HAL open science

Is Paris a good example for a X-minute city?

Sarah J. Berkemer, Simon Genet, Léopold Maurice, Marie-Olive Thaury, Paola Tubaro

To cite this version:

Sarah J. Berkemer, Simon Genet, Léopold Maurice, Marie-Olive Thaury, Paola Tubaro. Is Paris a good example for a X-minute city?. FRCCS 2023, May 2023, Le Havre, France. hal-04103593

HAL Id: hal-04103593

https://hal.science/hal-04103593v1

Submitted on 24 May 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Distributed under a Creative Commons Attribution 4.0 International License

Noname manuscript No.
(will be inserted by the editor)

Extended Abstract: Is Paris a good example for a X-minute city?

Modeling city composition on POI data and X-minute statistics in Paris

Sarah J. Berkemer · Simon Genet · Léopold Maurice · Marie-Olive Thaury · Paola Tubaro

Received: date / Accepted: date

Keywords X-minute statistics · City composition · Urban modeling · Paris · OpenStreetMap

1 Motivation

Cities play an important role in various contexts such as society and economy but also sustainability and ecology. In many countries, urban areas host a large number of people working in the industrial sector, and also include main touristic sites as well as governments and administrations. City development has a high impact on the economics of a country as well as on the living quality of its inhabitants [7]. Therefore, cities can be considered as complex systems and summarizing all aspects of urban life is a challenging task [4]. Even though cities continuously change, many of them still show traces of historical events and keep historically grown aspects of composition and infrastructure. Thus, urban areas are not only a set of buildings and streets but they include complex dynamics of infrastructure and also their population [6]. Here, we do not only see daily movement in various transportation systems but also structural changes regarding the movement of subgroups of the population within the city regarding housing possibilities. Thus cities reflect socio-economic history [5] and at the same time show current societal and economic changes and their effects.

S. Berkemer
LIX, Ecole Polytechnique
E-mail: berkemer@lix.polytechnique.fr

P. Tubaro
CREST CNRS-ENSAE
E-mail: Paola.Tubaro@ensae.fr

M. Thaury, L.Maurice, S.Genet
ENSAE

In recent years, urban development and design shifted towards a more pedestrian and cycling-friendly approach. One of the most popular models hereby is the 15-minute city concept [1] or its more generalized version, the X-minute city concept [2]. The Covid-19 pandemic triggered the emergence of a total rethinking of the functionality, composition and design of cities towards rather social , sustainable and resilient concepts. The aim is to provide access to a broad range of amenities within x minutes walking distance in order to recreate social links between the inhabitants and to avoid car journeys for public health and environmental reasons. X-minutes cities is an urban planning objective defined by Carlos Moreno [1] and made public by Anne Hidalgo during the 2020 municipal campaign and since then, Paris serves as an example city for many existing studies in the field. However, we did not find an extensive study showing to which extent Paris can be seen as a 15-minute city. In this project, we analyze the city of Paris , including its composition, accessibility to amenities and usage as an example for the 15- or X-minute city concept.

2 Data

OpenStreetMap (OSM, `www.osm.org`) data for Paris consisting of mapping data for streets and buildings annotated with names, numbers and points of interest (POI) such as shops, schools, restaurants, monuments, and parks as well as public transport annotations and bicycle paths. For many entries in OSM, the user can find very detailed information, e.g. names, categories of shops or food, or line numbers for public transport.

As a secondary source, we use a grid of squares of 200m x 200m on Paris with additional information on social and fiscal demographic properties. This grid - named *INSPIRE* - comes from the *FiLoSoFi* (`https://www.insee.fr/fr/statistiques/4176290?sommaire=4176305`) data set made by *INSEE* (`www.insee.fr`).

3 Methods and preliminary results

The purpose of our project is to develop a statistical model of city composition based on different types of points-of-interest (POIs). POIs are notable urban locations like schools or shops and are divided into several categories (public, health, leisure, catering, accommodation, shopping, money, tourism...), which are themselves subdivided. For example, OSM distinguishes bars from restaurants and fast food outlets. OSM also provides the ethnic character of the restaurants. These data thus make it possible to see the difference between a tourist, residential, commercial, wealthy or ethnic district.

First of all, we focus on different districts of Paris in order to compare their composition both quantitatively and qualitatively. In parallel, we are also looking to implement the x-minutes cities model to measure residents' accessibility to essential shops and amenities.

Fig. 1 Composition of two Parisian districts, Javel and Opéra Garnier regarding the amenity categories restaurants (blue), supply shops (orange), food shops (green), fashion (red), education (purple) and culture and arts (brown). We clearly see differences between a more touristic district such as Opéra Garnier and a more residential one like Javel.

Inspired by Knap et al [2] and Paris Mayor policy, we are concentrating on the composition of cities driven by services accessibility in a one kilometer radius (corresponding to a 15min walk at a 5km/h speed).

The categories for amenities that we are using during this study are the following: restaurants, supply shops, food shops, fashion, education, culture and art as it can be seen in Figure 1.

3.1 Composition of districts

As a first step towards the composition analysis of the complete city of Paris, we arbitrarily chose a dozen of places, such as monuments or metro stations, around which the social life of the neighborhood is organized. The neighborhood in question corresponds to a perimeter of one km of the pedestrian network around the chosen location. In each neighborhood we count the POIs for each of the categories defined above.

We find obvious disparities between neighborhoods in terms of the concentration of activities. In particular, the most outlying neighborhoods, such as Porte de la Chapelle or Eglise du Saint Esprit (Daumesnil district, 12th arrondissement), which are also relatively poor neighborhoods (particularly Porte de la Chapelle), are those containing the fewest amenities. On the contrary, the districts around Place des Vosges and Garnier Opera, which are more central and more affluent, have a much higher number of amenities.

