Online Course
**Data Visualization for Professionals**
THE UNIVERSITY of EDINBURGH


# Visualizing and Exploring Networks with The Vistorian

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VIS HUB University of Edinburgh Visual+ Interactive Data
Inria
Microsoft Research
THE UNIVERSITY of EDINBURGH

# Session Outline

- **Visualization of a Network**
- **Common Representations of Network**
- **What is Network Visual Exploration?**
- **Network Exploration with the Vistorian: Demo Datasets (1 + 2)**
  - How to import data through the Vistorian?
  - Interactive Visual Exploration Strategies (Interaction types, Visualizations):
    - Temporal Exploration
    - Filtering
- **Data Formatting**
  - What tables are there?
  - Finding the right format
  - Notes on Your Network Data Preparation

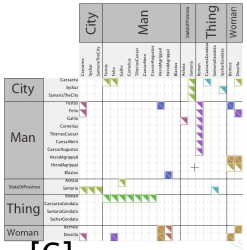
# Visualization of a Network

# Visualization of a Network

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | **Index** | **Name1** | **Place1** | **Qualification** | **Name2** | **Place2** | **Date** |
| 2 | 0 | Hubert Antheaume | Nantes | Commerce | Jacques Yvon, sr des l | Santo Domingo | 03/08/1673 |
| 3 | 1 | Marie Boucher | Nantes | Commerce | Hubert Antheaume | Nantes | 06/08/1675 |
| 4 | 2 | Marie Boucher | Nantes | Famille | Hubert Antheaume | Nantes | 06/08/1675 |
| 5 | 3 | Marie Boucher | Nantes | Famille | Roze Boucher | Nantes | 15/09/1671 |
| 6 | 4 | Marie Boucher | Paris | Commerce | Roze Boucher | Nantes | 15/09/1671 |
| 7 | 5 | Marie Boucher | Paris | Commerce | Hubert Antheaume | Paris | 15/09/1671 |
| 8 | 6 | ? Vallet | Santo Domingo | Travail | ? Bec de Fort | | 01/01/1676 |

# Marie Boucher Dataset

# Common Representations of Network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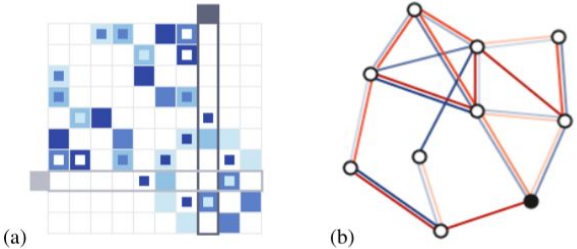
(a)
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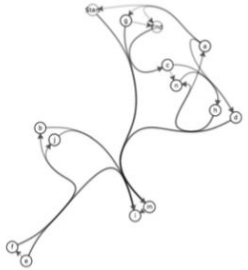

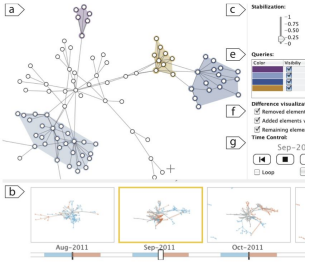
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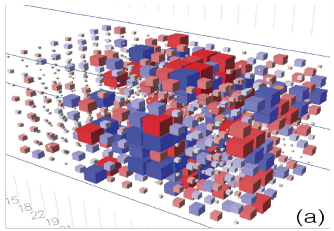
Oct-2011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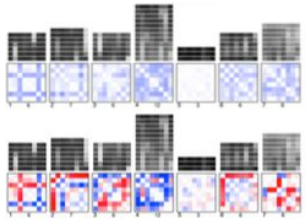

