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RESEARCH ARTICLE

A review of effects of visual landscape and soundscape perception on elderly walking intentions: Case studies in urban residential neighborhood

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ABSTRACT

This systematic literature review aims to assess the effects of visual landscapes and soundscape environments on elderly people's intention to walk in urban residential areas. The findings summarize and discuss various visual features, such as environmental greening and exterior beautification, as well as sound features, focusing on the restorative properties of natural sounds and noise phobia. Perceived risks, such as inadequate lighting and the walkability of environments, are identified as significant factors influencing elderly mobility. The spatial impact of sound emphasizes the integration of both visual and auditory design elements. The results show that coordinated visual and auditory stimuli enhance walking intentions, while disharmonious sounds reduce the desire to move. Based on studies conducted in different urban settings, this review consolidates qualitative findings and offers best-practice advice for policymakers and urban planners. The results suggest a need for multi-sensory, elder-accessible designs that foster movement, improve mood, and encourage social interactions in urban environments for older adults. Future research should focus on experimental investigations into sensory integration and cross-cultural studies to expand the knowledge base for urban planning practices.

Keywords: elderly mobility; urban soundscapes; visual landscapes, walkability; sensory integration

1. Introduction

1.1. Contextual background

As global populations grow older, providing facilities that enhance the health and mobility of the elderly is becoming increasingly important. Among various neighborhood characteristics, abundant, safe, and accessible spaces for daily walking are essential for promoting active, healthy aging in urban residential areas. Walking is one of the most practical forms of exercise for older people and has numerous health benefits, including improved cardiovascular health, decreased incidence of chronic illnesses, better mental health, and reduced loneliness [1]. Walking is a low-impact aerobic exercise that provides benefits in physical, psychological, and social domains, such as better heart health, sharper cognitive function, and decreased loneliness. However, the mobility of the elderly depends on the physical and sensory characteristics of the

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environment in which they live, such as access, comfort, and safety, which significantly influence their engagement in physical activities [2].

Urban residential neighborhoods are particularly important because they provide immediate access to places conducive to daily walking. Studies show that elderly individuals are more likely to engage in walking when their neighborhoods provide tangible features such as properly maintained pavements, green spaces, and low noise pollution [3]. The vibrancy of urban spaces, through proper consideration of accessibility, comfort, and aesthetics, can increase elderly people's engagement in regular physical activity and consequently enhance their life expectancy.

Unfortunately, the urban environment itself presents several challenges to elderly mobility. High population density, traffic patterns, and poorly organized public spaces may reduce mobility and, in turn, negatively affect mental and physical health. Furthermore, previous urban design plans have often focused more on economic and spatial optimization rather than addressing the needs of the elderly, particularly those with sensory impairments. These aspects are of paramount importance for elderly people: the availability of clear, smooth, and safe paths, the presence of green areas, and a quiet atmosphere. Therefore, creating environments that are both visually and acoustically appealing is critical for improving elderly mobility and general well-being [4].

1.2. Research objective

This study aims to address the following objectives: (1) To identify the visual elements of urban residential neighborhoods that most significantly influence elderly walking intentions. (2) To identify the auditory elements of urban residential neighborhoods that most significantly influence elderly walking intentions. (3) To explore the combined effects of visual and soundscape characteristics on elderly mobility and overall well-being.

These objectives guide a systematic review of existing literature, allowing for a comprehensive analysis of various studies in different urban contexts rather than relying on empirical fieldwork. This approach synthesizes findings to provide insights into the factors influencing elderly walking behaviors and offers practical recommendations for urban design.

1.3. Research question

To guide the systematic review, the following research questions have been formulated: (1) How do visual landscape features, such as greenery, pathways, and lighting, influence the walking intentions of elderly residents in urban residential neighborhoods? (2) What are the impacts of soundscape quality on elderly mobility, specifically in terms of encouraging or discouraging walking behavior? (3) How do visual and soundscape perceptions collectively contribute to the elderly's experience of urban residential neighborhoods and influence their mobility intentions?

2. Literature review

2.1. Visual appeal of urban landscapes

Research indicates that the overall sensory qualities, including nature, smell, and particularly the visual appearance of a neighborhood, significantly shape the daily experiences of elderly residents. Key visual features such as well-maintained greenery, clean pavements, and sufficient lighting contribute to a sense of safety and attractiveness, thereby promoting engagement in physical activities [5]. The World Health Organization's Age-Friendly Cities Framework [1,6] has emphasized the importance of accessible green and public spaces in supporting physical activity and mobility among older adults. Prior studies have shown that

older adults are more likely to walk in environments that are visually appealing and include elements such as vegetation and water features [7]. These features not only offer visual pleasure but also provide psychological comfort, fostering a greater willingness to spend time outdoors.

In contrast, spaces that lack vegetation or are poorly maintained tend to evoke discomfort and a sense of insecurity, which can discourage elderly individuals from going outside [8]. In particular, Loukaitou-Sideris has contributed foundational research on elderly-sensitive urban design [9], highlighting how fear of crime, insufficient seating, and inaccessible pathways act as barriers to outdoor mobility. Her work bridges urban planning and gerontology by revealing how age-specific concerns must be accounted for in neighborhood design. Similarly, Michael demonstrated that neighborhood walkability, aesthetics, and safety collectively predict mobility among elderly populations, reinforcing the need for a holistic urban design perspective [10].

