

RESEARCH ARTICLE

# Mapping 25 Years of Urban Morphology Research: Co-Citation Analysis

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**Abstract**

Urban morphology, as a discipline, focuses on analyzing the structural components of urban space and how these components come together, often in response to user needs. This study aims to identify the scientific trends and thematic trajectories in urban morphology by analyzing 1073 publications indexed in the Web of Science (WoS) database between 2000 and 2025. Co-citation analysis, one of the bibliometric techniques, was conducted using the CiteSpace software. This method allows for the identification of thematic clusters within the urban morphology literature, the key publications representing these clusters, and the temporal relationships among them. The analysis reveals that the literature is shaped around six main thematic clusters: "urban form evolution," "diachronic analysis," "cities," "urban sprawl," "informal settlements," and "walkable cities". These clusters indicate a shift in the field from static analyses focused solely on physical form toward multidimensional, data-driven, and socially engaged research agendas. Temporal analysis further reveals that inter-cluster interaction has significantly increased, particularly after 2019. This study maps the thematic and temporal evolution of urban morphology between 2000 and 2025, offering insights into the field's development and its emerging interdisciplinary connections.

**Keywords:** Urbanization, Urban Morphology, Bibliometric Analysis, Co-citation Analysis, CiteSpace

**Öz**

Kullanıcı ihtiyaçlarına göre biçimlenen kentsel mekânın yapısal öğelerini ve bu öğelerin bir araya geliş biçimlerini çözümlemek, kentsel morfoloji disiplininin temel araştırma alanını oluşturmaktadır. Bu çalışma, 2000–2025 yılları arasında Web of Science (WoS) veri tabanında yayımlanmış kentsel morfoloji konulu 1073 çalışmayı inceleyerek, alandaki bilimsel eğilimleri ve tematik yönelimleri ortaya koymayı amaçlamaktadır. Bibliyometrik analiz tekniklerinden biri olan ortak atf (co-citation) analizi, CiteSpace yazılımı kullanılarak gerçekleştirilmiştir. Çalışma, kentsel morfoloji literatüründeki tematik kümeleri, bu kümeleri temsil eden temel yayımları ve kümeler arasındaki zamansal ilişkileri belirlemeye olanak tanımaktadır. Analiz sonucunda, literatürün 6 ana tematik küme etrafında şekillendiği belirlenmiştir. "Kentsel formun evrimi", "tarihsel süreç analizleri", "kentler", "kentsel yayılma", "enformel yerleşimler" ve "yürünebilir kentler" başlıkları, bu alanın güncel araştırma yönelimlerini yansıtan temel temalar olarak öne çıkmaktadır. Bu kümeler, alanın yalnızca fiziksel biçimlere odaklanan durağan analizlerden, çok boyutlu, veri temelli ve toplumsal etkileşime açık araştırma gündemlerine doğru geçiş yaptığını göstermektedir. Zamansal analiz, özellikle 2019 sonrası dönemde temalar arası etkileşimin belirgin biçimde arttığını ortaya koymaktadır. Bu çalışma, kentsel morfolojinin 2000 ile 2025 yılları arasındaki tematik ve zamansal evrimini haritalandırarak, alanın gelişimi ve ortaya çıkan disiplinler arası bağlantıları hakkında içgörüler sunmaktadır.

**Anahtar Kelimeler:** Kentleşme, Kentsel morfoloji, Bibliyometrik Analiz, Ortak Atf Analizi, Citespace

## Introduction

Cities are dynamic structures shaped by the presence of social relations as well as the cultural values and needs of their users. The analysis of these dynamic structures constitutes the primary focus of urban morphology, a scientific field shaped by the contributions of multiple disciplines.

Urban morphology is defined as an interdisciplinary field that analyzes the streets, buildings, and plots that constitute the urban fabric, along with the relationships among these elements and their patterns of use (Oliveira, 2013). Although its intellectual foundations can be traced back further, the term "urban morphology" was first introduced in English literature in 1928 (Larkham and Jones, 1991). Thereafter, the concept has expanded to encompass historical processes, typologies, planning and design approaches, and spatial analysis techniques.

From the mid-20th century onward, urban morphology acquired a theoretical basis through the historical-geographical approach of Michael Robert Günter Conzen. The contributions of various schools of thought in the UK, Italy, and France further enriched its conceptual diversity. As a result, urban morphology evolved from a field focused solely on physical structures to a broader research area that includes historical processes, spatial typologies, urban sprawl, social inequalities, and sustainability. The establishment of the International Seminar on Urban Form (ISUF) in 1994 institutionalized the interdisciplinary nature of the field, such as geography, history, archaeology, architecture, and urban planning (Moudon, 1997).

Since the 2000s, the increasing importance of environmental concerns with the impact of developing technology has brought new analytical techniques and data-driven approaches to the field of urban morphology. Contemporary researches explore urban form not just as a physical structure, but as a product of complex socio-spatial dynamics. These researches are increasingly supported by data visualization, spatial analytics, computational modeling, and simulation-based approaches (Fleischmann, 2019; Oliveira, 2016; Taubenböck et al., 2018).

