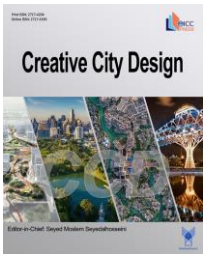

Volume 8, Issue 3, 082514 (1-14)

Creative City Design (CCD)

https://doi.org/10.57647/j.ccd.2025.0803.14

Formulating a Conceptual Framework for Behavior Resulting from the Perception of Participants in Behavioral Settings, with an Emphasis on Barker's Theory

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Review Article

Received:
25 November 2024

Revised:
10 January 2025

Accepted:
3 February 2025

Published in Issue:
30 September 2025

Abstract:

Aims: Environmental psychology has increasingly examined the subtle ways, in which perception influences human behavior in specific behavioral environments. This study builds upon Roger Barker's theory of behavioral regulation, particularly the concept of isomorphism, which highlights the coordination between the environment and behavior. The research aims to develop a comprehensive framework integrating sensory perception with behavioral regulation, analyze how multisensory dimensions shape human actions and emotions, and provide practical strategies for designing inclusive and sustainable urban spaces. By addressing the interaction between human needs, sensory landscapes, and environmental factors, this study bridges the communication gap between perceptual research and its practical implications for urban design.

Methodology: This study employs a systematic review methodology, evaluating 74 filtered sources from an initial set of 396 articles retrieved from Scopus and Google Scholar, along with 27 categorized articles from 110 research papers obtained from six Iranian academic databases, including SID and Civilica. The PRISMA framework was used to ensure methodological transparency, applying clearly defined inclusion and exclusion criteria such as relevance, recency, and citation credibility. The extracted data underwent qualitative content analysis to identify dominant themes, interpret patterns, and establish connections between perception and behavior in urban settings.

Findings: The findings highlight the crucial role of sensory perception comprising vision, hearing, touch, smell, and taste in shaping behavior and emotional responses in shared spaces. Spatial design factors, such as territoriality, inclusiveness, and environmental cues, play a major role in fostering social cohesion and user engagement. The study underscores how urban planning strategies can leverage sensory elements to enhance well-being and social interactions.

Conclusion: This research presents a conceptual framework outlining how environmental perception translates into behavioral responses, demonstrating the impact of sensory landscapes on urban interactions. By integrating sensory, spatial, and behavioral elements, the study offers a foundation for urban designers to create inclusive and sustainable environments. Future research should explore these dynamics in the context of technological advancements and evolving urban landscapes to develop innovative approaches for enhancing urban livability.

Keywords: Behavioral Settings, Ecological Psychology, Multisensory Landscape, Perception, Behavior

Cite this article: Sharifkazemi S., Farah H., Ghalambor Dezfuly M., Formulating a conceptual framework for behavior resulting from the perception of participants in behavioral settings, with an emphasis on Barker's theory, *Creat. City Des.* 2025;8(3):1-14 https://doi.org/10.57647/j.ccd.2025.0803.14

1. Introduction

Cities are vibrant ecosystems where sensory experiences shape how individuals interact and behave. Urban spaces have unique sensory fingerprints composed of sounds, sights, smells, textures, and tastes, all of which influence perception and actions. For instance, a bustling market evokes vibrancy through lively colors and sounds, while a serene park offers calmness through greenery and natural sounds. These sensory elements are pivotal in shaping emotional and behavioral responses in urban spaces. As Spence (2020) explains, the brain processes these inputs to form a unified perception of space. For example, tactile surfaces, calming auditory cues, and natural scents enhance user engagement and emotional well-being. Studies by Ebrahem et al. (2018) have shown that multi-sensory environments tend to be perceived as more immersive and affective, leading to stronger emotional responses from individuals. The design of collective spaces plays a pivotal role in shaping how people perceive and engage with them. Zhang et al. (2021) found that incorporating natural features such as greenery and water elements can reduce stress and foster relaxation, making spaces more inclusive and enjoyable. Spaces that encourage a sense of ownership and control, such as those with clear boundaries and flexible seating arrangements, make people feel more secure and comfortable [66]. This sense of belonging is vital for fostering positive perceptions of shared environments. Meanwhile, poorly maintained or concrete-dominated spaces can evoke discomfort and alienation, highlighting the importance of aesthetic and functional design. Soft edges areas that balance privacy and openness are essential for creating comfortable shared spaces. These semi-private zones allow individuals to control their level of social interaction, fostering feelings of safety and inclusion [12]. Spaces with features such as separated seating or lounge areas promote both solitude and interaction and are more welcoming to diverse users. The aesthetic qualities of spaces also significantly influence perceptions. Greenery, public art, and innovative architectural designs can evoke positive emotional responses, while poorly designed or neglected environments discourage social interaction. Zhang et al. (2021) demonstrated that natural elements in parks lead to heightened relaxation and positive feelings, emphasizing the importance of integrating such features into urban planning. Environmental psychology highlights the role of spatial design in shaping human behavior. Well-designed urban spaces promote social interaction and mental well-being, while overcrowded or noisy environments can create stress and hinder positive interactions [44]. Spaces that offer areas for personal retreat or reflection enhance mental well-being and lead to more favorable perceptions. Marginalized groups often face additional challenges in public spaces, including safety concerns or feelings of exclusion. Navarrete-Hernandez et al. (2021) and UN Women (2020) have emphasized the importance of designing inclusive spaces where all individuals feel welcome and safe. The balance between openness and privacy is crucial for collective spaces. Semi-private areas, such as transitional zones and flexible seating, create environments that are more inviting and adaptable to various needs. These considerations are particularly important for marginalized communities, who may perceive certain spaces as unsafe or inaccessible due to a lack of inclusivity or investment. In summary, urban spaces should integrate multisensory and inclusive design principles to create environments that foster positive perceptions, emotional well-being, and social cohesion. By combining sensory features with thoughtful spatial planning, cities can become more equitable and welcoming for all inhabitants. The methodology employed in this study was a systematic review of 506 sources, including English and non-English academic databases, filtered to 101 relevant studies. These sources span behavioral settings, sensory landscapes, and environmental perception. Using frameworks such as PRISMA ensures transparency and rigor in the data selection process, enabling this research to consolidate diverse insights into actionable strategies. Previous studies, based on Roger Barker's theory of environmental regulation and behavior (Synomorphy) and other related research in environmental psychology, have examined many aspects of the interaction between environment and human behavior. However, none of these studies have analyzed the processes of perception and behavior in an integrated manner, especially in relation to the multidimensional interaction between sensory landscapes and environmental perception. In summary, the primary aim of this study is to develop a comprehensive framework that integrates sensory perception with behavioral settings to analyze how multisensory dimensions shape human actions and emotions in urban spaces. By synthesizing theoretical insights and practical applications, the research provides strategies for urban planners, policymakers, and architects to design inclusive, adaptive, and sustainable environments that enhance well-being and social cohesion.

