

Geo-historical Data

**EuroSDR Historical Data seminar
2014/10/17**

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Julien Perret

Collaborations

Several french projects

GeOpenSim (LSIIT, LIVE) - ANR 2008-2011

GéoPeuple (EHESS, LIP6) - ANR 2010-2013

Collaboration with EHESS

PhD Theses

Bertrand Dumenieu (2010-2014)

Benoît Costes (2012-2015)

Collaboration with EHESS, CEA, IFSTTAR, ArScAn, BnF...

GeoHistoricalData (started in 2013)

lead by EHESS, IGN, CEA

IGN, EHESS, CEA, IFSTTAR, ArScAn, Géographie-Cités, BnF, INRA, LIVE, Théma, Charta SRL, Le Ny conseil, geospective, NYPL, Stanford

Context

Increasingly available data

Increasingly performant tools

- georeferencing, digitizing, analyzing, etc.

A persistent need and little sharing

- larger scale
- more diverse

Collaborative approaches bring solutions

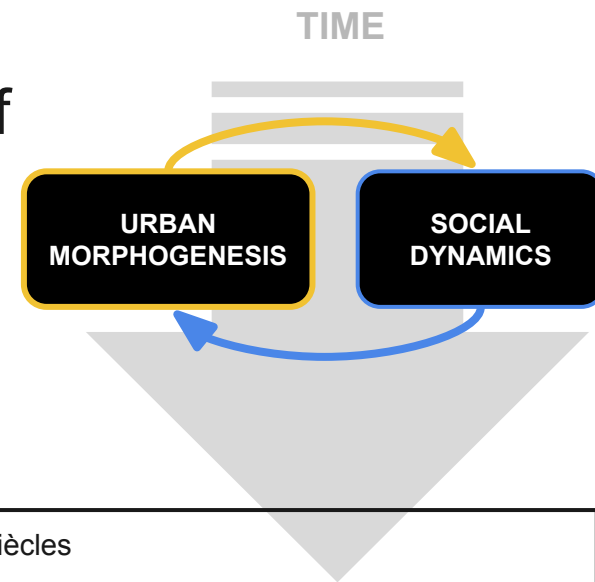
- shared data and shared digitizing effort
- shared tools

Reproducible research

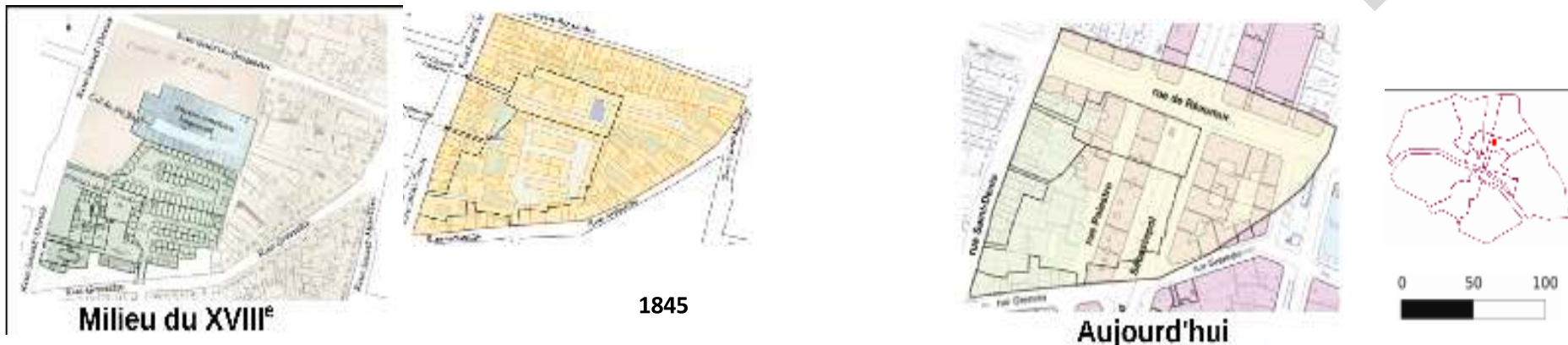
Challenges

Understanding urban development =
to study the spatial and social organisations of
cities through time

Feedback loop between phenomena



[Gribaudi09] : Transformations spatiales et sociales dans un îlot parisien du XVIIIe au XXe siècles

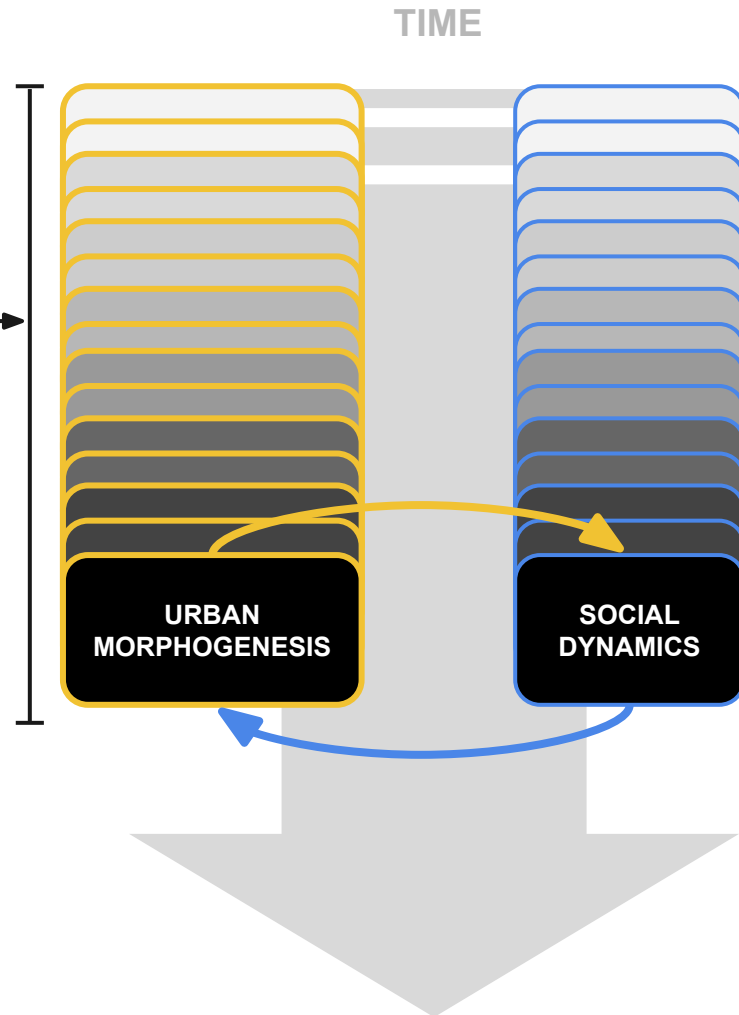


Challenges

Dynamic phenomena must be studied over the long term

No adapted tool

- **to build databases** adapted for the study of urban dynamics
- **for the quantitative analysis** of linked phenomena



Goals

Construction of **geo-historical databases**

data structures

imperfection modeling

data management

Analysis of geo-historical data

data matching

information fusion

transformation analysis

Overview

1. Context and challenges
- 2. Collaborative database construction**
3. Spatio-Temporal graphs construction
4. Multi-temporal analysis
5. Conclusion

Collaborative construction

GeoHistoricalData project

lead by **Marc Barthelemy**, **Maurizio Gribaudi** and **Julien Perret**

Different sources

- **France**
 - **Cassini** (18th)
 - **État Major** (19th)
- **Paris**
 - **Verniquet, Jacoubet, Maire, Poubelle**, etc. (18th+19th)