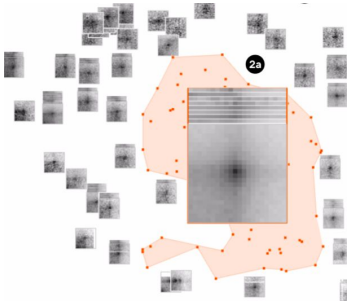
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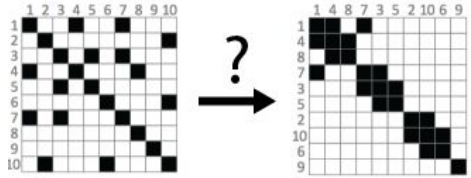
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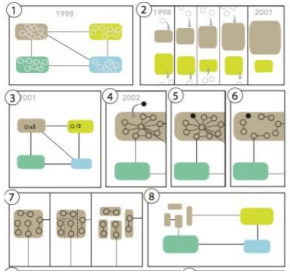
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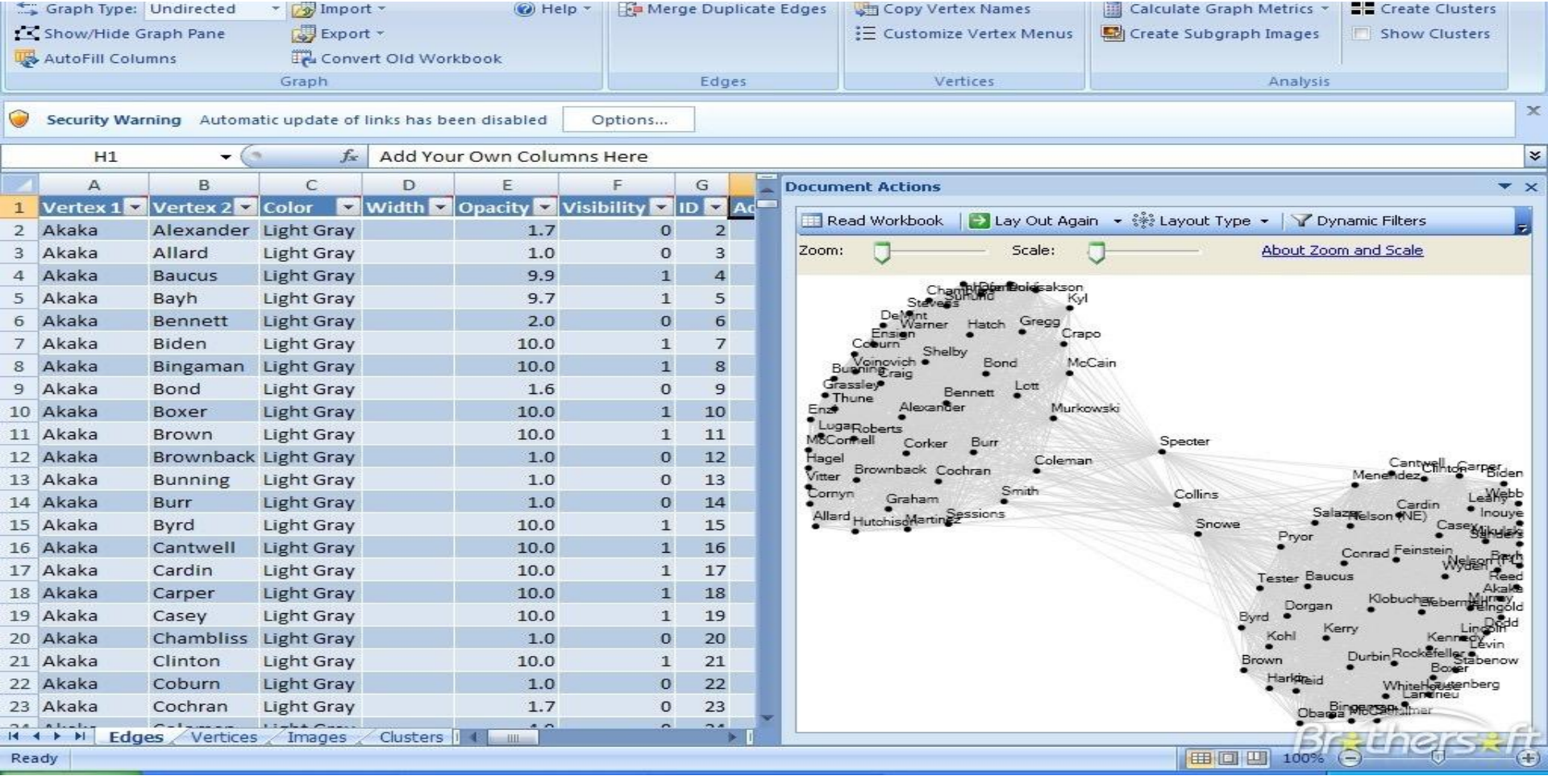
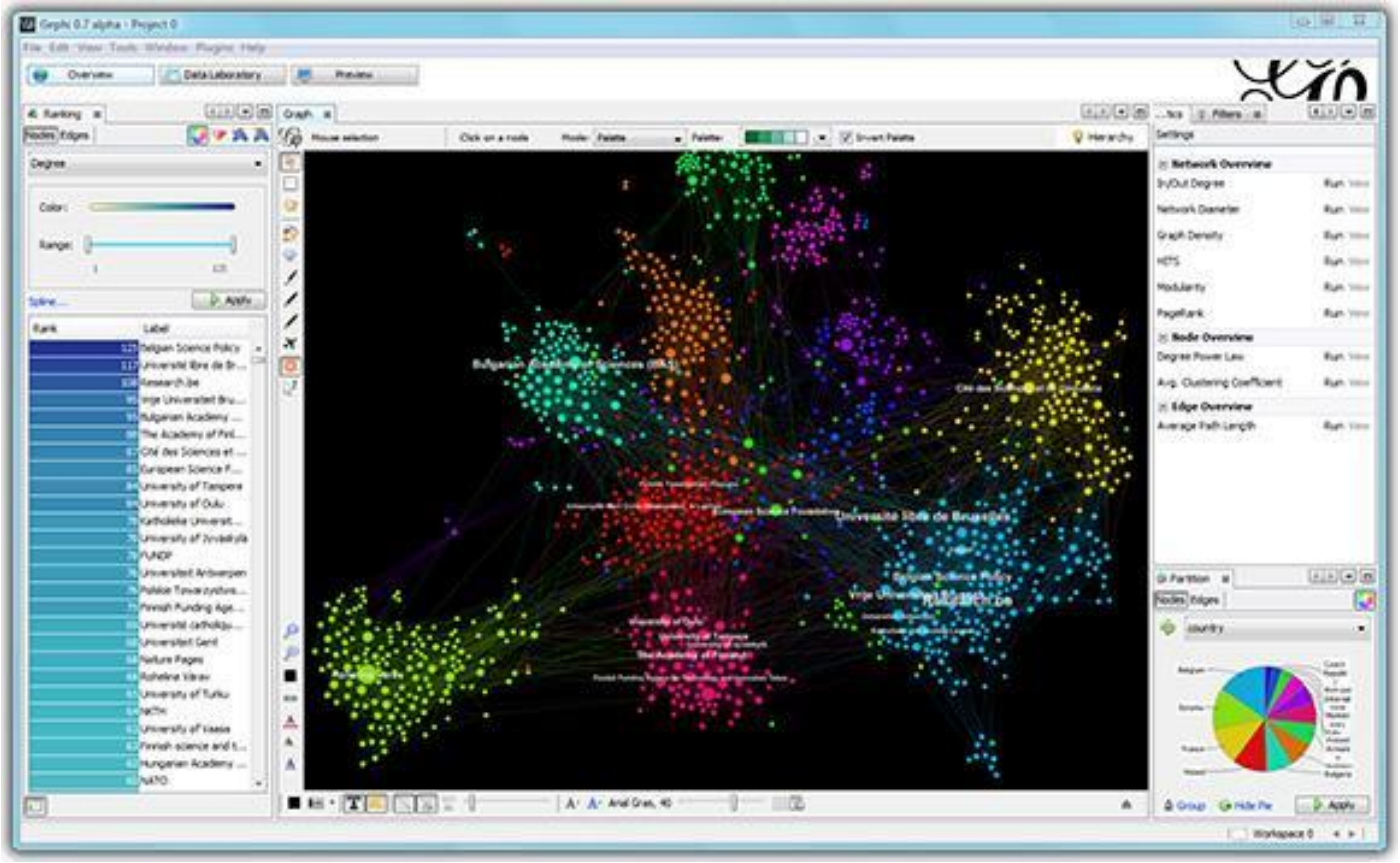
# NodeXL