2.2. Soundscape and noise aversion

Sound or sonic environment, also known as soundscape, is one of the critical elements of the elderly's mobility interventions. This is even more the case in elderly people where any form of noise such as traffic or construction noise is likely to cause stress and minimize elderly people's desire to go out [11]. On the other hand, there are relaxation soundscapes like a bird singing, water flowing, or whispering wind, which make the outdoor experience even more enjoyable and safe [12]. The auditory experience, particularly natural sound cues, can influence emotional states and support cognitive restoration, adding a layer of safety and comfort. According to the research, appealing visuals, coupled with effective sounds, can potentially enhance the elderly residents' well-being, which results in an increased possibility of them exercising [13]. While several studies underscore the harmful effects of traffic noise, others suggest that its impact varies based on habituation or individual health status. For instance, elderly residents accustomed to urban environments may report lower noise sensitivity than those living in quieter areas, which indicates the need for more tailored and context-specific approaches. Moreover, cross-cultural research remains limited, and certain sounds perceived as intrusive in one environment may be considered acceptable or go unnoticed in another, depending on cultural norms and daily soundscapes.

2.3. Combined sensory impact

Few studies have systematically investigated how visual and auditory inputs interact to shape walking intentions among older adults. Studies suggest that elderly individuals are more likely to engage with environments that offer a balanced combination of visual and auditory stimuli, highlighting the importance of multisensory design in public spaces [13]. For instance, it was revealed that the green areas with natural sounds promoted attractiveness and walking compared to similar places with no auditory stimuli. Conversely, spaces that are visually appealing but acoustically unpleasant (e.g., green parks with traffic noise) were less favored, indicating sensory dissonance may negate environmental benefits. Such facts strengthen the call for further research into the incorporation of the different constructs into a single unit because most of the current studies are centered on the sensory elements separately.

2.4. Gaps in the literature

However, a considerable number of gaps can still be identified despite prior works that have given decent insight. First, many of them encompass very local sensory aspects visual or auditory without taking into account the optimization of their combination. While some prior works provide related studies, these works do not focus on the multisensory experience and interact to predict elderly walking intentions. Further, there is the assessment of studies carried out showing that most are undertaken in higher-income urban settings; therefore, knowledge drawn from these could be different in mid and low-income settings where patterns of urban infrastructure and sensory experiences differ.

Moreover, current literature often lacks methodological consistency, as many rely on self-reported preferences without using standardized sensory assessment tools or objective behavioral measures. One of the drawbacks is the absence of a stronger focus on certain design activities. Although existing research highlights the challenges and enablers in mobility, most of them lack practical implementation advice for policymakers and urban designers. Additionally, few studies adopt longitudinal designs, making it difficult to assess the lasting impacts of sensory-based interventions on mobility. Likewise, mounting research attention has been paid to the effects of auditory environments augmenting sensory mismatches, for example, beautiful places with noise pollution.

2.5. Contributions of this study

In the following sections, this research aims at filling these gaps in the following ways. First, it takes the multisensory approach, systematically assessing the influence of the visual and auditory modalities on elderly walking intentions. This coordinated strategy offers richer insights into the haptic characteristics of urban territories. Second, incorporating recent evidence from varied global and cultural environments increases the generalizability of the findings to other contexts, as the studies included present the ideas useful for high-income and resource-limited urban environments.

In addition, this study progresses beyond some previous works frequently associated with simply listing barriers to mobility by incorporating its practical implications for urban design and policy into its framework. By integrating spatial and sensory design recommendations, such as plant density optimization, sound insulation strategies, and aesthetic wayfinding features, this research outlines actionable strategies for urban planners. They provide best practices including design measures including proportions of green areas, controlling noise, and featuring permeable road surfaces to enhance elder accessibility. Finally, this review outlines specific recommendations for future research concerning the topic, published experiments, and long-term studies for the further development of this field.

Therefore, by collecting and analyzing evidence from multiple geographical areas, and addressing these gaps, this research shall offer a proper foundation on which initiatives to enhance elderly mobility can be based depending on the urban planning and architectural techniques applied.

3. Methodology

3.1. Research design

This study utilized a qualitative systematic literature review (SLR) framework to comprehensively synthesize current evidence regarding the influence of visual landscapes and soundscapes on elderly walking intentions in urban residential neighborhoods [14]. The review process is summarized visually in **Figure 1**, which is included and clearly labeled in the manuscript. All major steps, including database searching, study screening, data extraction, and thematic analysis (with open, axial, and selective coding), are transparently presented to ensure methodological clarity and reproducibility.

