

# Visualization Types I

Hierarchy and Time

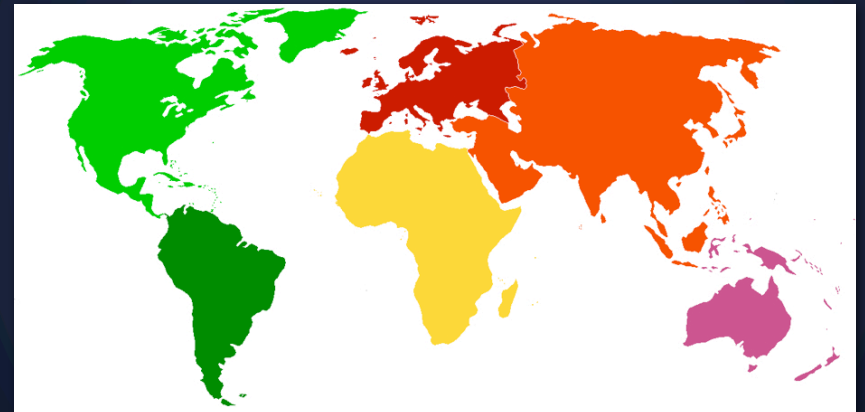
March 6, 2012 – Michael Porath

## Hierarchy

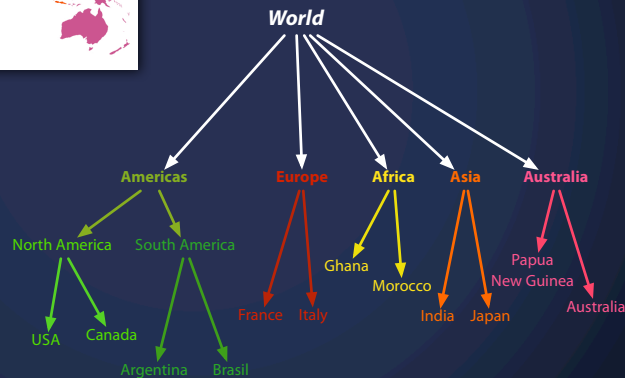
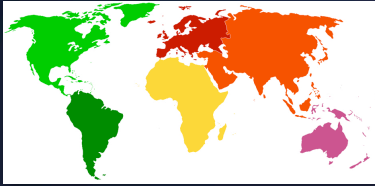
## Hierarchy != Order



## Hierarchy



# Hierarchy



# Hierarchical Data

Genealogies (Family histories)

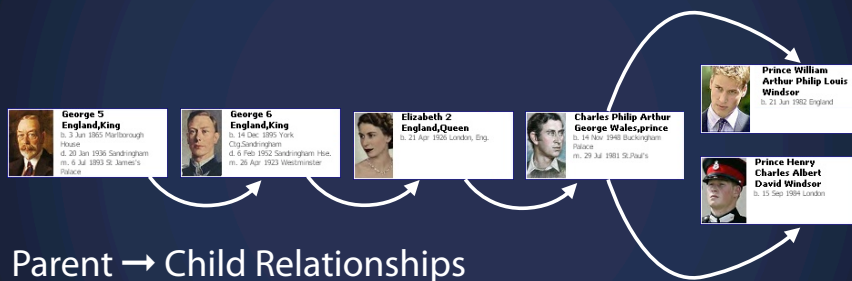
Genealogical tree of James I in five rows, with James and Anne at the top and Henry VII and Elizabeth at the bottom (1603)



<http://bibliodyssey.blogspot.com/2009/07/british-printed-images.html>

# Hierarchical Data

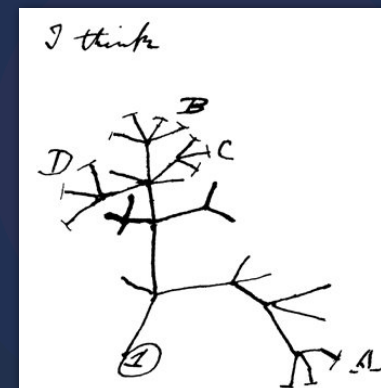
Genealogies (Family histories)