https://nodexl.codeplex.com



# Gephi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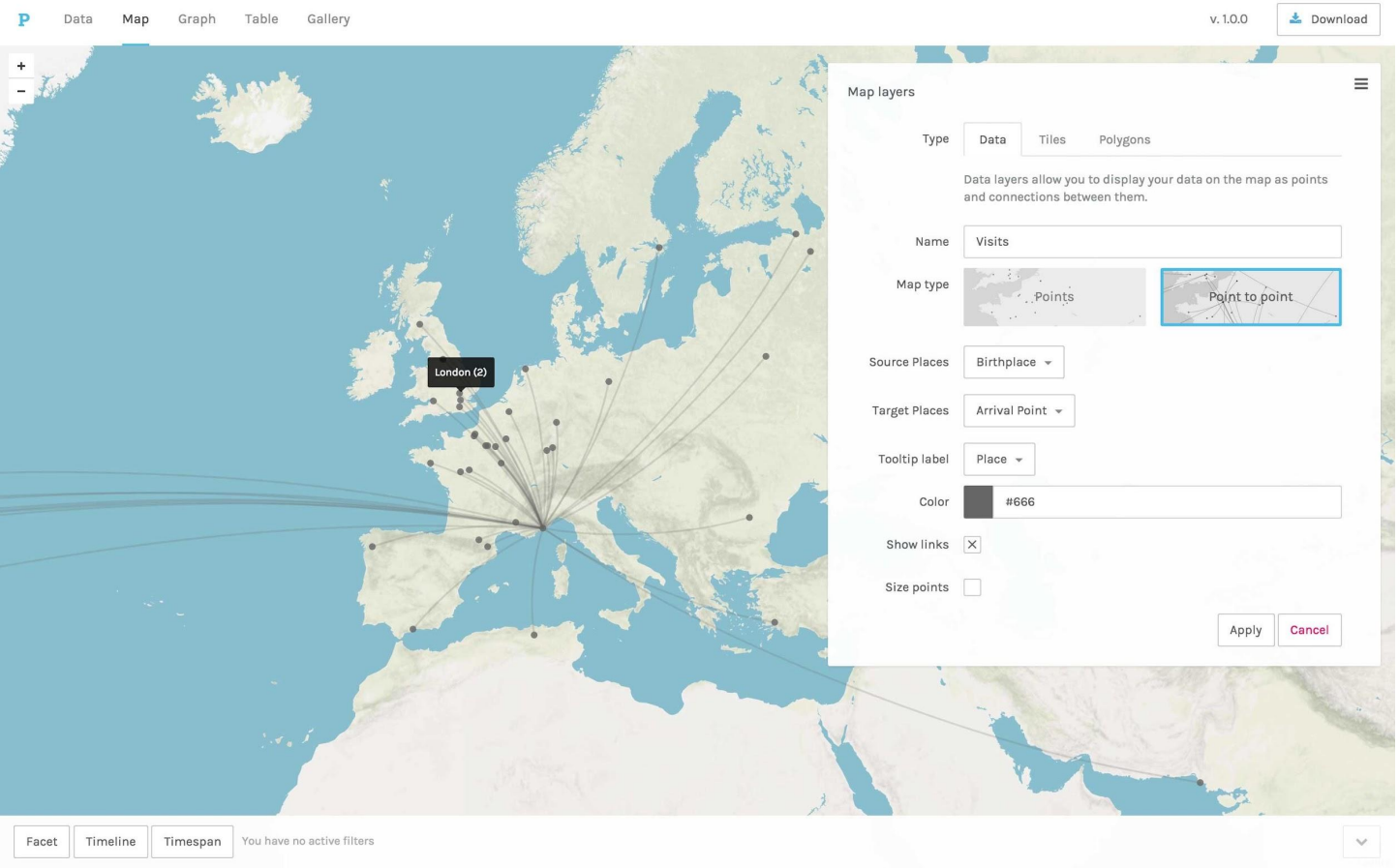
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Data layers allow you to display your data on the map as points and connections between them.
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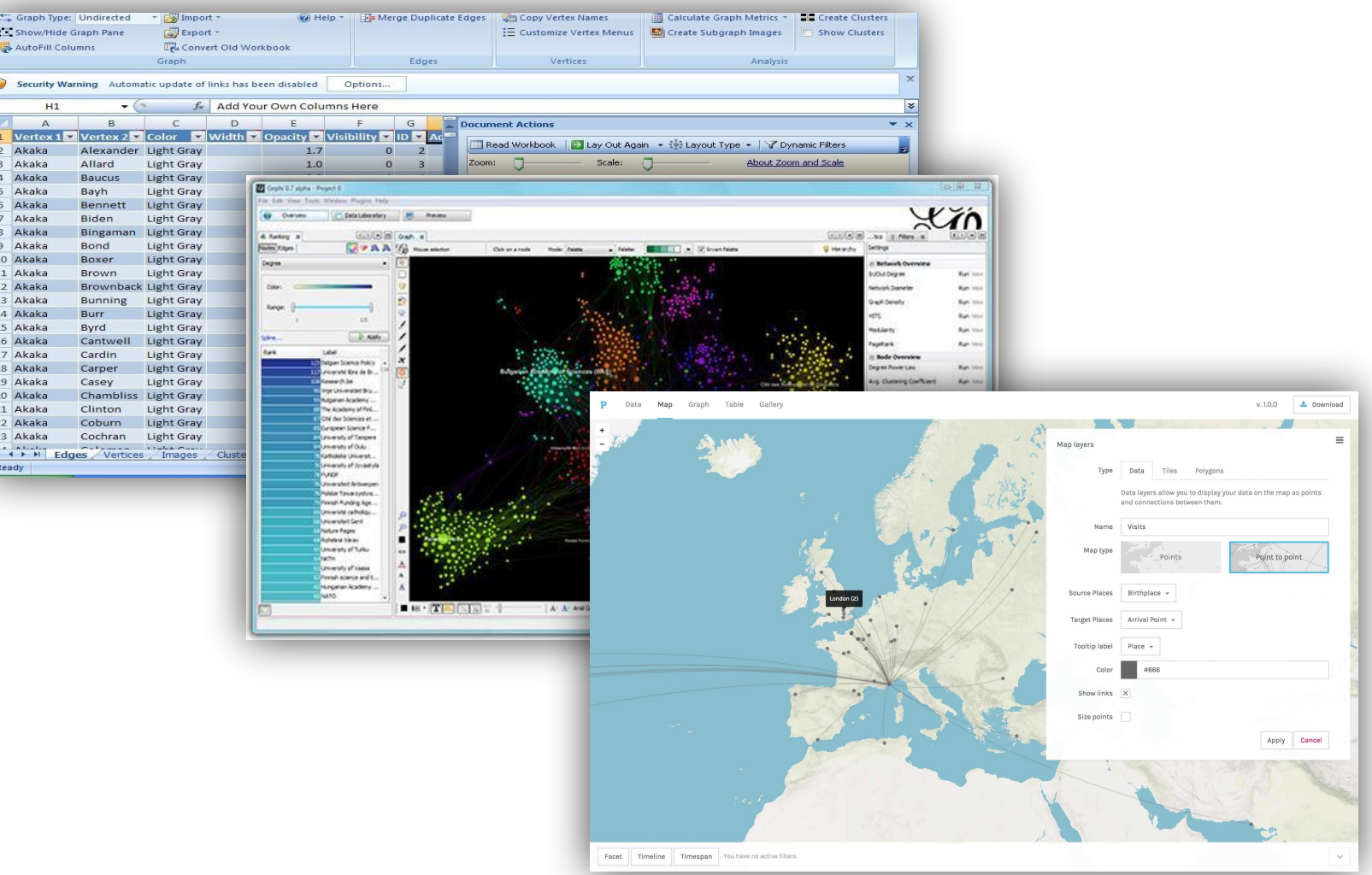
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Data layers allow you to display your data on the map as points and connections between them.