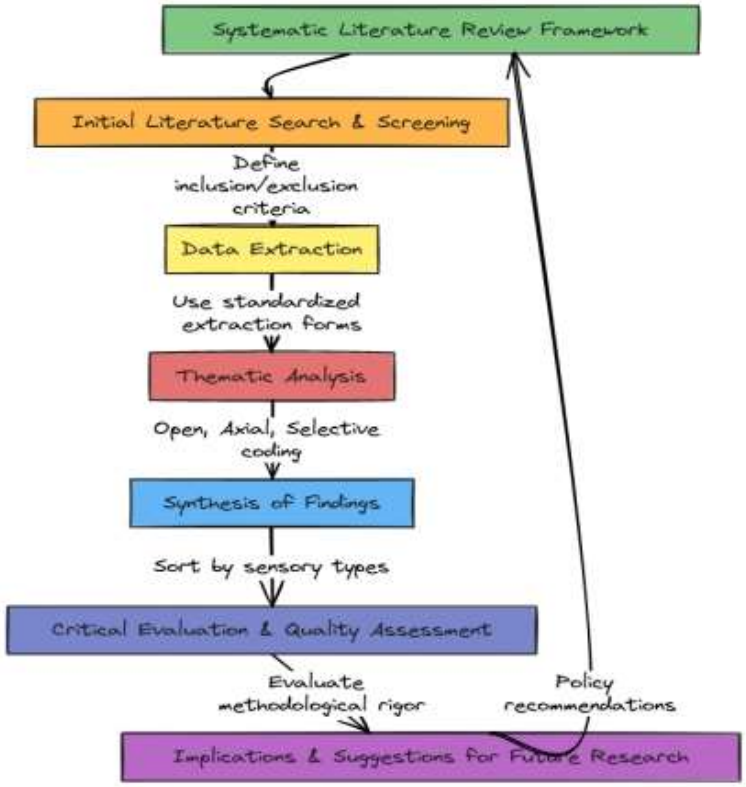

Figure 1. SLR framework

3.2. Thematic analysis

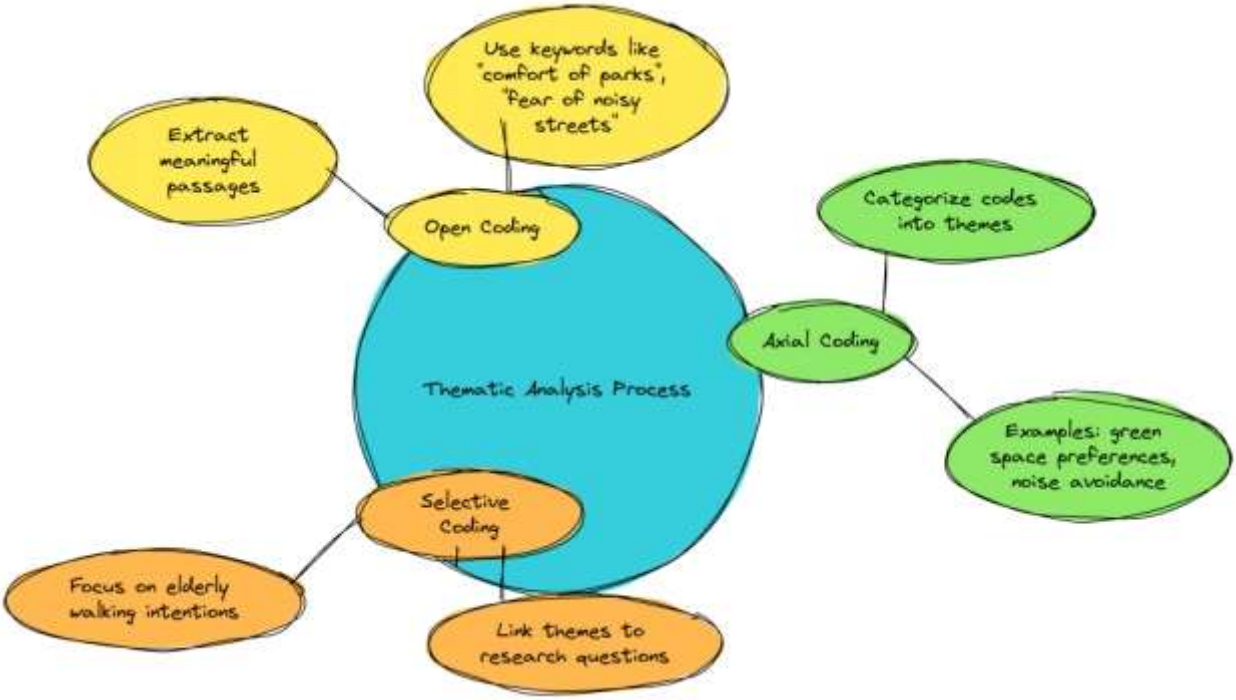

Figure 2. Thematic analysis and coding structure

A thematic analysis approach was adopted to identify, code, and interpret key factors influencing elderly mobility, following Braun and Clarke's six-phase procedure. The coding process included open coding to

identify meaningful statements, axial coding to develop refined themes, and selective coding to relate findings to the research objectives. The structure of the thematic analysis and the specific coding process are visually presented in **Figure 2**. Major themes extracted included green space preference, noise sensitivity, appearance, and safety. This analytic framework supported the examination of the interplay between visual and auditory environmental factors and enabled synthesis of findings into practical urban planning recommendations for elderly-friendly cities.

3.3. Search strategy

A systematic search was carried out in four prominent databases: Scopus, Web of Science, PubMed, and Google Scholar. Search terms were carefully selected to maximize coverage and relevance, including elderly walking intentions, visual landscape, soundscape perception, urban residential neighborhood, and health and mobility in aging, with Boolean operators (AND, OR) applied to improve precision [15]. The search was limited to the years 2000–2024 to reflect recent advances and urbanization trends. Reference lists of included articles were also screened using backward and forward citation tracking to reduce publication bias and identify key literature [16].

