


SPATIAL SYNTAX AS A MORPHOLOGICAL APPROACH
SINTAXE ESPACIAL COMO UM ABORDAGEM MORFOLÓGICA
LA SINTAXIS ESPACIAL COMO ENFOQUE MORFOLÓGICO

 <https://doi.org/10.56238/sevened2026.019-052>

Antonio Willamys Fernandes da Silva¹, Jean-Baptiste Marc Scharffhausen², Ilanna Clara Macedo Santos³, Yasmin da Conceição Marques⁴, Karlessandra Potwyn Souza Lima Kraho⁵, Raquel da Costa Lima⁶, Isadora Rodrigues Moura⁷, Kamilly Raquel Sousa Meireles Carvalho⁸, Sttéphany Romana da Silva dos Anjos⁹

ABSTRACT

Space Syntax (SS), grounded in the "social logic of space," investigates how urban configuration shapes human behavior and social interactions. This research conducted a bibliometric analysis between 2020 and 2026 in the Web of Science, Scopus, and SciELO databases, using Bibliometrix software to map the scientific production in the field. The results reveal an expanding field, totaling 146 articles and an annual growth rate of 4.91%. A clear geographical shift in production is observed, with China and Australia leading in citation volume, indicating a decentralization from the original European axis. The content analysis of the most relevant publications highlights the integration of SS with hybrid methodologies, such as GIS and Network Analytic Process, applied to themes of public health, socio-spatial equity, and revitalization of historical districts. Seminal studies propose a paradigmatic transition to "evidence-based design," using quantitative and predictive models to optimize urban planning. However, researchers point to limitations in conventional axial modeling, suggesting the refinement of methods to better represent effective accessibility and metric distance. It is concluded that SE is a robust and interdisciplinary scientific tool, essential for understanding and managing the complexity of contemporary urban dynamics.

¹ Dr. in Regional Development. Universidade Federal do Tocantins (UFT). E-mail: awfsilva@uft.edu.br

² Doctoral student in Design. Universidade Federal de Pernambuco (UFPE).
E-mail: jean-baptiste.scharffhausen@ufpe.br

³ Undergraduate in Architecture and Urbanism. Universidade Federal do Tocantins (UFT).
E-mail: ilanna.santos@mail.uft.edu.br

⁴ Undergraduate in Architecture and Urbanism. Universidade Federal do Tocantins (UFT).
E-mail: yasmin.marques@mail.uft.edu.br

⁵ Undergraduate in Architecture and Urbanism. Universidade Federal do Tocantins (UFT).
E-mail: karlessandra.potwyn@mail.uft.edu.br

⁶ Undergraduate in Architecture and Urbanism. Universidade Federal do Tocantins (UFT).
E-mail: raquel.costa1@mail.uft.edu.br

⁷ Undergraduate in Architecture and Urbanism. Universidade Federal do Tocantins (UFT).
E-mail: Isadora.moura@mail.uft.edu.br

⁸ Undergraduate in Architecture and Urbanism. Universidade Federal do Tocantins (UFT).
E-mail: kamilly.meireles@mail.uft.edu.br

⁹ Undergraduate in Architecture and Urbanism. Universidade Federal do Tocantins (UFT).
E-mail: sttephany.romana@mail.uft.edu.br

Keywords: Urban Morphology. Spatial Syntax. Bibliometrics.

RESUMO

A Sintaxe Espacial (SE), fundamentada na "lógica social do espaço", investiga como a configuração urbana molda o comportamento humano e as interações sociais. Esta pesquisa realizou uma análise bibliométrica entre 2020 e 2026 nas bases *Web of Science*, *Scopus* e *Scielo*, utilizando o software *Bibliometrix* para mapear a produção científica da área. Os resultados revelam um campo em expansão, totalizando 146 artigos e uma taxa de crescimento anual de 4,91%. Observa-se um claro deslocamento geográfico da produção, com a China e a Austrália liderando em volume de citações, indicando uma descentralização do eixo europeu original. A análise de conteúdo das publicações mais relevantes destaca a integração da SE com metodologias híbridas, como o SIG e o Processo Analítico em Rede, aplicadas a temas de saúde pública, equidade socioespacial e revitalização de distritos históricos. Estudos seminais propõem uma transição paradigmática para o "design baseado em evidências", utilizando modelos quantitativos e preditivos para otimizar o planejamento urbano. Contudo, pesquisadores apontam limitações na modelagem axial convencional, sugerindo o refinamento dos métodos para melhor representar a acessibilidade efetiva e a distância métrica. Conclui-se que a SE é uma ferramenta científica robusta e interdisciplinar, essencial para compreender e gerenciar a complexidade das dinâmicas urbanas contemporâneas.

Palavras-chave: Morfologia Urbana. Sintaxe Espacial. Bibliometria.