Literature Review

1.1. Core Concepts of Roger Barker's Environmental Psychology

Barker's primary contribution was the idea of behavioral settings, which are specific environments where particular types of behavior regularly occur. These settings are characterized by two key components: A. Physical environment: The tangible space and features (e.g., a room, a park, a street), B. Social environment: The roles and expectations that guide interactions within the space (e.g., a classroom, a community center). A behavioral setting is not just the physical space, but also the routine behaviors that occur within it. Barker emphasized that behavior is inseparable from the environment, meaning that human actions are deeply influenced by where they are, the time of day, and the social dynamics within the space [8]. One of Barker's key concepts was ecological validity, which refers to the idea that research in environmental psychology should reflect real-world settings. Barker was critical of laboratory-based psychology and advocated studying behavior in natural, real-life environments. This focus on ecological validity has become a central tenet of modern environmental psychology [11]. Proxemics and Territoriality: While Barker himself did not fully develop these ideas, his work

on behavioral settings inspired later researchers (such as Edward T. Hall and others) to explore how people use space. For example, Barker's work laid the groundwork for understanding concepts such as territoriality (how people claim and defend space) and proxemics (the study of personal space and spatial behavior) [27]. While Barker's research initially emphasized the influence of environments on behavior, he also recognized that there is a dynamic interaction between individuals and their environments. Environmental determinism (the idea that environments strictly control behavior) was never his position. Instead, Barker advocated a transactional view, where individuals and environments co-construct each other [33]. Barker often focuses on ecological psychology, which focuses on the relationship between people and the environment. This approach is rooted in the belief that people are always embedded within environments and that behavior can only be understood in its context. This is a significant departure from mainstream psychology, which has traditionally focused more on the individual in isolation [84].

1.2. Theoretical Foundations of Sensory Landscape

The term "sensory landscape" is grounded in environmental psychology, phenomenology, and human geography, which emphasizes the subjective experience of space. In environmental psychology, the sensory experience of the built environment is seen as a critical component in shaping human well-being, behavior, and interaction with urban surroundings. Researchers have long pointed out that cities are more than just visual landscapes; they are experienced through multiple sensory channels [83]. The sensory landscape concept has been specifically relevant in human geography, where it is understood that landscapes are shaped by both natural and cultural forces, and are perceived differently depending on individual and collective experiences. By considering how sensory experiences are culturally framed, urban spaces are seen as places where sensory stimuli—sounds, textures, smells, and tastes—carry symbolic, emotional, and functional meanings that contribute to the social fabric of the city [89]. Moreover, sensory landscapes can also influence the level of social interaction in urban spaces. In crowded, noisy environments, people tend to avoid prolonged interaction due to sensory overload. However, more tranquil spaces with calming sounds and visually appealing surroundings encourage social gatherings and collective activities, such as sitting on benches, chatting, or playing sports [101]. Auditory Landscape: The auditory dimension of the sensory landscape refers to the sounds that people hear in urban spaces. These sounds can range from the hum of traffic, the chatter of pedestrians, to the more subtle sounds of birds, wind, or water. The acoustic properties of urban spaces influence how people perceive safety, privacy, and even their sense of belonging [19]. Sound can define the character of a place; sounds of a busy street, for example, create a sense of activity, while the quietness of a park or residential neighborhood promotes relaxation and tranquility [77]. Olfactory Landscape: Olfaction relies on a range of top-down processes and is not, as previously assumed, a mere crude sensation devoid of cognitive load. On the contrary, according to olfactory science, a variety of top-down processes such as anticipation, attention, and rehearsal fundamentally shape not only the recognition of olfactory qualities, but also their hedonic evaluation [13]. Researchers of urban odor landscapes recognize that smell is not simply a biological and psychological sensation, but a cultural, social, and historical phenomenon [17]. Tactile Landscape: The importance of integrating tactile and other sensory experiences into urban green spaces is a key pillar for increasing people's psychological well-being. Tactile elements, such as textured surfaces and natural materials, combined with smells and sounds, improved stress reduction and vitality in diverse urban settings [69]. Additionally, multisensory approaches to urban environments emphasize how features such as smooth pavements or rough materials can significantly affect movement rhythms and emotional responses. This aligns with broader discussions on neuroarchitecture, which explore how physical textures and spatial designs influence cognitive and emotional well-being [37]. Visual Landscape: The visual dimension remains one of the most widely discussed aspects of urban sensory landscape. Visual elements such as architecture, public art, lighting, and landscaping contribute to the aesthetic quality of a place and how people experience and relate to it. The visual environment can impact one's mood, productivity, and sense of connection to the city. Research in urban aesthetics emphasizes the role of visual design in creating inclusive, accessible, and emotionally resonant spaces for people [47]. Gustatory Landscape: Taste, though often neglected in urban design, is an important aspect of the sensory landscape, particularly in cities known for their diverse culinary offerings. The presence of street food markets, restaurants, and cafes creates a vibrant gustatory landscape that not only contributes to the sensory richness of the urban environment, but also serves as a medium for social interaction and cultural exchange. The taste experience is often linked to the aromas that pervade public spaces and contribute to the overall atmosphere [104].