3.4. Inclusion and exclusion criteria

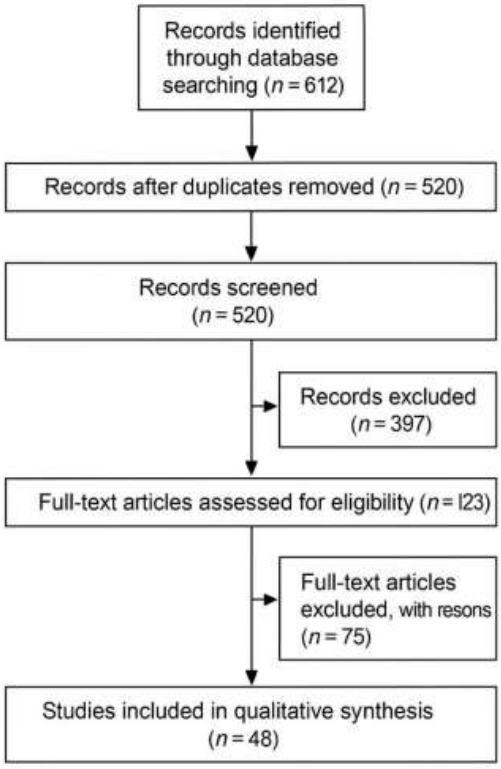

Figure 3. PRISMA flow diagram of study selection

Explicit inclusion and exclusion criteria were developed to ensure focus and scientific rigor. Inclusion criteria required that studies: (a) involve participants aged 60 or above; (b) be conducted in urban residential environments; (c) address visual or auditory environmental features and their impact on elderly movement or perceived quality of life; and (d) contain quantitative or qualitative data on walking intentions or behaviors. Exclusion criteria eliminated studies lacking original data, those focused on rural or nonresidential areas, studies involving non-elderly populations, or papers not addressing sensory environmental factors related to elderly mobility. Reviews, theoretical articles without primary data, and non-English language publications were also excluded.

The literature screening and selection process is detailed in the PRISMA flow diagram, as shown in **Figure 3**. A total of 612 records were initially identified. After removing duplicates, 520 records remained for screening. Title and abstract review resulted in 123 full-text articles assessed for eligibility, and 75 were excluded for not meeting inclusion criteria. Ultimately, 48 studies were included in the final synthesis.

3.5. Study quality appraisal

Table 1. shows the CASP checklist

Question	Assessment	Notes
Did the review address a clearly focused question?	Yes	Focused on the effects of visual landscapes and soundscapes on elderly walking intentions in urban areas.
Did the authors look for the right type of papers?	Yes	Included qualitative and quantitative studies from multiple databases (Scopus, Web of Science, etc.).
Do you think all important, relevant studies were included?	Yes	Used a comprehensive search strategy with clear inclusion/exclusion criteria; covered key and seminal works.
Did the authors assess the quality of the included studies?	Yes	Used CASP checklist for systematic assessment and described methodological rigor in Section 3.3.
If the results of the review have been combined, was it reasonable to do so?	Yes	Thematic synthesis used; results from different contexts were combined with attention to heterogeneity.
What are the overall results of the review?	Yes	Visual appeal, soundscape, and safety are central to elderly mobility; multisensory integration is key.
How precise are the results?	Can't tell	General patterns identified, but some heterogeneity and lack of meta-analysis affect precision.
Can the results be applied to the local population?	Can't tell	Applicability to low- and middle-income countries may be limited by predominance of high-income settings.
Were all important outcomes considered?	Yes	Considered walkability, safety, psychological well-being, and practical design implications.
Are the benefits worth the harms and costs?	Yes	The review supports interventions that are practical, low-risk, and likely to benefit urban older adults.

The quality of all included studies was assessed using the CASP Systematic Review Checklist. Key items included clarity of research questions, appropriateness of search strategy, data extraction, risk of bias, and the applicability of findings. **Table 1** summarizes the appraisal for the included studies.

4. Data collection

Data extraction was conducted using a standardized approach. For each study, key information such as type of study, population features, findings, and limitations was systematically collected. A standard data extraction form helped to ensure consistency, including details on sample characteristics, research methods, environmental factors, and main findings related to walking intentions. After extraction, the data were analyzed thematically to identify emerging patterns regarding how visual landscapes and soundscapes influence the willingness of elderly people to walk in urban environments [17].

Studies were grouped by their primary environmental emphasis as visual, auditory, or both. This organization allowed for clear analysis of the separate and combined influences of sensory factors on walking intentions. The methodological quality of each study was assessed to identify potential sources of bias and strengthen the interpretation of findings. Limitations present in the literature were summarized, especially where studies did not examine both visual and auditory elements together. Suggestions for further research in urban studies were also provided.

The integrated methodology described in this paper aims to deliver a rigorous and comprehensive understanding of how visual landscapes and soundscapes within urban neighborhoods affect walking intentions among the elderly. This systematic approach provides a strong foundation for future research and for policy development focused on promoting active aging through thoughtful urban design.

