The 15-Min City: A Configurational Approach for Understanding the Spatial, Economic, and Cognitive Context of Walkability in Vienna

Claudia Yamu[1] and Chiara Garau[2](✉)

[1] Department of Civil Engineering and Energy Technology, Oslo Metropolitan University, 0166 Oslo, Norway

[2] Department of Civil and Environmental Engineering and Architecture, University of Cagliari, 09129 Cagliari, Italy

cgarau@unica.it

Abstract. This paper focuses on how a city's configurational patterns impact the city-wide and neighbourhood spatial, economic, and cognitive context through the case study of Vienna. The authors investigate Vienna by applying the space syntax method to get a better grasp of the city-wide and local to-movement, through-movement potentials, and intelligibility. This approach allows the authors to determine the degree of street life and liveliness of Vienna in relation to walkability potential, which includes social and economic factors. The case study of Vienna is performed using quantitative analyses, with a mathematical street network modelling approach and statistical analyses. Additionally, this quantitative approach is enriched with a qualitative photographic survey. The data imply that Vienna, as a historically developed city, has a high potential for walkability. This is also confirmed by the balance between the foreground network for long-distance movement via motorised public transport, trams, and cars and the background network for walkability in neighbourhoods. The paper concludes by juxtaposing socio-spatial potentials with realised walkability and influencing factors that support or hinder walkability, and by considering how a sustainable urban future can be achieved through well-functioning strategic planning guidelines.

Keywords: City of short distances · Configurative analysis · Walkable neighbourhoods

1 Introduction

Cities at short distances that are accessible to all urban services within 15 min provide a promising way for redesigning the urban system (temporal, spatial and activity-related) to address contemporary challenges, including not only the most recent COVID-19 pandemic but also the different initiatives related to the evolution of sustainable urban mobility policies [1, 2]. The 15-min city model integrates several urban approaches and is vital for post-COVID-19 recovery and for developing sustainable cities. Walking improves mental and physical health [3] but was restricted for many people during the

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pandemic period [4], in some cases causing severe threats to public health [5]. Walking can reduce inequities among urban residents as it is not dependent on social status and affordability. Creating inclusive access for all also demands that cities enable walkability through social-spatial integration and by avoiding segregation. However, the 15-min city model is not new; it evolved from the ‘neighbourhood unit’ concept, which was conceived in 1923 in a national context in Chicago [6]. The concept sought to define compact residential neighbourhoods where the proximity of services and homes is centred on satisfying all the needs of an individual within a 15-min radius with minimal travel. The 15-min concept has been refined by new urbanist ideas. Urban theorists, such as Jane Jacobs, Jahn Gehl, Christopher Alexander, and Leon Krier, have included the pedestrian-friendly city in their work as a key foundation of the 15-min city. The current strategy to remodel cities is in line with the United Nations Sustainable Development Goals (UN SDGs) which aim to promote global development towards universal wellbeing, and the move away from the unsustainable way of life in cities. Applying the “15-min city” model can improve urban planning and policies to create a post-COVID-19 sustainable and healthy community, addressing the city’s efficiency and resilience, and contributing to climate change mitigation. It is argued, therefore, that Vienna should follow the example of other global cities and implement the 15-min neighbourhood strategy for creating sustainable, equitable, and socio-economically prosperous communities.

Starting from these assumptions, the purpose of the paper is to determine the degree of street life and the vitality of Vienna in relation to the potential for walkability. It adopts a targeted approach to the 15-min city integrated with the space syntax method through the case study of Vienna. To accomplish this, the paper begins with Hillier’s theoretical framework that focuses on the natural movement economic process, the dual network, and the spatial centrality of neighbourhoods (Sect. 2). This is followed by the case study of Vienna (Sect. 3), applying a mixed-methods approach combining qualitative and quantitative analysis, through (1) configurational analysis using the space syntax approach, (2) statistical analysis, and (3) a photographic survey (Sect. 4). Section 5 provides the results and discussion. The final section concludes this paper, providing reflections on the results and the future direction of research in this area.