1.3. Perception of Collective Spaces: A Contemporary Understanding

Collective spaces serve as the stage for human interaction, activities, and cultural expression. Perception of these spaces is shaped by sensory experiences, cognitive processes, and behavioral patterns. As people engage with their environment, they interpret urban spaces based on both tangible elements, e.g., architecture, and intangible factors such as cultural associations [24]. These spaces are often seen as places that foster social interaction. The perceived success of these spaces depends largely on how they facilitate meaningful interactions among users. The perception of a collective space is closely tied to its ability to promote inclusivity and community engagement. Spaces that are designed to be open and welcoming tend to foster social cohesion [53]. For example, research has explored how women's safety concerns and intersectionality affect their use of public spaces. Cultural expectations around gender roles, socio-economic status, and other identity markers shape how individuals interact with such spaces. Additionally, cultural norms around socializing, leisure, and political engagement further influence how public spaces are perceived and valued. In

some cultures, parks are primarily social spaces, while in others, they serve as areas for relaxation or even political activities. These insights align with urban studies and research on environmental perception, such as studies on how cultural norms impact our behavior in public spaces [38]. The design of collective spaces plays a pivotal role in shaping how people perceive and engage with them. One key aspect of design is the concept of "territoriality," how individuals claim and defend space. People are more likely to feel comfortable in spaces that are designed to encourage ownership, even in shared environments. Spatial layouts allow people to have a sense of control, such as clear boundaries, flexible seating arrangements, and areas for both solitude and social interaction. These elements contribute to a sense of security and belonging, which are vital for positive perceptions [46]. Human behavior not only responds to urban design, but also shapes how spaces are perceived over time. This dynamic relationship underscores the importance of considering behavioral patterns in urban planning. Place attachment refers to the emotional bonds individuals form with specific locations. High levels of place attachment are associated with increased civic engagement and a sense of belonging [76].

1.4. Behavior Resulting from Perception

Perception is the process by which individuals organize and interpret sensory information to make sense of their environment. It is not merely the passive reception of stimuli, but an active construction based on prior knowledge, expectations, and cognitive processes. Social perception is a subset of perception that involves interpreting and making judgments about others. In a behavioral environment, the way individuals perceive their peers, managers, or subordinates can significantly influence their actions [26]. This subjectivity in perception leads to differences in how people behave in similar environments. For instance, one employee may perceive a colleague's behavior as supportive, while another may view it as patronizing. Such perceptual differences influence how individuals respond and behave in organizational settings [71]. Human behavior in urban environments is significantly influenced by perceptual processes, where sensory experiences shape spatial understanding and behavioral responses, ultimately affecting place identity and social interactions [49]. For example, the presence of benches, greenery, and open spaces encourages gatherings and casual interactions, which are critical for building social capital [97]. Human behavior not only responds to urban design, but also shapes how spaces are perceived over time. This dynamic relationship underscores the importance of considering behavioral patterns in urban planning. Place attachment refers to the emotional bonds individuals form with specific locations. High levels of place attachment are associated with increased civic engagement and a sense of belonging [76]. The behavior of others significantly influences individual perceptions of urban spaces. Crowded environments can evoke feelings of vibrancy or discomfort, depending on the context. For instance, a lively market may be perceived positively, while overcrowded public transportation may elicit stress [55]. Post-pandemic urbanism has further spotlighted the role of public spaces in facilitating human connection and promoting mental well-being. According to Mehta & Mahato (2021), urban design must prioritize inclusivity, allowing for diverse age groups and socio-economic classes to engage with spaces comfortably. This inclusivity is essential for fostering belonging and mitigating urban alienation. Technological advancements have transformed urban behavior, particularly through the proliferation of smart cities and digital platforms. Apps for navigation, mobility, and social networking redefine how residents interact with urban spaces. Townsend (2013) asserts that digital technologies enhance urban efficiency, but also raise concerns about privacy, surveillance, and equitable access. Moreover, the integration of artificial intelligence (AI) into urban management is reshaping behavioral norms. Smart surveillance systems, for instance, aim to enhance safety, but may inadvertently alter public behavior by fostering feelings of being watched, thus affecting spontaneity and freedom in public spaces [103].

2. Methodology

To achieve the research objectives, this study used a systematic review method of documents and previous studies, which is considered qualitative research in nature. The review research method is a systematic process for synthesizing the existing literature on a specific topic, aiming to summarize, evaluate, and integrate findings from previous studies. Unlike original research that generates new data, the review method relies on analyzing and interpreting data that already exists. This method plays a crucial role in academic research by providing a comprehensive understanding of a topic, identifying gaps in knowledge, and suggesting future research directions. Review research serves several vital functions in scientific works; first, it consolidates and organizes vast amounts of data into a coherent structure, making it easier for researchers, policymakers, and practitioners to access critical information. By synthesizing findings from multiple studies, review research also helps in highlighting trends, patterns, and discrepancies within the literature [45]. Moreover, review research is essential for identifying research gaps. By reviewing the existing body of knowledge, researchers can pinpoint areas that have been underexplored or inconsistently studied. This is crucial for guiding future research efforts and ensuring that resources are directed toward unresolved issues [16]. While review research provides valuable insights, it is not without its challenges. One common challenge is the volume of literature available. The sheer number of studies can make it difficult to conduct a comprehensive review, especially when studies use varied methodologies, populations, and outcome measures [28]. Another challenge is the potential for heterogeneity in study designs. Studies in the same field may use different research methodologies, which can make it difficult to compare results directly. In these cases, a meta-analysis may not be feasible and a narrative review or qualitative synthesis might be more appropriate [36]. This systematic review methodology revealed significant insights into how sensory perception influences human behavior in shared spaces, forming the foundation for