4.1. Data analysis

This review used thematic analysis for qualitative data analysis to better understand how elderly individuals perceive landscapes and soundscapes in urban residential settings. Thematic analysis is well suited for identifying and interpreting recurring patterns and themes in qualitative data. This method made it possible to capture detailed perspectives on how characteristics such as greenery, visual appeal, and environmental sounds affect walking intentions in older adults.

The analysis focused on key factors including green space preference, noise sensitivity, appearance, and safety. These aspects together reflect important dimensions of elderly perceptions that shape mobility decisions. For example, a preference for green spaces shows that natural environments support relaxation and encourage walking [18]. Noise avoidance highlights how urban noises like traffic and construction reduce outdoor activity among the elderly and foster a desire for quieter environments [12,13].

4.1.1. Coding process

Table 2. Encoding process

Stage	Description	Examples
Open Coding	Initial reading of studies to extract passages and meaningful statements, such as keywords like "comfort of parks", "fear of noisy streets", and "aesthetic pleasure". This stage allows for broad categories.	Keywords: "comfort of parks", "fear of noisy streets", "aesthetic pleasure"
Axial Coding	Categorizing open codes into more refined themes based on similarities and differences, e.g., green space preferences and noise avoidance.	Green space preferences: Trees, benches, green areas; Noise avoidance: Traffic, noise, complaints in parks
Selective Coding	Linking themes with concepts closely related to the review's research questions, examining the impact of each theme on elderly walking intentions.	Linking green space preferences to walking intentions, and noise avoidance to decreased walking intentions.

Table 2 shows Encoding Process. The coding process in this review began with open coding, each study was read carefully to extract passages and statements meaningful to the characterization of elderly walking behavior about urban landscapes and soundscapes. The main topics with which the respondents were associated were identified using keywords such as "comfort of parks," "fear of noisy streets," and "aesthetic pleasure." Such broadness at the initial stages of the coding is beneficial as it does not restrict the researchers by strict categories that are set during the analysis [19].

Then the axial coding was done whereby these codes were categorized into more refined themes according to similarities and differences. For instance, codes regarding trees, benches, or green areas as favorites were categorized under green space preferences; complaints regarding traffic, noise, or people in parks and noise complaints were categorized under noise avoidance. The benefits of this step included moving from general areas of interest to more specific areas that would be pertinent to elderly perceptions. Selective coding was then performed to link these themes to other concepts closely related to the review's research questions which, again, examined the impact of every thematic category on the intentions of walking.

5. Findings

5.1. Theme 1: Visual appeal of urban landscapes

Appealing urban landscapes, particularly those characterized by greenery, aesthetic design, and good maintenance, play a significant role in encouraging walking among older adults. As shown in Table 3, multiple studies demonstrate that features such as tree-lined streets and well-kept green spaces foster a sense of comfort and motivation to engage in physical activity[5,20,21]. These findings highlight the importance of visual quality in shaping elderly mobility decisions.

However, not all visual stimuli have a positive influence. Neglected environments with graffiti or lack of landscaping not only reduce visual appeal but also raise perceived safety concerns. This contrast between appealing and neglected spaces shows that visual influence is not only about presence (e.g., trees or flowers) but also about condition and maintenance. Moreover, while most studies point to positive influences of green elements, few offer quantitative comparisons between different visual features, limiting generalizability. It is also notable that few studies explored intersections between visual aesthetics and other urban characteristics such as lighting or seating availability.

Table 3. Key contents of the literature regarding Theme 1

Study	Focus Area	Findings	Implications
Sugiyama et al. (2013)	Preference for greeneries and tree-shaded roads	Elderly prefer walking in greeneries and tree-shaded areas with restorative characteristics.	Green and shaded areas should be prioritized in urban design for elderly mobility.
Spano et al., 2021	Biophilia theory: preference for green areas	Green areas are preferred for walking, as they provide comfort and safety.	Urban planners should incorporate green spaces to align with biophilia theory.
Gardener et al. (2020)	Appeal of beautiful views and aesthetics in elderly engagement	Beautiful views encourage elderly to engage in physical activity.	Urban environments should focus on aesthetics to increase physical activity among elderly.
South et al. (2018)	Negative impact of unappealing environments on walking intentions	Visually unappealing environments discourage walking due to safety concerns and lack of maintenance.	Poorly maintained environments should be avoided to promote safety and mobility.

5.2. Theme 2: Soundscape and noise aversion

Table 4. Key contents of the literature for Theme 2

Study/Author	Focus/Topic	Key Findings
Payne (2009)	Influence of natural soundscapes (e.g. leaves, birds, water) on elderly mobility	Natural soundscapes in parks and green areas decrease stress and facilitate walking
South et al. (2015)	Impact of high noise levels (e.g. traffic, construction) on elderly walking frequency	High noise levels lead to anxiety, discomfort, and reduced walking among elderly
Gardener et al. (2020)	Role of noise reduction measures (e.g. barriers, quiet zones) in enhancing walking intentions	Noise reduction strategies like barriers and quiet zones increase walking frequency and improve well-being

Acoustic environments have been identified as critical to walking behavior in the elderly. As shown in Table 4, key studies summarize the main findings regarding soundscapes and noise aversion among older adults. Natural sounds such as birdsong and flowing water offer calming effects [12], who found that these sounds reduce stress and increase walking engagement. These findings suggest a strong sensory-affective relationship between soundscapes and emotional readiness for outdoor activity.

