

Analyzing, Visualizing, and Navigating the Republic of Letters

- Bodleian Digital Library Systems and Services at Osney Mead
Oxford, UK

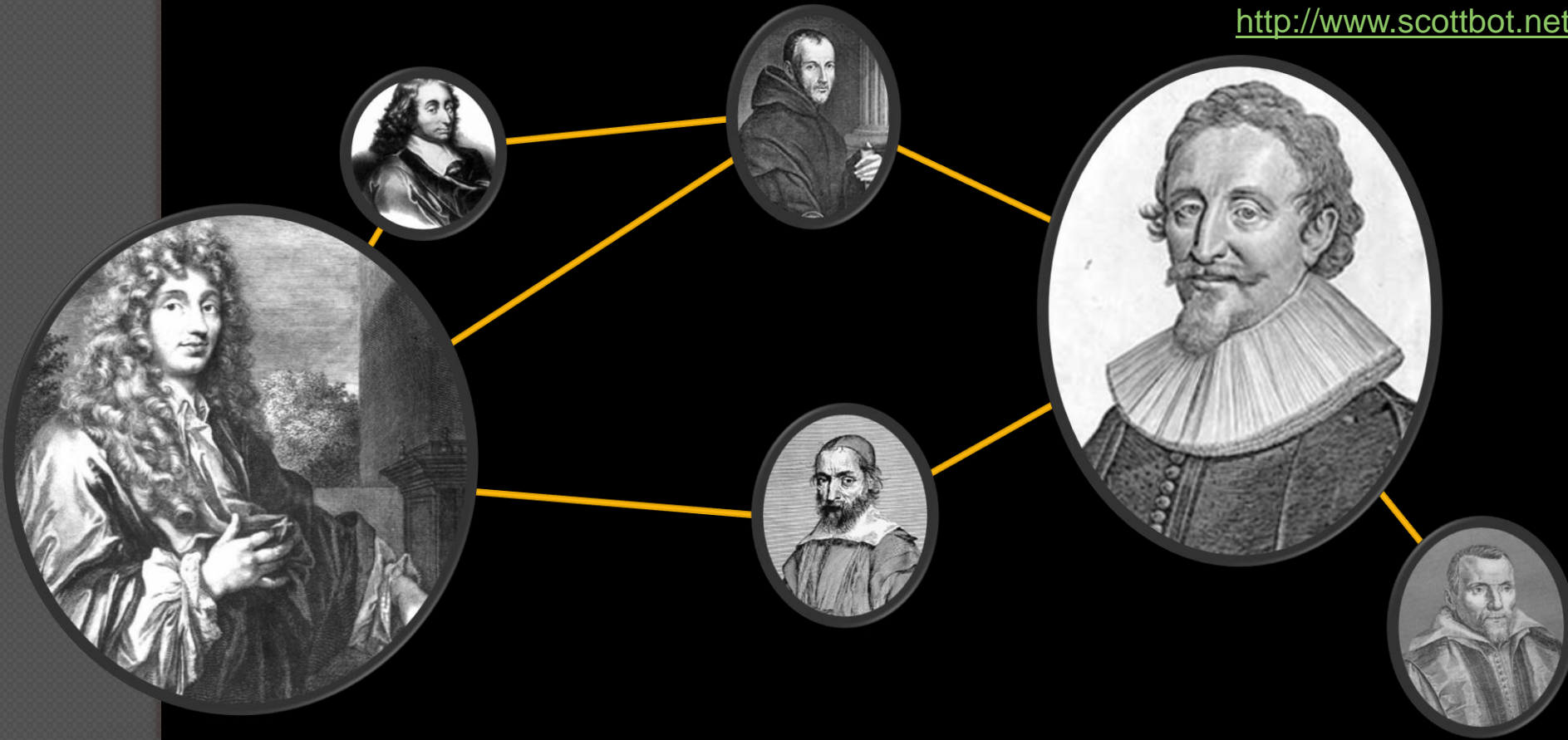
School of Library and Information Science
Department of History & Philosophy of Science

Indiana University, Bloomington, IN

14:00-16:00 on July 11, 2011

Scott Weingart

<http://www.scottbot.net>





Schedule

- 14:05 - 14:15: Why Visualize?
- 14:15 - 14:30: Visualizations of the Republic of Letters
- 14:30 - 14:45: Future Possibilities
- 14:45 - 14:55: Questions

- 15 Minute Break

- 15:10 - 15:15: Data Conceptualizations
- 15:15 - 15:25: Data Formats
- 15:25 - 15:40: Visualization Packages
- 15:40 - 15:45: To-Do
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Why Visualize?



INSPIRATION

Napoleon's March

-Minard

Army Location, Direction, Split, Size | Temperature | Time

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

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les hauteurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Néjome et du Maréchal Davoust qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

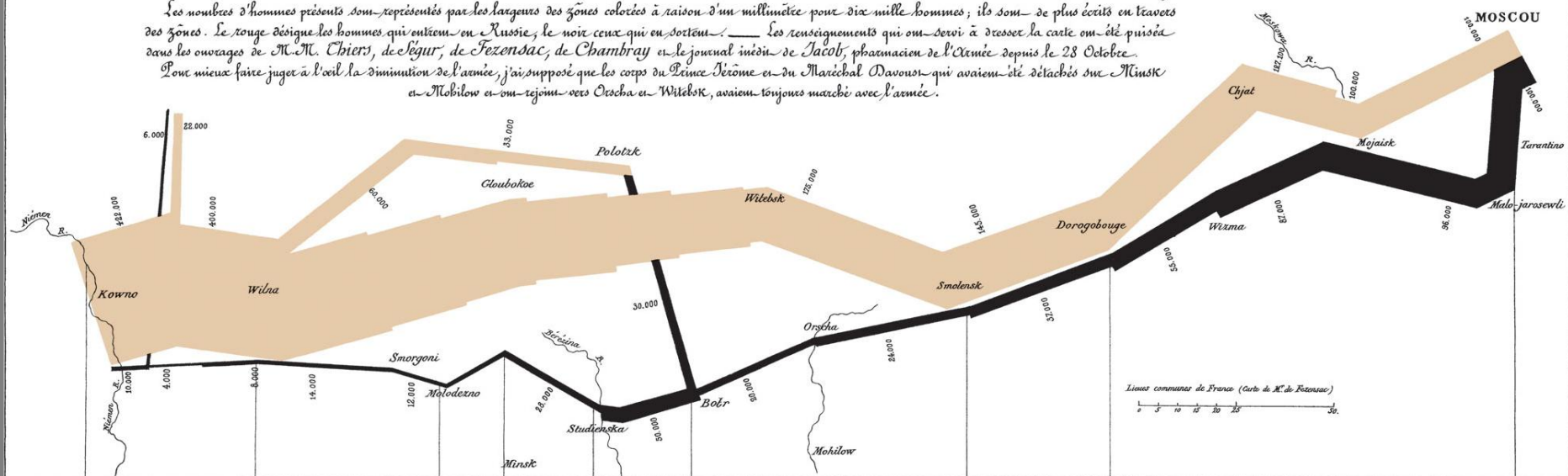
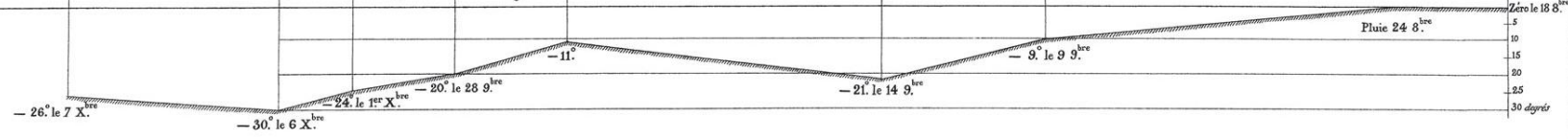


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Les Cosaques passent au galop le Niémen gelé.

Why Visualize?



THE MANY USES



The Importance of Visualization

[Visualizations] aim at more than making the invisible visible. [They aspire] to all-at-once-ness, the condensation of laborious, step-by-step procedures in to an immediate *coup d'oeil*... What was a painstaking process of calculation and correlation—for example, in the construction of a table of variables—becomes a flash of intuition. And all-at-once intuition is traditionally the way that angels know, in contrast to the plodding demonstrations of humans.

Descartes's craving for angelic all-at-once-ness emerged forcefully in his mathematics..., compressing the steps of mathematical proof into a single bright flare of insight: "I see the whole thing at once, by intuition."

Lorraine Daston – On Scientific Observation



The Many Uses of Visualizations

- Solidification of objects of inquiry
- Summarizing data
- Exploration/Navigation
- Discovery
- Trend-spotting
- Evidence
- Audience Engagement
- Engaging public / funding agencies



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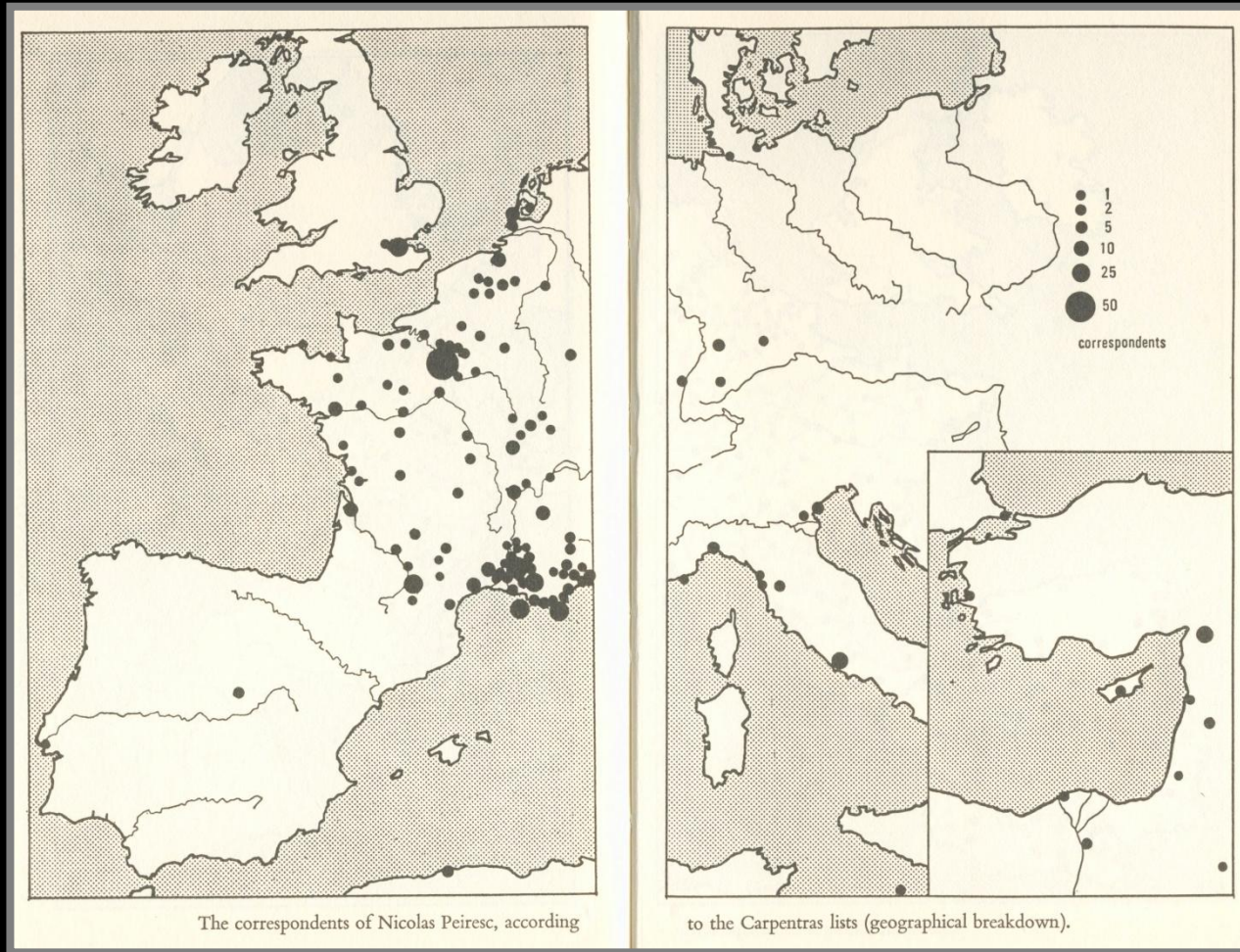
Visualizations of the Republic of Letters



PREVIOUS WORK

Peiresc Correspondence -Mandrou

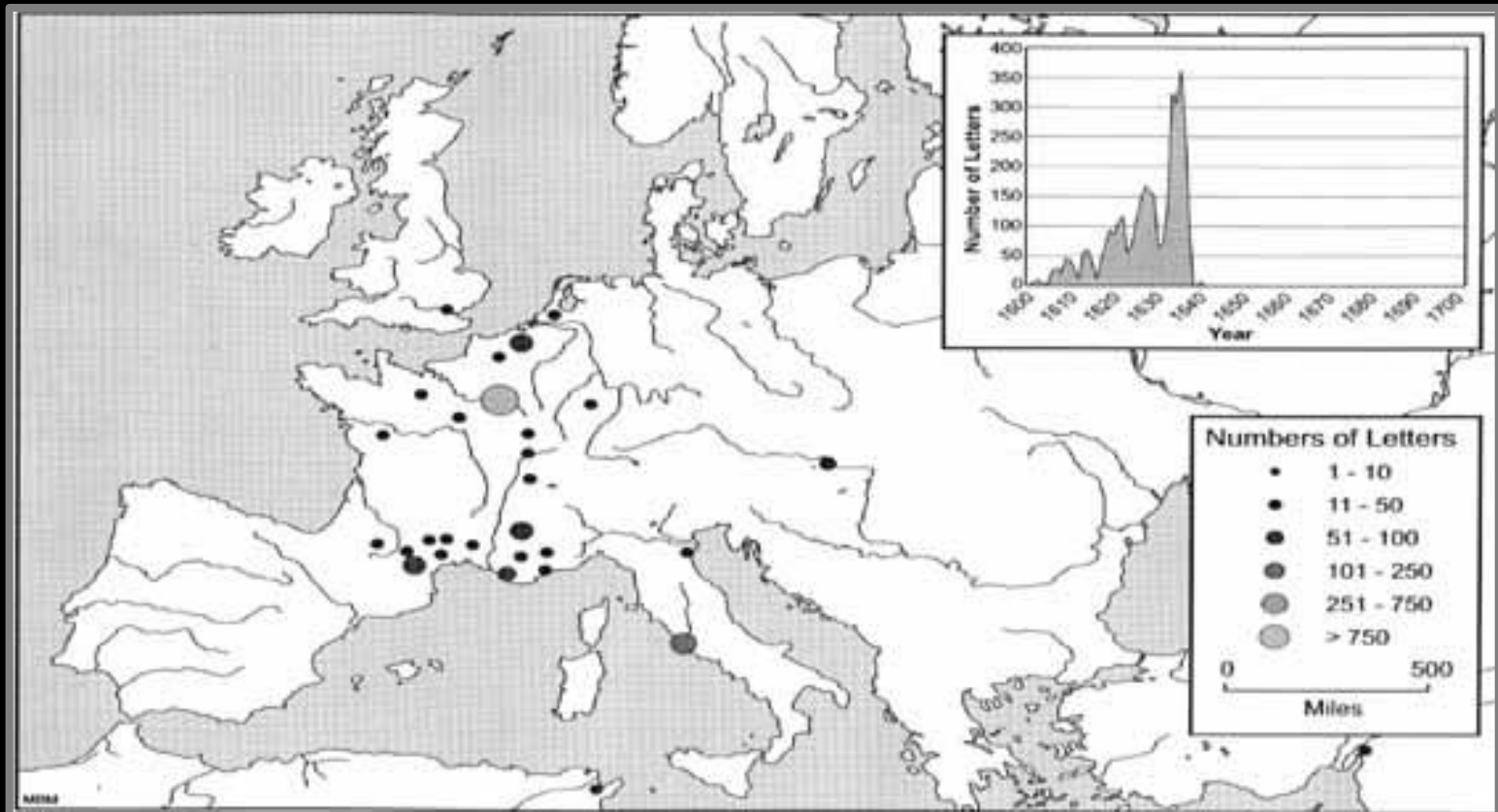
Correspondents Per City | Geographic Spread