Collaborative construction

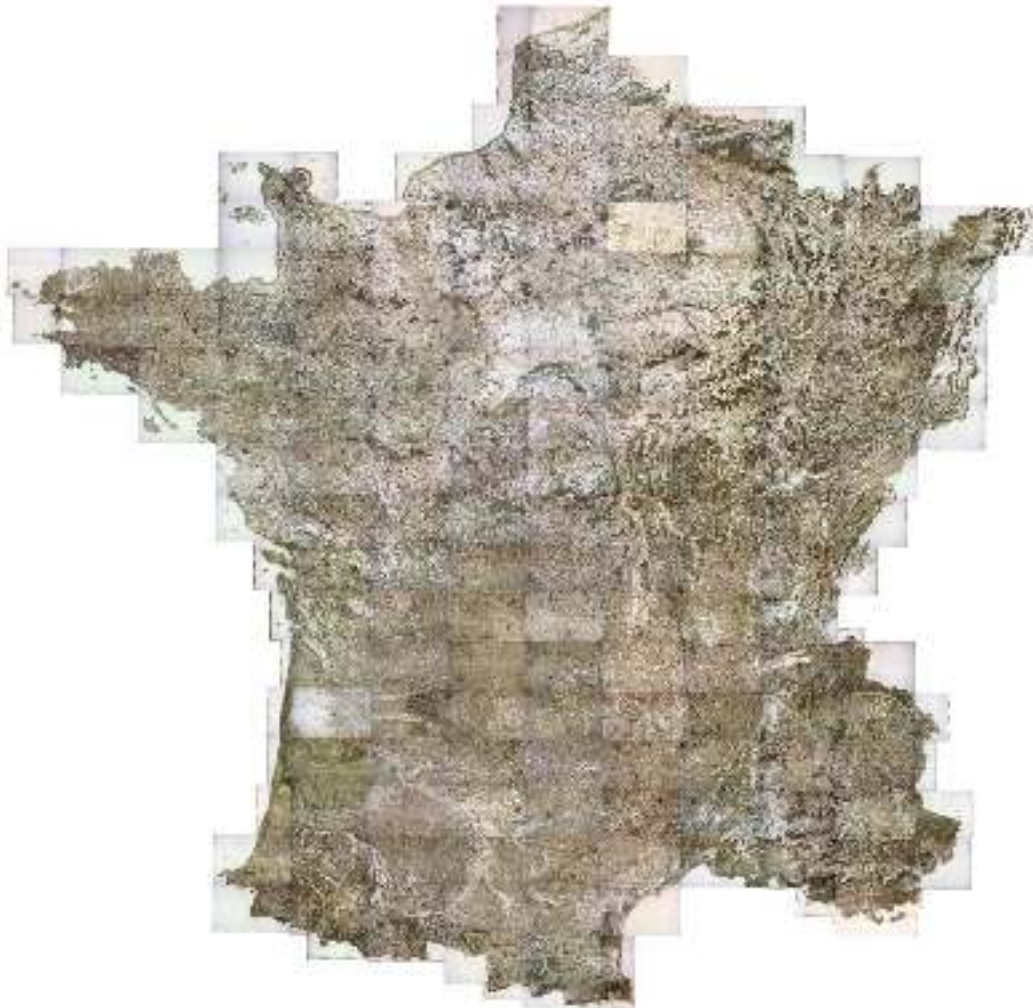
Example on Cassini maps

- WM(T)S from the géoportail
- PostgreSQL/PostGIS database
- QGIS for the digitizing