2 Theoretical Framework

2.1 The Theory of the Natural Movement Economic Process

This theory states that the spatial configuration of the street network influences the flow of human movement and the location of shops in the built environment. There is a causal link between space, movement, and economic activity [7–9]. The more the spatial integration of streets, the greater the flow of movement and the more the land along the street network becomes attractive for economic use [10–12]. However, socio-economic processes are intertwined with spatial processes. Changes in the urban configuration influence the socio-economic context. This theory has shown that over time and when it comes to the location patterns of economic activities, the built environment optimises itself in this regard independently of planning processes. In line with Van Nes and Yamu [12] (p. 179) this theory can be summarised as follows:

(1) The spatial configuration or urban space affects the flow of the human network.
(2) The spatial configuration of the urban space influences the location pattern of economic activities.
(3) The amount of human movement determines the location pattern of economic activities in the built environment.
(4) The location pattern of economic activities has an effect on the amount of human movement in the built environment.

2.2 The Dual Network

According to Hillier, cities have the dual nature of a foreground and a background network. At all scales and levels, the foreground network links urban centres [10]. The citywide through-movement analysis shows the foreground network and is constituted through main routes. In traditional European cities, this foreground network entails a deformed wheel structure with radials and orbitals. The background network is the local network of residential areas. Hillier explains that the foreground network is composed of metrically long roads that connect with each other whereas the background network consists of metrically shorter lines that intersect with each other [12]. Van Nes and Yamu's [12] findings from several space syntax analyses show that the five following spatial conditions exist for generating vital urban areas with a high diversity of active land uses:

- a well-integrated topological and geometric street network exists on a local to global scale;
- primary routes with a high centrality ratio (indicating accessibility) for through-movement and citywide analysis;
- major routes that run through neighbourhoods rather than around them;
- a foreground network that is directly connected to the background network; and
- main routes that run through, or are strongly connected to, a town or city's locally integrated centre.

2.3 Spatial Centrality for Neighbourhoods

According to Hillier (1999), a city or neighbourhood's city centre is a concentrated and mixed-use of land and social activities in a prominent place. Centrality often implies a high degree of movement and flow of people. Thus, the urban configuration plays a vital role in determining the centrality of street segments and, therefore, the generation of movement patterns that affect land use. In line with Hillier's ideas, a cascade of more and less intensive movement and land uses emerges as a result of people's movement patterns, thus generating an urban hierarchy of the centrality and periphery. Centrality becomes diffuse across a city through proximity to smaller and much larger centres. For movement around centres, it is important to differentiate between pedestrian movement and individual motorised movement [9] (p. 517). Whereas often planned centres with their twentieth-century attractions emphasised accessibility by car, historic local centres emphasise the long-standing tradition of pedestrian accessibility. These walkable local centres appear with spatial qualities that include a walkable environment, mixed land use, and urban density. Often, emerging centres at a local level become connected to the citywide level over time. The constitution of spatial centrality works through its spatial configuration and the route choices of people within a street network in line with Hillier's theory of the natural movement economic process.

3 The Case Study of Vienna in Austria

Vienna was selected as a case study because, according to the annual Mercer study that evaluates over 450 cities worldwide, Vienna has been ranked as the most liveable city in the world several times [13]. The evaluation defines 10 criteria which encompass different aspects of the spatial, social, economic, and political context. From a socio-spatial and socio-economic perspective, walkability is evaluated according to accessibility to functions, green areas, and the quality of the built environment.

Vienna is a historic European city characterised by a radial-concentric spatial design. As of 2021, the population was around 2 million growing steadily since a drop in numbers during the two world wars. Spatially, Yamu [9] (p.522) notes that according to Marshall's classification, Vienna has four distinct urban structures: (1) an "Altstadt" or A-type, which is the core of historic cities, particularly walled cities, with an angularity combined with a variety of directions resulting in a rudimentary radiality; (2) a "Bilateral" or B-type, which is typical in recently built settlements in which the four-way perpendicular junctions result in bilateral directionality; (3) a "Characteristic/ Conjoint" or C-Type, which is descriptive of arterial roads, whether they serve as the heart of a hamlet, an entire settlement, or a suburban extension; and (4) a "Distributory" or D-type, a contemporary hierarchical structure comparable to distribution. Marshall [14] asserts that the ABCD types may manifest individually or in mixed mode. The spatial hierarchy of cities is often influenced by street centrality, as a symbol of accessibility and connectivity. This kind of centrality-based structure is characteristic of traditional European towns and cities [9].