Peiresc Correspondence

-Hatch

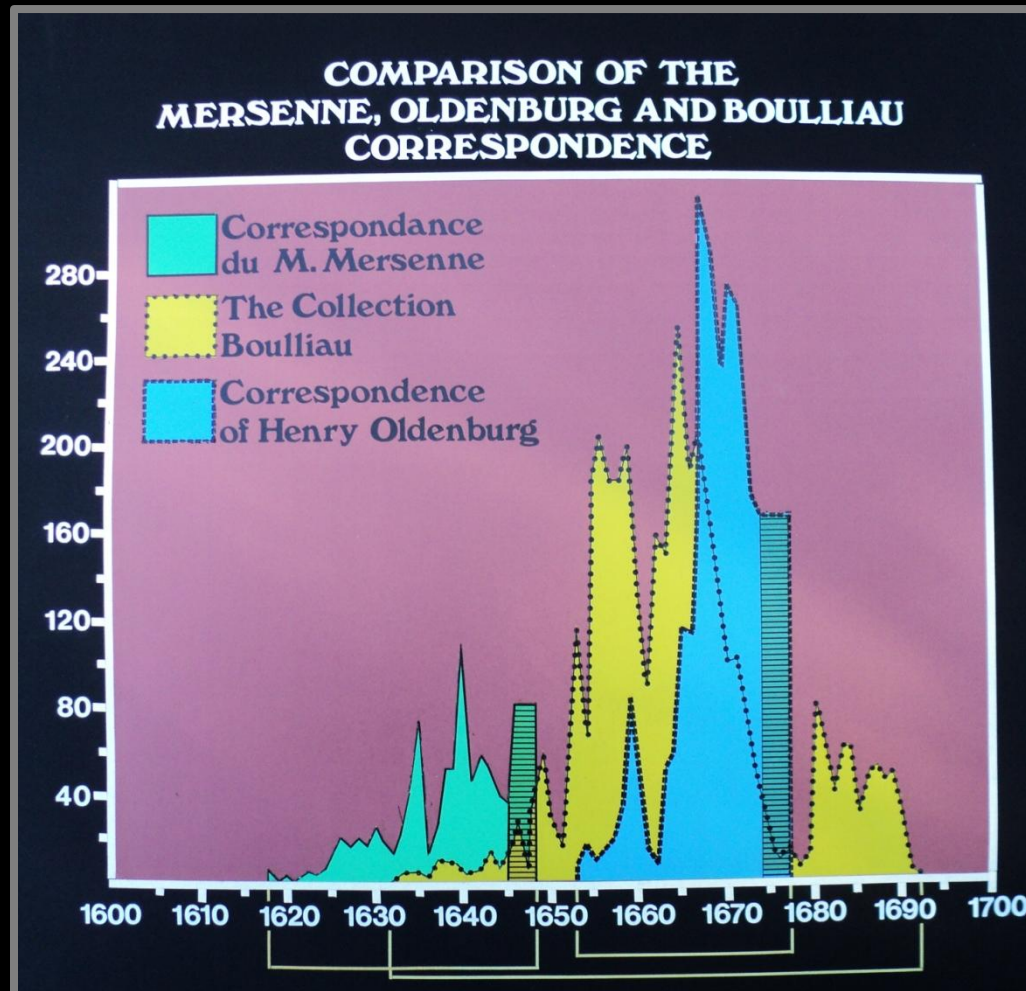
Letters per Year | Letters per City | Geographic Spread



Republic of Letters

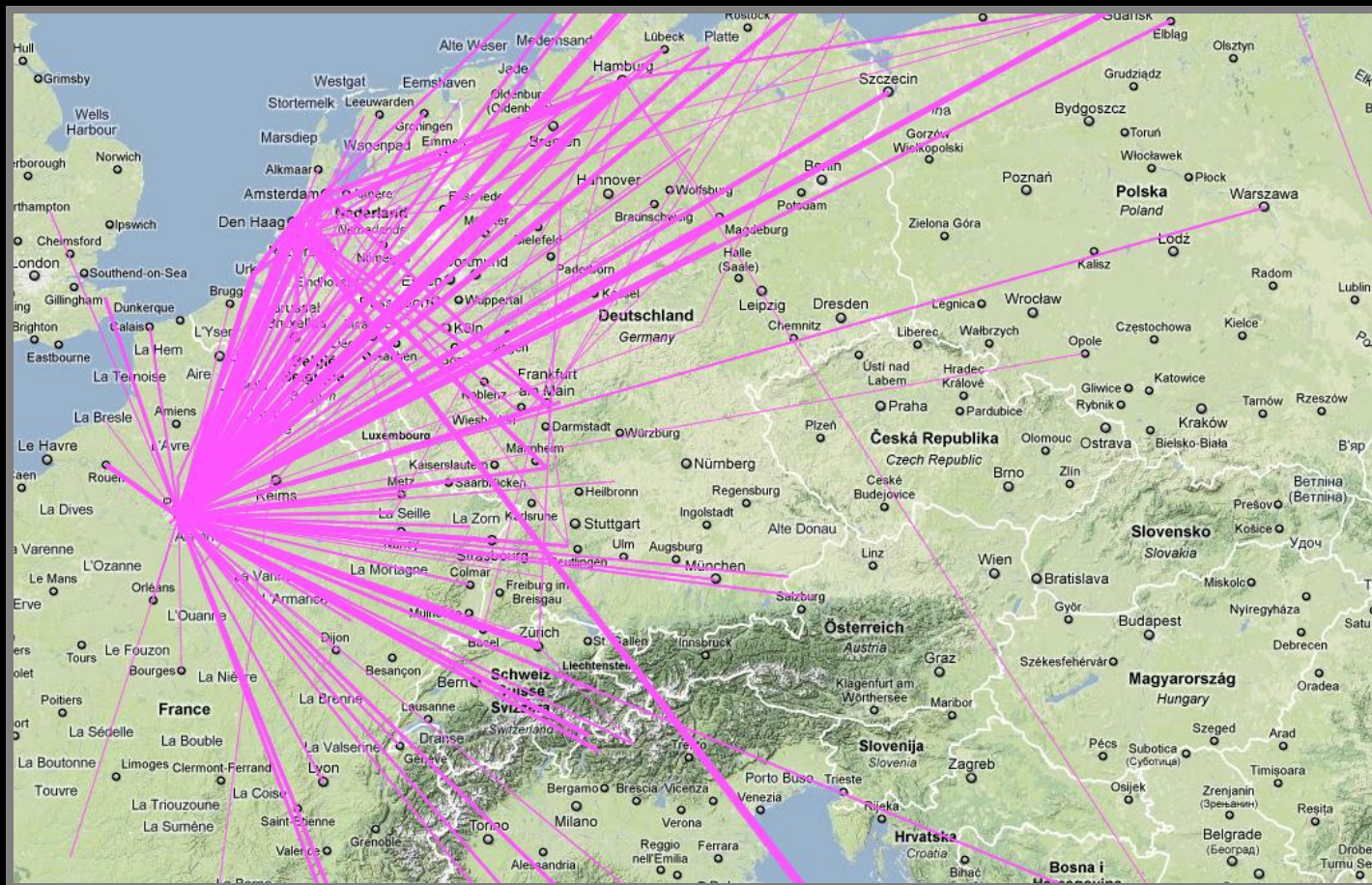
-Hatch

Letters per Year | Correspondent Comparisons



Grotius Correspondence - Weingart

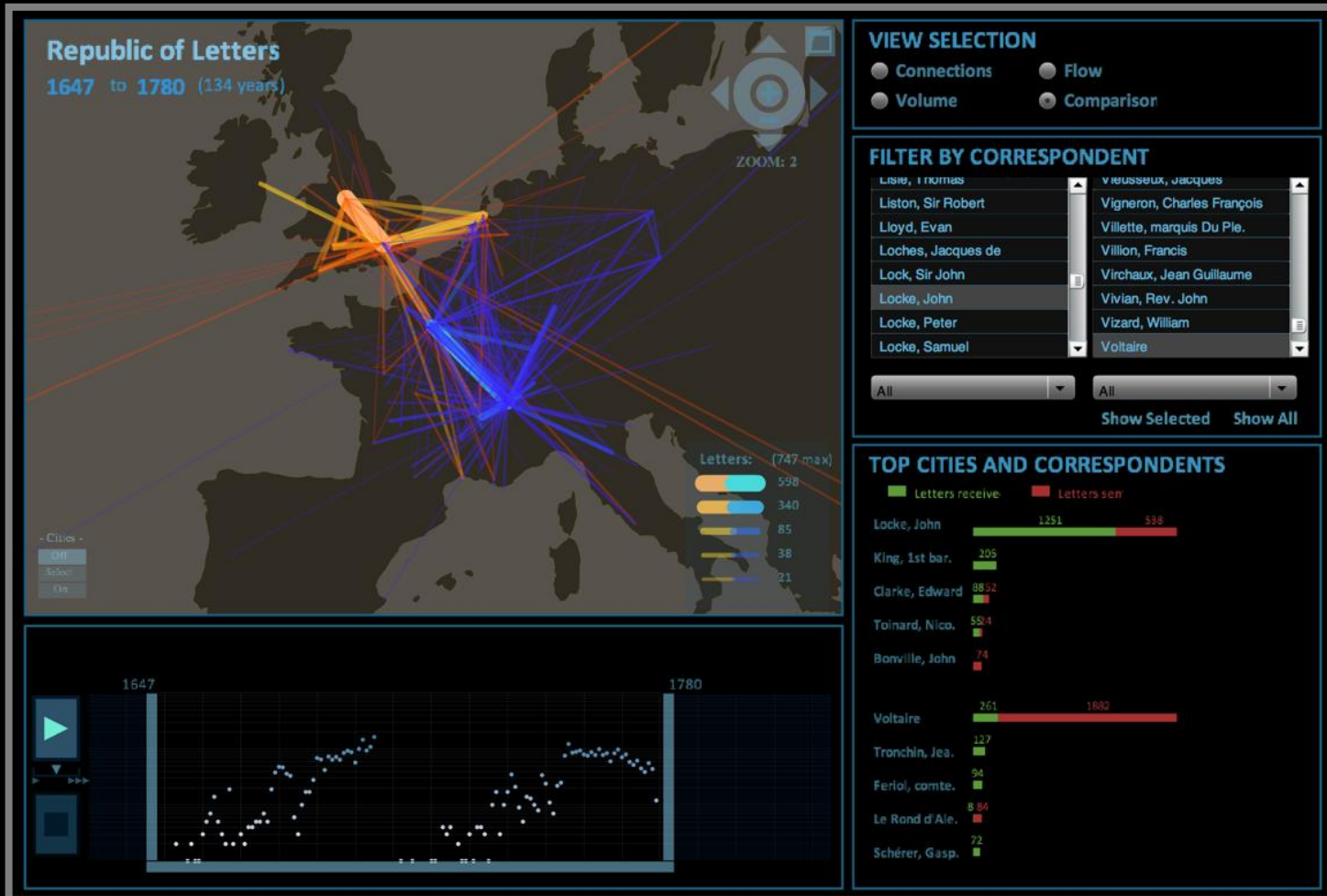
Sender & Recipient Locations | Geographic Spread



Republic of Letters

-Stanford

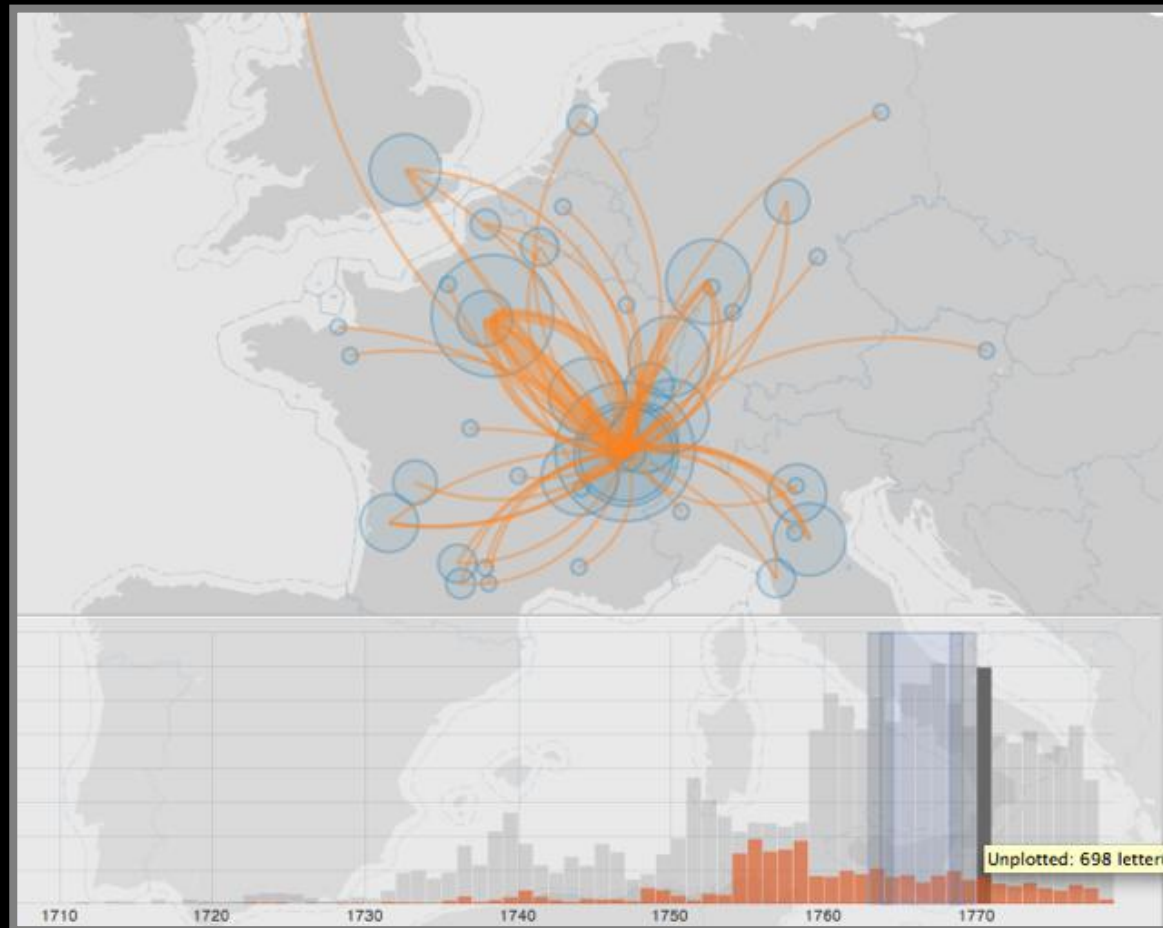
S&R Locations | Comparisons | Time | Correspondents