actionable recommendations in urban design and planning. By integrating diverse data sources and applying robust quality assessment techniques, the study ensures a comprehensive and credible exploration of the interplay between sensory dimensions and behavioral settings. The data collection process involved both international and national databases. Specifically, articles were retrieved from Scopus and Google Scholar alongside six prominent Iranian academic databases, including SID, Civilica, IranDoc, Noormags, Ensani.ir, and Elmnet. The inclusion criteria required studies to focus on behavioral settings, sensory landscapes, and perception of environment. Studies irrelevant to these themes or duplicates were excluded. Through a multi-phase filtering process, an initial pool of 1916 articles from Scopus and 263 from Iranian databases was narrowed down to 238 primary sources for detailed analysis. This process adhered to the PRISMA framework, ensuring methodological transparency and replicability. Figure 1 illustrates the PRISMA flowchart, which documents the inclusion and exclusion stages, highlighting the rigor of the review process.

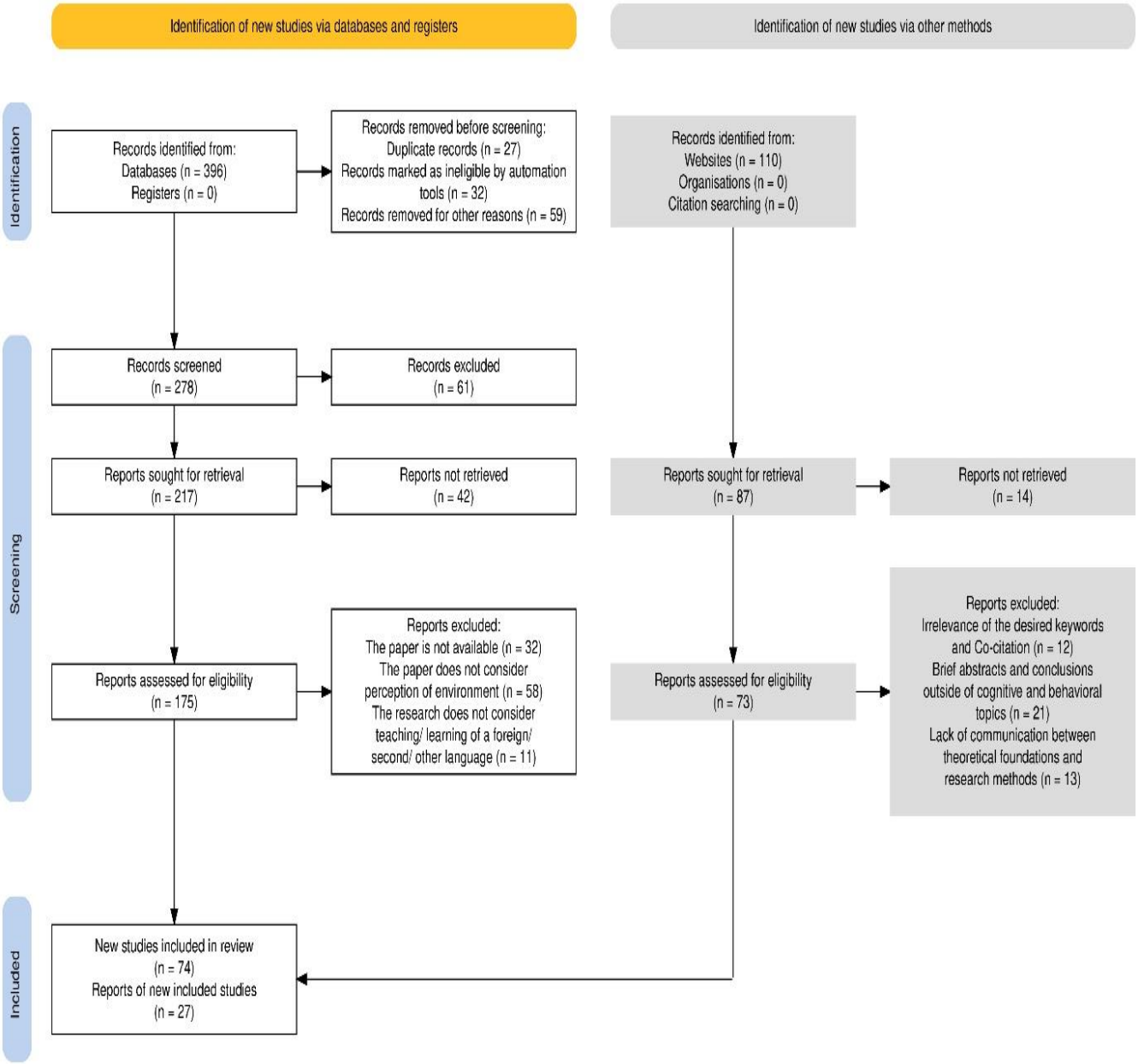

Figure 1. The process of exploring and categorizing studies using Prisma

3. Finding

Given the nature of the research, which employs a systematic review method to achieve its primary goal of formulating a structured framework for the process of perception influencing individual and collective behaviors in space, it is necessary to extract perceptual and behavioral components and criteria from previous studies. However, in the initial step, identifying research gaps in these documents is the most critical step that can serve as a foundation for clarifying the primary objective. Table 1 provides a list of sources utilized in this research for this purpose. These analyses and studies form the core thoughts and trends in the research process, shaping the main findings of the study and guiding the refinement of the conceptual framework to be inferred.