From the citywide and local configurational analysis, six neighbourhoods with different characteristics connected to Marshall's classification were chosen: (1) the historic city core 'Innenstadt', a tourist attraction with high levels of pedestrian movement; (2) 'Mariahilf–Spittelberg', a shopping and hospitality destination for locals and tourists with a shared street concept as its main shopping street; (3) 'Favoriten' with its street markets and multi-cultural background of its residents including the area of the main train station; (4) 'Hietzing', a former village in Vienna adjacent to the Vienna Woods with villas; (5) 'Am Spitz' in Floridsdorf, a former agricultural area; and (6) 'Kaisermühlen' lying in close proximity to the leisure area 'Danube island', a popular destination for locals. The neighbourhood boundaries do not follow administrative borders, but mental boundaries as perceived by locals.

4 Method and Data

The authors used a mixed-method approach combining qualitative and quantitative analysis to evaluate the 15-min city of Vienna as a case study. This approach entails three steps (1) configurational analysis using the space syntax approach; (2) statistical analysis; and (3) photographic survey.

4.1 Computational Analysis with Space Syntax

The street network configuration is analysed using a graph-theory based approach that shows the relationship between one street and the other streets in the spatial system [15, 16]. It is based on the principle of centrality, which is symbolised through accessibility. Using an axial line approach allows for the computation of the same spatial model with topological direction change (axial integration) and angular analysis with metric radii (angular segment integration and angular segment choice).Van Nes and Yamu [9] (p. 140f) explain that the term 'integration' refers to the process of determining how spatially integrated a street is in relation to all other streets in a town or city; the fewer direction changes, the higher the integration value for a street, and the more integrated the street. This is a connectivity-based measure. Additionally, angular segment integration is referred to as 'to-movement'. For the measure of choice, Conroy Dalton proved that the angular relationship of streets has a significant effect on how people orient themselves. Thus, angles affect how people choose their routes at road junctions [17]. Angular choice demonstrates the through-movement potential and is also hierarchically organizing the city in terms of movement. Economic centres gravitate toward areas with a high correlation between integration and choice values to catch to-movement and through-movement. In this paper, the authors applied normalised angular choice (NACH) and normalised angular integration (NAIN) [12], by considering the well-established normalisation approach for data visualisation:

$$NACH = log(Choice(r) + 2) \tag{1}$$

$$NAIN = log(Angular\,Int(r) + 2) \tag{2}$$

Table 1. Calculation of space syntax centralities and comparison to related fields using the primal and dual graph approach [18] (p. 49)

Dual graph – space syntax	Primal graph	Formula	Concept	References
Integration (int.)	Closeness centrality	$C(x) = \frac{1}{\sum_y d(x,y)}$	Measure the distance between elements in a network; in space syntax, denotes the relative accessibility or movement potential of a road-element, as it informs how close – in topological terms – a road-element is in relation to the others	Bavelas, 1950; Sabidussi, 1966

(*continued*)

Table 1. (*continued*)

Dual graph – space syntax	Primal graph	Formula	Concept	References
Choice (ch.)	Betweenness centrality	$C_B(v) = \sum_{s \neq v \neq t \in V} \frac{\sigma_{st}(v)}{\sigma_{st}}$	Measures the number of times a certain network element is traversed when moving through the shortest paths from all origin-destination pairs of elements within the network. In space syntax, it denotes the hierarchy of preferential routes throughout the system	Freeman, 1977; 1978 Freeman et al.,1979
Connectivity (C)	Degree centrality	$C_D(v) = \deg(v)$	Measures the number of links that are incident upon a node or the number of ties such a node has. In space syntax, it indicates the number of connections between road-elements	Euler (1736)

4.2 Data

To gain a better understanding of Vienna's urban fabric, an axial map was generated using a geographic information system (GIS). The 2014 axial map was modelled in GIS using Google Maps as a base map. For the space syntax analysis, measures with a city-wide radius r = n, a local syntactic radius r = 3, and a metric radius r = 1200 m (which equals a 15-min walk) were applied. The radii allowed for the depiction of city-wide and neighbourhood structures and were connected to the concept of a 15-min city through the potential of the centrality of street segments and accessibility. Further, the natural boundaries of the urban fabric were considered, rather than the administrative boundaries, allowing for an inclusive analysis and taking into consideration the edge effect. This decision was taken as it more accurately reflects the current spatial and functional reality of Vienna. In addition, the neighbourhoods were computed independently as contained networks.