RESUMEN

La Sintaxis Espacial (SS), fundamentada en la «lógica social del espacio», investiga cómo la configuración urbana moldea el comportamiento humano y las interacciones sociales. Esta investigación realizó un análisis bibliométrico entre 2020 y 2026 en las bases de datos *Web of Science*, *Scopus* y *SciELO*, utilizando el software *Bibliometrix* para mapear la producción científica en el campo. Los resultados revelan un campo en expansión, con un total de 146 artículos y una tasa de crecimiento anual del 4,91 %. Se observa un claro cambio geográfico en la producción, con China y Australia a la cabeza en volumen de citas, lo que indica una descentralización del eje europeo original. El análisis de contenido de las publicaciones más relevantes destaca la integración de la SS con metodologías híbridas, como SIG y el Proceso Analítico de Redes, aplicadas a temas de salud pública, equidad socioespacial y revitalización de distritos históricos. Estudios fundamentales proponen una transición paradigmática hacia el «diseño basado en la evidencia», utilizando modelos cuantitativos y predictivos para optimizar la planificación urbana. Sin embargo, los investigadores señalan las limitaciones del modelado axial convencional, sugiriendo el perfeccionamiento de los métodos para representar mejor la accesibilidad efectiva y la distancia métrica. Se concluye que la sintaxis espacial es una herramienta científica robusta e interdisciplinaria, esencial para comprender y gestionar la complejidad de la dinámica urbana contemporánea.

Palabras clave: Morfología Urbana. Sintaxis Espacial. Bibliometría.

1 INTRODUCTION

Spatial Syntax (SE) is a field of theoretical and methodological research that proposes an innovative vision of architecture and urbanism. Originating in the early 1970s at the Architectural Studies Unit at University College London, the theory was consolidated by researchers Bill Hillier and Julienne Hanson. The central objective of the SE is to establish a descriptive autonomy of space, allowing the morphological variety of cities to be analyzed in terms of their direct relationship with social life and patterns of human behavior.

The epistemological framework of Spatial Syntax was formalized mainly in the work *The Social Logic of Space* (1984). In this book, Hillier and Hanson present space not only as a passive receptacle of activities, but as an active dimension of society. The theory argues that there are cultural and social traits determined by spatial patterns, with a transition between physical configuration, spatial life and, finally, social life. Thus, the system of open spaces is seen as a continuous set of identifiable elements that structure social encounters and land use patterns.

To operationalize these analyses, the SE uses techniques for decomposing the system into convex spaces and axial spaces, resulting in convexity and axiality maps. These abstractions allow us to reveal fundamental attributes of the urban environment and correlate the built form with social and behavioral concepts. In addition, the theory uses graph theory to represent spatial configurations logically: each space is treated as a "node" and its connections as "lines". Through the concept of justified graphs, researchers can organize the system into depth levels by measuring the topological distance between spaces from a reference point or "root".

In this way, Spatial Syntax is consolidated as a robust set of analytical tools that allow a descriptive analysis of urban sectors or buildings. By focusing on the social logic of space, the SE offers a scientific basis for understanding how spatial structure shapes the dynamics of cities and the interactions of their inhabitants. According to Karimi (2023), in order to understand the current state of urban morphology as a distinct academic domain, it is essential to explore the diversity of approaches that have emerged over the last century. Regardless of their specific focuses, these approaches can be broadly grouped.

According to Silva (2025), there are criticisms of the theory of spatial syntax, such as that the analysis is more topological than geometric and the problem of continuity of axial lines, but applications have tried to solve these issues and there has been an increasing approximation between topological and geometric analysis.

2 METHODOLOGY

The method used in the research was descriptive, which aims to transcribe, describe, interpret and explain the results obtained with the help of bibliometric analysis. This aims to identify and analyze the profile of the scientific production of a given topic, making use of the quantitative approach through descriptive statistics. The databases used were the Web of Science, Scielo and Scopus, which are available on the journal portal Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES). These databases have databases of abstracts and citations of peer-reviewed literature, including scientific journals, books, and conference proceedings, which cover topics from various areas of knowledge. The search was carried out on 04/22/2026, covering the period from 2020 to the year 2026. The terms used were searched in the title, abstract, and keywords of the articles. The search was restricted to articles from open journals. The query syntax in the databases was as follows: "*urban morphology and spatial syntax*". The main search was through this keyword, restricting the search to only the articles.

The data related to these documents (journals, authors, references, citations, etc.) were stored in a text file for performance analysis and bibliometric mapping. The descriptive analysis and mapping were performed by the Bibliometrix software, which is part of RStudio, which is the most popular integrated development environment (IDE) for the R programming language, being widely used in data science, statistics and academic research.

The method of analysis of the empirical objects will follow three main phases organized as follows: Preparatory phase: Cut out the theme and keyword for the research (urban morphology and spatial syntax); Search in databases (web of Science and Scopus); Export the data to the Bibliometrix application in RStudio; Generate quantitative data tables and graphs in Bibliometrix; Analytical phase: Review of the literature on the subject; Grouping of quantitative data in tables and graphs generated in Bibliometrix; Bibliometric analysis; Descriptive phase: Interpretation of the results found in the Bibliometrix.

