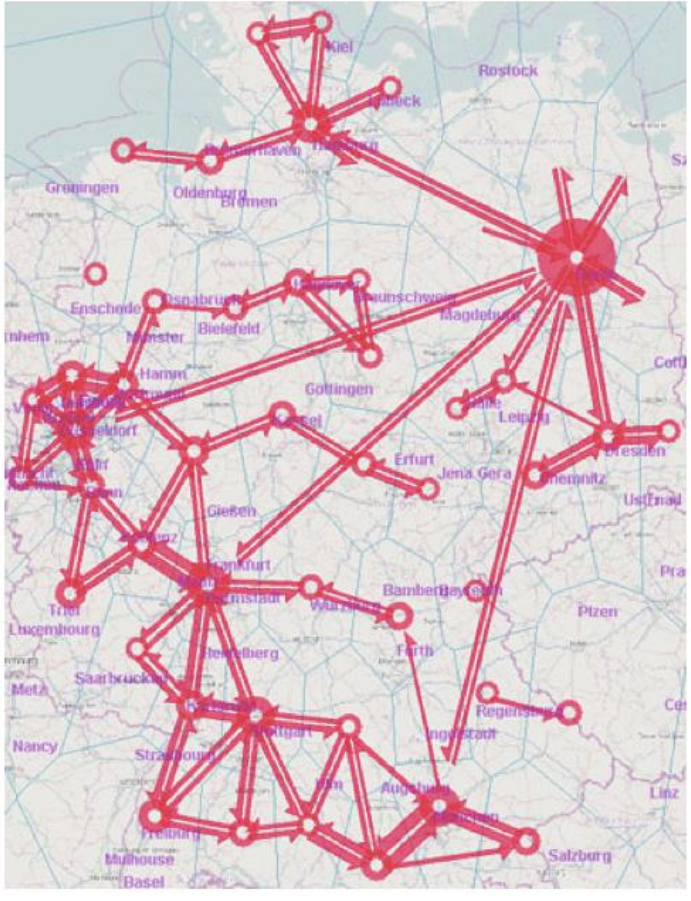
Napoleon's Russian Campaign of 1812



Charles Joseph Minard, 1861. Cited in [Tufte, 1983]

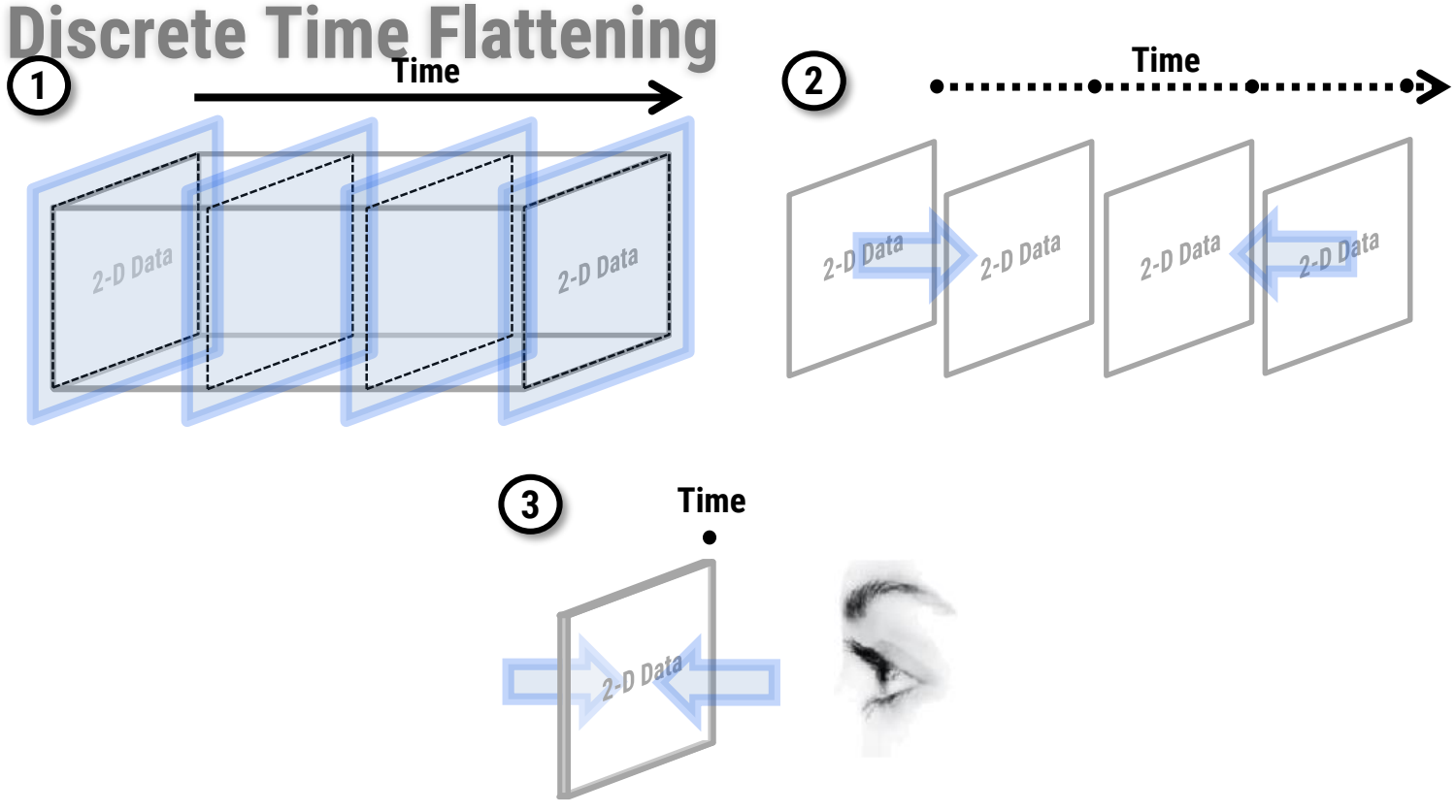
2D + TIME

Flow Maps



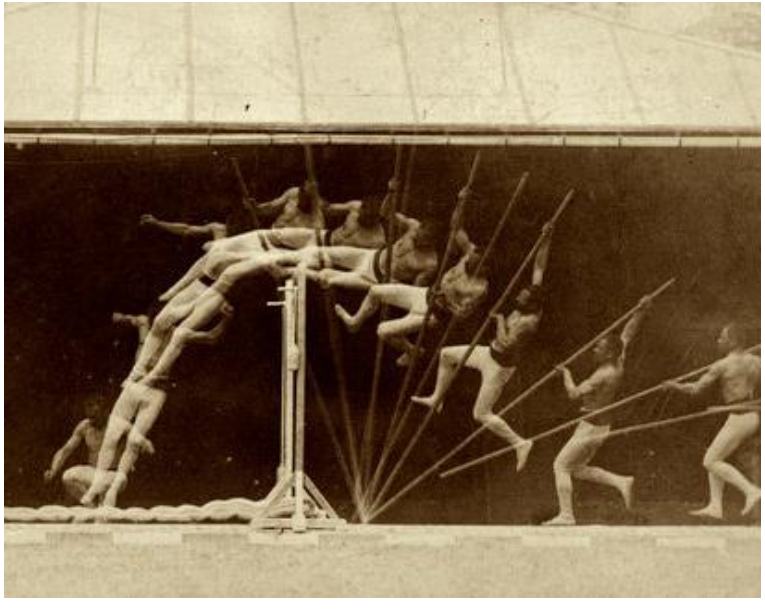
[Tobler, 1987]
[Adrienko, 2011]

2D + TIME


Discrete Time Flattening
1
Time
2-D Data
2-D Data
2
Time
2-D Data
2-D Data
2-D Data
2-D Data
3
Time
2-D Data

2D + TIME

Marey's Chronophotography Technique

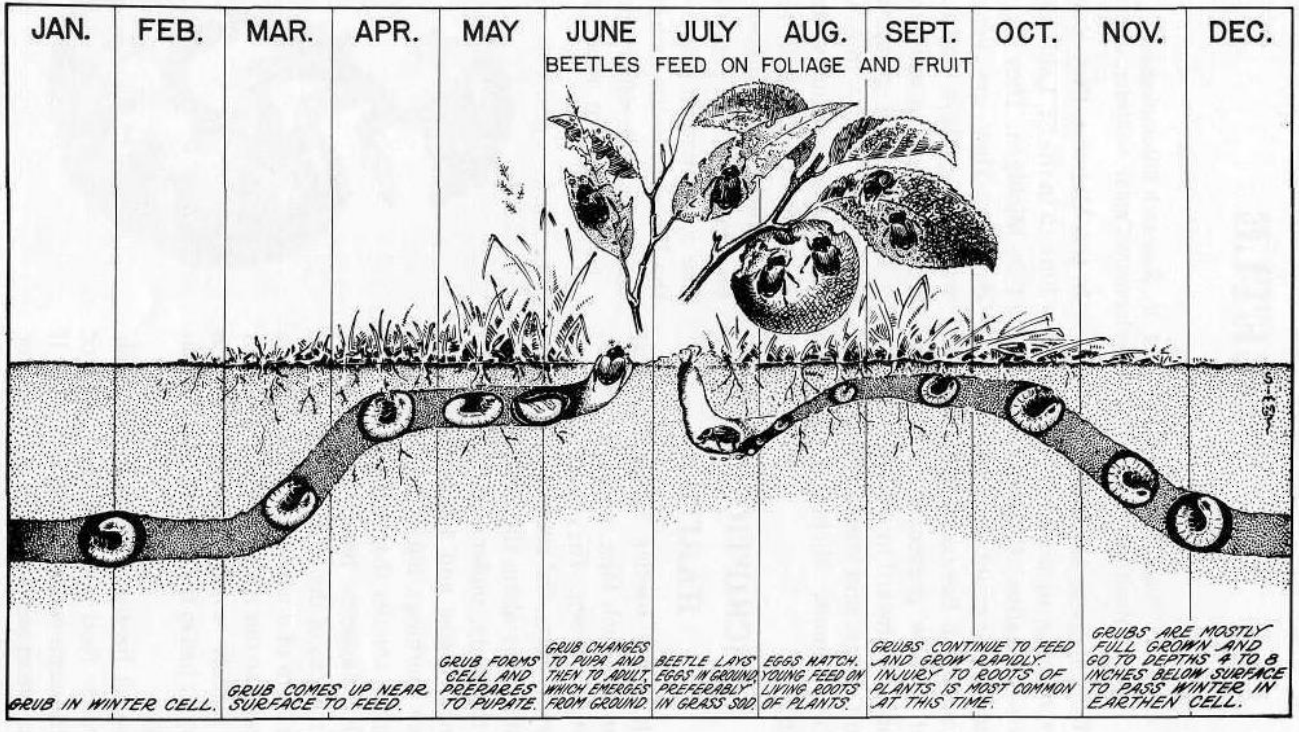


(image source)

Étienne-Jules Marey, 1880s (source)

2D + TIME

Sequences



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

Cited in Tufte, 1983

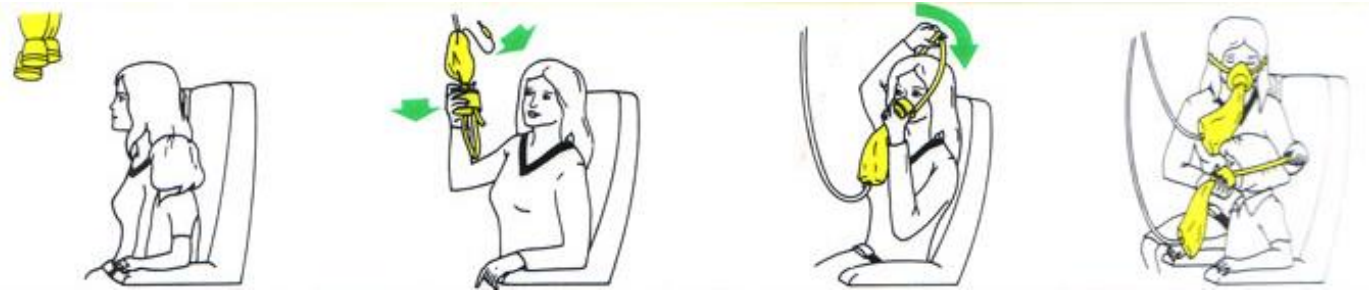
2D + TIME

Sequences

Megan Jaegerman. Cited in Tufte, 2007

2D + TIME

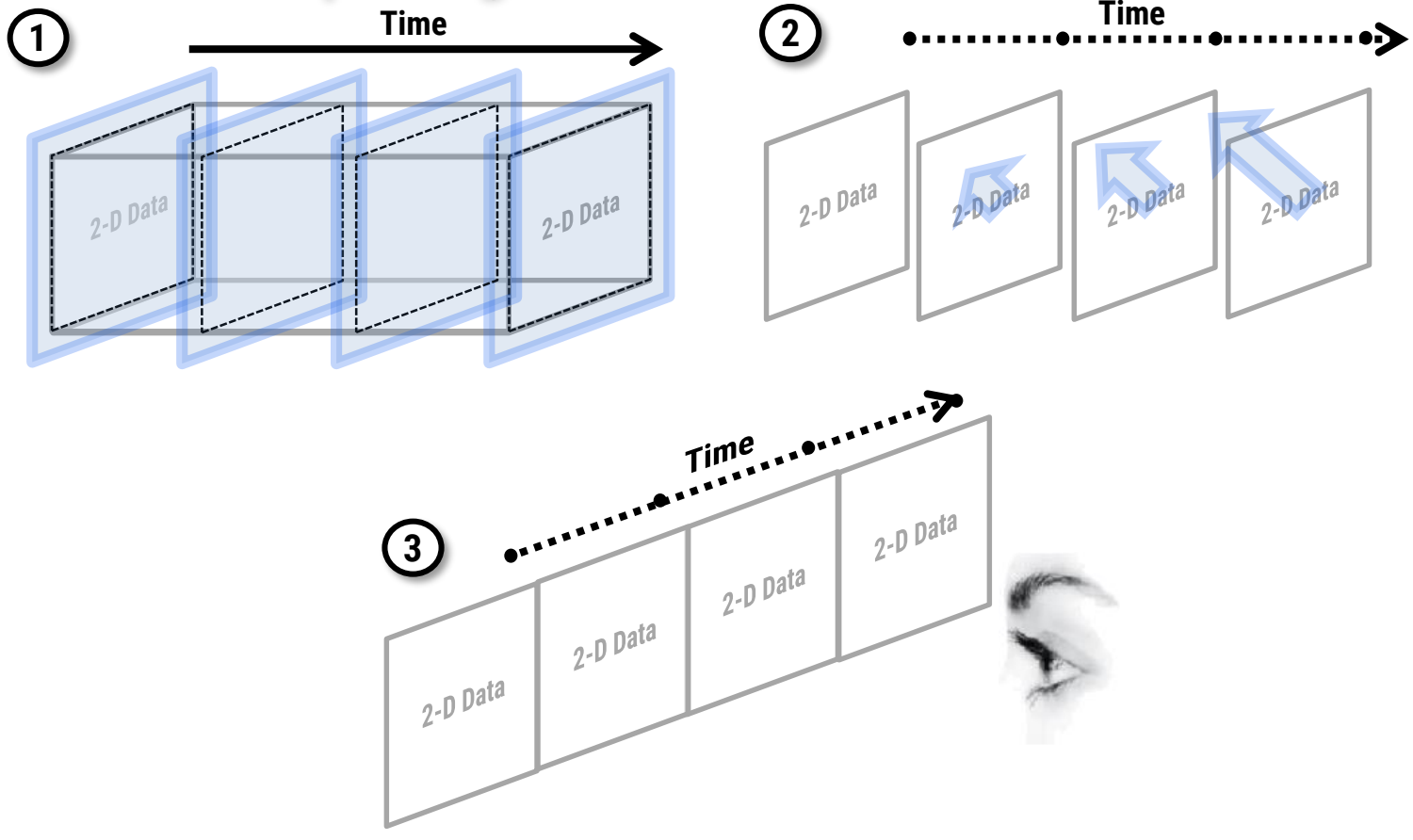
What about this?



(image source)

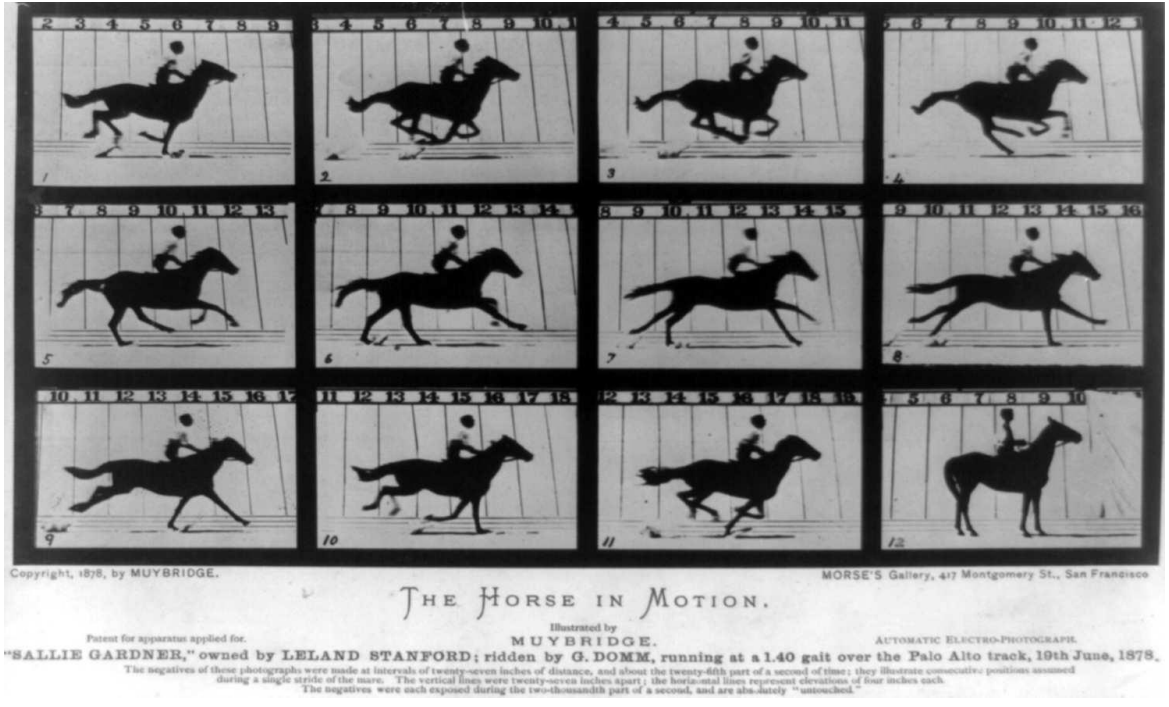
2D + TIME

Time Juxtaposing



2D + TIME

Muybridge's Chronophotography Technique



Eadweard J. Muybridge, 1878 (source)

