Sustainable Aging in Aix-Marseille-Provence Metropolis: Assessment Indicators and Interactive Visualizations for Policy Making

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Abstract. As the world's population continues to age and urbanization accelerates, the focus of urban sustainability has evolved towards promoting the needs and well-being of older adults in addition to environmental concerns. Urban environments have a significant impact on the experiences of city dwellers, particularly of older adults, and from this perspective certain neighborhoods present greater challenges than others. To address issues related to aging, cities around the world have launched initiatives to improve urban sustainability for older adults, ranging from redesigning public spaces to providing opportunities for social interaction. However, to design effective interventions, open-access data related to urban environments must be collected and analyzed to identify neighborhoods with the greatest need for improvement. This paper presents a case study of the Aix-Marseille-Provence metropolis in France, showing that a range of assessment indicators focused on walkability and urban form can be calculated using open-access data. Through the presentation of these indicators and exploratory analysis results in a visual and interactive format (HTML-based platform), planners and policymakers can quickly identify patterns and trends, thereby helping them identify neighborhoods with the most significant needs and create more effective policies.

Keywords: Aging · walkability · urban form · data visualization · urban sustainability

1 Introduction

As the world's population ages and more people choose to live in urban areas, the focus of urban sustainability has evolved beyond environment issues to also encompass the needs and well-being of older adults. This evolution has been driven by a growing recognition of the important role that urban environments play in promoting healthy aging and social inclusion, as highlighted by academics and intergovernmental organizations [1, 2]. The locations are significantly impacting the experiences and possibilities of all city dwellers,

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and especially of older adults, and from this perspective certain neighborhoods are presenting greater challenges than others. This is for example the case of car-dependent suburbs made of single-family homes, hard to walk areas because of obstacles or steep slopes, or the presence/absence of close-by shops and services which leads to different degrees of vitality for neighborhoods [3]. The challenge for cities and policy makers is to ensure that older adults are, regardless of their residential location, fully integrated into the urban environment. In recent years, cities around the world have launched initiatives aimed at improving urban sustainability for older adults. These initiatives have included everything from redesigning public spaces to better meet the needs of older adults [4], to providing more opportunities for social interaction and community engagement [5]. To summarize, the aim is to make urban spaces more livable, sustainable, and resilient for generations to come.

Built environments yet require improvements and modifications to varying degrees of urgency, depending of course on the type of issues at hand, but also on the requirements of the inhabitants living in different locations. From this perspective, the collection, analysis, and interpretation of open-access data related to urban environments can help identify the level of immediacy to which different neighborhoods, associated to different ratio of older adults, are exposed to sustainability and walkability issues. Urban planners and policy makers can for example use the output of a different range of assessment indicators to design, implement and modify urban locations within the aim of improving the overall quality of life for aging residents. However, to reach that aim, it is important for assessment indicators to be designed to address specific issues and for their results to be easily comprehensible and accessible at a metropolitan scale. This paper thus focuses on a test metropolitan area, the Aix-Marseille-Provence metropolis in southern France, and shows that a wide range of assessment indicators focusing on the link between locations and aging can be calculated using specific data in open-access. The range of indicators addressed in this paper focuses on the ratio of older adults, walkability issues (steep slopes and accessibility to amenities) as well as on the physical features of urban spaces (morphotypes), as they could be perceived by people. By presenting data in a visual and interactive way, planners and makers can then quickly identify patterns and trends that might not be immediately apparent.

This paper is organized as follows. Section 2 introduces the case study Aix-Marseille-Provence Metropolis and the different datasets gathered for this study. Section 3 presents the assessment indicators that have been calculated. Section 4 presents preliminary results obtained by cross-analyzing the different indicators presented in Sect. 3. Section 5 introduces an interactive platform to visualize and explore the spatial results calculated in the previous sections. Section 6 concludes the paper with a discussion on future applications.

2 Case Study and Data Presentation

2.1 Aix-Marseille-Provence Metropolis

The Aix-Marseille-Provence Metropolis is an intercommunal organization made of 92 communes in southern France (Fig. 1). Its area is about 3,150 km^2 for a population of 1,9 million inhabitants in 2019. Marseille and Aix-en-Provence are the main cities of this

intercommunal organization. The urban agglomeration, defined by the French Statistical Institute INSEE as the continuously built-up area with gaps up to 200 m, covers 1,758 km^2, with a population of 1,614,500 in 2019. Spatially, the urban agglomeration includes the city of Aix-en-Provence and the industrial and logistic area around the coastal lagoon of Berre, and covers most of the Bouche-du-Rhône administrative department (5,087 km^2 and 2,034,000 inhabitants in 2019).