3 BIBLIOMETRIC ANALYSIS

The objective of this section is to analyze the performance of bibliometric results, considering some aspects, such as the annual scientific production, the evolution of citations, relevant sources and authors, world scientific production and the bibliometric networks that most collaborate with each other in scientific productions on the theme transition of institutional paradigms and sustainability. Table 1 shows the main data on this survey in the period from

2020 to 2026. 146 documents with 399 authors involved and 20,986 references were found in the databases (web of Science, scielo and scopus).

Table 1

Summary of the survey data

Key information about the survey data	
Description	Results
Time Range	2020/2026
Sources (newspapers, books, etc.)	93
Documents (articles)	146
Annual growth rate (%)	4,91
Average document age	2,6
Average citations per document	10
Authors	399
Most used keywords (ID)	457
Keywords by author (DE)	350

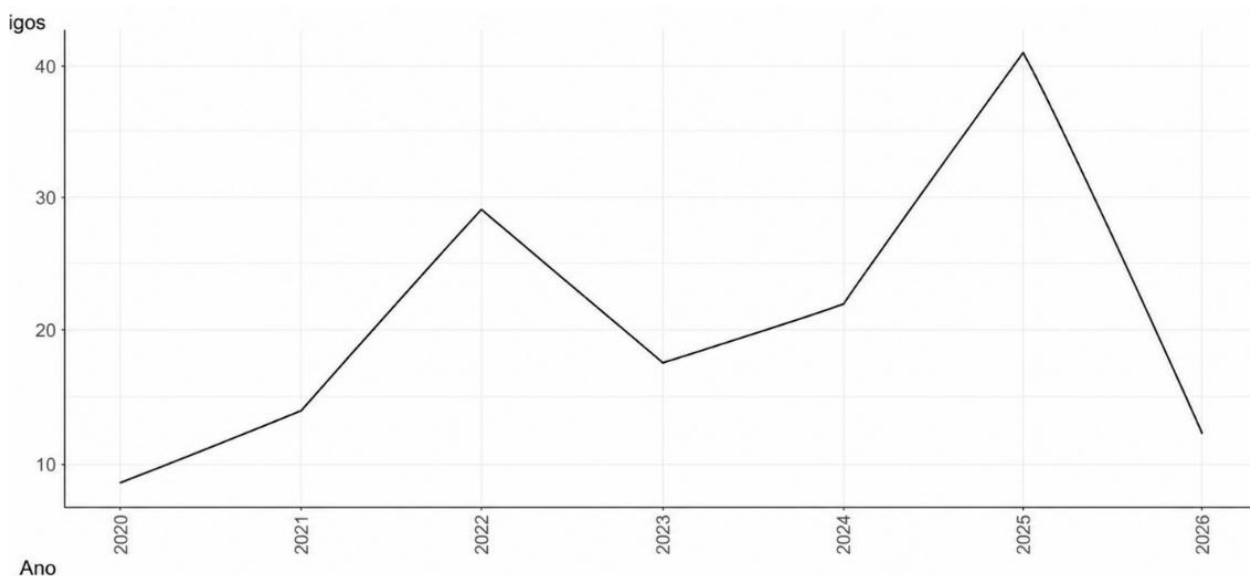
Source: Result of the Web of Science, Scopus, Scielo search, obtained from Bibliometrix (2026)

4 ANNUAL SCIENTIFIC PRODUCTION

Figure 1 shows the evolution of the number of publications from 2020 to 2026 on the topic of urban morphology and spatial syntax. It can be identified that in 2020 there are approximately 7 articles published, with a noticeable increase in 2022 to almost 30 articles, tripling, compared to 2020. In 2025 there was an increase of 10 articles compared to 2022. In the year 2026, due to being still at the beginning, the number of publications was not so expressive, being around 15 publications.

Figure 1

Annual scientific production



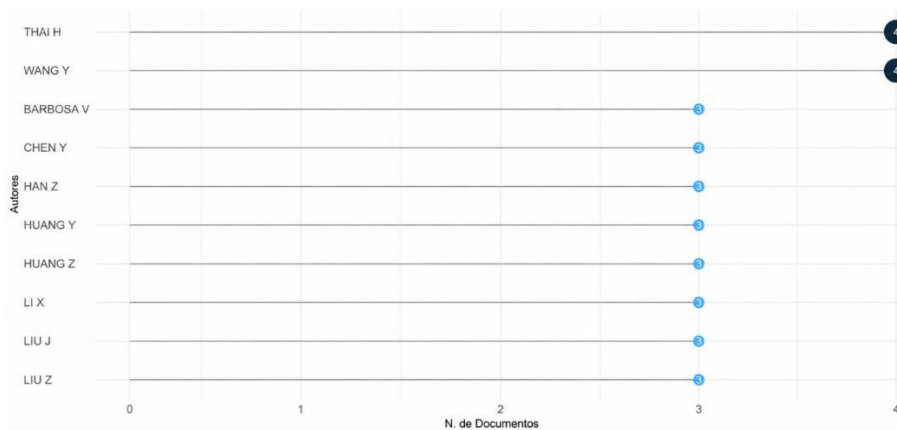
Source: Result of the Web of Science, Scopus, Scielo search, obtained from Bibliometrix (2026)

5 MOST RELEVANT AUTHORS

The ten authors, who published the most on the theme of urban morphology and spatial syntax, can be seen in figure 2, where it identifies the researchers with the greatest impact and academic production on the researched theme within the selected databases (Web of Science, Scopus, Scielo). Thai HMH and Wang are the most relevant with 4 publications and an impact factor of H=1.67 and 1.12 respectively. In second place, the author Barbosa and the others with 3 articles each.

