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How Cities Influence Social Behavior

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Abstract

Over the past century, urbanization has witnessed a significant rise, with the global population in urban areas surpassing 55% today and expected to reach nearly 70% by 2050. While cities contribute to productivity and innovation, dense urban living can bring challenges such as increased living costs, social segregation, traffic congestion, and rising levels of air pollution. The COVID-19 pandemic, coupled with technological advancements and social shifts, has reshaped urban landscapes. Since the majority of the world's population resides in urban areas, addressing societal and environmental challenges necessitates a focus on cities. This chapter explores the intricate relationship between urban form and social behavior, drawing insights from an extensive review of literature across various themes: human cooperation, mobility, social interactions, integration, quality of life, health, and safety perception. These findings provide a comprehensive framework to understand the complexities of social dynamics in urban environments.

Cities as Complex Systems

The world is experiencing an unprecedented, substantial trend toward urbanization. As reported by the United Nations (UN-Habitat 2022), more than 55% of the global population currently lives in urban areas, and projections indicate this proportion will reach approximately 70% by 2050. This progression will lead to intensified concentration of people, goods, means of production, and services within increasingly confined spaces.

The driving force behind urban growth lies in the advantages that are linked to *economies of scale* (Gill and Goh 2010; Wheaton and Shishido 1981). Urban environments serve as hubs that concentrate a diverse array of job opportunities by facilitating the convergence of key agents, including people and workplaces. This concentration optimizes essential resources, reduces infrastructure investments, and encourages the development of collective transportation

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systems (Pentland 2014). Presently, urban economies form the backbone of the most high-income countries (Frick and Rodríguez-Pose 2018), leading to the continual growth of cities in terms of population and economic prosperity over time (Thisse 2018). In the last decade, Dobbs and Remes (2013) estimated that the 2,600 largest global cities accommodated 38% of the global population while contributing to 72% of the global gross domestic product (GDP). Recent projections from the World Bank (2023) suggest that the contribution percentage might have already surpassed 80%.

Some particular discrepancies contradict previously mentioned arguments, one of which lies in the nonuniform correlation between global urbanization and wealth expansion. Balsa-Barreiro et al. (2019a) analyzed the sustainability of global economic growth from the 1960s, using factors such as wealth generation (in terms of GDP), environmental impact (CO_2), and population indicators, particularly urbanization. By estimating the average location of the planet's activity for each indicator annually, they illustrated the trajectory of these indicators over time. The findings revealed diverging trends: while global wealth gravitates toward the East, population growth and urbanization trend toward the South.

The progression of urbanization brings forth a multitude of challenges, particularly in environmental and social contexts. Notably, the upsurge in mobility and resulting traffic congestion poses significant costs, potentially impeding urban competitiveness (Sweet 2011). Urban residents face the risks of exposure to the environmental impacts stemming from cities, which currently contribute to two-thirds of global energy consumption and over 70% of greenhouse gas emissions (World Bank 2023). Moreover, rising social tensions, including urban segregation and gentrification, arise from imbalances in supply and demand within a fiercely competitive global context. These complex issues underscore the concept of *urban diseconomies*, a notion highlighted by scholars to portray the compounding challenges associated with agglomeration economies (Richardson 1995).

Regional disparities in urbanization rates highlight distinct patterns. In low- and middle-income countries, rapid urbanization stems primarily from limitations in rural areas rather than urban opportunities. This phenomenon has resulted in pseudo-urbanization processes (Balsa-Barreiro et al. 2021; Hashimov et al. 2013), posing risks of environmental unsustainability and social exclusion. This includes the rise of poverty pockets, which can increase crime rates, and the expansion of informal settlements with inadequate services, heightening vulnerability to potential hazards for their dwellers (Williams et al. 2019; Zerbo et al. 2020).

Four additional aspects are pertinent to comprehend the magnitude of the global urbanization process. The first involves evaluating the accuracy of estimated projections for the mid-century within the current intricate context. Factors such as the impact of the COVID-19 pandemic and the technological transformation derived from artificial intelligence (AI) have contributed

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to deepen the economic deglobalization initiated in the mid-2010s, potentially leading to short- to medium-term structural changes in the labor market (Balsa-Barreiro et al. 2020b; Rossi and Balsa-Barreiro 2020). Some authors have initiated discussions on the future impacts of these factors over cities (Williams 2023) and population distribution, debating the potential for urban resilience (Foster 2020) versus the urbanization crisis (Kotkin 2020) over the next decades. The second aspect concerns the granularity and scaling of the urbanization process (Bettencourt 2013). Although urbanization processes are commonly linked to large metropolises, they manifest at various scales and levels. Balsa-Barreiro et al. (2021) illustrated how the urbanization process operates across multiple scales, not solely confined to large cities, displaying fractal patterns characterized by repetitive geometry across scales (Batty and Longley 1994; Mandelbrot 1982). Consequently, smaller cities may experience rapid population growth, leading to heightened traffic congestion and pollution beyond their capacity (Borck and Tabuchi 2019). The third aspect highlights the growing role of cities as primary economic centers for entire regions, emphasizing the need for an urban-focused approach to tackle global social and environmental challenges (UN 2016). Finally, the fourth aspect refers to spatial disparities among cities based on wealth levels. High-income countries demonstrate steady urbanization rates and low demographic growth, featuring built and well-established cities. Conversely, low- and middle-income countries experience rapid urbanization, often marked by unregulated and informal construction in many cities.

