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IS THE SPACE SYNTAX APPROACH USEFUL FOR THE 15-MINUTE CITY CONCEPT? A COMMENTARY

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Review paper

Abstract: The 15-minute city, as a paradigm in contemporary urbanism, reflects a shift toward proximity, accessibility, and sustainability. This commentary discusses the potential of the space syntax approach to operationalise this concept by analysing how spatial configuration influences movement, economic activity, and urban vitality. Rooted in graph theory, space syntax conceptualises cities as networks of interconnected spaces, enabling the measurement of relational properties such as connectivity and centrality. Central to this discussion is Hillier's theory of the natural movement economic process, which posits a causal relationship between spatial configuration, movement flows, and the distribution of economic activities. We highlight a conceptual distinction between accessibility – commonly defined by distance or travel time – and centrality, understood as the relational position of streets within a network. We argue that proximity alone is insufficient to ensure functional and vibrant neighbourhoods; instead, well-configured street networks are essential for sustaining movement and local economies. Furthermore, we situate space syntax within the broader smart city discourse, emphasising its role in bridging spatial design with data-driven urban planning. While acknowledging its limitations, we conclude that space syntax offers a valuable complementary framework for evaluating and refining the 15-minute city, thereby advancing a more nuanced and socio-spatially grounded understanding of urban accessibility.

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1. Introduction

The resurgence of the 15-minute city as a guiding paradigm in contemporary urbanism reflects a growing desire to reconfigure cities towards proximity, human-scale accessibility, and sustainability (Moreno, 2024). Popularised in recent years, particularly in response to the COVID-19 pandemic (Moreno et al., 2021; Yamu and Garau, 2022), the concept envisions a city where essential services – work, education, retail, healthcare, and leisure – are reachable within a short walking or cycling distance, or via a short public transport journey. In this context, the space syntax approach, pioneered by Bill Hillier and colleagues, offers a compelling framework (Hillier and Hanson, 1989; Hillier, 1996). Rooted in graph theory and configurational analysis, space syntax conceptualises cities as networks of interconnected spaces whose urban fabric influences movement, social interaction, and economic activity. This analytical methodology allows for linking spatial configuration with socio-economic phenomena (Mohamed and Van der Laag Yamu, 2024).

This commentary engages with the critical reflection of whether and to what extent space syntax is useful for operationalising the 15-minute concept. We engage with key theoretical ideas, including Hillier's natural movement economy, the interpretation of urban space as a street network graph, and the distinction between centrality and accessibility, which are related but conceptually distinct. We further consider how space syntax contributes to the broader smart city debate surrounding the 15-minute city.

2. Space Syntax – does spatial configuration matter?

Space Syntax is a method for analysing spatial relationships by modelling public spaces (mostly urban spaces with 24/7 accessibility) as networks of interconnected spaces. Streets and public squares are represented as elements within a graph structure, allowing for the calculation of relational properties, such as connectivity, and the centrality measures of integration, also known as "to-movement" (closeness) and choice or "through movement" (betweenness) (Hillier, 1994; Van Nes and Yamu, 2021). This modelling approach shifts the analytical focus from the understanding of an absolute urban form to configurational relationships, emphasising how spaces are related to one another. Unlike traditional transport graph models, which treat intersections as nodes and streets as links, space syntax treats entire street axes as nodes within a network of movement possibilities (axial lines constituting the axial map) (Penn, 2003; 2020). Hillier argues that this inversion, departing from traditional graph theory, allows us to capture the centrality of each street, which is further linked to the continuity of movement based on our cognitive perception of space how we, as human beings, orient and navigate through spaces (follow your nose – principle). Thus, space syntax works solely with extrinsic

properties (Yamu et al., 2021) and how each space is related to all other spaces (Van Nes and Yamu, 2021). This graph-based approach is particularly relevant for the 15-minute city, which is inherently concerned with spatial relationships, proximity, and connectivity. However, a well-functioning 15-minute city is not only a city of short distances (Holz-Rau und Sicks, 2013), but a city where functional accessibility through a transport-land use relationship is supported by the urban layout and further an effective configuration of the street network. A neighbourhood may be compact, but if poorly connected due to a fragmented street network, its functional accessibility is limited. Space syntax provides a means to understand and quantify spatial enablers and hinderers. To borrow the words of Bill Hillier, "Space Syntax allows us to understand the hidden spatial rules of cities" (Hillier, 1994)

Hillier`s Natural Movement Economic Process concept argues that the configuration of the street network plays a decisive role in shaping patterns of human movement as well as the distribution of commercial activities within urban environments. It proposes a causal relationship linking spatial structure, movement flows, and economic functions. Streets that are more spatially integrated and, therefore, have higher centrality values tend to attract higher volumes of movement, which in turn increases their attractiveness for economic uses such as retail (Hillier et al., 1993). However, it is essential to distinguish between streets that are central for pedestrian movement and those that are central primarily for vehicular traffic. This distinction represents a critical consideration in space syntax analyses of urban systems. The street network functions as a shared infrastructure accommodating multiple modes of transport, which may operate either in a complementary or competing manner depending on the street profile and design.