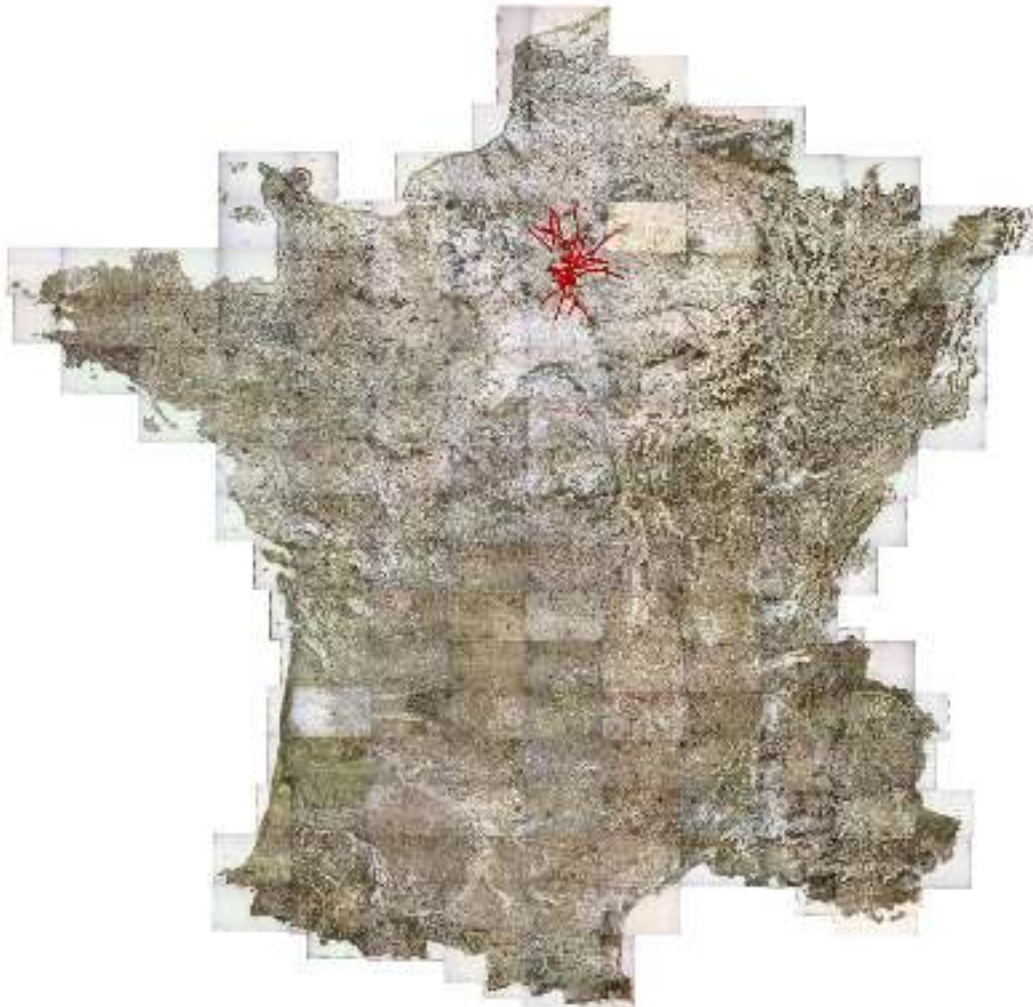
Collaborative construction

2013-07



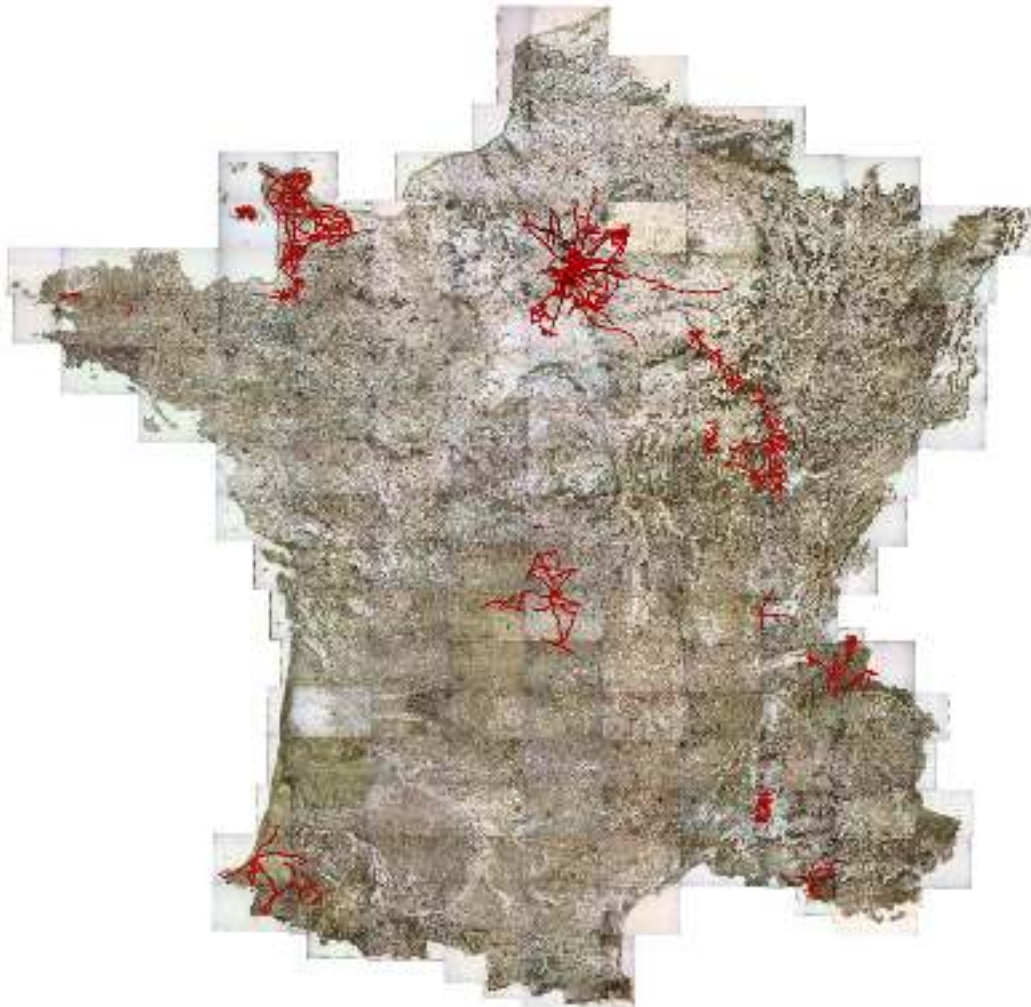
Collaborative construction

2013-08



Collaborative construction

2013-09



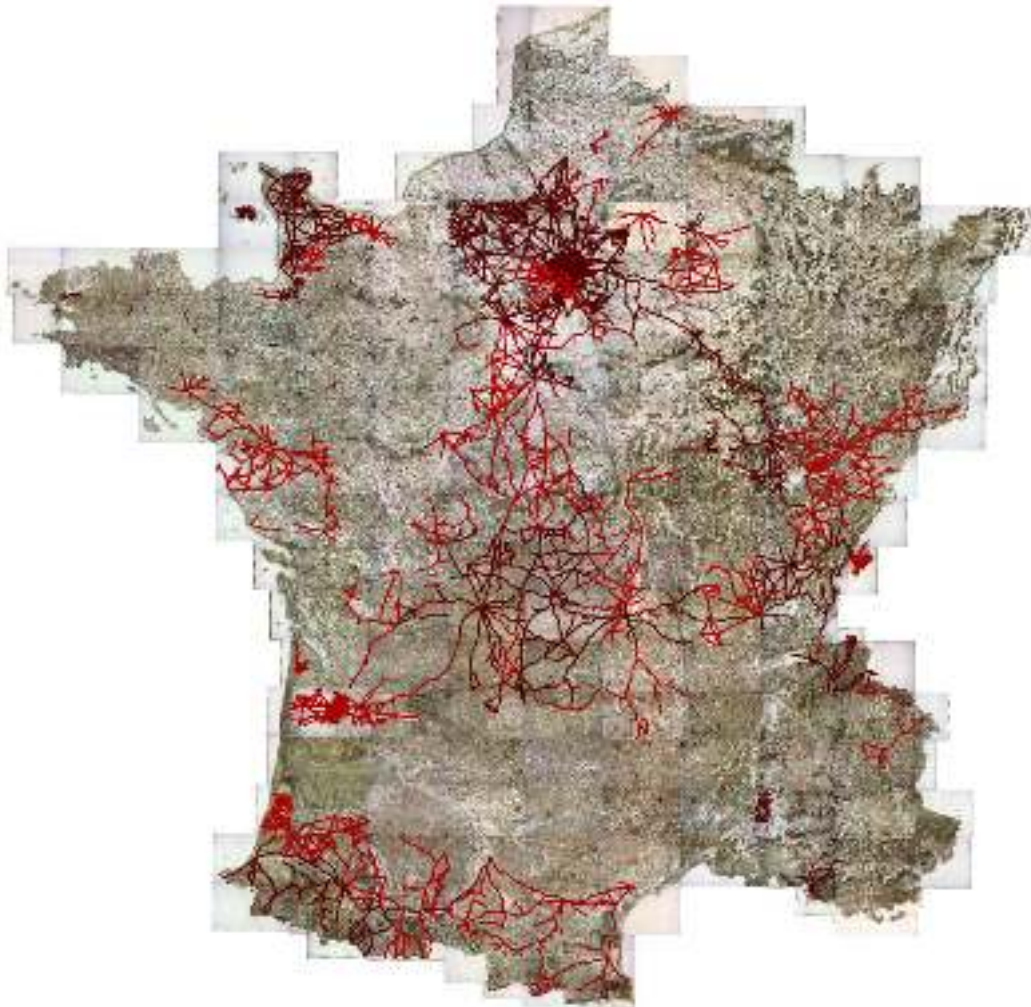
Collaborative construction

2013-10



Collaborative construction

2013-11



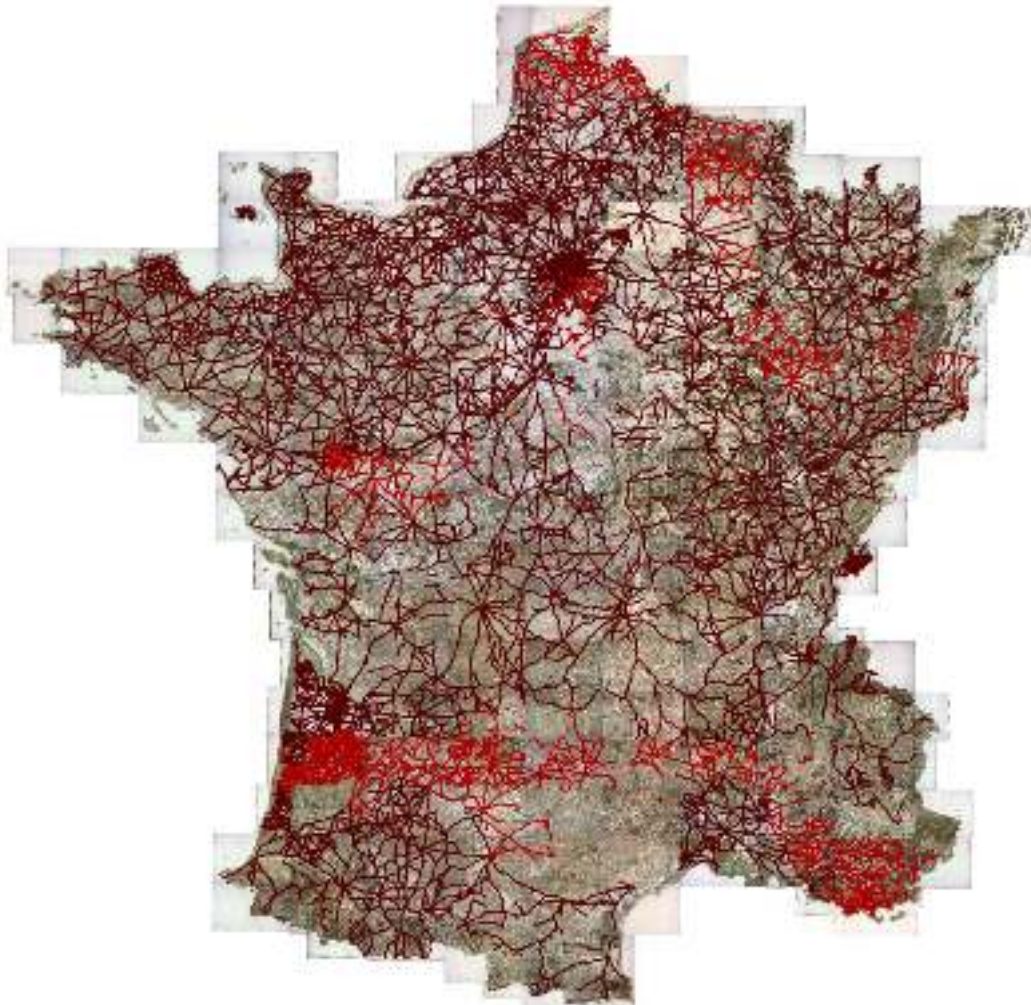