2D + TIME

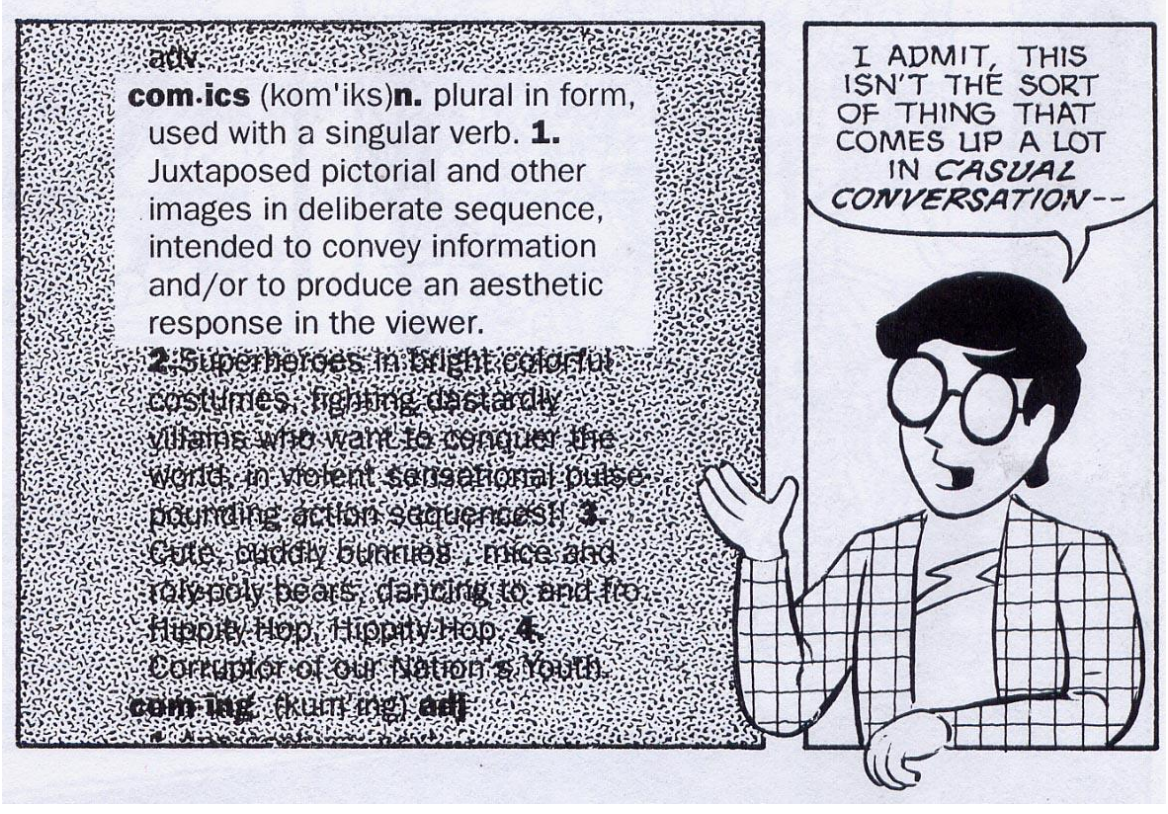
Comics

Understanding Comics: The invisible Art

Scott McCloud, 1993

2D + TIME

Comics

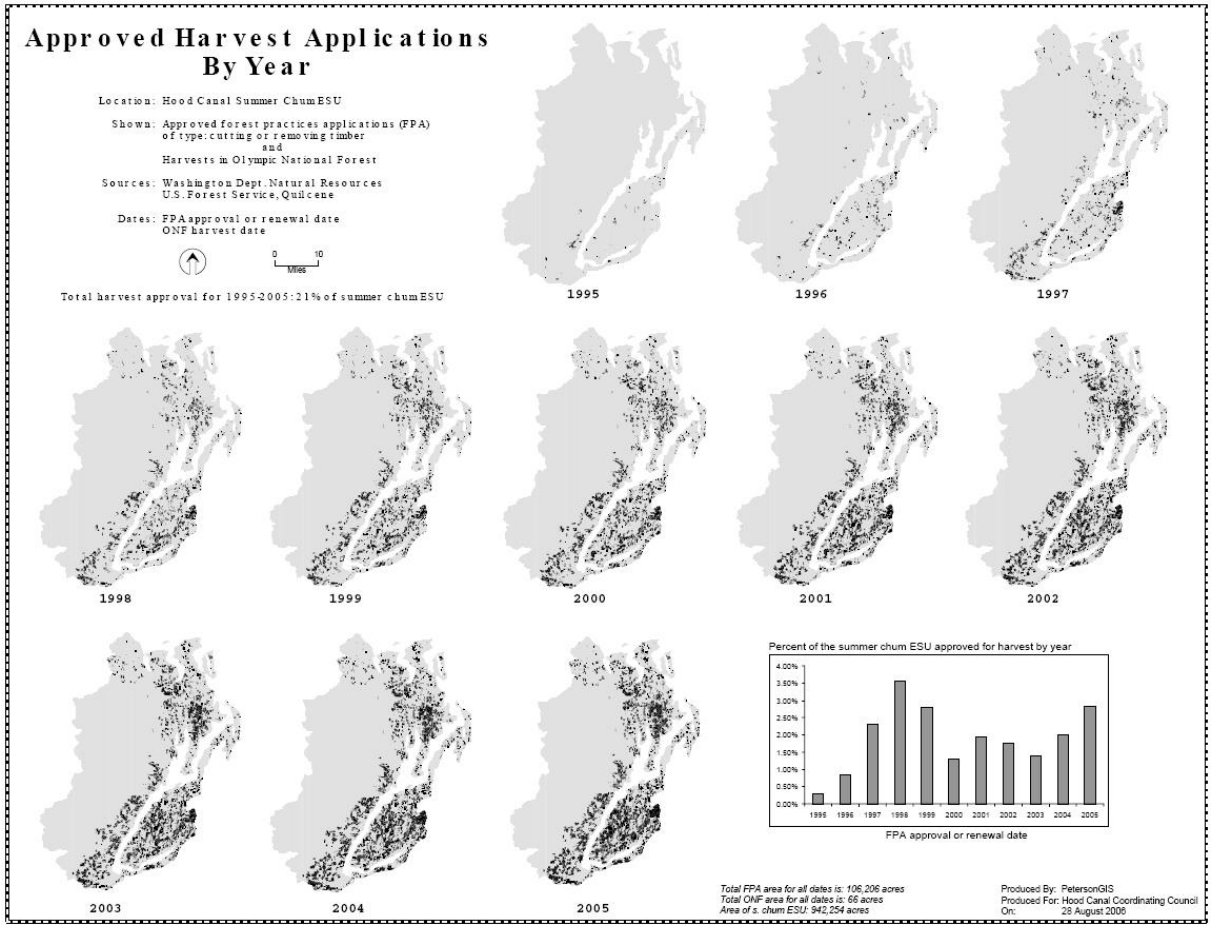


Understanding Comics: The invisible Art

Scott McCloud, 1993

2D + TIME

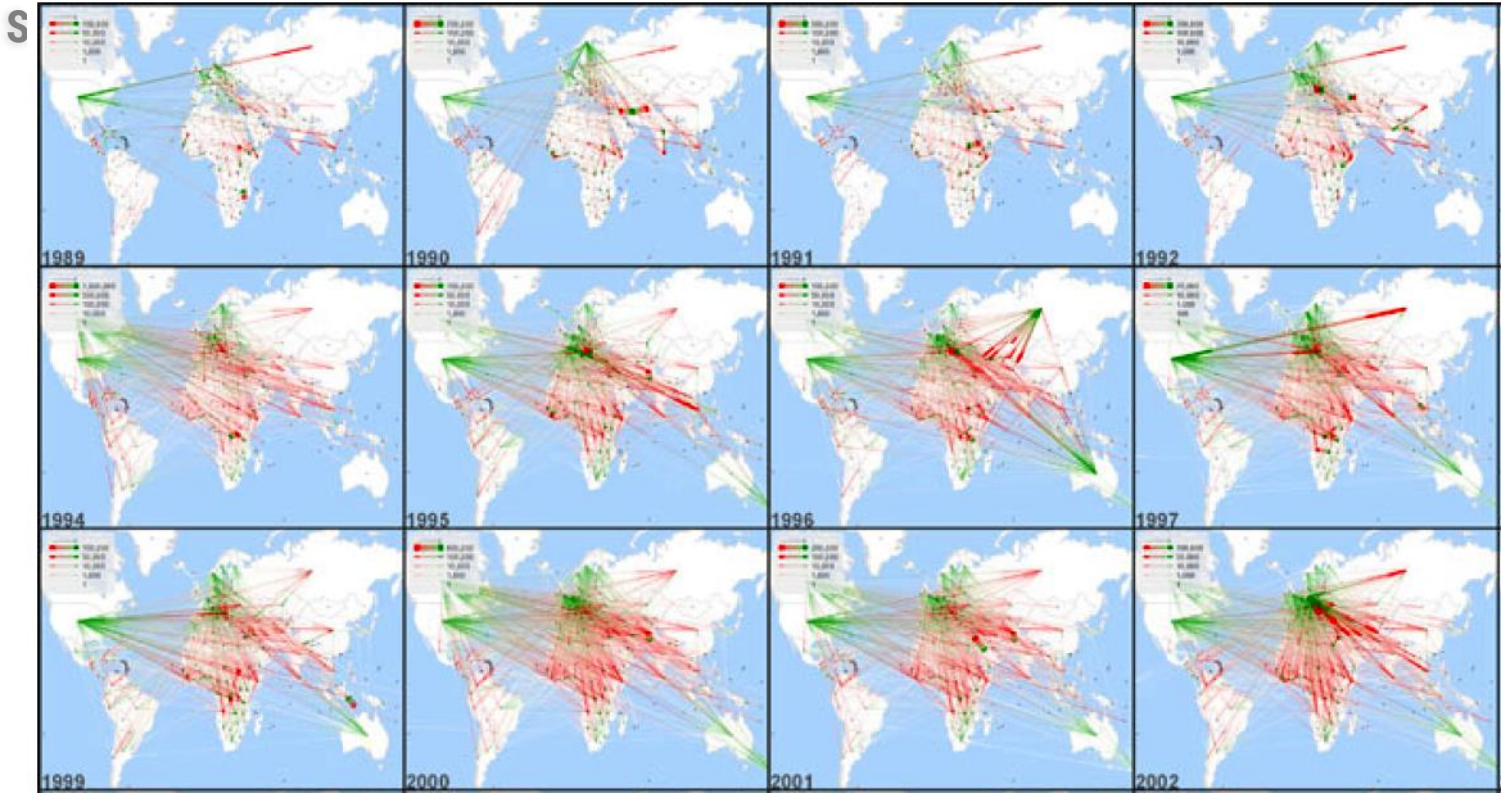
Small Multiples



Tufte, 1983

(image source)

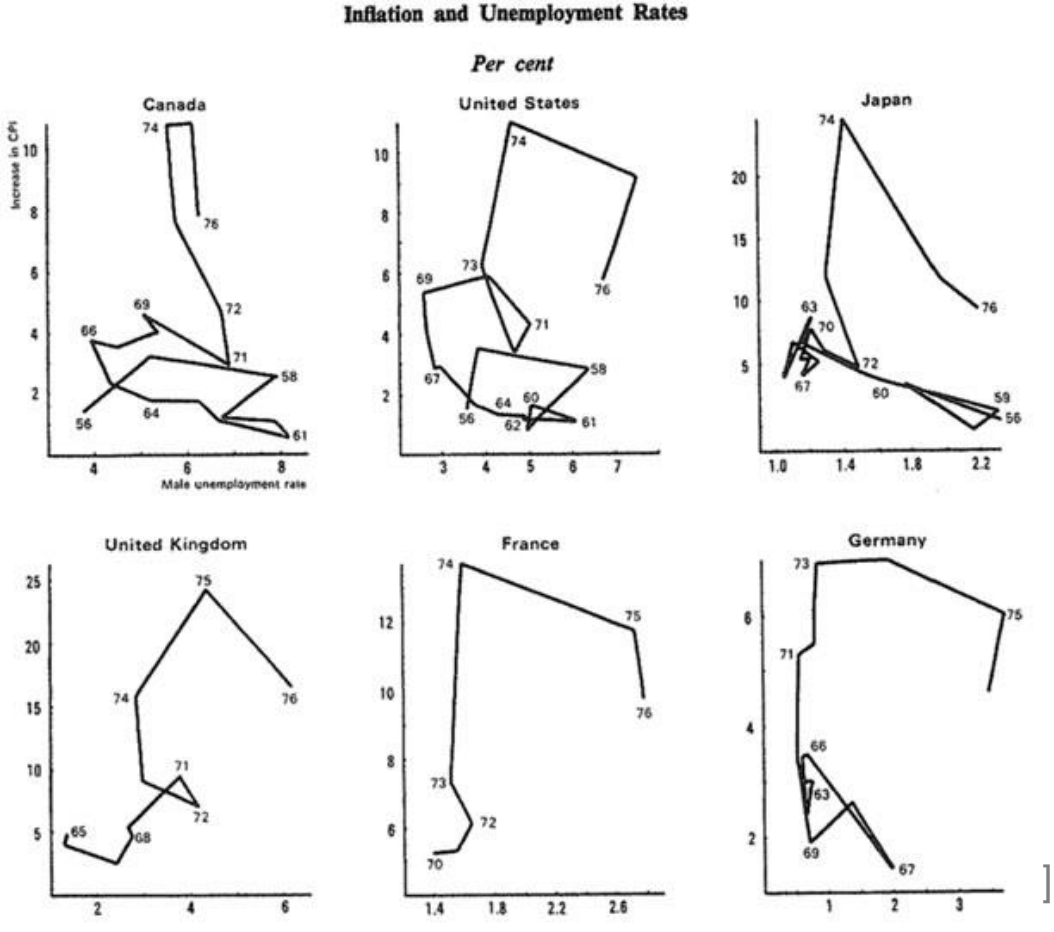
2D + TIME



Aigner et al, 2011

2D + TIME

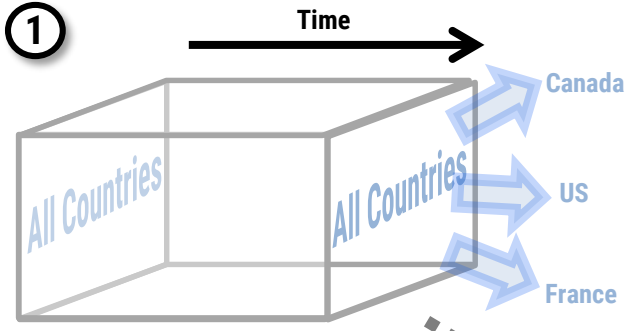
What about this?

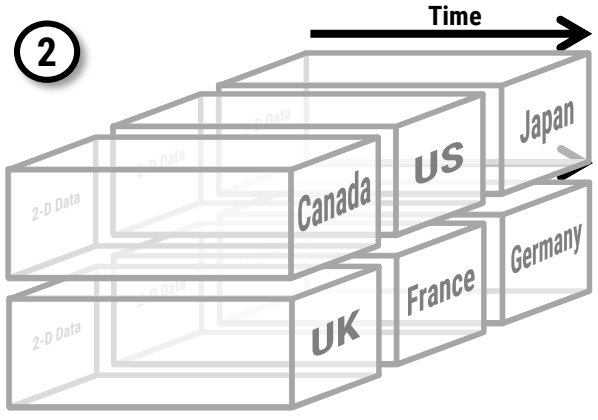


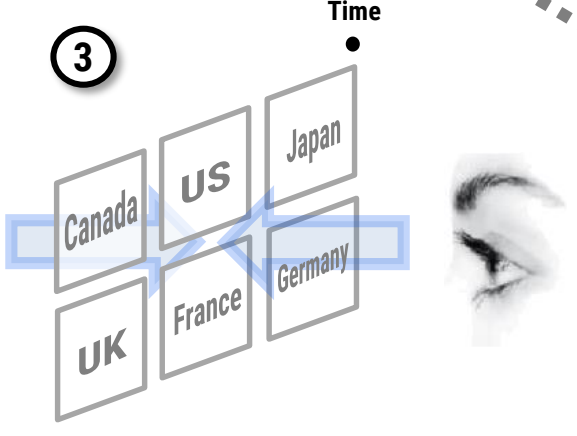
(image source)

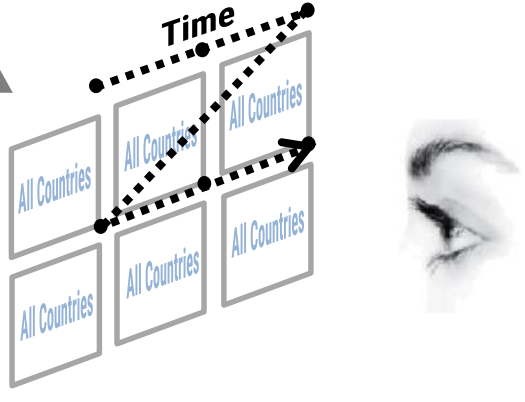
2D + TIME

What about this?