Several literature reviews offer perspectives on this transformation. One notable example is the

work of Conzen (2004), which systematically evaluates the contributions of M. R. G. Conzen (his father), to the field of urban morphology between 1932 and 1998. A particularly noteworthy instance is the scholarly work of Michael Conzen, who undertakes a systematic evaluation of the contributions made by his father, M. R. G. Conzen, to the field of urban morphology during the period from 1932 to 1998. This study represents a distinctive and relevant example of academic work that explores the theoretical evolution of the field within the framework of historical continuity.

On the other hand, the contemporary urban morphology literature is increasingly reinterpreted through bibliometric analysis. These studies frequently focus on themes such as thermal comfort (Chen et al., 2021), air quality (Augusto et al., 2024), public health (Köseoğlu & Burkut, 2023), street network morphology (Nor et al., 2021), and urban sprawl (Siyavuş & Aydın, 2022).

This study analyzes 1073 publications on urban morphology indexed in the Web of Science (WoS) database between 2000 and 2025 to uncover scientific trends and thematic orientations in the field. The study employs co-citation analysis, one of the bibliometric techniques, using the CiteSpace software. This method enables the identification of thematic clusters, representative publications within those clusters, and the temporal relationships among them in the urban morphology literature. Since 2019, the urban morphology literature has entered a phase of increased thematic interaction and conceptual convergence, marking a departure from the earlier period of isolated research clusters. This shift reflects both the integration of emerging themes and the strengthening of intellectual connections among previously disconnected areas of study.

Presenting a comprehensive bibliometric analysis of urban morphology literature between 2000 and 2025, this research reveals thematic structures and temporal dynamics through co-citation mapping. It also contributes to a deeper understanding of the evolution of the field and provides a foundation for future interdisciplinary research by visualizing intellectual connections and emerging research clusters. Identifying the currently promi-

nent research themes and analyzing their transformation over time is significant not only for understanding the current state of the literature but also for guiding future research directions.

## Literature

This literature review is structured around two main thematic axes. The first focuses on the theoretical development of urban morphology, tracing the historical evolution of key schools of thought, including the British, Italian, and French traditions, and highlighting their foundational contributions to the conceptualization and analysis of urban form. The second axis examines the methodological foundations of bibliometric analysis, with particular attention to co-citation techniques used to map intellectual structures and thematic shifts in the field. These sections provide a comprehensive overview of the methodological context within which the present study is situated.

## Theoretical Development of Urban Morphology

The scientific investigation of urban forms began in the 18<sup>th</sup> century with the development of reliable topographic maps and detailed city plans, gaining further importance in the 19<sup>th</sup> century through the adoption of approaches focused on the analysis of building groups, squares, and street layouts (Gauthiez, 2004). At the beginning of the 20<sup>th</sup> century, the approach introduced by Fritz—emphasizing that the physical structures, formation processes, and plans of settlements should be evaluated together with urban development periods and regulatory planning processes—remained influential until the mid-century (Hofmeister, 2004). In the 1960s, the inadequacy of quantitative methods for spatial analysis played a significant role in the growing interest in urban morphology (Whitehand, 2001b).

Conzen, the founder of the British School of Urban Morphology, conducted research in the 1960s that comprehensively analyzed urban form through the integration of street, block, plot, and building analyses, alongside a focus on urban land uses and functions from historical and geograph-

ical perspectives (Whitehand, 2001b). His contributions, shaped by his background as an academic who migrated to England before World War II and who pursued studies first in planning and then in geography, enabled him to play a pioneering role in the development of the British school. This approach, pioneered by Conzen, helped to accelerate academic research in the field of urban morphology on an international scale, influenced by other research schools led by figures such as architect Saveria Muratori in Italy and Philippe Panerai and Jean Castex in France (Moudon, 1997).

The "historico-geographical approach" developed by Conzen sought to analyze space within its broader contextual setting, focusing on the small-scale spatial transformation of distinct character areas (Whitehand, 2001a). The "town-plan analysis" model proposed within this framework posits that urban fabric undergoes cyclical and continuous change, consisting of morphological processes such as accumulation, adaptation, persistence, and substitution. Conzen explored this process through detailed spatial analyses at the plot scale, providing insights into the historical evolution of urban form (Conzen, 1988).

Developed in parallel with the British School, the Italian School was shaped by influential figures such as Muratori, Giovannoni, Piccinato, and Trincanato. This approach introduced the concept of the "Process Typology," which embraced historicity in architectural style—particularly with the aim of improving historic city centers. According to this approach, findings obtained from analyses at the architectural scale help to understand transformations at the urban scale and within the social structure. The process typology advocates that new buildings should be designed in harmony with the existing urban fabric, drawing references from historical forms (Gauthiez, 2004).

In contrast, the French School emerged as a critique of modernist approaches. This school was shaped by the sociological perspectives of Henri Lefebvre and the contributions of architectural historians such as Françoise Boudon and André Chastel (Sadeghi & Li, 2019). Studies within the French School have predominantly focused on parcel structures, property relations, spatial formations, and character analyses (Gauthiez, 2004).