The intricate nature of urban complexities underscores the critical need for a more profound comprehension of urban dynamics to address proactively forthcoming social and environmental challenges. Achieving this requires a deeper understanding of the driving mechanisms that shape city performance, encompassing both physical and social dimensions. In this chapter, we investigate the correlation between the physical structure of cities and the social behavior of their residents. To achieve this, we conduct an extensive literature review of prominent studies that link these factors. Our goal is to establish a robust framework for future research, shedding light on how physical and human factors interact in urban environments.

We will begin with an introduction to the factors influencing urban form. We then define the concept of urban morphology and its treatment in current literature. Next, we explore the reciprocal relationship between cities and human behavior through a literature review across seven major social themes: human cooperation, mobility, social interactions, integration, quality of life, health, and safety perception. We then outline potential data sources for gathering information related to both social behavior and urban morphology. We conclude by summarizing key insights to consider in planning sustainable, efficient cities for the future.

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Urban Form across Scales

There are two primary factors explaining the urban configuration of cities. First, the physical context surrounding cities constitutes a primary determinant of their layout. Proximity to natural features such as rivers, coastlines, or valleys strongly influences and constrains the directional expansion of a city. Many cities are strategically planned to capitalize on their natural potential. Urban designs in tropical regions prioritize maximizing cooling breezes, while cities in desert areas often feature narrower road networks to mitigate sun exposure (Hang et al. 2009; Masoud et al. 2020). Second, the socioeconomic aspect, reflected in the diverse urban forms and their evolution, emerges from the interplay between physical and human factors, particularly regarding the economic utilization of natural resources. Throughout history, a notable portion of the world's population has settled in coastal zones, utilizing water resources for various industrial purposes and enabling ease of navigation and coastal fisheries. Approximately 40% of the global population resides within 100 kilometers of coastal regions (Moser 2014), although this ratio significantly rises when accounting for riverbanks, lakes, and other water bodies. This underscores the critical role of these natural elements in human development. Medieval cities were historically located in strategically favorable and well-connected sites, serving as pivotal hubs for the development of markets catering to vast rural regions (Fujita et al. 2001). The expansion of these exchange centers and their transformation into substantial urban centers stemmed from the significance of their potential market.

Technological advancements, particularly in transportation, played a pivotal role in both the expansion and morphology of cities across scales (Balsa-Barreiro and Menendez 2021, 2022) Globally, the emergence of large cities centered on major commercial ports is attributed to low costs associated with maritime freight traffic, fostering extensive trade (Fujita and Mori 1996). Likewise, the extensive growth of suburbanization processes, known as *urban sprawl*, in American cities is primarily linked to the widespread use of private vehicles, allowing point-to-point mobility. Within cities, this influence explains the prevalence of regular city grids, characterized by broad streets designed primarily for vehicular traffic flows.

The historical arrangement of elements reveals a diverse array of shapes and sizes that trace the complexity of the *urban tissue* (Marshall 2004), highlighting human influence on constructing the built environment over time. Actual urban forms define its present usage, as reflected in its varying degrees of physical accessibility, social integration, and economic functionality (Martino et al. 2021). This underscores the reciprocal connection between urban form and the socioeconomic factors molding cities.

Drawing upon these factors, urban forms can be examined across two distinct scales. First, the macro-scale focus on the *city as a whole* provides the most comprehensive perspective. At this scale, urban sprawl encompasses

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building blocks and configurations of street patterns. The distribution, configuration, hierarchy, orientation, and connectivity of the street network are crucial elements that define the city layout, as shown in Figure 8.1. Second, the meso- and micro-scales are mainly characterized by neighborhoods, districts, or any aggregated units, such as visible building blocks observed at a more detailed level. This scale allows the evaluation of socioeconomic disparities in urban forms, showcasing differences in land uses, economic prosperity, and social segregation based on income and racial factors. The integration of metrics related to urban form and social indicators enables the assessment of accessibility to infrastructures, open spaces, and basic services across different regions of the city.