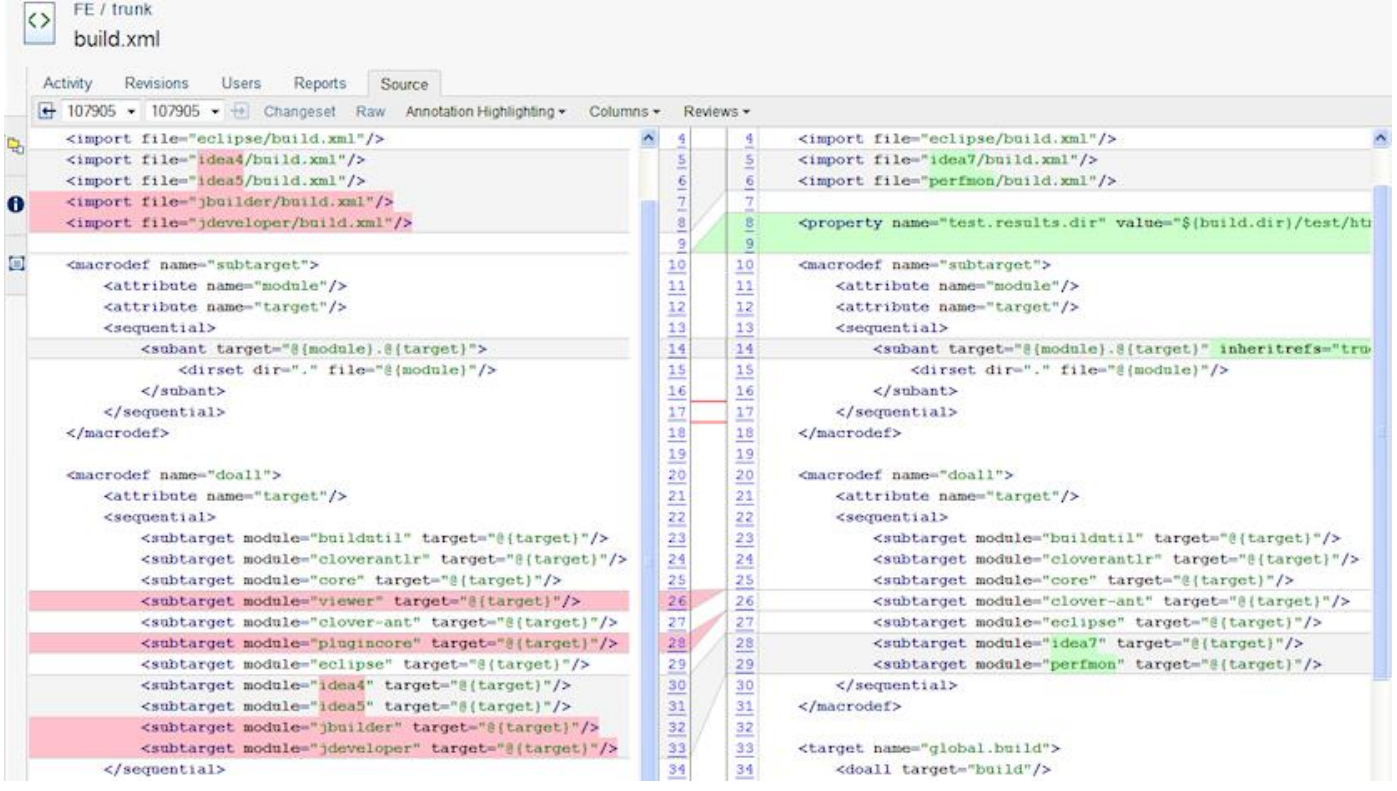






2D + TIME

Side-By-Side Views

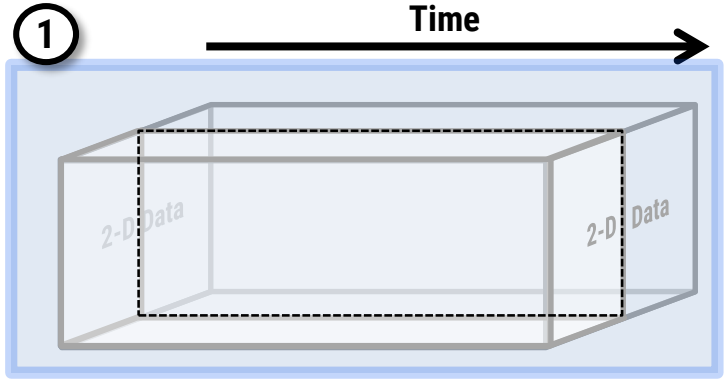


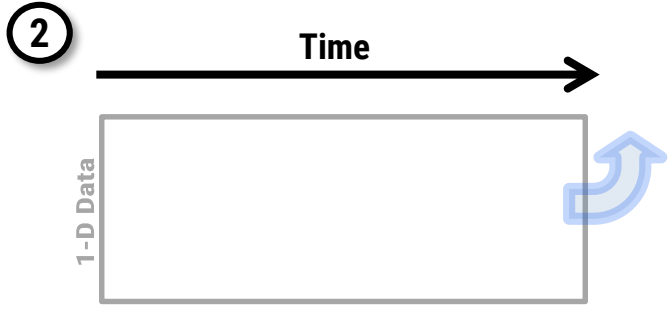
2D + TIME

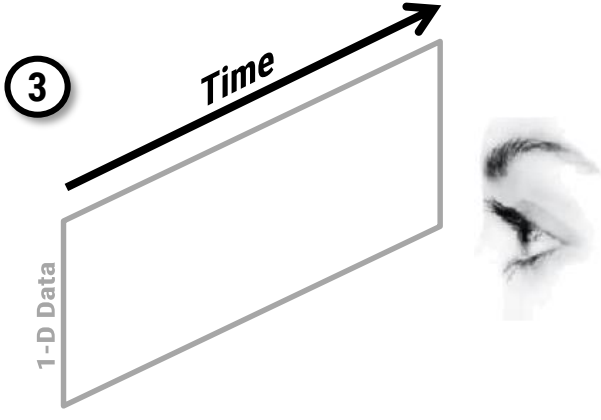
Side-By-Side Views

2D + TIME

Space Cutting

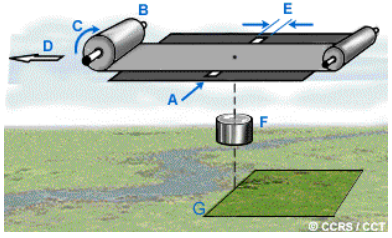


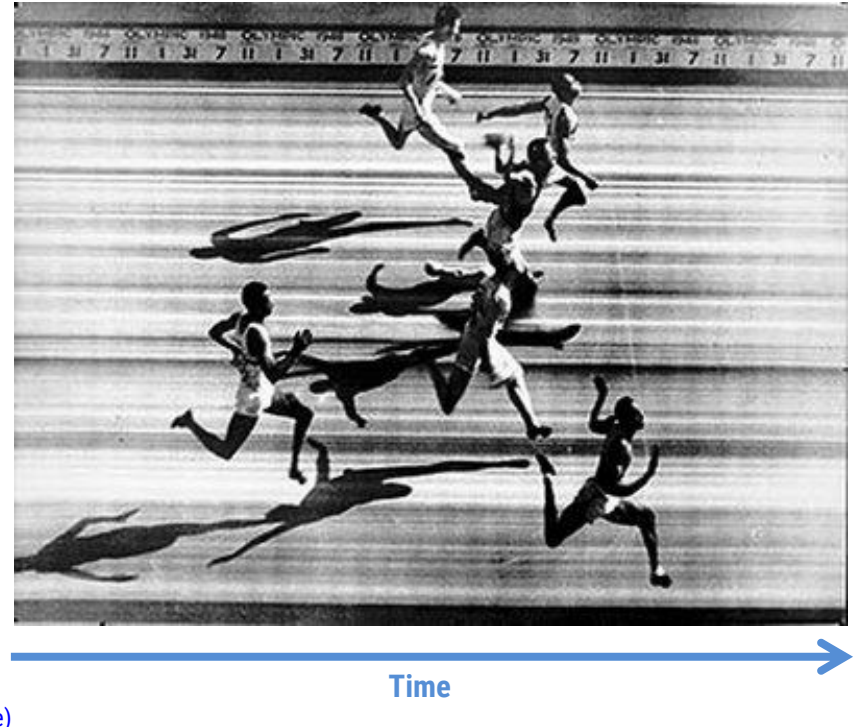




2D + TIME

Slit-Scan Photography

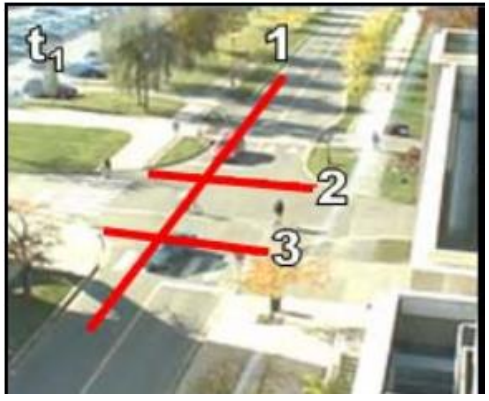


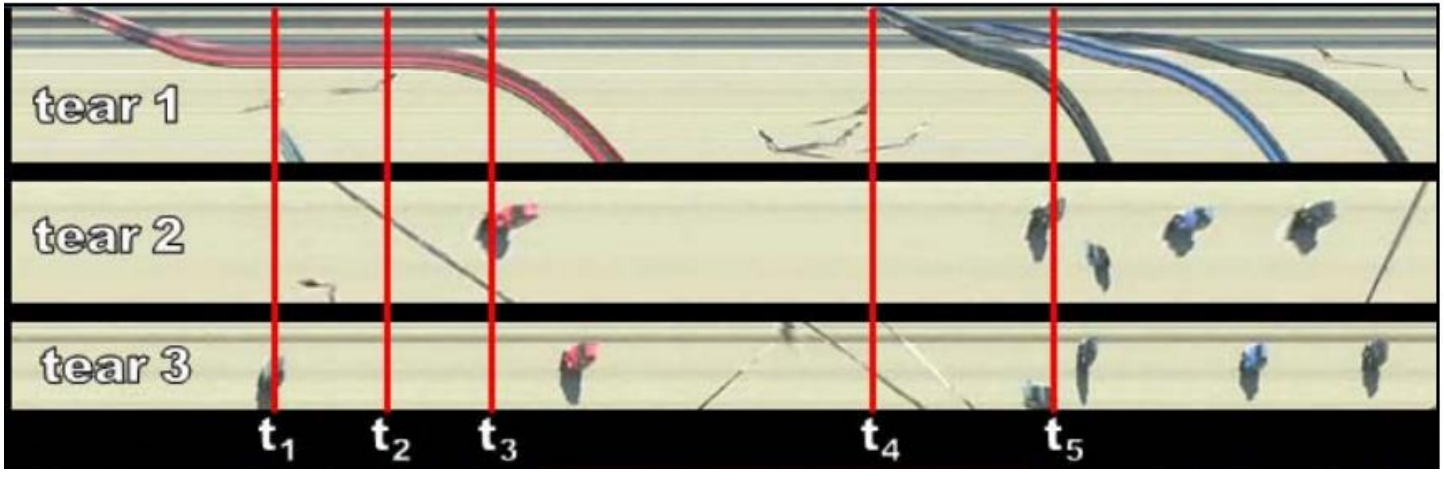


(images source)

2D + TIME

Slit-Tear Exploration of Videos





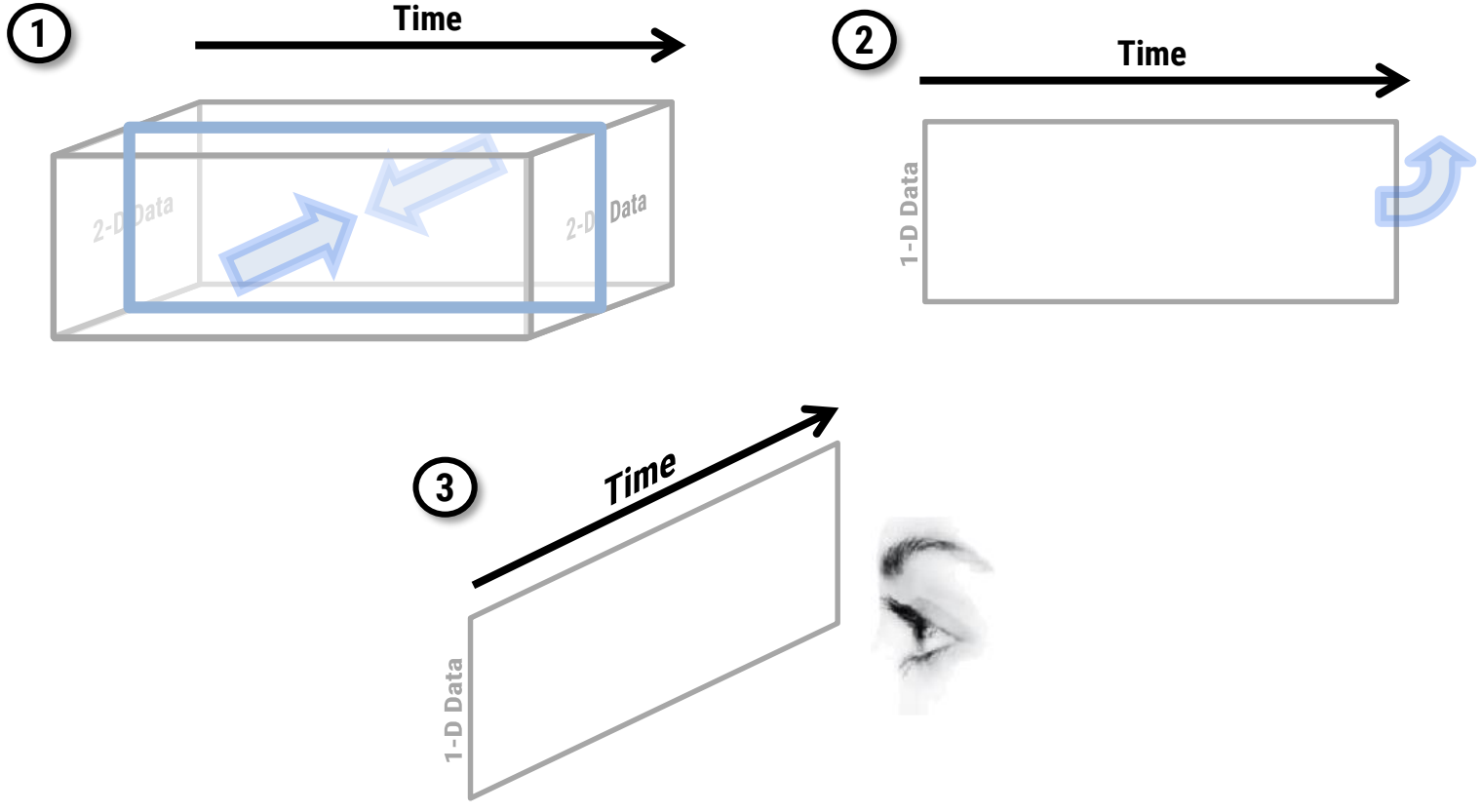
Tang et al, 2009 (video)

Exploring Video Streams using Slit-Tear Visualizations

Anthony Tang, *University of British Columbia*
Saul Greenberg, *University of Calgary*
Sidney Fels, *University of British Columbia*