Enriched by contributions from various research traditions in the 1970s, urban morphology studies were institutionalized globally in 1994 under the umbrella of the International Seminar on Urban Form (ISUF). Among ISUF's founding goals are the interdisciplinary study of urban forms within a common framework; the encouragement of theoretical and methodological diversity; and the advancement of urban form research beyond local analyses to embrace international comparative perspectives (Whitehand, 2001a). From this perspective, urban morphology research since 2000 has expanded in scope and interdisciplinarity, with the increasing influence of modern technologies contributing to a rise in studies across diverse fields of expertise. Thus, the field—once defined by a limited number of historically oriented studies and stylistic approaches prior to the 21st century—has transformed into a dynamic, rapidly evolving, and interdisciplinary research environment since the establishment of ISUF.

### **Bibliometric Analysis and Co-Citation Method**

The concept of "bibliometrics" was first defined in 1922 by E. Wyndham Hulme as "statistical bibliography"—a method considered as a tool to measure the development of scientific knowledge. In 1962, Raisig defined bibliometrics as a method for revealing the nature of a discipline by quantifying and analyzing various aspects of written communication (Pritchard, 1969). Pritchard (1969) emphasized the inadequacy of the term "statistical bibliography" and introduced the term "bibliometrics" to describe the application of mathematical and statistical methods to books and other communication media.

One of the most commonly used techniques in bibliometric analyses is citation analysis. This method enables the examination of the importance, influence, and relationships of scientific publications through metadata such as authorship, publication venue, and subject headings (Garfield, 1979; Wang, 2021). Citations to a given publication allow the identification of thematic and structural connections among works that share certain commonalities. Bibliometric citation analysis facilitates both content-based and visual mapping of data,

thus revealing how knowledge within a particular domain has evolved over time (Tomaszewski, 2023).

Frequently used tools for such analyses include VOSviewer, CiteSpace, Bibliometrix, HistCite, and ImpactStory. These programs facilitate the graphical and statistical processing of large academic datasets. CiteSpace is particularly known for its strong visualization features, which make it possible to trace the evolution of scientific concepts over time. In contrast, VOSviewer excels at uncovering relationships within the literature through network analysis and clustering techniques. Bibliometrix, due to its R-based structure, offers flexible analytical possibilities and can be adapted to data mining workflows. These tools enable researchers to perform multidimensional analyses of the distribution, interaction patterns, and emerging thematic clusters within a given field.

Koehler (2001) classifies bibliometric studies into four main categories: (i) citation analyses focused on authors, institutions, countries, or individual works; (ii) co-citation analyses that map intellectual movements, such as authorship, countries, and schools of thought; (iii) publication count analyses centered on productivity; and (iv) investigations of informational outputs such as books, articles, and patents. These methods offer diverse perspectives for understanding the structure of scholarly communication and the processes of knowledge production.

Within this classification framework, the present study applies co-citation analysis as a bibliometric technique to examine the intellectual structure of the literature through thematic clustering. Co-citation analysis identifies clusters of studies that are frequently cited together, enabling the visualization of structural relationships among these thematic research groupings. In this regard, co-citation analysis allows for the multidimensional analysis of theoretical diversity, historical progression, and thematic transformation within the field.

### **Methodology**

In this study, the body of literature on urban morphology—shaped over time by scholars from dif-



ferent schools of thought and approached from diverse perspectives—was analyzed using bibliometric methods to reveal trends in the academic literature. Co-citation analysis focuses on identifying patterns of conceptual affinity by examining how often pairs of documents are cited together. This makes it particularly suitable for mapping thematic clusters and tracking the theoretical evolution of urban morphology over time. Within this scope, the co-citation analysis method was selected, as it enables the measurement of interrelationships among articles and the mapping of thematic clusters. Co-citation analysis is a method developed to identify and visualize structural relationships among academic publications within a specific field, making it possible to map the intellectual structure of that domain (Small & Griffith, 1974). Co-citation analysis groups publications that are frequently cited together, helping to identify thematic connections and track the evolution of research areas across time. To examine the intellectual structure and thematic orientations within the literature on urban morphology, this study employed the bibliometric analysis software CiteSpace (v6.3.R3). CiteSpace facilitates the mapping of nodes within the literature—such as authors, publications, and keywords—to examine how scientific concepts and relationships evolve over time.

The data source selected for the study was the Web of Science (WoS) database, owned by Clarivate Analytics. The analysis included publications indexed in the following citation indices: Social Sciences Citation Index (SSCI), Emerging Sources Citation Index (ESCI), Science Citation Index Expanded (SCI-EXPANDED), Arts & Humanities Citation Index (A&HCI), Conference Proceedings Citation Index – Science (CPCI-S), Book Citation Index – Science (BKCI-S), Book Citation Index – Social Sciences & Humanities (BKCI-SSH), and Conference Proceedings Citation Index – Social Sciences & Humanities (CPCI-SSH). The search included all publications containing the phrase "urban morphology" in their abstract, title, or keywords and matched the query "WC=Urban Studies AND TS=Urban Morphology AND PY=2000-2025". As a result of this search, a total of 1073 academic studies were retrieved.

The following criteria were adopted in the CiteSpace analysis (Figure 1):

- Time slicing: Annual intervals from 2000 to 2025.
- Text source: Title, abstract, author keywords, and Keywords Plus.
- Node types: References were used as the primary unit of analysis.
- Selection criteria: g-index, with k set to 25.