Republic of Letters

-Stanford

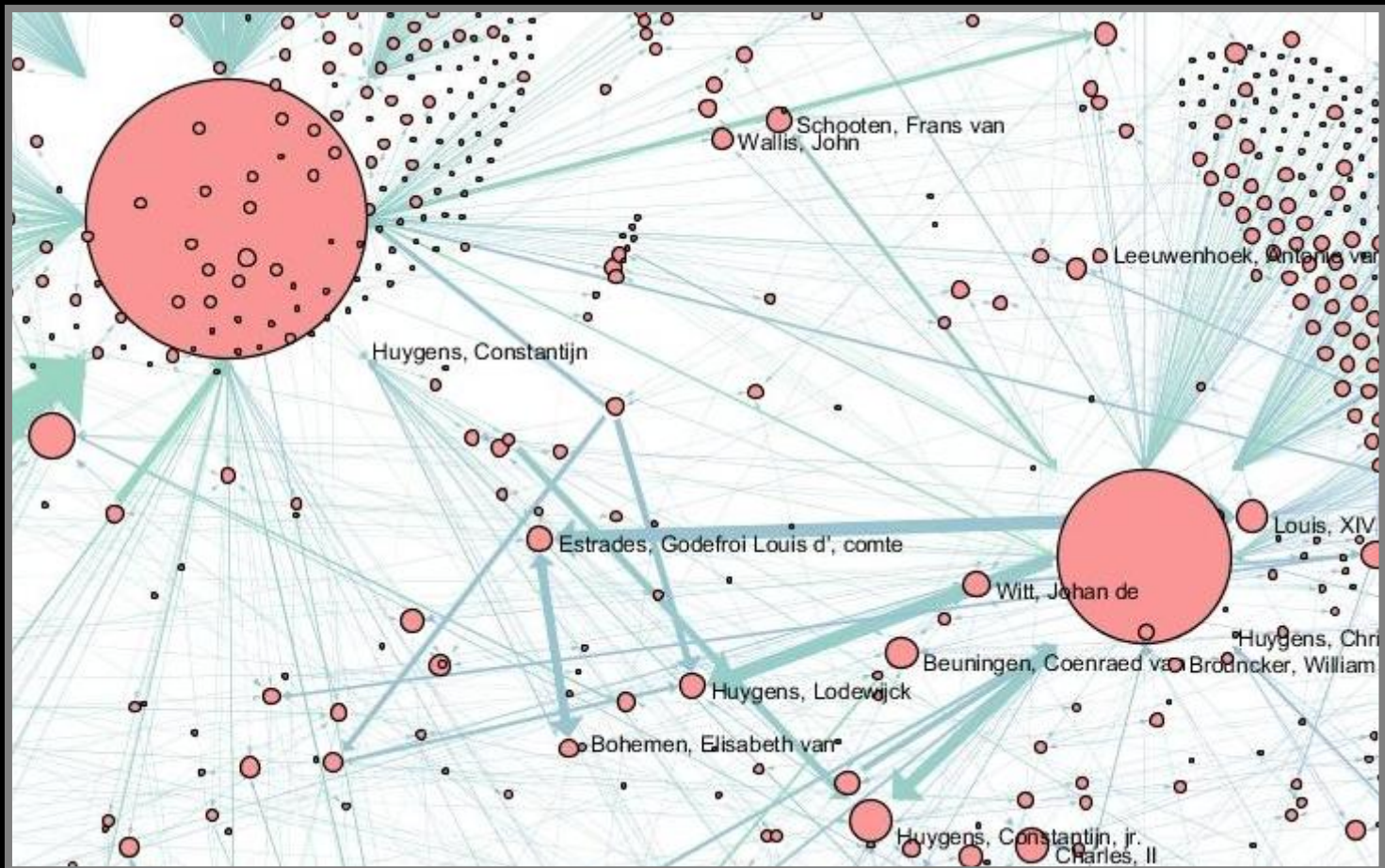
S&R Locations | Location Volume | Time | Uncertainty



Republic of Letters

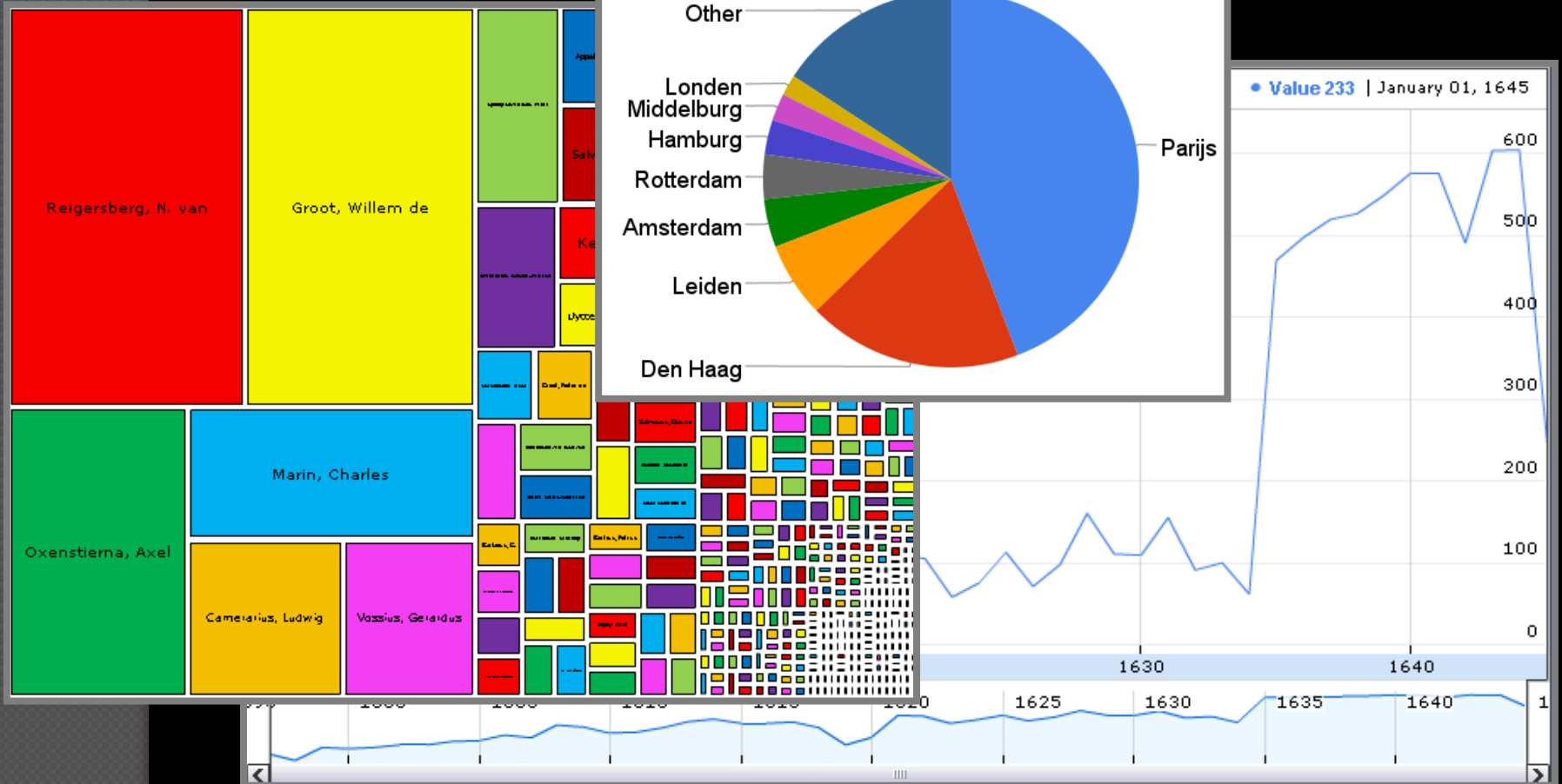
-Weingart

Communities | Time | Central Correspondents | Volume & Flow



Grotius Correspondence -Weingart

Letters over Time | Correspondent Share | Location Share




Epistolarium

-CKCC

Full Text | Senders & Recipients | Keywords | Time | Language

Letters Visualisation Network CKCC

Selector

Letters: 40 

Sort by:

Text

No suggested terms...

1645 French	Gautier, Jacques (fl. 1617–1652) ?	Huygens, Constantijn (1596-1687) ?
----------------	---------------------------------------	---------------------------------------

Corpora

All None

<input checked="" type="checkbox"/> Caspar Barlaeus (Brandt)	505
<input checked="" type="checkbox"/> Hugo de Groot (Molhuysen et al.)	7968
<input checked="" type="checkbox"/> Constantijn Huygens (Worp)	7297
<input checked="" type="checkbox"/> Christiaan Huygens (Vollgraff et al.)	3086
<input checked="" type="checkbox"/> Antoni van Leeuwenhoek (Palm et al.)	282