Name
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Birthplace
Target Places
Arrival Point
Tooltip label
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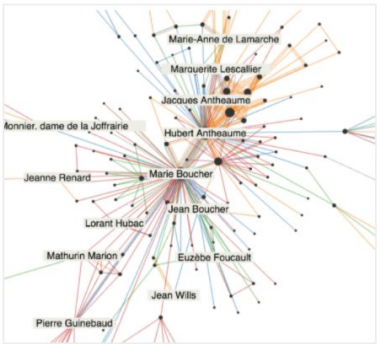
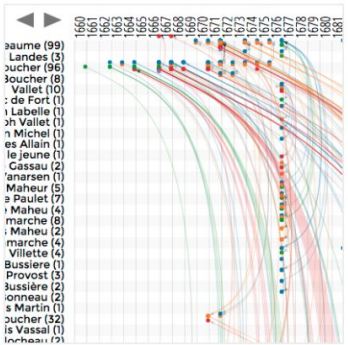
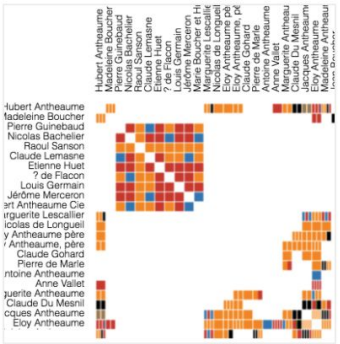
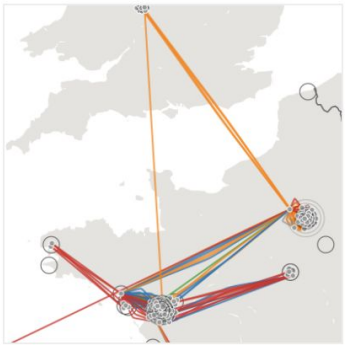
# What is THE VISTORIAN (BETA)

Interactive Visualizations for Dynamic and Multivariate Networks.
Free, online, and open source.



