

Study on Human Factors and Micro-spatial Behavior in New Urbanism

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Abstract: This study aims to comprehensively explore, from an interdisciplinary perspective, how human factors such as physiological, psychological, cultural, and social aspects influence micro-spatial behavior under the concept of New Urbanism. The results indicate that these factors not only shape micro-spatial behavior within the New Urbanist environment but are also influenced by the principles of New Urbanism. These principles include walkability, mixed-use diversity, the importance of public spaces, and human-centric architecture, which further enhance the impact of human factors. Furthermore, the research emphasizes that integrating human factors into urban design can create more inclusive, dynamic, and appealing urban spaces, thereby effectively improving the quality of urban life.

Keywords: New Urbanism, Human Culture, Micro-Spatial Behavior.

1. Introduction

In contemporary urbanization processes, environmental design has become a critical component of urban planning and community development. Faced with the challenge of creating urban environments that satisfy material needs while respecting humanistic values, the concept of New Urbanism has emerged. As a modern urban design philosophy, New Urbanism emphasizes a people-centered approach and promotes the diversity and integration of urban environments [1], aiming to create high-quality public spaces that balance environmental and humanistic needs. As Dupré (1995) noted, the principles of New Urbanism prioritize human scale and needs, offering a new perspective for environmental design.

Human factors encompass various dimensions, including cultural, social, economic, and political aspects, shaping behavioral patterns and activity habits [2]. These factors manifest in individual and community needs, values, cultural practices, and behavioral patterns (Lynch, 1960). In environmental design, the influence of human factors on micro-spatial behavior cannot be overlooked. For instance, cultural customs and beliefs may affect how people use and perceive spaces; social relationships and networks might determine mobility paths and gathering spots; economic conditions and resources may influence residential choices and activity ranges. However, further investigation is needed to concretize these human factors in micro-spatial behavior, such as understanding how people choose walking paths, select resting spots, and interact with others and their environment in public spaces like plazas.

This study adopts New Urbanism as its theoretical framework to explore the role of human factors in environmental design and analyze how they influence micro-spatial behavior. Through theoretical analysis and case studies, it demonstrates how human factors shape micro-spatial behavior and how environmental design can address humanistic needs. The primary objective is to elucidate the mechanisms through which human factors affect micro-spatial behavior, aiming to enhance the human-centered quality of environmental design. It is hoped that this research will provide theoretical guidance and practical references for

urban planners and designers, offering new perspectives and insights for the future development of New Urbanism-inspired environmental design.

2. Literature Review

2.1. The Concept of New Urbanism and its Impact on Environmental Design

New Urbanism, an urban planning and design philosophy, emerged in the late 1980s as a response to the intensifying urbanization processes, introducing a new approach to understanding and designing cities [3]. Its development is fundamentally a reflection on the issues of excessive urbanization and expansion from the 1950s to the 1970s. Driven by industrialization and motorization, cities expanded on a massive scale, resulting in the phenomenon known as "suburbanization" [4]. However, excessive urban expansion imposed tremendous pressure on the environment and triggered socio-economic challenges such as traffic congestion, housing shortages, and community fragmentation.

To address these issues, New Urbanism advocates against the excessive segregation and mechanization of cities, proposing an organic and integrated view of urban spaces to meet diverse human needs. It places human scale and quality of life at the center of urban planning and design, emphasizing walkable mixed-use spaces, human-scale public areas, and diverse urban forms. New Urbanism promotes a people-centered philosophy, prioritizing walking, cycling, and public transportation. It seeks to encourage walking and cycling through mixed-use developments and controlled block sizes, fostering community interaction and enhancing urban vibrancy.

Additionally, New Urbanism respects history and the environment, values public spaces and civic participation, and aims to improve urban living quality through better environmental design. Since the 1990s, New Urbanism has been widely applied and promoted globally. Cities such as Cascadia in the United States, Vauban in Europe, and Singapore have successfully implemented the principles and strategies of New Urbanism, achieving significant results.

Overall, New Urbanism is a human-centered and

environmentally friendly urban planning philosophy. Its evolution reflects a deep societal concern for urban spatial quality and sustainability, offering a crucial theoretical and practical foundation for understanding and applying human factors to influence micro-spatial behavior.