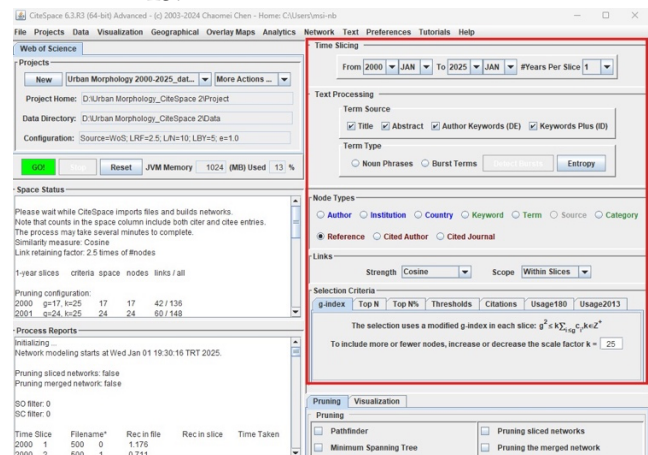


Figure 1. Criteria for Analysis

Each node represents a specific publication, and the resulting clusters indicate a particular theme or subfield of research. The selected g-index value (k=25) increases the representativeness of highly influential publications, facilitating the identification of prominent works in the literature. Thus, the study visualizes and analyzes research areas within urban morphology, highlights the key publications associated with each, and identifies the periods when these areas emerged or transformed.

## Findings

### Distribution of Publication Types

Among the 1073 publications evaluated based on the analytical criteria defined in Figure 1 and retrieved from the Web of Science (WoS) database, 773 were journal articles, 169 were conference proceedings, 55 were book chapters, 19 were review articles, 18 were unpublished articles, and 39 fell under other types such as books, book reviews, corrections, and editorial materials (Table 1).

**Table 1. Distribution of Publications Obtained from WOS Database by Type**

Publication Type	Number of Publication	Percentage (%)
Article	773	72,0
Conference Paper	169	16,0
Book Chapter	55	5,0
Review	19	2,0
Unpublished Article	18	1,0
Others	39	4,0
<b>Total</b>	<b>1073</b>	<b>100,0</b>

### Thematic Research Clusters

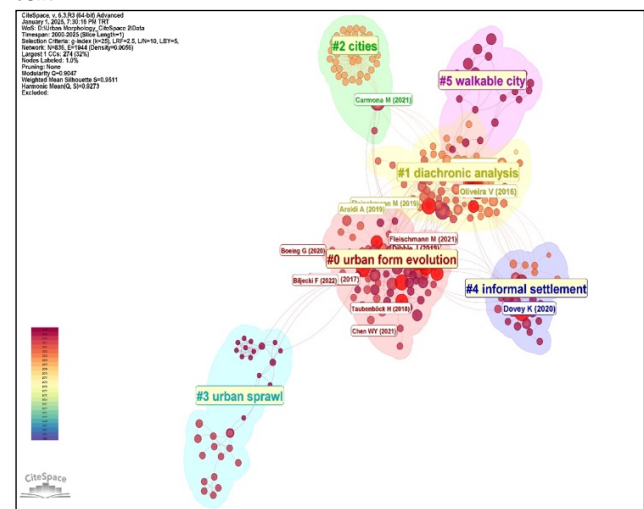
A total of 1073 documents were analyzed using co-citation techniques via the CiteSpace software (version 6.3.R3). This analysis reveals the research areas within the literature, the publications associated with those areas, and how they have evolved over time. Figure 2 visualizes the six major thematic clusters that emerged in the urban morphology literature, with their sizes, average publication years, and silhouette scores summarized in Table 2.

**Table 2. Top 6 Research Clusters and Their Characteristics**

Cluster No	Cluster Name	Size	Silhouette Scores	Average Publication Years
0	Urban Form Evolution	79	0,952	2019
1	Diachronic Analysis	76	0,904	2016
2	Cities	38	0,986	2014
3	Urban Sprawl	30	0,995	2020
4	Informal Settlement	29	0,972	2020
5	Walkable City	22	0,961	2021

Co-citation analysis represents how cited references are grouped under subtopics and reflects the strength of co-citation links among references. Figure 2 displays the six largest research clusters related to urban morphology, along with their respective sizes and thematic labels. These research clusters are collections of scientific studies that have been cited by researchers publishing on a common topic (Chen, 2017). In co-citation analysis, which uncovers the intellectual structure within a scientific field, CiteSpace visualizes research clusters based on key concepts found in the literature

and their derived hierarchical relationships, resulting in a network analysis (Chen, 2017). Thus, the resulting hierarchical research clusters reflect the core concepts embedded in the scientific publications produced within the field. The largest research cluster is labeled as #0, followed by clusters #1, #2, and so forth in ascending order. Silhouette value, a measure of clustering quality, indicates stronger internal relationships among publications within the same cluster as it approaches 1 (Chen, 2016). In other words, the higher the silhouette score, the more coherent and strongly related the publications are considered to be within that cluster.

**Figure 2. CiteSpace Network Map with Cluster Labels and Nodes**

### Cluster #0 – Evolution of Urban Form

Cluster #0 represents the largest thematic group in the urban morphology literature from 2000 to 2025, encompassing 79 publications. With an average publication year of 2019 and a silhouette score of 0.952, this cluster exhibits strong internal consistency. Labeled as “Evolution of Urban Form,” the studies in this group represent the rise of data-driven, measurable, replicable, and systematic analytical approaches within the field.

