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A Conceptual Framework for the Influence of Visual Landscapes and Soundscapes on Leisure Walking Intentions of Older Adults in Urban Residential Neighborhoods

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Abstract

This study develops a conceptual framework to examine the impact of visual landscapes and soundscapes on the leisure walking intentions of older adults in urban residential areas. Grounded in the Stimulus-Organism-Response (SOR) theory, the framework integrates Sensory Landscape Theory and Place Attachment Theory, identifying visual and auditory environments as key factors influencing place attachment through place dependence and place identity. These psychological mechanisms affect older adults' willingness to engage in leisure walking. By incorporating environmental and psychological perspectives, the study provides insights into how multisensory factors shape walking behavior in aging-friendly urban environments. The findings contribute to urban planning, public health, and residential design, offering practical guidance for creating walkable, sensory-enriched environments that support active aging and enhance well-being.

Keywords: Visual Landscapes, Soundscapes, Older Adults, Walking Intention, Urban Residential Neighborhood, Conceptual Framework

Introduction

As populations worldwide age rapidly, "aging in place" has become a preferred lifestyle for older adults, particularly in China, where most seniors choose to remain in familiar residential settings to preserve their independence and sense of belonging (He & Jiang, 2023). Given this trend, developing age-friendly urban residential environments that support active and healthy aging is increasingly important. Among health-promoting activities, leisure walking is widely recognized for its physical, psychological, and social benefits. Walking, as a low-impact and accessible form of physical activity, helps prevent mobility decline, reduce cardiovascular

risks, and enhance sociprevent mobility decline, reduce cardiovascular risks, and enhance social interactions, older adults' well-being (Yamashita et al., 2024; Punia et al., 2022).

Leisure walking, distinct from utilitarian walking, is primarily motivated by enjoyment, relaxation, and engagement with the surrounding environment rather than necessity or commuting purposes. Unlike goal-driven walking, which typically involves reaching a destination efficiently, leisure walking is characterized by a slower pace, a higher degree of environmental interaction, and a focus on psychological and social well-being (Kim & Hall, 2021). Research shows that older adults participate in leisure walking not only to maintain physical health but also to relieve stress, restore cognitive function, and foster social interactions. This is especially evident in urban residential areas, where the quality of the environment significantly influences their willingness and motivation to walk (Herbolsheimer et al., 2020).

In the context of this study, leisure walking serves as a key indicator of how environmental and psychological factors influence active aging. Well-designed urban spaces with visually appealing landscapes and harmonious soundscapes can significantly enhance the walking experience, fostering a sense of place attachment that encourages continued outdoor activity (Mengjia et al., 2020; Wang & Xiao, 2024a). Unlike structured exercise routines, leisure walking is spontaneous and heavily influenced by sensory perception, meaning that Visual and acoustic environmental factors can either facilitate or hinder participation.

The built environment of residential neighborhoods plays a crucial role in shaping the leisure walking behavior of older adults. As aging populations increasingly rely on their immediate surroundings for daily activities, neighborhood design, infrastructure, and environmental quality become key determinants of mobility and outdoor engagement. Well-maintained sidewalks, accessible pedestrian pathways, and traffic safety measures contribute to a supportive environment that encourages regular walking. Additionally, factors such as the availability of resting areas, appropriate lighting, and barrier-free design improve walkability and enhance the sense of security among older adults. Research highlights that walkable residential environments not only facilitate physical activity but also promote social interactions and psychological well-being by providing safe and comfortable outdoor spaces (Zang et al., 2020; Schmidt et al., 2019). As urban planning increasingly prioritizes aging-friendly design, integrating elements that support leisure walking can enhance overall health and quality of life for older adults.

The quality of visual landscapes and soundscapes within residential environments plays a critical role in shaping the everyday experiences of older adults, particularly in relation to their mobility and outdoor engagement. Research suggests that visually appealing environments, characterized by greenery, well-maintained public spaces, and harmonious architectural design, enhance spatial perception, promote relaxation, and encourage frequent outdoor activities (Zhang et al., 2021). Similarly, soundscapes, including natural elements such as birdsong and flowing water, along with well-managed urban noise levels, help create a more relaxing and restorative outdoor environment. A pleasant acoustic setting can alleviate stress, enhance cognitive function, and make public spaces more inviting for walking and social engagement. (Iyendo et al., 2023). In well-designed residential neighborhood, the integration

of visual and auditory elements fosters a positive environmental experience, ultimately supporting active and healthy aging.