Figure 2

Most relevant authors

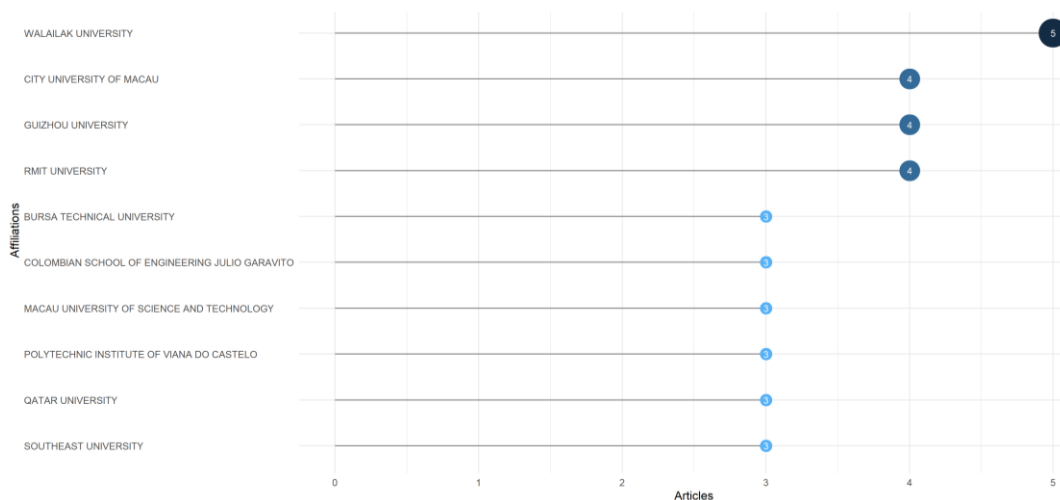


Source: Result of the Web of Science, Scopus, Scielo search, obtained from Bibliometrix (2026)

6 MOST RELEVANT AFFILIATIONS

Figure 3

Most relevant affiliations



Source: Result of the Web of Science, Scopus, Scielo search, obtained from Bibliometrix (2026)

Figure 3 shows the ten most relevant affiliations on the topic in question. Walailak University ranked first with 5 publications.

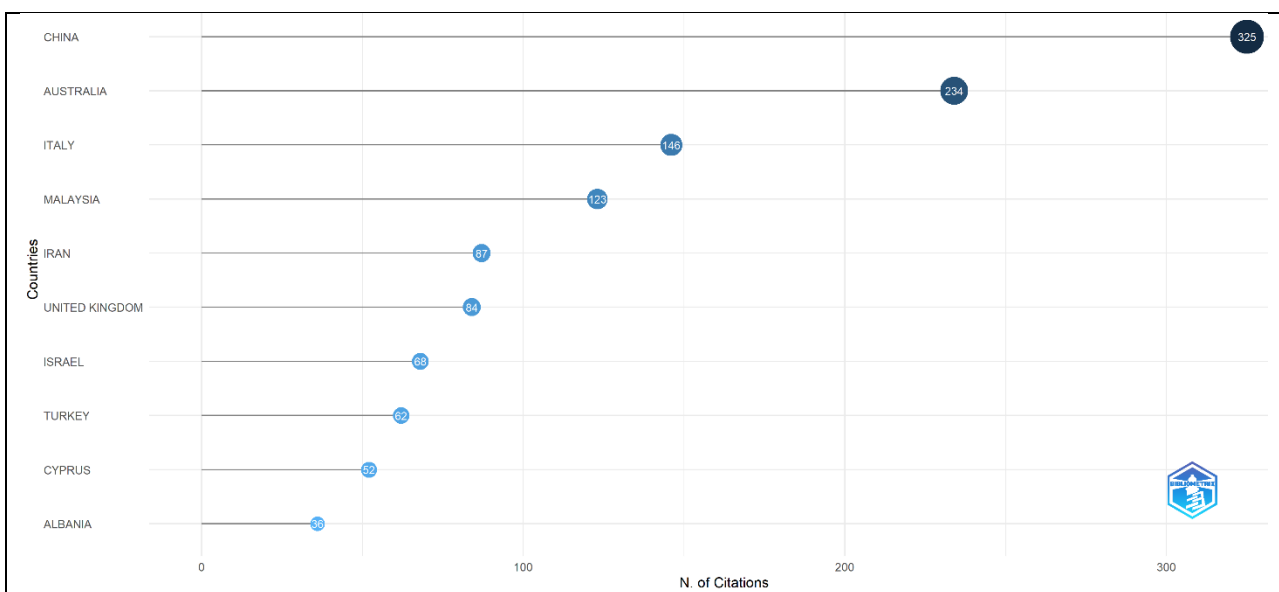
The City University of Macau, University of Guizhou and Rmit University with 4 were second. Bursa Technical University, Julio Garavito Colombian School of Engineering, Macau University of Science and Technology, Polytechnic Institute of Viana do Castelo, Qatar University and Southeast University in third with 3 publications each. The results corroborate the importance of collaborative bibliometric networks between institutions, where researchers are linked.