The most cited publication in this cluster is the work by Dibble et al. (2019), which offers a theoretical expansion aimed at understanding the evolutionary structure of cities through morphometric and taxonomic analysis. Similarly, the “Index of Elements” framework proposed by Fleischmann et

al. (2021) provides a systematic method for analyzing urban form based on six core dimensions—size, shape, spatial distribution, density, connectivity, and diversity. Boeing's (2017) open-source tool OSMnx enriches the applied dimension of morphological research by enabling automated urban network analysis using publicly available spatial data. Likewise, studies by Taubenböck et al. (2018) and Chen et al. (2021) introduce innovative morphological measurement techniques through satellite imagery and artificial intelligence, expanding the scope of analysis to thematic areas such as migrant cities and urban vitality.

A unifying feature of the studies within this cluster is their emphasis on constructing systematic and computational models that move beyond descriptive accounts of urban form, aiming instead to yield outputs that are measurable, reproducible, and analytically robust. This shift marks a transition in the field of urban morphology—from descriptive typologies and traditional spatial classifications to a more analytical and inductive orientation that is integrated with computational urban science.

Cluster #0 lies at the heart of a quantitative transformation in urban morphology, offering new conceptual tools for analyzing the evolution of urban form through the integration of data science, artificial intelligence, and remote sensing technologies. This cluster is also significant for its contribution to planning practices, smart cities, sustainability strategies, and global policy-making, as it translates the theoretical insights of urban morphology into directly applicable knowledge.

#### *Cluster #1 – Historical Process Analysis*

Cluster #1 consists of 76 publications and reflects strong thematic coherence, with an average publication year of 2016 and a silhouette score of 0.904. Labeled as "Historical Process Analysis," this cluster brings together studies that analyze evolving spatial structures, typological continuities, and the transformation dynamics of urban form over time.

The studies in this cluster aim not only to understand the current configuration of urban fabric but also to explore how it has developed and how it may evolve in the future, constructing historical-

theoretical frameworks. The most cited publication in this cluster, Oliveira (2016), relates the formation processes of urban form to actors, components, and historical context. Similarly, Kropf (2017) systematically defines the conceptual foundations of morphological analysis, drawing a methodological map for the field. These two works collectively update the historical process approach in the context of continuity and contemporary urbanization dynamics.

Fleischmann (2019) contributes computational tools to these historical analyses with the open-source Python library "momepy," which enables spatial data-driven morphological analysis. Araldi and Fusco (2019) incorporate pedestrian experience and mobility into the theoretical model of urban morphology, presenting a study that integrates a pedestrian perspective into the analytical framework. Meanwhile, Dovey and Pafka (2017) contribute to the theorization of mixed-use development by analyzing its morphological implications.

Cluster #1 provides a broad analytical framework that spans from the preservation of historical fabric to pedestrian-oriented urban transformation, from mixed-use planning policies to open-source spatial analysis systems. A defining feature of this cluster is its treatment of settlement patterns through the lenses of historical continuity, morphological layering, and socio-spatial transformation.

#### *Cluster #2 – Cities*

Cluster #2 brings together 38 publications, marked by a notably high silhouette score of 0.986 and an average year of 2014, indicating a consistent thematic orientation. Labeled as "Cities," this cluster encompasses studies that analyze urban environments not merely in structural terms but as meaningful and lived spaces. It spans from archaeological and historical contexts to contemporary planning strategies, deeply integrating urban morphology with the social sciences.

The most cited work in this cluster, Carmona et al. (2003), approaches urban form as a practical and educational tool, aligning morphological analysis with design practice and pedagogy. Dittmar (2019)

frames urban space in terms of quality of life and sustainability, positioning morphology within a social framework and aligning urban morphological research with societal values and goals. Hodos (2017) examines how globalization has shaped cities across different periods and geographies, emphasizing the archaeological and historical dimensions of morphological development. Knox and Mayer (2013), focusing on small towns and rural settlements, explore urban change through the lens of cultural continuity and sustainable development.

The studies in this cluster blend morphological analysis with sociological, anthropological, and design-oriented perspectives, extending the scope of urban morphology into multidimensional areas such as spatial practices, urban memory, quality of life, and design guidance.

Cluster #2 is one of the clearest examples of the interdisciplinary nature of urban morphology. These studies interpret cities not merely as formal entities but as lived environments, collective memory spaces, and objects of design. Therefore, this cluster represents a key subfield that captures the theoretical diversity and practical richness of urban morphological research.

### *Cluster #3 – Urban Sprawl*

Cluster #3 includes 30 publications published primarily around 2020, exhibiting exceptional internal coherence with a silhouette score of 0.995. Labeled as "Urban Sprawl," this cluster brings together research that connects urban morphology with environmental impacts, spatial comfort, and sustainability.