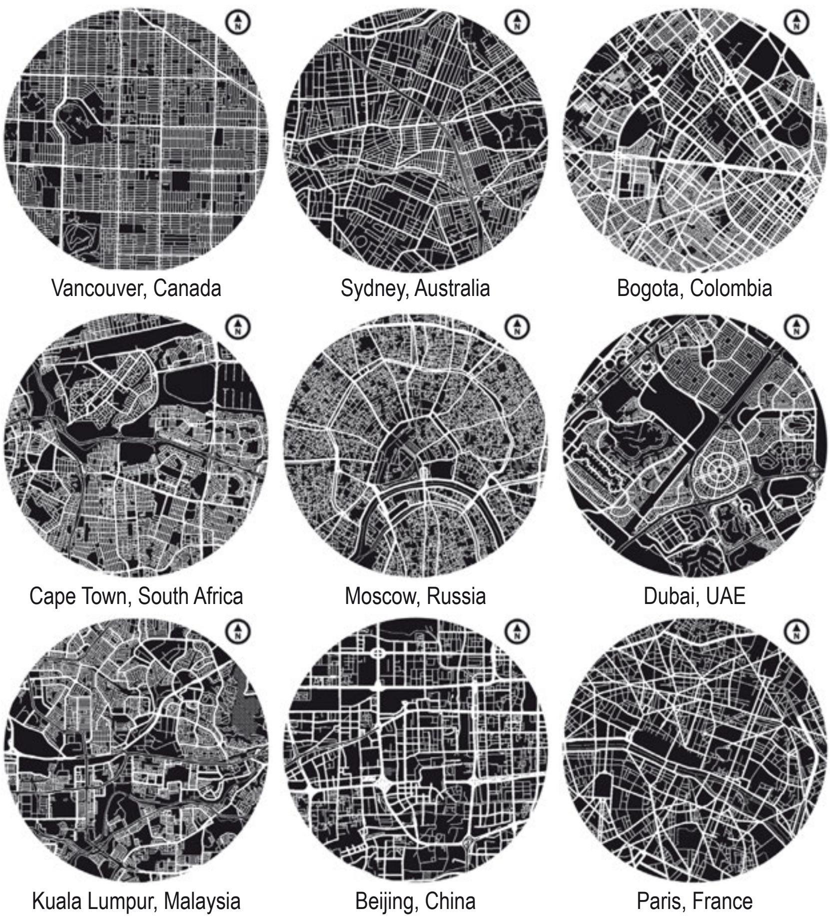

Figure 8.1 Configurations of street networks in densely populated cities on different continents. Different traces result from the interaction between physical and human factors. Each figure illustrates a distinct region, displaying diverse spatial scales for each city. The thickness of the lines represents the hierarchy within the street network.

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Urban Morphology

The study of urban environments involves various perspectives including visual, perceptual, and social aspects. Krier (1979) defines urban spaces as "all sorts of space between buildings," emphasizing physical construction and referring to spaces where interactions between people and places occur. The form of the urban core is made up of essential physical elements, including building blocks, plots, and streets (Moudon 1997). Subsequently, other elements like land use (Levy 1999), natural environments, and green spaces (Kropf 2009) were integrated later. Building blocks, which delineate the smallest enclosed spaces within an urban grid, and streets, which comprise the public network for movement across the urban landscape, are widely recognized as key indicators by most authors.

Urban design encompasses primary dimensions, including form. *Urban morphology*, as a distinct discipline, investigates physical structures, spatial layout, and changes of cities over time (Kropf 2017). This discipline, traditionally qualitative and visual, has been transformed due to the abundance of data and enhanced computational capabilities, resulting in the emergence of quantitative methods known as *urban morphometrics* (Dibble et al. 2017). This advancement contributes significantly to measuring and categorizing urban form, particularly enhancing *typo-morphology* studies (Samuels 2008) and *space syntax* theories for the analysis of spatial configurations of urban networks (Elek et al. 2020; Hillier 1996).

Urban morphologists have developed indicators to estimate various morphological relations (orientations, areas and dimensions in 2D, volumes in 3D) between discrete elements, describing the morphology, geometry, and typology of the built environment. Vertical indicators aid in studying building façades, horizontal indicators cover building distribution factors (density, distances), while volumetric indicators define compactness. Street indicators refer to road network configuration describing urban grid and axial lines, but also street composition, which include width, position, length, area, and orientation of roads. Additionally, land use, particularly the presence of green spaces, is a significant factor in these studies. In this case, we must consider aspects related to total area as well as spatial distribution and fragmentation of green spaces throughout the city. Hence, urban morphology involves physical characteristics such as shape, size, and density, yet its complexity lies in assessing spatial relationships among its elements. A simplified proposal for the classification of urban indicators is shown in Figure 8.2.

The estimation of these attributes involves the development of specific methodologies to derive a set of metrics or indicators. Methods and outcomes might differ depending on factors such as the basic spatial unit, the spatial scale, and level of data aggregation, among others. For instance, studies conducted by Hermosilla et al. (2014) and Boeing (2019) estimated indicators at the street level, whereas Biljecki and Chow (2022) conducted their analysis

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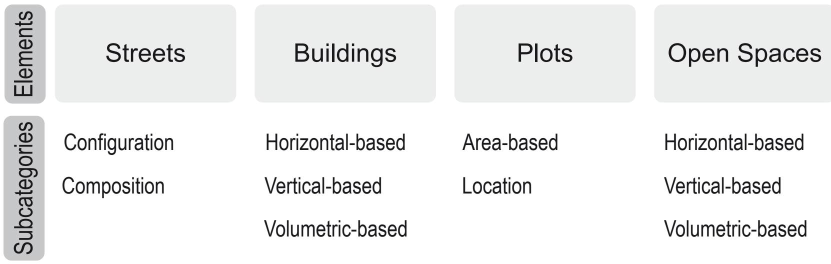

Figure 8.2 Classification of urban morphology indicators, aligned with Elzeni et al. (2022).

at the building level. Unlike many studies that propose a limited number of indicators, the latter is one of the most comprehensive studies, presenting a list of 43 morphology indicators. Noteworthy contributions also come from Bourdic et al. (2012) and the enhanced version by Fleischmann et al. (2020). Their comprehensive review encompasses 72 quantitative studies, identifying a list of 465 measurable indicators of urban form. Due to terminological inconsistencies and vague methodological descriptions in some studies considered, they refined the list to 361 valid indicators. These indicators were classified across six categories (dimension, shape, spatial distribution, intensity, connectivity, and diversity) and three conceptual scales (small, medium, and large). A brief summary of this proposal is given in Table 8.1.

