

Quantifying the co-evolution of economic activities locations with geo-historical data: Paris, 19th century

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Social Dynamics in Urban Context

Open tools, models and data - Paris and its suburbs, 1789-1950

Welcome to the SODUCO project

SODUCO is a 4 years pluridisciplinary project funded by the French National Research Agency, it has started in march 2019 and will end in 2023. SODUCO brings together people from the geographical sciences, from urban history, specialists of network morphogenesis and computer scientists to study the evolution of Paris over time, both in terms of its morphological transformations and its social evolutions.

Project partner institutions

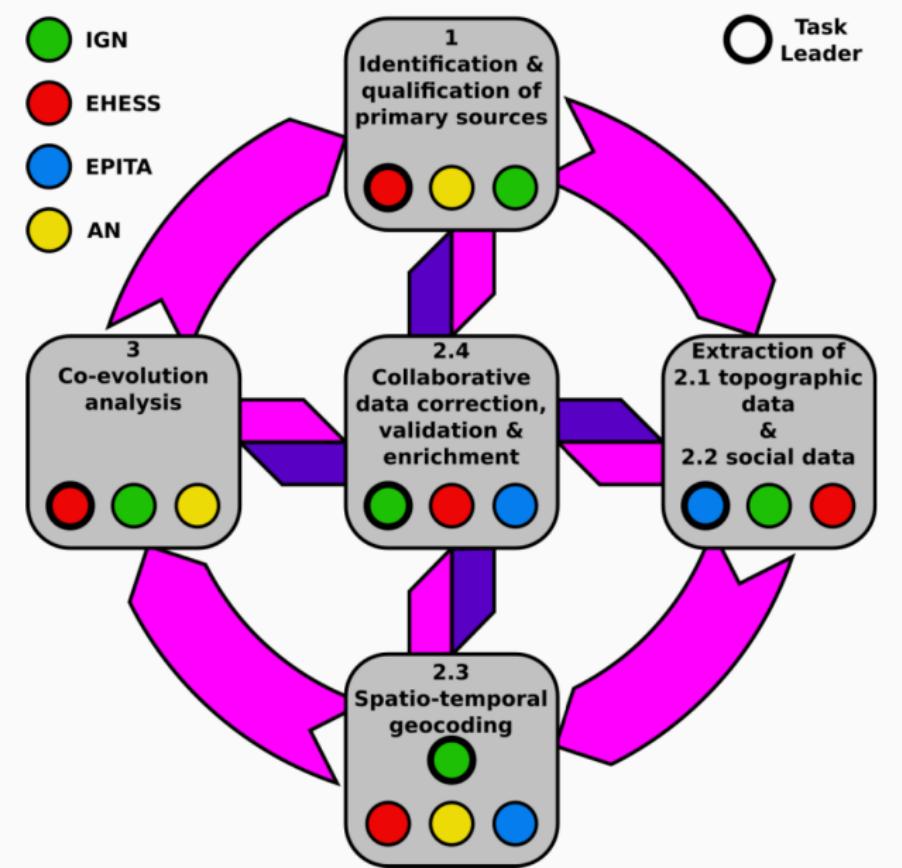
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Structure of the SODUCO project



WP 1: Identification and qualification of relevant sources

→ Catalog of primary sources; qualification of sources and metadata construction; online publication as Linked Open Data; modeling of uncertainties.

WP 2: Digitalisation of sources

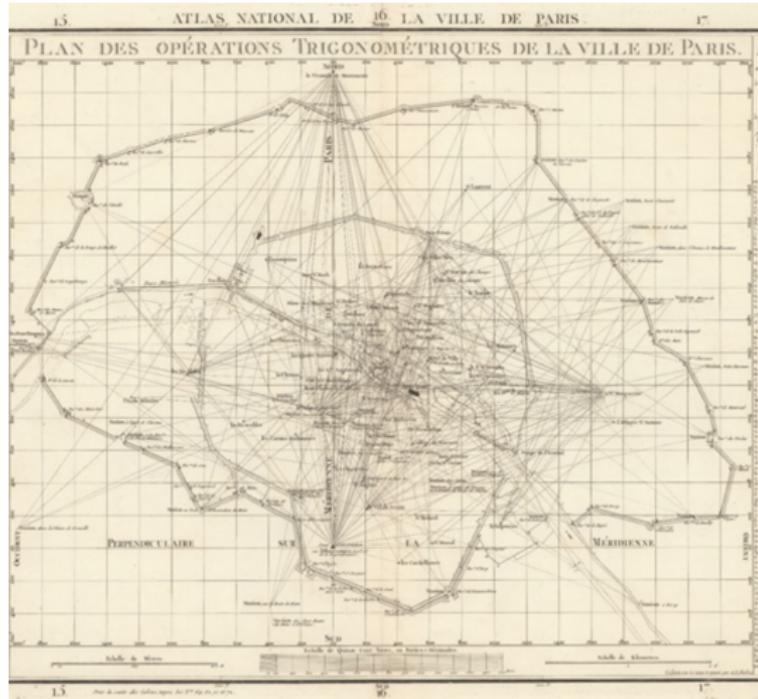
→ Extraction of topographic data (2.1); extraction of socio-economic data (2.2); spatio-temporal geocoding (2.3); collaborative data correction, validation and enrichment (2.4).