Table 1. The most important concepts deduced from previous research

	Author/Authors	Year	Example of applications, goals or inferential concepts
1	[57]	2023	Sensory experiences boost place attachment and commercial stability. Comparing bazaars and malls reveals memorability and contentment as key, with bazaars prioritizing identity and malls, security.
2	[60]	2023	Urban development fragments ecological landscapes. This study uses a modified Gravity model and GIS network analysis to propose ecological corridors in northeast Tehran, prioritizing them based on cost, impedance, and core patches to enhance urban ecological connectivity.
3	[48]	2023	This eye-tracking study examines gender differences in visual perception of the landscape in Mizumoto Park, finds eye movement patterns and element preferences, and informs gender-sensitive park design.
4	[40]	2022	Improving urban space design, promoting desirable citizen behaviors, examining environmental impact on behavior, providing design solutions; Statistical analysis of collected data (Friedman test, Pearson's correlation, regression); Correlation between physical environment and citizen behaviors;
5	[93]	2022	Investigating how demographic factors and COVID-19 affect the perceived restoration of urban spaces (green, exhibition, commercial, sports) using the perceived restoration scale and inferring green spaces as the most restorative perceived factor
6	[41]	2022	The perception of soundscapes in virtual reality is evaluated using different visual reproduction methods. They analyze perceptual indices and descriptors to assess how visual context affects the perception of sound and scenery in urban environments, using the virtual reality technique.
7	[2]	2022	Unity of body and soul in the embodied experience; Connection between perception and reality in ontological encounters; Integration of feeling and environmental meaning to define a place;
8	[34]	2022	Reducing crime/delinquency in urban areas, enhancing citizen security, settlement empowerment model addressing physical/psychological issues. Correlation between physical environment and perceived insecurity
9	[81]	2021	Using observational data, it finds a correlation between green spaces and increased social interaction, suggesting design strategies for promoting community engagement.
10	[35]	2021	They analyze contemporary landscape definitions via content analysis, proposing a comprehensive definition based on the perceptual relationship between perceiver and perceived environment, linked continuously and yielding objective-subjective products.
11	[75]	2020	Landscape perception stems from sensory interaction with the environment and its rational interpretation. Analyzing this process and influential factors (senses, cultural, individual) enhances landscape experience and responsiveness.
12	[31]	2019	Analyzing behavioral patterns and the impact of physical quality and land uses by library and field methods (observation and filming) and examining the impact of environmental characteristics on pedestrian behavior in urban spaces with a focus on square space.
13	[6]	2020	They investigate how social interactions influence urban pedestrian behavior using space syntax, observation techniques (gate counts, snapshots, traces, following), and ArcGIS, revealing the impact of built environment quality on personal behavior.
14	[52]	2020	This study argues social structures are interconnected networks of collective control used to stabilize physical and cultural environments. Social change arises from individuals' attempts to reorganize perceptions they cannot satisfactorily control within these environments.
15	[63]	2019	Evaluation of urban space in terms of spatial perception using cognitive maps, spatial syntax, aesthetic criteria, visibility, and cognitive-emotional factors.
16	[87]	2019	It explores how language and culture influence perception and its control, analyzing the relationship between these factors, and power and politics.
17	[64]	2018	Analyzing pedestrian behavior, defining permeable behavioral domains, minimizing urban barriers, enhancing social presence via diverse activities, integrating functional, spatial, and cultural dimensions, and observing user-environment interactions.
18	[68]	2018	Sensory experiences in tourism are multifaceted. While visual aspects are traditionally emphasized, auditory and other senses contribute significantly to a richer, more immersive experience, varying by individual preference and context.
19	[50]	2018	Examining citizens' behaviors in parks based on gender, age, and socioeconomic characteristics shows that socio-psychological, physical-structural, economic, and environmental factors are recognized as factors affecting social behaviors in urban green spaces.
20	[22]	2017	Steven Holl uses parallax in architecture, blending sensory perception with dynamic spatial movements, emphasizing vertical, diagonal shifts for enriched experiences.