Cities and Human Behavior

Some environmental factors contribute significantly to our perception of a place. In urban settings, these encompass physical and built environments shaping and defining the existing urban morphology. Their interaction highlights the complexity of urban spaces and their impact on our perception, extending beyond purely aesthetic or subjective comfort criteria. Cities located in naturally favorable environments with pleasant climates may possess poor urban planning, leading to varying perceptions among individuals. To address this ambivalence, numerous studies have employed diverse approaches to understand the impact of built environments on experience and perception. Multiple approaches span different disciplines, including the ones coming from subjective geography (Hiss 1991; Lynch 1960), psychogeography (Self 2007), and environmental psychology (Kopec 2012).

Geographical and sociological approaches offer significant insights into the impact of the environment on social behavior. *Geographic determinism* emphasizes environmental factors as primary influencers on human behavior, cultural development, and societal progress. In contrast, *possibilism* highlights societies' capacity to overcome these natural constraints (de Quadros 2020). The *Chicago School* (ecological school) made substantial sociological

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Table 8.1 Condensed version of the morphological indicator's list developed by Fleischmann et al. (2020), including categories with their respective definitions and a list of relevant indicators.

Category	Definition	Indicators
Dimension	Geometric properties of individual objects	• Length • Height • Number of floors • Mesh size • Area
Shape	Geometric dimensions' mathematical properties	• Height-to-width ratio • Compactness index • Form factor • Fractal dimension • Rectangularity index • Complexity index
Distribution	Spatial distribution of objects in space	• Built front ratio • Distance • Continuity • Concentration index
Intensity	Density of elements by unit area	• Covered area ratio • Floor area ratio • Number of plots • Weighted number of intersections
Connectivity	Spatial interconnection of street networks	• Closeness centrality • Clustering coefficient • Node/edge connectivity • Node connectivity
Diversity	The diversity and complexity of the elements	• Power law distribution of areas • Plot area heterogeneity • Plot area diversity • Intersection type proportion

contributions. *Symbolic interactionism* theories proposed that both the built environment and social structures shape human behavior (Bulmer 1984). In the early 20th century, these ideas were tested in Chicago through compelling experiments. Thomas and Znaniecki (1918) argued that immigrants' transition from controlled European societies to the more competitive urban environments fueled Chicago's dynamic growth. The school explored a wide array of social behavior in urban settings, analyzing specific behaviors such as alcoholism, homicide, suicide, psychosis, and poverty. Their findings suggested that the urban lifestyle weakened primary social relationships, leading to social disorganization with significant impacts on human behavior. Recent studies reinforce these conclusions, demonstrating that insufficient integration and higher mobility rates are associated with increased crime rates (Caminha et al. 2017).

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Aligned with the theories of *possibilism*, a thorough understanding of the intricate interplay between urban form and human behavior necessitates recognizing their reciprocal influence. At the outset, an individual's socioeconomic status shapes their urban preferences. Initially, individuals may identify with their place of birth, but social class increasingly shapes housing choices within cities. The gradual process of urban development significantly reflects social hierarchies, with income playing a pivotal role in shaping urban landscapes. Traditionally, higher-income households tend to favor exclusive areas with superior amenities, opting for spacious homes in less congested suburbs, often surrounded by extensive green spaces.

In recent decades, Western countries have transformed their urban landscapes. Criticism of the urban sprawl model, reliant on automobiles and incurring associated costs, has sparked renewed interest in revitalizing city centers. This revitalization has been driven by factors like gentrification, prompting affluent individuals to relocate to urban cores. It has favored interaction between affluent and lower-income groups, particularly during transitional periods with both groups sharing spaces (Lees et al. 2007). The changing dynamics are urging a reconfiguration of urban spaces within central neighborhoods, emphasizing policies that target their revitalization by limiting motor vehicle access and expanding green spaces. This indicates a partial transformation of urban metrics in established areas, demonstrating the continuous interplay between human behavior and urban design, guiding adjustments according to socioeconomic conditions.

Several notable studies have analyzed the substantial impact of urban design on the collective lives of residents. Jacobs (1961) criticized the mid-20th-century American urban planning, advocating for diverse neighborhoods and community-driven city growth. She emphasized vibrant streets and highlighted the significance of intricate urban environments in fostering community interaction and creativity. Her urban planning model challenges conventional approaches by emphasizing the significance of neighborhoods and local communities in the development of cities. More recently, Hern (2017) also contested prevailing narratives regarding urban development, questioning preferences that prioritize economic growth and urban rejuvenation at the expense of social equity and community welfare.

At present, urban policies adopted by many Western cities prioritize human-centric approaches. They focus on environmentally sustainable models, such as eliminating industrial pollution, improving urban green spaces, reducing reliance on private vehicles, and expanding pedestrian-friendly zones. This transformation advocates for city models that emphasize human livability through compact, interconnected, and economically diverse forms (Burgess 2000; Kain et al. 2022). The urban transition presents three key criticisms. First, certain once-praised urban models, like *sprawling suburbs*, now face criticism due to extended commuting times, environmental impacts, and their tendency to foster social isolation despite their perceived design benefits. The

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city models perceived as being optimized today may lose their efficiency in the face of ongoing socioeconomic or technological changes. The current focus on compact, pedestrian-friendly, human-centered cities might yield considerable adverse effects, potentially resulting in less resilient urban economies, marked by job decentralization and fewer industries due to limited accessibility or an overreliance on the services sector. Second, the influence of digital economies and remote work may diminish the attractiveness of cities as business hubs, potentially causing residential dispersion. Alternatively, increased labor flexibility and mobility levels could ultimately reshape many cities into tourist hubs, intensifying gentrification and the displacement of their residents (Moskowitz 2017). Third, a comprehensive evaluation of city-specific forms, exemplified in Figure 8.3, necessitates contextual assessments within their respective geographical contexts (Balsa-Barreiro et al. 2022). Hence, certain urban designs and policies may be suitable for specific cities but not universally applicable across all.