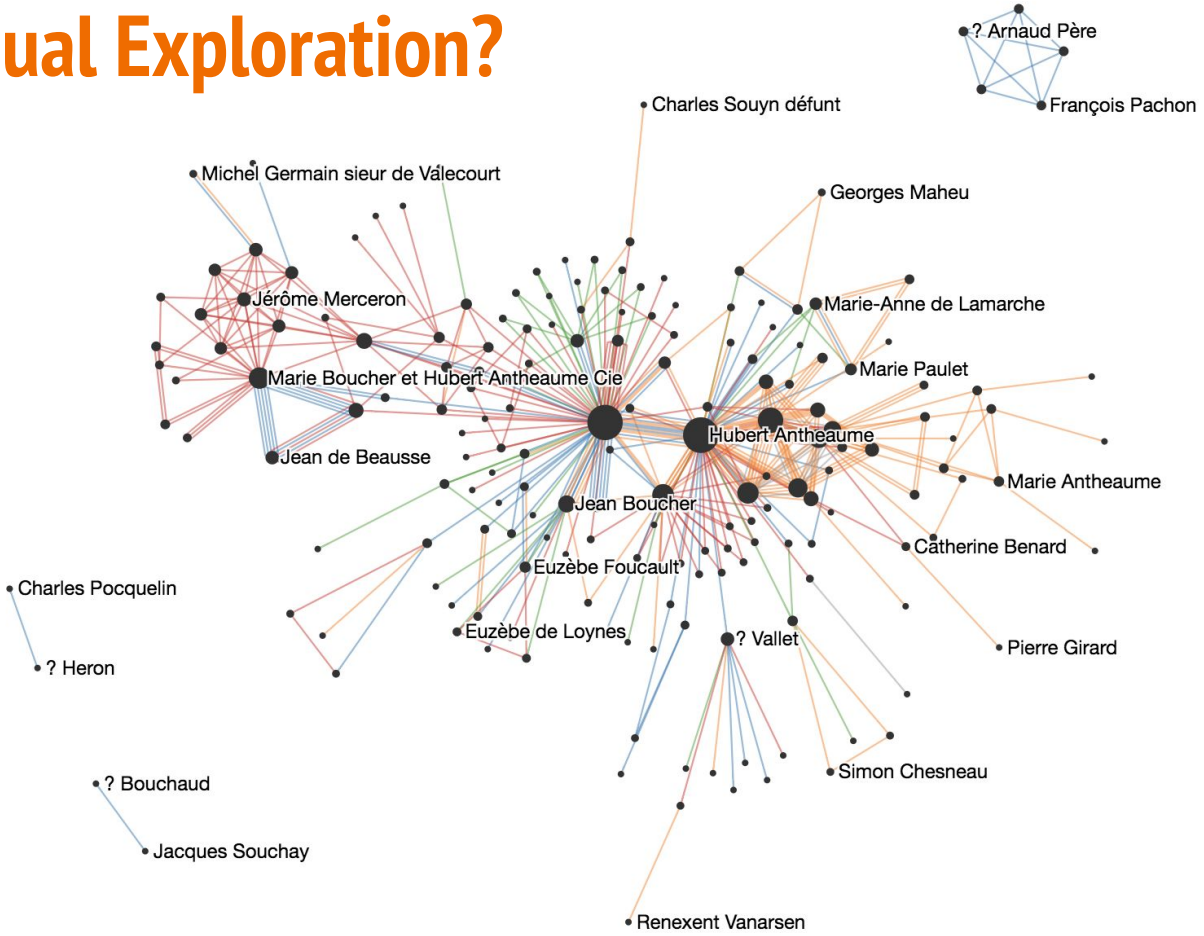




Blog: https://vistorian.github.io
Website: https://vistorian.net

# What is Network Visual Exploration?

# What is Network Visual Exploration?



Point

Actor

Vertex

Nodes

Link

Arc

Relation(ship)

Connection

Directed Link

Multiple Links

Link Types

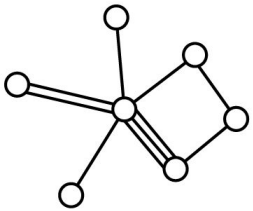
Node type

Weighted link

Our network model currently supports the following information:

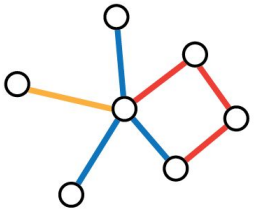
- multiple links between the same pair of nodes,
- geographic locations associated to nodes,
- changing over time, time, i.e. changing network topology, attributes, and locations

## Combinations



Multiple links

+



Link types

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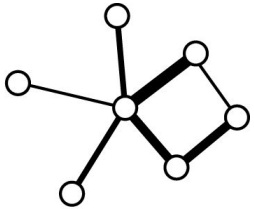
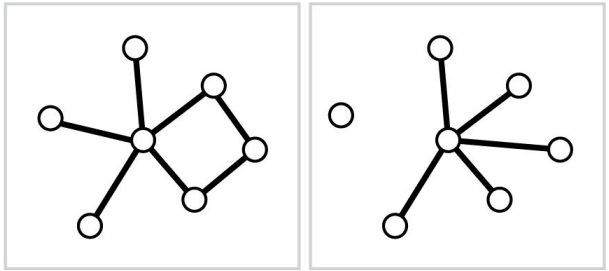


