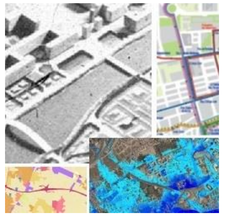

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Analysis of the implementation of the 15-minute city philosophy in the city of Madrid

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ABSTRACT

This article delves into the concept of the 15-minute city, which seeks to provide essential needs within a short walking or biking distance. The study examines Madrid utilizing Python and OpenStreetMap for a proximity analysis. The research focuses on six categories: living, working, shopping, fitness, learning, and leisure. This city has not undergone a previous scientific evaluation. Traditional urban models have been unsuccessful due to issues such as gentrification, segregation and urban decay. The 15-minute model incorporates proximity, diversity, density, and ubiquity, with the aim, of addressing shortcomings in urban planning and create more accessible and integrated urban spaces.

INTRODUCTION

Rural exodus has been a process that has been occurring for several centuries but intensified during the Industrial Revolution in the 18th and 19th centuries. At that time, the mechanization of agriculture and industrial development attracted many people to the cities in search of factory jobs and opportunities that rural areas could not offer. This phenomenon has continued and evolved over time to the present day due to multiple socio-economic and technological factors.

Today, 56% of the world´s population -4,4 billion people- live in cities. This trend is expected to continue, and the urban population is expected to more than double its current size by 2050, when almost 7 out of 10 people will live in cities [1]. Population migration will continue to exacerbate existing urban problems such as housing shortages, overcrowding, traffic, pollution, and resource constraints [2]. These problems have been aggravated by the urban planning policies of the last decades of the 20th century, which focused on promoting accessibility through the use of automobiles and improving travel speed, generating, in addition to the abovementioned problems of urban sprawl [3] and gentrification. This extended abstract, presents the 15-minute city model and presents first approach to its implementation in three different types of cities.

AREA OF STUDY: X MINUTE CITIES

In 2016, based on "chronourbanism" and the Neighbourhood Unit (Perry,1929) [4] that Carlos Moreno proposed the concept of the "Ville du Quart d´heure" or 15-minute city as the antithesis of the abovementioned, combining in an exemplary way four fundamental elements: (i) proximity, (ii) diversity, (iii) density, and (iv) ubiquity [5]. This term has become popular owing to the COVID phenomenon and its corresponding movement restrictions, which increase the need for individuals to live in self-sufficient neighborhoods and, on the other hand, the inclusion of the term in the political agenda of the city of Paris by its mayor Anne Hidalgo in March 2020, which in July of the same year was extended to the C40 Cities Climate Leadership Group [6]. The fundamental objective of the term is to maximize three sources of welfare: (i) the personal, with more time available, (ii) the social, with more interaction and finally with (iii) the planet, with respect to the others, for the environment and for the resources [5], so that everyone can to reach the six essential necessities of life within 15 minutes on foot or by bicycle: (i) living, (ii) working, (iii) shopping, (iv) fitness, (v) learning and (vi) leisure [5]. Although all previous urban planning models along the same lines are based on equitable resource distribution, decentralization, and infrastructure decongestion, it can be empirically confirmed that all of them have failed and ultimately contribute to negative gentrification, population segregation and urban fragmentation [7]. This leads us to believe that this paradigm may repeat itself, which is why many groups of opponents and detractors have come to the fore.

METHODOLOGY

To conduct the study a review of the literature and the state of art [8] shows that the city of Madrid has not been previously analyzed qualitatively and quantitatively in a scientific manner.

Python 3.16.11 and the open data network OpenStreetMap (OSM) [9] were used for proximity assessment, from which the following points of interest (POI) were selected.

- Origin: each node in the walkable network is derived from the intersection of two or more paths.
- Destiny: the 20 closest POI that can be reached within a 15-minute time frame.

Hospitals, Universities and Public Transit are not taken into account because they are considered at the metropolitan level and not at the neighborhood level [10]. Job opportunities were also not considered because of the lack of open data on the location of work places [10].

- The time required to reach each POI is defined by the following formula [11]:

$$t = l / s$$

- l is the distance from the shortest route to the POI in a network based on walkable roads.
- s is the approximate walking speed of an average person; this is equal to 4,8 km/h [10].

If from a node, all categories can be reached in 15 min, then the node is considered a 15-minute node [11].

Category of Study	OSM Category	OSM features
Education	amenity	school, nursery
Entertainment	amenity	social center, studio, theatre, libraries, cinemas
	leisure	sport center, fitness center
Grocery	shop	alcohol, bakery, beverages, brewing supplies, cheese, chocolate, coffee, frozen food, greengrocer, health food, pasta, pastry, seafood, spices, tea, water, supermarket, department store, general, kiosk, mall
Health	health facility	clinic, dentist, doctors, nursing home, pharmacy, social facility, counselling center
Parks	leisure	park, dog park, garden, playground
Post and Banks	amenity	atm, bank, bureau de change, post office
Shops	shop	department store, general, kiosk, mall, wholesale, baby goods, bag, boutique, clothes, shoes, variety store, chemist, garden center, funeral directors, laundry, pet, tobacco
Social Services	amenity	social service, police station
Sustenance	amenity	restaurant, pub, bar, cafe, fast-food, food

FUTURE WORKS

Future work in urban planning should encompass two phases: an initial analysis of the existing cityscape and a subsequent phase focused on future planning and execution. The first analytical stage is pivotal to assess the city structure and potential for meeting the "15-minute city". This involves examining aspects such as: (i) population density, (ii) infrastructure type and walkability, (iii) prioritizing services based on community needs, (iv) assessing service quality, (v) including public transportation for metropolitan connectivity and (vi) conducting a discrete study for accuracy [12]. Additionally, it requires defining measures for evaluating (vii) digitalization and (viii) equity dimensions [12]. The subsequent measure is to supply deficient services in pinpointed areas, while simultaneously monitoring progress using the indicators established in the initial study.