The studies within this cluster examine issues such as thermal comfort challenges, air pollution dispersion, and the urban heat island effect resulting from rapid urbanization, high-density developments, and unplanned growth. Acero et al. (2021) investigate the influence of urban geometry on outdoor thermal comfort in high-rise, mixed-use areas using simulation techniques. Similarly, Shi et al. (2018) and Fan et al. (2019) identify morphological design factors that affect air quality and climate adaptation. Their studies apply quantitative analysis to define critical urban form variables

and estimate optimal green space sizes for thermal mitigation in dense urban environments. Chang et al. (2018), on the other hand, integrate GIS and CFD techniques to plan urban ventilation corridors, proposing a data-driven approach to improve air circulation and reduce environmental degradation.

Cluster #3 distinguishes itself by translating data-driven modeling techniques into spatial design criteria that enhance environmental performance. By embedding the concepts of livability and healthy urbanization within the framework of urban morphology, this cluster emphasizes technical and measurable outputs. Compared to other clusters, it remains relatively limited in theoretical or socio-cultural engagement, but it provides valuable insights for environmentally responsive urban planning.

### *Cluster #4 – Informal Settlement*

Cluster #4 is composed of 29 publications and demonstrates a high level of thematic integration, with an average year of 2020 and a silhouette score of 0.972. Labeled as "Informal Settlements," this cluster represents the growing academic interest in spatial configurations that develop outside formal planning mechanisms, positioning informal settlements as legitimate subjects of morphological inquiry.

The studies in this cluster highlight those informal settlements, while often described as irregular or unplanned, display distinct morphological patterns and spatial regularities. The most cited study in this cluster, by Dovey et al. (2020), analyzes the formal components of such areas—including building types, block-lot arrangements, and street patterns—arguing that they are based on complex but intelligible modes of spatial production. Kamalipour and Dovey (2019; 2020) emphasize that informal settlements are spaces that may be hidden within the urban fabric or made visible as symbols of identity, shaped by their own dynamics such as belonging, identity, and social representation. In another study, Dovey (2019) proposes micro-scale morphological criteria—such as building typologies, density, access, and lot sizes—to explain the production of urban space. Kamalipour (2020), on



the other hand, explores the fluidity of space and interprets informal settlements through the lenses of adaptation and incremental transformation.

Cluster #4 reframes informal settlements not simply as problematic areas but as alternative forms of spatial production. It links urban morphology to transformation processes that begin at the micro-scale, offering a socially and politically engaged reading of urban space. Moreover, these studies emphasize that such areas should not be viewed solely as unplanned but rather as spaces shaped through user-driven interventions and process-based morphological evolution. By introducing the concepts of spatial fluidity and incrementalism, Cluster #4 offers a novel theoretical approach that defines urban form as a continuously evolving and adaptive process.

#### *Cluster #5 – Walkable City*

Cluster #5 contains 22 publications, centered around 2021, and highlights emerging themes with a silhouette score of 0.961. This cluster reflects the growing prominence of themes such as accessibility, spatial justice, and user experience within the field of urban morphology. Labeled as "Walkable Cities," this literature approaches morphological analysis through the lens of how urban space is used and experienced.

The most cited study in this cluster, by Dovey and Pafka (2020), argues that walkability cannot be defined by a single metric; instead, it should be understood through the interplay of multiple morphological factors such as functional diversity, density, and connectivity. Logan et al. (2022) and Moreno et al. (2021) highlight the importance of short-distance, accessible urban services—especially in the context of spatial constraints observed during the COVID-19 pandemic—through concepts like the "X-Minute City" and "15-Minute City." Majic and Pafka (2019) examine how urban form influences pedestrian mobility using walkability indicators derived from morphological features. Meanwhile, Anguelovski et al. (2022) draw attention to the socio-environmental outcomes of morphological interventions by analyzing "green gentrification" and its implications for spatial and social inequality.

Cluster #5 expands both the theoretical and practical boundaries of urban morphology by connecting it to contemporary issues such as multidimensional walkability, the influence of urban design on human behavior, mobility, accessibility, and healthy living. This user-centered approach goes beyond formal analysis, focusing on the social function of space and its role in everyday life. Directly tied to environmental sustainability, the studies in Cluster #5 demonstrate how values that gained prominence in the post-pandemic era—such as locality, slow mobility, spatial equity, and urban quality of life—can be integrated into morphological thinking. The cluster ultimately reflects a theoretical shift where form meets function and space merges with lived experience.

#### **Citation Bursts and Thematic Intensifications**

Using the burst detection feature provided by the CiteSpace software, the impact of publications that gained prominence during specific periods was analyzed. Findings regarding publications that experienced a sudden rise in citation frequency between 2000 and 2025 were evaluated using the criteria of burst strength and burst period.


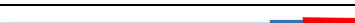



In a literature analysis that incorporates both temporal information and content, the emergence of a topic is marked by a burst of activity in which the frequency of certain features increases as the topic becomes more prominent (Kleinberg, 2002). Such bursts, which provide insights into the structural dynamics of a meaningful dataset, only measure change rates that are both sufficiently intense and sustained (Kleinberg, 2002). In CiteSpace, where citation burst strength and burst period metrics are supported, a burst in citation frequency indicates a time interval during which a sudden shift in citation rate occurs (Chen, 2016).