Years

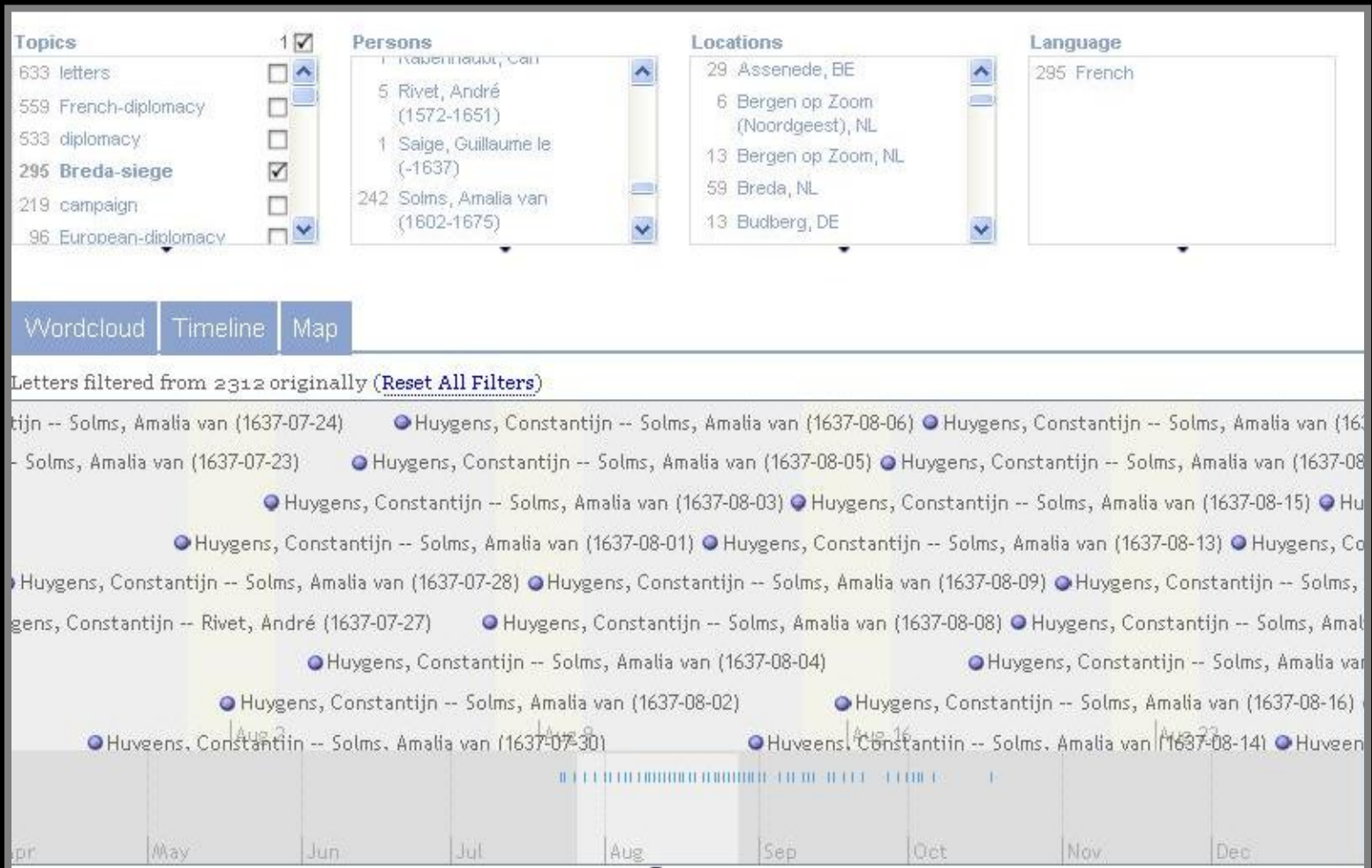
From: To: Unknown



Epistolarium

-CKCC

Time | Correspondent | Volume



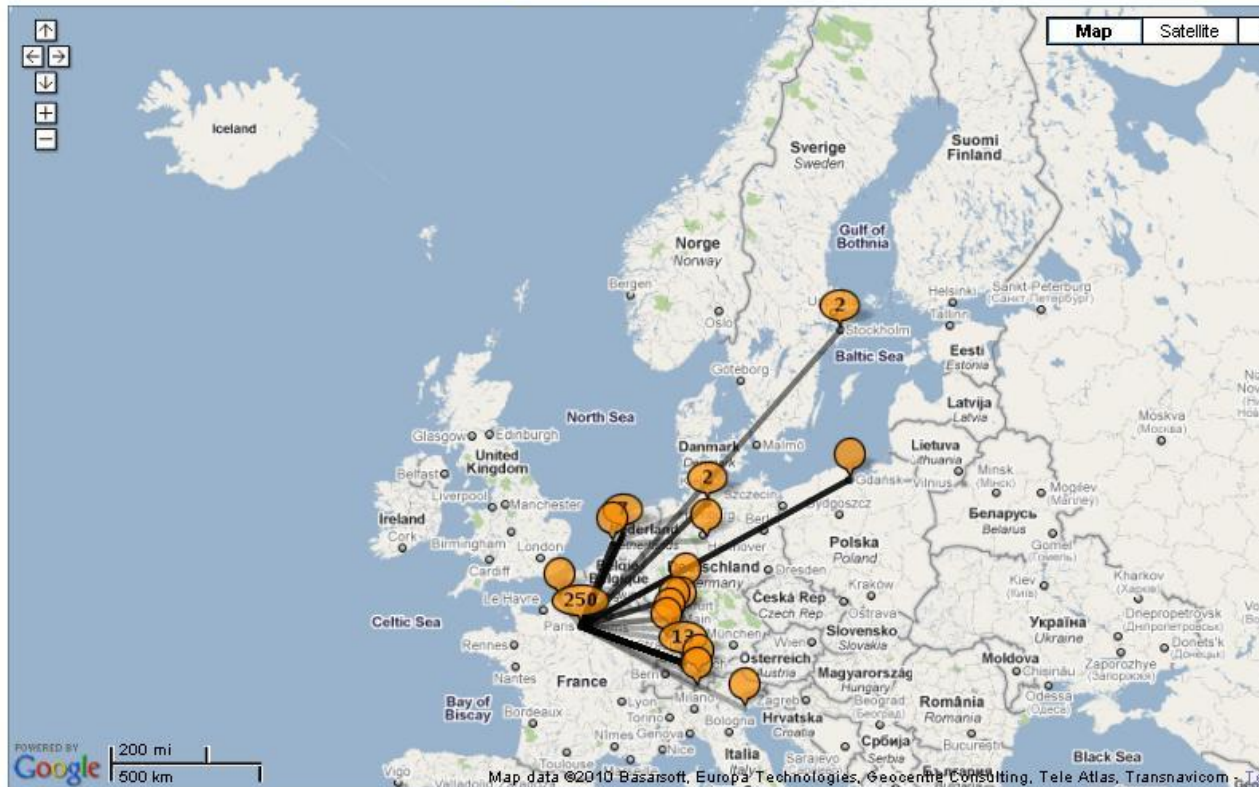
Epistolarium

-CKCC

Geographic Spread | Volume

311 Letters filtered from 1098 originally ([Reset All Filters](#))

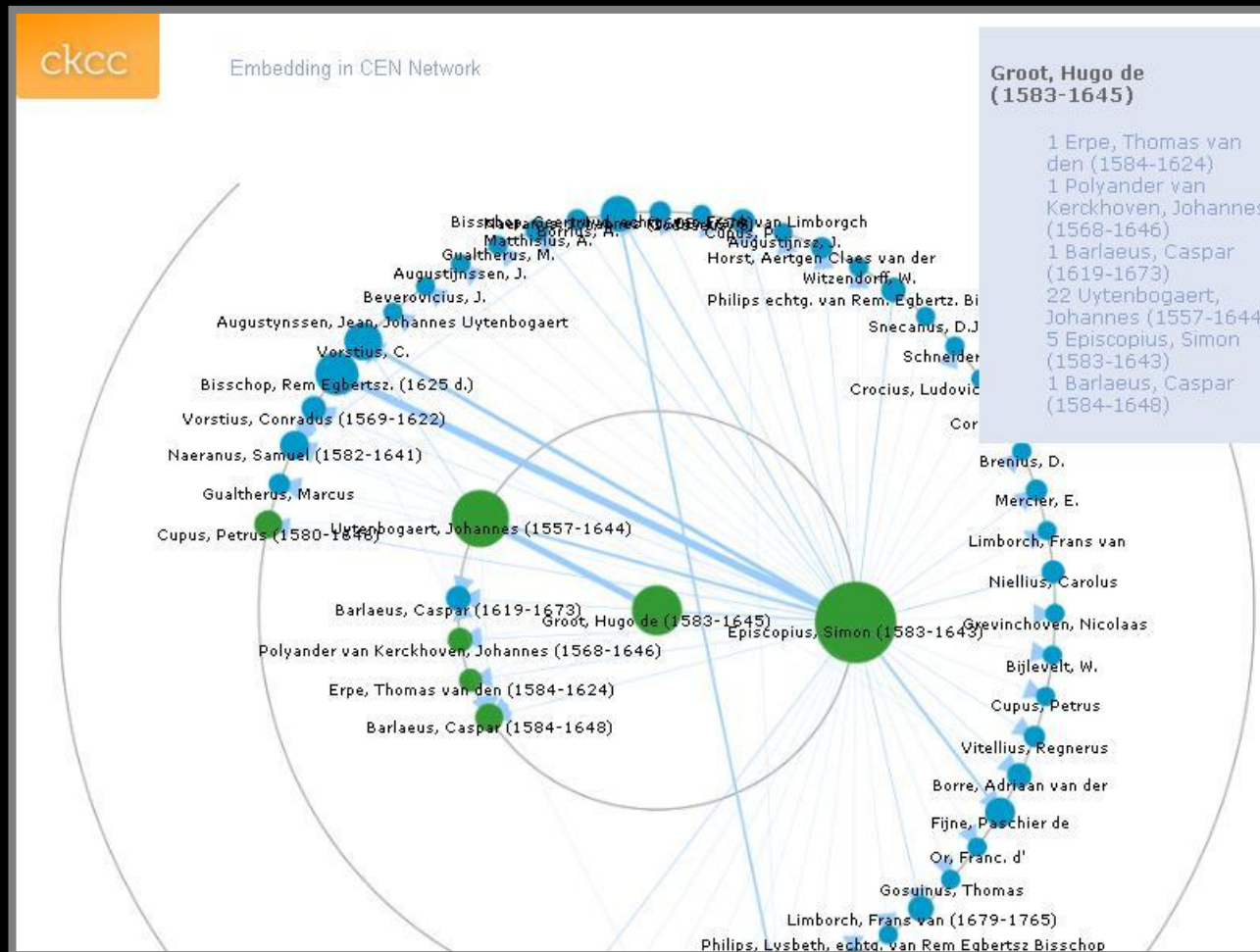
25 results out of 311 cannot be plotted.



Epistolarium

-CKCC

Communities | Correspondent Centrality | Volume



Epistolarium

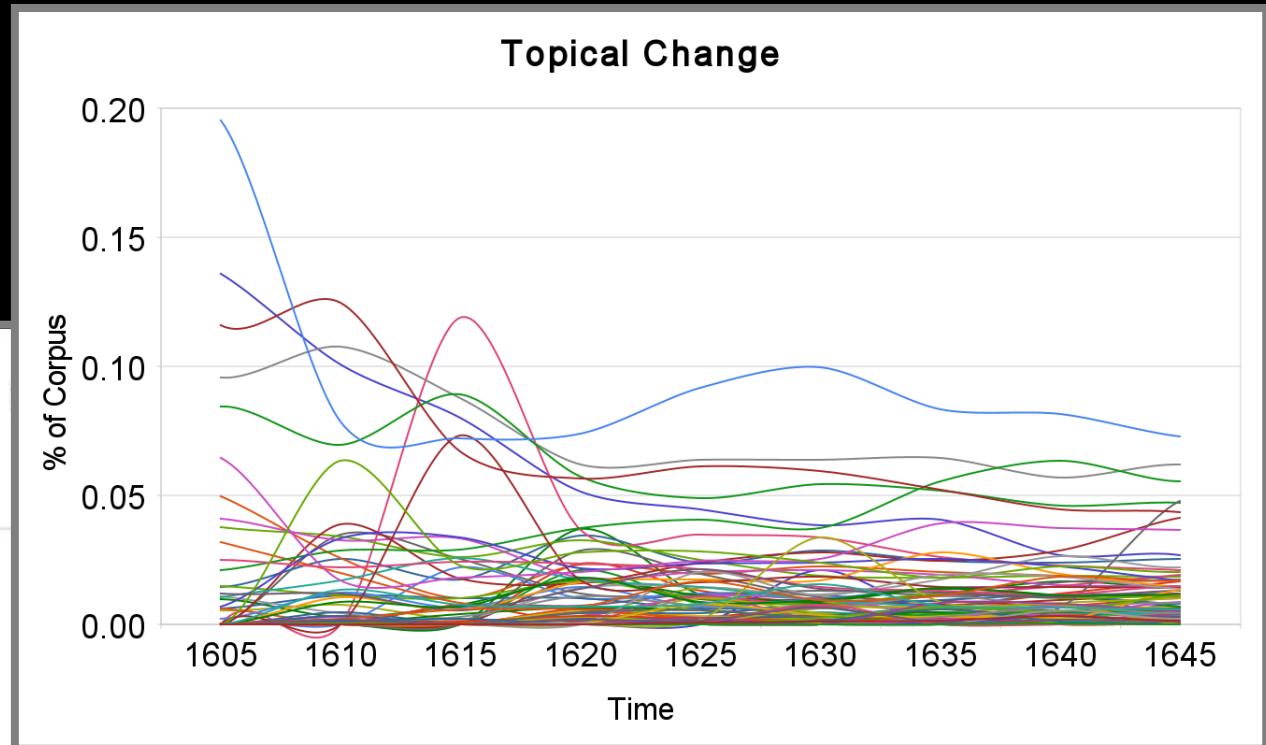
-CKCC

Topics



Topics

- 381 letters
- 339 mathematics
- 144 astronomy
- 106 salutation
- 74 diplomacy
- 59 geometry



Wordcloud Timeline Map

astronomy barometry books botany dioptrics-telescopes diplomacy Dutch-diplomacy family-news
French-Dutch-relations geometry Hugo-and-Jan-Grotius Hugo-and-Willem-Grotius laws-of-motion Leiden-
university **letters** **mathematics** military-affairs news-about-scientists peace-treaties poetry
religion salutation scholastic-theology theology trigonometry valediction



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Future Possibilities



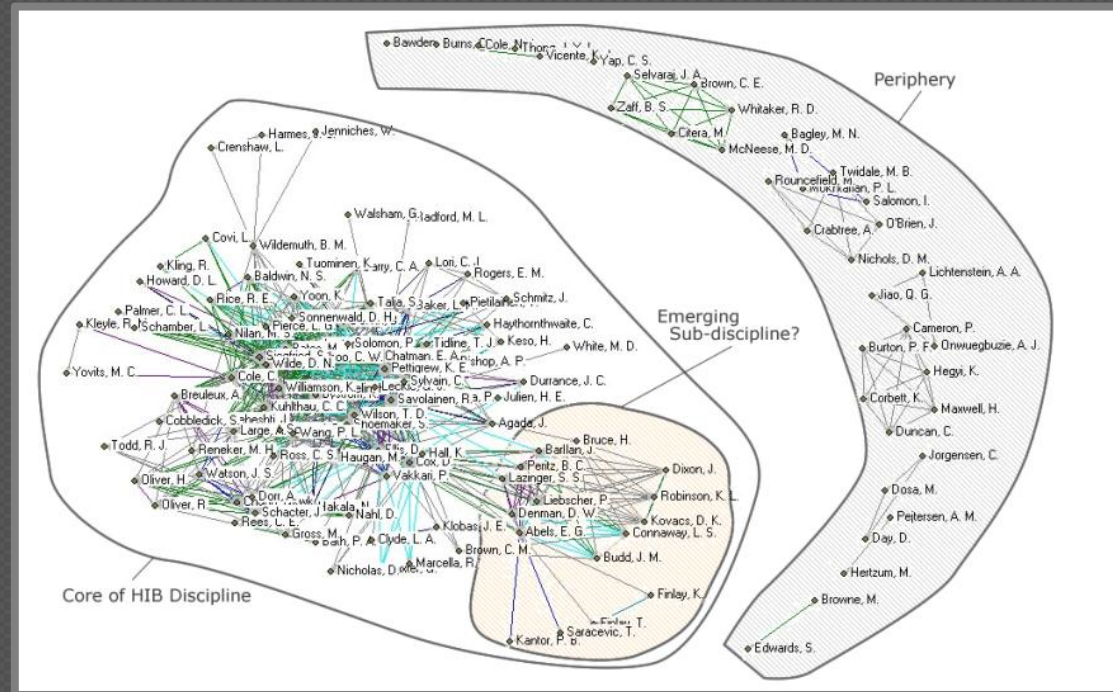
BREAKING FREE OF GRAPHS

CLUSTERING

McKechnie et al.