Parent → Child Relationships

<http://lagenealogy.net/CharlesPraspx>

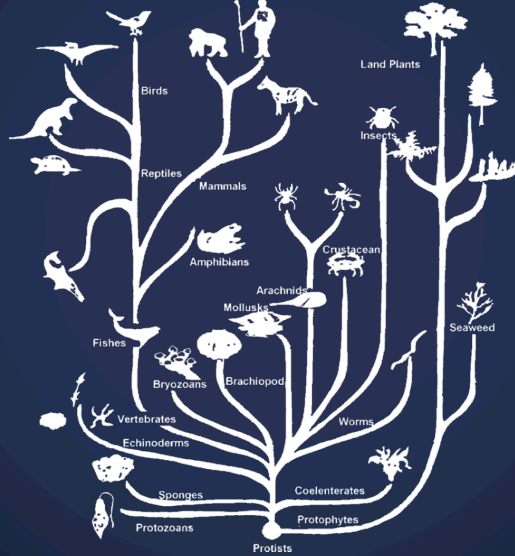
# Hierarchical Data



Charles Darwin

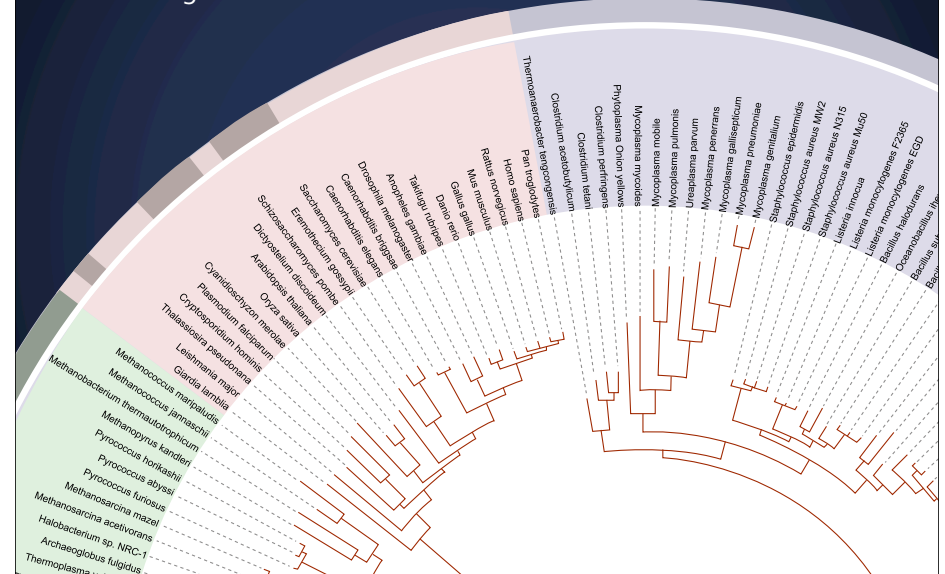
# Hierarchical Data

Animal Kingdom



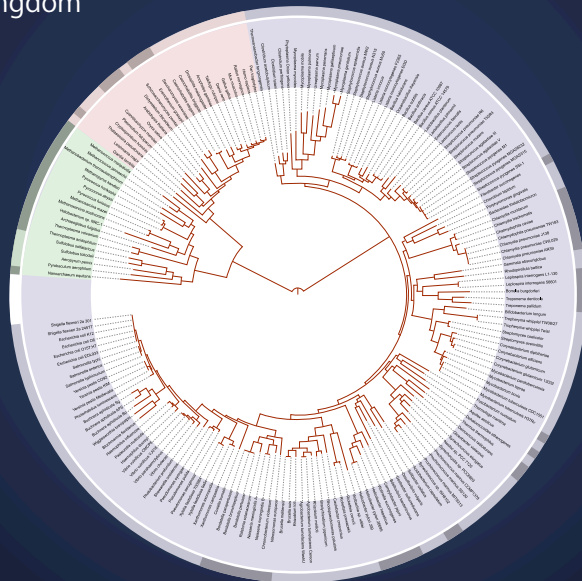
# Hierarchical Data

Animal Kingdom

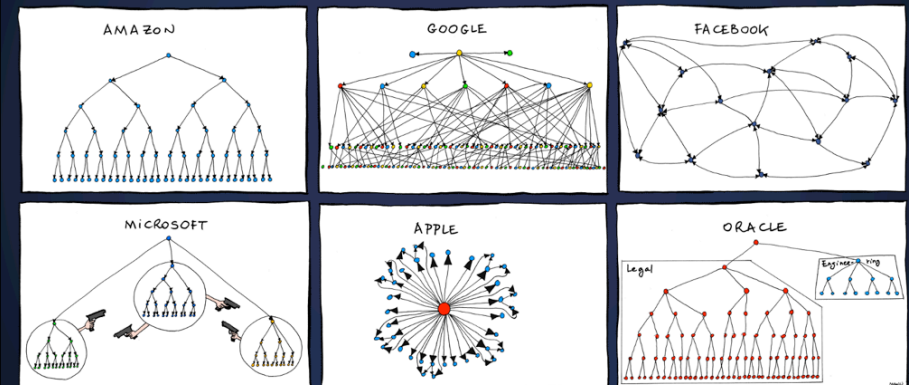


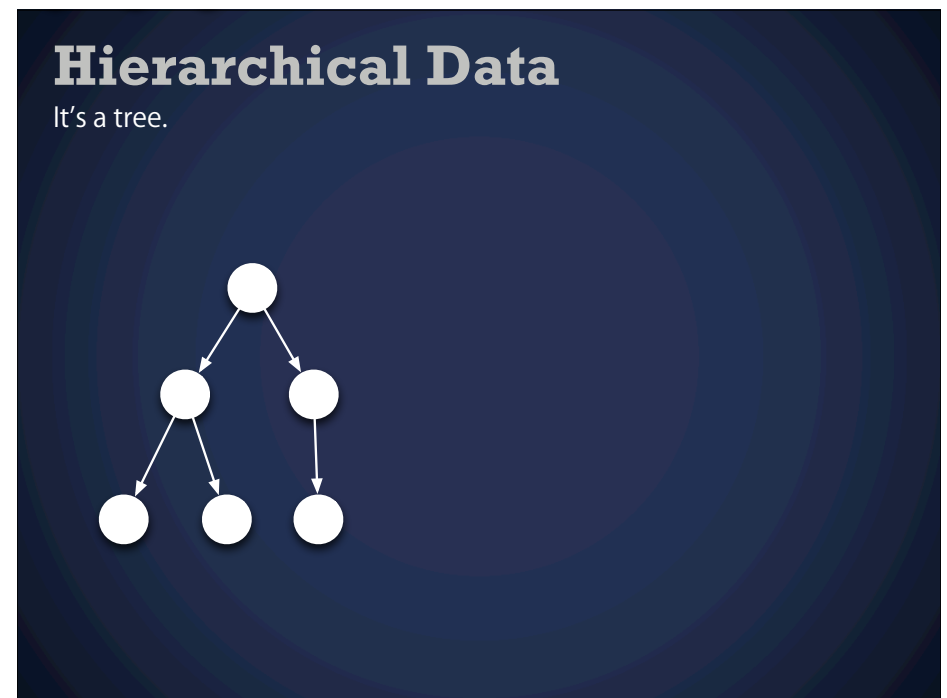
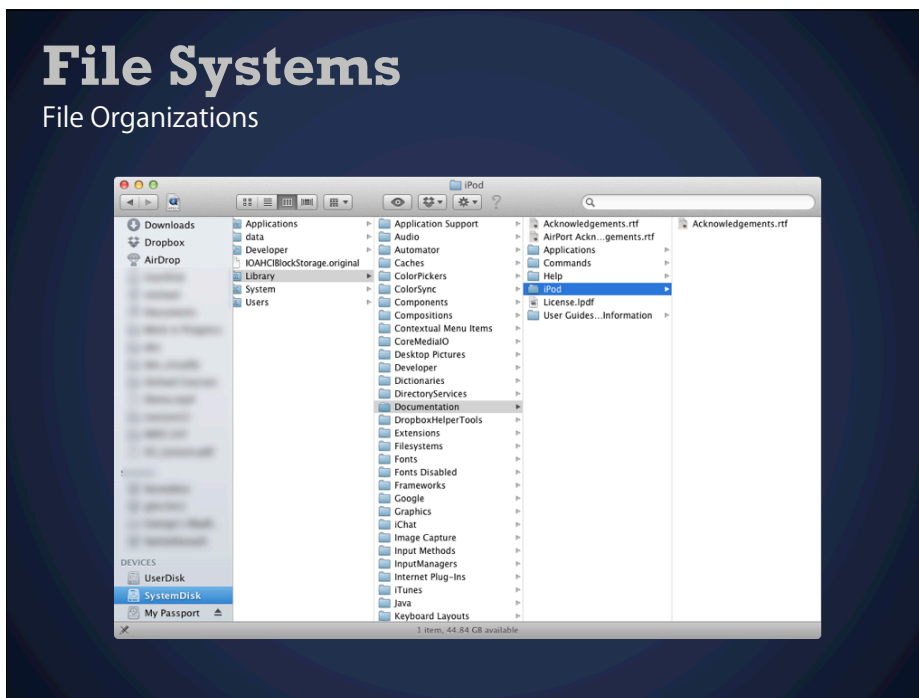
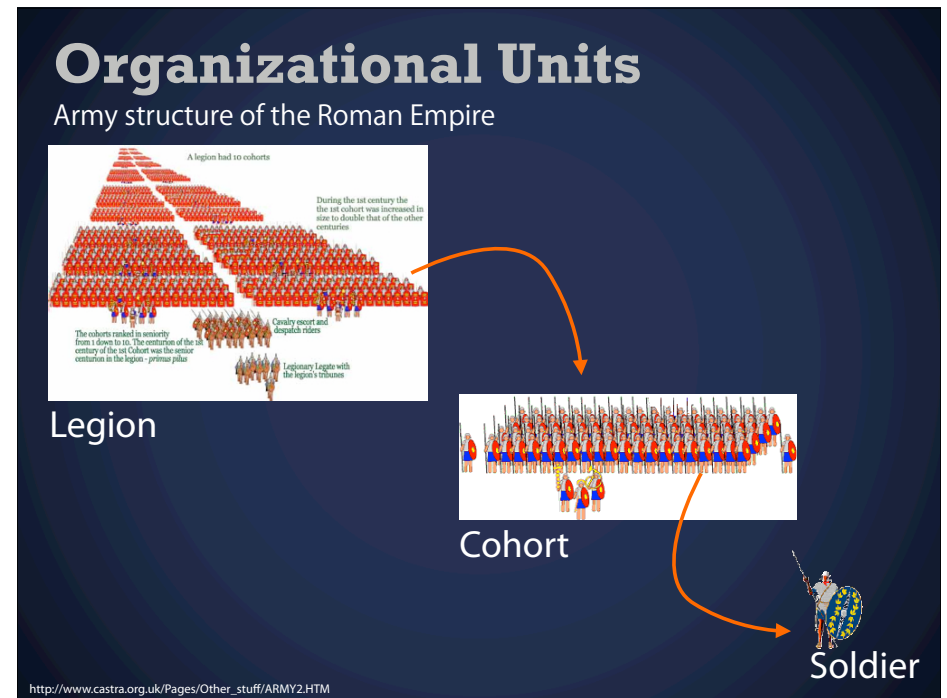
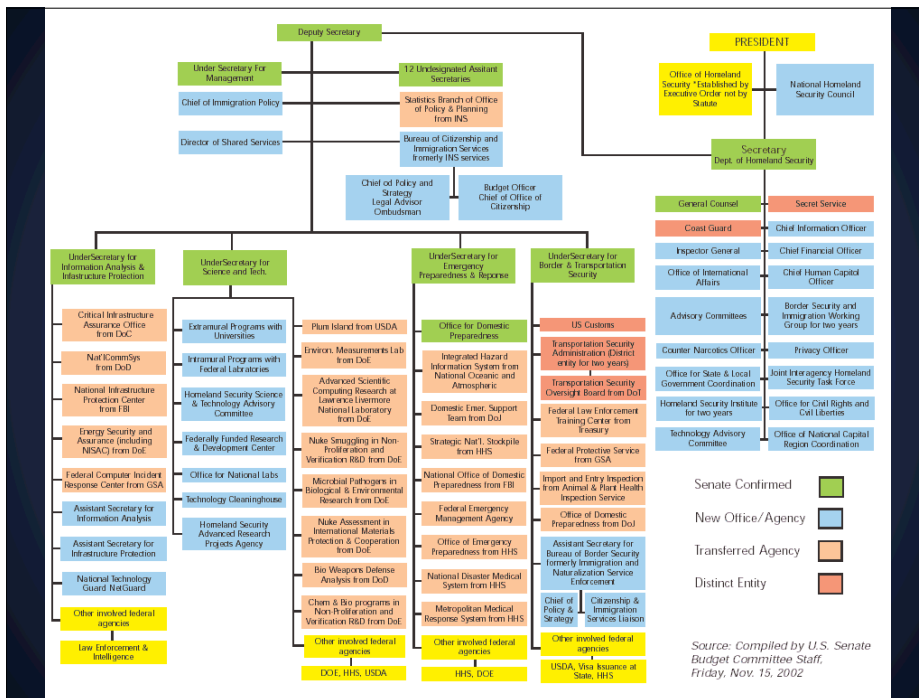
# Hierarchical Data