	Author/Authors	Year	Example of applications, goals or inferential concepts
21	[79]	2017	Strong risk perception correlates with better environmental awareness and earthquake behavior; contextual interventions enhance both perception and preparedness.
22	[5]	2017	Merleau-Ponty's phenomenology, with its emphasis on the perception of the embodied subject, examines human experience in cyberspace, finding meaning and intersubjective interactions in this space, despite physical limitations.
23	[101]	2017	A systematic review of the literature on how sensory experiences influence consumer creativity and on testable hypotheses to stimulate further research in the emerging field.
24	[43]	2015	Urban growth has prioritized physical development over psychological impacts. Visual factors influence behavior, leading to design recommendations for improving visual environments and behavioral changes.
25	[51]	2016	This study uses behavior mapping (stationary, tracking, tracing, territorialization) across three seasons at Zrêbar Lake waterfront to assess user satisfaction. Findings reveal dissatisfaction due to limited seating, short visit durations, lack of diverse activities, and inadequate design for various age groups.
26	[29]	2015	Providing social interaction spaces (e.g., women-specific bus stops), child-friendly areas, mixed-use development, vibrant street life, improved public spaces, social surveillance, and connected urban nodes.
27	[1]	2014	A multisensory approach to investigating sensory experiences such as taste and smell on individuals, tourists, and users of the environment.
28	[86]	2013	Smoking and its olfactory impact in urban environments are explored, including its influence on social policies, behavioral norms, and the public's perception of urban spaces.
29	[20]	2012	It reviews behavioral settings theory, particularly Shogren's work, to define behavioral settings and their components (behavior patterns, environment, synomorphy), aiming to improve built environment analysis and design practices.
30	[84]	2011	Exploring landscape urbanism (design-centered) and urban ecology (science-based) and emphasizing the importance of "landscape ecological urbanism" as a combination to inform urban design and planning
31	[78]	2009	Iranian garden studies typically assume observer-garden independence or identity. This research uses an interactive, psychological approach to explore garden perception, meaning, mindfulness, solitude, and "environmental discontinuity-semantic attachment."
32	[39]	2008	Townscape perception, primarily visual, is influenced by time, motion (pedestrian/vehicular), and gradual variations. Landscape architecture principles can be achieved by evaluating townscape comprehension through expert-derived checklists of prominent design principles.
33	[67]	2008	Exploring ethnography as placemaking. Analyzing shared sensory experiences (walking, eating, etc.) to understand how ethnographers, through visualization, perceive and create ethnographic places.
34	[72]	2002	Sensory experience shapes our understanding of place. Individual perceptions, cultural influences, and the environment interact, making senses active participants in constructing geographical knowledge. Different societies and cultures perceive and interpret the world differently.
35	[18]	1956	This work explores designing psychological experiments that reflect real-world conditions, emphasizing the ecological validity of stimuli and the generalizability of results.
36	[85]; [32]; [102]; [23]		Developing a synomorphy-based model for collective settings, observing vibrant spaces' ecology, mapping behavior, analyzing structural links and synomorphy, evaluating physical-social interactions, and aligning designs with lived experience.
37	[74]; [42]; [58]		Philosophy of mind, epistemology, cognitive science; explanation of rational perception from the perspective of the experts and examination of the role of the body in perception. Comparative analysis of their philosophical texts; immateriality of reason, role of the body as an enabling condition, mind-body duality versus unity.
38	[4]; [97]		"Environment and Social Behavior" examines the influence of physical and social settings on human actions, focusing on privacy, personal space, territoriality, and crowding.
39	[8]; [9]; [10]; [11]; [14]; [15]; [7]; [70]; [91]; [59]		They have examined how real-world environments influence human behavior, introducing "behavior settings" as environment-behavior units with distinct behavioral patterns, specific time-space boundaries, and powerful influence on individual actions. It expands ecological psychology theories, focusing on person-environment interaction.
40	[17]; [98]; [95]; [94]		They have explored urban experience through a sensory lens, examining seescapes, soundscapes, smellscapes, tastescapes, and touchscapes to understand how individuals perceive and interact with the city. How to shape sensory experiences of perception when using urban space and categorize positive and negative spatial elements to improve urban design and satisfaction of environmental users

Urban spaces are not simply physical locations, but are imbued with meaning by the individuals who experience them. The way these spaces are perceived can vary greatly depending on one's background, cultural context, and personal experiences. Cognitive and emotional responses to the environment, such as the feelings of safety, comfort, or discomfort, are central to how urban spaces are interpreted and navigated. According to Alexander et al. (1977), urban spaces are designed to foster certain types of interactions and behaviors. For example, open plazas or squares may encourage social gatherings and spontaneous events, while enclosed alleyways may evoke feelings of danger or isolation [25]. Environmental psychologists such as Gibson (2014) have emphasized the importance of affordances, the perceived possibilities for action in the environment. How people perceive the affordances of urban spaces (e.g., spaces for walking, socializing, or resting) significantly impacts their behavior within these spaces. The relationship between sensory perception, individual experience, and time profoundly shapes behavior in urban space. Sensory perception acts as the immediate gateway through which individuals engage with their environment. Visual elements including architectural designs, signage, or lighting dictate movement and safety perceptions, while auditory stimuli, such as ambient noise or music, influence mood and spatial engagement. Smells and textures further evoke emotional and physical reactions, enhancing or deterring participation in the space. For instance, a bustling plaza's lively sounds and vibrant sights may encourage social interaction, while overwhelming noise or unpleasant odors may prompt avoidance. Individual experience injects subjectivity into these sensory interactions. Personal history, cultural background, and emotional states heavily influence how spaces are interpreted and utilized. A commuter might view a subway station as a functional transition zone, while a tourist sees it as a novel landmark, creating different patterns of behavior. Cultural norms and personal familiarity also dictate actions, such as social conduct or the choice to linger or move quickly through an area. Time adds a dynamic layer, transforming behavior based on rhythms and temporal context. Chronological patterns rush hours, weekends, or seasons shift the sensory and experiential relevance of spaces. For instance, a quiet park in the morning might become a hub of activity in the afternoon. Historical shifts in urban design further shape how spaces are perceived and used over time. Immediate interactions, such as responding to stimuli, contrast with longer-term patterns that establish habitual use. According to Figure 2, these dimensions are deeply interwoven. Sensory perceptions filter through individual experiences, which are then contextualized by time. Together, they create dynamic, adaptive behaviors in urban environments. Understanding this triadic relationship offers crucial insights into how urban spaces can be designed to support diverse and evolving human needs. There is a dynamic relationship between human needs, sensory perception, environmental stimuli, and behaviors resulting from the process of meaning creation. It highlights how sensory input such as visual, tactile, olfactory, auditory, and gustatory landscapes interact with spatial features (both constant and variable) and human activities to shape perceptions, experiences, and behaviors. This model aligns with contemporary theories of perception, which underscore the active role of sensory and cognitive processes in constructing our reality. Key elements include the interplay between "space features" and "human senses," which act as mediators for how people interpret their surroundings. These interpretations are informed by cultural and educational influences, highlighting the role of learned behaviors in perception. The role of "behavioral settings," such as social norms and physical conditions that regulate individual and collective behaviors, can be more prominent than all environmental factors. These settings enable the translation of human needs into variable and constant behavioral patterns, underscoring the cyclical nature of perception and action.