WP 3: Co-evolution analysis

→ geovisualisation of data and associated dynamics.

Tools: collaborative open platform to ensure reproducibility and traceability of data and processes.

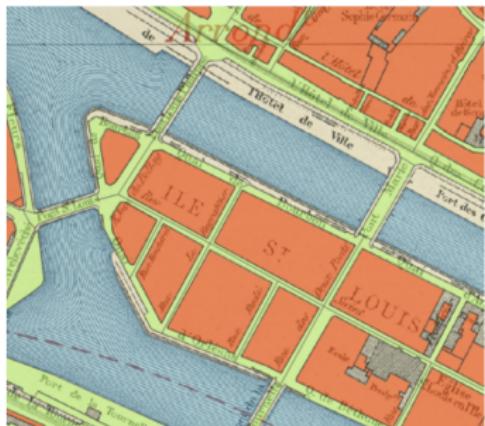
Verniquet atlas accuracy



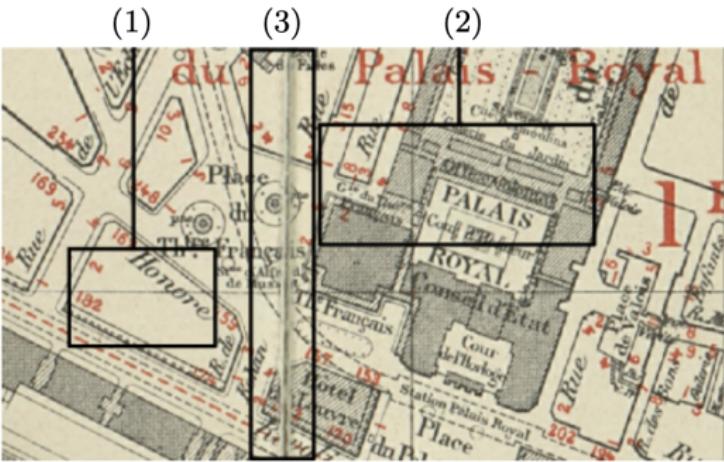
Fieldwork survey with modern instruments to verify the planimetric accuracy of Verniquet atlas (claimed at 1/10 of a toise $\simeq 19\text{cm}$)

- Claimed uncertainties were correct
- CRS parameters for the historical coordinate system (reused as reference in many historical plans)

Vectorisation of historical maps



Historical Map



Edge Probability Map

Closed Shapes



Deep Contour
Detection



Filtering &
Watershed



PhD thesis by Yizi Chen soon finished: vectorisation combining deep learning and mathematical morphology [Chen et al., 2021b] [Chen et al., 2021a]

- Multi-dimensionality of urban systems is one aspect of their complexity, strongly present in the co-evolution of economic activities locations.
- Understanding past processes better inform urban theories and models for future sustainable planning.

Research objective of this contribution (partly WP3):

Use geo-historical data to quantify the co-evolution of economic activities in Paris during the 19th century; methodological aspects on the issues linked to the exploitation of such data.

Urban systems and geo-historical data

- Contemporary intra-urban dynamics are better and better characterised through the emergence of urban data and urban analytics [Kandt and Batty, 2021]; more difficult with past dynamics.
- Interdisciplinary approaches to the modeling of settlement systems transitions: qualitative or very sparse data, stylised models (Transmondyn project) [Sanders, 2018]
- Stylised models for systems of cities on long time scales [Pumain and Reuillon, 2017]
- Difficulty to build geo-historical data: geocoding [Cura et al., 2018], vectorisation [El Gouj et al., 2022]