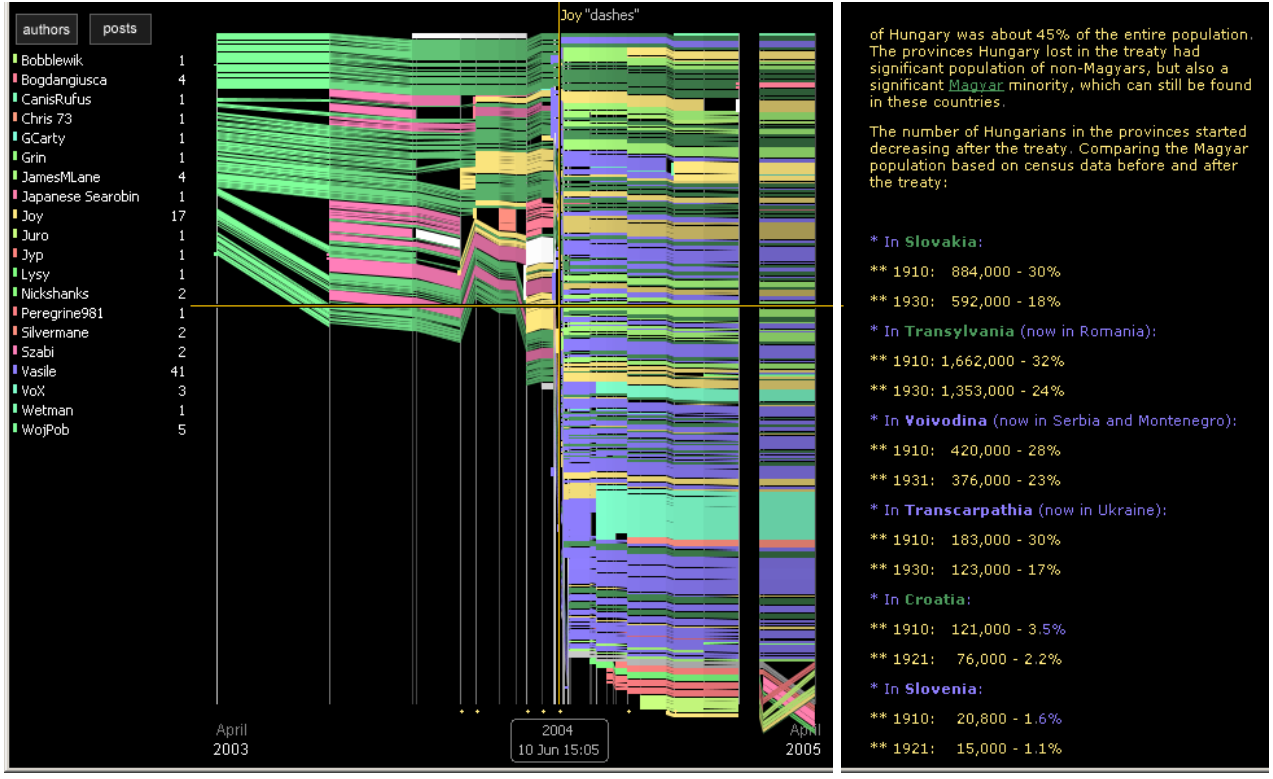
2D + TIME

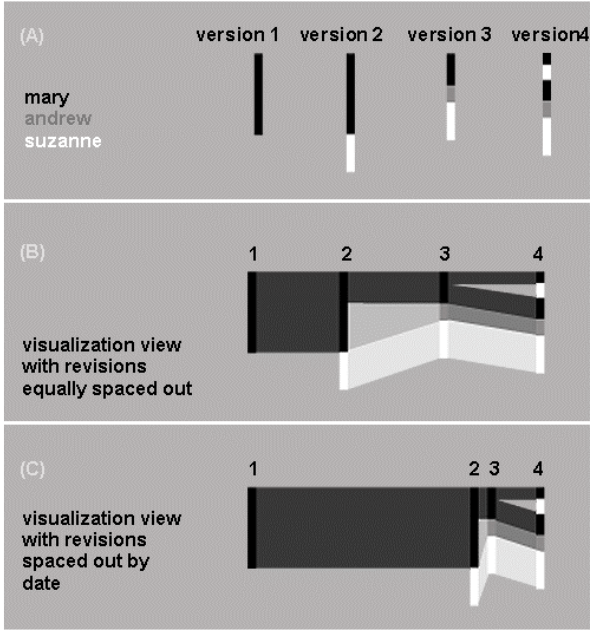
Space Flattening



2D + TIME

History Flow

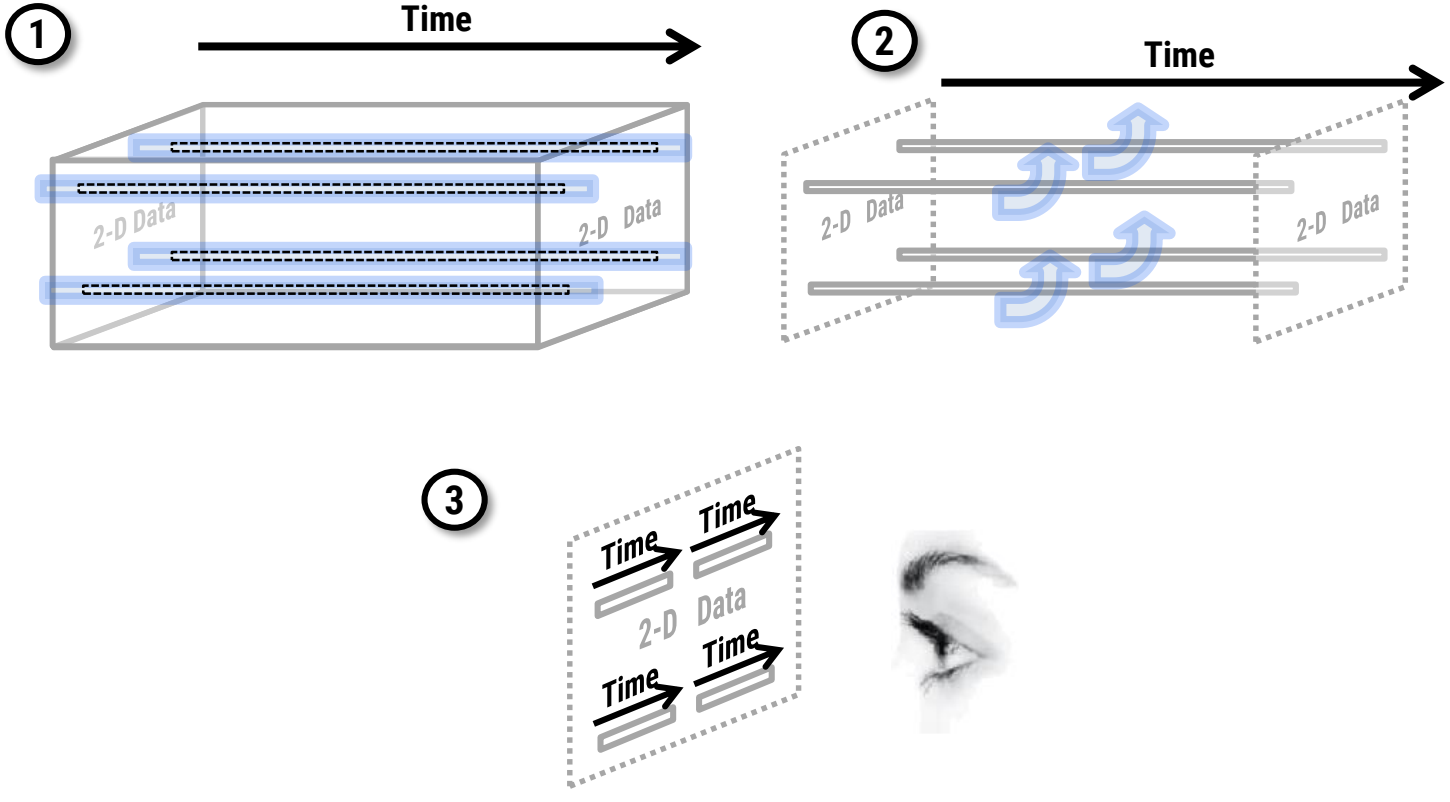




Viegas et al, 2003

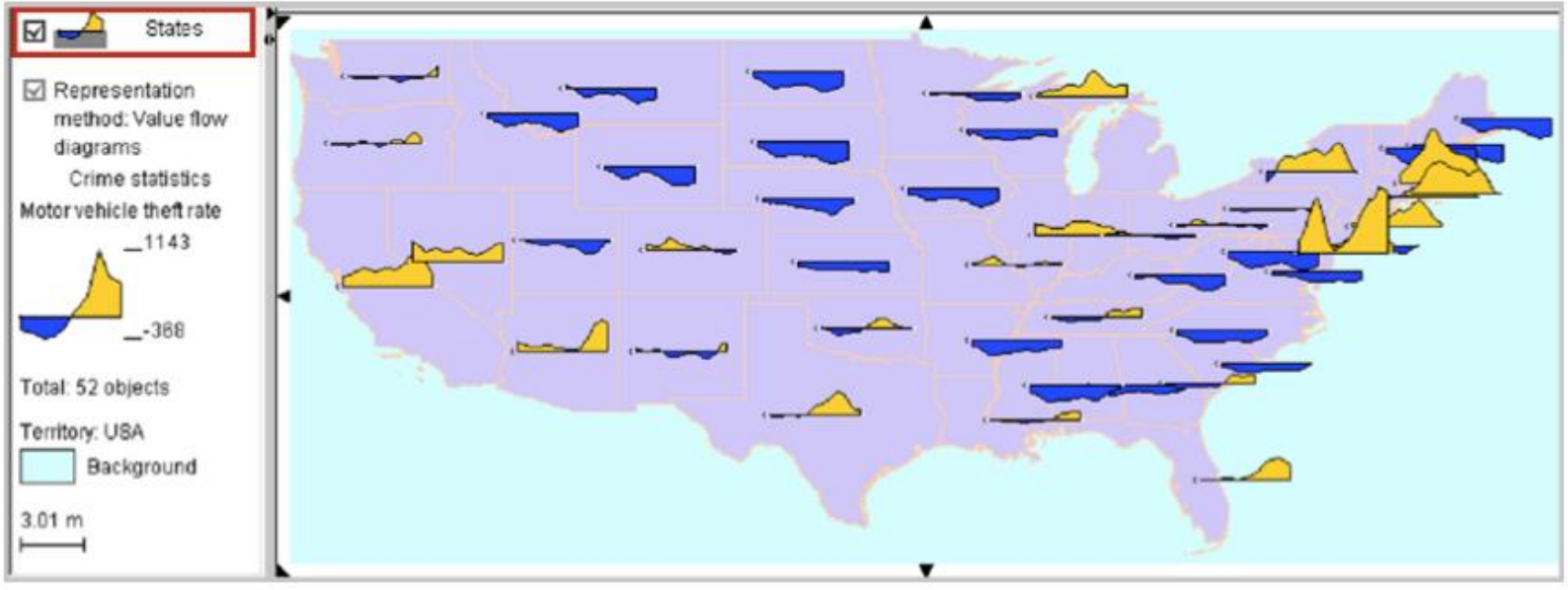
2D + TIME

Sampling



2D + TIME

Multiple Silhouette Graphs



Andrienko and Adrienko, 2004

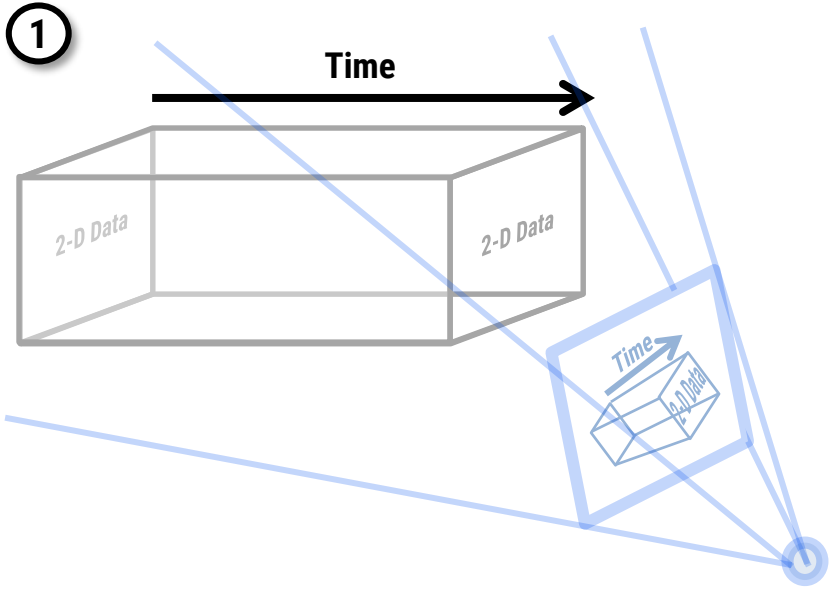
2D + TIME

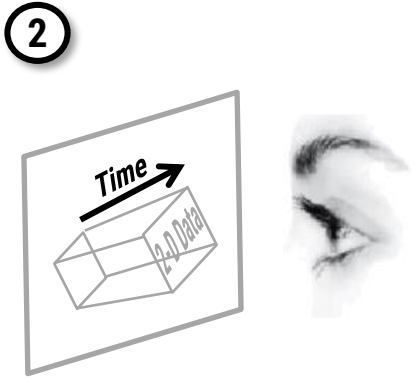
Planning Polygons

Shanbhag, 2005

2D + TIME

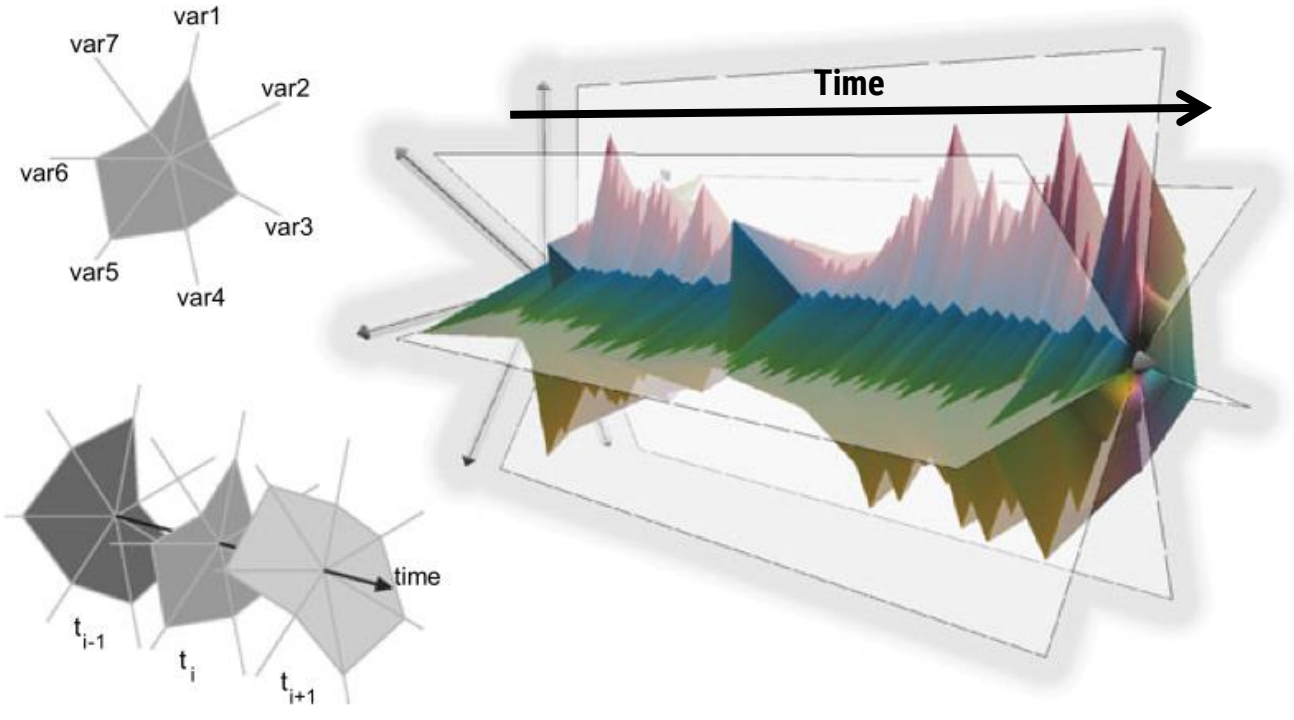
3D Rendering





2D + TIME

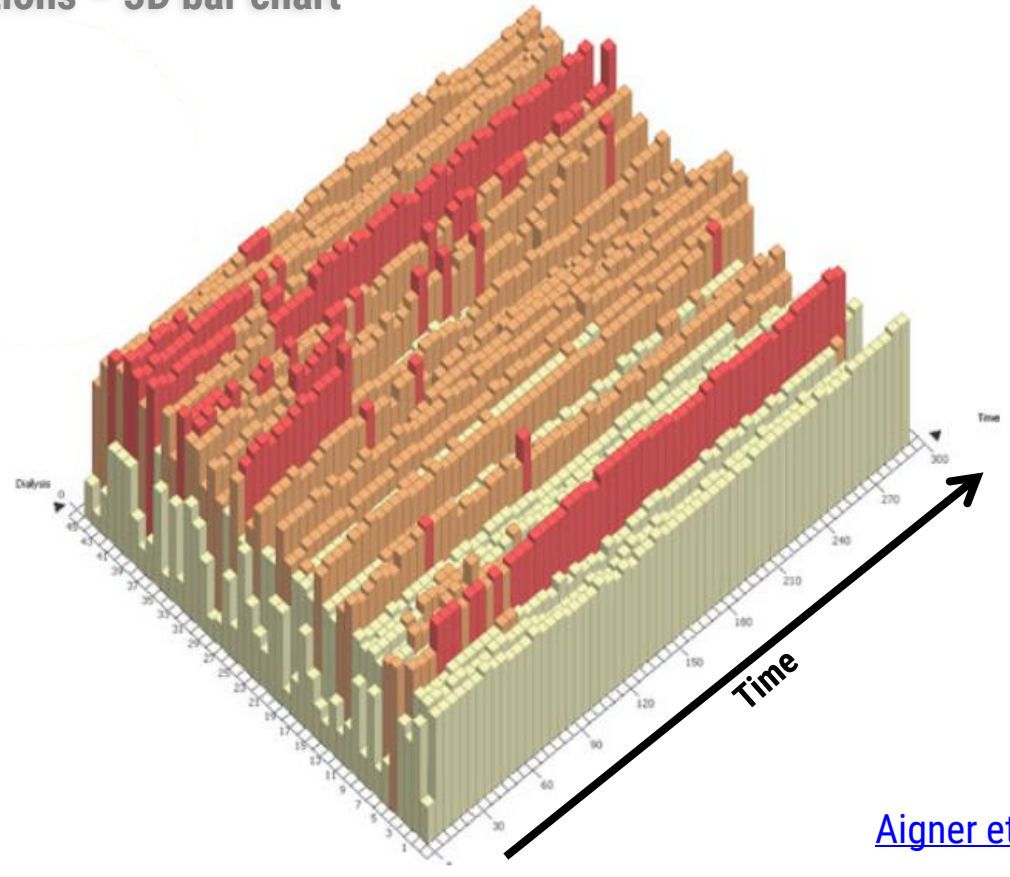
3D visualizations - Kiviat Tube



Aigner et al, 2011

2D + TIME

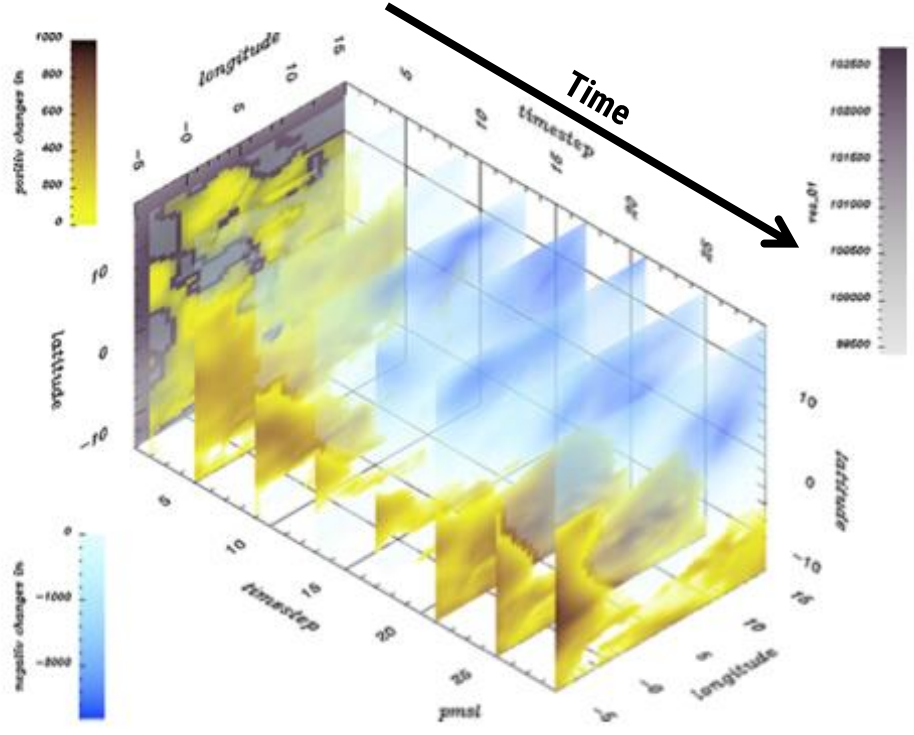
3D visualizations – 3D bar chart



Aigner et al, 2011

2D + TIME

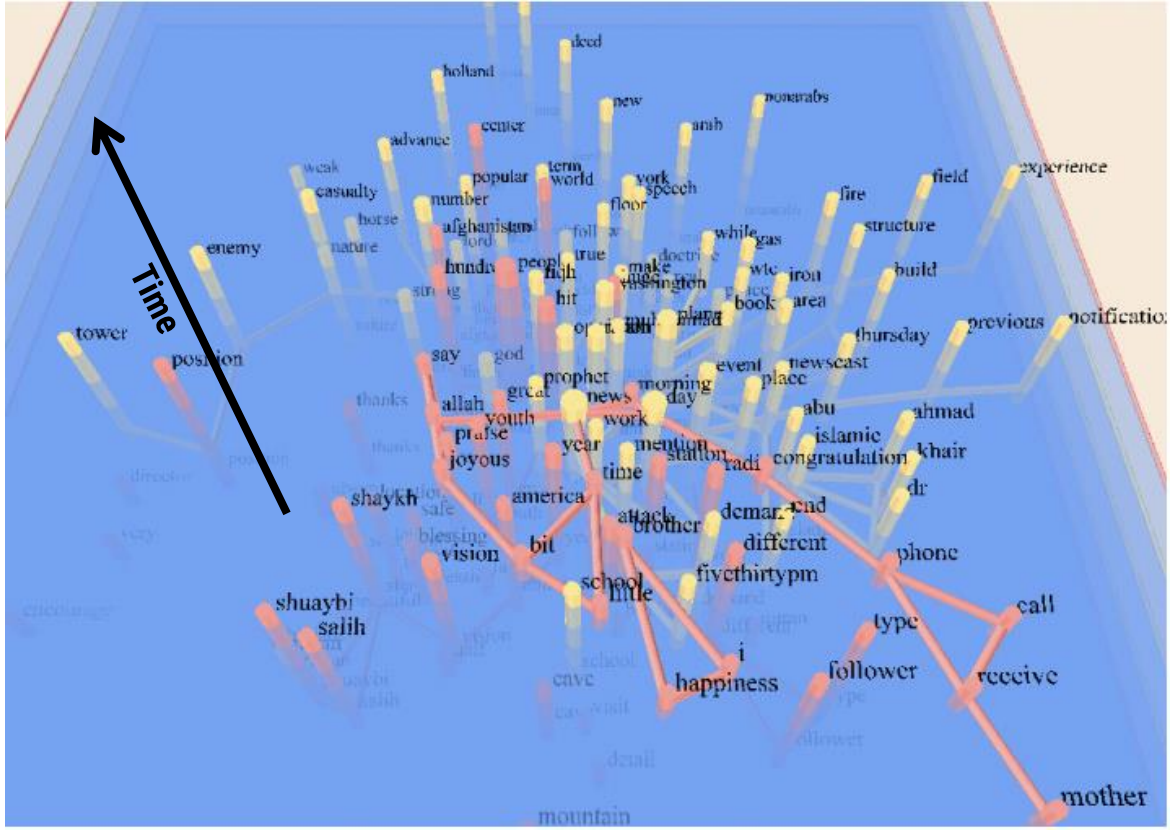
3D visualizations – Climate data



Aigner et al, 2011

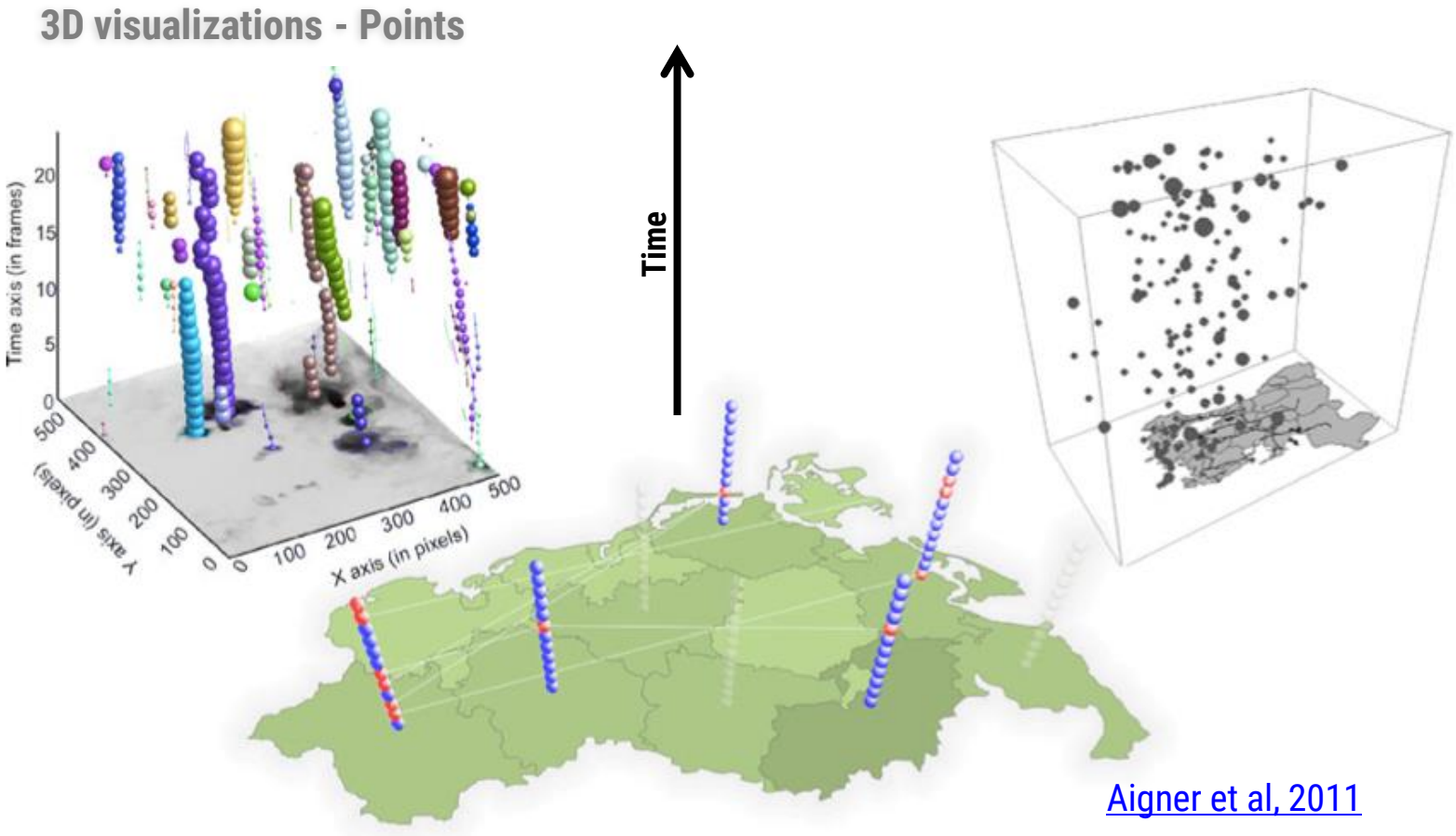
2D + TIME

3D visualizations – Time-evolving graphs



[Brandes and Corman, 2002]

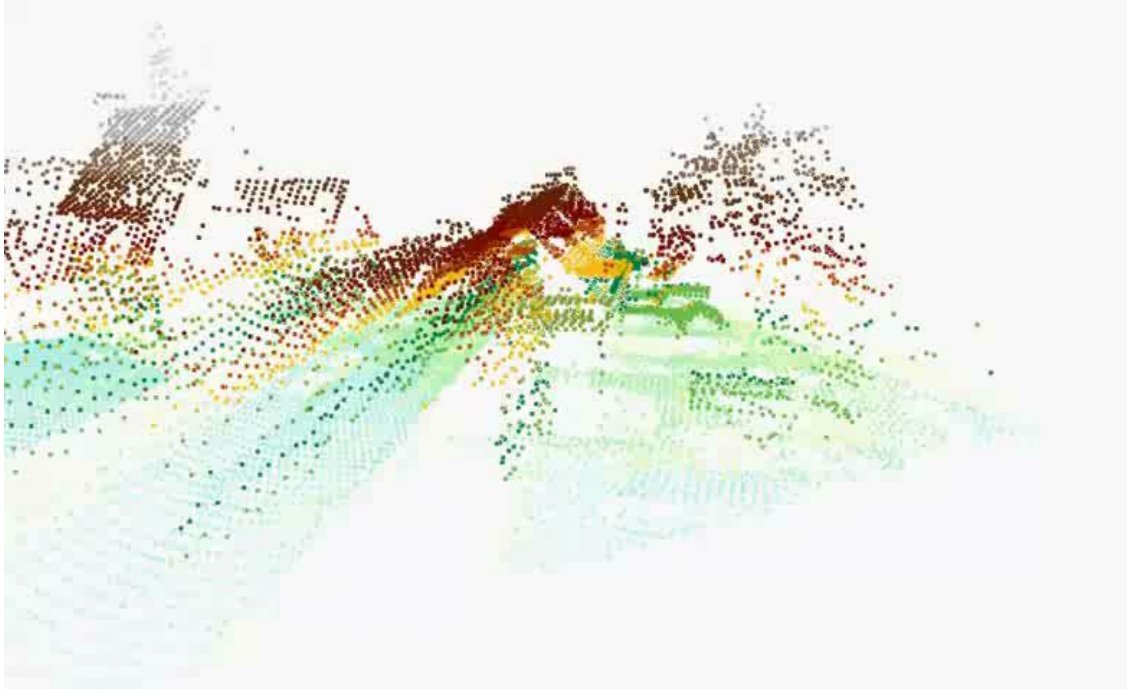
2D + TIME



Aigner et al, 2011

2D + TIME

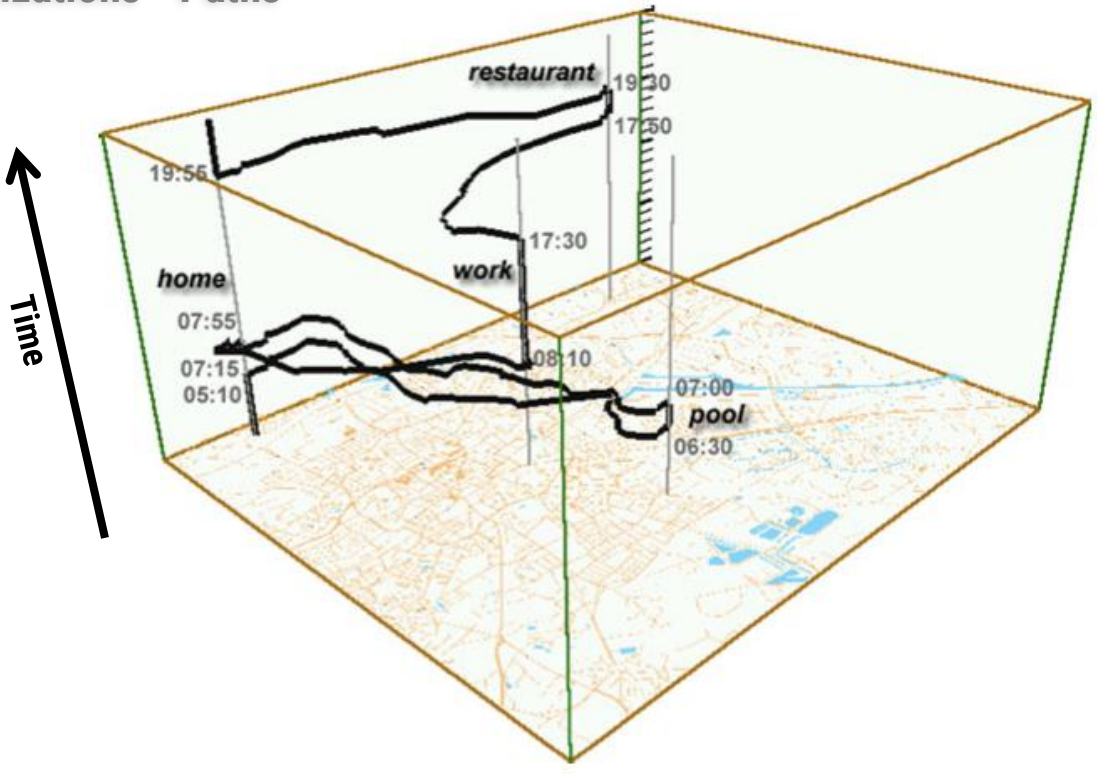
3D visualizations - Points



(video source)