Collaborative construction

2013-12



Collaborative construction

2014-01



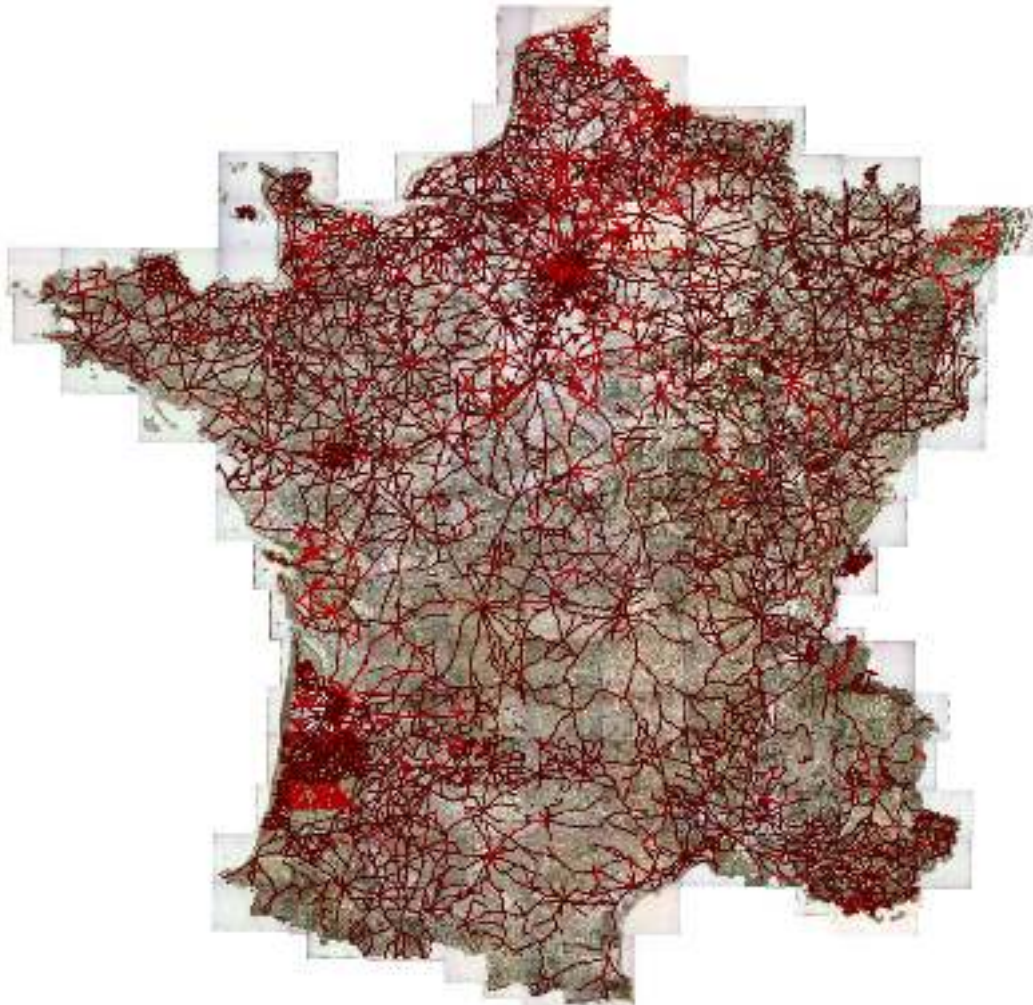
Collaborative construction

2014-02



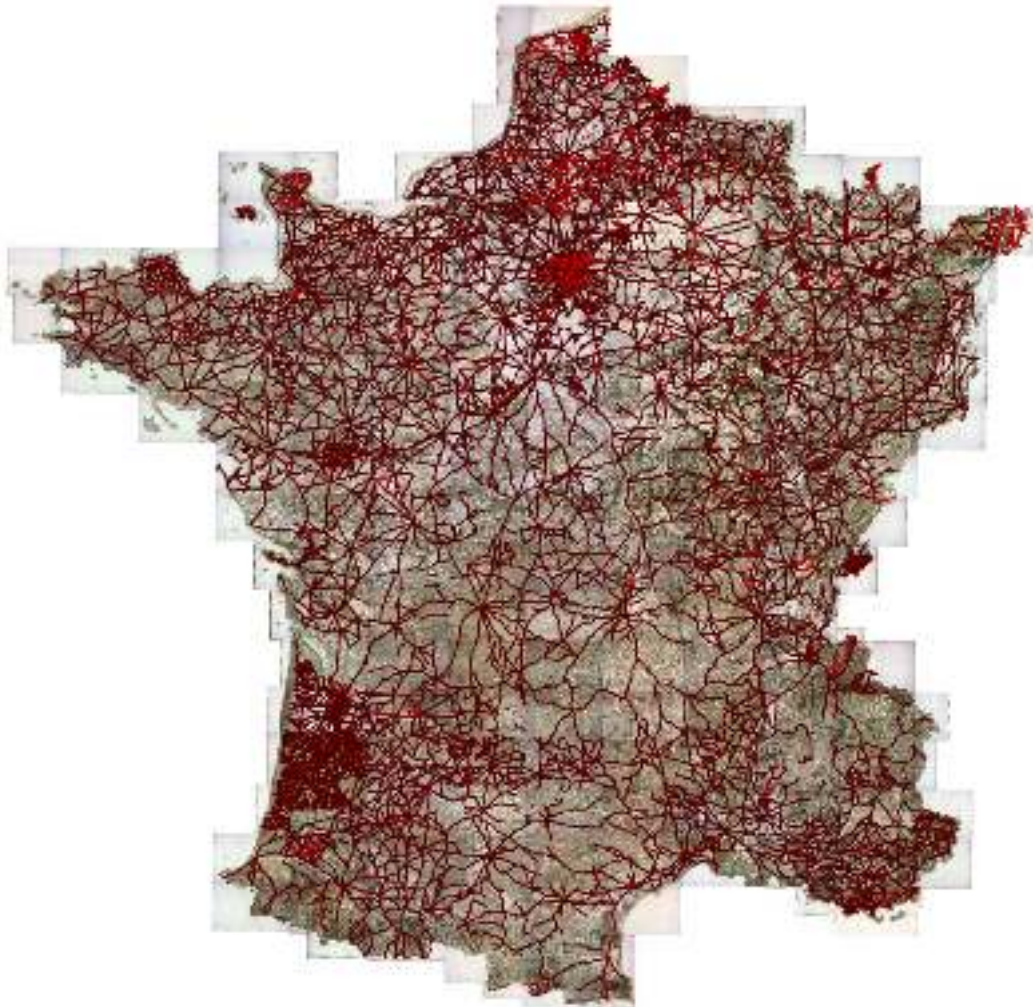
Collaborative construction

2014-03



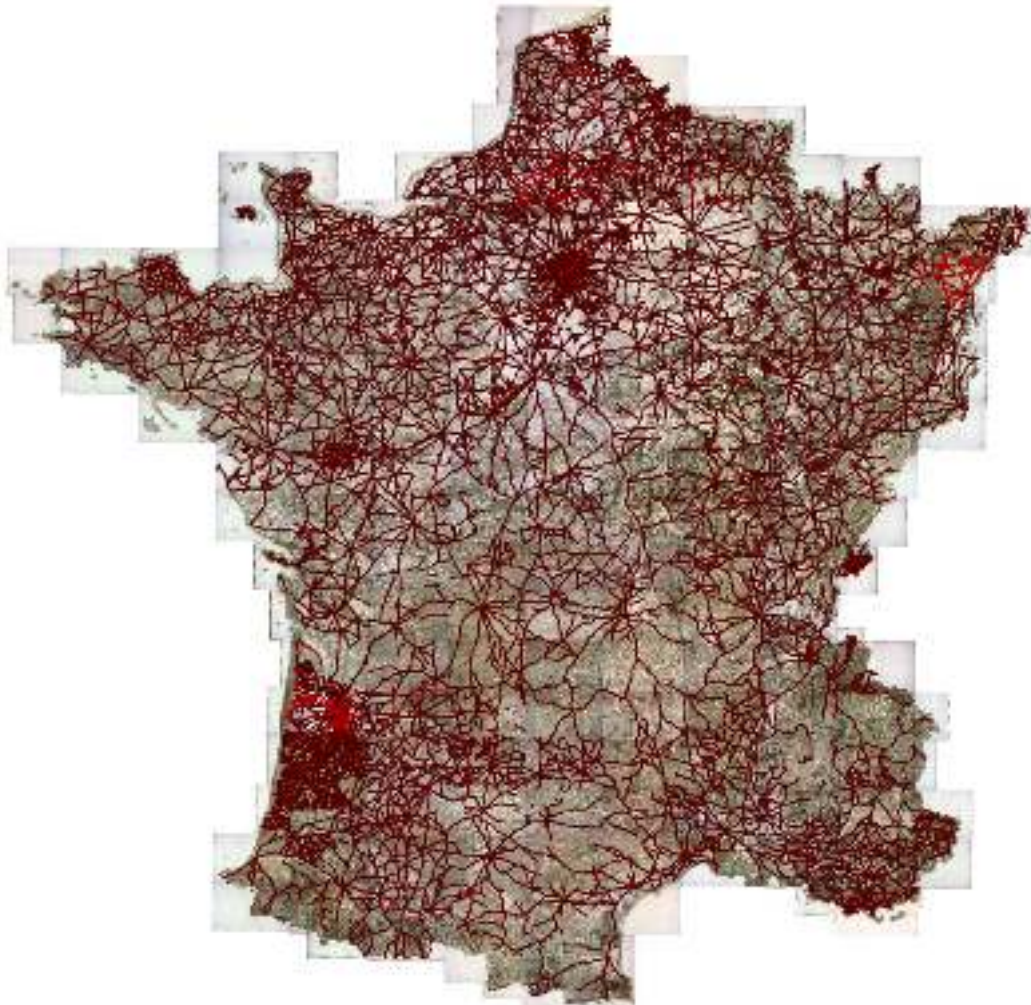
Collaborative construction

2014-04



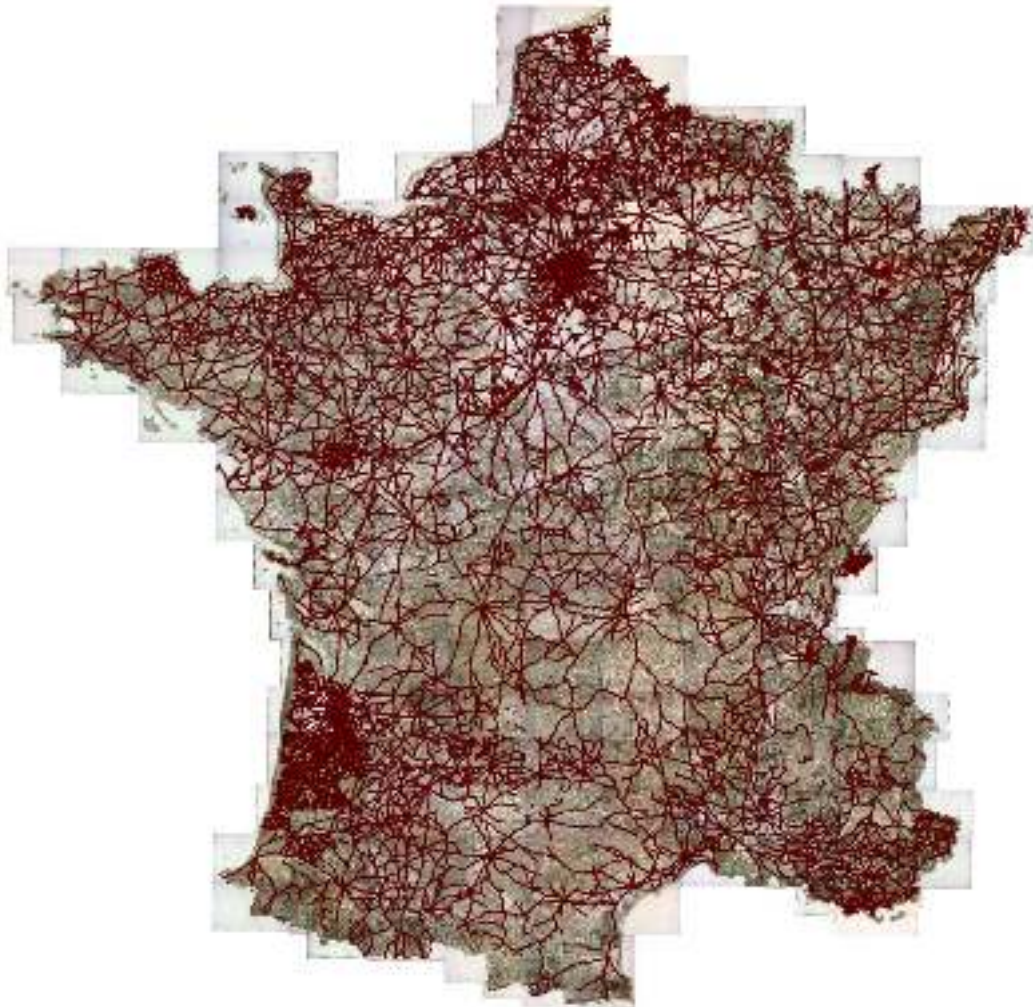