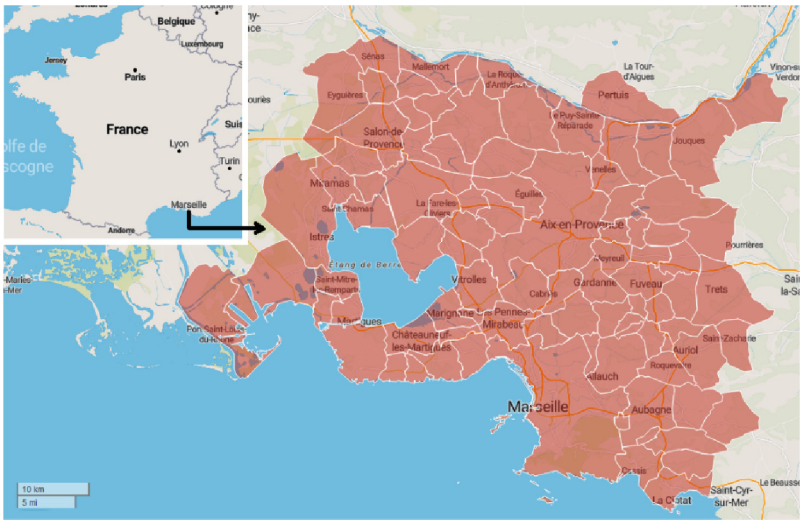

Fig. 1. Administrative boundaries of the 92 communes belonging to Aix-Marseille-Provence Metropolis [6].

The *«Logements, individus, activité, mobilités scolaires et professionnelles, migrations résidentielles»* database of the French National Institute of Statistics and Economic Studies (INSEE) [7] provides variables and information related to the French housing units and the households occupying them. Over the last decade (2008–2018) and across the entire metropolitan area, the population of people aged over 80 has grown by 25%, while the total population has only grown by 3.5%. However, the growth of the elderly population is significantly more pronounced in the least densely populated municipalities on the outskirts of urban areas, while in the center of the Marseille and Aix agglomerations, the trend is towards stagnation or even a decrease in the proportion of people aged over 80.

Across the Aix-Marseille-Provence metropolitan area, households consisting of a single senior, known as "isolated seniors," represent 52.3% (68,782 out of 131,522) of the households possessing at least one senior aged 75 or older. 43% of the households with at least one senior aged over 75 live in single-family houses, 90% of which owner-occupied. Among the remaining 57% living in apartments, only 53% of which are owner-occupied, and half of the remaining 47% are tenants living in social housing and the other half in private rental apartments. In the metropolitan area as a whole, 50% of

apartments that elderly people occupy lack elevators, making it difficult for those living on higher floors. This lack of elevator access is equally prevalent among isolated seniors.

2.2 Data collection

With the availability of census data accessible through open data access, it is possible to delve deeper and to conduct a more comprehensive analysis of spatial disparities associated with aging. This section provides a list of all the datasets, in open access, that have been used for the calculation of assessment indicators (Sect. 3) focusing on walkability and readability of urban spaces.

- The *« localised disposable income system (Filosofi®)»* of INSEE in 2017 [8]. The scale of data collection corresponds to a square tessellation of the French territory with tiles measuring of 200 m on each side. This file gathers 35 variables related to the structure and characteristics of both households (size, age, etc.) and housings (sqm of housing units, owner, etc.).
- The *«Permanent database of facilities (BPE®)»* of INSEE in 2019 [9]. This dataset gathers all the amenities in France with their geolocation. Amenities are divided into several categories and sub-categories such as service, commerce, education, health and social services, transportation and mobility, sports-leisure-culture and tourism.
- The *«Topographic dataset (BD TOPO®)»* from the French National Geographic Institute (IGN) in 2019 [10]. BD TOPO® are GIS layers containing, amongst other things, building footprints (polygons on a two-dimensional plane) where buildings are digitized as single-part polygons and roads (polylines on a two-dimensional plane).
- The 30-m resolution digital elevation model (DEM) of the Shuttle Radar Topography Mission of the NASA Earthdata program [11].