2D + TIME

3D visualizations - Paths

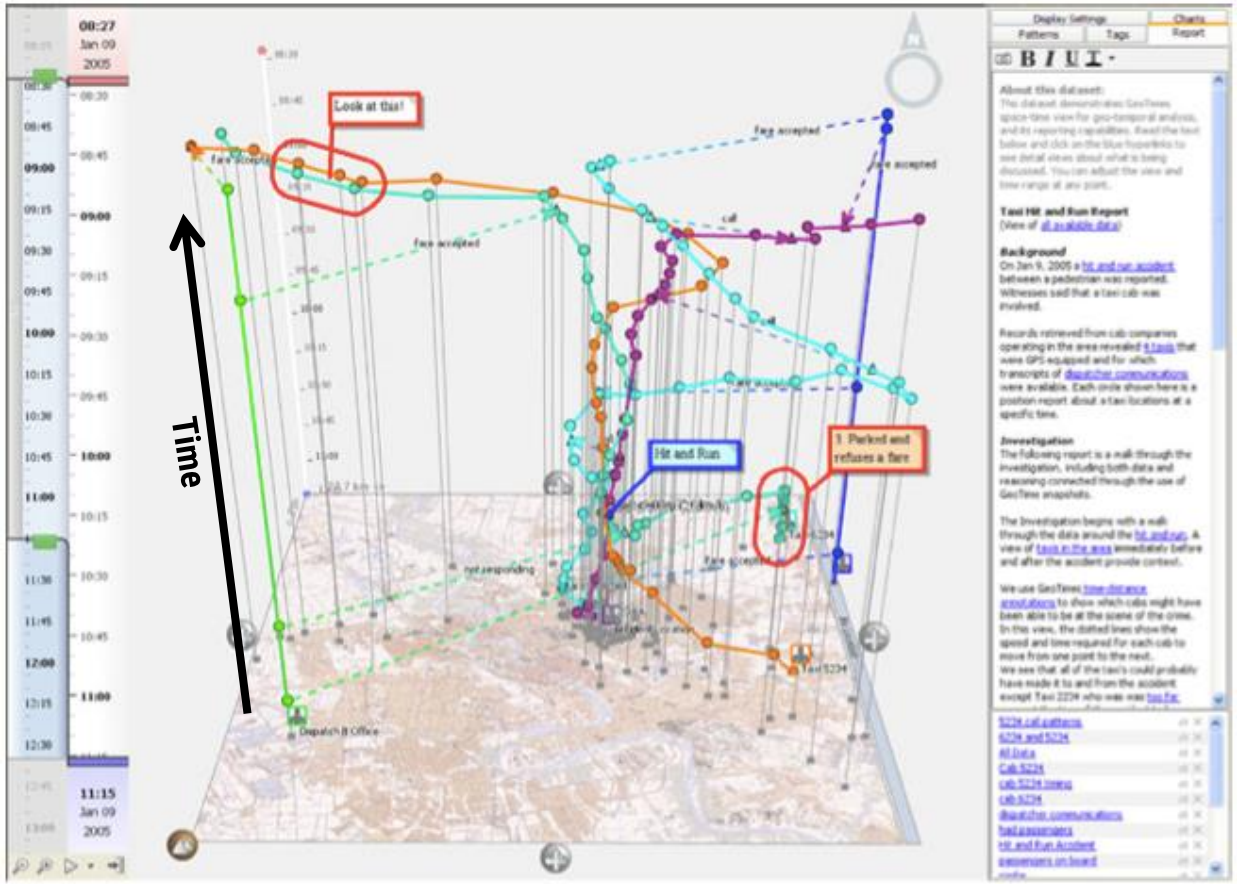


Kraak, 2003. Cited in Aigner et al, 2011

2D + TIME

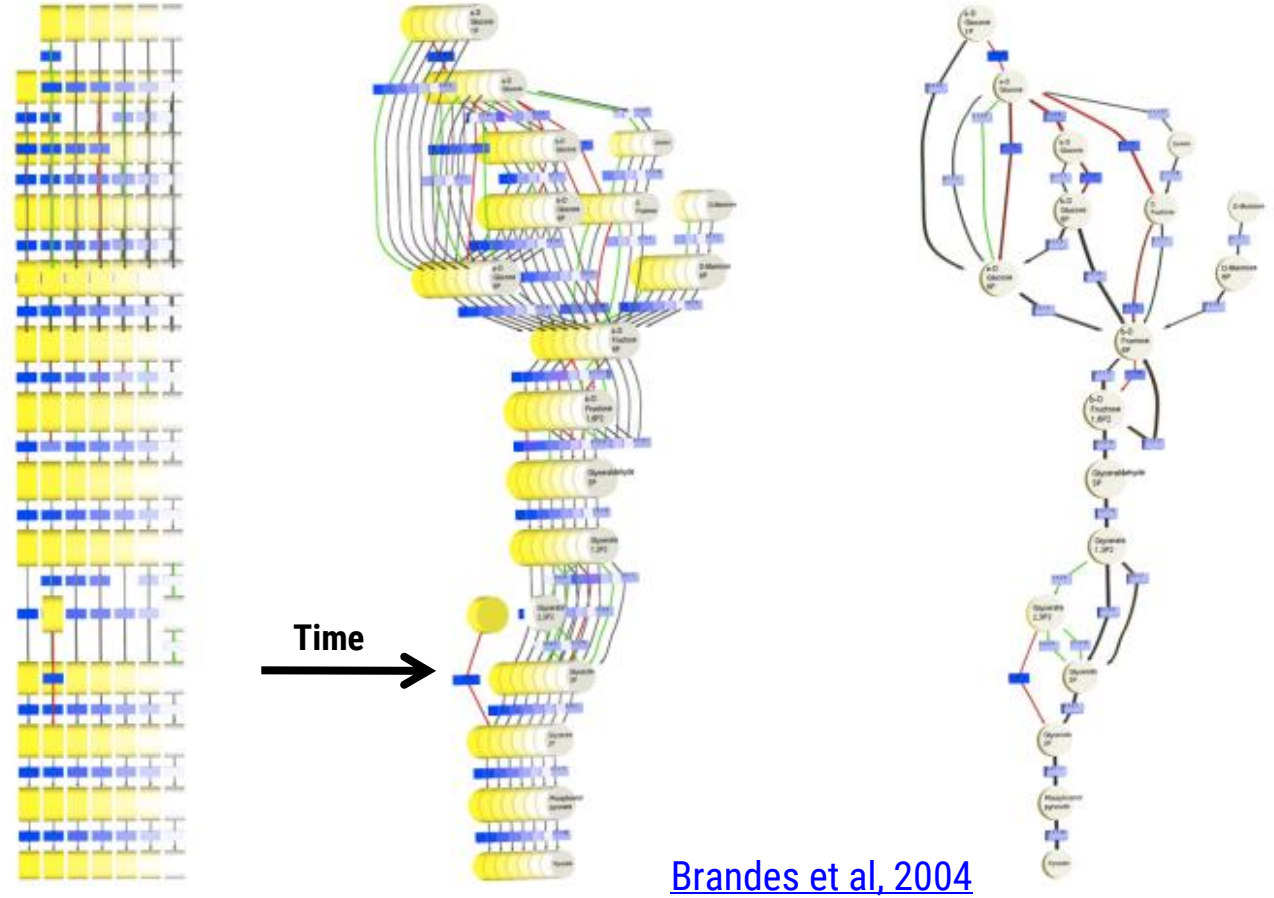
3D visualizations - GeoTime

geotime.com



2D + TIME

3D visualizations – Time-evolving graphs

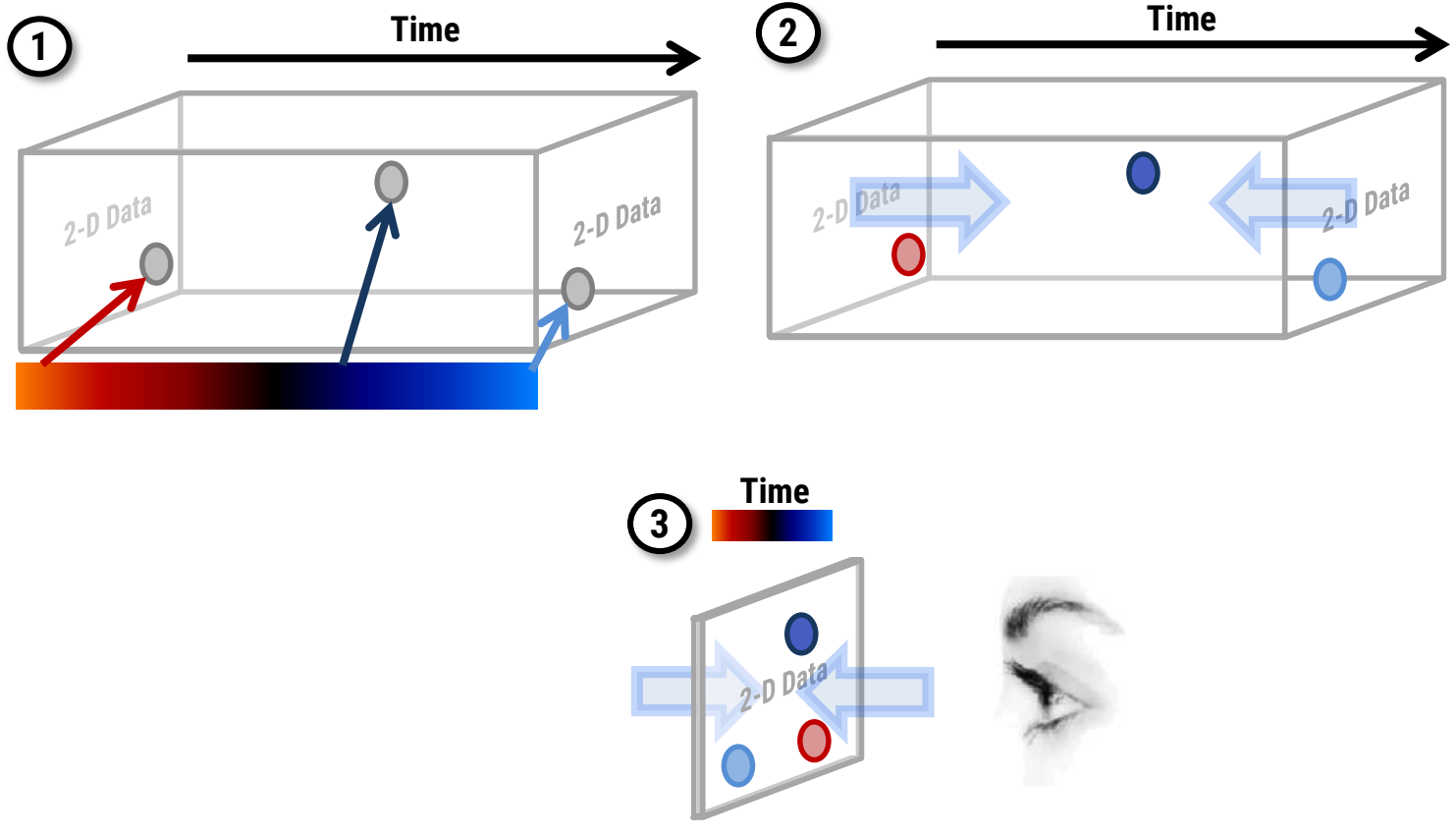


Brandes et al, 2004

MAPPING TIME TO SPACE

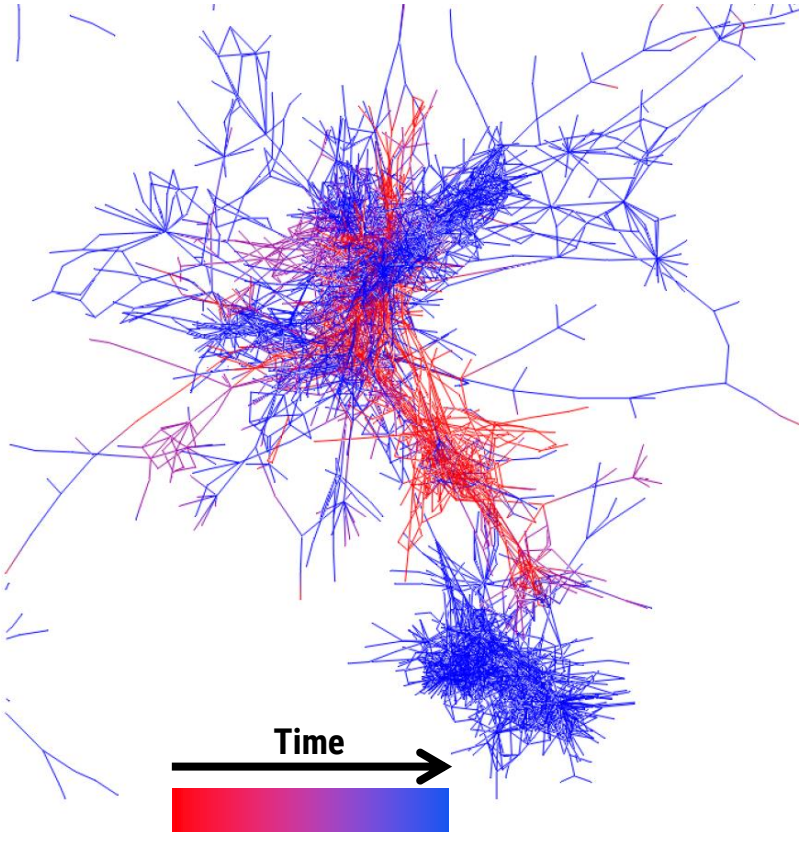
2D + TIME

Colored Time Flattening



2D + TIME

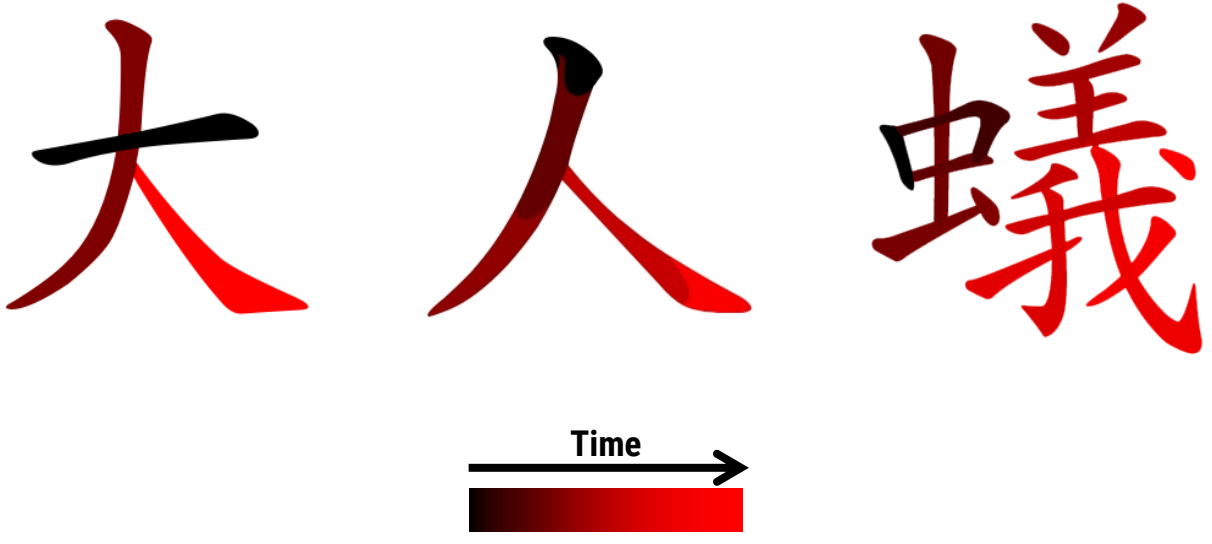
Using Color – GEOVOL



Collberg et al, 2003

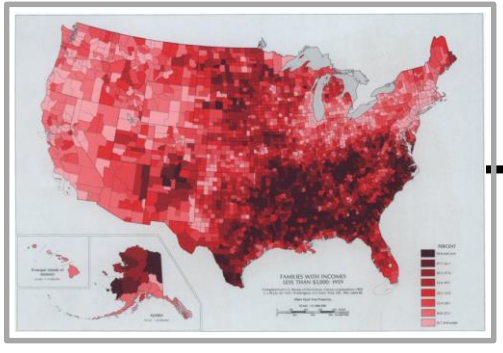
2D + TIME

Using Color – Stroke Order



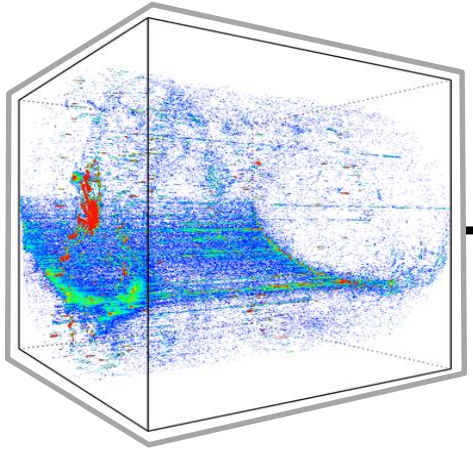
User:Yug

MAPPING TIME TO AN AXIS



2D Data

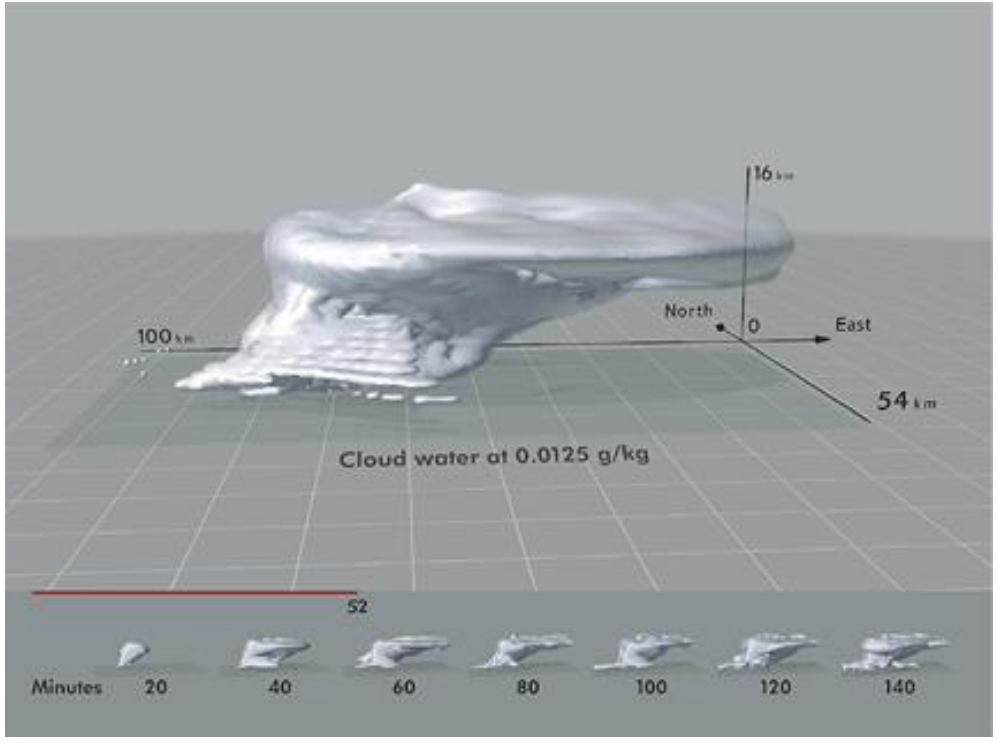
MAPPING TIME TO AN AXIS



3D Data

3D + TIME

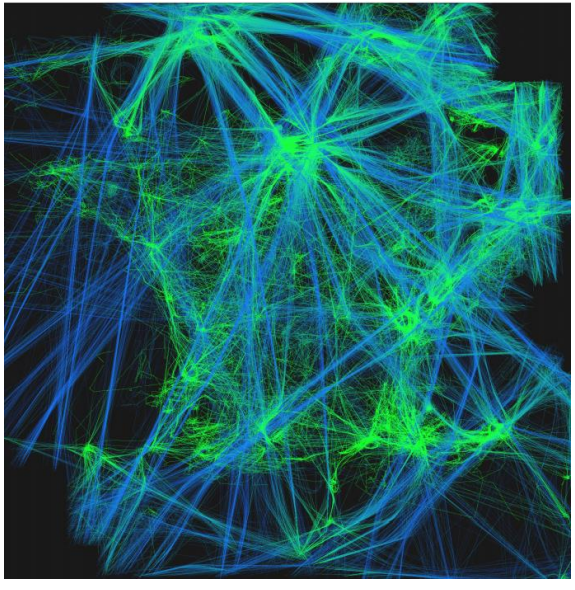
Slicing + Juxtaposing – 3D Small Multiples