<http://informationr.net/ir/10-2/paper220.html>

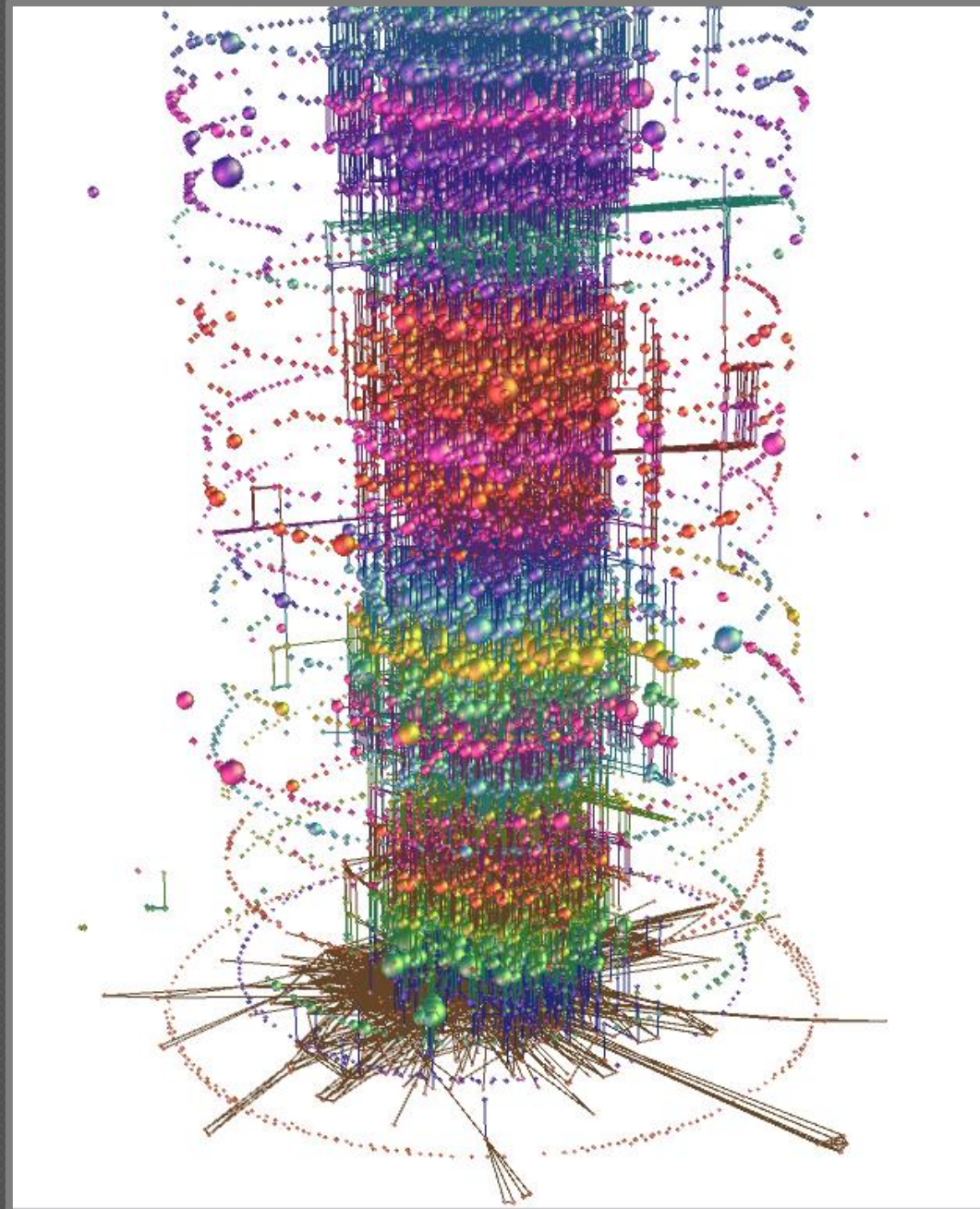
- Hierarchical
- Groups
- Still Spaghetti



INCREASING DIMENSIONALITY

http://www.medialab.sciences-po.fr/index.php?mact=CGCalendar,cntnt0|,default,0&cntnt0|event_id=23&cntnt0|display=event&cntnt0|returnid=15

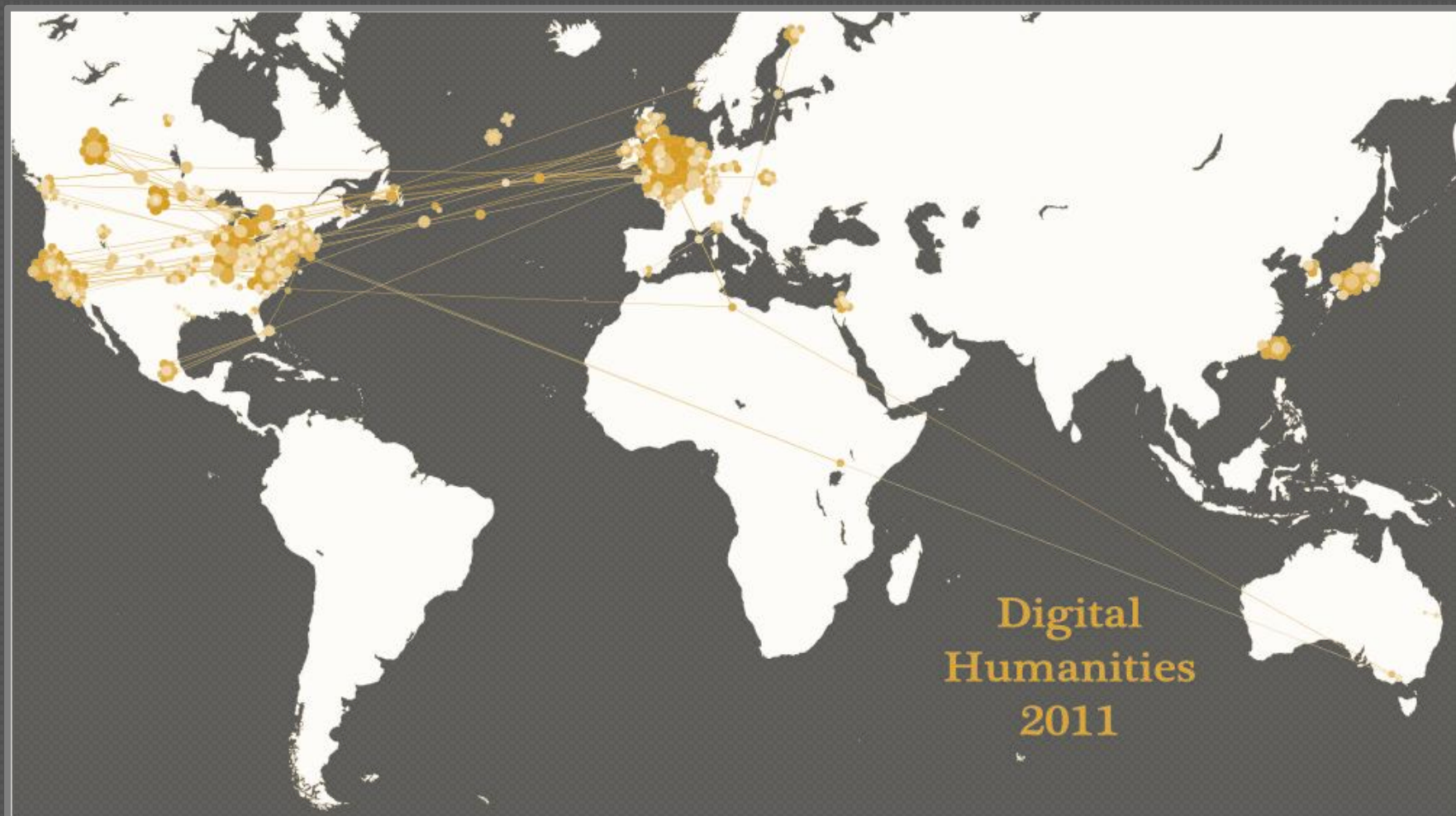
- Graphs in 3.5 dimensions
- (Time? Space?)



MAPS – ADDING ADVANCED NETWORKS

Meeks

<http://dh2011network.stanford.edu/acercaDe.html>



BRINGING IN THE OLD

David Rumsey – Google Earth
<http://www.davidrumsey.com/>

- Visualizing the world as they saw it



BRINGING IN THE OLD

David Rumsey – Google Earth

<http://www.davidrumsey.com/>


David Rumsey Historical Map Collection [back to index](#)

Montreal 1815 Map shows the expansion of Montreal on the north, east and west with the suburbs of Lewis, Quebec, and Recollet. The port also shows significant growth. This map is an inset map in the 1815 Map of Canada. ([more ...](#)) [link to this page](#)

Map Satellite

Montreal 1815

transparent map



1500 ft
450 m

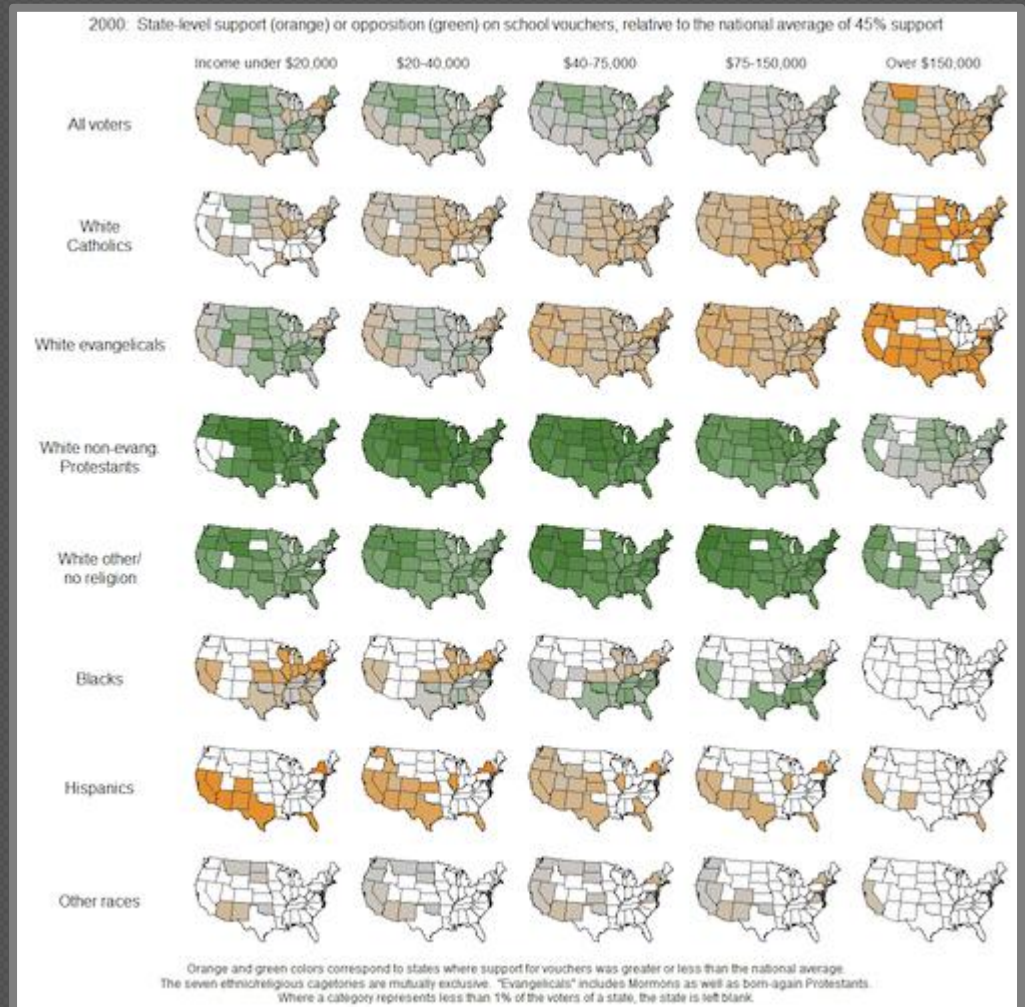
45°30.6416' N, 73°33.1938' W (Link)

Copyright ©2008 DigitalGlobe. GeoEye. Map data ©2008 Tele Atlas. Terms of Use

SMALL MULTIPLES

Andrew Gelman -

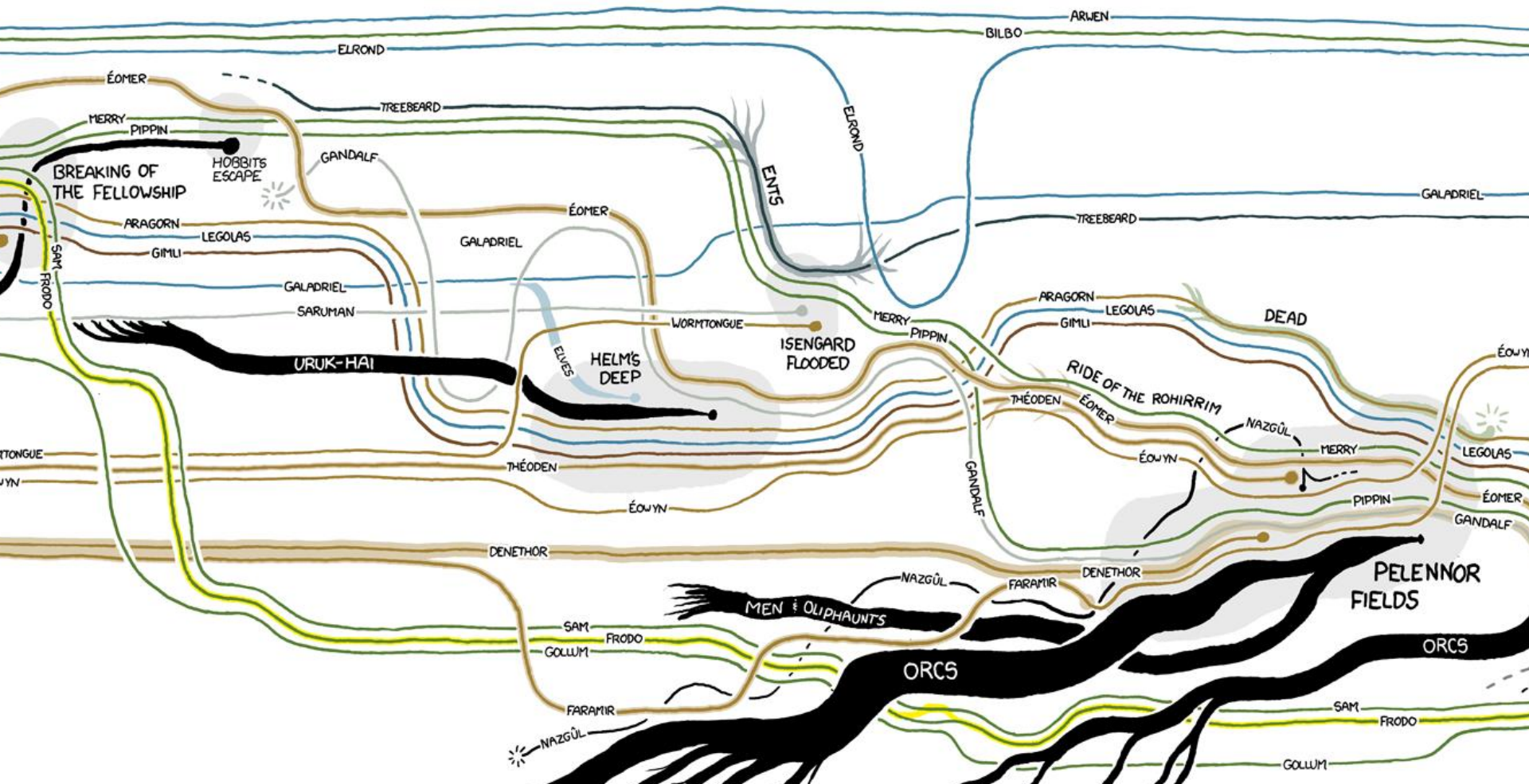
<http://www.juiceanalytics.com/writing/better-know-visualization-small-multiples/>



VISUALIZING NARRATIVE - XKCD

Randall Munroe – <http://www.xkcd.com>

LORD OF THE RINGS



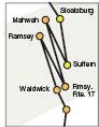
TRAVEL TIME ON COMMUTER RAILS

New York Times - <http://nyti.ms/irMnHS>

Travel Times on Commuter Rail

The map shows the travel times, in minutes, from Manhattan to stations in the region's commuter rail system during the evening rush. Each alternating ring shows how much farther you can travel in an additional 15 minutes. Inbound times may differ.