Conversely, the negative impact of urban noise emerges strongly across studies. Traffic and construction noise reduce walking frequency due to heightened anxiety [13]. This is particularly relevant in dense urban settings. Research demonstrates that noise mitigation strategies, such as quiet zones and physical barriers, can promote walking and enhance overall well-being [21].

A synthesis across these studies shows a clear dichotomy: natural sounds support walking, while mechanical noise deters it. However, the degree to which different types of natural or artificial sounds affect subgroups within the elderly population is not always clearly delineated. Few studies compare sensory thresholds or tolerance levels across age, gender, or health status, which could offer deeper understanding.

5.3. Theme 3: Combined sensory impact

Table 5. Key contents of the literature for Theme 3

Study Author(s)	Focus Area	Key Findings
Spano, Dadvand, and Sanesi (2021)	Visual Environment & Biophilia Theory	Greenery and natural environments are perceived as restorative; they promote walking.
Payne (2009)	Soundscape & Stress Reduction	Natural soundscapes like birds and water help reduce stress, thus encouraging walking.
South et al. (2015)	Urbanization & Noise Impact	Noise in urban settings counteracts the benefits of green spaces and reduces walking frequency.

Environmental stimuli play a significant role in modifying elderly walking intentions. As shown in Table 5, key studies summarize the combined impact of visual and auditory features on walking behavior among older adults. The reviewed studies demonstrate that visual and auditory features are not isolated; rather, their combined effects produce a holistic sensory experience that shapes behavior. For instance, studies highlight the restorative influence of greenery and calming sounds, supporting a multisensory interaction model in which stress reduction is maximized when visual and auditory environments are aligned [5,12].

Some studies caution that urban noise can diminish the restorative benefits of visually pleasant environments [13]. This finding highlights a gap in planning: beautifying spaces alone may not be effective unless noise pollution is simultaneously addressed. Therefore, design interventions should consider multisensory coherence, not single-feature improvements.

Few studies examine how older adults respond when faced with incongruent environmental features. Some research shows that green spaces do not improve mobility when located near major roads, which highlights the need for more nuanced analysis of how sensory elements interact under different environmental, cultural, and socioeconomic conditions. This lack of consensus suggests that multisensory environments should be evaluated within specific contexts rather than through generalized conclusions.

5.4. Synthesis of findings

The themes collectively reinforce the centrality of both visual and auditory qualities for elderly walking intentions. Green spaces and pleasing soundscapes consistently emerge as supportive factors, while noise and neglect act as barriers. These findings intersect: environments that are green, quiet, and safe reinforce each other's benefits, highlighting the need for multisensory harmony rather than focusing on single elements.

The positive influence of nature aligns with biophilia theory, where natural settings are associated with psychological benefits and increased motivation to engage in physical activity (Koohsari et al., 2018; Spano et al., 2021) [5,18]. Simultaneously, the role of noise as a deterrent is well documented, with evidence showing that noise-related anxiety can reduce the amount of time people spend outdoors [12]. Aesthetic preferences such as colorful plants, benches, and clean paths also proved meaningful in encouraging physical activity [22].

Safety perception was another frequently emerging sub-theme. Studies found that good lighting, clear crosswalks, and clean surroundings enhance confidence and mobility among the elderly [3]. Importantly, these findings intersect: environments that are green, quiet, and safe reinforce one another's positive effects.

5.5. Critical analysis

Beyond methodological limitations, a key weakness in the current literature is the inconsistency of findings across settings. Some studies report that aesthetic improvements lead to increased walking, while

others suggest these changes have little impact without parallel improvements in safety, accessibility, or noise mitigation. Such contradictions remain under-explored and merit deeper discussion. When critically evaluating the reviewed studies, several methodological strengths and limitations emerge. Most of the studies employed qualitative methods such as in-depth interviews and focus groups, which allowed for rich, nuanced accounts of elderly perspectives [17]. These methods are appropriate for understanding subjective experience, which is key in sensory perception.

However, a common methodological weakness is sampling bias. Many studies focused on specific neighborhoods or regions, making it difficult to generalize findings. Also, there was inconsistent reporting of environmental features; in some cases, site characteristics were not systematically described, which reduced comparability across studies.

Despite these limitations, this systematic review identifies consistent patterns and gaps. Visual attractiveness, low noise levels, and perceived safety are critical to promoting elderly mobility. Urban planners and public health professionals should adopt integrated strategies that prioritize multisensory harmony to create walkable, age-friendly neighborhoods.

6. Discussion

6.1. Interpretation of findings

This review demonstrates that while greenery and visual aesthetics are important, their benefits are context-dependent and often moderated by perceptions of safety, maintenance, and sociocultural factors. Similarly, the positive effects of pleasant soundscapes can be undermined by urban noise if not addressed holistically in planning.

Similarly, the soundscape appeared as a critical spatial element where natural sounds helped enhance motivation among elders to walk while urban noise discouraged them. Some studies have observed that traffic noise and other urban sounds are associated with reduced walking frequency among older adults. Such insights demonstrate the need to address noise pollution as well as environmental enrichment in terms of pleasant sound occurrences in urban environments.