The growing accessibility of building-level and individual-level data has amplified research exploring the intricate correlation between urban form and social behavior. To grasp this relationship comprehensively, we conducted an extensive literature review centered on key social aspects influenced by city configurations. Our review comprises seven primary subsections: human cooperation and altruism, human mobility, social interactions, social integration, quality of life and livability, health, and crime and safety perception.

Human Cooperation and Altruism

The urban environment influences (negatively) individuals' tendencies toward prosocial behavior and helpfulness. Various studies indicate that residents in urban settings exhibit lower inclinations to engage in activities such as responding to postal surveys (Couper and Groves 1996), assisting a distressed stranger (Levine et al. 1976), rectifying accidental overpayments in stores (Korte and Kerr 1975), or contributing to charitable causes (Chen and Mace 2019).

Korte and Ayvalioglu (1981) conducted a Turkish field study to compare urban settings' impact on individuals' willingness to help. They assessed four indicators: giving change, cooperating in an interview, responding to an accident, and reacting to a lost postcard. Their findings revealed lower helpfulness among urban residents compared with those living in small towns. Moreover, they noted behavioral variations among urban dwellers based on specific urban districts. In a recent U.K. study, Zwirner and Raihani (2020) conducted a similar experiment across 37 neighborhoods in 12 cities (200,000 to 1,000,000 residents) and 12 towns (fewer than 20,000 residents). Analyzing actions like posting a lost letter or assisting pedestrians, their results diverged from Korte and Ayvalioglu's study and showed no link between urban residency and willingness to help strangers. Their findings highlighted, however, that the neighborhood's deprivation level was a significant factor influencing helping

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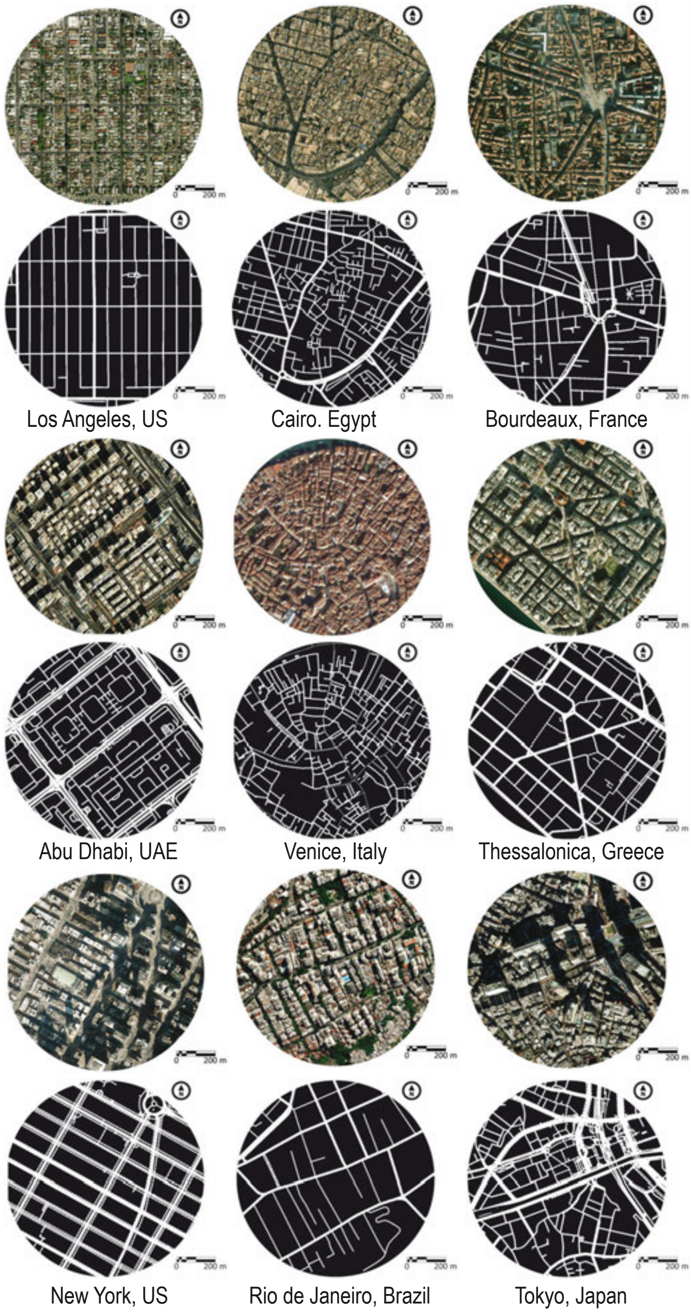

Figure 8.3 Configurations of street network and urban typologies in densely populated cities on different continents. Each figure represents a specific layout in each particular city, all standardized to the same scale. Aerial imagery collected from Google Earth (2022).

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behavior. This underscores that prosocial tendencies depend more on the income factors than population size.

The ambiguity in the outcomes of the aforementioned studies was already evidenced more than four decades ago by Amato (1983), who scrutinized numerous studies examining urban–rural differences in helping behavior. In his assessment of six helping measures across 55 cities and towns stratified by population size and geographical isolation, he found a negative correlation between population size and helping behavior in four of the measures examined, with many studies exhibiting contradictory results.