EXPRESS TRAIN EFFECT

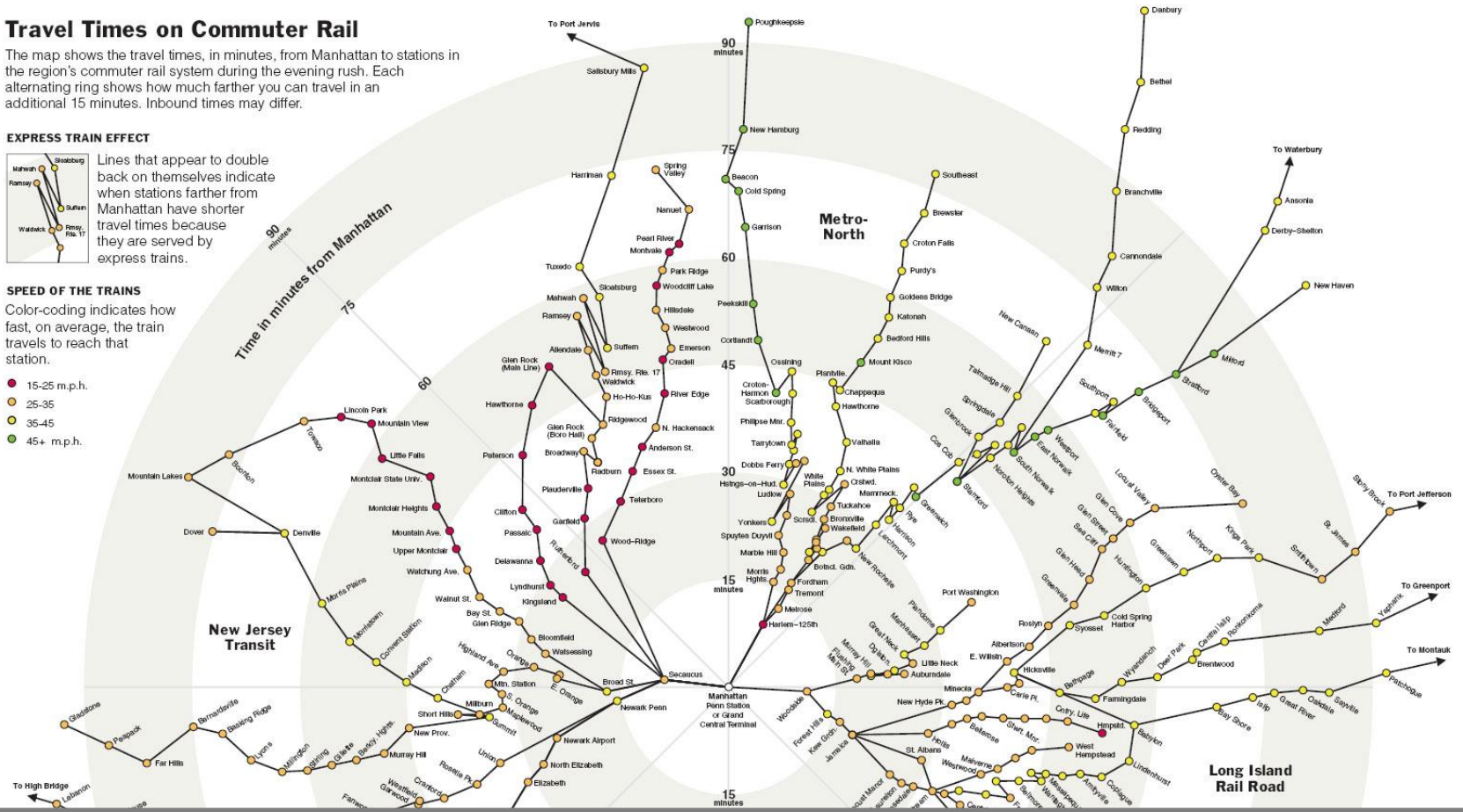


Lines that appear to double back on themselves indicate when stations farther from Manhattan have shorter travel times because they are served by express trains.

SPEED OF THE TRAINS

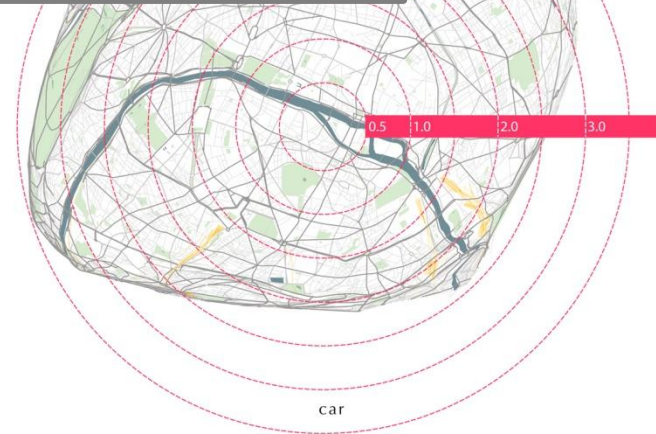
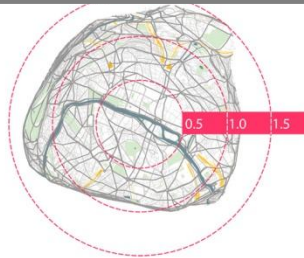
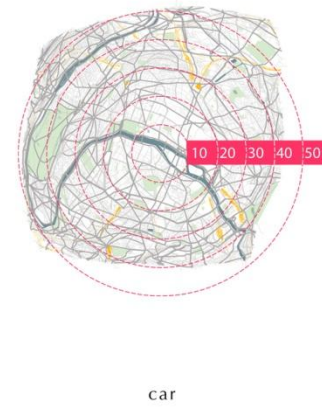
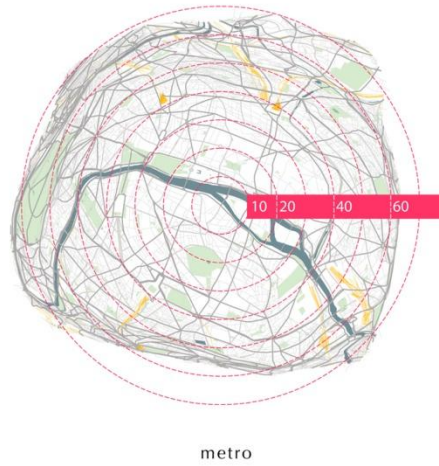
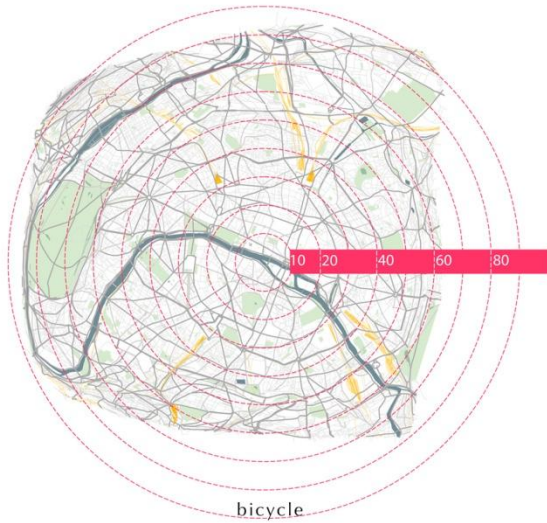
Color-coding indicates how fast, on average, the train travels to reach that station.

- 15-25 m.p.h.
- 25-35
- 35-45
- 45+ m.p.h.



TRAVEL TIME VS. CARBON FOOTPRINT IN PARIS

<http://xiaoji-chen.com/blog/2010/map-of-paris-visualizing-urban-transportation/>



NEW YORK SUBWAY RIDERSHIP

<http://diametunim.com/blog/?p=111>



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– Scott Weingart

 **THANK YOU**



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IMPLEMENTATION



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Data Conceptualizations



PLANNING EARLY



Representing Uncertainty

- Three kinds of uncertainty:
 - Uncertain fields within an entry
 - Missing entries
 - Unknown entries
- Degrees of certainty
- Ranges of certainty (time, space, quantity)



Representing Continuity

- Digital vs. Analog, Discontinuous vs. Continuous, Points vs. Fields
- Time (point vs. range)
- Space
 - Granularity – town, city, county, country
 - Range – town, city, county, country
- Authorship – how is it distributed?
- What is a document? Can they be nested? Sent along? Continued?



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Data Formats



NETWORKS

Network Formats

- Matrix
- Adjacency List
- Node & Edge List

Nodes		
1	Newton	
2	Oldenburg	
3	Flamsteed	
Edges		
1	2	13
1	3	38
2	1	24
2	3	45
3	1	62
3	2	7

Newton	Oldenburg	13
Newton	Flamsteed	38
Oldenburg	Newton	24
Oldenburg	Flamsteed	45
Flamsteed	Newton	62
Flamsteed	Oldenburg	7

	Newton	Oldenburg	Flamsteed
Newton	0	13	38
Oldenburg	24	0	45
Flamsteed	62	7	0

NWB Format

*Nodes

id*int label*string totaldegree*int

16 "Merwede van Clootwyck, Matthys van der (1613-1664)" 1

36 "Perrault, Charles" 1

48 "Bonius, Johannes" 1

67 "Surenhusius Gzn., Gulielmus" 1

99 "Anguissola, Giacomo" 1

126 "Johann Moritz, von Nassau-Siegen (1604-1679)" 6

131 "Steenberge, J.B." 1

133 "Vosberghen Jr., Caspar van" 1

151 "Bogerman, Johannes (1576-1637)" 25

*DirectedEdges

source*int target*int weight*float eyear*int syear*int

16 36 1 1640 1650

16 126 5 1641 1649

36 48 2 1630 1633

48 16 4 1637 1644

48 67 10 1645 1648

48 36 2 1632 1638

67 133 7 1644 1648

67 131 3 1642 1643

99 67 9 1640 1645

126 16 3 1641 1646

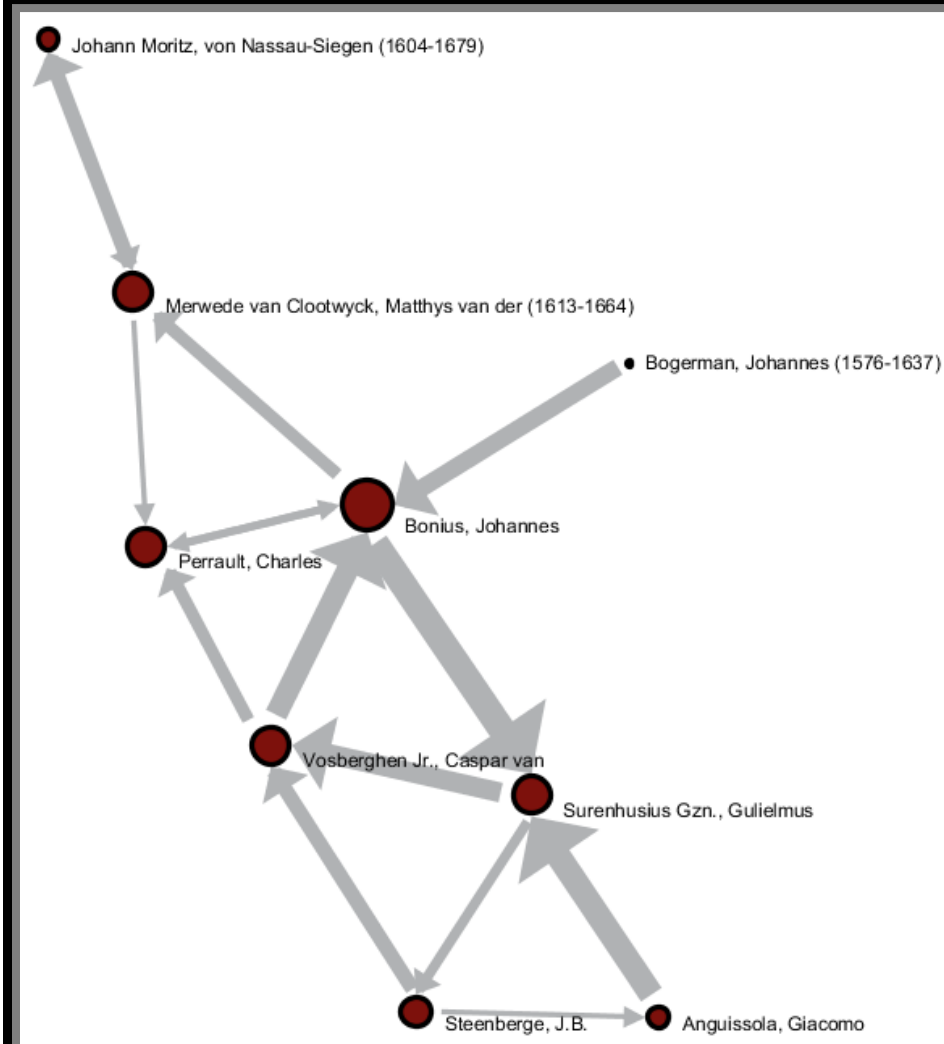
131 133 5 1630 1638

131 99 1 1637 1639

133 36 4 1645 1648

133 48 8 1632 1636

151 48 6 1644 1647



GraphML Format

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- This file was written by the JAVA GraphML Library.-->
<graphml xmlns="http://graphml.graphdrawing.org/xmlns"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://graphml.graphdrawing.org/xmlns
http://graphml.graphdrawing.org/xmlns/1.0/graphml.xsd">
  <graph id="G" edgedefault="directed">
    <node id="n0"/>
    <node id="n1"/>
    <node id="n2"/>
    <node id="n3"/>
    <node id="n4"/>
    <edge source="n0" target="n2"/>
    <edge source="n1" target="n2"/>
    <edge source="n2" target="n3"/>
    <edge source="n3" target="n5"/>
    <edge source="n3" target="n4"/>
  </graph>
</graphml>
```

JSON Format