Link weight

+

Geography

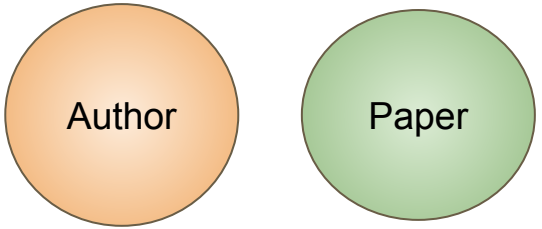
+

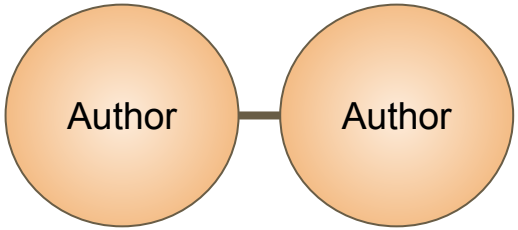


Changes over time

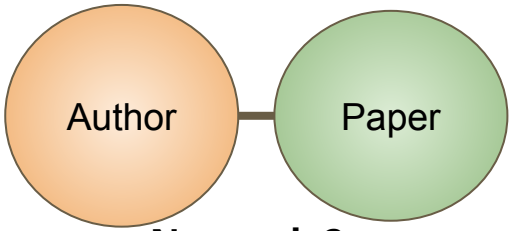
# Network Exploration with the Vistorian: Demo Dataset 1

- Demo Dataset (1): Co-Authorship Data of Research Papers
- How can we explore such data set?
  - What objects can we identity in such dataset?
  - How can we relate them to each other?
  - What sort of question(s) can we ask?

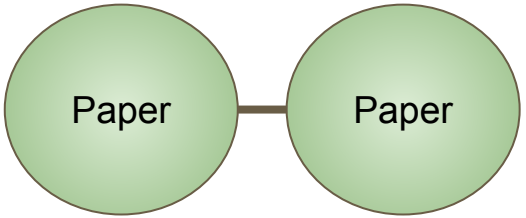



**Network 1**



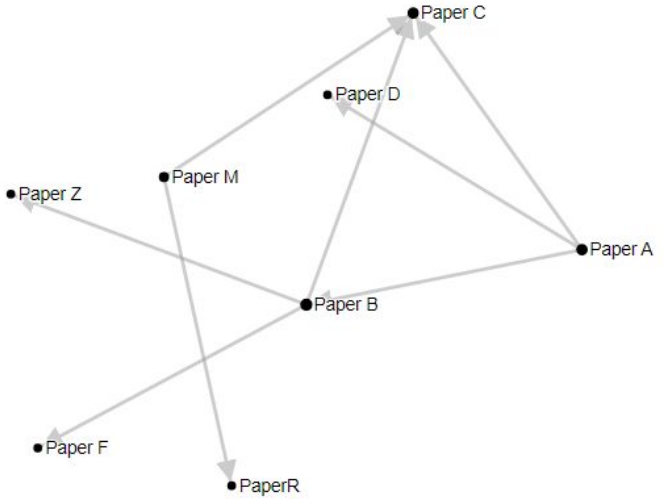

**Network 2**




**Network 3**

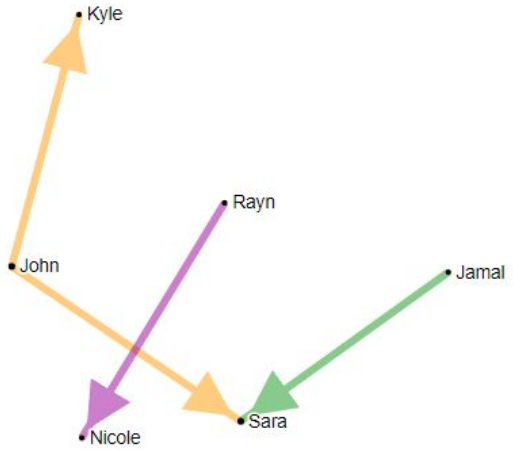
# Co-Authorship Network Example (Paper-to- Paper)

| Paper | References |
|---|---|
| Paper A | Paper B |
| Paper A | Paper C |
| Paper A | Paper D |
| Paper B | Paper C |
| Paper B | Paper F |
| Paper B | Paper Z |
| Paper M | Paper C |
| Paper M | PaperR |



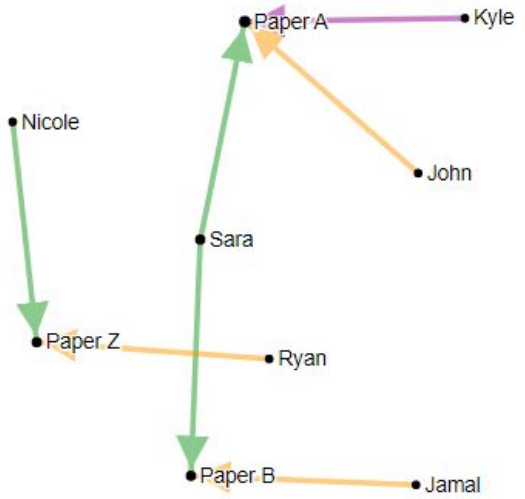
# Co-Authorship Network Example (Author-to- Author)

| Author 1 (Source) | Author 2 (Target) | Paper (Link Type) |
|---|---|---|
| John | Sara | Paper A |
| John | Kyle | Paper A |
| Jamal | Sara | Paper B |
| Rayn | Nicole | Paper M |



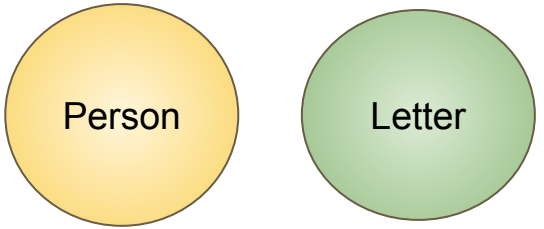
# Co-Authorship Network Example (Author-to- Paper)