Despite the increasing emphasis on walkability and environmental design, research on how visual and soundscape factors jointly influence walking behavior in urban residential neighborhoods remains insufficient, particularly regarding their synergistic effects on place attachment and behavioral outcomes. This gap is especially evident in aging societies, where creating environments that actively support and encourage leisure walking is essential for maintaining older adults' health and well-being as urban populations continue to age. To address this issue, this study proposes a multisensory framework that integrates environmental perception and psychological attachment, providing a more comprehensive understanding of how visual and auditory elements shape walking intentions. By bridging environmental and psychological perspectives, this research not only deepens theoretical insights into the multisensory influences on behavior but also offers practical guidance for urban planning. Ultimately, the goal is to enhance the quality of urban environments, promote active lifestyles among older adults, and contribute to healthier, more age-friendly cities.

Methodology

This study adopts a literature-based approach to explore the relationship between environmental perception, place attachment, and walking behavior among older adults in urban residential settings. Relevant academic sources were identified through Web of Science (WoS), Scopus, Google Scholar, and ScienceDirect, focusing on studies published between 2018 and 2024. The search terms included “visual landscape,” “soundscape,” “older adults,” “place attachment,” “walking behavior,” and “urban residential environments.” Studies were selected based on their contributions to understanding how sensory environmental factors influence psychological attachment and behavior intentions.

The research process involved analyzing existing studies to extract key insights on the impact of visual landscapes and soundscapes on pedestrian experiences. Prior research highlights that visual aesthetics enhance urban livability and pedestrian engagement (Meshkini et al., 2020), while soundscapes influence spatial perception and emotional responses to the built environment (Zhu et al., 2022). Additionally, place attachment has been found to mediate the relationship between environmental quality and mobility behavior, shaping individuals’ willingness to engage in outdoor activities (Yoon et al., 2024). By synthesizing these findings, this study constructs a theoretical framework that links sensory environmental factors to walking behavior.

Integrated Stimulus-Organism-Response (S-0-R) Model

The Stimulus-Organism-Response (S-O-R) model, originally proposed by Mehrabian and Russell (1974), provides a theoretical foundation for understanding the relationship between environmental stimuli, psychological responses, and behavioral outcomes. This model has been widely applied in environmental psychology and urban studies to analyze how sensory inputs shape human perceptions and behaviors. In this study, the S-O-R framework is employed to explore how visual landscapes and soundscapes influence older adults' walking intentions in urban residential neighborhoods.

Within the S-O-R model, the Stimulus (S) represents environmental factors that trigger psychological and emotional responses. Based on Sensory Landscape Theory (Pallasmaa, 1996), this study identifies visual landscapes and soundscapes as key stimuli shaping individuals' environmental perceptions. Visual landscapes, comprising elements such as greenery, spatial arrangement, and architectural aesthetics, contribute to urban livability and aesthetic appreciation. Soundscapes, encompassing natural sounds (e.g., birdsong, water flow) and artificial noise (e.g., traffic, human activity), affect emotional well-being and spatial experience (Wang & Xiao, 2024b). The interaction between these stimuli plays a crucial role in shaping individuals' sensory engagement with the built environment.

The Organism (O) represents the cognitive and emotional processes that mediate the relationship between environmental stimuli and behavioral responses. Drawing on Place Attachment Theory (Shumaker & Taylor, 1983), this study conceptualizes place attachment as a key psychological mechanism linking sensory perception to behavioral outcomes. Place attachment is further divided into two dimensions: place dependence and place identity. Place dependence reflects the functional and instrumental reliance on a particular location for meeting specific needs, while place identity captures the emotional and cognitive connections individuals develop with their surroundings (Ernawati, 2018). These two dimensions mediate the impact of environmental stimuli on behavioral responses, reinforcing an individual' s sense of connection to their urban environment.

The Response (R) component of the model refers to behavioral outcomes influenced by environmental and psychological factors. In this study, walking intention is the primary behavioral response, reflecting an individual's motivation and willingness to engage in outdoor walking activities (Fishbein & Ajzen 1975). This study posits that positive sensory experiences and strong place attachment enhance walking motivation among older adults. When urban environments provide visually stimulating and acoustically pleasant experiences, they foster stronger psychological connections, thereby increasing the likelihood of walking engagement (Kil et al., 2021). Conversely, negative environmental stimuli, such as visual clutter or excessive noise, may weaken place attachment and reduce walking motivation.