Figure 4. Thoughtfully designed pathways, lush greenery, and cozy seating areas create a vibrant space for relaxation and interaction in the heart of the city

Figure 5. Green environment in the residential neighborhood of an urban setting characterized by the sound of fountains and low rumbling of traffic in the background

The systematic consideration of these sensory dimensions in elderly walking sheds light on the combined sensory impact, thus yielding the overall understanding of this experience. Beauty improves the overall design and, together with pleasant music, makes the environment therapeutic as well as motivational to exercise. However, when one sensory element is misaligned, such as noise in otherwise green settings, the benefits may be undermined. This emphasizes the need for integrated sensory planning in urban environments.

6.2. Policy and design implications

The results have cumbersome implications for urban planning and designing for the improvement of aging well-being. First, policymakers should invest in green spaces, such as parks, trees on the sidewalks, and community gardens to enhance elderly mobility. These features not only can increase the phenomenon of appreciation of landscape details but also afford a natural sound environment which is a notable predictor for psychological well-being. Such encouraging characteristics can be in addition preceded by urban designers to improve these spaces in ways that can be suitable for the elderly through integrating accessible paths, sitting zones, and lights increasing accessibility and safety.

Another important domain of focus is the level of noise management. Measures such as the creation of quiet areas, utilization of plants for screening purposes, and increased noise control barriers can minimize the impact of urban noise perturbation on elderly mobility. Also, the application of auditory design components like water and birds can also improve the haptic of urban environment settings.

The social context must also be taken into consideration by policymakers when planning urban development. Open spaces that promote social interaction, such as plazas and community centers, can serve as additional incentives for walking among older adults. These areas should be designed to ensure that elderly individuals feel safe, comfortable, and welcomed. Together, such design strategies emphasize the importance of holistic urban planning that addresses not only mobility infrastructure but also sensory quality and opportunities for social engagement.

6.3. Impact on public health

The findings of this review pinpoint the fact that urban design has meaning for advancing health, particularly for the aging population. Aerobic walking is essential for older people since it has major benefits

for improving cardiovascular health, disease risk reduction, and better psychological health. By understanding environmental factors that facilitate or hinder walking, city Planners can promote healthier lifestyles and discourage healthcare costs associated with sedentary living.

Besides, there are places that encourage the elderly to walk can help lift the spirit of loneliness, which is rampant among the elderly. Thus, the social human spaces decorated with appropriate visuals and soundscapes can help people strengthen their social interaction and enhance their physical and psychological well-being. Therefore, walkable environments contribute not only to individual health but also to broader public health systems through community cohesion and reduced disease burden.

6.4. Safety and accessibility concerns

Comfort regarding elderly people walking in urban residential areas highly depends on safety and access to these areas. Proper illumination, signs, and properly lit pathways for pedestrians will provide a safe and comfortable environment. Research indicates that older adults prefer well-lit areas where they perceive the environment as safe, particularly in the evening, as poor lighting discourages outdoor walking due to increased risk of accidents [3].

Moreover, the environment that is observed as available and accommodating for pedestrians mainly includes ramps for the disabled, benches for resting, and crosswalks for walking also influences the intentions of walking. Research suggests that older people prefer places where these factors feature because these factors lower stumbles and physical exertion. There should be provision for shaded rest areas to help the elderly take a break and restart the walking exercise without exhaustion.

Concerns about safety hazards of crime like theft, and harassment affect the degree of elderly mobility. The presence of surveillance such as cameras and or regular police patrol within neighborhoods makes the areas safer and encourages elder people to walk. Stakeholders should address these concerns by formulating policies that enhance urban planning and incorporating the community in such decisions since it will encourage more elderly persons to engage in more outdoor activities that positively impact their well-being and safety.

Figure 6. Consistent Lightening, lit pathways for walking, benches for resting provides a safe and accessible environment.

6.5. Theoretical implications

This review contributes to environmental psychology and urban design theory by providing a critical analysis of how visual and auditory environments jointly shape elderly behavior through the lens of biophilia

and restorative environments theory. The biophilia hypothesis suggests that humans possess an inherent affinity for natural elements, which supports not only psychological well-being but also motivates physical activity [22]. However, this review goes beyond a descriptive approach by examining how biophilic urban features (such as greenery and water sounds) can be diminished or even negated by the presence of stressors like urban noise or poor maintenance. This dynamic reveals the need to balance positive and negative sensory inputs to fully realize the benefits proposed by biophilia theory.

The restorative environment theory posits that exposure to natural settings aids in stress reduction and attention restoration [23]. Our synthesis finds that environments offering both visual and auditory comfort are more likely to support restorative experiences for older adults. In contrast, sensory mismatches such as green spaces accompanied by disruptive noise can undermine these restorative benefits, which highlights the importance of considering the synergy or conflict between different sensory modalities. This critical perspective advances the application of restorative environments theory from a static description to a more nuanced, context-dependent framework that acknowledges potential limitations in real-world settings.

By explicitly analyzing the interaction between biophilic design and restorative environments within multisensory urban contexts, this review identifies a key theoretical gap: current frameworks often overlook cross-modal or integrative sensory effects. Our findings indicate that simply increasing green space or reducing noise in isolation is not sufficient; instead, a holistic approach is required to maximize both psychological and behavioral outcomes for the elderly.