Animal Kingdom



# Organizational Charts

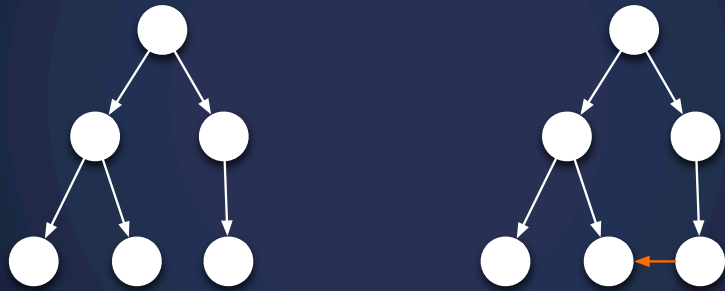






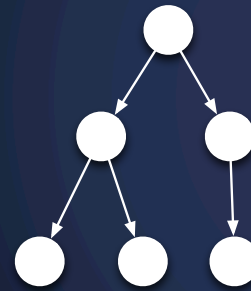
# Hierarchical Data

It's a tree.



# Hierarchical Data

It's a tree.

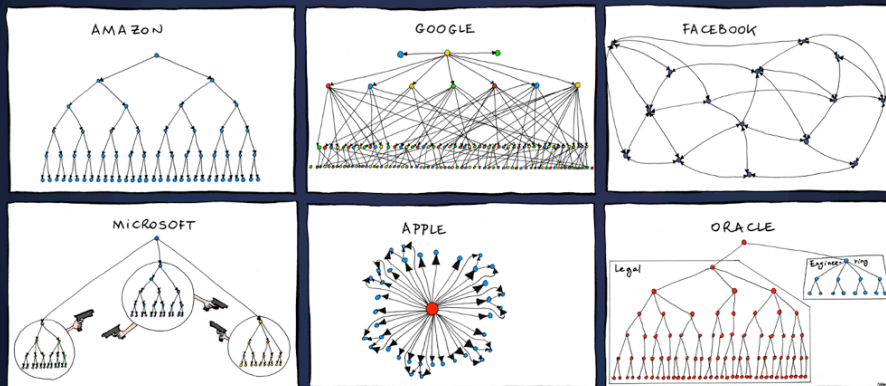


Tree



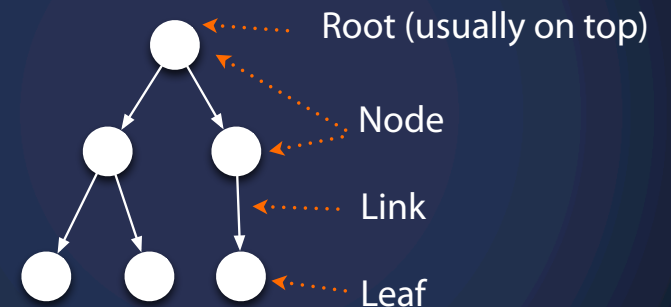
Graph

# Organizational Charts



# Hierarchical Data

Node-Link graph



# Node-Link Graph

Alternative



# Node-Link Graph

Alternative



Which nodes can  
be root?