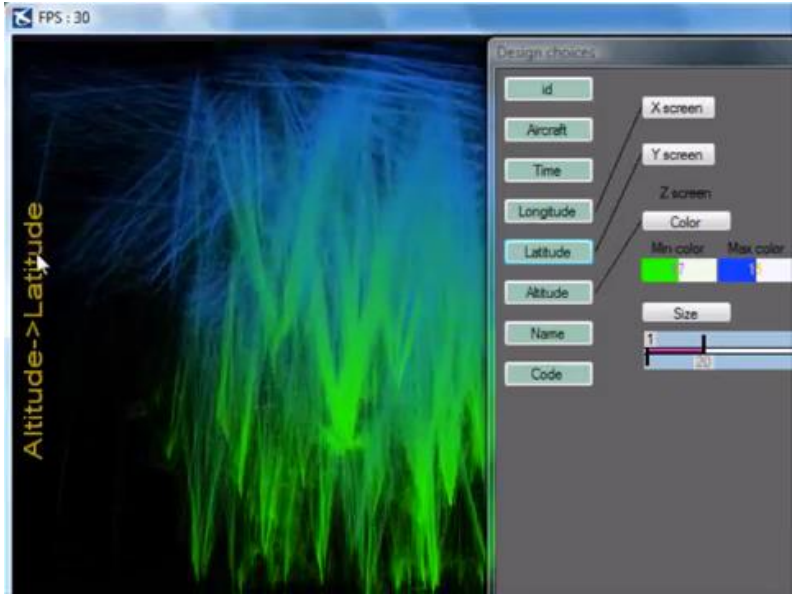


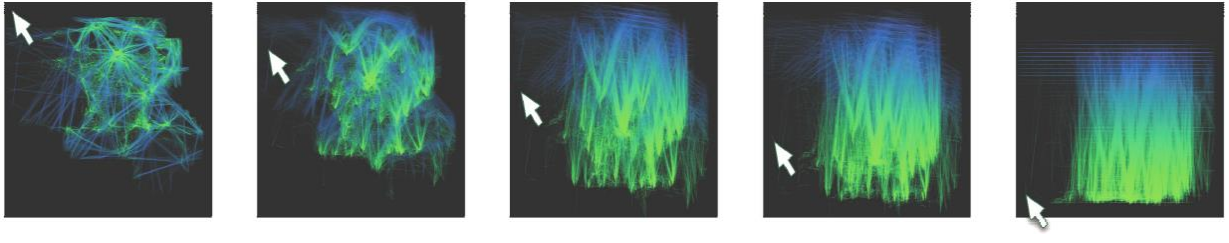
Tufte and Bushell, 2005

3D + TIME

Flattening - FromDaDy



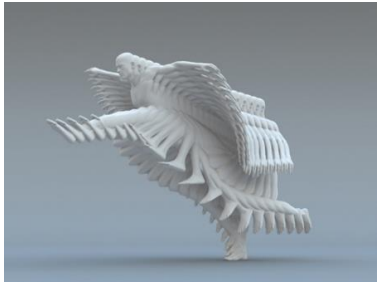




[Hurter et al, 2009]

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

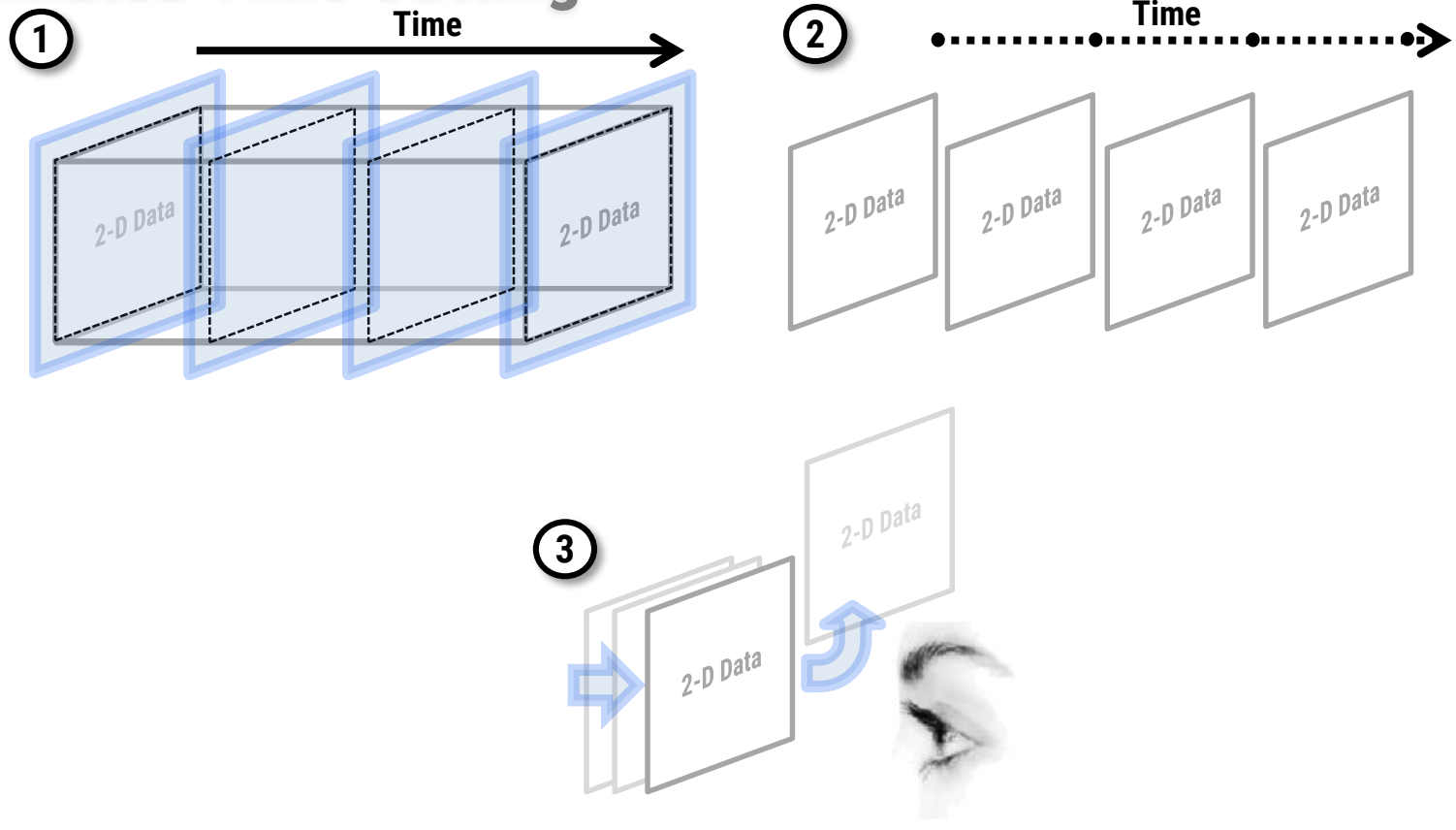
- Static Visual Content
  - Visual content that is fixed over time
- Dynamic Visual Content
  - Visual content that changes over time
- Interactive Visual Content
  - Visual content that changes over time
  - Under the user's influence

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

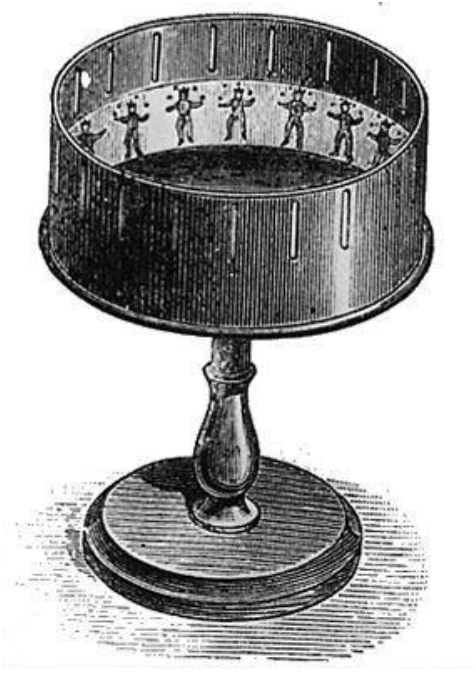
(image source)

(image source)

Eadweard J. Muybridge, 1879

2D + TIME

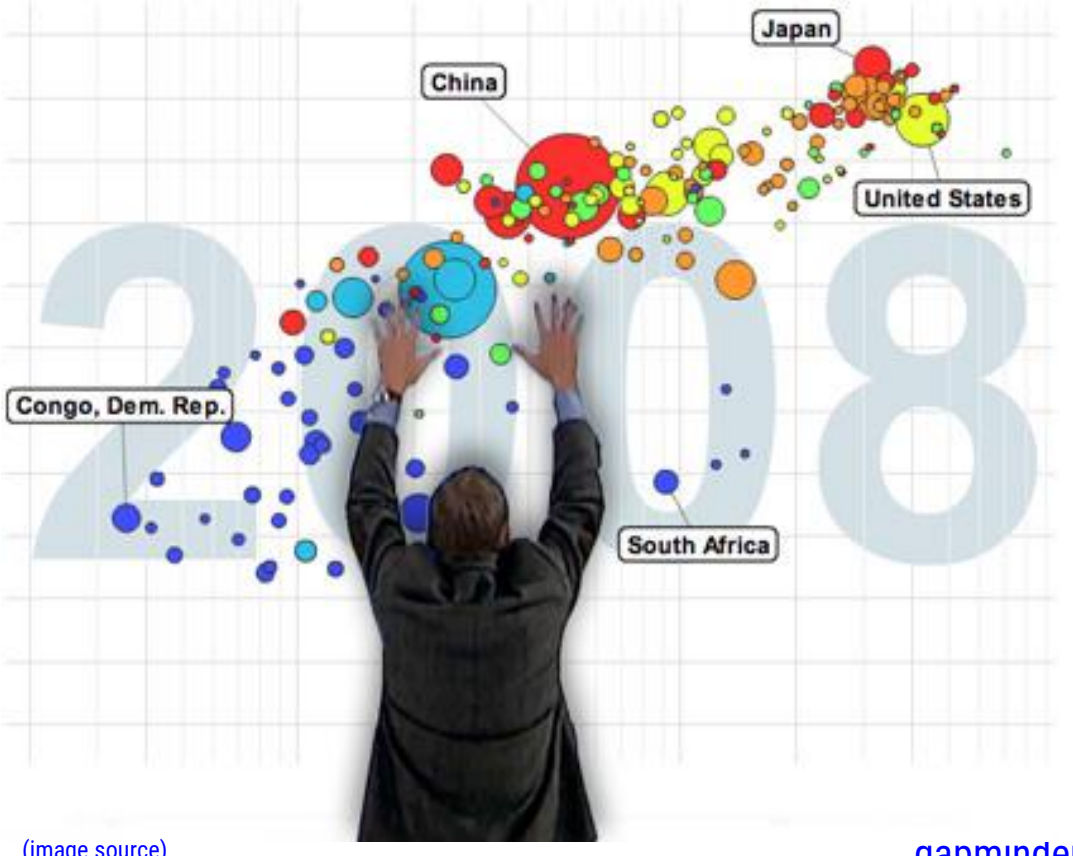
Zoetrope



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

2D + TIME

Animation – Gap Minder



(image source)

gapminder.org

2D + TIME

Animation – Gap Minder

(video source)

gapminder.org

2D + TIME

Animation vs. Other Approaches

(image source)

2D + TIME

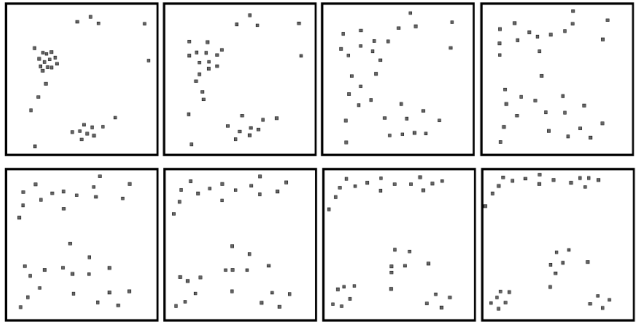
Animation vs. Other Approaches

(image source)

2D + TIME

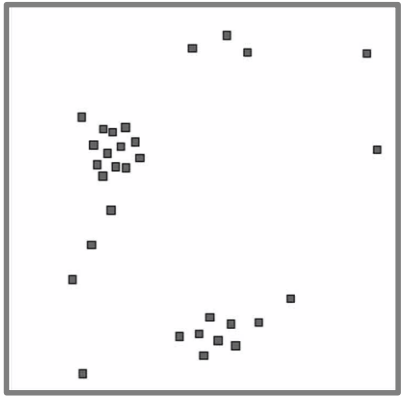
Animation vs. Other Approaches

Small Multiples



Trails (Coloring + Flattening)

Animation

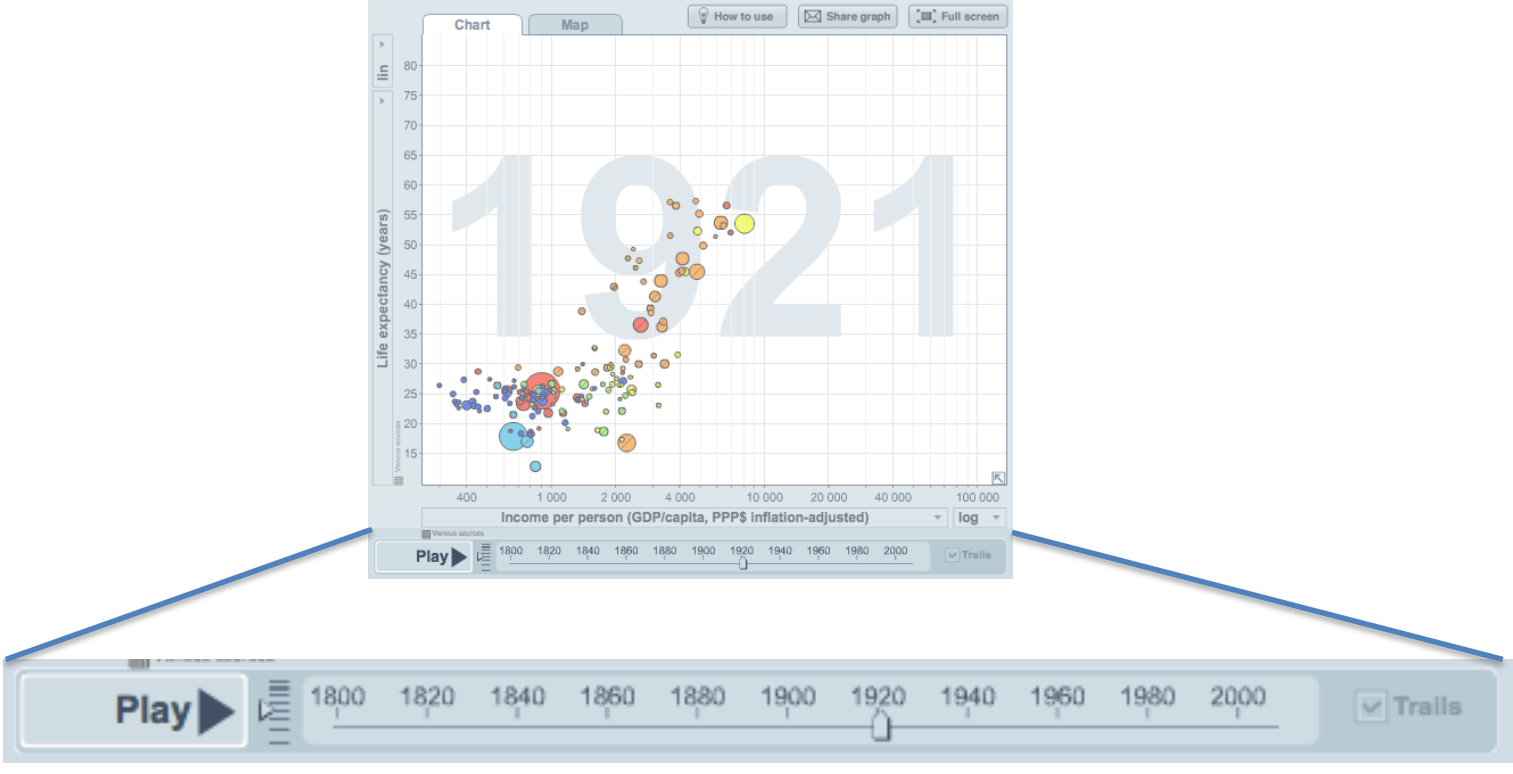


2D + TIME

Animation vs. Other Approaches

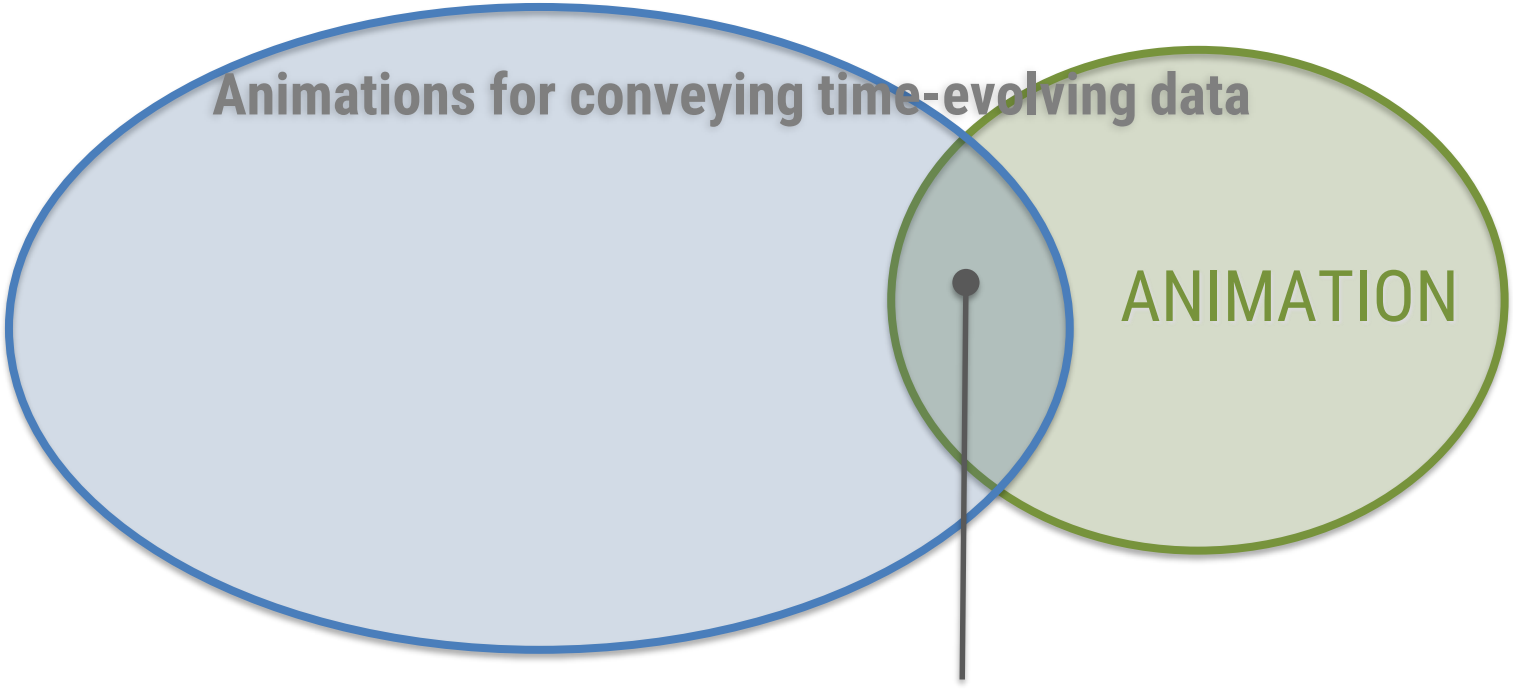
2D + TIME

Time Slider – GapMinder



gapminder.org

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
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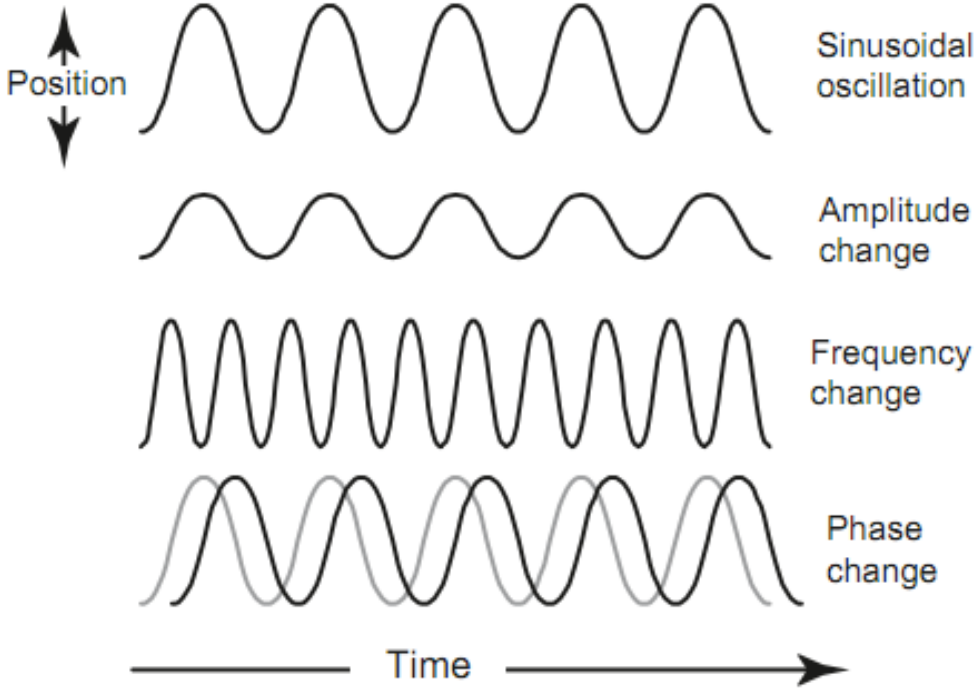
ANIMATIONS