Collaborative construction

2014-05



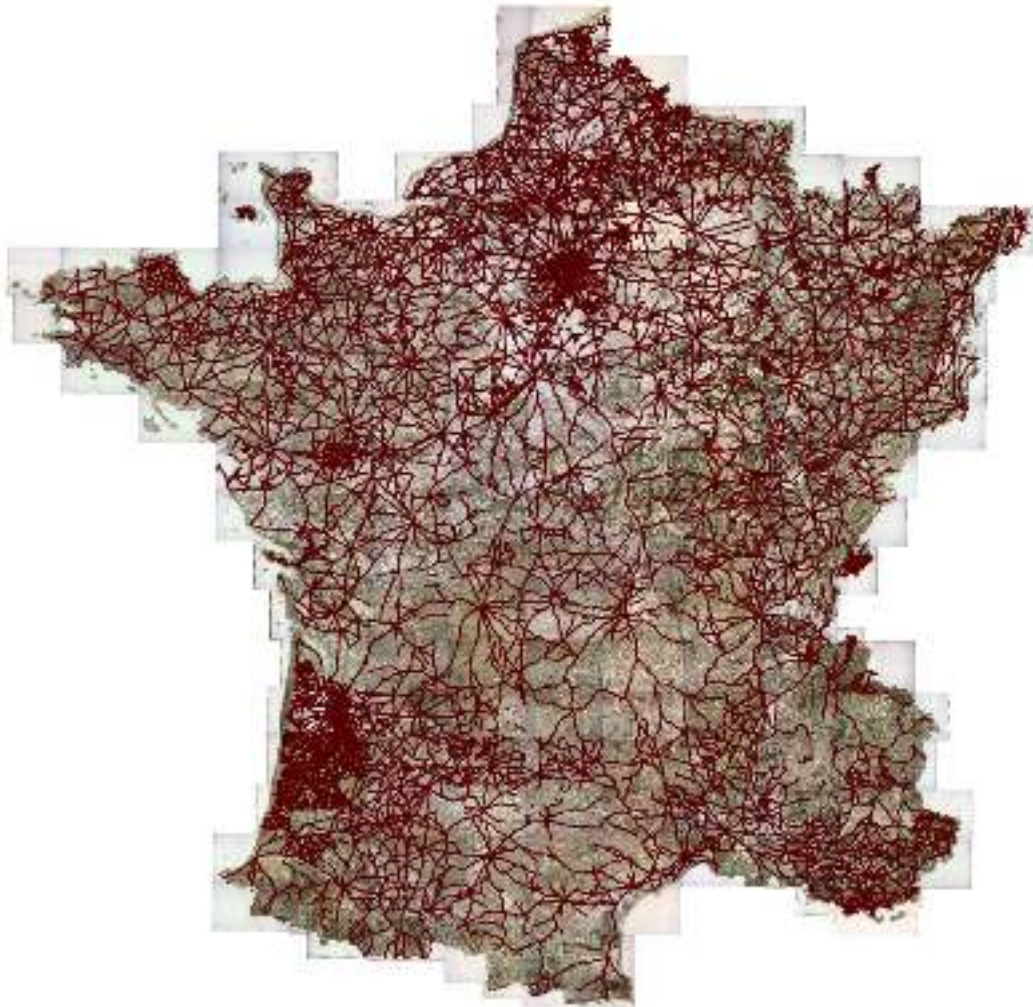
Collaborative construction

2014-06



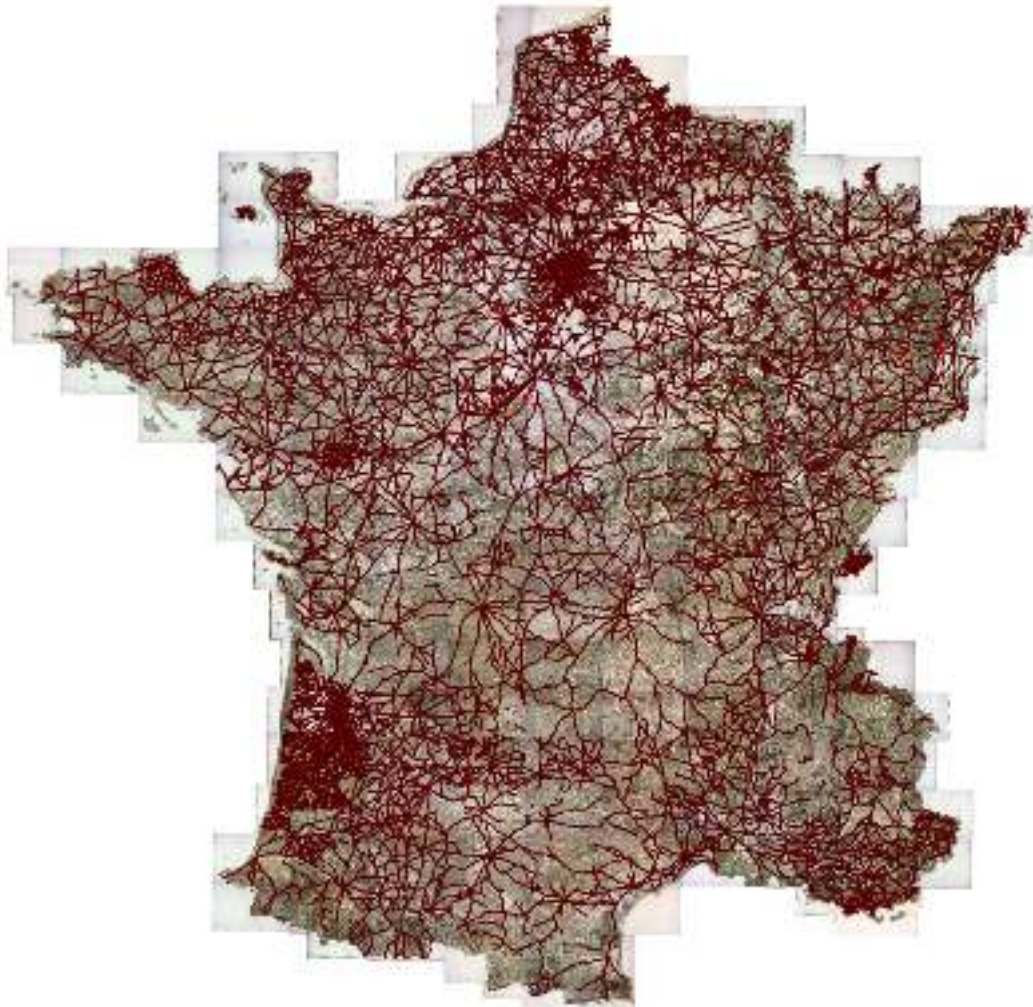
Collaborative construction

2014-07



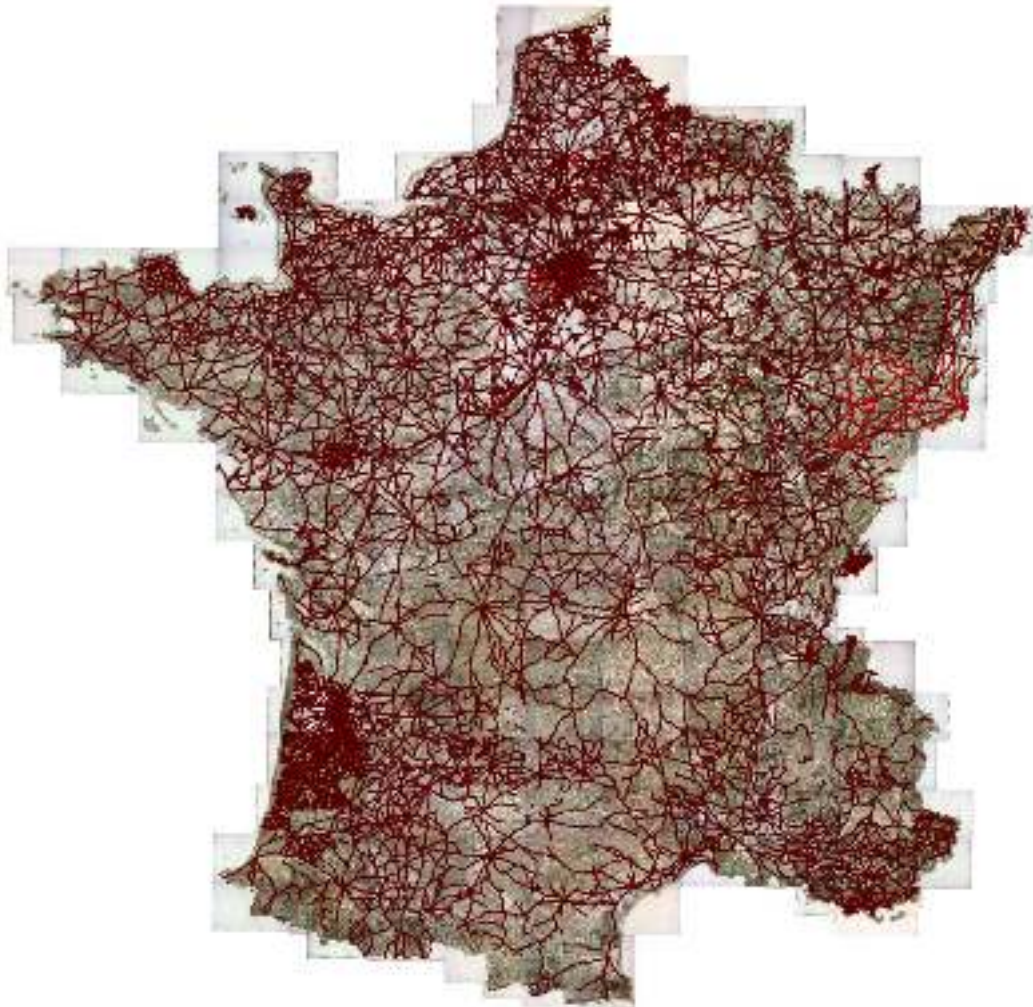
Collaborative construction

2014-08



Collaborative construction

2014-09



Collaborative construction

Towards a **collaborative data validation**

with NYPL Labs (buildinginspector, etc.) **starting next week**

Process for **socio-professional data** (text)

almanacs, etc.

with EPITA (Scribo) soon

Releases

Open Data

Free Software



Overview

1. Context and challenges
2. Collaborative database construction
3. **Spatio-Temporal graphs construction**
4. Multi-temporal analysis
5. Conclusion