Table 3 presents the citation bursts and periods of the most cited works among the 1,073 publications indexed in the WoS database between 2000 and 2025. The book *Urban Morphology: An Introduction to the Study of the Physical Form of Cities* by Oliveira (2016) had the highest citation burst strength of 8.62 during the period 2018–2020. The work is significant for its inclusive approach and

for addressing the components, actors, and processes of urban form, historical transformations, and diverse disciplinary perspectives in urban morphology—filling a gap in the literature.

co-cited works authored by Dibble and Fleischmann.

*Table 3. Burst power and burst interval of the top 5 most cited works out of 1073 works in the urban morphology literature in the Web of Science database between 2000 and 2025*

Node Name	Cluster #	Burst Strength	Burst Period (years)	2000 - 2025
Oliveira V, 2016, URBAN BOOK SERIES,V0, PP1	1	8,62	2018-2020	
Dovey K, 2020, HABITAT INT, V104, P0	4	5,5	2022-2025	
Kropf K, 2017, THE HANDBOOK OF URBAN MORPHOLOGY	1	4,57	2018-2020	
Dibble J, 2019, ENVIRON PLAN B-URBAN,V46, P707	0	4,76	2022-2025	
Fleischmann M, 2021, ENVIRON PLAN B-URBAN, V48, P2133	0	4,02	2022-2025	

During the same period, Kropf's (2017) "The Handbook of Urban Morphology", which serves as a guide for morphological analyses by interpreting methods, techniques, definitions, and concepts through a series of case studies, ranks third in burst strength with a score of 5.5. The works of Oliveira and Kropf appear to constitute the core of historical process analysis represented by Cluster #1.

The article by Dovey et al. (2020) "Towards a Morphogenesis of Informal Settlements", which develops a method and mapping model for spatial formation processes, is featured among the top four cited publications in the informal settlements cluster (Cluster #4). With a burst strength of 5.5, it is the second-highest citation burst in the literature (see Table 3).

Dibble's (2019) study "On the Origin of Spaces: Morphometric Foundations of Urban Form Evolution", which proposes a quantitative, historically informed method for examining urban form evolution, holds the fourth position with a burst strength of 4.76.

Similarly, the article by Fleischmann et al. (2021) "Measuring Urban Form: Overcoming Terminological Inconsistencies for a Quantitative and Comprehensive Morphologic Analysis of Cities" ranks fifth, also with a burst strength of 4.76, and is notable for its quantitative approach that addresses terminological consistency. The thematic structure of Cluster #0, centered on urban form evolution (2000–2025), is anchored by frequently

### Temporal Relationships Between Thematic Clusters

Temporal analysis reveals how inter-thematic relationships within the urban morphology literature have taken shape and transformed over time. Figure 3 visualizes how citation linkages between thematic clusters evolved annually between 2019 and 2024, highlighting the growing intensity of these connections. Prior to 2019, there was no significant conceptual or methodological interaction among the identified clusters, which appeared relatively isolated from one another. However, after 2019, this limited relationality gave way to a period marked by increased interaction and convergence. The post-2019 period not only reflects the incorporation of new themes into the literature but also signifies a conceptual integration among existing themes, which had previously exhibited minimal interaction.

In 2019, Cluster #1 (Diachronic Analysis) established connections with Cluster #0 (Urban Form Evolution) and Cluster #2 (Cities), indicating that historical perspectives began to be integrated with both formal classifications and conceptual approaches developed at the urban scale. In this context, Cluster #1 not only represented a specific thematic area but also functioned as a persistent axis in the literature by bridging data-driven methodologies with spatial understandings of history.