By integrating Sensory Landscape Theory, Place Attachment Theory, and Behavioral Intention within the S-O-R framework, this study provides a comprehensive perspective on the multisensory and psychological dimensions influencing walking behavior (as shown in Figure 1).

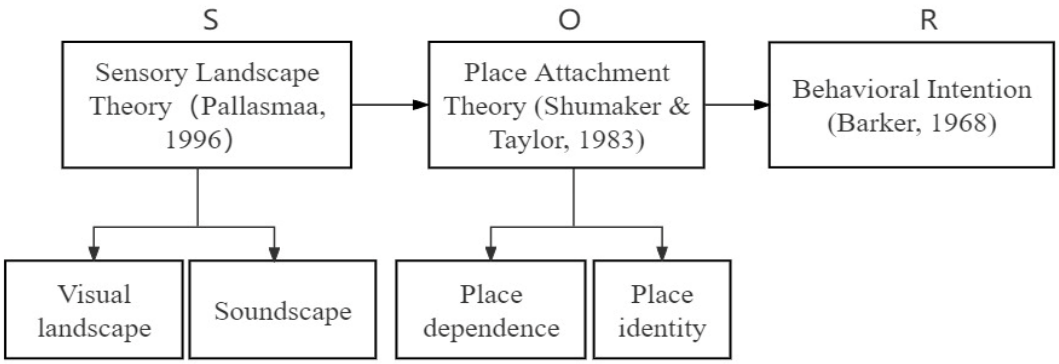

Figure 1 Theoretical Framework
(Source:By Author)

Conceptual Framework

This study constructs a conceptual framework to explore the influence of visual landscapes and soundscapes on the leisure walking intentions of older adults in urban residential areas. It integrates Sensory Landscape Theory, Place Attachment Theory, and Behavioral Intention Theory to explain how environmental stimuli shape psychological attachment, which in turn influences walking behavior. Specifically, visual landscapes and soundscapes contribute to place attachment through two dimensions: place dependence, which reflects the functional reliance on a location, and place identity, which represents emotional and cognitive connections to the environment. These psychological mechanisms serve as mediators that translate environmental perceptions into behavioral outcomes, shaping the likelihood of engaging in leisure walking. The framework highlights the multisensory impact of environmental quality on walking behaviors, emphasizing the importance of harmonious urban design that enhances both physical and psychological well-being (as shown in Figure 2).

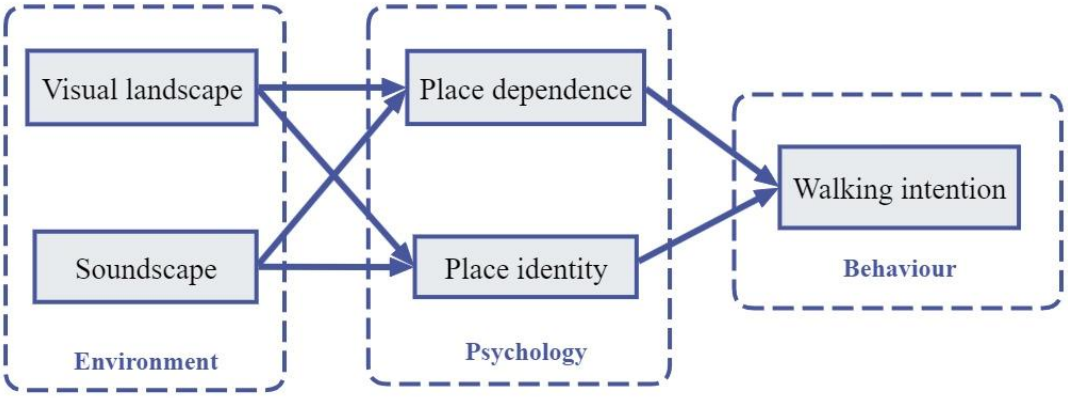

Figure 2 Conceptual Framework
(Source: By Author)

