Mapping scientific affinities through temporal networks

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Experiences as a dataviz designer
Overview

What?

- Presenting a R&D project in dataviz
- Unpacking the crafting of a network visualization

Outcomes?

- Introduction to visual network analysis
- Highlight innovative paths for future research in dataviz theory & practice
Research context of the project

- 4 months of internship at DHLAB (EPFL)
- Under the supervision of PhD student Dario Rodighiero


Project team:

- Dario Rodighiero, lead design and dev
- Alexandre Rigal, sociological theory building and concepts uses
- Loup Cellard, design/dev/theory
Problematic of our project

Research question:

- What are the scientific affinities between researchers at EPFL?

Method:

- To look at who is publishing with who using visual network analysis.

Hypothesis:

- Scientific objects of interest are spread among fields and disciplines.

Design issue:

- How to represent the network of co-publications between researchers?
First iteration: draw a network of co-publications

Basic data model:

<table>
<thead>
<tr>
<th>1st Author</th>
<th>Co-Author</th>
<th>Number of publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dario</td>
<td>Loup</td>
<td>1</td>
</tr>
</tbody>
</table>

Dario ---Loup
Qualities of network viz:

- Possible to map limitless relations and entities: no quantitative limits a priori
- Scientific affinities can be mapped through the variation of *distances* between nodes
- Enable a zooming effect: from distant to close reading (Moretti, 2013)
Spatialisation algorithms for graphs in Gephi software

Force-directed algorithms: attraction and repulsion effects based on nodes relations and weights

Source: one network and four algorithms. Bernhard Rieder, 06/09/10. URL: http://thepoliticsofsystems.net/2010/10/one-network-and-four-algorithms
First iteration: represent the network of co-publications of a single lab

Data:
DHLAB’s publications from 2013 till 2015
Source: infoscience.epfl.ch

Software used:
Gephi
Limits of classical visual network analysis:

- Networks do not distinguish the *qualitative differences* of represented entities,
- Networks are stabilized snapshots/synthesis of an activity *at a certain time*,
- Networks are stable images, keeping each entity immobile, without movements and evolutions.

\[= \text{the temporal dimension is not represented}\]
Why the time dimension matters?

Changes in connections and disconnections of entities happen because of particular *events*.

Our proposition -> representing the dynamic of affinities as *trajectories*
Second iteration: representing trajectories

Drawing a network based on a vertical timeline
Second iteration: representing trajectories

How to add the temporal dimension into a network?

-> by transforming fixed points/nodes in lines/trajectories
Qualities of trajectories:

- Represents not only distances, but also *durations*: the temporality of scientific affinities
- No interruption, visibility of continuity and discontinuity
Trajectories: representing duration of affinities and their continuities
Marcel Duchamp, *Nude Descending a Staircase*, 1912
Etienne-Jules Marey, *Flying pelican*, Chronophotography on a fixed plate, 1887.
Trajectories -> sequencing a story

- Representation of an evolution break down in a space: a sequence of networks.

- Just like in cinema: a sequence creates a narrativity

= a movement of entities through static simulation
Third iteration: web experimentation with more data

Three independent networks about three Digital Humanities Conferences:

DH2013 in USA, DH2014 in Switzerland, and DH2015 in Australia

See online:

http://dhlab-epfl.github.io/Trajectories
Third iteration: what we can learn -> New scholars entering the field
Third iteration: what we can learn -> Presence of senior scholars in the field since a long time
Third iteration: what we can learn -> scholars who attended all conferences
Third iteration: what we can learn -> papers of new attendees
Benefits of trajectories -> a vocabulary to describe affinities dynamic *through time*

- Continuity vs. discontinuity
- Growth vs. stops and bifurcation
- Convergence of interests vs. polarities
- Emergence vs. disappearance of entities and relations

= Less reduction, more possibilities of interpretation
Paradox: More data, less dataviz innovation

Dataviz in crisis, why?

- Effects of datafication -> more data, too many dataviz, less time to involved in innovative crafting...
- Crisis of information design -> design works take in charge by automation and non-designers...

Resulting Effects:

- Industrialization/standardization vs. DIY “innovative” crafting
- Fewer creative and critical acts with data, more dataviz showing off through rhetoric
- Imposition of particular ways of visualizing
Conclusion: some innovative paths for future research in dataviz theory & practice

1) **Re-invest time and effort in conceptual works** (imaginary of networks + trajectory)

2) **Demultiplicate viz format** (static image, poster, variations networks/lines, web viz)

3) **Collaborate with other field of study**: art, design, statistics, computer science...
Thanks for your attention!

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If you want to know more on this project:

Conference Paper:

*The Trajectories Tool: Amplifying Network Visualization Complexity.* Alexandre Rigal, Dario Rodighiero & Loup Cellard, EPFL. Digital Humanities 2016, Kraków, Poland, 12-16 July 2016
More examples of temporal networks:

DH Humanist list viz:

http://humanist.dclure.org

Phylomemetic networks:

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0054847
Moretti, Franco, *Distant Reading*, Verso, 2013