Spatio-Temporal Graphs

Applied to PARIS

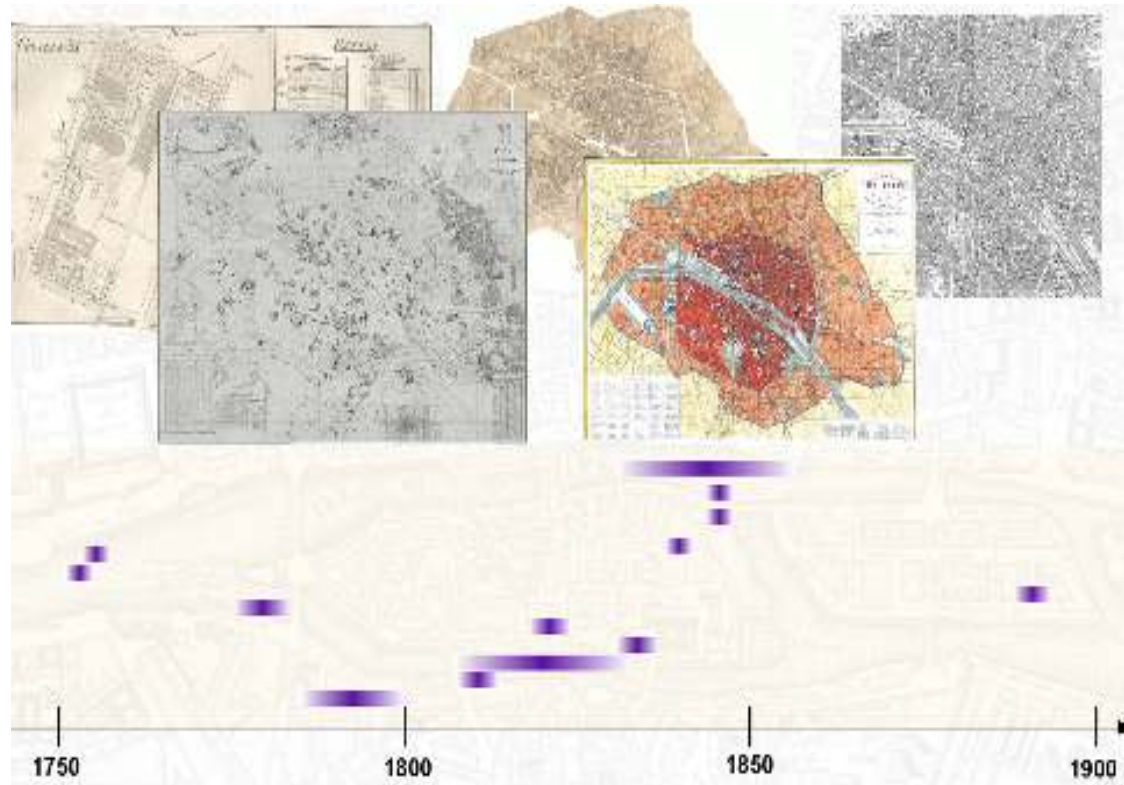
Available spatial sources
city maps

Complex sources

- imprecise
- uncertain
- incomplete

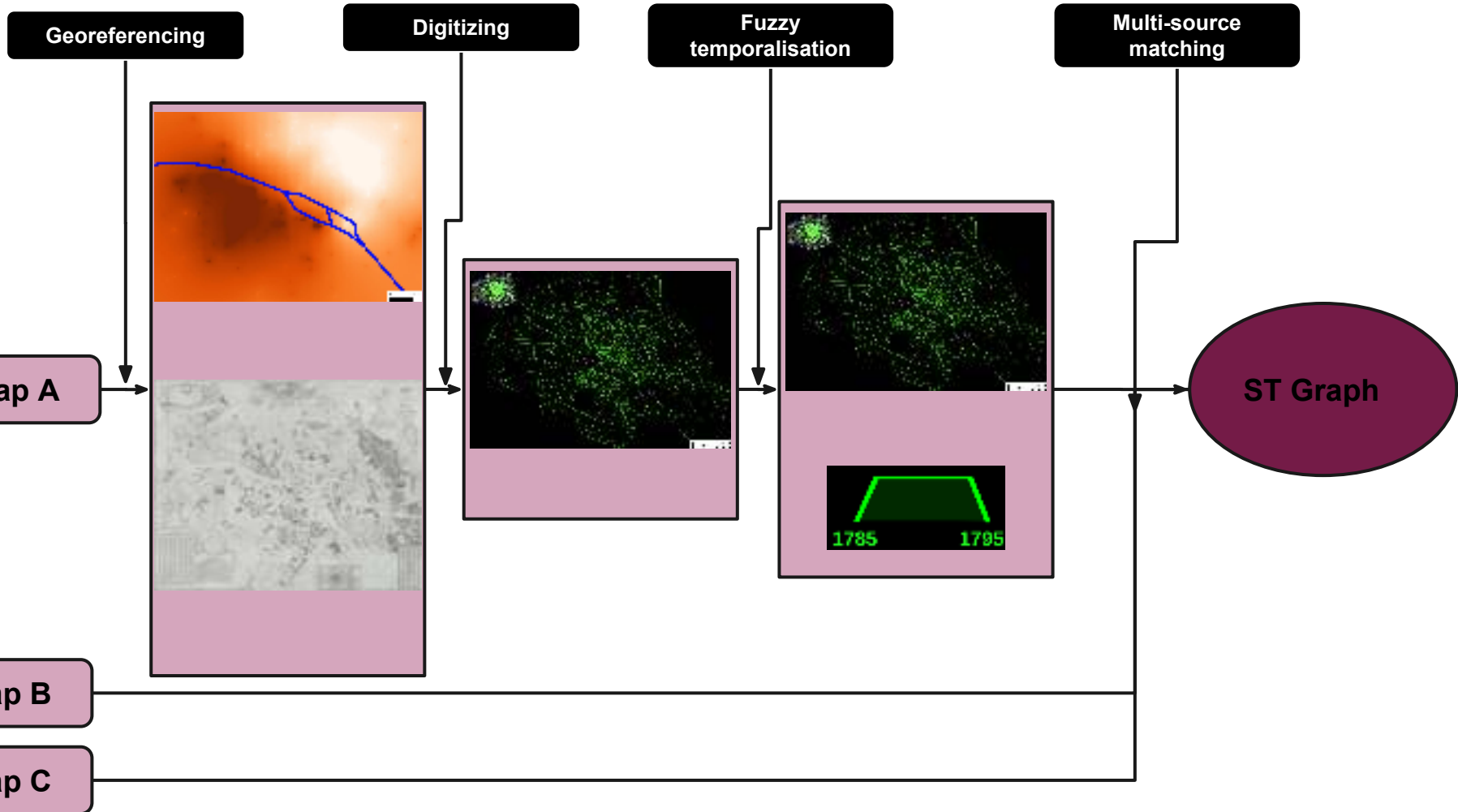
Construction of

Spatio-temporal Graphs

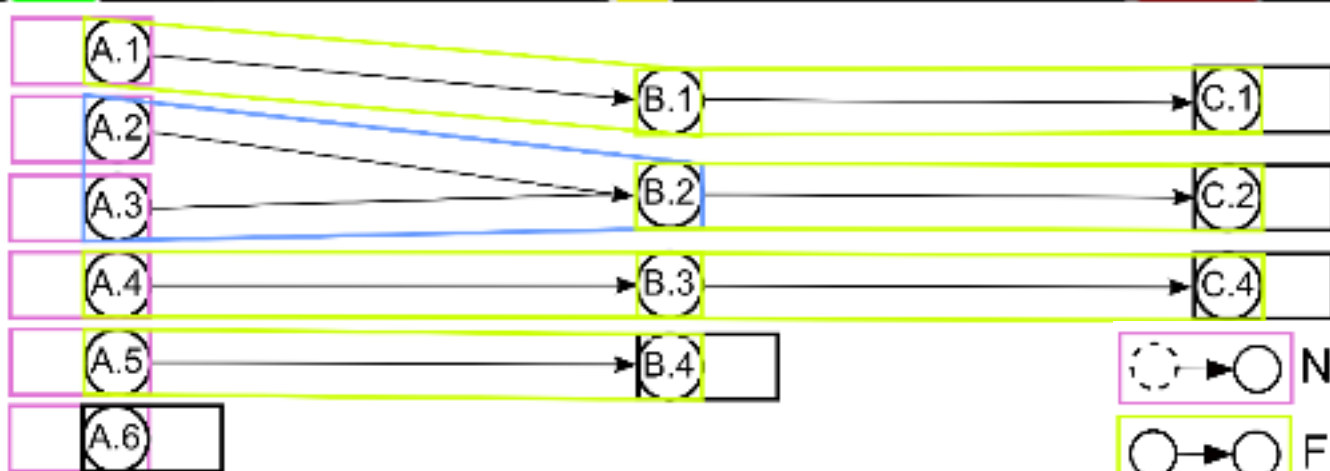
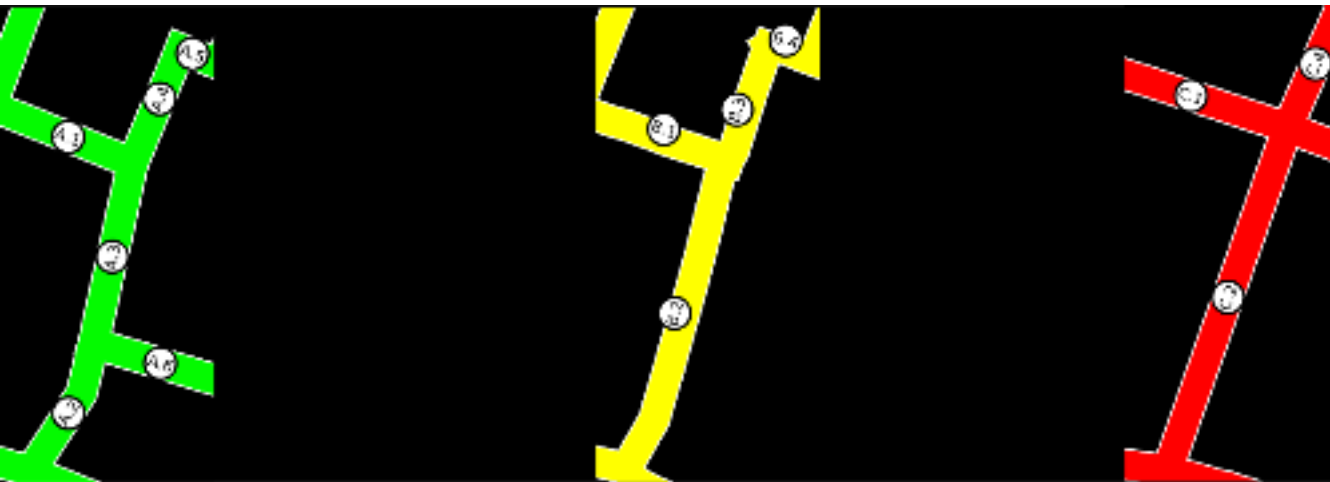