Visual Landscape

i.Definition of Visual Landscape

According to the European Landscape Convention (ELC), a landscape is defined as an area perceived by people, whose character is the result of the action and interaction of natural and/or human factors (Council of Europe, 2000). Visual landscapes encompass the perceived aesthetic and spatial qualities of an environment, shaped by natural, built, and designed elements that influence human perception and experience (Shedid & Hefnawy, 2022). As a critical component of urban and environmental design, the concept of visual landscape extends beyond simple scenery, integrating color, form, texture, spatial arrangement, and environmental harmony to create visually engaging and functionally meaningful spaces (Nikolaeva, 2022). The quality of a visual landscape significantly affects urban livability, impacting individuals' emotional responses, place satisfaction, and interaction with the environment (Metin, 2022).

ii. Assessment of Visual Landscape

The assessment of visual landscapes is closely tied to the evaluation of visual quality, as it determines how individuals perceive, engage with, and derive satisfaction from their surroundings. Studies have shown that visual quality significantly influence people's visual behavior, satisfaction, and preferences (Gao et al., 2024; Sun et al., 2021; Gao et al., 2023). As illustrated in figure 3, visual quality is shaped by several key factors, including the

naturalness of the environment, the harmony and balance among its elements, and the diversity and richness of landscape features. These aspects play a crucial role in shaping individuals' experiences, influencing their engagement with and preference for outdoor spaces (Tveit et al., 2006; Ode et al., 2008; Martín et al., 2016). Additionally, visual scale and imageability are essential in shaping the perception of urban landscapes, as spaces that emphasize spatial openness, perceptual depth, and recognizable landmarks strengthen the sense of place and attachment. Moreover, stewardship and ephemera, which reflect perceptions of order, maintenance, and seasonal variations, contribute to the dynamic and evolving nature of urban environments. These elements play a crucial role in fostering continuous engagement and enhancing the long-term well-being of city residents (Zhang et al., 2022).

Soundscape

i.Definition of Soundscape

The concept of soundscape refers to the perceived acoustic environment as experienced by individuals in a specific place, encompassing both natural and human-made sounds (Schulte-Fortkamp & Brooks, 2024). Unlike traditional noise studies that focus solely on sound levels, the soundscape approach integrates subjective perception, environmental context, and auditory quality, emphasizing the interaction between sound and human experience (Brooks & Schulte-Fortkamp, 2024). According to the ISO 12913-1 standard, soundscape is defined as the acoustic environment as perceived and understood by people, in context, highlighting its multidimensional nature and its role in shaping spatial perception and well-being (Turin et al., 2022).

Soundscapes are classified into positive (restorative) and negative (disturbing) auditory environments, with natural sounds such as birdsong and flowing water often linked to stress reduction and enhanced cognitive function, while mechanical or industrial noises contribute to discomfort and reduced environmental quality (Hami et al., 2023). The perception of a soundscape is influenced by sound source composition, spatial characteristics, and listener expectations, meaning that two individuals may experience the same environment differently based on personal, cultural, and situational factors (Jo & Jeon, 2020).

ii. Assessment of Soundscape

As illustrated in figure 3, Soundscape quality assessment has evolved beyond traditional noise-level analysis to focus on human perception and experience within an acoustic environment. Recent studies highlight several perceptual dimensions that define soundscape quality, including pleasantness, eventfulness, familiarity, adverseness, restorativeness, emotionality, and indifference, as outlined in ISO 12913-2 (Nagahata, 2021). These perceptual attributes allow for a more holistic evaluation of soundscapes, integrating both objective acoustic measurements and subjective human responses (Ma et al., 2023). Pleasantness and restorativeness are associated with positive soundscapes dominated by natural sounds, such as birdsong and flowing water, which enhance psychological well-being and relaxation (Hamid et al., 2023). Conversely, adverseness and indifference often emerge in soundscapes dominated by mechanical noise and urban disturbances, leading to discomfort and stress (Gao et al., 2023).

In urban settings, eventfulness and familiarity play a crucial role in shaping an individual' s engagement with the sound environment. Studies suggest that soundscape appropriateness, or how well the auditory environment aligns with the surrounding context, significantly influences perceptions of acoustic comfort (Yang et al., 2024). The relationship between visual and auditory cues also affects soundscape assessment, where harmonious urban environments with well-integrated sounds foster positive emotional responses, while discordant soundscapes may trigger negative reactions (Hamid et al., 2023). As a result, soundscape assessment is increasingly used in urban planning and public health strategies to enhance the acoustic quality of public spaces, improve well-being, and promote active urban life (Botteldooren et al., 2020).