Human Mobility

The surge of big data over the last decade has enhanced our comprehension of human mobility at a profound level of detail. Some prominent studies (e.g., Lu et al. 2013; Song et al. 2008) exemplify the high predictability and consistency observed in our mobility patterns, notably accentuated within urban settings. This illustrates how our commuting and leisure patterns can be remarkably similar, contingent upon our socioeconomic and demographic conditions. An alternative perspective, albeit yielding closely aligned outcomes, emerges from transportation studies. Ambuhl et al. (2021) conducted an extensive analysis of traffic behaviors across various cities spanning a year, utilizing data collected from loop detectors placed at diverse points within the urban network. Their findings revealed a remarkable consistency in the aggregated patterns exhibited by the majority of cities over time.

The urban form influences our mobility patterns. Leck (2006) illustrated how land use mixing in built environments strongly predicts our travel behavior. In general, city models characterized by extensive urban sprawl lead to widespread mobility challenges (Batty et al. 2003), resulting in larger commuting distances and exacerbated traffic congestion (Travisi et al. 2010). Prolonged congestion times not only increase commuting durations but also pose a potential surge in road fatalities (Yeo et al. 2015). In 2022, one-way commuting time in the top 50 U.S. metropolitan areas averaged 28 minutes, reflecting a 20% increase from 2019 (Candiloro 2023), mainly due to the resurgence of urban sprawl driven by COVID-19 (Peiser and Hugel 2022).

Advocates of compact city models emphasize their advantages in fostering shorter commutes and encouraging preferences for active transportation (Mouratidis et al. 2019). The opposite scenario may, however, occur, leading to higher traffic density and consequent congestion in urban centers (ADB 2019). Consequently, the debate regarding urban sprawl versus traffic externalities remains ambiguous (Wang 2023).

Confronting this, numerous cities are adopting comprehensive policies aimed at discouraging the use of private vehicles, limiting road capacities, and promoting alternative transportation modes. Many European cities, for instance, are implementing urban designs based on *shared spaces* that encourage

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drivers to adopt more pedestrian-friendly behavior. The efficacy of this strategy is, however, a subject of debate, particularly concerning its capacity to establish secure mobility models (Methorst et al. 2007). The impact of these policies evidence that individuals residing in urban areas drive significantly less frequently compared with residents in other regions. In cities like Tokyo, the average car ownership value stands at merely 0.32 cars per household, which is three times lower than the national average (Japan) of 1.06 cars per household (Knowles 2023).

From an intraurban perspective, Wang and Debbage (2021) underscored the substantial influence of urban form on traffic congestion. Their research indicated that cities characterized by intensified urban land use or with multiple centers (polycentric configurations) are more susceptible to traffic congestion. Examining the impact of the size of a city block on urban mobility, Zhang and Menendez (2020) revealed that opening superblocks to certain traffic flows notably improved traffic conditions. Loder et al. (2019) demonstrated how congestion hinges on urban network topology, observing that certain indicators (e.g., network density and the number of road intersections) contribute to congestion by amplifying conflict zones. Likewise, Choi and Ewing (2021) explored additional topological indicators in the Wasatch Front metropolitan area in Utah, United States. Their findings indicated that urban networks with higher density and connectivity typically experience lower levels of traffic congestion.

The uncertainty in assessing the impact of specific topological indicators on urban traffic congestion may be attributed to factors related to the location of each city and substantial variations in the spatial orientation of urban networks across the globe (Boeing 2019). Nevertheless, despite some ambiguity and conflicting results, the paradox lies in the feedback loop between these factors, where traffic congestion can induce urban sprawl, leading cities to become more extensive and less densely populated (Legey et al. 1973). Once again, this raises the question of whether this urban model represents the problem or the solution.

Social Interactions

City structure influences resident interactions. Public spaces, such as streets, squares, and parks, play a pivotal role in fostering social integration and communal life. Talen (1999) refers to the concept of "sense" that pertains to the capacity of built environments to foster a feeling of community belonging among urban residents. Many cities emphasize the need to expand public spaces (Mahmoud et al. 2013), considering aspects like spatial distribution and fragmentation as relevant metrics. The type and frequency of social relationships within public spaces depend on a wide range of factors including urban design, pollution levels, and collective safety, among others. In a study conducted in San Francisco, Appleyard et al. (1981) investigated the influence

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of urban design and traffic on residents. His analysis of three streets with different traffic levels revealed that dwellers in high-traffic areas had fewer social connections and a diminished sense of community compared with those in low-traffic zones.

Cities offer significant advantages by facilitating social interactions among diverse individuals, leading to competitive benefits in terms of innovation (Pentland 2014). In the physical realm, Schläpfer et al. (2014) demonstrated a close relationship between the total number of contacts, communication activity, and population size according to well-defined scaling relations. Sato and Zenou (2015) analyzed interaction types and revealed that while individuals in densely populated regions interact with more people, these interactions are more random due to weaker social ties compared with residents in rural regions. Examining factors like distance and population density, Büchel and von Ehrlich (2020) discovered a positive correlation between cell phone usage and population, especially in close proximity, suggesting a complementary relationship between face-to-face and mobile interactions. Their findings validate the operation of economies of scale facilitated by cell phones. Moreover, Dong et al. (2017a) investigated how urban dwellers' social interactions influence their purchasing behavior: individuals working in nearby locations, despite living in different communities, often act as "social bridges" between their communities, leading to similar purchase behaviors within those communities.