Hillier's concept further suggests that socio-economic patterns in cities emerge largely from the spatial structure itself, rather than solely from planning decisions. In this sense, it is the configuration of the street network that primarily determines movement patterns and the optimal locations for economic activities, rather than movement attractions shaping the spatial structure. It suggests that traditional European cities have often optimised their spatial structure over centuries. Nevertheless, this predominantly bottom-up emergent process of urban growth, characterised by an inherent tendency toward spatial optimisation, has also been shaped by top-down planning interventions (Yamu and Frankhauser, 2015). The central contribution of Hillier's Natural Movement Economic Process concept is its positioning of a causal relationship among spatial configuration, movement patterns, and economic activity. The concept can be summarised as follows: (1) spatial configuration influences movement flows, (2) movement flows influence the location of economic activities, and (3) economic activities attract further movement, reinforcing socio-economic patterns. Thus, it suggests that urban functionality emerges not solely from urban planning decisions but also from the interaction between spatial structure and human behaviour. The literature emphasises, "the more central a street is, the greater the flow of people movement

and the more attractive the land becomes for economic activities" (Hillier et al., 1993). For the 15-minute city, this insight is important because the concept often assumes that the provision of local services will automatically lead to a vibrant neighbourhood. In contrast, space syntax suggests that the spatial configuration supports movement flows for such services to thrive. Without sufficient centrality of streets, local amenities may struggle to sustain themselves economically. The space syntax approach adds a layer to the 15-minute debate: proximity alone is insufficient, and it must be supported by spatial configuration that generates natural movement.

3. Centrality versus Accessibility: A conceptual Distinction

The key conceptual contribution of space syntax lies in its nuanced understanding of urban street centrality. In traditional urban planning and transport models, accessibility is often measured in terms of distance or travel time to specific destinations. In contrast, space syntax defines centrality relationally, based on a street segment's position within the entire street network and therefore its relationships with all other streets in an urban system. Space Syntax's to-movement (integration) highlights how easily a space/street can be reached from many places in the city, and through-movement (choice) highlights how likely a space/street is to be part of a journey within the city. This marks an important difference between accessibility and centrality. Accessibility is typically origin-destination oriented, focusing on how easily one can reach a specific destination from a specific origin in the network. Centrality, in space syntax, is relational and systemic, reflecting the overall position of a space/street axis within the network. It is important to note that centrality in space syntax is a relative measure. It depends on the configuration of the entire network and can vary over time through urban growth and shrinkage. Hillier explains that centrality should be understood as an evolving process, producing a hierarchy of centres and sub-centres that can emerge and shift over time (Yamu, 2020).

In comparison, spatial accessibility, as originally conceptualised by Walter G. Hansen (1959), refers to the potential for reaching opportunities – such as employment–based on the distance–cost–time relationship between origins and destinations. This formulation, widely adopted in economics, planning, and engineering, enabled accessibility to be quantified and compared across locations and over time, particularly as transport conditions or the spatial distribution of destinations evolved. However, despite their enduring influence, traditional potential accessibility measures rest on a strong assumption: that individuals possess equal or near - perfect knowledge of opportunities across space. Under this premise, the configuration of the street network plays a relatively minor role, and locational outcomes are largely governed by network or Euclidean proximity rather than by qualitative characteristics of the built environment.

This limitation has long been recognised in the field. For instance, Torsten Hägerstrand (1970) introduced the concept of space–time prisms, highlighting how individual mobility is constrained by spatial and temporal factors. Building on this, activity - space approaches have sought to capture accessibility as a dynamic, lived experience shaped by daily movement patterns. In parallel, the notion of perceived accessibility – particularly prominent in transport research – has drawn attention to how different social groups subjectively perceive and evaluate their access to opportunities (e.g., Lättman et al., 2016; Vafeiadis, 2024; Negm et al., 2025). Nevertheless, while behavioural dimensions are increasingly incorporated, the role of the built environment – especially the configuration of street networks – remains comparatively underexplored (Östh and Türk, 2020). Although a small body of work (e.g., Ståhle et al., 2005) begins to engage with these spatial qualities, research explicitly linking accessibility and space syntax has yet to systematically examine how such relationships shape the urban distribution of services and amenities.
In using urban analytics to operationalise the 15-minute city concept, this distinction is highly relevant. Policies often focus on ensuring that residents have access to services within a fixed radius, e.g. 15-minute walking distance. However, space syntax reveals that not all locations within such a radius are equally central or connected. A neighbourhood may meet the criterion of proximity yet lack the centrality needed to sustain diversity and vibrant urban life. Therefore, space syntax may challenge the simplistic interpretation of the 15-minute city as a matter of distance, emphasising the importance of network configuration and relational positioning of public spaces and streets within an urban system.