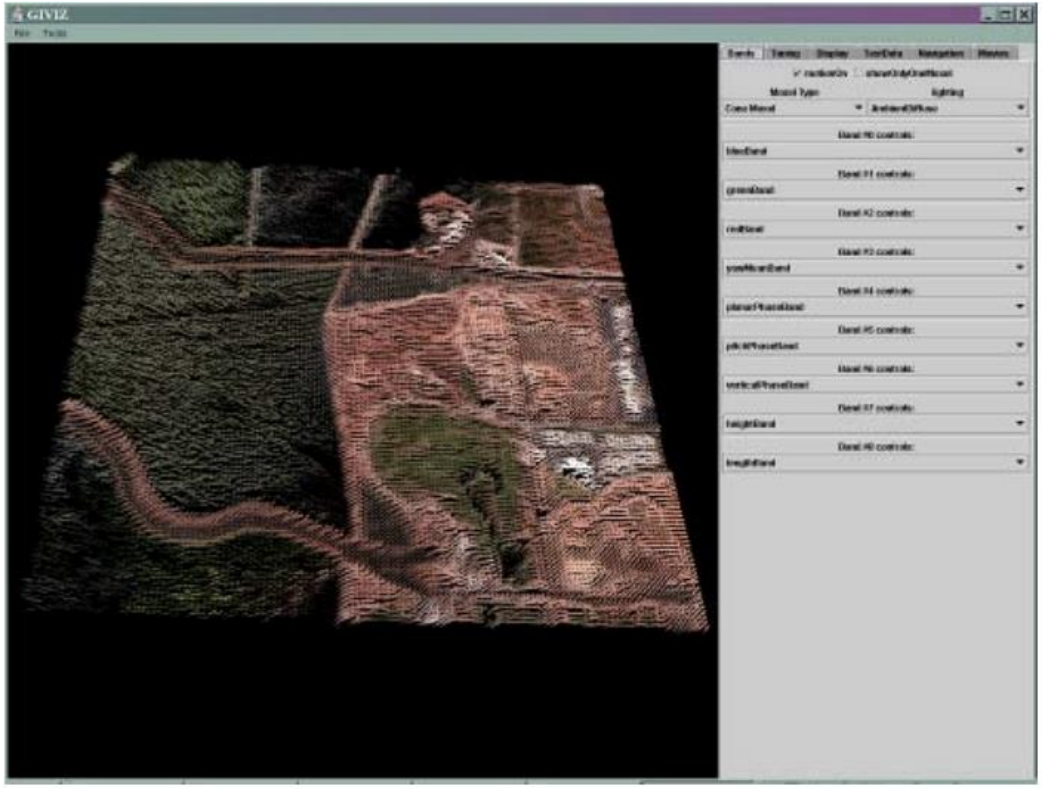
Motion primitives as visual variables



Ware and Bobrow, 2006. Also see Bartram.

ANIMATIONS

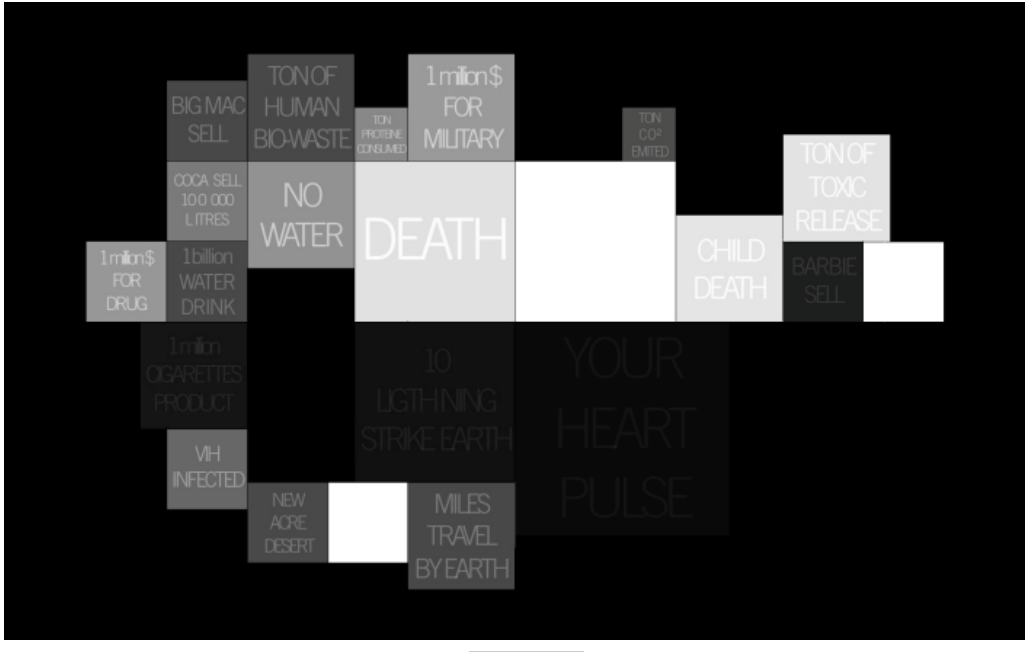
Motion primitives as visual variables



Ware and Bobrow, 2006. Also see Bartram.

ANIMATIONS

Rhythm as a visual variable



LINK

Samuel Huron, 2008

ANIMATIONS

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

ANIMATED TRANSITIONS

Change Blindness Demo

Rensink, 2002

ANIMATED TRANSITIONS

Change Blindness Demo

Rensink, 2002

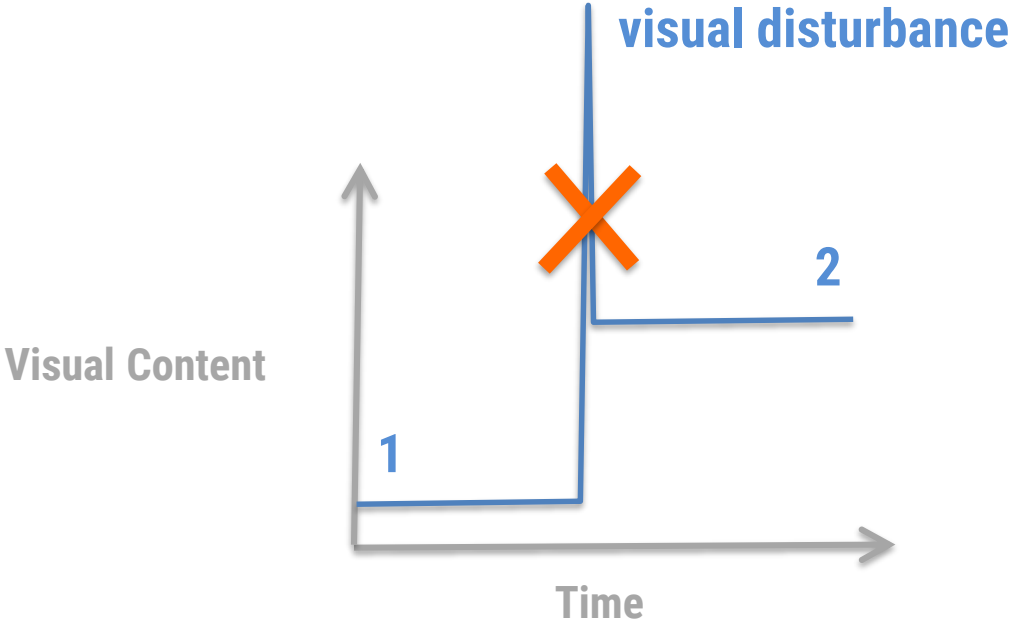
ANIMATED TRANSITIONS

Change Blindness Demo – Try again

Rensink, 2002

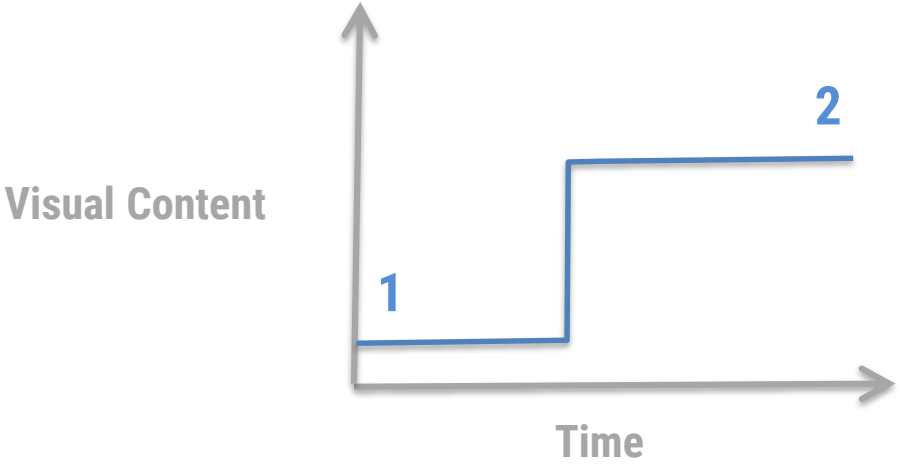
ANIMATED TRANSITIONS

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

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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.

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ANIMATED TRANSITIONS

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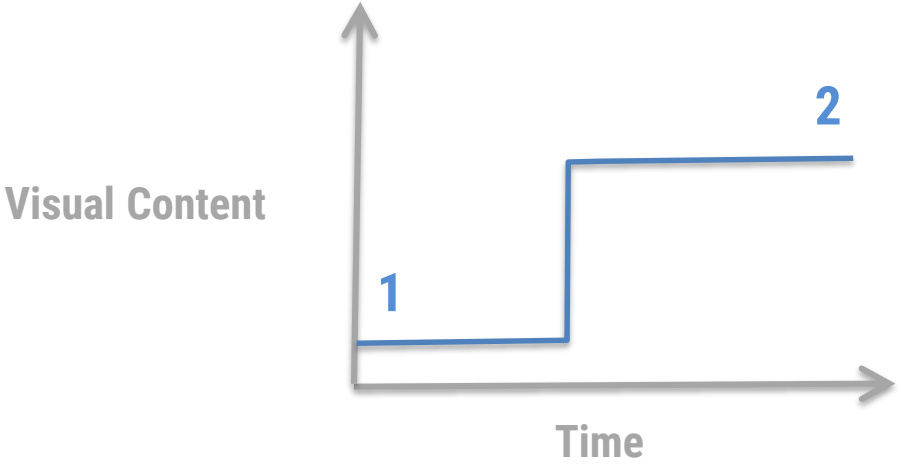
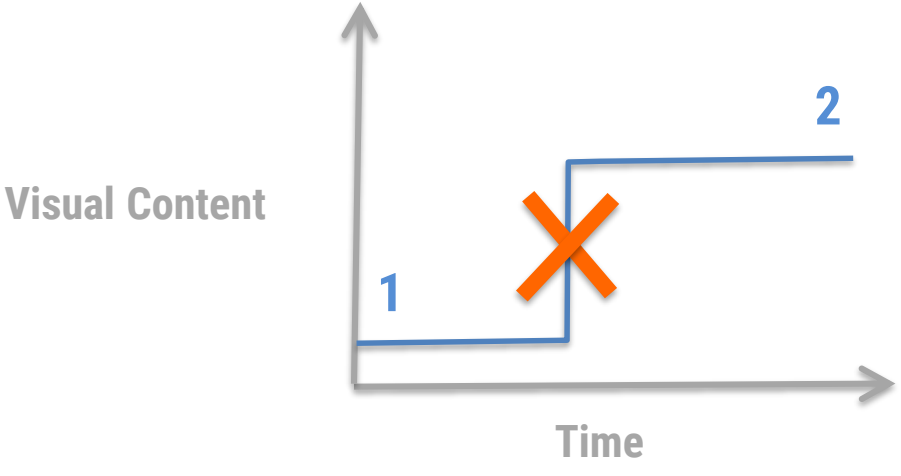
ANIMATED TRANSITIONS

Understanding Visual Transitions



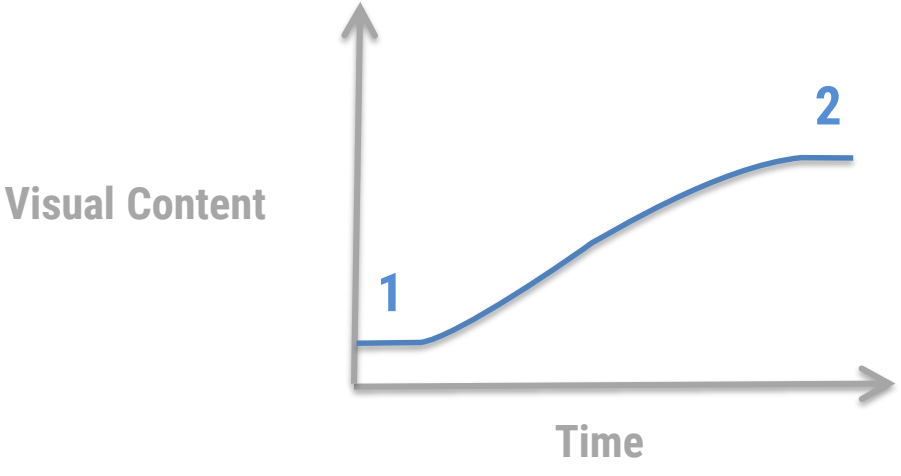
ANIMATED TRANSITIONS

Understanding Visual Transitions



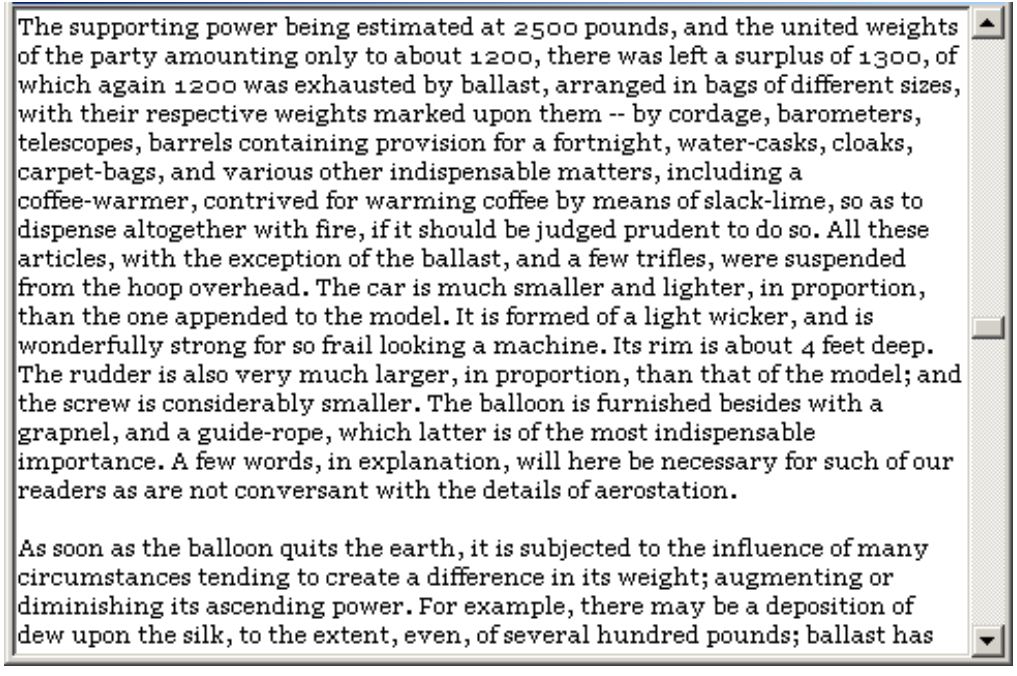
ANIMATED TRANSITIONS

Understanding Visual Transitions



ANIMATED TRANSITIONS

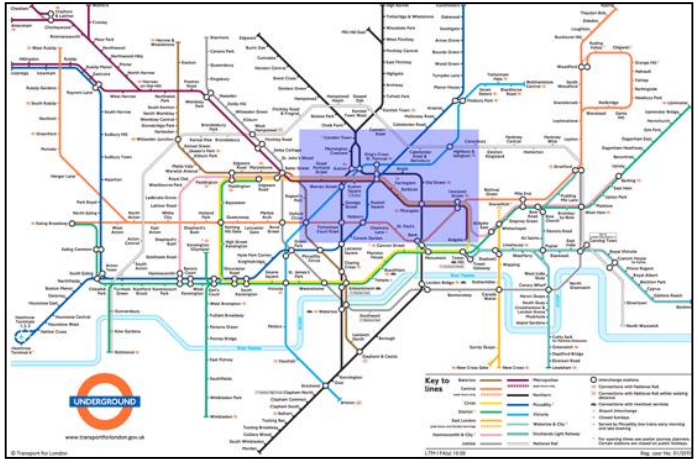
Help when scrolling documents

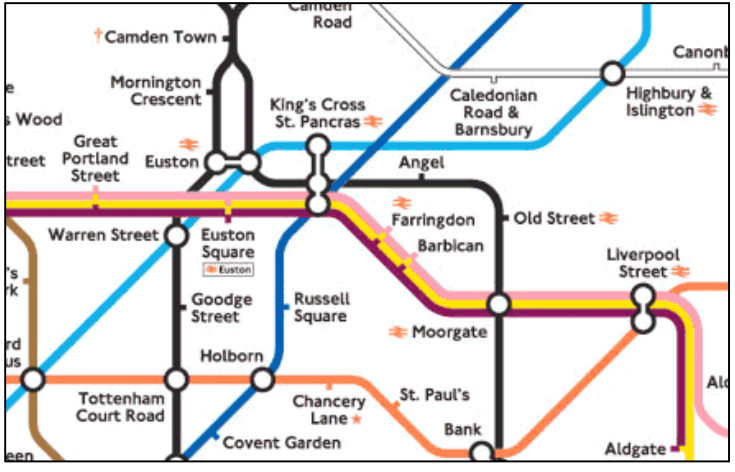


Klein & Bederson, 2005

ANIMATED TRANSITIONS

Help when panning and zooming

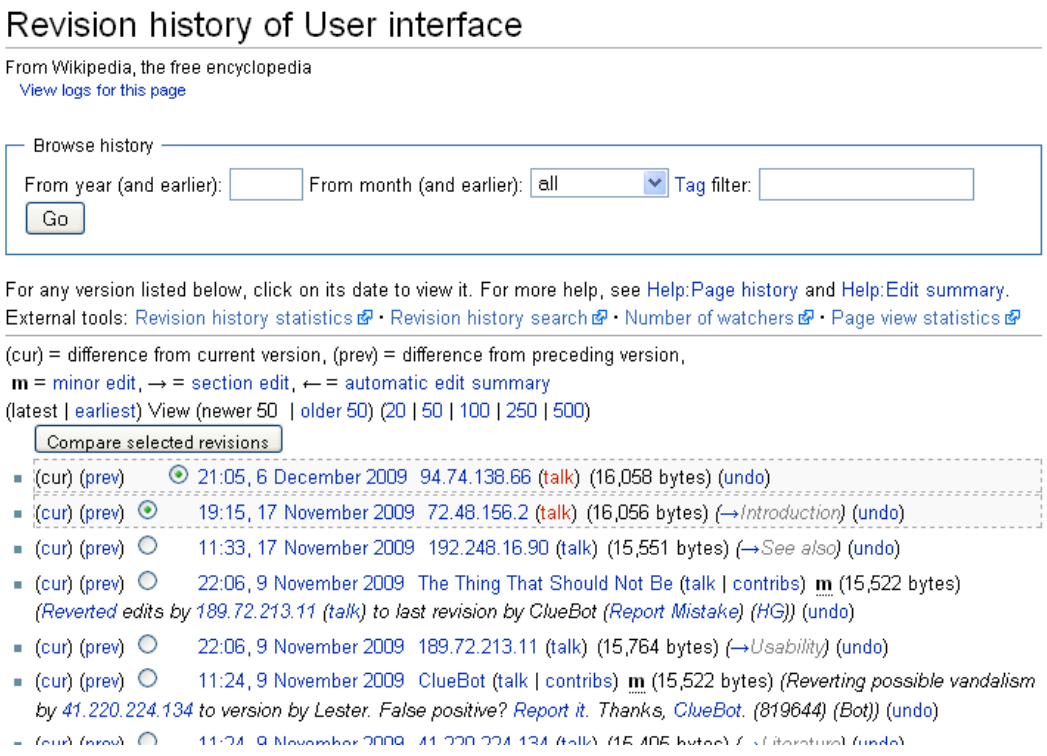




[Shanmugasundaram & Irani, 2008]