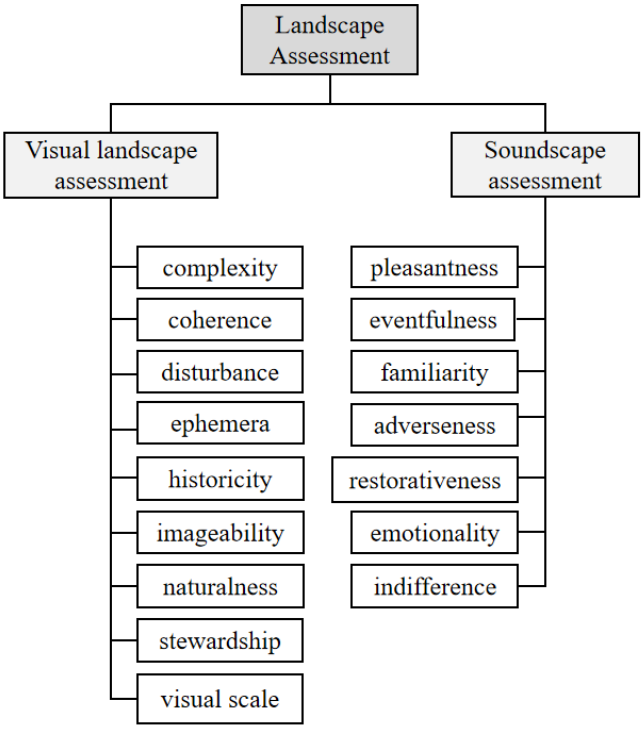

Figure 3 Structure for Landscape Assessment
(Adopted from Tveit et al., 2006; Ode et al., 2008; Martín et al., 2016; Aletta et al., 2016; Zhu et al., 2023)

Place Dependence

i. Definition of Place Dependence

Place dependence refers to the functional and psychological connection individuals develop with a location based on its ability to meet specific needs or offer unique attributes that cannot be easily substituted (Alrobaee & Al-Kinani, 2019). It is a key dimension of place attachment, highlighting the role of physical environment quality and accessibility in fostering long-term associations with places. This concept comprises two key aspects, place quality and place expectation, which influence individuals' dependence on a specific location for activities, social interactions, and emotional well-being (Alrobaee & Al-Kinani, 2019).

Recent research emphasizes the significance of environmental factors such as open spaces, green areas, diverse land uses, and efficient transportation networks in reinforcing place dependence (Chen et al., 2024). In urban planning, the concept is particularly relevant in age-friendly residential areas, where older adults rely on familiar environments to support daily

routines and maintain social connections (Pope et al., 2022). Studies show that place dependence plays a pivotal role in shaping perceptions of environmental restoration and well-being, as individuals associate certain places with comfort, accessibility, and personal history (Chen et al., 2024). Moreover, place dependence is deeply intertwined with urban sustainability and landscape design, influencing decisions related to land use changes, conservation efforts, and public space development (Prayitno et al., 2021).

ii. Assessment of Place Dependence

Place dependence is evaluated based on functional suitability, goal fulfillment, and environmental uniqueness, reflecting how well a location meets users' needs and fosters a sense of reliance on that space (Gokce & Chen, 2020). Functional suitability assesses whether a space is accessible, well-equipped, and effectively supports daily activities. Goal fulfillment examines the extent to which the location facilitates intended activities, such as social interaction, recreation, or relaxation, while environmental uniqueness refers to distinctive qualities, including landscape aesthetics and cultural significance, that make a place irreplaceable (Khaidzir & Kamal, 2023). These factors collectively shape an individual's attachment to a location based on its practicality and emotional value.

To quantitatively assess place dependence, researchers commonly employ Likert-scale surveys, which capture self-reported perceptions of accessibility, usability, and engagement with a space (Khaidzir & Kamal, 2023). Additionally, spatial analysis and movement tracking provide objective insights into the frequency and consistency of space usage, reinforcing its functional importance (Gokce & Chen, 2020). By integrating subjective and objective measures, urban planners can design environments that enhance place dependence, ensuring that public spaces remain both functionally effective and psychologically meaningful for long-term use.