As the next sections will show, municipalities and policymakers can gain insights that were previously unavailable by leveraging and cross analyzing the aforementioned data sources.

3 Indicators

It is important for assessment indicators to be designed to address specific issues in order to maximize their impact and ensures their comprehensibility. Within this research, we put the focus on walkability as well as on the physical features of urban spaces as they could be perceived by an aging population. Walkability typically refers to various factors that make an environment conductive to walking. As discussed in Lo [12] different pedestrian performance metrics have been developed within various disciplines such as traffic engineering, transportation planning, urban design, public health or sociology, and all these fields have varying definitions and methods on how to assess walkability. In the context aging and urban planning, walkability mostly refers to creating a resilient and healthy city [13] while the physical features of urban spaces refer to morphotypes around street segments.

3.1 Share of Individuals Aged 65 Years or Older

The concept of the third age is a term that is often used interchangeably with old age. The third age is generally associated with individuals who have retired from full-time work and are no longer raising children, but are not yet considered to be in the final stages of life, also referred to as the fourth age. People belonging to the third and fourth age are commonly referred to as "seniors", "elderly persons" or "older adults" and are often recognized as a distinct demographic group with specific needs and challenges. The age structure of the population is available within the 2017 *« localised disposable income system (Filosofi®)»* database of INSEE [8]. First, the population aged 65 years or older, which roughly corresponds to both the third and the fourth age, has thus been extracted and divided by the total population per tile to obtain the share of older adults per location. On a given tile, if the number of households is less than 11, the data are imputed in order to respect the confidentiality threshold set by the French government. Overall, most of the tiles (79%) contain less than 11 households but they only account for 20% of the population.

3.2 Slope Averages

Older adults have weaker muscles and joints, making it more difficult for them to navigate steep slopes. This can lead to increased fatigue and discomfort, which can further increase the risk of falls. Moreover, walking on a steep slope enhances the intensity of physical activity, resulting in an elevation of heart rate, which in turn increases the risk of cardiovascular complications for older adults [14]. When considering the needs of aging populations, it's important to consider the slope of the terrain, above all in the case of Aix-Marseille-Provence metropolis, which includes a contrasted topography. Even if an area has pedestrian-friendly amenities, steep slopes can create difficulties for older adults who may have limited mobility. For this project, for the second assessment indicator, we thus computed the slope average using the 30-m resolution elevation data from the Shuttle Radar Topography Mission (SRTM) of the NASA Earthdata program [11], at the very same scale than the previous indicator i.e., the tiles measuring 200 m on each side of the Filosofi® database. The indicator has been named "slope average".

3.3 Accessibility to Amenities

The concept of the "15-min walk city" or of hyper-proximity has gained traction in urban planning in the last decade. The idea is that cities should be designed so that residents can access most of their daily needs within a 15-min walk, bike ride, or public transit trip, thus contributing to more vibrant, compact and sustainable communities [15, 16]. Studies have also highlighted an association between a lack of shops and weak walkability scores, within neighborhoods that could be described as food deserts [17]. Given both these rationales, the number of accessible amenities has been calculated in a queen's topological space of contiguity from the scale of the 200-m tiles of the Filosofi® dataset [8] using the *permanent database of facilities* of INSEE [9]. A queen's topological space of contiguity corresponds to a maximum of 600 m of walk from edge to edge, or of 300 m from the center to an edge, and thus look in perfect adequation to the concept

of the "15-min walk city". From this perspective, *SSi* (Shops and Services) expresses the sum of amenities accessible within a given tile *i* based on the occurrences within the said tile and within the contiguous tiles. Amenities within the queen's neighborhood of *i* have been weighted according to the slope average. In other words, the steeper the slope, the less the amenities are contributing to the final score of *SSi*. The *permanent database of facilities* of INSEE contains hundreds of categories of shops and services. For this research, we operated a subset on categories of shops and services that could be used by the elders, such as health services, convenience stores, supermarkets, post offices, etc. A specific list of amenities used by older adults does not stand out in the academic literature and thus, the detail of the retained categories we decided to select for the research has been made available in Appendix A. From now on, this subset will be referred to as amenities.

$$SS_i = i + \left(\sum_{j=0}^{n} L_j + \left(\frac{M_j}{2} \right) + \left(\frac{H_j}{4} \right) \right)$$

Given *i* the number of amenities within a tile, *Lj* (low slope) are the values observed in the queen's neighborhood of *i* where the slope average is <5%, *Mj* (medium slope) are the values observed in the queen's neighborhood of *i* where the slope average is between 5% and 8%, and *Hj* (high slope) are the values observed in the queen's neighborhood of *i* where the slope is > 8%.