ANIMATED TRANSITIONS

Help when navigating document revisions



Revision history of User interface

From Wikipedia, the free encyclopedia

View logs for this page

Browse history

From year (and earlier): From month (and earlier): all Tag filter:

Go

For any version listed below, click on its date to view it. For more help, see Help:Page history and Help:Edit summary.
External tools: Revision history statistics · Revision history search · Number of watchers · Page view statistics

(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)

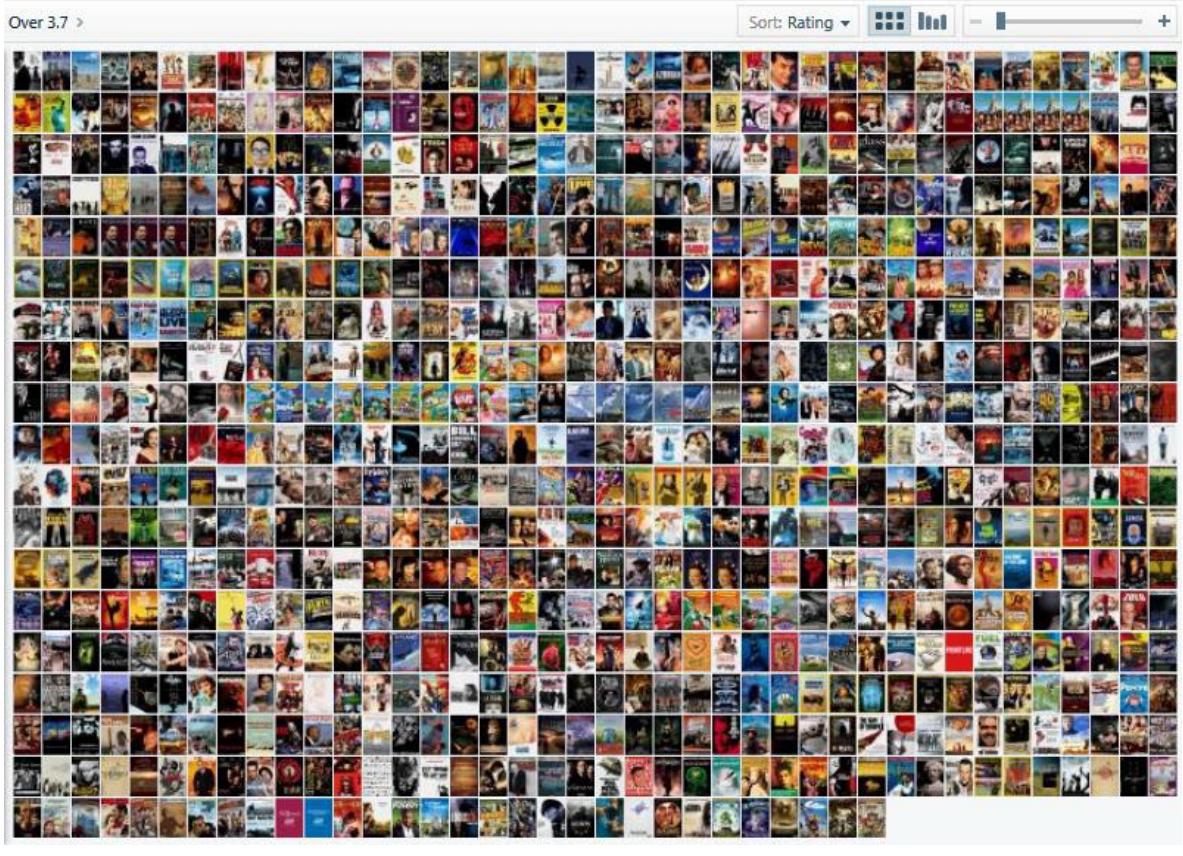
Compare selected revisions

- (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)

Chevalier et al, 2010

ANIMATED TRANSITIONS

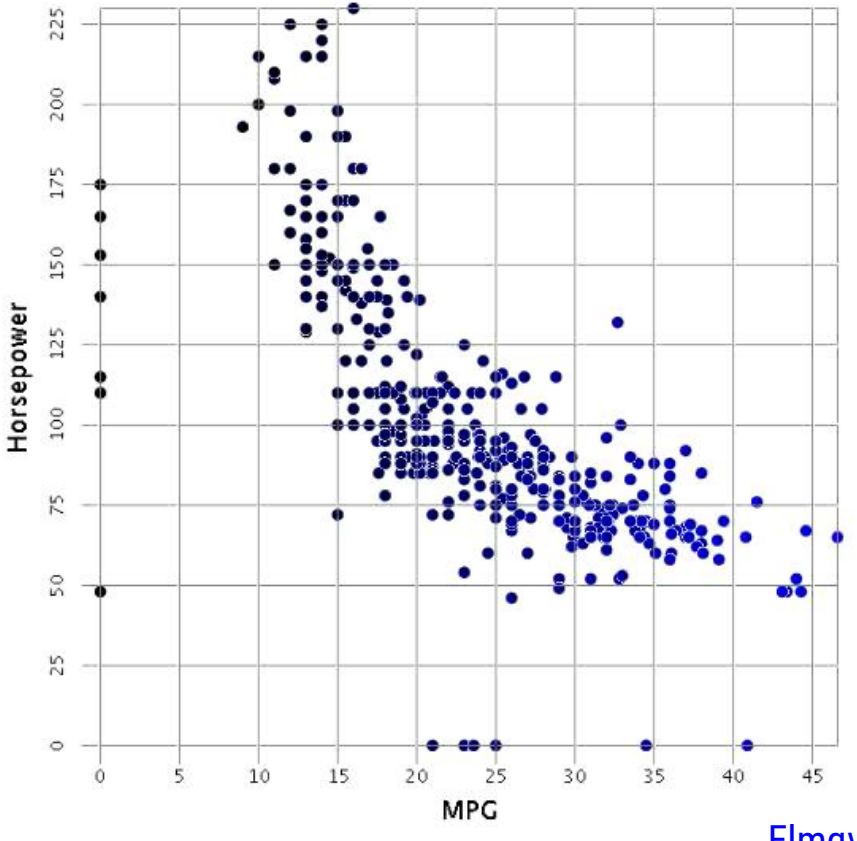
In faceted browsing - Pivot



Microsoft Pivot

ANIMATED TRANSITIONS

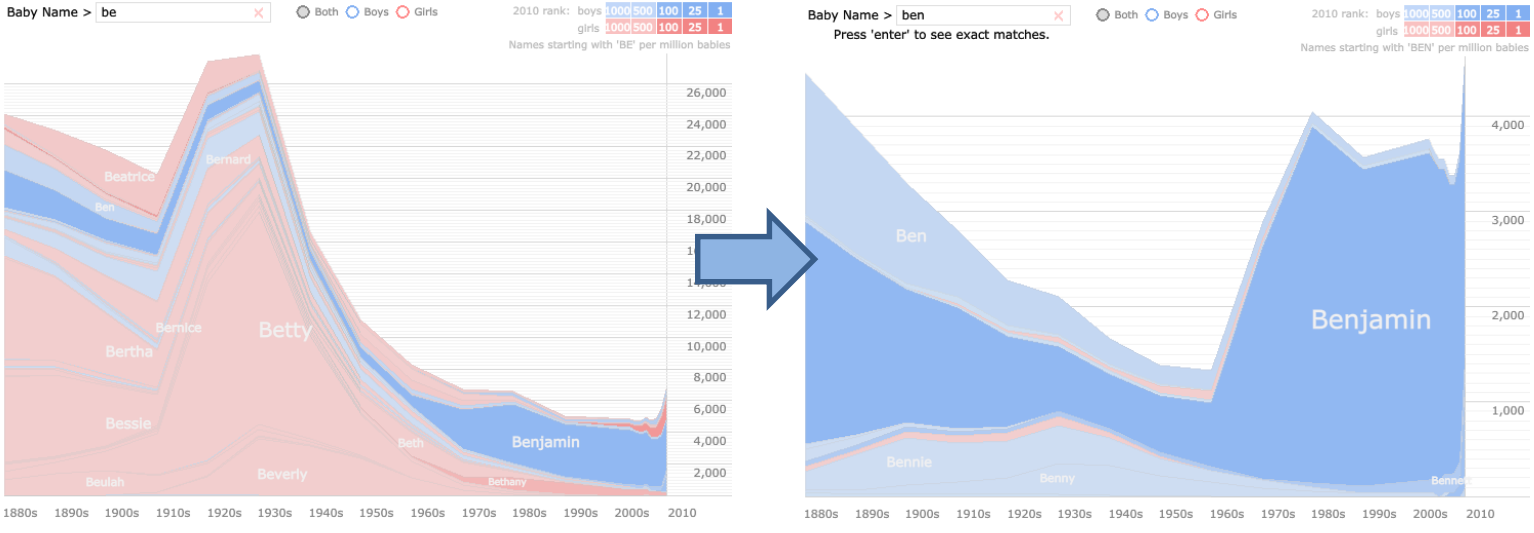
In multidimensional exploration - ScatterDice



Elmqvist et al, 2009

ANIMATED TRANSITIONS

In charts – Baby Name Voyager

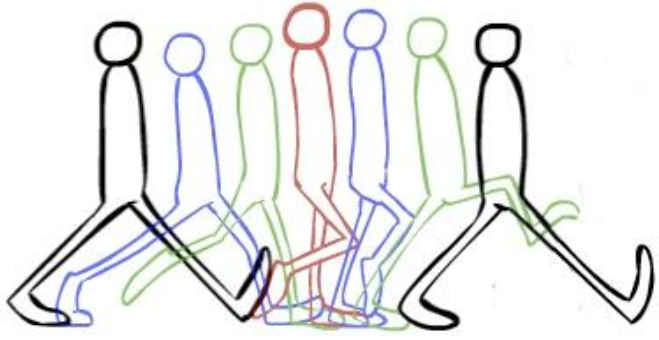


Wattenberg, 2005

ANIMATED TRANSITIONS

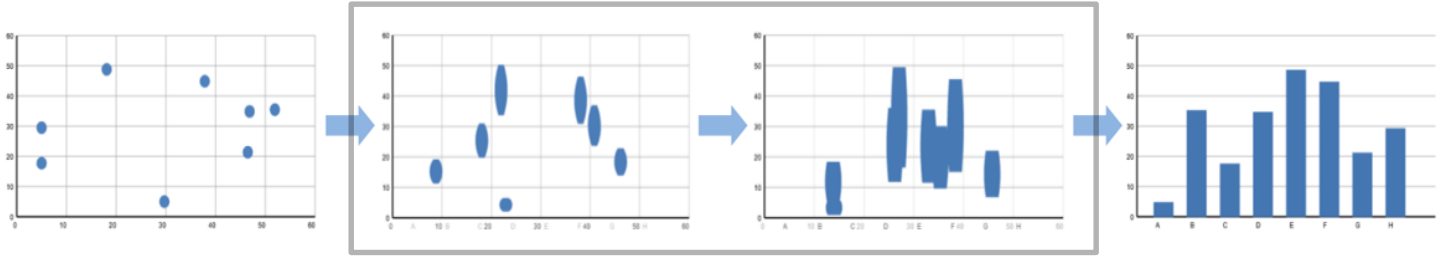
How to design them?

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

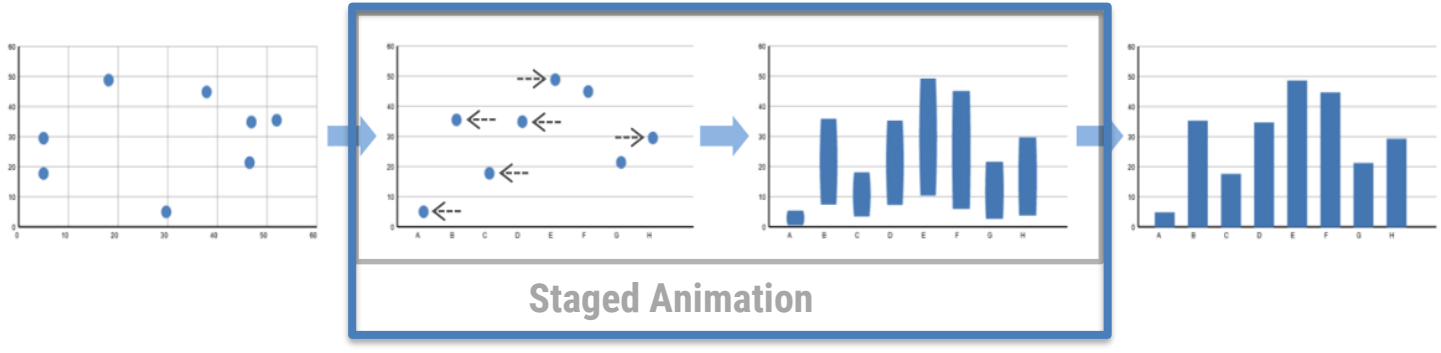


ANIMATED TRANSITIONS

Designing Animated Transitions



Direct Interpolation

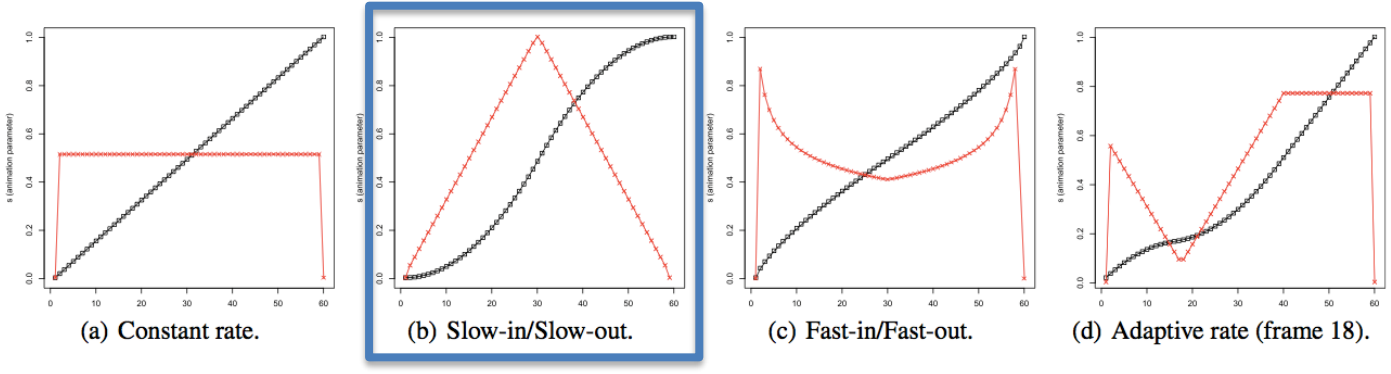


Staged Animation

Heer and Robertson, 2007

ANIMATED TRANSITIONS

Designing Animated Transitions



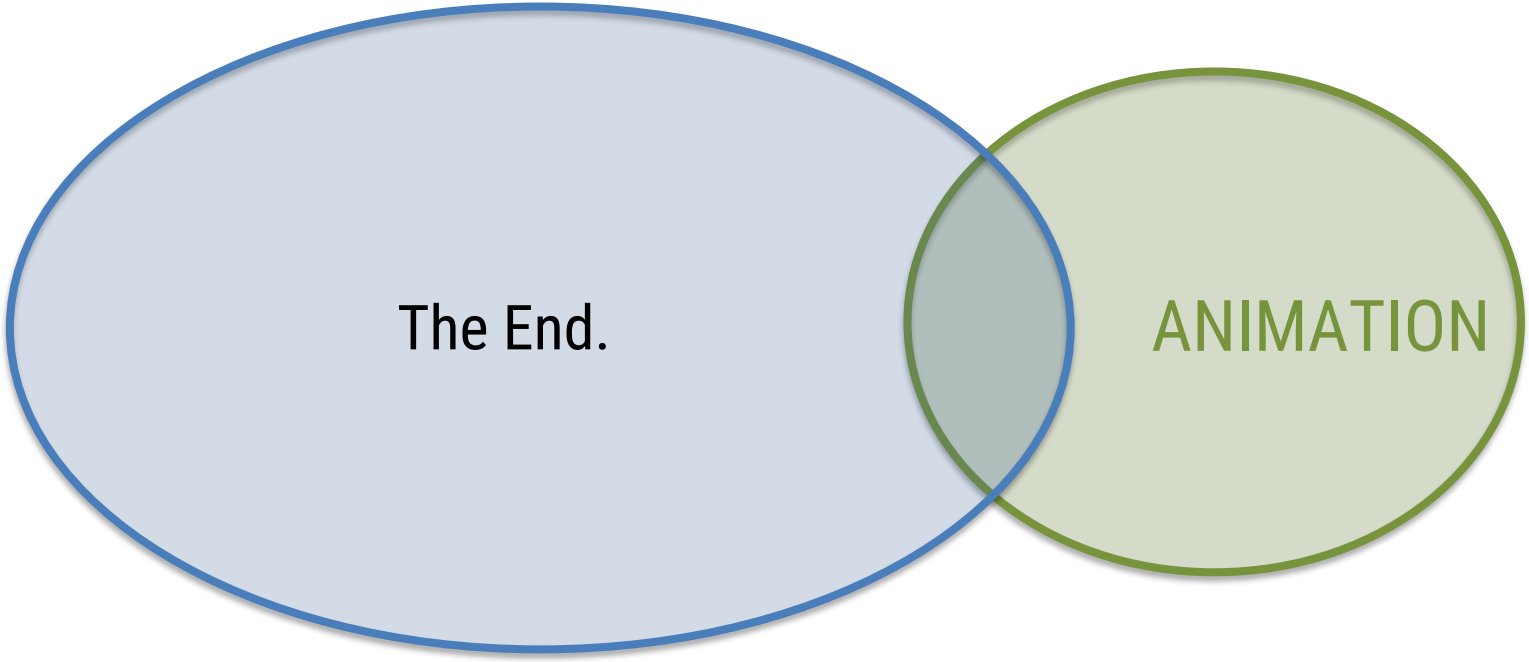
(a) Constant rate. (b) Slow-in/Slow-out. (c) Fast-in/Fast-out. (d) Adaptive rate (frame 18).

Dragicevic et al, 2011

ANIMATED TRANSITIONS

Use them!

TIME VISUALIZATION



ACKNOWLED

Slides in were inspired and adapted from slides by

- Pierre Dragicevic (Inria)