Bertrand Dumenieu's PhD Thesis

Spatio-Temporal Graphs



Spatio-Temporal Graphs



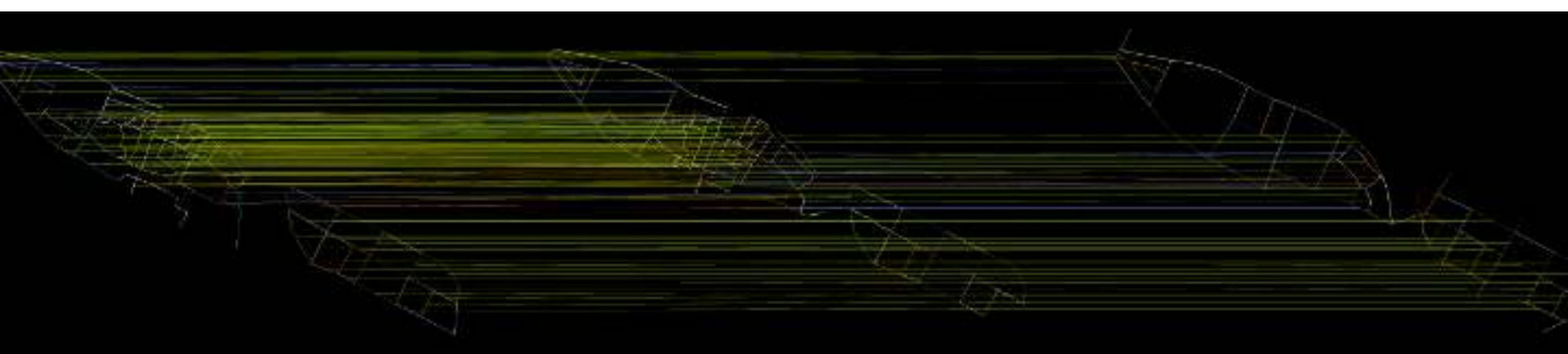
Spatio-Temporal Graphs

Optimizing the **likelihood of the links**

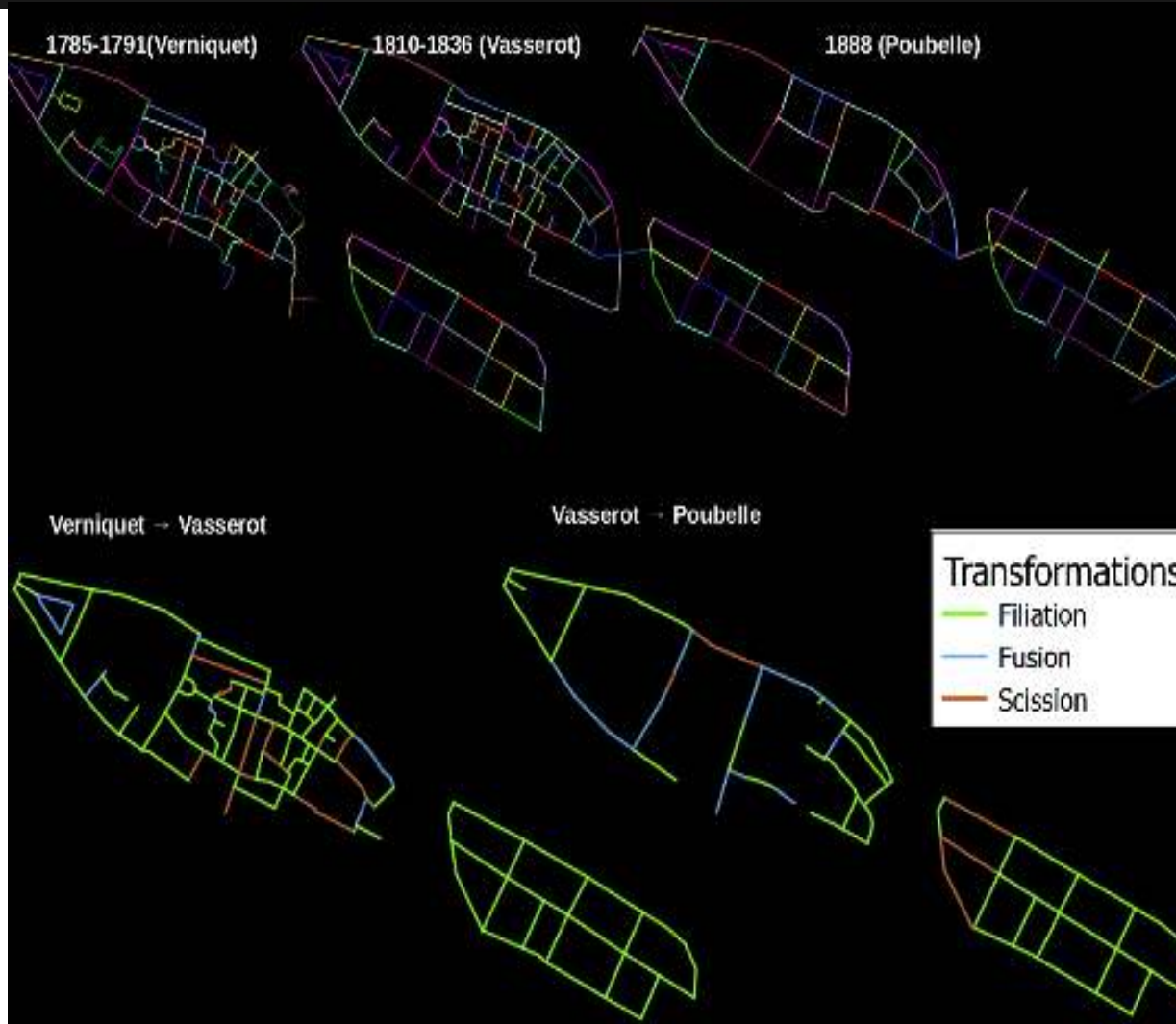
temporal, geometrical, semantic

Multi-Goal optimisation problem

- **Multi-Goal Simulated Annealing** [Suppapitnarm 2000]
- **Simple Criteria:** temporal antecedence, shape similarity, phonetic similarity



Spatio-Temporal Graphs



Overview

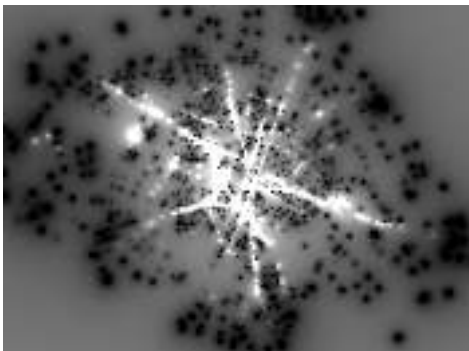
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Multi-temporal Analysis

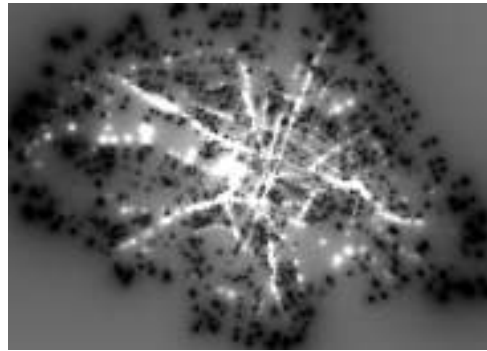
Benoît Costes' PhD Thesis

morphological analysis of **networks**

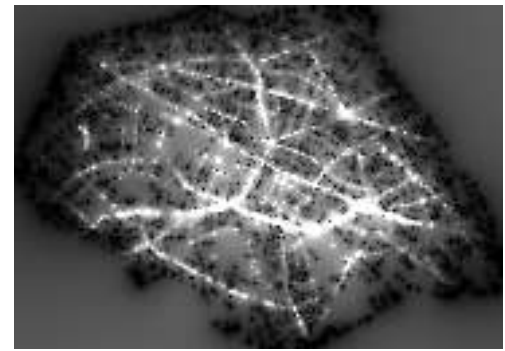
betweenness centrality



1789



1810



1889

Multi-temporal Analysis

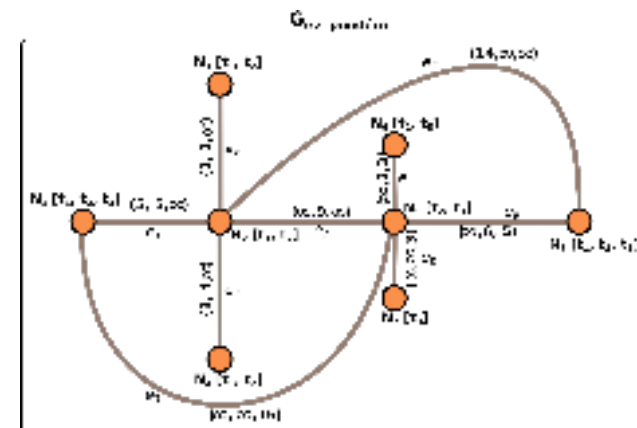
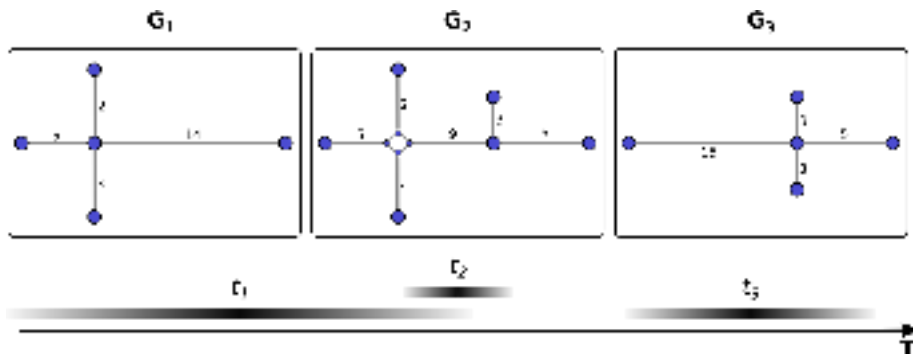
Morphogenetic analysis

evolution dynamics

Spatio-Temporal Aggregated Graphs (TAG)

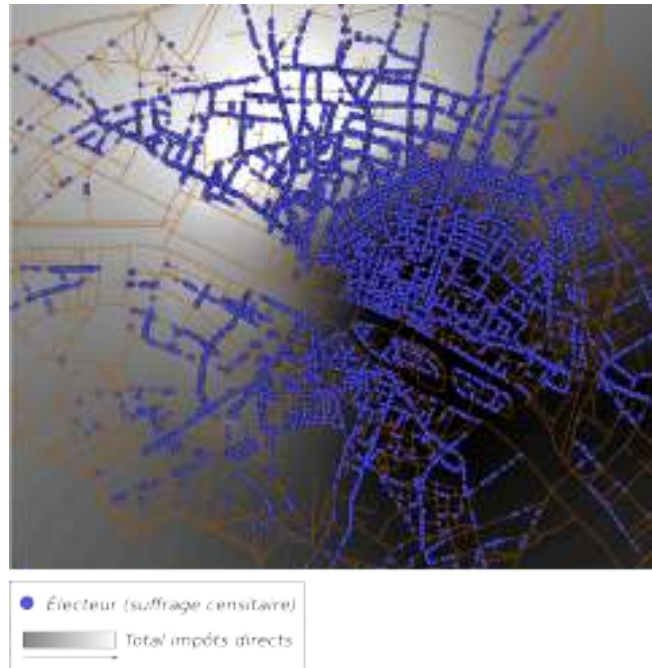
Structural analysis together with dynamics analysis

Easy to query



Multi-temporal Analysis

Links between social data and networks



around 1830

Overview

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Conclusion

Important challenges

towards a free platform based on free softwares

georeferencing and **digitizing**

sharing

analyzing geo-historical data

Difficulties

data and hypotheses management

imperfections management

for data integration, matching and spatio-temporal graph construction

for diachronic analysis

Thank you!



Place de la Concorde, Hôtel de Ville, Louvre, Théâtre Français, Rue de la Paix, le Midi.