Place Identity

i. Definition of Place Identity

Place identity refers to the psychological and emotional bond individuals establish with a location, shaping their perception of self in relation to the environment. It is a key component of place attachment, encompassing cognition, affect, and conation, which together define an individual's sense of belonging to a specific place (Belanche et al., 2021). Unlike place dependence, which focuses on a location’s functional suitability, place identity is deeply rooted in subjective experiences, memories, and cultural associations (Mansour et al., 2023). Research highlights that cognition, affect, and conation form the foundation of place identity. Cognition refers to the knowledge and awareness individuals develop about a place through experiences and environmental interactions. Affect represents the emotional connection, including attachment, nostalgia, and personal significance tied to a location. Conation and evaluative perception involve behavioral tendencies and judgments about a place, influencing individuals' engagement and their commitment to preserving and enhancing their surroundings (Belanche et al., 2021).

In urban planning, place identity is crucial for fostering cultural continuity and social cohesion, as well as for designing environments that reflect the historical and social values of a community. Planners integrate architectural identity, landscape characteristics, and

communal spaces to strengthen place identity, ensuring that public spaces remain psychologically meaningful and socially inclusive (Umar et al., 2024).

ii. Assessment of Place Identity

The assessment of place identity involves quantitative measurement tools that evaluate individuals' cognitive, emotional, and behavioral connections to a location. Researchers commonly use Likert-scale surveys to measure cognitive awareness, capturing how well individuals recognize and describe key environmental features. Affective attachment is assessed through self-reported emotional connections, where participants rate the sentimental value and cultural significance of a place (Mansour et al., 2023). Behavioral commitment (conation and evaluation) is analyzed through observational studies, participatory mapping, and spatial tracking, which document individuals' movement patterns, engagement levels, and long-term interaction with a space (Umar et al., 2024).

Recent studies emphasize that the integration of quantitative and spatial analysis methods provides a more comprehensive understanding of place identity, enabling urban planners to design environments that reinforce cultural identity, social belonging, and long-term attachment. By incorporating psychological and behavioral indicators, place identity assessments contribute to the development of resilient and meaningful urban spaces that reflect both individual and collective experiences (Belanche et al., 2021).

Walking Intention

Walking intention refers to an individual's motivation and willingness to engage in walking activities within urban environments (Zacharias, 2024). It is widely studied in urban planning and environmental psychology, particularly concerning how built environments influence pedestrian behaviors. Research indicates that well-designed pedestrian infrastructure, including walkable streets, green spaces, and traffic safety measures, plays a crucial role in encouraging walking. Moreover, factors such as accessibility, comfort, and the perceived attractiveness of the environment significantly impact an individual's decision to walk (Tong & Maliki, 2024).

Physical and psychological aspects of the environment collectively shape walking intention. Walkability is directly influenced by physical attributes such as the presence of sidewalks, street connectivity, and mixed land use, which enhance accessibility and reduce barriers to mobility. Psychological perceptions, including safety, social interactions, and environmental aesthetics, further determine an individual’s likelihood of walking. Studies show that individuals are more inclined to walk in spaces that feel safe, visually stimulating, and socially engaging. The presence of green spaces, street furniture, and shaded walkways contributes to a positive walking experience, while high traffic volumes and excessive noise can act as deterrents (Dong et al., 2023).

Social and cultural factors also play a role in shaping walking intention, as walking behaviors are often influenced by social norms and cultural expectations. In many urban settings, individuals are more likely to engage in walking when it is perceived as a socially accepted and encouraged activity. Cities that integrate pedestrian-friendly policies and urban designs that facilitate walking as a preferred mode of transport have higher walking participation rates. Community-based infrastructure, such as pedestrian-only streets and well-maintained public

squares, further promotes walking by fostering social interactions and increasing engagement with public spaces (Le et al., 2021).

Walking intention has become a focal point in sustainable urban development, as increasing walkability contributes to public health, environmental sustainability, and overall urban livability. Encouraging walking as a primary mode of transport reduces car dependency, lowers emissions, and promotes active lifestyles. Urban planners and policymakers emphasize the importance of designing pedestrian-friendly environments that not only improve mobility but also enhance psychological well-being and social cohesion. As cities continue to expand, the development of walkable environments remains a critical strategy for creating inclusive and sustainable urban spaces (Sundling & Jakobsson, 2023).