Social Integration

Some studies have focused on the social integration of individuals and communities within urban areas. In the United States, Baum-Snow (2007) conducted a study investigating the impact of the interstate highway system, authorized in the Federal-Aid Highway Act of 1956, on some major metropolises. The construction of high-capacity roads to new suburban areas through existing Afro-American communities contributed to the decline and spatial isolation of these communities within cities as a result of *redlining* policies.[1] At the same time, it facilitated the migration of White middle-class populations to suburban areas. Dmowska and Stepinksi (2018, 2019) evaluated the long-term consequences of these policies by analyzing the spatial patterns of residential racial segregation in 41 American cities from 1990 to 2010. Interestingly, urban segregation extends beyond physical spaces. Morales et al. (2019) analyzed interactions on Twitter/X among urban residents across diverse European and American cities. Their findings demonstrated that the physical segregation of

[1] *Redlining* is a discriminatory practice of withholding services, particularly financial, in neighborhoods labeled "risky" due to high minority and low-income populations. This practice began in the United States with housing programs from the 1930s New Deal and initially targeted areas where Black residents lived.

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some communities extended into the virtual space, visible through their online interactions and the diverse topics discussed.

Koramaz (2014) also investigated spatial aspects of urban segregation in Istanbul. She observed that social groups with lower levels of structural integration, particularly in the job market and education system, tend to reside in informally developed residential areas with poor environmental quality. Conversely, groups with higher levels of structural integration live in formally developed areas with optimal public services and environmental conditions. Beyond residential segregation, Legeby (2010) confirmed that the structure and layout of public spaces in Swedish cities also play a role. Bakker et al. (2019) analyzed large volumes of cell phone data to examine the social integration of Syrian refugees in Turkey. They found that refugees in Istanbul lived in more integrated neighborhoods compared with those living in less populated regions. Moreover, regions like southeastern Anatolia showed a higher positive correlation between refugee employment and their interaction with locals, indicating a potential relationship between job opportunities and social integration.

Quality of Life and Livability

Quality of life represents a dimension that can be complex to estimate as it depends on various factors. Dubois and Ludwinek (2014) compared quality of life in both urban and rural Europe by examining a spectrum of factors, encompassing subjective elements like life satisfaction and more objective metrics such as living conditions, material deprivation, trust in institutions, and social exclusion. Their research highlighted significant disparities in the perception of various indicators based on the place of residence. Residents in urban areas within some of Europe's wealthiest countries (e.g., France, the United Kingdom, or Germany) showed higher rates of social exclusion and dissatisfaction with their living conditions and accommodation compared with their rural counterparts. Conversely, in other Northern and Eastern European countries (e.g., Denmark, Finland, and Romania), opposite findings were observed.

A significant dimension in quality of life pertains to individual perceptions of happiness. Burger et al. (2020) discovered that, on average, urban populations tend to be happier than rural ones. They attributed this perception to factors such as higher living standards, higher access to diverse activities and services, and better economic prospects, particularly for individuals with higher educational attainment. Similarly, Leyden et al. (2011) highlighted that key factors contributing to this perception include physical accessibility, affordability, and a wider array of cultural and recreational amenities.

The correlation between urban form and quality of life has been a subject of examination in various recent studies. Residents in suburban areas of sprawling cities experience longer commuting times and often display lower subjective well-being (Clark et al. 2020; Stutzer and Frey 2008). Sapena et

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al. (2021) conducted an analysis of the spatial structures of 31 cities in North Rhine-Westphalia, Germany, revealing a significant correlation between the spatial structure (e.g., compactness, spatial distribution, and fragmentation of built areas) and quality of life indicators. Venerandi et al. (2018) found that the most deprived neighborhoods in the six major UK conurbations commonly exhibited higher population densities, larger areas of undeveloped land, an increased prevalence of dead-end roads, and more uniform street patterns. This observation aligns with a recent report from the Economist Intelligence Unit (EIU 2022) that ranked the most livable cities globally, where notably, none of these cities showcased a highly regular urban network. Mumford (1961) offered a compelling perspective, suggesting that American gridiron plans, designed for efficient car traffic, lacked differentiation between main arteries and residential streets. This oversight potentially prioritizes car traffic over sustainable transportation modes, potentially impeding social interactions among urban residents.

Health

According to the U.S. County Health Rankings, rural residents are more likely to have higher rates of obesity, sedentary behavior, and smoking habits, along with higher risks of various health issues such as diabetes, heart attacks, and high blood pressure (University of Wisconsin Population Health Institute 2022). Conversely, urban dwellers face greater exposure to air pollution, exhibit higher rates of sexually transmitted diseases, and are more prone to excessive alcohol consumption. Additional studies indicate higher likelihoods among urban dwellers to experience mental illnesses and depression (Fauzie 2015).

Effective urban design can affect the physical and psychological health of urban residents (Mehta 2014), especially benefiting active older adults. The presence of green spaces in cities correlates with lower morbidity by promoting physical activity, aiding psychological relaxation, and stress reduction (Braubach et al. 2017). The integration of more green spaces into urban streetscapes has been associated with better mental health and higher social cohesion among city residents (de Vries et al. 2013). Moreover, the structure of tree canopies contributes to mitigating traffic pollution, noise, and heat-related stress (Fisher et al. 2022; McDonald et al. 2020).