7 SCIENTIFIC PRODUCTION OF COUNTRIES

Figure 4 shows the situation of scientific production in the countries in relation to the authors who published on the subject. It is noted that there is a progressive increase, showing that China and Australia have been standing out with 325 and 234 respectively, closely followed by Italy with 146 mentions and Malaysia with 123. Iran appears in fifth place with 87 citations, closely followed by the United Kingdom, where the theory of spatial syntax was created, with 84 citations, demonstrating a shift in the study of this theme from the European continent (England) to other continents, such as Asia, Oceania and the Middle East (Iran, Israel, Turkey and Cyprus).

Figure 4

Most cited countries



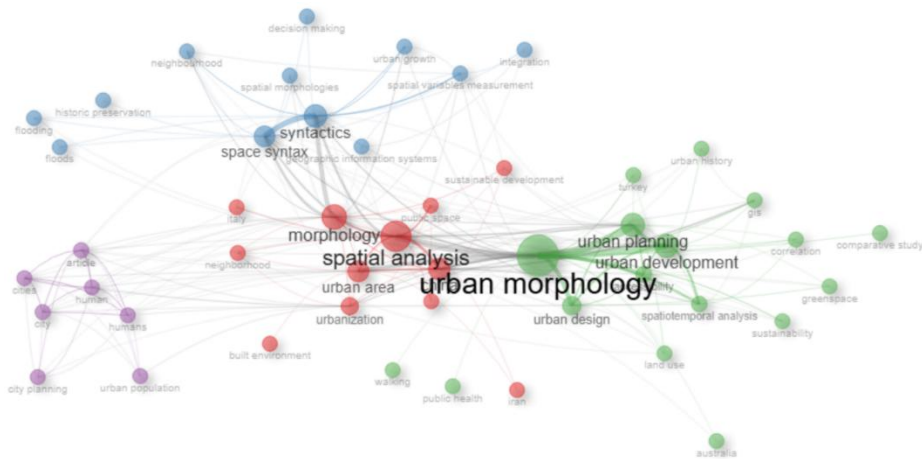
Source: Result of the Web of Science, Scopus, Scielo search, obtained from Bibliometrix (2026)

8 BIBLIOMETRIC NETWORKS

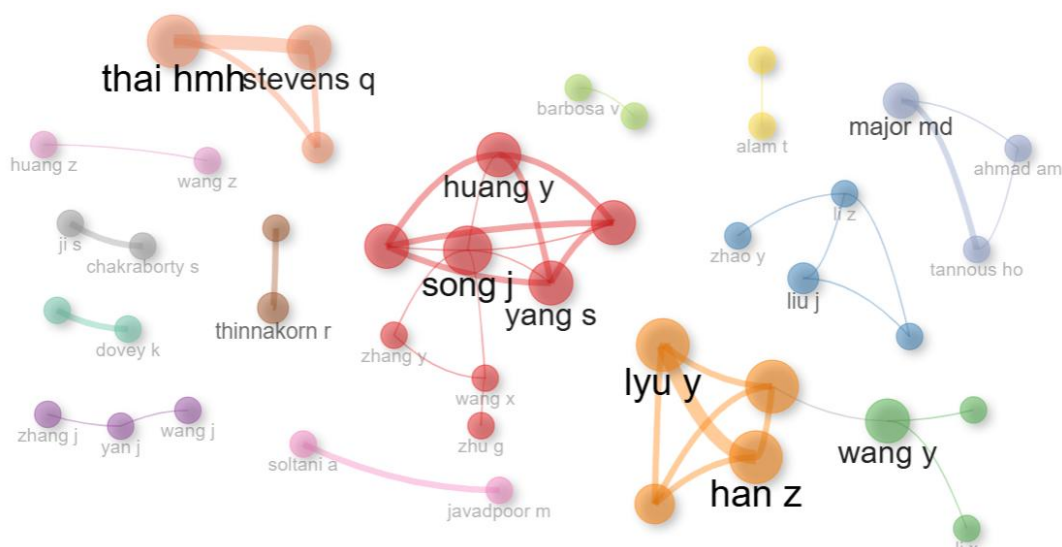
Figure 5 shows the network of co-occurrence of the keywords; in it, the following are observed: the most frequent terms, with the occurrences proportional to the size of the circles and label; the associations between the words, given by the links and proximity; the groups, indicated by the colors. In this network, four groups were formed, three of which stood out the most: the green cluster, representing the occurrence of the terms *urban morphology*. The cluster represented by the color blue identified the highlighted terms *syntactics* and *space syntax*. The red cluster stood out with the keywords *spacial analysis and morphology*. It was observed that, although each group has a specific theme, these groups research very similar themes and connections and integrations occur more frequently, forming a large bibliometric network.