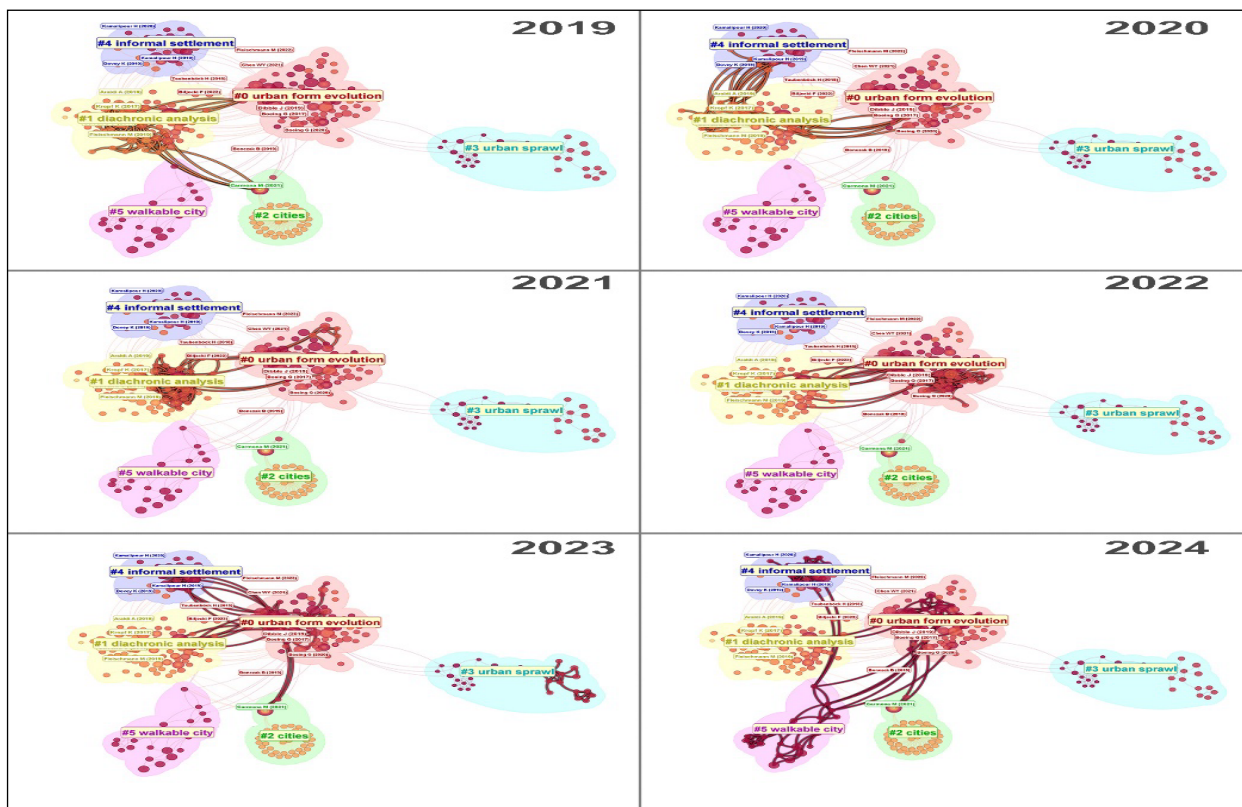


Figure 3. Temporal connections between 2019 to 2024

From 2020 onwards, Cluster #4 (Informal Settlements) began to emerge more prominently in inter-cluster citation relations. This marks a significant shift, as socio-spatial organizational forms operating outside formal planning norms started to be integrated into the urban morphology literature. In this context, the study expanded the scope of morphological analysis. It emphasized that not only spatial form, but also the formation of social structures should be taken into account.

By 2023–2024, the increasing interconnection among the five main clusters suggests a transition into a new phase in which thematic plurality could be addressed within a more coherent theoretical framework. During this period, analyses of urban form became increasingly multilayered, establishing conceptual linkages among spatial, social, and environmental components. Cluster #3 (Urban Sprawl), however, remained relatively isolated due to its focus on environmental comfort and engineering-oriented approaches, maintaining a more technical orientation with limited interaction with other clusters.

The relational analysis covering the period from 2019 to 2024 points to three distinct theoretical orientations emerging within the literature: (i) the integration of historical processes with formal morphological analyses, (ii) the inclusion of socio-spatial organizations within the analytical scope, and (iii) the incorporation of user-centered sustainability into morphological thinking. The consistently central role of Cluster #1 particularly indicates that these three orientations are approached through a lens of historical continuity and analytical inquiry. The network structure observed during this period highlights not only the temporal distribution of morphological themes but also their theoretical restructuring. The rise of data-driven approaches, the shifting balance between public and private spaces in the post-pandemic era, and the growing discourse on spatial justice collectively define the evolving conceptual framework of urban morphology. As suggested by the emerging co-citation networks, it is anticipated that future research in urban morphology will adopt a multi-layered and transformative structure, engaging social, environmental, and spatial dimensions in an integrated manner.

## Conclusion and Discussion

This study examines the urban morphology literature published between 2000 and 2025 in the Web of Science database through bibliometric methods, revealing the intellectual structure of the field both thematically and temporally. It is limited to publications indexed in the Web of Science (WoS) database and written in English and excludes other academic databases such as Scopus and Google Scholar, as well as non-English publications within the field of urban morphology. Using co-citation analysis via the CiteSpace software, the analysis identifies six main thematic clusters and explores their interrelations over time.

Findings indicate that the clusters labeled "urban form evolution" and "historical process analysis" constitute the foundational theoretical pillars of the field. In contrast, contemporary themes such as "informal settlements" and "walkable cities" have gained prominence especially in the post-2020 period, shaped by user-centered and sustainability-oriented approaches. This shift marks an important theoretical shift in urban morphology. The field now includes social and environmental dimensions beyond a purely physical analysis.

Temporal relationship analysis reveals a marked increase in inter-cluster interaction after 2019, indicating a growing theoretical integration in the literature. Cluster #1 (Historical Process Analysis) consistently bridges other clusters, embodying the intersection of historical continuity and data-driven methodologies. The emergence of Cluster #4 (Informal Settlements) after 2020 reflects a growing effort to integrate formal spatial analysis with socially grounded interpretations. Similarly, the rise of Cluster #5 (Walkable Cities) highlights how themes such as spatial justice, accessibility, and user experience have become central to morphological thinking.

Beyond mapping past developments, this study offers a multidimensional roadmap for future research in urban morphology. The increasingly data-rich theoretical frameworks—fueled by tools such as data science, artificial intelligence, and open-source software—enable more effective application of morphological analyses in practice and

polycymaking. Policymakers can utilize these insights by integrating historical urban form analyses with emerging themes such as informal settlements and walkability to develop inclusive and sustainable urban policies. This integration fosters more holistic urban planning that supports physical, social, and environmental dimensions for resilient city development. Thus, this study contributes not only a historical account of thematic trends but also a forward-looking perspective that enriches the theoretical depth and strategic orientation of urban morphology research.

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