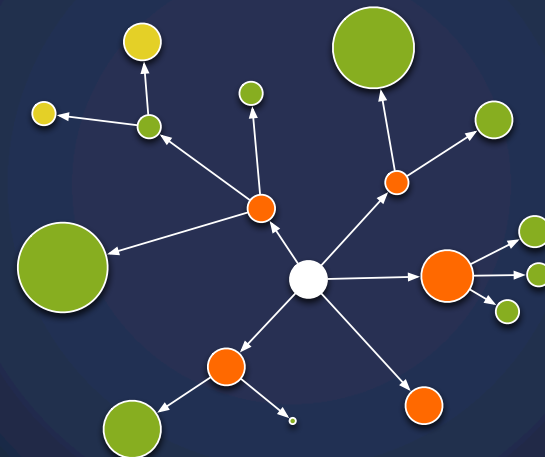
# Node-Link Graph

Coloring Options: Color by branch

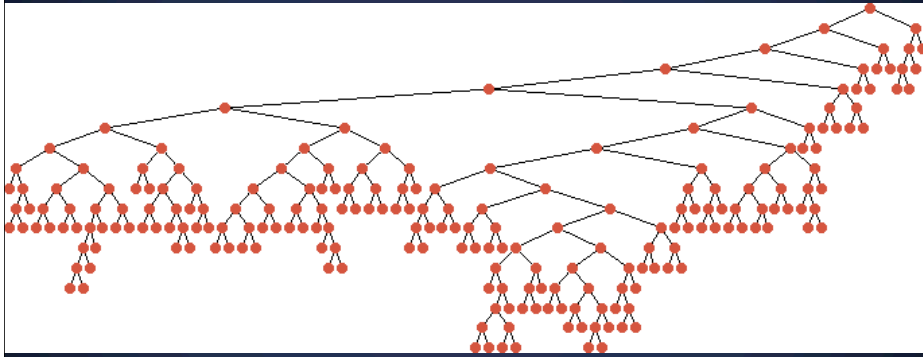


# Node-Link Graph

Size to show quantitative values



# Tree Visualization

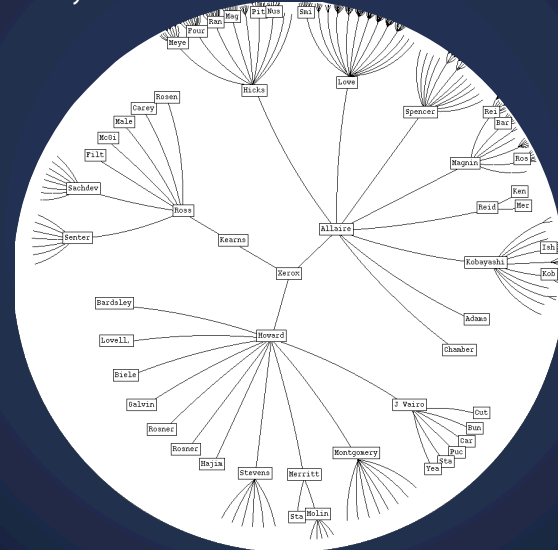


[http://www.informatik.uni-koeln.de/s\\_juenger/research/vbctool/](http://www.informatik.uni-koeln.de/s_juenger/research/vbctool/)

Problems?

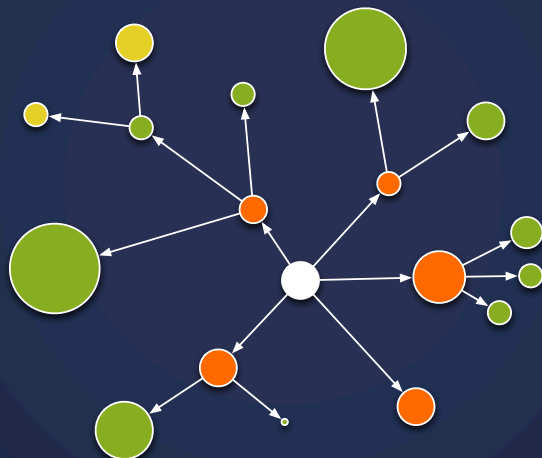
# Alternative

Up to 10x as many nodes

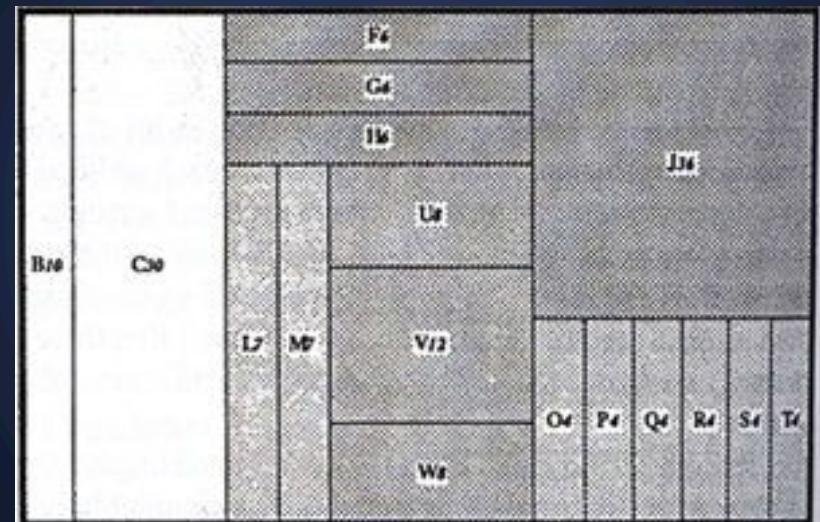


# Node-Link Graph

Alternative representation for quantitative values?



# Tree Maps



Johnson + Shneiderman, 1991

## Example

Sales Figures ACME Inc. (\$M)

- **North America**
  - United States (\$200)
  - Canada (\$200)
- **Europe**
  - Germany (\$150)
  - Austria (\$100)
  - Russia (\$150)
  - Sweden (\$100)
- **Asia**
  - S. Korea (\$50)
  - China (\$50)



## Example

Sales Figures ACME Inc. (\$M)

- **North America (\$400)**
  - United States (\$200)
  - Canada (\$200)
- **Europe (\$500)**
  - Germany (\$150)
  - Austria (\$100)
  - Russia (\$150)
  - Sweden (\$100)
- **Asia (\$100)**
  - S. Korea (\$50)
  - China (\$50)



## Example

Sales Figures ACME Inc. (\$M)

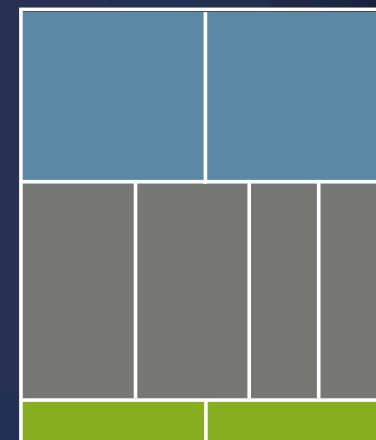
- **North America (\$400)**
  - United States (\$200)
  - Canada (\$200)
- **Europe (\$500)**
  - Germany (\$150)
  - Austria (\$100)
  - Russia (\$150)
  - Sweden (\$100)
- **Asia (\$100)**
  - S. Korea (\$50)
  - China (\$50)



## Example

Coloring

- **North America (\$400)**
  - United States (\$200)
  - Canada (\$200)
- **Europe (\$500)**
  - Germany (\$150)
  - Austria (\$100)
  - Russia (\$150)
  - Sweden (\$100)
- **Asia (\$100)**
  - S. Korea (\$50)
  - China (\$50)