3.4 Morphotypes Around Street Segments

The urban landscape of Aix-Marseille-Provence Metropolis is made of a patchwork of very diverse forms of the urban fabric. Within this project, a first analysis of the diverse urban fabric of Marseille was carried out [18]. The Multiple Fabric Assessment protocol [19] was used to identify and characterize morphotypes around street segments, i.e. typical forms of the urban fabric, using street-based morphometrics of buildings, streets and plots, and their mutual relations, as they can be perceived by pedestrian moving on the street using the *BD TOPO*® from the French National Geographic Institute (IGN) in 2019 [10] as the primary source of data. A new version of the MFA protocol implements several improvements related to precision, robustness and scalability to analyse larger study areas, and compare them between one another. The new protocol was applied to the whole department of Bouches-du-Rhône, roughly corresponding to the Aix-Marseille-Provence Metropolis, and allowed detecting and characterizing 19 different morphotypes (Fig. 2).

Five morphotypes make up the compact urbanization in around the old city centres: **UF1**. Old compact village centres and densified faubourgs, organic or planned, made of townhouses and small adjoining buildings (2.4% of the street segments of the study area) **UF15**. Compact grid-based heterogeneous urban fabric, with varied adjoining buildings aligned on regularly meshed networks, including some specialised buildings (1% of the street segments). **UF16**. Compact and dense fabric of small-to-mid-sized adjoining buildings and townhouses aligned on meshed and irregular networks, with strong presence of specialised buildings (1%). **UF9**. Densified urban subdivisions of

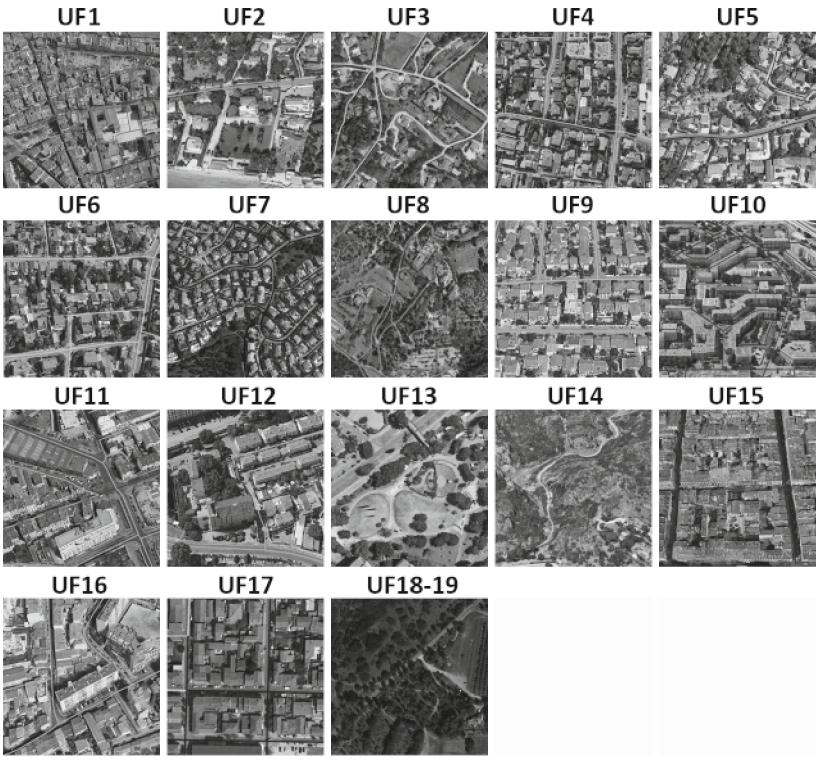

Fig. 2. The 19 morphotypes around street segments identified by the Multiple Fabric Assessment protocol in Aix-Marseille-Provence Metropolis

townhouses and houses moderately aligned and close to dense partially meshed and irregular networks (2.8%). **UF17**. Fabric of townhouses and adjoining buildings aligned on a regular grid (negligible).