4.3 Statistical Analysis

Firstly, the authors summarise and categorise the properties of the different data sets of the spatial analysis. Secondly, the four-pointed star diagram is demonstrated, by illustrating the relationship between the foreground and the background network in comparison to fifty cities in the world [19]. The four-pointed star diagram of this paper is based on standard deviations and is based on Hillier's study of fifty cities with different spatial patterns. Third, a linear correlation of the measures' connectivity and global integration is used to understand the neighbourhoods' degree of intelligibility. A high degree of intelligibility is indicated by a significant linear correlation between both measures (variables) and vice versa. Intelligibility refers to the area's ease of orientation and navigation, which is vital. A weak correlation between the two variables implies a segregated area in relation to the city.

For the four-pointed star diagram, we use the following formulae for calculating the Z-scores for NACH and NAIN, as stated by van Nes and Yamu [12] (p. 79). Hillier et al. [19] provide the values for the fifty analysed cities:

$$\overline{X}_{max} = \frac{\sum_{i=1}^{50} X_{max}(i)}{50} \tag{3}$$

$$Z_{max}(i) = \frac{X_{max}(i) - \overline{X}_{max}}{\overline{S}_{max}(i)} \tag{4}$$

where $X_{max}(i)$ denotes the maximum value of the city i.

$$\overline{X}_{mean} = \frac{\sum_{i=1}^{50} X_{mean}(i)}{50} \tag{5}$$

$$Z_{mean}(i) = \frac{X_{mean}(i) - \overline{X}_{mean}}{\overline{S}_{mean}(i)} \tag{6}$$

where $X_{mean}(i)$ denotes the mean value of the city i.

4.4 Visual Analysis

Visual analysis enables the assessment of the public domain on a qualitative level. It allows an understanding of streets and squares at a micro-scale, revealing factors that contribute to enhancing or hindering walkability. Thus, the micro-scale is important to understand how the walking potential from the normative space syntax analysis is realised. For this study, a personal photographic database and Google Street View are used to visually analyse streets with significant results from the spatial analysis.

5 Results and Discussion

5.1 Mathematical Street Network Analysis of Vienna

The city-wide through-movement analysis (NACH r = n) reveals a deformed wheel structure for Vienna. The deformed wheel pattern consists of radial and orbital main routes. This deformed wheel connects the understanding of Hillier that cities have a dual nature that consists of a foreground and background street network. The foreground network (streets with high centrality indicated in red in Fig. 1) links urban centres at all scales and levels [10]. These highly central streets form the main routes in Vienna. These main routes form the urban through-movement hierarchy and are the main "arteries" of the city. Important to note is that a street network is highly efficient for movement when the spokes of the deformed wheel structure go through neighbourhoods. Yet, the spokes run through and between neighbourhoods from the inner part of the city to its outskirts, which allows efficient inbound and outbound movement. Thus, it connects city-wide movement with local movement. Many historically grown neighbourhoods, such as Vienna, entail this logic as well as neighbourhoods with planning interventions of the twentieth century. For Transdanubia, the areas across the Danube, the deformed wheel spikes no longer follow a strict deformed wheel logic. This is also the case in those areas that did not play a major role in the formation of Vienna until the nineteenth and twentieth centuries. Recent urban developments and the property price landscape have given Transdanubia more prominence. However, they are an extension of the city's urban core and traditional urban areas.

In contrast, the city-wide to-movement (NAIN r = n) analysis shows a strong central cluster covering the historically evolved structures and major urban planning interventions implemented as a grid structure. Given that to-movement is strongly correlated with connectivity, the grid structure is co-present in its dominance. This is known as the Manhattan Problem [20], which refers to space syntax axial models where it is difficult to distinguish centrality patterns from regular grids, especially in terms of betweenness centralities. However, what is true about the orthogonal grids on a neighbourhood scale for Vienna is that they are highly accessible and in recent years, have become, popular destinations for a culturally diverse local population.

Both through- and to-movement analyses highlight the identification of a well recognisable overlap of the same central streets and roads and is thus indicative of vitality across economic locations. Streets that catch both through- and to-movement allow for a vital economy.