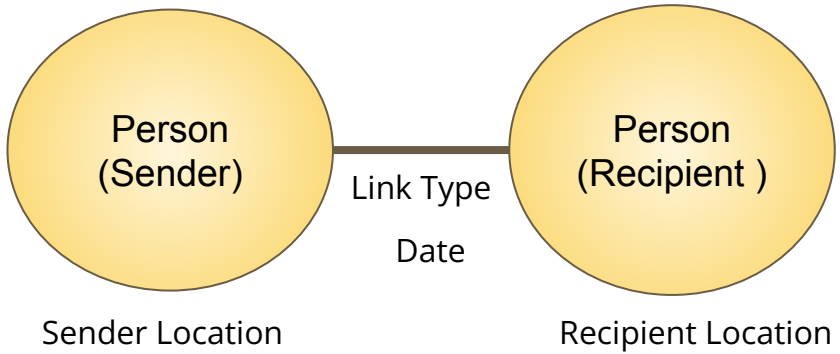
| Author | Paper | Link Type |
|---|---|---|
| John | Paper A | First |
| Sara | Paper A | Second |
| Kyle | Paper A | Third |
| Jamal | Paper B | First |
| Sara | Paper B | Second |
| Ryan | Paper Z | First |
| Nicole | Paper Z | Second |



# Network Exploration with the Vistorian: Demo Dataset 2

- Demo Dataset (2): Marie Boucher Dataset from Exchanged Letters
- How can we explore such data set?
  - What objects can we identity in such dataset?
  - How can we relate them to each other?
  - What sort of question(s) can we ask?




**Chosen Network**

# Questions to Ask through your Network Exploration

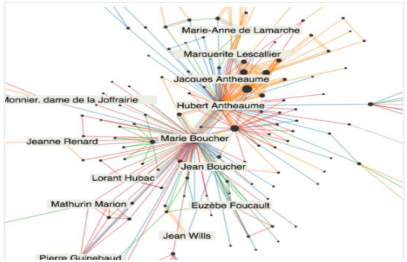
| Question | Vistorian Assisting Features |
|---|---|
| What kind of clusters the network has (e.g. high-density)? Why? | • Node-Size<br>• Link Width |
| Are there any disconnected nodes/clusters? Why? | • Node Opacity<br>• Node Overlap (Map) |
| Can I reduce the complexity of my network? | • Show/hide links/nodes<br>• Change links colors<br>• Use Edge Gap to merge replicate links<br>• Zooming out (e.g. looking into dyads/cliques/clusters) |
| Are there any links of interest? Such as (ex. bidirectional relations, Transitive relations) | • Node Opacity<br>• Link Opacity |
| Can I locate certain nodes/links? (e.g. by name, location) | • Search / Zooming<br>• Use Map |
| How nodes/links appear through time? | • Timeline bar |

# Data Formating

# Tables to Networks

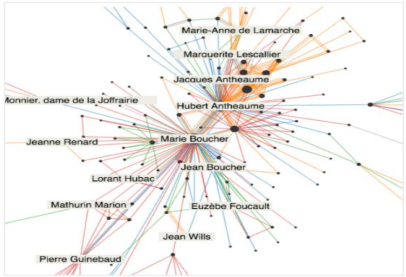
**A) Single Link table:**

| Sender | Receiver |
|---|---|
| Ana | Charles |
| Charles | Bob |
| ... | ... |




**B) Single Node table:**

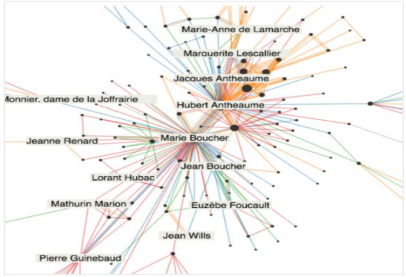
| Name | Profession |
|---|---|
| Ana | Lawyer |
| Bob | Merchant |
| Charles | Accountant |




**C) Node Table + Link Table:**

| Sender | Receiver |
|---|---|
| Ana | |
| Char | |
| ... | |

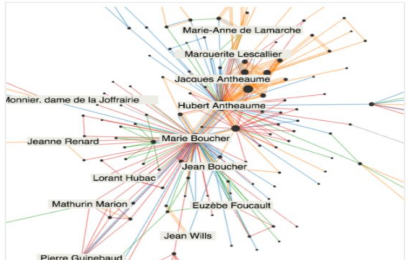
| Name | Profession |
|---|---|
| Ana | Lawyer |
| Bob | Merchant |
| Charles | Accountant |



# Tables to Networks

**A) Single Link table:**

| Sender | Receiver |
|---|---|
| Ana | Charles |
| Charles | Bob |
| ... | ... |




B) Single Node table:

| Name | Profession |
|---|---|
| Ana | Lawyer |
| Bob | Merchant |
| Charles | Accountant |



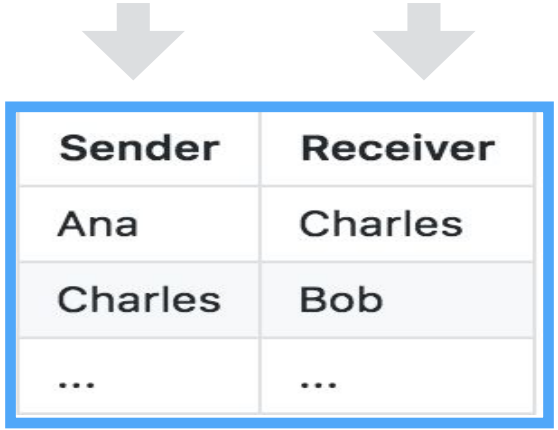
C) Node Table + Link Table:

| Sender | Receiver |
|---|---|
| Ana | |
| Charles | |
| ... | |

| Name | Profession |
|---|---|
| Ana | Lawyer |
| Bob | Merchant |
| Charles | Accountant |