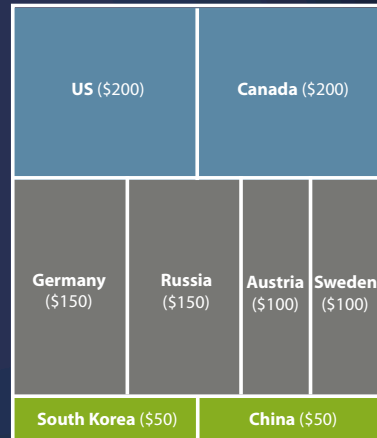
# Example

Labels

*North America (\$400)*

*Europe (\$500)*

*Asia (\$100)*



# Example

Labels



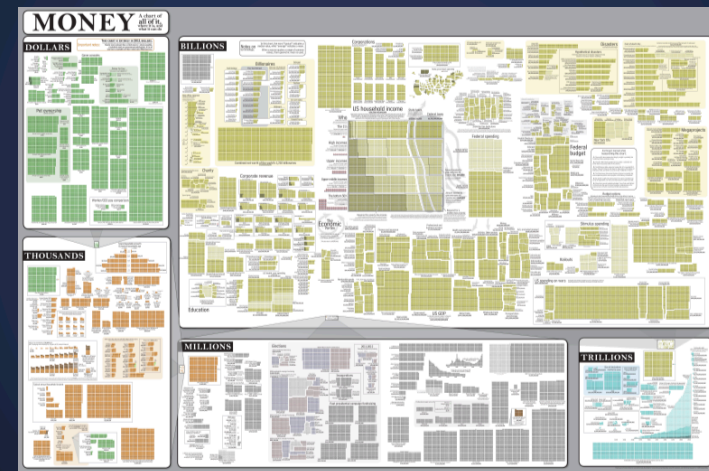
# Example

Labels



# Tree Map

sort of. xkcd Money visualization



<http://xkcd.com/980/huge/>

# Tree Map

News Stories



# Tree Map

Pros and Cons

# Tree Map

Pros and Cons

## Pros

Color + Area  
(2 Attributes)

# Tree Map

Pros and Cons

## Pros

Color + Area  
(2 Attributes)

## Cons

Hierarchy / Structure  
hard to convey

aspect ratios

# Tree Map

Pros and Cons

## Pros

Color + Area  
(2 Attributes)

## Cons

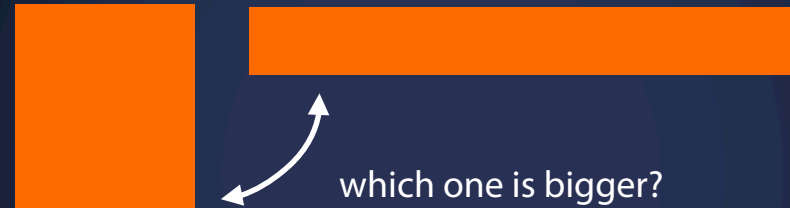
Hierarchy / Structure  
hard to convey

aspect ratios

aesthetics?

# Aspect Ratios

Remember this?



# Aspect Ratios

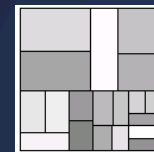
Remember this?



make the segments more square!

# Tree Map

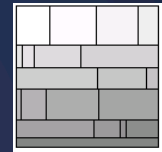
Layout Strategies / Algorithms



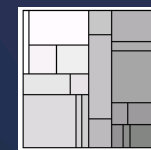
*Cluster*



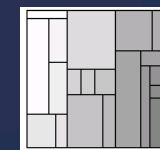
*Squarified*



*StripTreemap*



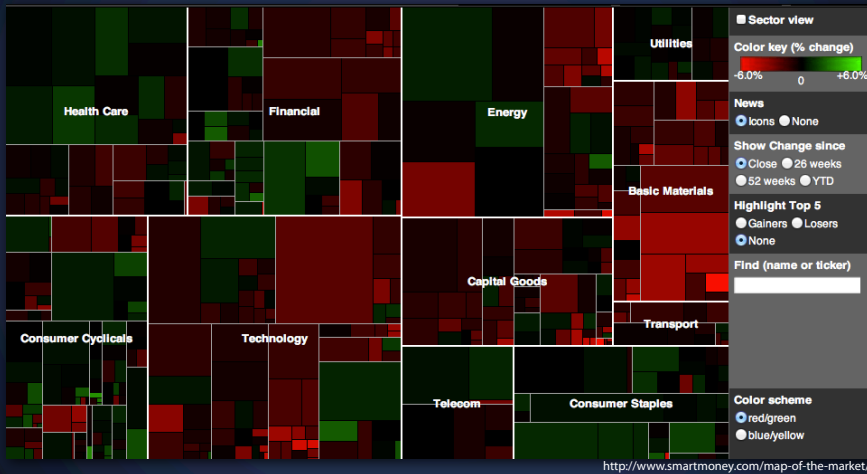
*Pivot By Middle*



*Pivot By Size*

# Tree Map

Map of the Market (Martin Wattenberg)



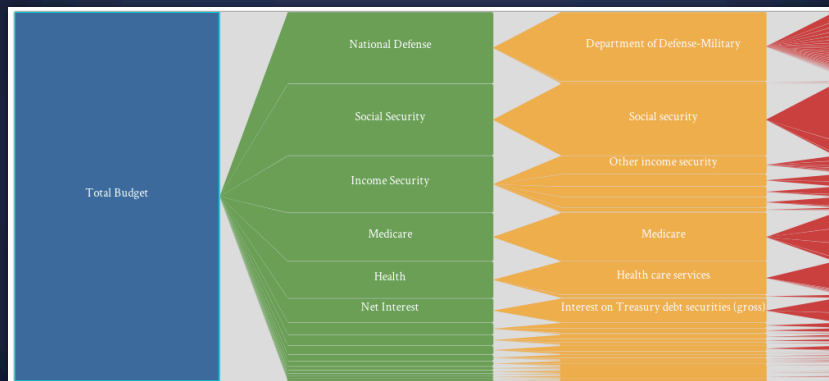
# Other Space Filling Systems



<http://www.cs.umd.edu/hcil/treemap-history/>

# Case Study

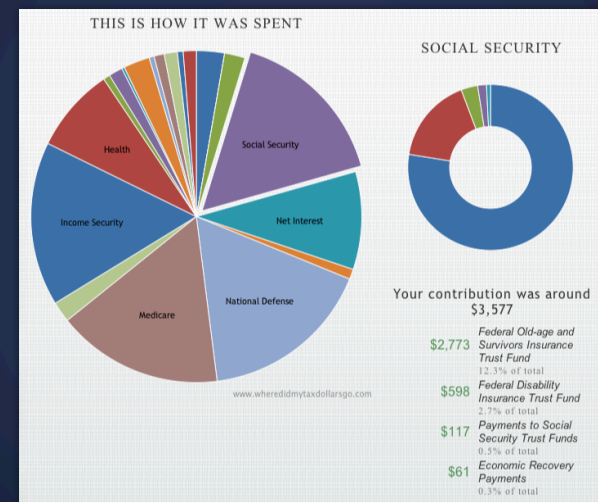
Where Do My Taxes Go? (Google Data Visualization Challenge 2011)



<http://blog.thejit.org/assets/dataviz/index.html>

# Case Study

Where Do My Taxes Go? (Google Data Visualization Challenge 2011)