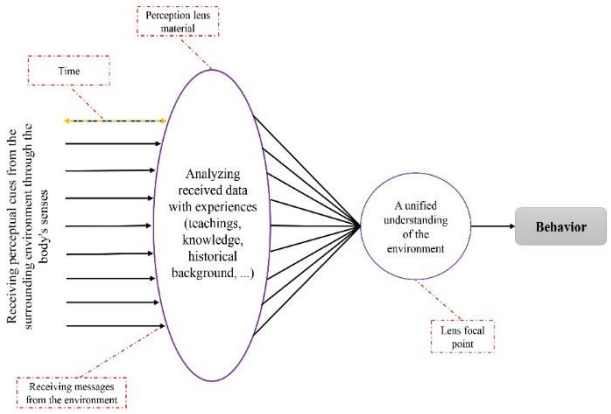

Figure 2. The three pillars influencing environmental behavior

The role of time in shaping human experience is important from two aspects: "when" meaning when a person is present in the environment and "how much time" meaning the amount of time spent in the behavioral environment. It influences how individuals perceive activities and cultural norms, shaping their behaviors over the long term. The model also resonates with findings in sensory psychology, where sensory processing, selection, and organization are foundational to interpreting environmental stimuli and guiding action [93]. This integrative approach is reflective of ecological models in psychology, where behavior is understood as an outcome of continuous interactions between humans and their environments [26]. By bridging sensory, spatial, and behavioral elements, the framework provides a robust foundation for understanding how environments shape human actions and how individuals adapt to them. At the core lies human needs, which are fundamental in driving interactions with spaces. Human behavior is influenced by the physical environment, with spaces offering different features (both constant and variable) that shape experiences. These spaces are categorized into constant features (e.g., architectural design, layout) and variable features (e.g., lighting, sound, temperature), both of which interact with sensory experiences. According to Mehrabian and Russell (1974), the physical environment plays a crucial role in shaping emotions and behavior by stimulating different sensory inputs. Figure 3 shows a conceptual framework that examines the relationship between perception, space, and human

behavior. This framework combines elements such as human needs, spatial characteristics, sensory landscapes, and behavioral patterns, which is a detailed analysis of the components and interrelationships suggested by theoretical perspectives and recent research.

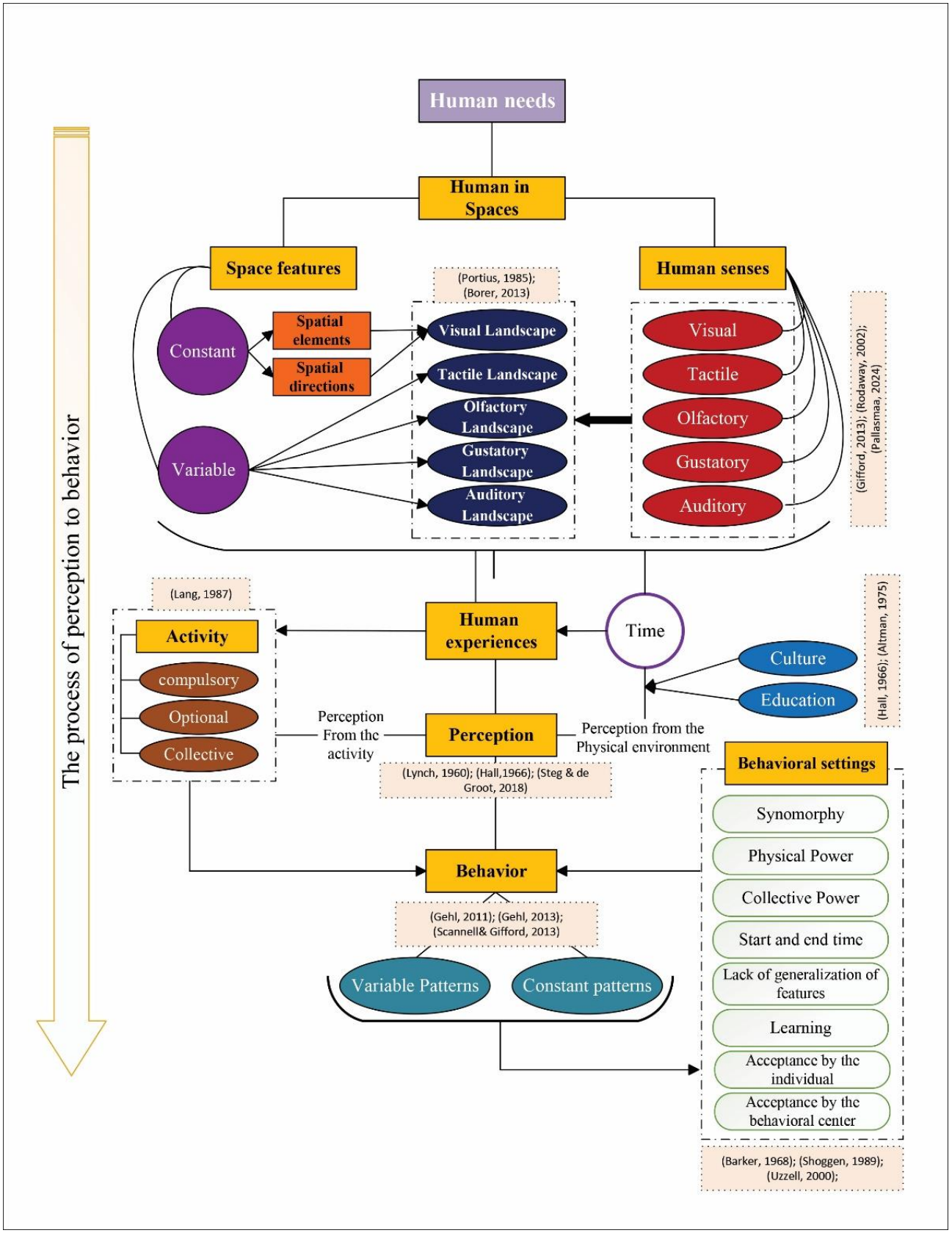

Figure 3. Conceptual framework of the process of perception to the occurrence of behavior