**Impacts of New Urbanism on Environmental Design
Urban Scale and Form:**

New Urbanism adheres to a human-centered urban design philosophy, addressing the diverse needs of living, working, and recreation. It emphasizes the importance of urban spatial scale and form in design to create walkable and socially engaging environments while ensuring spatial legibility and comfort. For instance, blocks should be designed to be compact and walkable; public spaces should be rich and diverse to meet social and recreational needs. Additionally, architectural designs should harmonize with streets and public spaces to create a coherent and consistent urban image.

Mixed-Use Design:

The mixed-use principle of New Urbanism has profoundly influenced environmental design by integrating residential, commercial, and leisure functions within urban spaces. This approach enhances urban vibrancy, diversity, and the fulfillment of residents' multifaceted needs. Moreover, New Urbanism emphasizes human-scale, distinctive architectural designs that prioritize pedestrian comfort, perceptual

experience, and the adaptability of buildings to their surroundings. These principles aim to strengthen urban identity, continuity, and the cohesion between buildings, streets, and public spaces.

Public Space Design:

New Urbanism places a strong emphasis on the design and utilization of public spaces, elevating their significance in environmental design. Public spaces such as plazas, parks, and sidewalks are regarded as essential venues for community life, promoting social interaction and fostering community cohesion and vibrancy.

Sustainability:

The sustainability principles of New Urbanism have significantly influenced environmental design. These principles promote environmental protection and sustainable development through measures such as improving urban green infrastructure, enhancing energy efficiency, and minimizing environmental impacts.

In summary, New Urbanism has profoundly reshaped the understanding of urban design, providing new perspectives for integrating human factors into micro-spatial behavior. These influences not only redefine urban design but also offer innovative approaches to addressing human needs within environmental design frameworks.



Fig. 1 Design by author

2.2. Theoretical Background of Micro-Spatial Behavior

Micro-spatial behavior is a significant subfield of human behavior research, focusing on patterns and interactions in specific environments, such as walking, pausing, conversing, observing, playing, working, and shopping [5]. It holds a central position in environmental design because it addresses people's spatial needs and expectations and how they perceive these spaces. By observing and understanding micro-spatial

behavior, designers can more accurately cater to people's needs, enhancing their quality of life and well-being. For example, studying behavioral patterns can reveal preferences for public space usage, such as where individuals choose to pause, what activities they engage in, and how they interact with others.

The theoretical foundation of micro-spatial behavior primarily originates from disciplines like environmental psychology, geography, and sociology [6]. From the perspective of environmental psychology, studies emphasize

the impact of the environment on human behavior, cognition, and emotions. For instance, Proshansky, Ittelson, and Rivlin's (1970) "environmental cognition" theory explains how spatial environments shape behavior and cognition, subsequently influencing spatial behavior. From geography, Hägerstrand's (1970) "time geography" provides a framework for studying micro-spatial behavior, suggesting that spatial behavior is constrained by time and space, which in turn affects activity choices and patterns. Sociology offers insights into how social interaction and structures influence micro-spatial behavior, as demonstrated by the "dramaturgical theory," which highlights the role of social interaction in shaping spatial behavior. These theories construct a framework for understanding how human factors influence micro-spatial behavior, forming the basis for this study's exploration.

2.3. Definition and Characteristics of Human Factors

Before delving into how human factors influence micro-spatial behavior within New Urbanism, it is essential to define the term. Human factors, also known as human-centered factors, are a multidisciplinary field focusing on the interactions between humans, environments, and systems [7]. In the context of environmental design and urban planning, human factors encompass human behavior, needs, preferences, and psychological responses, which influence spatial behavior and design.

Specifically, human factors include the social, cultural, and psychological elements that shape people's lives and behaviors, such as needs, expectations, values, beliefs, habits, social relationships, identity, and psychological states. These factors are crucial for understanding and designing environments, as they determine how spaces are used and perceived, along with the satisfaction and well-being of individuals. For instance, community participation may enhance residents' sense of belonging and satisfaction with public spaces, cultural heritage can strengthen spatial identity and continuity, and mental health status may affect behavior and perceptions, impacting quality of life.