Figure 5

Co-occurrence networks



Source: Result of the Web of Science, Scopus, Scielo search, obtained from Bibliometrix (2026)

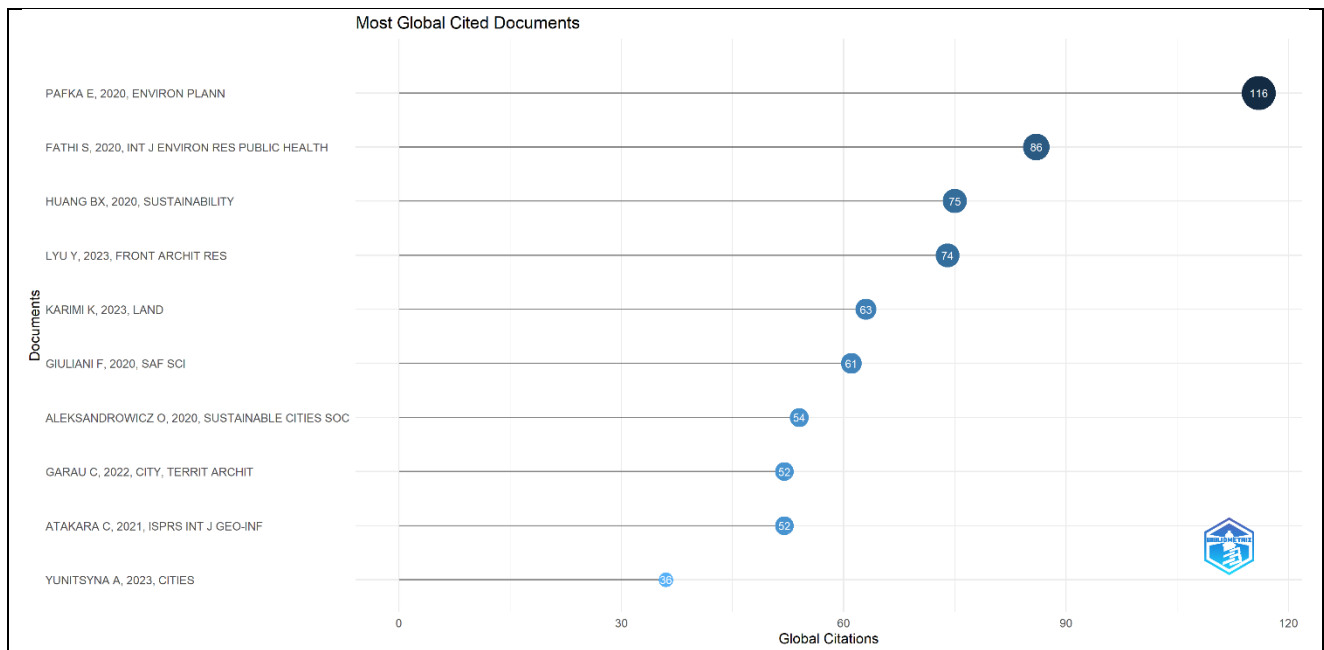
Figure 6*Collaboration networks by author*

Source: Result of the Web of Science, Scopus, Scielo search, obtained from Bibliometrix (2026)

Figure 6 shows the network of collaboration between the researchers, forming 14 small groups represented by circles of different colors. The collaboration network represented by the color red is the one that stood out the most, both in terms of the number of members, with the size of the circles increased, and in the quantity, in relation to the other groups. It is noteworthy that the collaboration groups do not connect much with each other. This means that collaboration networks can grow even more if connections and integration increase.

9 CONTENT ANALYSIS OF THE EIGHT MOST RELEVANT AND GLOBALLY CITED PUBLICATIONS

In this topic, the content of the abstracts of the eight most relevant and globally cited articles found in this bibliometric review was analyzed, and most of the findings identified a strong use of the theory of spatial syntax in the study of urban morphology and urban planning (Figure 7). In the samples examined, it was observed that the researchers used the bibliographic references produced over time, as well as empirical and statistical studies to support their research, which contributed to increase the confidence and security of the results presented. In these terms, with the purpose of verifying which articles published in journals, aroused the interest of researchers.

Figure 7*Most cited documents globally*

Source: Result of the Web of Science, Scopus, Scielo, Bibliometrix survey (2026)

The first article *Limits of space syntax for urban design: Axiality, scale and sinuosity* addresses the limits of spatial syntax for urban planning, considering axiality, scale and sinuosity. The authors of this research are Pafka, Dovey and Aschwanden (2020) with 116 citations. The researchers maintain that the exegesis of spatial syntax from the perspective of the economy of movement has deepened the understanding of urban structure, correlating systemic integration with vitality and functional diversity. However, conventional axial modeling has limitations by neglecting metric distance and morphological roughness variables.