[http://www.wheredidmytaxdollarsgo.com/tax\\_payers](http://www.wheredidmytaxdollarsgo.com/tax_payers)

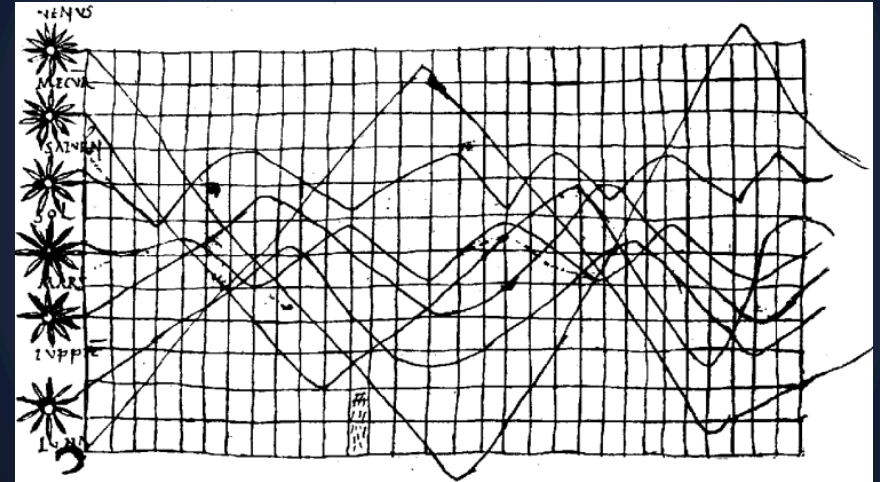


# Temporal Visualizations

Mostly Time Series

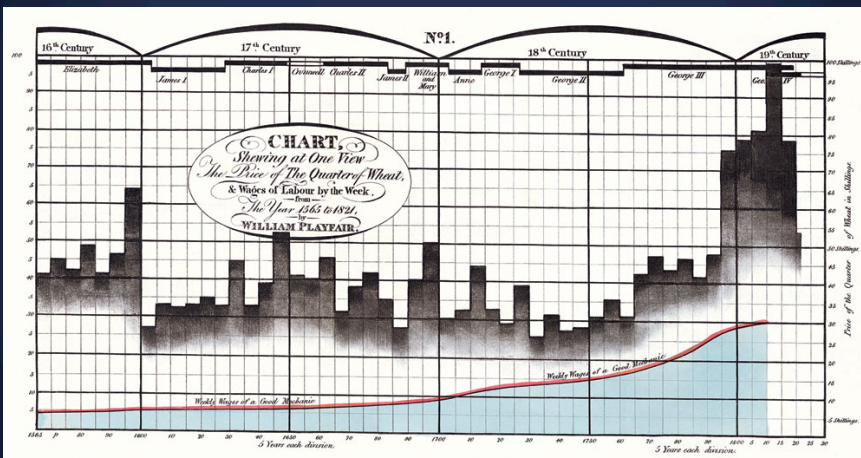
## Remember this one?

Funkhouser



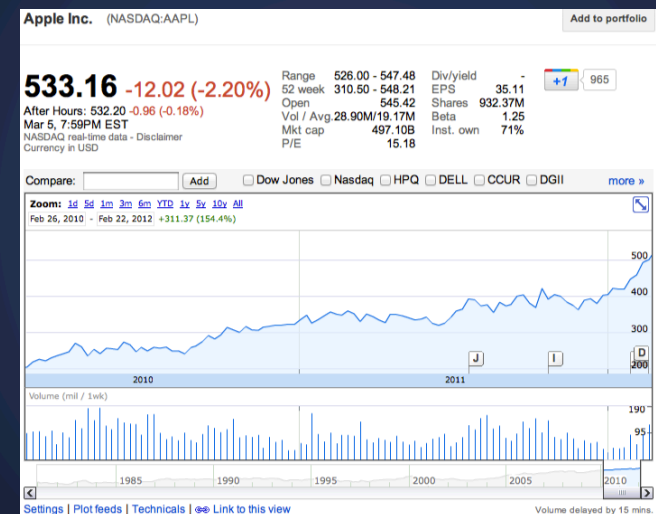
## Or this one?

Playfair



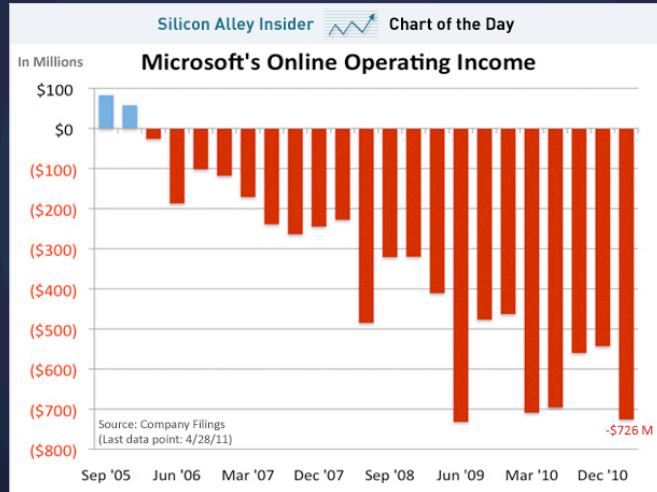
## Finance charts

Stock data (AAPL). Line chart



# Aggregated Data

Better shown as a bar graph



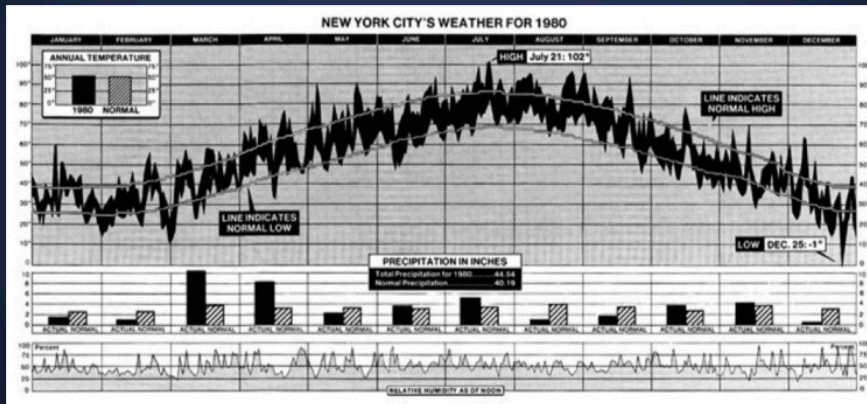
# Aggregated Data

Better shown as a bar graph



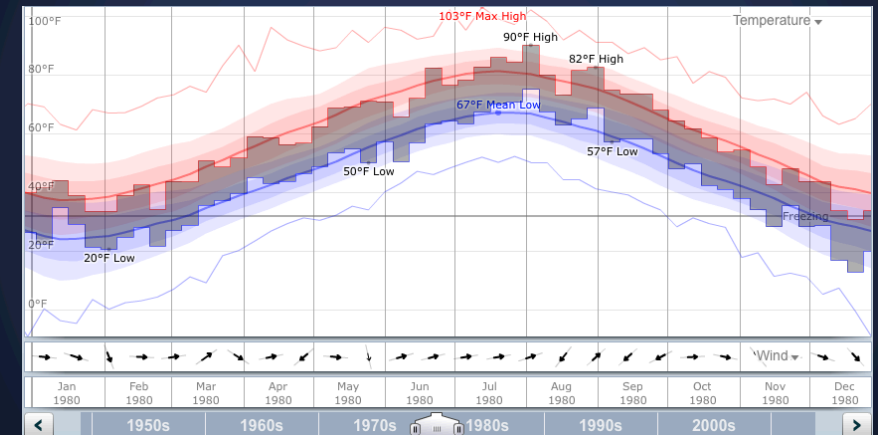
# Analyze

New York Weather 1980 (NY Times, 1981)