# Simple Link Table

**Source** **Target**



| Sender | Receiver |
| --- | --- |
| Ana | Charles |
| Charles | Bob |
| ... | ... |

**Bold** = mandatory attributes

# Complex Link Table

**Source** Location (source) **Target** Location (target) Weight Time Link Type

| Sender | Sender Location | Receiver | Receiver Location | Amount | Year | Type |
|---|---|---|---|---|---|---|
| Bob | Rome | Charles | Lisbon | 10 | 1801 | Loan |
| Bob | Paris | Charles | Lisbon | 14 | 1803 | Gift |
| Bob | Rome | Charles | Lisbon | 3 | 1810 | Purchase |
| Bob | Rome | Anton | London | 2 | 1801 | Purchase |
| Anton | London | Bob | London | 5 | 1810 | Loan |
| ... | ... | ... | ... | ... | ... | ... |

**Bold** = mandatory attributes

# Tables to Networks

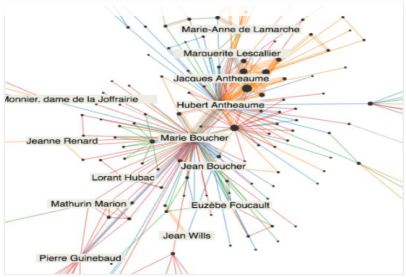
A) Single Link table:

| Sender | Receiver |
|---|---|
| Ana | Charles |
| Charles | Bob |
| ... | ... |



**B) Single Node table:**

| Name | Profession |
|---|---|
| Ana | Lawyer |
| Bob | Merchant |
| Charles | Accountant |




C) Node Table + Link Table:

| Sender | Receiver |
|---|---|
| Ana | |
| Charles | |
| ... | |

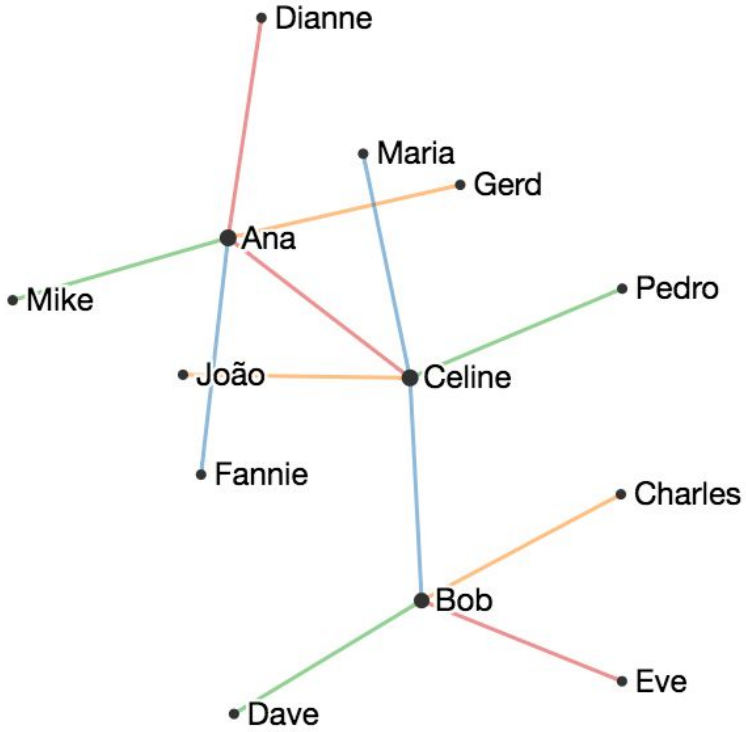
| Name | Profession |
|---|---|
| Ana | Lawyer |
| Bob | Merchant |
| Charles | Accountant |

# Single Node Table

**Node Relation** More relations

| **Child** | **Mother** | **Father** | **God-father** | **God-mother** | **Place-of-birth** |
|---|---|---|---|---|---|
| Bob | Celine | Charles | Dave | Eve | Paris |
| Ana | Fannie | Gerd | Mike | Dianne | London |
| Celine | Maria | João | Pedro | Ana | Lisbon |

**Bold** = mandatory attributes


Dianne
Maria
Gerd
Ana
Mike
Pedro
João
Celine
Fannie
Charles
Bob
Eve
Dave

# Finding the Right Format

- Your network is a **genealogy**: Use a **single node table**, with each column being a family relation
- Your network has **no attributes** to nodes and links: use a **single link table**
- Your network has **only link attributes** (link weight, link type, link time, source/target locations): use a **single link table** and specify each attribute in a column
- Your network has **attributes on nodes** (type): use **both tables**; a node table to specify node attributes and a link table to specify link attributes.

# Notes on Your Network Data Preparation

- A network can be created by transforming your (semi-structured or unstructured) data into tables to be visualized.
- This step might include data wrangling. To be able to analyze your network correctly you need to ensure:
  - **Your dataset is consistently formatted :**
    - by column: e.g. all dates are written in the same format
    - by row: e.g. same number of columns in each row (use similar value for values that doesn't exist such as null or similar values)
  - **Ensure the correctness of your data values: (** ex. Spelling of locations, names, .. etc)
  - **Understand the domain/field constraints and characteristics** that pulls its weight on the data collected

# Questions

Thank you for listening .

Resources:

- The Vistorian  http://vistorian.net
- Blog: https://vistorian.github.io

Contact us:

- vistorian@googlegroups.com join at https://groups.google.com/forum/#!forum/vistorian/join
- https://vistorian.github.io/team.html
- For any enquiries reach us on Slack Channel or email m.alkadi@sms.ed.ac.uk