Data extraction

LISTE GÉNÉRALE	
265	
<h1>ADRESSES DE PARIS,</h1>	
ET DES PRINCIPAUX ÉTABLISSEMENTS DE CETTE CAPITALE.	
Abladie, architecte, Maréchal-du-Temple, 69. Abladie fils, passementier, Bourg, 6 (2). Abladie (F.), peintre, Fossé St-Martin, 56. Abladie, table, Monumental, 132. Abladie, tailleur, Bon-Enfants, 36. Abancourt (Vieille), G. ♀, priez, présidé à la mort d'un complice, Assas, 3 bis. Abancourt (Vieille) ♀, messager d'Etat, Cor- sé le, 5. Abiffre : Grenelle, — Monuments, — Min- éral., — Montmartre, — Ville. Abiffre, chimiste, Corbeil, 16. Abista et Cie cosméticien, Petit-Saint-Eustache, 24. Abissel (H.), pharmacie, Ste-Apolline, 93 ½. Abibat, tailleur, St-Honoré, 262. Abbaudre (J.), député, Cassaneris, 1. Abbaudre (J.), église mar- carde de St-Thomas-d'Aquin, Sevres, 16. Abbaye (l'), prison militaire, pl. Ste-Margue- rite-St-Gerv. Abhay (John), fact. d'orgues, Faub.-Puisson- aine, 48. Abkol, vicere général hussarie, St-Louis-en- l'Île, 22. Abolle, propriét., Basse-du-Rempart, 36. Aboucada, épicier, Vaugirard, 51. Abel, tapissier, Colyse, 19. Abel, tailleur, Notre-Dame-de-Lorette, 35. Abel-Laroche, papet, filz, dessins, peintures, tableaux, Honnêve, 5. Abel du Puyg (de l'Institut), peintre d'hist., Albois, 18.	Aceret, libraire, Cassette, 23. Aceret et Gallot, imprimeurs, Fair, 19. Acoustique (vers et envois d'), Bourg, 3. Acoux alud, cassies, en quinze, Charlot, 41. Achard, ébéniste, Moreau, 62. Achard, grecce de papier, St-Sauveur, 30. Achard, hôtel du Due de Clarence, Grenelle, St-Germain, 22. Achard (Ch.), lapidaire, Palais-Royal, galerie Montpensier, 23, et rue Montpensier, 18. Ac and J.-P., joaillier, Monnaie, 11. Achat châtaignier, Villejuif, 57. Achart, meubles, Ste-Appareille, 22. Achart, fab. de parapluies, enclos de la Tri- niété, rue de la Laiterie, 40. Achart (Mme), fab. de poupées, St-Martin, 217. Achart (Mme), à la cour royale, Forum, 5. Achart et Cie, épuration de stérile, Bouar- paires, 13 (2). Achenoy, lapidaire, Pastorelle, 24. Achille Guilleminot ♀, caissier de la compa- gnie du chemin de fer de St-Étienne à Lyon, Lille, 105. Aixier, confiseur, Ecrivain, 3. Ackermann, sellier, Faub.-St-Denis, 53. Ackermann, tapisserie, St-Marc, 28. Ackroyd fils, avocat, Coedès, 19. Acoulon alud, cordier et marché, de chasseur, Ferrière, 27. Acquery Kervars, ancien notaire, boul. Poit- oussière, 14. Actes (Bourse des), Bac, 26 bis.
Adam (H.), peintre, Malignon, 3. Adam, vitre, St-Germain-des-Prés, 3. Adam, pâtissier et magasin, Dauphin, 24. Adam (H. E.), peintre, Niv-des-Petits-Ch., 6. Adam, satucier, quai des Augustins, 55. Adam, sous-cuistre à l'enseigne, Gros-Chenet, 9. Adam, tourneur sur mesure, Henry, 2. Adam, vins, Preuves, 22. Adam et Lepast, layetiers, Quincampoix, 64 (2). Adam Zellera, serrur. en vuit., Cadet, 29. Adamini, peintre-vitrice, Faub.-St-Denis, 105 bis. Adde, jardinier-fleuriste, pl. de la Madelaine, 6. Adde, libraire, boulevard Poissonnière, 17. Adde-Margras, nôé, Faub.-Poissonnière, 4. Adde, prof. au collège Henri IV, Copeau, 36. Adelbauer (R. E.), peint., Bretagne, 6. Adelot jeans, magasin-pâtisserie, Jour, 4. Adelot, peint., Victoire, 4. Adeline, rouennerie, St-Martin, 145. Adelmann, gardien des collections à l'Ecole des Beaux-Arts, Ecole, 28. Adelin ♀, modéliste, Faub.-St-Germain, 47. Adelaïward (baron G. d'), secrétaire à la légi- slation de Suide, Anjou-St-Honoré, 58. Adell (Mme), imprimerie, St-Martin, 179. Adens de la Roserie, Bergerie, 2. Adet de Rossette, modéliste, Paradis-Pois.,	

Data pre-processing

Location of activities

Definition and characterisation of co-evolution

Application to this dataset

Results: co-evolution

Simultaneous correlations

Discussion

Conclusion

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Soduco repository:

Models and results open at

<https://github.com/JusteRaimbault/HistoricalData>

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