# Analyze

New York Weather 1980 (weatherspark.com)



# Time Series Data

Of 4000 graphics from  
15 newspapers and  
magazines ('74-'78),  
were time series

Tufte

# Time Series Data

Of 4000 graphics from  
15 newspapers and  
magazines ('74-'78),  
**75%** were time series

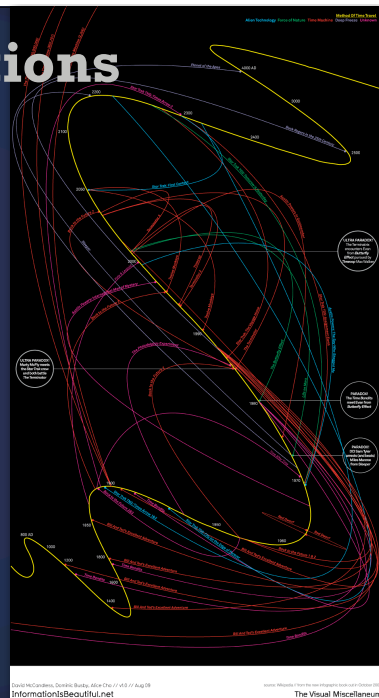
Tufte

## Other representations

Time Travel

<http://www.informationisbeautiful.net/visualizations/timelines/>

Alien Technology Force of Nature Time Machine Deep Freeze Unknown



## Other Representations

Frame-by-frame overlays



## Iso-chronic lines


$$D = \{(t1,d1),(t2,d2),...(tn,dn)\}$$


## Dichotomies

Discrete



# Interval



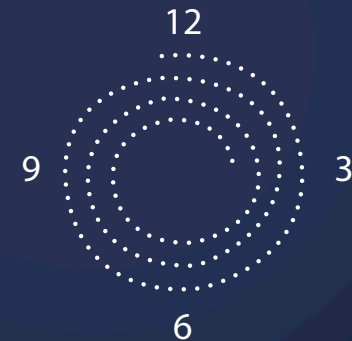
# Properties of Time

## Dichotomies

## Linear



Cyclical /  
Repetitive





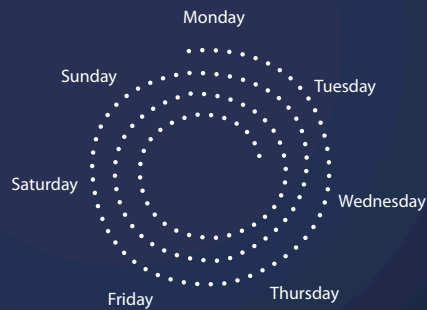
# Properties of Time

Dichotomies

Linear



Cyclical /  
Repetitive



# Properties of Time

Dichotomies

Ordinal



Continuous  
(Often Sampled)



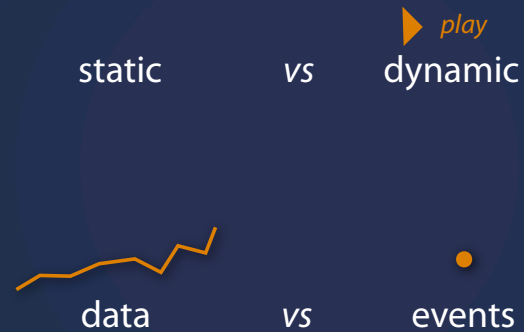
## Tasks

- When was something at min/max?
- Is there a pattern?
- Two series similar?
- Do any of the series match a pattern?
- Provide fast access to the series

## Tasks

- Does a data element exist at  $t$ ?
- When does a data element exist?
- How long does it exist?
- How often does it exist?
- How fast is the data changing?
- In what order do data elements appear?
- Do data elements exist together?

# Design considerations



# Case Study

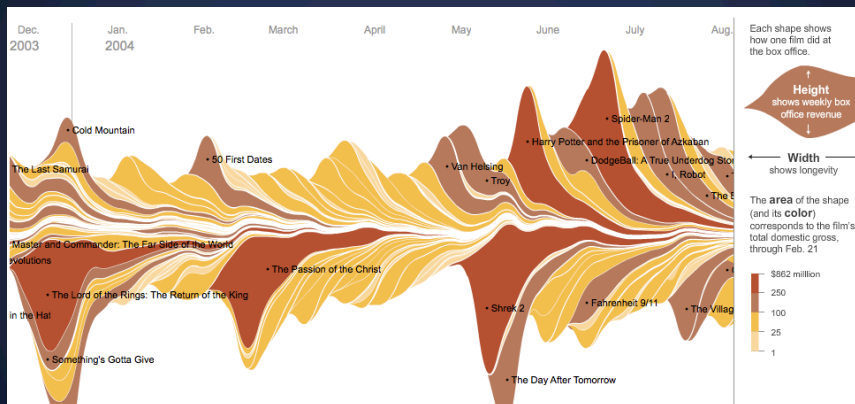
Calendar View; Dow Jones



Mike Bostock

# Case Study

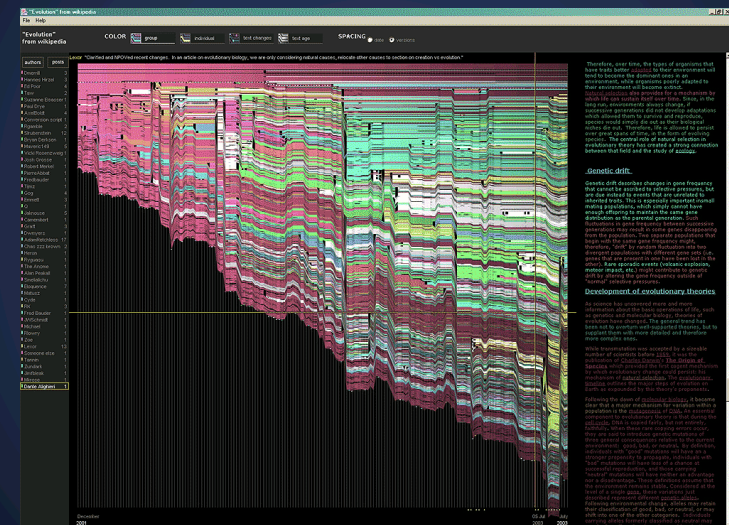
Movie Revenues (Byron & Wattenberg)