Human factors are a complex and interwoven set of elements, including physiological traits, psychological states, cognitive abilities, socio-cultural backgrounds, educational experiences, personal values, and attitudes. In the context of architecture and urban design, human factors often refer to people's needs, expectations, behaviors, perceptions, and reactions, which play a central role in the design process.

2.4. How Human Factors Influence Environmental Design and Micro-Spatial Behavior

The influence of human factors on environmental design and micro-spatial behavior is multidimensional and complex. Broadly defined, human factors include cultural, social, economic, educational, and habitual elements that affect individual and group spatial usage patterns. These factors can be categorized into four main groups:

Physiological Factors:

These include age, gender, and health status, which directly impact preferences for spatial dimensions, colors, lighting, sound, and materials. For example, visual, auditory, and

tactile characteristics influence people's perceptions and reactions to different colors, brightness levels, sound intensities, and textures. Body dimensions, shapes, and physical abilities affect how individuals perceive and interact with spatial size and layout.

Psychological Factors:

Psychological states, perceptions, and preferences influence emotions and cognition, shaping how people understand and evaluate environments. For example, optimistic individuals may have more positive evaluations of the same environment compared to pessimistic individuals. Emotions, motivations, and cognitive capacities affect how spaces are interpreted and used [8].

Cultural Factors:

Cultural background and values shape lifestyles and behavioral norms, influencing spatial acceptance and adaptation. For instance, Eastern and Western cultures may have distinct understandings of space and privacy.

Social Factors:

Social status and roles influence behavior and interaction patterns, shaping spatial usage and enjoyment. Social structures, cultural values, beliefs, and customs affect spatial interpretations and usage habits.

These factors are interconnected and collectively shape people's comprehensive perception and usage of environments. Understanding and applying these factors is critical for designing spaces that meet diverse human needs and improve micro-spatial behavior.

Incorporating human factors into environmental design addresses the physiological, psychological, cultural, and social dimensions of users' needs:

Physiological Needs: Design should provide appropriate facilities and services for people of different ages, genders, and health conditions.

Psychological Needs: Spaces should create a positive and comfortable atmosphere that satisfies aesthetic and harmony-related desires.

Cultural Needs: Designs should respect cultural diversity and accommodate the expectations of various cultural groups.

Social Needs: Environments should ensure fairness and inclusivity, offering equitable spaces for all social roles and statuses.

Environmental and temporal factors (e.g., climate, topography, seasons, and time of day) also significantly influence human behavior and decisions, necessitating their consideration in design.

New Urbanism emphasizes a people-centered approach, with human factors at its core, aiming to meet diverse needs through environmental design and enhance urban living quality. Its theoretical model suggests that human factors influence micro-spatial behavior in various ways while being shaped by New Urbanism's design principles. For example, human-centered design principles may amplify the impact of human factors on spatial usage, while mixed-use and public space principles promote cultural exchange and social activities, reshaping spatial behavior patterns. This indicates that the relationship between human factors and micro-spatial behavior is a complex network structure influenced by multiple factors and varies across different environmental designs.