Two morphotypes characterize modernist urbanization, together with specialized space: **UF11**. Modernised mid-rise continuous/discontinuous fabric alternating fragments of buildings and houses aligned on irregularly meshed networks (1%). **UF10**. Discontinuous modernist fabrics of elongated apartment blocks and towers with setback on irregularly meshed networks (3.2%). **UF0**. Specialized space is a specific morphotype characterized by the over-representation of specialized buildings (factories, commercial buildings, logistic buildings, hospitals, university campuses) (5.1%).

Seven morphotypes make up the vast low-rise peripheral and suburban urbanization: **UF6**. Fabric of urban subdivisions of aligned houses (1.1%). **UF7**. Suburban residential fabric of homogeneous subdivisions of houses and villas (or houses) with setback on organic or tree-like networks (4.7%). **UF4**. Subdivisions of partially aligned houses and 1-storey villas with setback and partially aligned on meshed/tree-like and irregular network (1.6%). **UF5**. Heterogeneous suburban fabric of houses and villas moderately aligned on tree-like and/or sloped networks (1%). **UF2**. Heterogeneous suburban fringe

of houses, villas and specialised buildings differently positioned with refence to irregularly meshed or tree-like networks (3.7%). **UF12**. Heterogeneous and discontinuous suburban fabrics alternating fragments with houses/villas and fragments with buildings, setback on tree-like networks (5.4%). **UF3**. Heterogeneous ex-urban fabric of houses, villas and specialized low-rise buildings, differently positioned on tree-like networks (14.4%).

Several residual morphotypes characterize less developed land around the urbanisation: **UF14**. Suburban/exurban fabric interfacing with undeveloped land (10.4%). **UF13**. Empty connective fragments (negligible). **UF8**. Rural space with scattered buildings (17.2%). of the study area. **UF18-UF19** are a single morphotype of undeveloped land interfaced with suburban and exurban fabric (10.2%). 12% of the study area are undeveloped land and 1.8% are highway segments, and both were not processed by the protocol.

4 Exploratory Analysis

The outskirts of towns often trade off pedestrian-friendliness in favor of car mobility. However, as people age, driving may become more challenging. Therefore, neighborhoods that are for example lacking nearby shops and services, or that are constructed on steep slopes may become problematic in the long run regarding the level of autonomy of older adults. This section thus aims at exploring the vulnerability and autonomy levels of the elderly population within the Aix-Marseille-Provence Metropolis based on three indicators calculated within the previous section: the share of individuals aged 65 years or older which provides information about intergenerational diversity within the neighborhoods, the slope average to evaluate walkability and accessibility to amenities. The scale of analysis is once again the 200-m tiles gridded data of the Filosofi® census in 2017 [8].

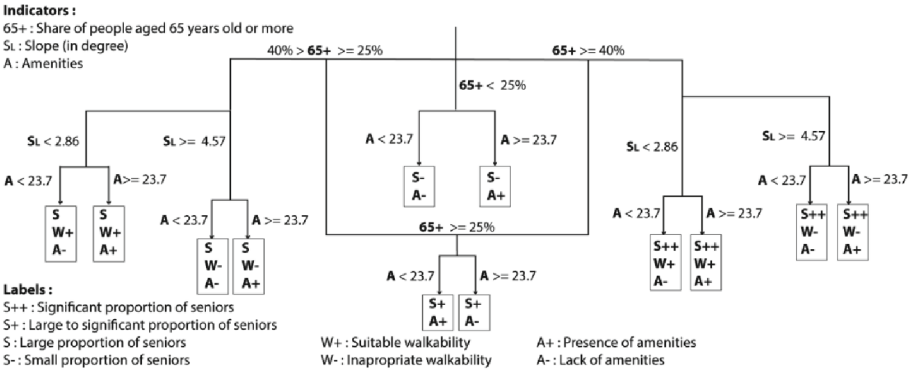

Fig. 3. A tree-like classificatory model to evaluate the degree of vulnerability/autonomy of the elderly population