```
var json = [  
  {  
    "adjacencies": [  
      "graphnode21",  
      {  
        "nodeTo": "graphnode1",  
        "nodeFrom": "graphnode0",  
        "data": {  
          "$color": "#557EAA"  
        }  
      }, {  
        "nodeTo": "graphnode13",  
        "nodeFrom": "graphnode0",  
        "data": {  
          "$color": "#909291"  
        }  
      }, {  
        "nodeTo": "graphnode14",  
        "nodeFrom": "graphnode0",  
        "data": {  
          "$color": "#557EAA"  
        }  
      } ...  
    ]  
  }  
]
```



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Visualization Packages

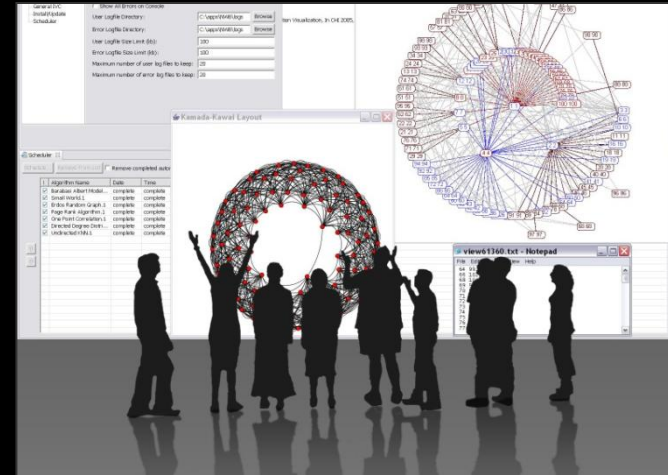


INDIANA UNIVERSITY

CYBERINFRASTRUCTURE FOR

NETWORK SCIENCE CENTER

Microscopes, Telescopes, and Macroscopes



Just as the **microscope** empowered our naked eyes to see cells, microbes, and viruses thereby advancing the progress of biology and medicine or the **telescope** opened our minds to the immensity of the cosmos and has prepared mankind for the conquest of space, **macroscopes** promise to help us cope with another infinite: the infinitely complex. Macroscopes give us a 'vision of the whole' and help us 'synthesize'. They let us detect patterns, trends, outliers, and access details in the landscape of science. Instead of making things larger or smaller, macroscopes let us observe what is at once too great, too slow, or too complex for our eyes.

Desirable Features of Macroscopes

Core Architecture & Plugins/Division of Labor: Computer scientists need to design the standardized, modular, easy to maintain and extend “core architecture”. Dataset and algorithm plugins, i.e., the “filling”, are provided by those that care and know most about the data and developed the algorithms: the domain experts.

Ease of Use: As most plugin contributions and usage will come from non-computer scientists it must be possible to contribute, share, and use new plugins without writing one line of code. Users need guidance for constructing effective workflows from 100+ continuously changing plugins.

Modularity: The design of software modules with well defined functionality that can be flexibly combined helps reduce costs, makes it possible to have many contribute, and increases flexibility in tool development, augmentation, and customization.

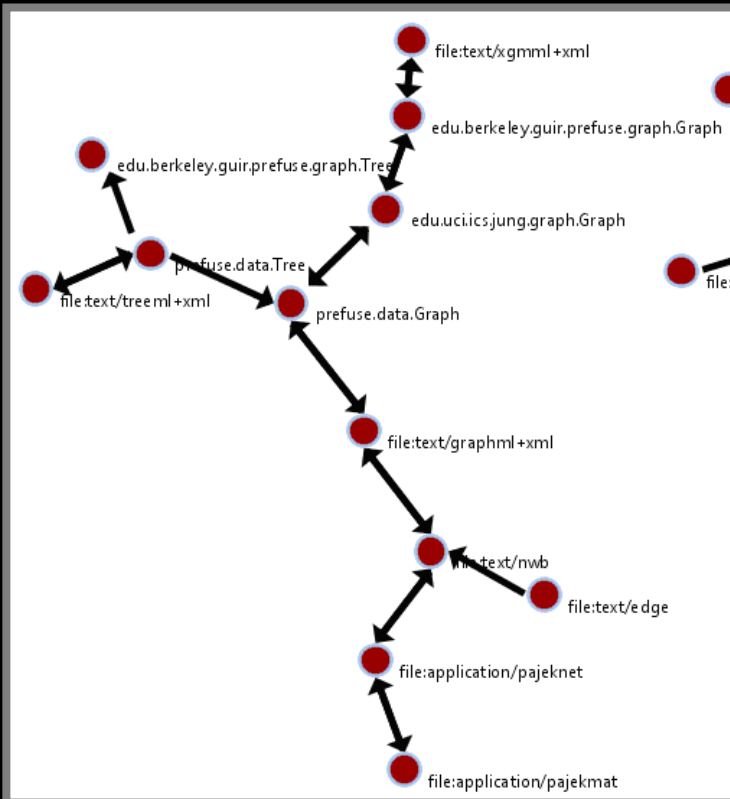
Standardization: Adoption of (industry) standards speeds up development as existing code can be leveraged. It helps pool resources, supports interoperability, but also eases the migration from research code to production code and hence the transfer of research results into industry applications and products.

Open Data and Open Code: Lets anybody check, improve, or repurpose code and eases the replication of scientific studies.

Macroscopes are similar to Flickr and YouTube and but instead of sharing images

or videos, you freely share datasets and algorithms with scholars around the globe.

Network Workbench



Network Workbench | Download - Windows Internet Explorer

http://nwb.sls.indiana.edu/download.html

File Edit View Favorites Tools Help

gigapan: no intro Network Workbench | D...

Network Workbench

A Workbench for Network Scientists

LOGIN

Home People Research Publications Community **Download** Documentation Dev Zone About

Download

NWB
Tool 1.0.0 Official Release
September 15th, 2009

Release Notes

Select Your Operating System

- Windows (XP & Vista)
- Windows (XP & Vista)
- 32-bit Linux
- 64-bit Linux
- Intel Mac OSX
- G3/G4/G5 Mac OSX

DOWNLOAD

NWB-Demo
Demo
Oct 13th, 2009

Release Notes

Select Your Operating System

- Windows (XP & Vista)

DOWNLOAD

Downloads for NWB Tool Releases

Number of Downloads per Month

Time

Dec-06 Dec-07 Dec-08 Jul-09

35,000
30,000
25,000
20,000
15,000
10,000
5,000
0

Cumulative Total

v0.5 v0.6 v0.7 v0.8 v0.9 v1.0.0

Network Workbench

The NWB tool supports loading the following input file formats:

- GraphML (*.xml or *.graphml)
- XGMML (*.xml)
- Pajek .NET (*.net) & Pajek .Matrix (*.mat)
- NWB (*.nwb)
- TreeML (*.xml)
- Edge list (*.edge)
- CSV (*.csv)
- ISI (*.isi)
- Scopus (*.scopus)
- NSF (*.nsf)
- Bibtex (*.bib)
- Endnote (*.enw)

and the following network file output formats:

- GraphML (*.xml or *.graphml)
- Pajek .MAT (*.mat)
- Pajek .NET (*.net)
- NWB (*.nwb)
- XGMML (*.xml)
- CSV (*.csv)

Formats are documented at <https://nwb.slis.indiana.edu/community/?n=DataFormats.HomePage>.

The Sci2 Tool

Sci² Tool
 File Preprocessing Modeling Analysis Visualization Scientometrics Help

Console