4. Implications for the Smart City Debate

Beyond the 15-minute city, space syntax offers valuable insights into he smart city discourse. While smart city initiatives often emphasise digital technologies and data-driven governance, they sometimes overlook the fundamental role of spatial configuration. The 15-minute city is often seen as the human-centred layer within the smart city model, for example, through data-enabled planning or shared sustainability goals. Thus, smart technologies can support the operationalization of 15-minute cities. Space syntax can help to bridge the gap between technological innovation and spatial design in the smart city debate by providing a robust framework for analysing urban systems. When complemented by data analytics, it enables socio-spatial and socio-economic reasoning, enhances the ability to test scenarios aligning with the predictive ambitions of smart city technologies, and further integrates social, economic, and cognitive dimensions.

5. Critical Reflection and Concluding Remarks

Space syntax, like many methods, is not without limitations. Critics have noted that it focuses primarily on spatial configuration, potentially underestimating the role of non-spatial factors such as policy, culture, and economic dynamics. It relies on a simplified representation of space, often neglecting three-dimensional aspects and qualitative experiences. Further, space syntax results require careful interpretation, as their results must be contextualised with broader socio-economic processes (Van Nes and Yamu, 2021). For the 15-minute city, this means, that space syntax should be used as a complementary tool rather than a standalone solution. It provides valuable insights into spatial structure but must be integrated with other forms of urban analysis.

However, the space syntax approach offers a powerful, robust, and nuanced framework for understanding spatial dynamics underlying the 15-minute city concept. By modelling cities as networks of interconnected spaces, it reveals how spatial configuration influences movement, economic activity, and social interaction. In the 15-minute debate, space syntax moves beyond normative aspirations, highlighting that proximity is not merely a matter of distance, but also of configurational centrality. At the same time, its insights extend to the smart city discourse, emphasising the importance of spatial analytics alongside technological innovation. To conclude, space syntax strengthens the 15-minute city vision and offers a tool to critically evaluate, refine, and implement the concept in a way that is both spatially coherent and socio-economically viable.

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DA LI JE PRISTUP PROSTORNE SINTAKSE KORISTAN ZA KONCEPT 15-MINUTNOG GRADA? KOMENTAR

Apstrakt: Koncept 15-minutnog grada, kao paradigma savremenog urbanizma, odražava pomeranje ka blizini, pristupačnosti i održivosti. Ovaj komentar razmatra potencijal pristupa prostorne sintakse da operacionalizuje ovaj koncept analizom načina na koji prostorna konfiguracija utiče na kretanje, ekonomsku aktivnost i urbanu vitalnost. Utemeljena u teoriji grafova, prostorna sintaksa konceptualizuje gradove kao mreže međusobno povezanih prostora, omogućavajući merenje relacionih svojstava kao što su povezanost i centralnost. Centralno mesto u ovoj raspravi zauzima Hilerova teorija prirodnog ekonomskog procesa kretanja, koja postulira uzročnu vezu između prostorne konfiguracije, tokova kretanja i raspodele ekonomskih aktivnosti. Ističemo konceptualnu razliku između pristupačnosti – koja se najčešće definiše distancom ili vremenom putovanja – i centralnosti, shvaćene kao relacioni položaj ulica unutar mreže. Tvrdimo da sama blizina nije dovoljna da obezbedi funkcionalna i vitalna susedstva; umesto toga, dobro konfigurisan ulični mrežni sistem je ključan za održavanje kretanja i lokalnih ekonomija. Nadalje, prostornu sintaksu smeštamo u širi diskurs pametnog grada, naglašavajući njenu ulogu u povezivanju prostornog dizajna sa planiranjem gradova zasnovanim na podacima. Uvažavajući njena ograničenja, zaključujemo da prostorna sintaksa predstavlja vredan komplementarni okvir za evaluaciju i unapređenje koncepta 15-minutnog grada, čime se podstiče nijansiranije i socio-prostorno utemeljeno razumevanje urbane pristupačnosti.

Ključne reči: 15-minutni grad, pametni grad, prostorna sintaksa, prostorna centralnost, pristupačnost

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Claudia van der Laag is a Full Professor of Urban Analytics in the Department of Built Environment at OsloMet – Oslo Metropolitan University, Norway. Her expertise on transport, land use planning, including people`s spatial behavior, combines a wide range of analytical techniques with mixed methods at the forefront of virtual modelling at the intersection of urban planning and urban design. Prof. van der Laag Yamu implements and develops new methods and tools, and shapes policies for sustainable cities and regions. She combines theoretical innovation with practice-oriented solutions and has been involved in numerous international projects. She is the co-author of the text book 'Introduction to Space Syntax in Urban Studies', editorial board member of Springer`s The Urban Book Series and associate editor of the Taylor and Francis journal 'Sustainable Communities'. In 2015 she received the prestigious Michael Breheny Prize for her work on complexity-based planning models.

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