An expert-based classification system has been developed to classify each 200-m tile based on the three aforementioned indicators. First, the share of individuals aged 65 years

or older has been divided into three categories using the following thresholds: less than 25% (S-), between 25 and 40% (S), and more than 40% (S+ for very aged population). This segmentation relies on the analysis of the density distribution of this indicator. Second, the slope average has also been divided into three categories. According to Alves *et al.,* [14] normal heartbeats are generally between 60 and 90 bpm, while a measurement of 120 'bpm is the outcome of great efforts for an elderly person. The authors then deduce the following categories related to the difficulty of a senior's walk according to the slope: $<5\%$—suitable, $5\% < x < 8\%$—acceptable and $>8\%$—inappropriate. We thus used the very same thresholds to evaluate walkability (W+ and W−) within a neighborhood. Lastly, using SS*i* (Sect. 3), we operated a division into two categories: presence and lack of amenities. The threshold between these two categories has been set to 23.7. Despites many studies on accessibilities to shops and services, as well as on the concept of walkability and walkability for the older adults [20, 21], a single and clear threshold of a given number of reachable amenities for an urbanized area to be considered as properly equipped does not stands out from the academic literature. As a result, we decided to pick three peripheral locations where amenities are present: *Septèmes-les-Vallons*, *Gardanne* and *Fuveaux*. The mean of SS*i* of these three locations allowed defining 23.7 as a threshold for the following two categories: properly equipped in amenities (A+) and lack or few amenities (A−). The tree-like classificatory model using these thresholds allowed obtaining 12 different class labels (Fig. 3).

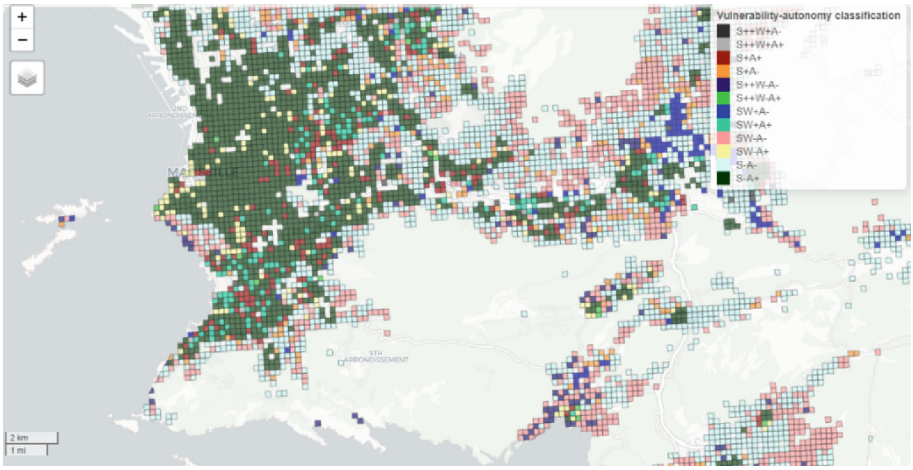

Fig. 4. Sample of the classificatory results in Marseille (source: HTML-based platform, see Sect. 5)

Several sub-categories and spatial clusters emerge (Fig. 4), based on how the proportion of seniors, walkability and accessibility to amenities are combined. As summarized in Table 1, the statistical results of this application allow locating and quantifying the number of seniors concerned by walkability and accessibility to amenities issues. It is for example interesting to note that the worst-case scenario (S++W−A−: significant proportion of older adults, a bad score of walkability and a lack of amenities) only concerns

Table 1. Statistical results by class label

Label	Description	% of Tot Pop	% of 65 yo+	% of urbanized surface
S++W+A−	Significant proportion of seniors, suitable walkability, lack of amenities	0.28	0.66	0.51
S++W+A+	Significant proportion of seniors, suitable walkability, presence of amenities	0.40	0.93	0.28
S+A+	Large to significant proportion of seniors, presence of amenities	4.00	6.36	1.56
S+A−	Large to significant proportion of seniors, lack of amenities	2.19	3.65	5.21
S++W−A−	Significant proportion of seniors, inappropriate walkability, lack of amenities	0.72	1.74	1.66
S++W−A+	Significant proportion of seniors, inappropriate walkability, presence of amenities	0.20	0.45	0.12
SW+A−	Large proportion of seniors, suitable walkability, lack of amenities	2.09	3.34	5.34
SW+A+	Large proportion of seniors, suitable walkability, presence of amenities	3.99	6.22	1.88
SW−A−	Large proportion of seniors, inappropriate walkability, lack of amenities	4.83	7.70	12.48
SW−A+	Large proportion of seniors, inappropriate walkability, presence of amenities	3.38	5.16	1.08
S−A−	Small proportion of seniors, lack of amenities	29.42	23.00	56.89
S−A+	Small proportion of seniors, presence of amenities	48.49	40.78	12.98