The through-movement analysis with a radius of 1200 m shows highly centralised street segments within a 15-min walking radius (Fig. 2). At the same time, it also shows the spatial mediator between neighbourhoods and urban quarters. From the spatial analytical results, the authors can identify that those areas with a particularly strong city-wide through- and to-movement have a spatial cluster with strong local street centralities. These clusters resemble distinct Viennese neighbourhoods – as a local would consider them independent of their administrative boundaries, but mentally composed by the centrality cohesion of their street network. The local axial integration analysis, for the most part, follows the through-movement logic for Vienna. In addition, more prominent foreground streets are captured in the local to-movement analysis. This can be observed

Fig. 1. City-wide configurational analysis of Vienna's street network: (a) NACH radius n, (b) NAIN radius n [6] (p. 526), [12] (p.77). (Color figure online)

Fig. 2. Local configurational analysis of Vienna's street network: (a) NACH radius 1200 m, (b) Integration radius 3 (axial map credited to Sebastian Zeddel; model computed by the authors)

especially in urban areas that do not have a distinct background network and are mainly automobile-dependent, as in the urban south, southeast towards the urban fringe and in Transdanubia. In cases where the city's main roads run through neighbourhoods with a central street background network, the movement for the neighbourhood is highly efficient as it gives accessibility for the neighbourhood across scales and establishes vital socio-economic activity across scales. Overall, Vienna's well-established and balanced foreground and background network support a lively city (Fig. 3). In addition, Table 2 shows the topological system size through a number of axial lines and street segments, and the mean values of key measures.

Table 2. Means of syntactic measures

	Number of axial lines	Number of segments	Connectivity	NAIN r = n	NACH r = n	NACH r = 1200 m	Int r = 3
Vienna	18,082	52,716	4.23	0.26	4.97	2.83	1.71

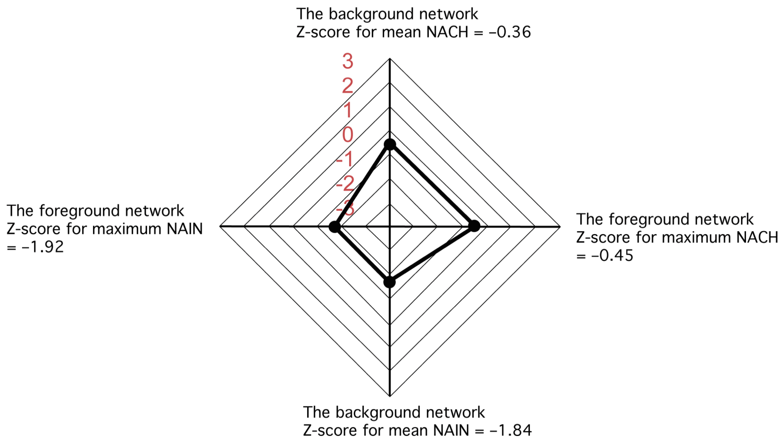

Fig. 3. Four-pointed star diagram of metropolitan Vienna [9] (p. 82)

The four-pointed star diagram reveals how the street network is constituted and enables or hinders the socio-economic success of a city. As the anchor for socio-economic activities, this is represented *inter alia* by centrality, accessibility, and land use. Where the foreground's network centrality correlates well with the background network, a high potential for socio-economic vitality exists (see Figs. 1 and 2; Sect. 2.2). Vienna's foreground and background network in relation to other cities is well balanced and therefore enables the movement of different modes of transport.

5.2 Spatial Centralities of Neighbourhoods

To understand the potential for pedestrian movement six neighbourhoods are isolated and computed using through- and to-movement measures (Fig. 4 and 5).