Urban form influences residents' health, though with some ambiguity. Compact cities may initially appear dense, potentially leading to traffic congestion and higher pollution levels. Many authors argue, however, that this model enhances efficiency concentrating and mixing land uses, fostering economic diversity, reducing work–home commutes, and encouraging sustainable transportation modes like public transit, cycling, and walking. This approach diminishes car usage and pollution levels substantially (Mansfield et al. 2015).

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Crime and Safety Perception

Studies like Parkinson et al. (2006) commonly uphold the belief that crime rates tend to be higher in cities, predominantly concentrated in the most deprived neighborhoods. Labbrook (1988) conducted a study in Japan, suggesting that higher urban crime rates may be attributed to various demographic factors. These factors encompass quantitative aspects, such as higher population densities and growth rates, as well as qualitative factors, such as younger populations and higher immigration. Interestingly, although crime rates are generally higher in cities, they do not necessarily escalate in direct correlation with city size (Oliveira et al. 2017).

Understanding criminal patterns relies on urban design factors. Kimpton et al. (2016) showcased a negative correlation between crime rates and green spaces. Their study highlighted that the existence of green spaces, at both micro and macro levels, is linked to lower crime rates. This trend is observable on a global scale, even in areas known for high crime rates, such as South Africa. Venter et al. (2022) observed that for every 1% rise in overall green space within urban settings, there was a corresponding decrease of 1.2% in the rate of violent crime.

Various studies have juxtaposed real crime rates with perceptions of safety, investigating the impact of built environments. For example, Zhang et al. (2021) scrutinized streets in Houston by comparing officially reported crime rates to safety perceptions via Google Street View imagery. Their results revealed intriguing paradoxes: places with elevated daytime activity seemed safer than perceived, whereas those with increased nighttime activity were perceived as more hazardous.

Mapping Context

Throughout this chapter, we have explored the intricate relationship between urban form and social behavior by synthesizing insights from various papers covering diverse social behavior topics. Some studies base conclusions on limited datasets or confined areas, whereas others speculate on the impact that urban forms have on social behavior. Notably, most emphasis focused on examining how urban morphology influences social behavior, thus revealing a research gap in investigating the reciprocal relationship and prompting the need for further exploration in future studies.

The proliferation of big data has ushered in a wealth of building-level and individual-level information, providing a robust framework for understanding the bidirectional relationship between urban form and social behavior (Balsa-Barreiro et al. 2018). Individual-level data facilitate the reconstruction of mobility patterns, purchase behavior, and social interactions in both physical and virtual spaces, gathered at high frequencies across extensive populations. To

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derive meaningful insights into human behavior, managing aggregated data becomes crucial, ensuring the confidentiality and privacy of information (Carballada and Balsa-Barreiro 2021; Hardjono et al. 2019). Concurrently, the extraction of building-level data offers a spectrum of variables and indicators pertinent to urban forms. Table 8.2 outlines various data sources and technologies utilized for data collection at both individual and building levels.

Conclusions

Cities are expanding rapidly and evolving into the predominant dwelling for the global populace. Future projections underscore a heightened inclination toward urban lifestyles in the forthcoming decades. As we confront substantial global challenges, cities will bear a considerable impact, underscoring the critical necessity to delve deeper into the underlying factors influencing urban

Table 8.2 Sources and information technologies for data collection related to social behavior at the individual level (I-L) and urban forms at the building level (B-L). P: physical space; V: virtual space.

Level	Data Source	Information	Data Description	Scope
I-L	Mobile phones	Call detail records Apps (profile, type)	Social/communication/mobility patterns Social/purchase behavior	P/V P/V
	Social networks	Interactions	Social patterns	P/V
	Personal wearables	Various	Social/health patterns	P/V
	Crowdsourcing	Volunteer data	Social/communication/mobility patterns	P/V
	Banking	Credit card transactions	Purchase behavior	P
	Mobility services	GPS traces	Social/mobility patterns	P
	Surveys	Experimental	Social/communication/mobility patterns	P
B-L	Aerial imagery	Imagery	Urban form/greenery	P
	Remote sensing imagery	Imagery	Urban form/greenery	P
	Laser scanner	Point cloud	Urban form/digital elevation models	P
	Cadastral plans	Thematic data	Urban form/building heights	P
	Official reports	Thematic data	Urban form/household data	P
	Census	Socioeconomic data	Household data	P
	Historical maps	Thematic data	Urban form	P
	Photogrammetry	Imagery/point cloud	Urban form/digital elevation models	P

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functionality and their interconnectedness with human behavior. Nonetheless, the intricate nature of cities, entangled within a web of multifaceted elements, leaves numerous inquiries and uncertainties unaddressed.

This chapter explored the intricate dynamics between urban morphology and social behavior. To achieve this, we analyzed pivotal aspects of both fields and conducted an in-depth literature review focusing on social aspects influenced by city configurations. Our exploration spanned human cooperation and altruism, human mobility, social interactions, social integration, quality of life and livability, health, and crime and safety perception.

The primary goal was to establish a comprehensive framework that facilitates a holistic understanding of the reciprocal relationship between urban form and social behavior. This study caters to a broad spectrum of interests across multiple disciplines, from urban planning to social sciences. The implications of our findings hold substantial significance for experts and policy makers, offering insights crucial for the development of future cities that prioritize sustainability and efficiency.

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