1.74% of the total population of 65-year-old or more within the Aix-Marseille-Provence metropolitan area for 1.66% of the total urbanized surface. In contrast, the best-case scenario (S++W+A +: Significant proportion of older adults, suitable walkability, presence of amenities) concerns 0.40% of the total population of 65-year-old or more for 0.28% of the total urbanized surface. Yet, those two examples are not sub-spaces where intergenerational diversity prevails, but rather areas where the older adults are overrepresented. Intergenerational diversity is better within the S− and S sub-categories which represent together 86.2% of the 65-year-old or more living in Aix-Marseille-Provence Metropolis.

5 Open Access to Data, Code, and Interactive Visualizations

All four indicators discussed in Sect. 3 as well as the results of the exploratory analysis that involves classification in Sect. 4 have been compiled into a geopackage file. Furthermore, an HTML-based interactive visualization platform using these indicators has been set up using the package *mapview* on R [22]. The Aix-Marseille-Provence Metropolis uses the same kind of HTML-based interactive visualization within the open-access project MData [6] (e.g. Fig. 1). Launched in 2021, this service allows accessing and visualizing data at the scale of the metropolis, related for example to urban planning, water management, road traffic and their regulation, sport, sanitation, waste management, construction.

Within this research, all indicators have been calculated at the scale of the 200-m tiles, except for the urban fabric typology which is at the scale of the street segments. The geopackage, the version 1.0 of the platform, as well as an R code have been made available (Appendix B). The R code provides information on the session, load the packages and the layers from the geopackage, simplify and prepare the color ramps for each layer, and finally produce the platform. In this version of the platform (v1.0), the urban fabric indicator has been filtered according to the tiles possessing population, and the segments below 10 m of length have been removed. This was done with the intention of reducing the platform's size, which now stands at 93 megabytes. The HTML-based platform can be easily accessed on any computer, making it simple to engage and solicit feedback from the public. The panels on the left side allow activating-deactivating the different layers, as well as zooming in and out any neighborhood part of Aix-Marseille-Provence Metropolis. Figure 5 displays a selection of the assessment indicators calculated within this research accessible in the version 1.0 of the platform.

6 Conclusion and Discussions

The aim of this paper was to show that it was possible to produce detailed new information about aging for the case of a metropolitan area such as Aix-Marseille-Provence Metropolis based only on open-source data. Within this study, we decided to put the focus on two dimensions: walkability and urban form. However, the challenge for us as researchers was not only to produce and analyze new data, but also to effectively