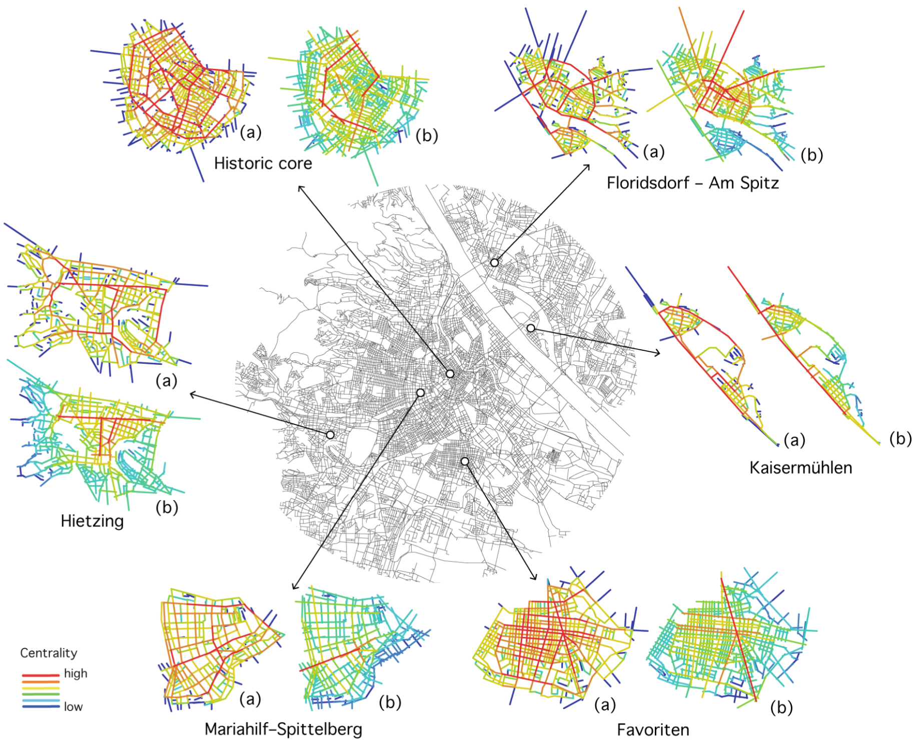

Fig. 4. Centralities for six neighbourhoods in Vienna: (a) Normalised angular choice r = n and (b) Axial integration r = n

The findings show the following aspects. (1) The through-movement in the historic core depicts a dense and fine-grained street network with a route hierarchy while the to-movement results show highly central streets for both car-based and pedestrian-based movement including one of the main shopping streets. (2) In Hietzing, the through-movement has a circular logic with high to-movement centrality for the main shopping street and important connectors to other districts and neighbourhoods, including the historically developed area of this neighbourhood. To- and through-movement correlate well for the local shopping street. (3) In Mariahilf-Spittelberg, the through-movement potential follows a deformed grid logic of the city including all the main strategic streets of this area and the main shopping street. Amerling Street (highlighted in red in both analyses) runs through the high street and enables both through- and to-movement with secondary connectors to other neighbourhoods. Notably, Amerling Street was a strategic location during WWII and has a flak tower, an anti-aircraft gun blockhouse, which is still located there. (4) In Favoriten, the through-movement is influenced by the grid pattern of this neighbourhood making most areas highly accessible. Regarding the to-movement, the main shopping street with public transport hubs is the most central; this area has a long tradition of being home to those from a migrant background. This neighbourhood also has high proximity and accessibility to other neighbourhoods. (5) Kaisermühlen is the location of the United Nations, Vienna, and is also very much car-based. This can be seen from the through- and to-movement analyses as they are congruent in areas where there is high independent motorized traffic. The main through-road is the centre of this neighbourhood. (6) In Floridsdorf, like Kaisermühlen, the route hierarchy is fragmented although the to-movement indicates the potential for establishing a local economic centre. However, in most of these areas, the built environment contributes to a car-based culture.

5.3 Intelligibility

For the six chosen neighbourhoods, the correlation between global integration and connectivity values refers to the concept of "intelligibility" of neighbourhoods and cities. Intelligibility is an important measure to predict wayfinding and environmental cognition, concepts developed by Kevin Lynch [12]. Table 3 shows the correlation coefficient as derived from the space syntax models for each neighbourhood.