According to Pafka, Dovey and Aschwanden (2020), the evidence suggests that adaptations in axial methods generate heterogeneous results for the same morphology. The dichotomy between closeness and betweenness indicates that network integration is a multidimensional phenomenon. It is concluded that purely axial analyses tend to privilege the hegemony of visibility over effective accessibility, which can compromise the accuracy of the representation of permeability on a pedestrian scale. They state that spatial syntax analysis is a powerful tool that will be even more useful the better these boundaries are understood.

The second article with 86 citations, called *The Role of Urban Morphology Design on Enhancing Physical Activity and Public Health*, which deals with the role of urban morphology planning in the promotion of physical activity and public health. The researchers FATHI, SAJADZADEH, SHESHKAL, ARAM, PINTER, FELDE, MOSAVI (2020) maintain that the contemporary literature ratifies the correlation between the configuration of the built

environment and public health indicators, underlining the role of urban morphology in mitigating psychopathologies and inducing healthy behaviors. This study investigates the promotion of active mobility through the functional and physical optimization of the urban fabric.

Using a hybrid methodological approach — which integrates the Network Analytical Process (ANP), structural equation modeling, and spatial syntax — the research identifies that systemic integration, diversity of uses, and aesthetic quality are significant predictors of physical engagement. The findings demonstrate that road axes with high levels of syntactic connectivity operate as catalysts for physical activity and subjective well-being, validating spatiality as a determining asset in the promotion of urban health.

The third document *Accessibility and Street Network Characteristics of Urban Public Facility Spaces: Equity Research on Parks in Fuzhou City Based on GIS and Space Syntax Model* with 75 citations deals with Accessibility and characteristics of the road network of urban public spaces, researching equity in parks in the city of Fuzhou using GIS and spatial syntax model. Huang, Chiou, and Li (2020) elucidate the positive correlation between urban green spaces and the holistic well-being of the population, showing, however, disparities in the socio-spatial distribution of these benefits. The research applies the Geographic Information System (GIS) and spatial syntax to measure equity and urban morphology in Fuzhou, providing empirical subsidies for the planning of sustainable cities.

The fourth article discussed *Unveiling the potential of space syntax approach for revitalizing historic urban areas: A case study of Yushan Historic District, China* contains 61 citations. LYU, MALEK, JA'AFAR, SIMA, HAN, and LIU (2023) Demonstrate in research the potential of the spatial syntax approach to revitalize historic urban areas through the case of the Yushan Historic District, China. The authors state that historic urban areas constitute primordial elements of heritage, safeguarding collective memory and unique morphologies. However, globalization brings challenges such as infrastructural obsolescence and the erosion of cultural vitality. This research proposes a revitalization methodology based on spatial syntax, applied to the Yushan Historic District. Through morphological modeling, the study identifies spatial determinants of vitality and proposes strategic guidelines that reconcile functional renewal with the preservation of the historical fabric, validating the potential of spatial syntax in heritage conservation.

The fifth article *The Configurational Structures of Social Spaces: Space Syntax and Urban Morphology in the Context of Analytical, Evidence-Based Design* was published in 2023 by researcher Kayvan Karimi from the Bartlett School of Architecture, UCL, London, UK. Karimi

(2023). It explores the Configurational Structures of Social Spaces using the approach of Spatial Syntax and Urban Morphology in the Context of Evidence-Based Analytical Design.

The article postulates a paradigmatic transition in urban morphology, migrating from purely descriptive analyses to quantitative and predictive investigations based on spatial syntax. The proposed approach integrates socioeconomic and cultural determinants into the physical configuration, enabling the development of evidence-based designs. Through an iterative methodological cycle applied in Jilin, a city in China, it is demonstrated how analytical spatial analysis optimizes infrastructure and transport planning. Ultimately, the integration of this tool empowers planners to manage the complexity of urban systems, ensuring the relevance of interventions in the face of the dynamics of human existence and ever-evolving physical structures.

In the sixth publication, Giuliano, Cutini (2020) address the management of post-earthquake emergencies in Italian historic centers, exemplified by the case of Lucignano. The research highlights that the morphology of these settlements is often neglected in traditional risk planning, aiming to increase urban resilience in the face of seismic events.

The seventh survey, In the context of **microclimatic comfort**, the methodology applied in Tel Aviv-Yafo uses high-resolution mapping to create "shading maps". Aleksandrowicz, Zur, Lebendiger, Lerman (2020) argue that the differential of the research is to relate the availability of external shade with the potential for pedestrian movement identified by spatial syntax, allowing urban managers to prioritize tree planting or conservation actions on streets.

Finally, Garau's study , Annunziata (2022), focused on the Metropolitan City of Cagliari investigates urban vitality. The research develops a method to quantify how the components of the built environment impact urbanity and the diversity of activities in public spaces. By integrating spatial syntax into the Geodesign paradigm, researchers are able to identify spatial manifestations of socioeconomic processes, providing subsidies to formulate strategies that strengthen urbanity, creating vibrant and sustainable urban spaces.