CONCLUSIONS

The initial survey of the city highlighted a notable lack of services in areas further away from the main centers, mainly in newly urbanized areas or rural areas absorbed by urban growth. In contrast, areas close to the center have sufficient services. It highlights the need for better development in new housing and planning to balance the demand generated by new settlements with the supply services. For consolidated historic areas, differentiating between private and public services is proposed. It is suggested to encourage the establishment of private services through location studies and, for public services, to use chronotopy [5] to maximize the coverage of activities over a wide temporal radius.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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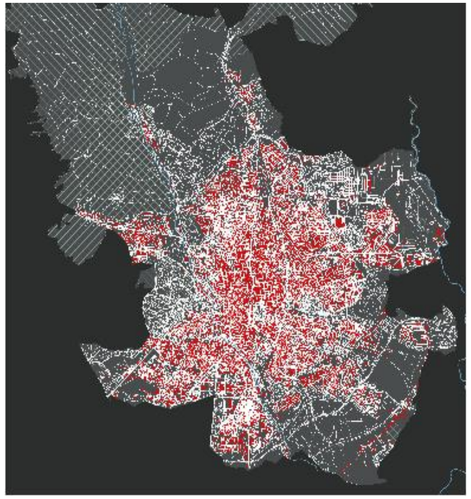
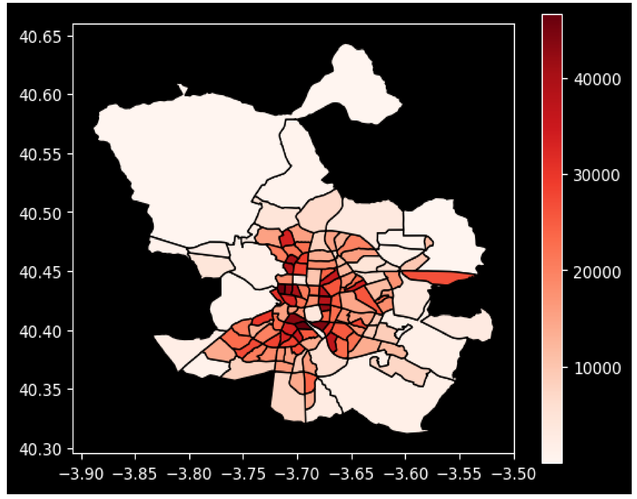
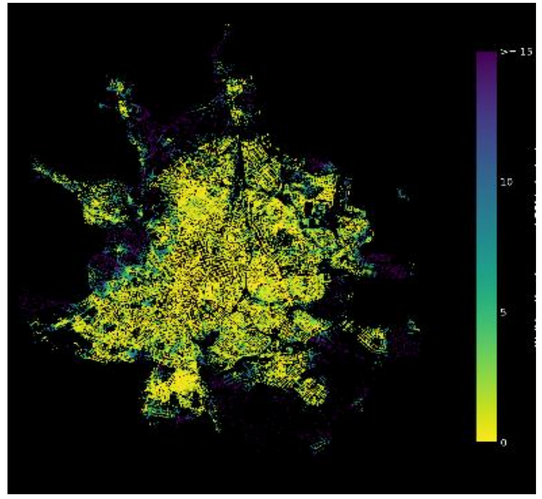
MADRID : is the capital of the Kingdom of Spain and the second most populated city in the European Union, with a population of 3,280,782 people [12] and a population density of 5,418 inha/km2. It comprises of 21 districts and 131 neighborhoods.



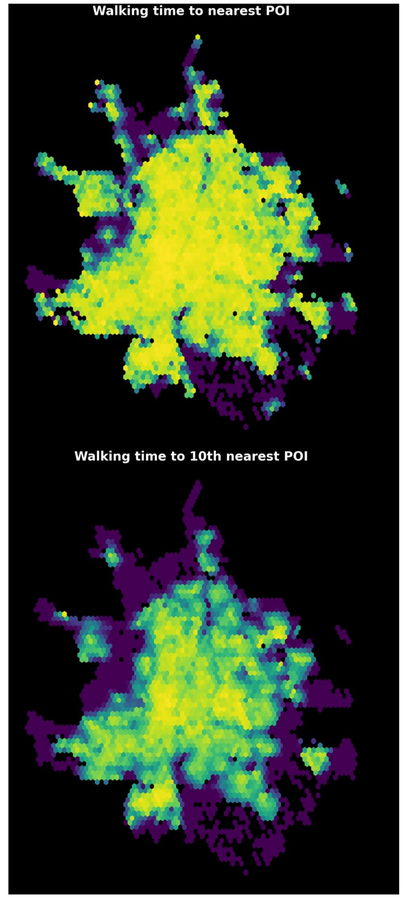
Topology and morphology.

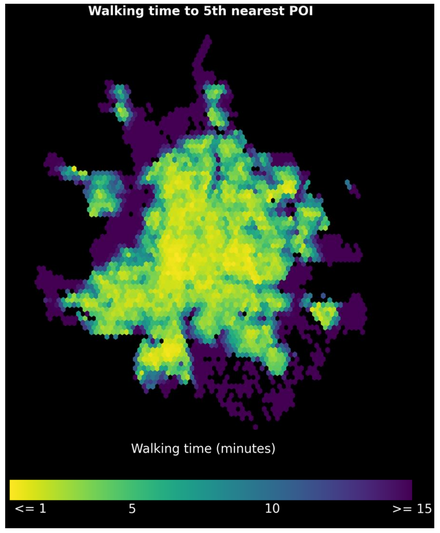


Population density.



15-minute model.





Walking time to nearest POI