Table 3. Linear correlation values ($R^{2)}$ for six neighbourhoods in Vienna: Intelligibility

Neighbourhood/City	Number of axial lines	Correlation value R^2
Greater vienna	26,359	0.15
Historic core	405	0.51
Mariahilf–Spittelberg	209	0.38
Favoriten – main train station	275	0.53
Hietzing	416	0.30
Floridsdorf – Am Spitz	376	0.26
Kaisermühlen	143	0.23

Favoriten has the highest correlation value at $R^2 = 0.53$ followed by the historic core with $R^2 = 0.51$. For Favoriten, this high value derives from the almost orthogonal street grid of the neighbourhood which establishes high connectivity of streets and therefore high integration values. However, orientation and navigation in this area are easy for visitors and residents. The historic core has high intelligibility given its historically grown structure and optimisation over time. Mariahilf, also a popular neighbourhood in which to live and shop has good intelligibility with a correlation value of $R^2 = 0.38$. The intelligibility linear correlation value of $R^2 = 0.30$ for Hietzing is a mixture of a historically developed structure with intermediate block sizes and large leisure areas like Roter Berg (red mountain) and Lainzer Tiergarten, a wildlife preservation area, adjacent to and part of the Vienna Woods. It means that the historic core is easy to navigate by visitors whereas the more residential areas with their local leisure areas are not a common destination for visitors. This results from the, on average, bigger block sizes with a few very large blocks which were established as functions for the Royal Court, such as the former stables and military functions, which include the National Defence Academy. The lower intelligibility values for Floridsdorf $R^2 = 0.26$ and Kaisermühlen at $R^2 = 0.23$ arrive from the partly fragmented network and fragmented connectivity. For Kaisermühlen the spatial pattern is constituted by large blocks like the United Nations with its restricted access for visitors and locals. Given the large blocks, this neighbourhood is prioritizing in large parts car-based movement. For Floridsdorf, the local centre "Am Spitz" is dominated by its establishment between two supra-regional historic trading and through routes which are mainly car-dominated nowadays. One of these streets, the Brünner Straße, was originally designed as a bypass road, deviating from local centres in proximity. This further influences the intelligibility of the area given its overall lower connectivity.

5.4 Photographic Illustration

The photographic illustrations highlight the difference in the quality of the built environment for the different neighbourhoods. As is the case with the majority of traditional European cities, the historic core has been carefully preserved as a tourist and retail attraction, and the buildings often exhibit several historical features (Fig. 5(a)). Mariahilf's (Fig. 5(c)) highly integrated main shopping street on a local and city-wide scale has been transformed into a shared space in line with the late Hans Monderman's notion [21]. The shared space concept slows down through-movement as traffic users must negotiate the available space since the street belongs to all users – including pedestrians, cyclists, and motorised traffic. However, this concept allows for a lively mixture of stationary activities with both through-movement and to-movement, which also makes this shopping street socio-economically vibrant. Hietzing (Fig. 5(b)) is a residential neighbourhood and district with its villas, single-detached dwellings, and later social housing alongside Schönbrunn Castle. Formerly, it was a village lying close to Vienna with vineyards and gravel pits that were used for building the castle. Nowadays, it is a popular neighbourhood and centre for locals.

In contrast, Favoriten (Fig. 5(d)) is highly efficient when it comes to through-movement, to-movement, and functions. Its built environment is not always very appealing. Long established Viennese economic functions moved out of this area. However, this area is popular for international food and restaurants, especially from the East, and for its local market. This neighbourhood is a heavily populated urban area with residential buildings and intermediate industry, including a business park and the Vienna skyscrapers, the 'Vienna Twin Towers', which are a typical representation of modernism. Many streets in this area are car-based with pavements on either side, but quite inconvenient for walking. Further, Kaisermühlen's (Fig. 5(e)) major landmark is the UNO-city with is Vienna International Centre and the Austria Centre Vienna, a modernistic ensemble. Added to this is the Donau City, a collection of skyscrapers built in the mid-1990s for living and working. This neighbourhood is a traditionally working-class area and is close enough to appreciate the leisure areas along the Danube. Since the 1960s, the neighbourhood has seen significant expansion, in the Zeitgeist of automobile-dependent urban development.