10 CONCLUSIONS

The objective of this study was to carry out a bibliometric mapping on the theme of urban morphology and spatial syntax. It was observed that there are already a reasonable number of studies that study this theme, but the scientific production still shows evolutionary progress. Based on the bibliometric and qualitative analysis of the documents presented, the conclusions about the current state of research in urban morphology and spatial syntax (SE), between the years 2020 and 2026, it can be noted the academic maturity and expansion, in which the field

demonstrates sustained growth, with an annual growth rate of 4.91% and a significant volume of 146 articles produced in a period of six years. The peak of publications between 2022 and 2025 reflects the consolidation of spatial syntax as a robust set of analytical tools for understanding urban dynamics.

A second aspect found was the geographic decentralization of production, although the theory originated in the United Kingdom, there is a clear shift in the axis of scientific production to Asia and Oceania, with China (325 citations) and Australia (234 citations) leading the academic impact. Institutions such as Walailak University and the City University of Macau are prominent research centers.

The articles demonstrated that interdisciplinarity and methodological integration in contemporary research transcends pure morphological analysis, integrating SE with other advanced methodologies, such as the Geographic Information System (GIS), the Network Analytical Process (ANP) and structural equation modeling. This hybridization allows, for example, to correlate spatial configuration with indicators of public health, social equity, and preservation of historical heritage. It is important to emphasize that the paradigmatic evolution towards evidence-based urban planning identifies a transition from merely descriptive analyses to quantitative and predictive approaches. The use of SE as a decision support tool in urban planning — the so-called "evidence-based design" — allows managing the complexity of urban systems and optimizing transport and active mobility infrastructures.

However, theoretical refinement and limitations are necessary. The most cited studies point to the need to overcome the limitations of conventional axial modeling. Researchers suggest that the SE should evolve to incorporate metric distance and morphological roughness variables, ensuring that visibility analysis does not overlap with effective pedestrian-scale accessibility. The structure of scientific collaboration, despite the density of publications, the networks of collaboration between authors are still fragmented, with groups that are little connected to each other. This indicates a growth potential for future research through increased integration and inter-institutional cooperation. In short, the archive reveals that spatial syntax remains a vital and constantly evolving theory, capable of providing scientific foundations to address contemporary urban challenges through the analysis of the social logic of space.

REFERENCES

Aleksandrowicz, O., Zur, S., Lebendiger, Y., & Lerman, Y. (2020). Shade maps for prioritizing municipal microclimatic action in hot climates: Learning from Tel Aviv-Yafo. *Sustainable Cities and Society*, 53. <https://doi.org/10.1016/j.scs.2019.101931>

- Garau, C., & Annunziata, A. (2022). Um método para avaliar o potencial de vitalidade de áreas urbanas: O estudo de caso da Cidade Metropolitana de Cagliari, Itália. *City, Territory and Architecture*, 9(7). <https://doi.org/10.1186/s40410-022-00171-9>
- Fathi, S., Sajadzadeh, H., Sheshkal, F. M., Aram, F., Pinter, G., Felde, I., & Mosavi, A. (2020). The role of urban morphology design on enhancing physical activity and public health. *International Journal of Environmental Research and Public Health*, 17(7), 2359. <https://doi.org/10.3390/ijerph17072359>
- Giuliani, F. A. D., & Cutini, V. (2020). The role of urban configuration during disasters: A scenario-based methodology for the post-earthquake emergency management of Italian historic centres. *Safety Science*, 127. <https://doi.org/10.1016/j.ssci.2020.104700>
- Hillier, B., & Hanson, J. (1984). *The social logic of space*. Cambridge University Press.
- Huang, B.-X., Chiou, S.-C., & Li, W.-Y. (2020). Accessibility and street network characteristics of urban public facility spaces: Equity research on parks in Fuzhou City based on GIS and space syntax model. *Sustainability*, 12(9), 3618. <https://doi.org/10.3390/su12093618>
- Karimi, K. (2023). The configurational structures of social spaces: Space syntax and urban morphology in the context of analytical, evidence-based design. *Land*, 12(11), 2084. <https://doi.org/10.3390/land12112084>
- Pafka, E., Dovey, K., & Aschwanden, G. (2020). Limites da sintaxe espacial para o planejamento urbano: Axialidade, escala e sinuosidade. *Urban Planning*, 47(3). <https://doi.org/10.1177/2399808318786512>
- Lyu, Y., Malek, M. I. A., Ja`afar, N. H., Sima, Y., Han, Z., & Liu, Z. (2023). Unveiling the potential of space syntax approach for revitalizing historic urban areas: A case study of Yushan Historic District, China. *Frontiers of Architectural Research*, 12(6). <https://doi.org/10.1016/j.foar.2023.08.004>
- Silva, A. W. F. da. (2025). *Relocação de cidades e morfologias urbanas: A experiência de planejamento regional da Chesf no Rio São Francisco (Tese de doutorado, Universidade Federal do Tocantins)*. Repositório Institucional UFT. <https://repositorio.uft.edu.br/handle/11612/7515>