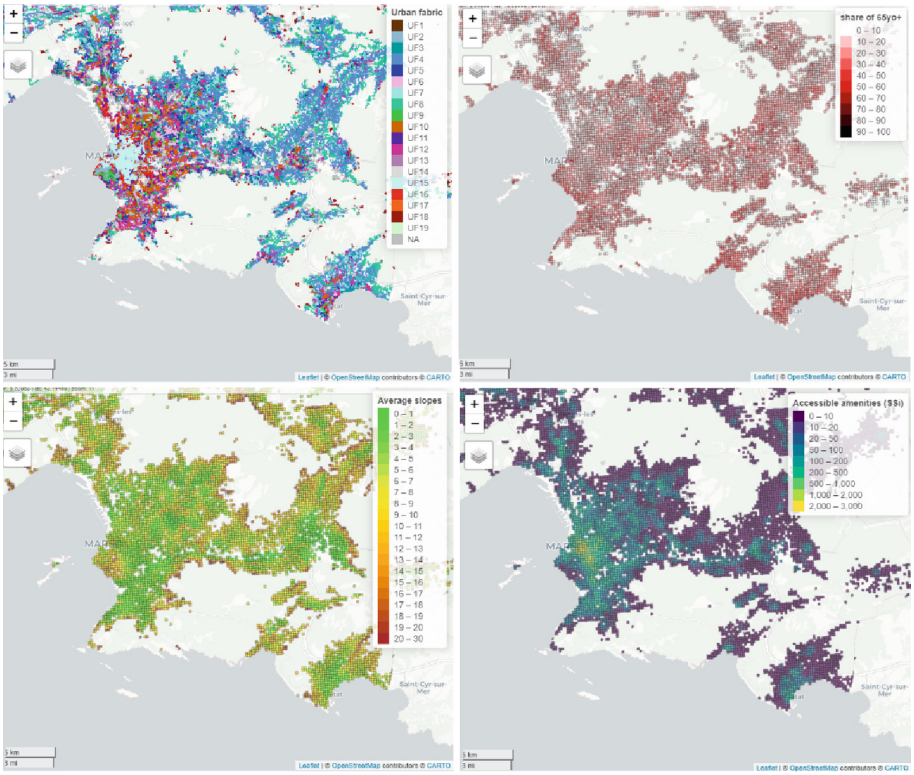

Fig. 5. v1.0 HTML-based platform related to Aging in Aix-Marseille-Provence Metropolis; top left: morphotypes around street segments in 2019, top right: share of 65-year-old or more in 2017; bottom left: average slopes; bottom right: accessible amenities in 2017.

communicate our findings to a broader audience. We recognized that sharing complex research results in a clear and concise manner is essential for policymakers, urban planners, and the public to make informed decisions about the future of their communities. To overcome this challenge, in addition to sharing our data, we integrated our results into an interactive viewing platform to spatially visualize and share our data in a user-friendly manner with interactive maps. Thanks to the MData initiative of Aix-Marseille-Provence Metropolis, data access and visualization has become a tool to help people in making strategic decisions about the future of the metropolis. The data format of the indicators calculated within the research project is compliant with the MData initiative, and we are thus in contact with the metropolis to add our results to the official platform.

From a thematic point of view, a future perspective for this project is to combine the identified morphotypes within the Aix-Marseille-Provence Metropolis with sociodemographic indicators of the resident population. We will thus be able to identify the urban forms which are more often associated with the different age classes within the resident population and/or with trends of aging or rejuvenation. The distribution of services can also be assessed with respect to the morphotypes where they are located. Aging also relates to certain concepts about urban form, such as readability or legibility, which

refers to how easily people can understand and navigate the physical layout of a city [23], or intelligibility which is the degree to which the spatial layout of an urban environment can be understood by its inhabitants [24]. An intelligible urban environment is likely to be accessible and efficient, while less intelligible environments can lead to confusion, disorientation, or even social isolation for older adults. As MFA focuses on perceptible elements of urban form, this perspective could well be carried out integrating our outcomes with surveys of intelligibility-readability by seniors within different morphotypes.

Finally, our study does not consider other factors besides slope, accessibility to amenities, and physical features of urban spaces. Yet, many other factors can make an environment conducive to walking, especially for elder people, and we plan to investigate other factors in future research.

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Appendix A: List of Retained Categories from the 2019 BPE® Dataset

A203, A101, A104, A206, A207, A208, A501, A502, A504, B101, B102, B201, B202, B203, B204, B205, B206, B301, B302, B303, B304, B305, B306, B307, B311, B312, B313, B315, D106, D108, D112, D113, D201, D202, D203, D206, D207, D208, D209, D211, D212, D213, D214, D221, D232, D233, D235, D236, D237, D238, D239, D240, D241, D242, D301, D302, D303, D305, D401, D402, D403, D404, E101, E107, E108, E109, F304, F101, F102, F108, F109, F113, F120, F201, F303, F306.

Full list of categories:

https://www.insee.fr/fr/metadonnees/source/fichier/BPE19_Liste_%C3%A9quipements_insee-fr.pdf

Appendix B: Files Upload

https://zenodo.org/record/7818160

This upload contains a geopackage file, R code, Readme file and an HTML-based platform with interactive maps created using the geopackage and R code. This upload presents various indicators and a HTML-based platform with interactive maps to help planners and policymakers to quickly identify patterns and trends related to aging within Aix-Marseille metropolis, France.

Files.

- 'AGING_AMP_INDICATORS.gpkg': The geopackage file contains spatial data used in the R code to create the maps.
- 'code_R_platform_v1.0_ForVie.R': The R code used to create the interactive maps.

- 'ForVie_platform_v1.0.html': The platform for visualizing the interactive maps.
- 'Readme.txt'

Instructions
To use this upload, follow these steps:

1. Download the geopackage file, R code, and index.html file.
2. Open the R code in RStudio or another R environment.
3. Install any necessary packages as listed in the first section of the R code.
4. Run the code in R to create the HTML-based platform with interactive maps.

Alternatively, it is possible to directly open the ForVie_platform_v1.0.html file in a web browser to view the maps.

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