Relationships between Concepts

The conceptual framework illustrates the interconnected relationships between visual landscape, soundscape, place attachment (place dependence and place identity), and walking intention, emphasizing the multisensory and psychological dimensions that shape pedestrian behavior in urban environments. The interplay between these factors highlights how environmental attributes influence individuals' attachment to a place, ultimately affecting their motivation and willingness to walk.

Visual landscapes and soundscapes serve as critical environmental stimuli that shape individuals' perception and experience of urban spaces. Research suggests that both visual and auditory stimuli significantly influence environmental satisfaction and spatial perception, with visually appealing landscapes and pleasant soundscapes contributing to place attachment and user engagement (Jeon & Jo, 2020). Studies indicate that natural visual elements, such as greenery and open spaces, combined with restorative soundscapes, enhance environmental preference, leading to higher place dependence and place identity (Yang & Zhang, 2024). In contrast, urban environments dominated by mechanical noise and visual clutter may hinder place attachment, reducing the likelihood of active engagement with the space (Tan et al., 2021).

Place dependence and place identity function as mediating factors that translate environmental perceptions into behavioral outcomes. Place dependence is driven by the functionality and uniqueness of a space, influencing individuals' reliance on a location for specific activities (Shi, 2024). Meanwhile, place identity encapsulates emotional and cognitive associations with a space, shaping long-term attachment and commitment to a location (Belanche et al., 2021). Empirical findings suggest that individuals with stronger place attachment exhibit higher walking intention, as they feel more connected to and comfortable within the environment (Yin et al., 2023).

Ultimately, walking intention emerges as a behavioral outcome shaped by the multisensory and psychological dimensions of the built environment. When visual landscapes and soundscapes align with individuals' expectations and foster a strong sense of place attachment, they enhance pedestrian motivation and walking frequency (Loreto et al., 2023).

Conclusion

As cities continue to expand and populations age, creating environments that encourage active and healthy lifestyles for older adults has become increasingly important. This study develops a conceptual framework to explore how visual landscapes and soundscapes influence the leisure walking intentions of older adults in urban residential neighborhoods. By integrating Sensory Landscape Theory, Place Attachment Theory, and Stimulus-Organism-Response Theory, the study emphasizes the role of environmental perception in shaping place attachment, which in turn affects walking behavior.

Findings suggest that visual and auditory environmental elements significantly impact place attachment by shaping individuals' experiences and emotional connections with their surroundings. Visually engaging landscapes and pleasant soundscapes enhance place dependence by improving functionality and accessibility, while also strengthening place identity through emotional and cognitive associations. Stronger place attachment fosters a greater intention to engage in leisure walking, reinforcing the importance of multisensory urban design in supporting active aging.

This study contributes to urban planning, public health, and residential design by emphasizing the necessity of integrating multisensory approaches in the creation of walkable and age-friendly environments. By constructing a conceptual framework that incorporates Sensory Landscape Theory and Place Attachment Theory, it provides a structured understanding of how visual landscapes and soundscapes jointly influence older adults' walking intentions. In particular, this study extends existing research by identifying the mediating role of place attachment, including both place dependence and place identity, in shaping walking behavior. Furthermore, it underscores the significance of designing sensory-enriched urban spaces that not only promote physical activity but also enhance psychological well-being and social engagement among older adults. The findings offer practical implications for urban planners and policymakers, reinforcing the importance of environmental aesthetics and acoustic quality in fostering active and healthy aging.

Future research should further investigate how specific environmental attributes interact with cultural and personal factors to shape walking behaviors. Additionally, urban designers and policymakers can apply these findings to improve the quality of public spaces by prioritizing visual and auditory elements that foster a sense of belonging and encourage physical activity. As cities continue to develop, creating residential environments that are not only functionally supportive but also emotionally enriching will be crucial in fostering active and sustainable urban aging.

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Ethics approval statements:This study was approved by the Ethics Committee of Universiti Putra Malaysia (JKEUPM Ref No: JKEUPM-2024-168) on March 06, 2024. All participants provided written informed consent prior to enrolment in the study. This research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki.
Data availability statement: All data that support the findings of this study are included in this manuseript and its supplementary information files.

DAS : All data generated or analyzed during this study are included in this published article [and its supplementary information files].

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