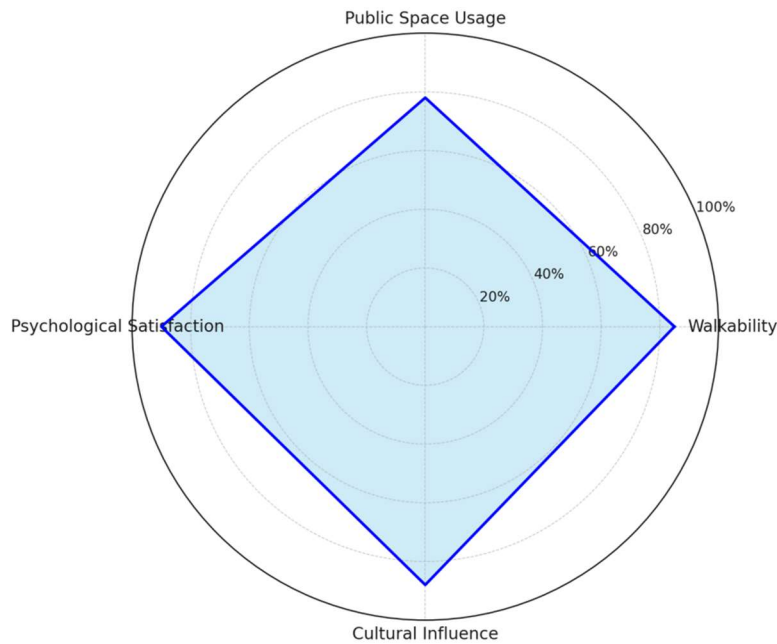


Fig. 2 Key Metrics of New Urbanism in Micro-Spatial Behavior

3. Theoretical Framework

3.1. Principles of Environmental Design in New Urbanism

New Urbanism presents a novel perspective in urban planning and design, offering significant insights for understanding and shaping urban spaces. It emphasizes human scale, community connectivity, and mixed-use functionality while opposing the segregation of functions and the excessive reliance on automobiles. The principles of environmental design in New Urbanism can be summarized into four key points:

Walkable Communities:

The core of the design prioritizes pedestrians and cyclists over vehicles to create a more human-centered urban environment.

Mixed-Use and Diversity:

New Urbanism advocates combining residential, office, and commercial spaces within the same community to foster more vibrant and dynamic urban environments.

The Importance of Public Space:

Public spaces are regarded as the core of the community, deserving emphasis and protection.

Human-Centered Architectural and Landscape Design:

Designs should cater to human scale and perception, creating comfortable and attractive environments.

These principles form the theoretical framework of New Urbanism, providing the foundation for this study to explore how human factors influence micro-spatial behavior under its tenets.

3.2. The Inevitable Connection Between Micro-Spatial Behavior and Public Space Design

German-American psychologist Kurt Lewin made significant contributions to understanding the interaction between human behavior and the environment. His 1951 formula $B=F(P,E)$ $B = F(P, E)$ profoundly influenced psychological research and found extensive applications [9]. This formula posits that behavior (BB) is a function of the interaction between the individual (PP) and the environment

(EE). It highlights the dynamic relationship between individual characteristics and the surrounding environment, indicating that behavior results not only from personal traits but also from environmental influences.

From an ecological perspective, individuals, behaviors, and the environment form an integrated system, with behavior serving as a critical element. Humans exist within this environment, both influenced by it and actively shaping it. Consequently, the relationship between humans and their environment is one of ongoing interaction.

Behavior is subject to individual control, and both physical spaces and abstract concepts such as social or cultural spaces can influence human behavior by guiding, encouraging, or obstructing it. Importantly, spaces are not passive backdrops for behavior but active entities shaped by human activities. Thus, the relationship between behavior and space is bidirectional. Appropriately designed spaces can enhance behavioral efficiency, underscoring the crucial role of design in influencing behavior and interaction patterns[10].

The complex relationship between space and behavior encompasses three main aspects:

Space-Induced Behavior: Certain spaces evoke specific behaviors.

Space-Facilitated Behavior: Proper design enhances desired behaviors.

Space-Inhibited Behavior: Poor design may obstruct or discourage certain behaviors.

Lewin's theory remains a valuable tool for understanding the intricate relationships among individuals, behavior, and the environment, explaining why specific spaces elicit specific behaviors due to their inherent inductive factors.

4. Conclusion

This study explores the impact of human factors on micro-spatial behavior within the context of New Urbanism environmental design. Findings highlight the centrality of human factors in shaping behavior, emphasizing their transformative influence on spatial design. New Urbanism excels in addressing diverse human needs, enhancing urban quality of life, strengthening community connections, and fostering inclusive and vibrant urban environments.

Human factors act as a "mediator" between environmental

design and micro-spatial behavior. While physical design may encourage certain behaviors, human factors significantly influence spatial perceptions and usage. Understanding these influences enables a comprehensive application of New Urbanism principles in practice.

New Urbanism calls for prioritizing human needs to enhance the human-centered design of urban spaces. Its principles promote the creation of "adaptive" spaces that can evolve based on human factors. A human-centered design approach is a hallmark of New Urbanism, aligning design with community needs and expectations.

Future research should explore the diverse dimensions of human factors to meet varying population needs and integrate them into New Urbanism to improve urban living quality, foster community development, and enhance sustainability. These findings offer fresh perspectives for understanding and applying New Urbanism in environmental design, paving new pathways for theoretical development and practical implementation. Future studies can build on this foundation to deepen and expand the topic, advancing the theory and practice of New Urbanism.

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