Future theoretical work should therefore build on this integrative, multisensory perspective, applying it to empirical studies of aging populations in diverse urban environments. Such an approach will help to clarify under which conditions biophilia and restorative effects are realized or hindered, contributing to a deeper and more actionable understanding of elderly mobility.

7. Limitations and recommendations

It is vital to admit that the present systematic review can contribute considerably to the insights regarding the visual and soundscape environment impact on elderly walking intentions, though it has certain limitations. One major threat to the study's validity is publication bias. Most of the studies incorporated in this review were identified from academic databases including Scopus and Web of Science, where there is likely to be reporting bias towards positive studies and non-reporting of null or negative results [24]. This bias could reduce the scope used in the findings and consequently reduce the provision of a balanced view of a research study.

The other limitation focuses on the geographical and cultural aspects of the studies that were under investigation. Much of the literature review about elderly mobility in urban surroundings has taken place in high-income countries with well-developed urban environments such as the United States, European countries, and certain countries in Asia. Thus, it means that in low- and middle-income countries, the findings could not be fully transportable due to differences in urban planning, support for aging populations, and environmental conditions. This geopolitical bias limits the generalization of the review's findings across the world.

Another significant limitation lies in the exclusive use of qualitative synthesis without incorporating statistical meta-analysis. While thematic analysis offers depth and contextual richness, it does not provide quantitative estimates of effect size or comparative strength across variables. Consequently, there is no measure of the proportion of various decision-making factors concerning the intentions of elderly people to engage in walking as derived from thematic analysis [25].

To address this gap, future studies should consider mixed-method approaches that combine qualitative insights with meta-analytical techniques. Such integration could enhance validity by quantifying key relationships while retaining the explanatory depth of qualitative themes. For example, meta-analyses examining intervention effects or comparing subgroup differences across gender, age brackets, and levels of urban density would improve generalizability and guide evidence-based design interventions.

Lastly, the use of language bias may have excluded relevant articles published in non-English languages. As all included papers were written in English, this might have limited the scope of perspectives, particularly from regions where urban mobility issues are emerging but underrepresented in English-language journals.

8. Future research directions

Addressing the limitations of this review provides an avenue for future research. One clear research recommendation is to conduct studies with longer observation periods to better understand how visual and audible urban features influence elderly walking behavior. Cross-sectional research can reveal only statistical associations, while such biases could be controlled in longitudinal studies that can uncover causal relationships and shifts in behavior over time.

Another important approach is to use experimental designs to make precise hypotheses about the effects of urban soundscapes in specific contexts. For instance, field experiments could test how elderly individuals' walking intentions change in response to variations in traffic noise, natural sounds, or other auditory stimuli. Such studies would help clarify the specific impact of auditory experiences on mobility.

To address geographic and cultural diversity, cross-national studies are needed. Research in low- and middle-income countries on elderly mobility could help identify unique mobility barriers and opportunities for improving physical accessibility. This can also support the identification of best practices and context-specific interventions for age-friendly urban environments.

Emerging technologies present promising tools for advancing elder-focused urban research. For example, web-based virtual reality (VR) platforms have been used to simulate urban environments and evaluate how design changes influence walking intentions and experiences among older adults, providing an immersive and safe setting for experimental research. Empirical studies demonstrate the feasibility and acceptability of VR in this context. Older participants could successfully navigate and assess virtual urban settings, identifying design features and barriers that impact their walking behavior [26]. Similarly, VR-based interventions enable precise evaluation of urban mobility challenges and are well accepted by older adults [27]. Artificial intelligence (AI) further supports this work by enabling analysis of large urban datasets and prediction of how proposed changes may affect elderly mobility. Preliminary applications show that AI tools can model walkability, forecast environmental impacts, and personalize mobility recommendations, thereby supporting more evidence-based and tailored urban planning [28]. These technological advances provide planners and researchers with powerful methods to design and evaluate elder-friendly environments.

Finally, future research should consider multi-sensory integration in urban contexts. While this review has focused on visual and auditory properties, other senses such as touch (including surface textures) and smell may also influence elderly mobility. Exploring how these sensory inputs combine to shape the overall walking experience can provide valuable insights for designing urban spaces that are more inclusive and supportive of older adults.

9. Conclusion

This review confirms the importance of multisensory urban environments for promoting elderly mobility. Integrating visual quality, greenery, and a comfortable soundscape is essential, but their positive impact depends on maintenance, safety, and local context. By foregrounding the interplay of sensory factors, this review provides a foundation for more inclusive and evidence-based urban planning.

Studies examining combined sensory inputs suggest that environments offering both visual and auditory comfort are more likely to produce restorative experiences that encourage physical activity. In contrast, even visually attractive environments may be undermined by auditory discomfort, highlighting the importance of integrated sensory design.

Future research should prioritize longitudinal and experimental approaches to better understand sensory integration in diverse urban settings, especially in low- and middle-income regions. This will support more inclusive, age-friendly and sustainable urban development. This review offers a distinctive contribution by foregrounding the sensory dimensions of elderly mobility, providing a foundation for future interdisciplinary research and planning.

Conflict of interest

The authors declare no conflict of interest.

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