[http://www.nytimes.com/interactive/2008/02/23/movies/20080223\\_REVENUE\\_GRAPHIC.html](http://www.nytimes.com/interactive/2008/02/23/movies/20080223_REVENUE_GRAPHIC.html)

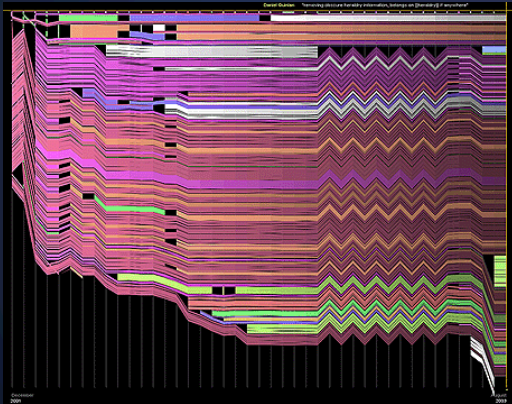
# Case Study

Evolution of a document (Viegas)



# Case Study

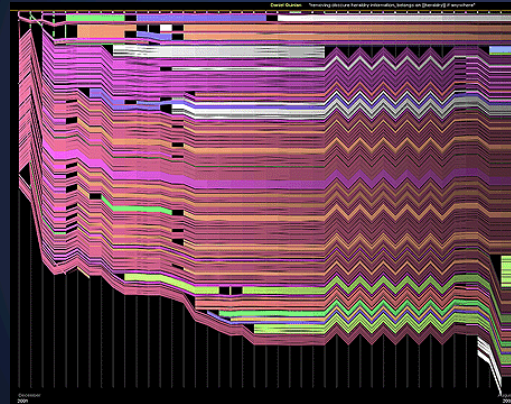
Evolution of a document (Viegas)



Chocolate Wikipedia page

# Case Study

Evolution of a document (Viegas)

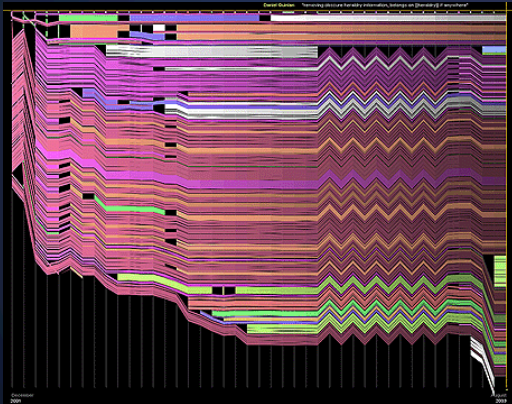


Chocolate Wikipedia page

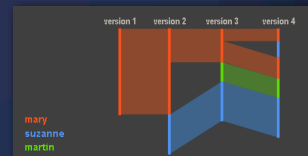
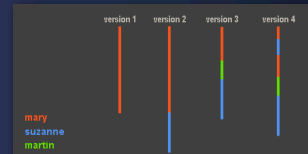


# Case Study

Evolution of a document (Viegas)



Chocolate Wikipedia page



# Case Study

Spiral Visualizations

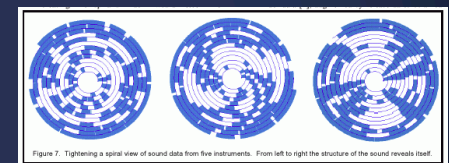
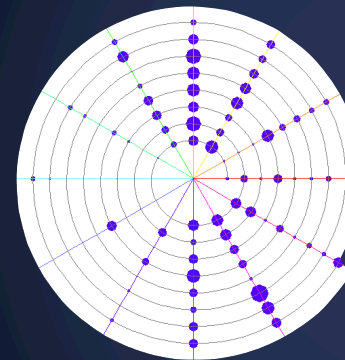
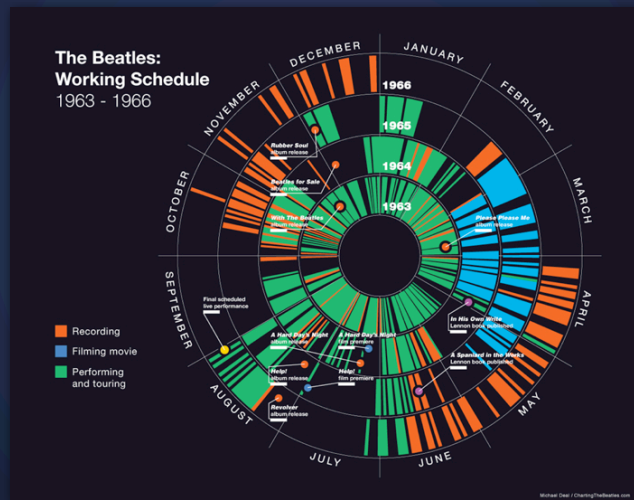


Figure 7. Tightening a spiral view of sound data from five instruments. From left to right the structure of the sound reveals itself

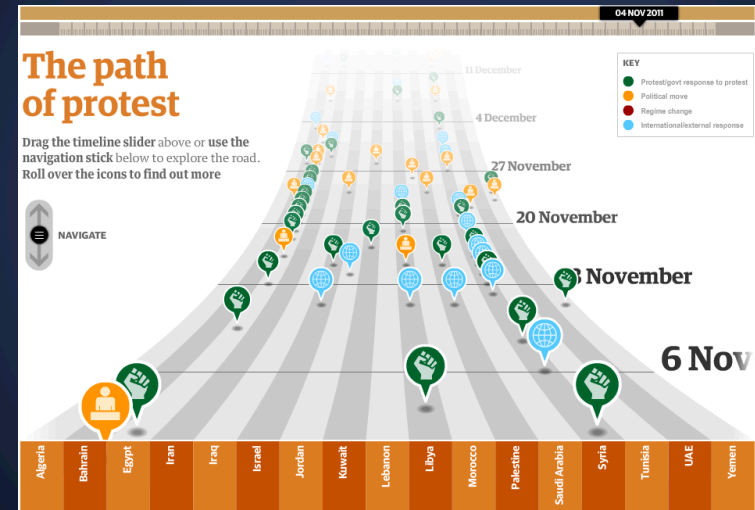
# Case Study

Spiral Visualizations



# Case Study

Arab Spring; events over time in different countries



<http://www.guardian.co.uk/world/interactive/2011/mar/22/middle-east-protest-interactive-timeline>

## Recap

## Announcement

Final Project: Project Pitches

In next week's lab section you can pitch your visualization project ideas

Group sizes: 3-4 student

We'll talk more about project admin next week



## **Show & Tell**

## **Show & Tell**

<http://dtrace.org/blogs/brendan/2011/12/18/>

## **Show & Tell**

<http://99percentinvisible.org/post/7604541347/>

## **Visualization Critique**

**Assignment 3**

# Critiquing Visualizations

*Critique the design, not the designer*

## DO

Listen before speaking.

Suggest alternatives.

Avoid statements that refer to absolutes.

Point out good aspects.

## DON'T

Be overly nice

"That's interesting"

"That's stupid"

# Critiquing Visualizations

Questions to consider

What is the user's intent?  
Does the visualization add value?

Could it have been done without interaction?

Is it intuitive?

Does it (still) make use of pre-attentive attributes?