Welcome to the Science of Science Tool (Sci²). The development of this tool is supported in part by the Network Science center and the School of Informatics at Indiana University, the National Science Foundation Grant IIS-0715303, and the James S. McDonnell Cyberinfrastructure portal (<http://sci.slis.indiana.edu>)

The primary investigators are Katy Börner, Indiana University, SciTech Strategies Inc. The Sci² tool was developed by J. Duhon, Patrick A. Phillips, Chintan Tank, and the Network Science Center (<http://cishell.org>) for Network Science Center (<http://cns.slis.indiana.edu>). Many algorithm plugins were derived from the Network Science Center (<http://nwb.slis.indiana.edu>).

Please cite as follows:

Sci² Team. (2009). Science of Science Tool. Indiana University, SciTech Strategies Inc., <http://sci.slis.indiana.edu>.

Scheduler

Remove From List Remove completed



!	Algorithm Name	Date	Time	% Comp
<input checked="" type="checkbox"/>	Extract Co-Author Netw...	09/03/2009	00:15:20 AM	<div style="width: 100%; height: 10px; background-color: green;"></div>
<input checked="" type="checkbox"/>	Load and Clean ISI File	09/03/2009	00:15:05 AM	<div style="width: 100%; height: 10px; background-color: green;"></div>

GUESS

GnuPlot

Radial Tree/Graph (prefuse alpha)

Radial Tree/Graph with Annotation (prefuse beta)

Tree View (prefuse beta)

Tree Map (prefuse beta)

Force Directed with Annotation (prefuse beta)

Fruchterman-Reingold with Annotation (prefuse beta)

DfL (VxOrd)

Specified (prefuse beta)

Horizontal Line Graph

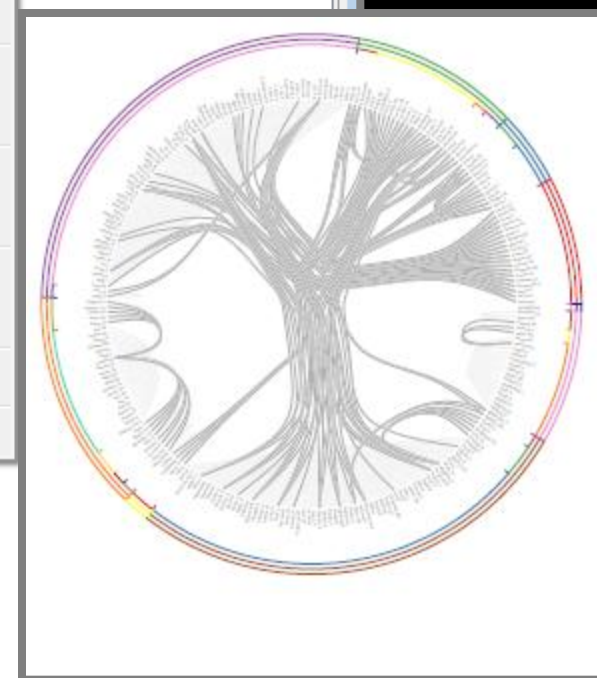
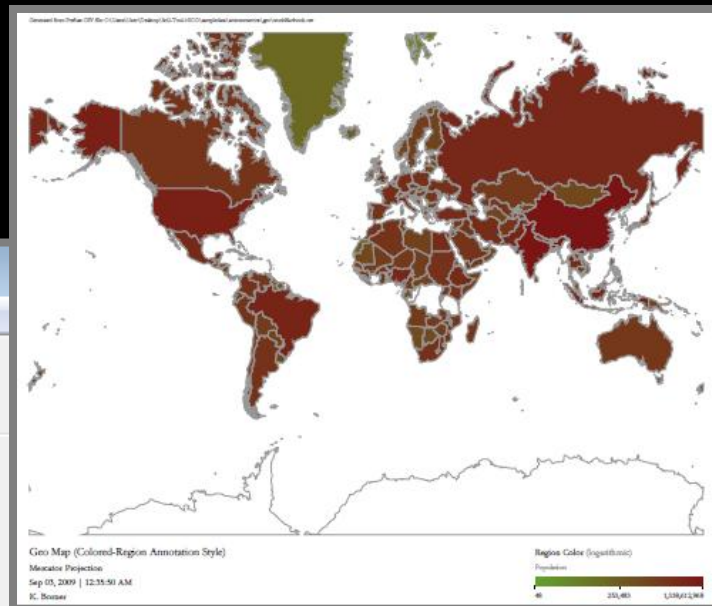
Circular Hierarchy

Geo Map (circle annotations)

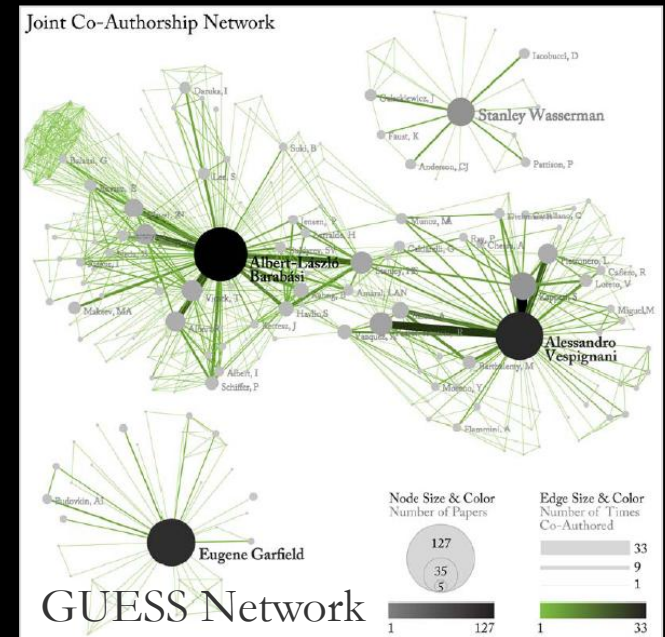
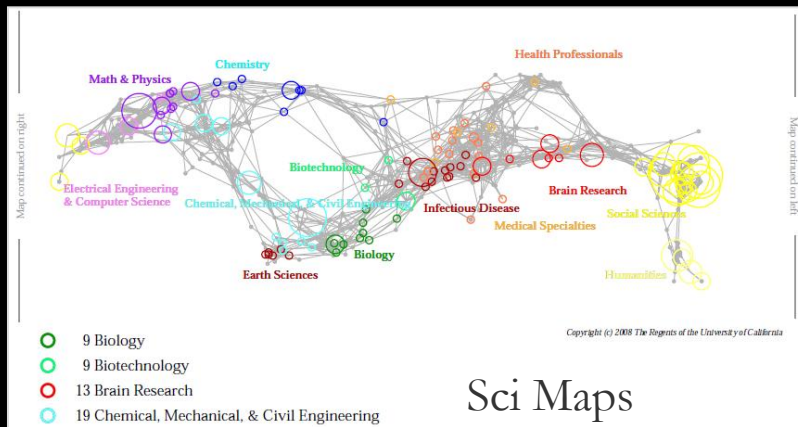
Geo Map (region coloring annotations)

Image Viewer

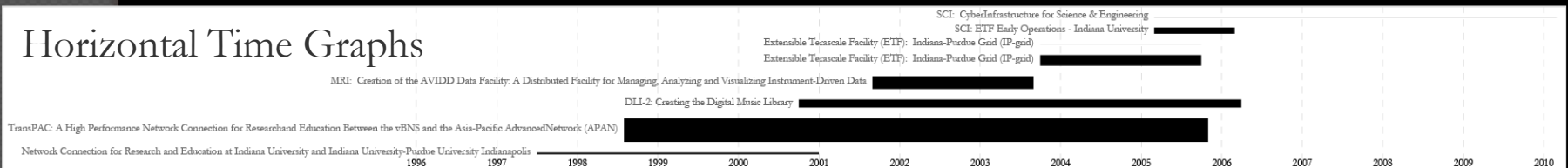
RefMapper



The Sci2 Tool



Horizontal Time Graphs

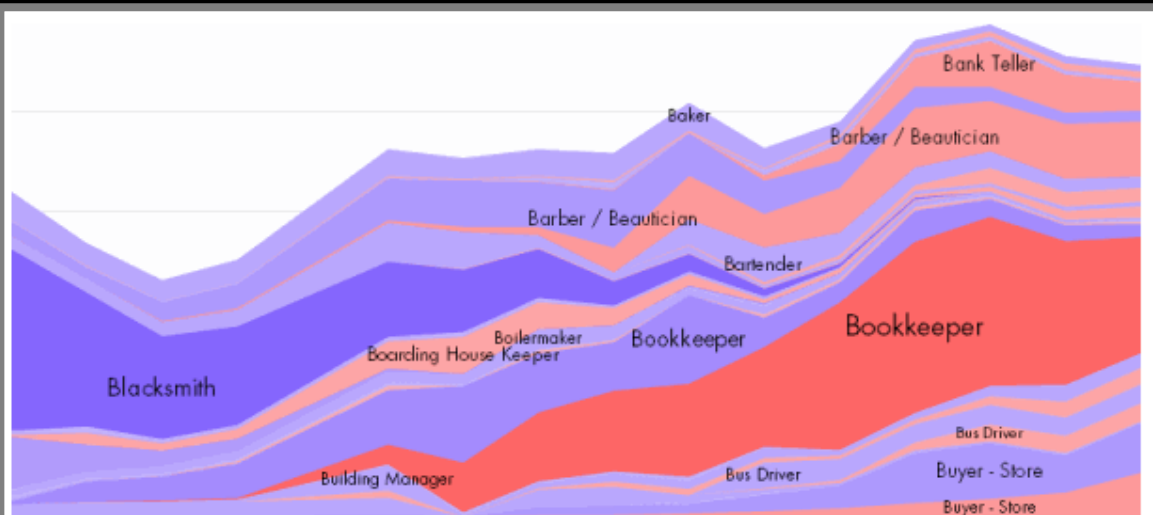


Visualization Packages



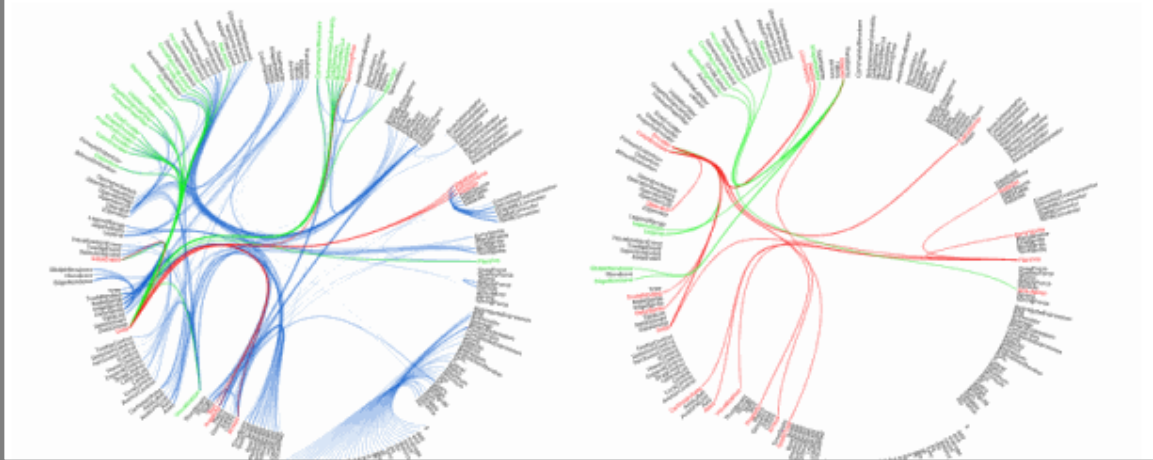
WEB-BASED

Flare



The *Job Voyager* uses stacked time series to visualize 150 years of changes in the United States Labor Force.

Flare Dependency Graph



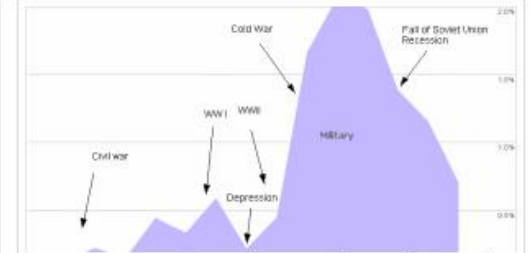
Prefuse



DocuBurst by Christopher Collins



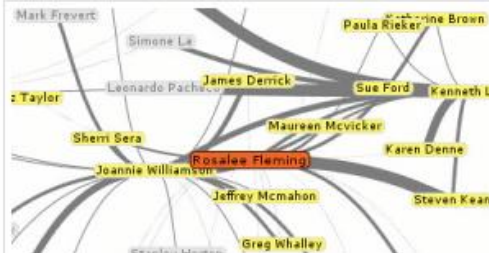
Uncertainty Lattices by Christopher Collins



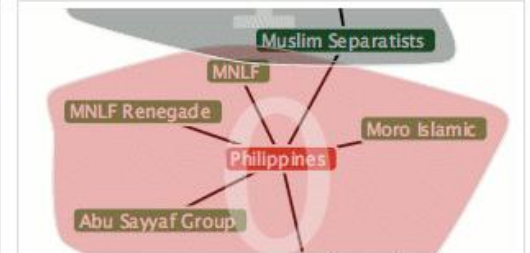
sense.us by Heer, Viégas, and Wattenberg



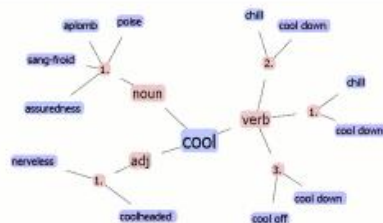
StudiAnalyze by Christoph Gerstle and Florian Moritz



Enron Explorer by Trampoline Systems



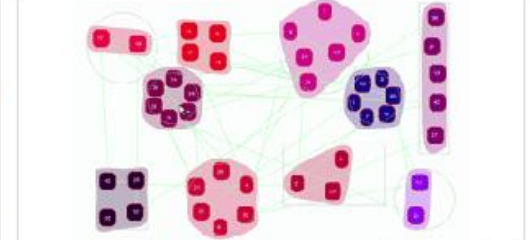
Social Action by Adam Perer



Nearword by Gregory Vaughan

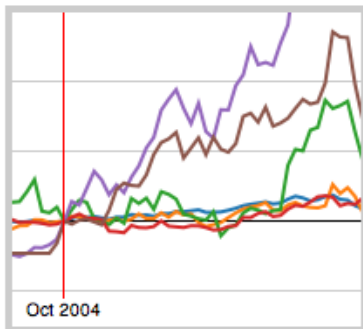


34all by Martin Dudek

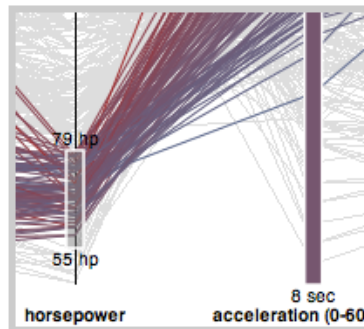


Zone Manager by Martin Dudek

Protovis



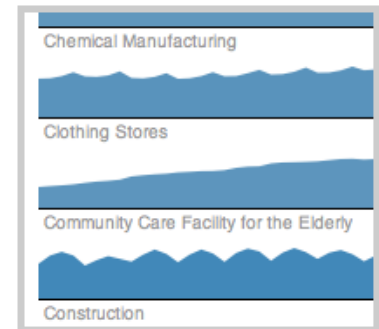
Index Charts



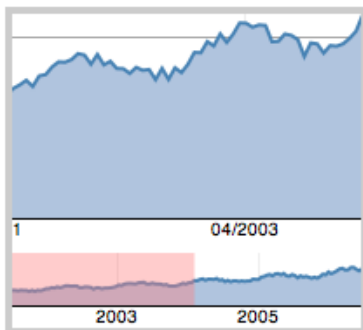
Parallel Coordinates



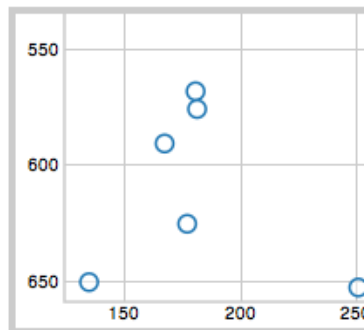
Job Voyager



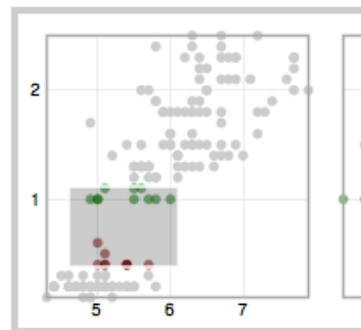
Minnesota Employment



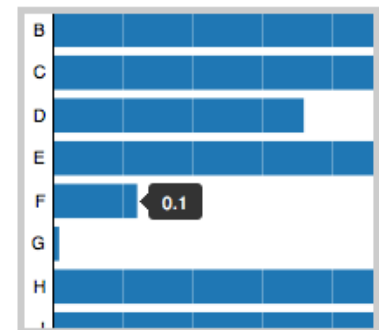
Focus + Context



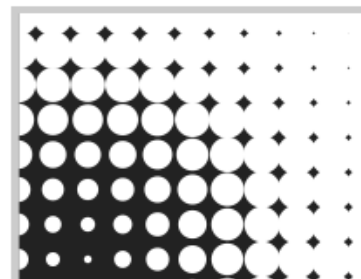
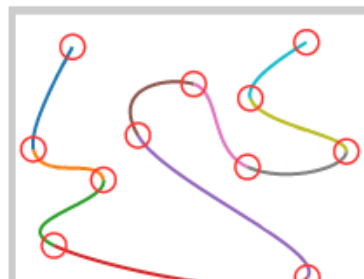
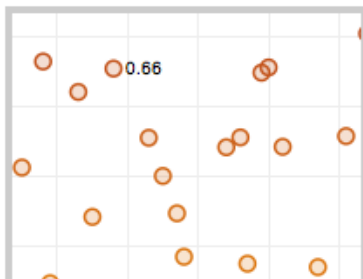
Pan + Zoom



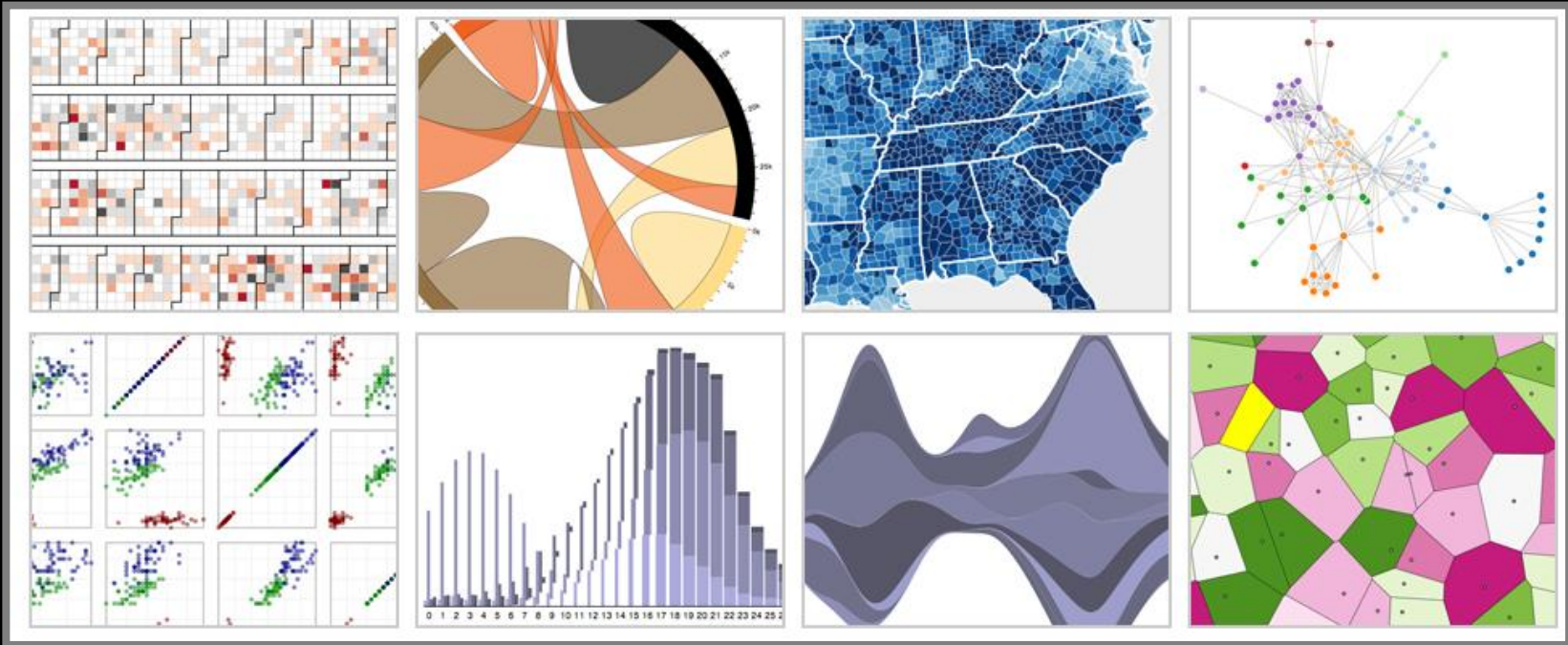
Brush + Link



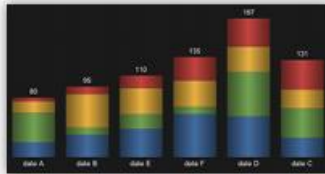
Tooltips



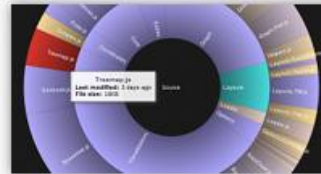
d3.js – Data Driven Documents



JIT – JavaScript InfoVis Toolkit



Stacked AreaChart
Vertical Stacked BarChart
Horizontal Stacked BarChart
Stacked PieChart



File System Visualization
Custom Nodes and Edges



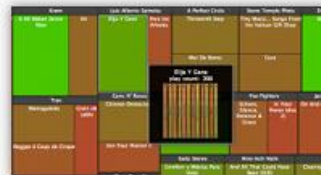
Static Icicle Animation
File System Visualization

ForceDirected



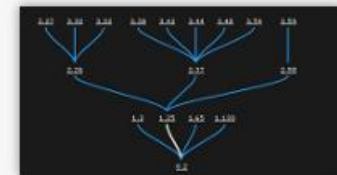
Graph Manipulation
Graph Manipulation and Editing

TreeMap



Squarified Animated Treemap
On-Demand Nodes
Cushion Treemap

SpaceTree



Tree Animation
On-Demand Nodes
Add/Remove Subtrees
Custom Style Animations

RGraph



HyperTree



Advanced/Other





Schedule

- 14:05 - 14:15: Why Visualize?
- 14:15 - 14:30: Visualizations of the Republic of Letters
- 14:30 - 14:45: Future Possibilities
- 14:45 - 14:55: Questions

- 15 Minute Break

- 15:10 - 15:15: Data Conceptualizations
- 15:15 - 15:25: Data Formats
- 15:25 - 15:40: Visualization Packages
- 15:40 - 15:45: To-Do
- 15:45 - 16:00: Questions



To-Do

- Visualizations more seamlessly integrated with navigations & facets
- Handle more data
- Stream data of different types from different sources
- Immersive environments as humanistic tools



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Analyzing, Visualizing, and Navigating the Republic of Letters
– Scott Weingart

 **THANK YOU**



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