The pie charts in Figure 1 enable us to distinguish a touristic district (Garnier Opera district, bottom) from a more residential district (Javel district, top). It is easy to see that more than 50% of the Javel district is composed of daily services (food shops, supply shops, education), compared to 26% in the Garnier Opera district. On the contrary, the Garnier Opera district has more than 70% of luxury services (restaurants, fashion), compared to 45% in the Javel district.

3.2 Accessibility statistics

Accessibility scores are an application of the two-step floating catchment area method (2SFCA) [3]. It has been first used to measure health services accessibility, but it can be applied to any sort of extensive variables like the number of amenities for instance. The idea behind 2SFCA is to measure for each service provider the surrounding demand. Then for each person (or place) asking for this service, we calculate the surrounding offer by considering that each service provider divides itself up on the previously calculated demand.

The *FiLoSoFi* data set also includes some socio-demographic variables like age pyramid or poverty rate. From those data, we calculate for each category the accessibility index using the 2SFCA method previously explained. The demand for a square is the weighted sum of the total population in the squares in 1 km radius. Weights are decreasing with the square of the distance (the weight of the center square is 1).

By using the accessibility index we consider that a square is influenced partially by its neighbors (in a 1 km radius), it is a proxy of the neighboring squares, while the total number is an "individual" measure. By combining the two, we can for instance separate a square which represents a commercial street (a lot of shops in the square) from a residential neighborhood or a commercial one.

Figure 2 clearly depicts in purple and yellow the Olympiades district in the South of Paris, historically known for gathering a large number of social housing units, as well as the low-income housing belt in the East of the city. You can also see the 16th, 7th, 8th and 6th arrondissements in the West and center of Paris (in red), which are known to be well-to-do districts.

4 Conclusion and Outlook

The aim of our analysis is twofold: (1) we plan to develop a model of the composition of a city's district and (2) we aim to analyze Paris regarding the X-minute city concept. For both parts, we took the first steps by defining data sets and formulating methods.

Next steps will include for (1) a more specific analysis of the city district composition by choosing a homogeneous set of district centers such as metro stations. For a more detailed analysis, we plan to include additional information provided by INSEE regarding socio-demographic variables. To refine the model, we plan to run clustering or regression methods. Regarding part (2) we plan to include further categories of amenities and run the analysis for the complete city of Paris. Hereby, we will be able to analyze how certain services are distributed among the city. A regression analysis of accessibility statistics will be conducted to identify the most important parameters for the accessibility measures inside a city as described by [2]. Both aspects of the project are planned to be extended to further (French) cities.

References

1. Moreno, C. , Allam, Z., Chabaud, D. , Gall, C., Pratlong, F.. Introducing the 15-Minute City: Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities. *MDPI Smart Cities* 4(1):93-111, 2021.
2. Knap, E., Baran Ulak, M. , Geurs, K.T., Mulders, A. , van der Drift, S.. A composite X-minute city cycling accessibility metric and its role in assessing spatial and socioeconomic inequalities – A case study in Utrecht, the Netherlands. *Journal of Urban Mobility* 3, 2022.
3. Wei Luo and Fahui Wang. Measures of Spatial Accessibility to Health Care in a GIS Environment: Synthesis and a Case Study in the Chicago Region. *Environment and Planning B: Planning and Design* 30.6:865–884, 2003.
4. Bettencourt, L. M. Cities as complex systems. *Modeling complex systems for public policies*:217-236, 2015.
5. Almusaed, A., & Almssad, A. City phenomenon between urban structure and composition. *Sustainability in Urban Planning and Design* 3, 2019.
6. Batty, M. Cities as Complex Systems: Scaling, Interaction, Networks, Dynamics and Urban Morphologies. *Springer*:1041-1071, 2009.
7. Abrahamson, M. Globalizing Cities: A Brief Introduction. *Routledge* 2019.

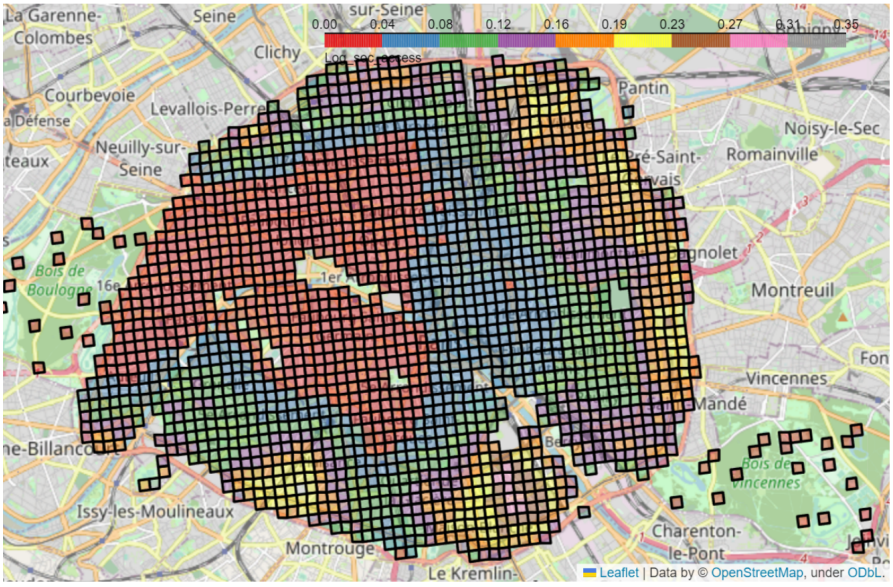

Fig. 2 Access to social housing in Paris where the red squares denote no access and the squares colored in yellow, brown or pink show a high access to social housing.