Human perception of spaces is primarily shaped by the sensory information received from the environment. These sensory experiences form the landscape of a space, influencing how individuals engage with their

surroundings [27]. For example, visual elements, such as the design and arrangement of a space, significantly affect alter the mood or productivity of individuals within that environment. Perception and Activity; The framework also underscores the relationship between activity and perception. Activities can be compulsory (e.g., work or school), optional (e.g., leisure activities), or collective (e.g., group interactions), each affecting how individuals perceive and respond to a space. According to environmental psychology, activities in a space can shape one's emotional and cognitive responses, influencing subsequent behaviors [7]. Perception, shaped by sensory input and the context of the activity, directly informs how people interact with and adapt to their environments. Behavioral Outcomes; The relationship between perception and behavior is central to the framework. Behavior is the outcome of human interaction with space and activities. It can manifest as variable patterns (responsive or adaptive behavior based on changing conditions) or constant patterns (habitual or learned behaviors). According to Gifford (2013), behaviors are influenced by both physical space and social settings, leading to habitual patterns based on prior experiences or social expectations. This aligns with the framework's concept of behavioral settings, which are defined by factors such as synomorphy (compatibility between behavior and space), physical power (control exerted by the environment), and collective power (social influences). Spatial Features and Perception; The framework divides spatial features into constant (e.g., physical structures) and variable (e.g., dynamic aspects like light or sound). These features form multisensory landscapes; visual, tactile, olfactory, auditory, and gustatory, which influence perception. Spatial cognition theories suggest that human interaction with space involves both sensory integration and cultural context. This aligns with research indicating that physical attributes such as natural light and spatial layouts profoundly impact emotional states and cognitive functions [65];[81]. Cultural and Educational Influences; The framework also includes the impact of culture and education on human behavior. Cultural norms and educational systems shape how individuals interpret and engage with spaces, influencing perceptions and behaviors. For example, the design of public spaces in different cultures varies to reflect social values, norms, and behaviors [30].

4. Conclusion

This study identifies a significant gap in previous research regarding the process of environmental perception and its influence on human behavior in space. While earlier studies have primarily focused on physical elements and certain psychological aspects, they have not adequately addressed the complex interaction between sensory perception and spatial behavior. One of the key findings of this research is the direct impact of seasonal changes on individuals' perception of urban spaces and, consequently, their behavioral responses. Whereas past research has emphasized physical components such as urban design, visual elements, and spatial arrangements, this study highlights how environmental fluctuations such how comfortable or engaging the space feels. Similarly, auditory elements such as noise levels can as variations in light, temperature, sounds, and scents can profoundly alter people's spatial experiences. A major contribution of this study is the development of a conceptual framework that integrates principles from environmental psychology and urban design to provide a comprehensive understanding of the dynamic interplay between sensory perception, time, and space. The findings suggest that spatial perception is shaped not only by the physical attributes of an environment, but also by subjective factors, personal experiences, and changing environmental conditions. Therefore, urban planners and designers must move beyond static and one-dimensional approaches to space and, instead, embrace a more flexible and dynamic perspective that accounts for the evolving nature of human-environment interactions. From a practical standpoint, this study underscores the necessity of prioritizing sensory and perceptual factors in urban planning to enhance the quality of public spaces and foster a sense of belonging and social interaction. Thoughtful urban design one that acknowledges the influence of environmental stimuli on human experiences can significantly improve comfort, safety, and public engagement. Practical strategies include the use of materials that minimize noise pollution, lighting designs that adapt to seasonal changes, the incorporation of diverse surface textures, and the inclusion of natural elements such as greenery and water features to enrich sensory experiences. Moreover, the findings highlight the importance of considering individual and group differences in spatial perception. Factors such as age, gender, cultural background, and personal experiences play a crucial role in shaping how people interact with their surroundings. Consequently, urban planning should aim to create flexible and multi-functional spaces that cater to diverse user needs and preferences. Ultimately, this study emphasizes the need for urban policies that are informed by a deep understanding of environmental perception and its behavioral implications. By leveraging these insights, policymakers and urban designers can develop public spaces that are not only responsive to contemporary societal needs, but also adaptable to seasonal and temporal changes, ensuring a more engaging, inclusive, and enriching urban experience for all. Future directions for research include examining the impact of emerging technologies, such as augmented reality and AI, on urban sensory design. These tools offer opportunities to create adaptable environments that respond to individual and collective needs. For instance, smart technologies can be employed to modulate sensory inputs dynamically, creating environments that shift between activity-based and relaxation-oriented designs. Exploring these advancements will further strengthen the connection between theory and application in urban planning. In conclusion, this study not only advances theoretical insights into the relationship between sensory perception and behavior, but also provides actionable recommendations for urban design. By addressing the dynamic interplay between sensory environments, cultural contexts, and temporal factors, the findings offer a path forward for creating inclusive, adaptive, and sustainable cities that meet the evolving needs of their inhabitants.

Acknowledgments

We extend our gratitude to all individuals who have contributed to the advancement of knowledge, particularly through extensive studies and research in the field of urban plan.

Authors Contribution

The authors confirm the study conception and design: In this research, Saeed Sharif Kazemi was responsible for collecting data and preparing the manuscript; Farah Habib was responsible for checking the accuracy of the data and evaluating the results, and Maryam Ghalambar Dezfuly was responsible for selecting and reviewing the research method through written reviews.

Conflict of interests

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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