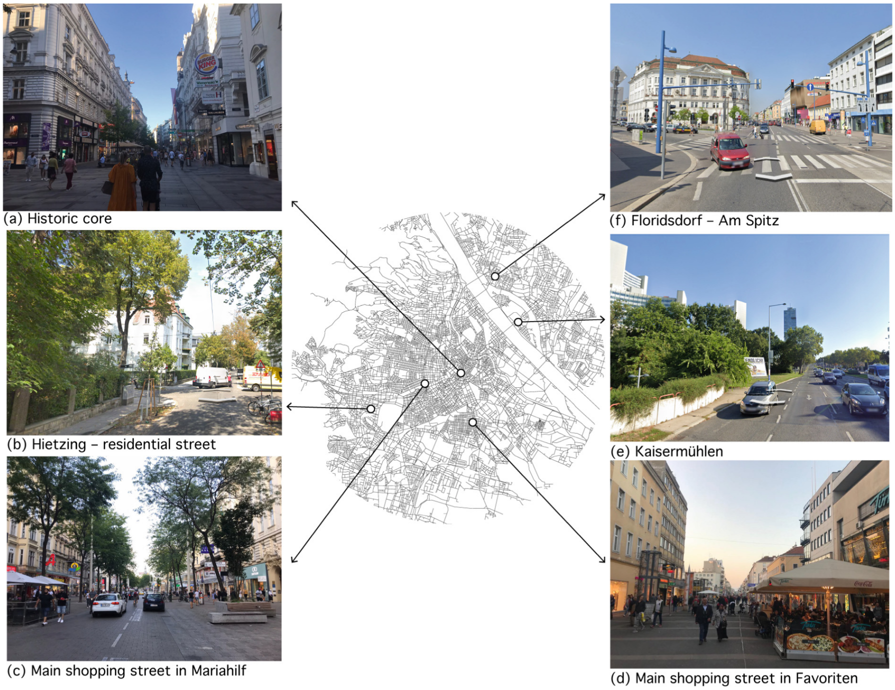

Fig. 5. Photographic illustrations of the six neighbourhoods in Vienna

Furthermore, Floridsdorf (Fig. 5(f)) is a collection of former villages. Because the local centre 'Am Spitz' was a flood plain, its urban development came relatively late. However, settlements can be dated back to the New Stone Age. In the twentieth century, this neighbourhood aimed to become independent from Vienna, which explains the oversized administrative building for this local centre (Fig. 5(f)) and its prominent location in the urban fabric. Today this area is continuously under development.

6 Conclusions

The foreground and background of Vienna's network are well-balanced. This is mostly due to infill developments which contribute to the city's pedestrian-friendly nature. However, the spatial studies suggest that Transdanubia, with the chosen neighbourhoods of Kaisermühlen and Am Spitz, deviates from the efficient spatial logic. This is mostly due to the fact that parts of these areas were flood plains for the Danube River and, hence, remained mostly undeveloped until the late nineteenth century. This changed dramatically during the twentieth century. Nevertheless, Vienna's spatial fabric contributes to a well-balanced socio-spatial and socio-economic context through its mesh/high spatial coverage of citywide and local centres, accessibility to many functions, and public transport network. This contributes to Vienna's overall quality of life [13].

Centrality is an indicator of people's potential movement and socio-economic activities. This can be connected to Hillier's theory of natural movement and economic process, as well as his future thoughts about the foreground and network, to understand and forecast the economic effects and flow of movements caused by the configuration of the urban fabric [9, 12]. The emergence, transformation, and decline of urban centres work through the configuration of a street network. The layout of urban street patterns and their centralities affect land use and social processes. According to Hillier, each location has both a smaller and a much bigger centre nearby with overlapping neighbourhoods based on proximity [22].

Understanding the centrality of individual streets and how local centres function from both a city-wide and neighbourhood perspective, enables understanding not only of how a city is spatially constituted but also where interventions are needed to establish a city of short distances, i.e., the 15-min city. Thus, centrality and accessibility are key to a well-functioning future city and are more socially equitable. To conclude, Vienna is composed of well-functioning central spaces that overlap with local centres, and that are in close proximity to city-wide centres. This is vital for establishing a 15-min city within the framework of walking and cycling. However, there also exist a number of spatially ineffective areas impacting the socio-economic context that need to be transformed in order to provide a base to establish the 15-min city.

Using a targeted approach and analysis of the city of 15-min integrated with a space syntax analysis, this paper has shown Vienna's existing normative potential and challenge for walkability. We further made a link to vitality of neighbourhoods and intelligibility for orientation and wayfinding of pedestrians. The authors intend to develop this study by amplifying the concept of vitality in light of the findings of this research, integrating it with other elements, to enable analysis of the potential for walkability from a more holistic perspective [23–25].

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