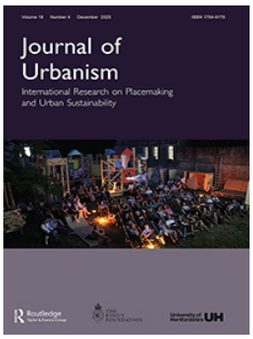

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Exploring women's perception of safety through sensorial experiences

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ABSTRACT

Women may face challenges in their use of and participation in public spaces due to concerns about vulnerability to potential victimisation, which can impact their perception of safety. While current research predominantly explores women's safety perceptions through visual aspects, it often overlooks the gendered perception of safety through sensorial experiences. This paper investigates how women's perceived safety in the public spaces of Reading is influenced by sensorial experiences. To explore the impact of sensorial stimuli, specifically sound and touch, on safety perceptions, this paper uses non-participant observation, photographs, surveys, and morphological mapping. It focuses on two streets in Reading town centre: one perceived as "safer" (Broad Street) and the other as "less safe" (Minster Street). Female residents participated in a survey reflecting on their perceptions of safety, with photo and audio-visual simulations used to explore sensorial experiences of sound and touch. Findings confirm that sensorial experiences significantly influence safety perceptions. Visual features shape touchscapes and soundscapes, which impact women's streetlife positions and perceptions of safety, particularly through co-presence. This paper's significance lies in its potential to inform urban design interventions, with implications for towns and cities across the UK, aiming to enhance perceived safety and mitigate gender-based exclusion in public spaces.

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Introduction

Gender-based disparities persist in public spaces, compromising their inclusiveness. Ensuring safety and security in urban environments is crucial for individual well-being (Adams 2014), yet equitable access remains a challenge. Women, in particular, often face increased vulnerability and exclusion, shaping their perception of risk and limiting freedom of movement (Navarrette-Hernandez, Vetro, and Concha 2021). The issue of women's safety extends beyond the absence of violence; it includes the "perception of safety," defined as one's comfort and perceived risk in relation to the built environment, which is important to human well-being (Mouratidis 2019).

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While existing research primarily focuses on visual aspects of safety, other sensorial dimensions have often received less attention. For example, design interventions such as removing graffiti, incorporating windows (Navarrette-Hernandez, Vetro, and Concha 2021), enhancing visibility through improved permeability (Roy et al. 2022), and implementing lighting and active functions to support "eyes on the street" (Jacobs 1961) have proven beneficial. However, urban design literature often overlook women's perceptions of safety as shaped by sensorial engagement. Multisensorial input such as olfactory, tactile, and auditory elements is fundamental to how we experience public spaces and influences our emotional responses to the environment (Degen and Rose 2012). Sensorial experiences also play a crucial role in shaping our sense of place; as we walk through urban spaces, we naturally engage with all our senses, giving us a deeper understanding of our surroundings (Wunderlich 2008). While there has been research on sensorial experiences related to gender (Olofsson 2017) and safety (Guo et al. 2022), the relationships between these aspects have often been overlooked. Nevertheless, this connection is important because, as Navarrette-Hernandez, Vetro, and Concha (2021) state, perceptions involving temperature, smells, and points of view can enhance or diminish the impact of the visual, a limitation in their research, which focused solely on vision. Thus, sensorial experiences play a significant role in understanding individuals' perceptions of safety in public spaces and should be thoroughly examined, with a particular focus on women's perspectives.

Women's perceived safety in public spaces

The experience of public spaces significantly influences whether they are perceived as places of safety or fear. While such spaces are intended to promote freedom and vibrant public life (Stevens 2007), their design plays a key role in shaping how they are used and understood (Carmona 2019). Feelings of safety and security are particularly critical for enabling women's freedom and well-being in urban environments (Adams 2014). In this sense, the perception of public spaces as safe is fundamental to achieving true freedom within them.

The exclusion of women from public spaces is a long-lasting and pervasive issue. Historically, societal norms have associated women primarily with private and domestic spaces, while reserving public spaces for men (Day 2011). Many of these assumptions persist today, disadvantaging women in environments that do not reflect their experiences or needs. This increases their sense of vulnerability and perceived risk, ultimately limiting their freedom of movement in urban areas (Navarrette-Hernandez, Vetro, and Concha 2021). Feminist approaches to urban design have responded by challenging the divide between public and private realms, bringing attention to concerns such as sexual harassment in public spaces (Day 2000). Acts such as looking at, commenting on, or harassing women conflate intimate and private matters with women's public presence in public spaces, thereby restricting their freedom and mobility (Franck and Paxson 1989). While May (2014) advocates for openness and accessibility in public spaces, their perspective tends to overlook the complex interplay of public and private issues that women navigate daily. Experiences of objectification significantly shape women's perceptions of public space, rendering it incongruent with the idealised public realm where all individuals participate equally and freely (Day 2011). Thus, women do not experience the same

degree of "freedom of the street" as their male counterparts (Franck and Paxson 1989). However, the most successful public spaces often exhibit a notably high proportion of female users (Whyte 1980), suggesting the importance of carefully studying women's spatial behaviours to inform the creation of environments that are safe and inclusive for everyone, regardless of gender.

Women's experiences of public spaces are also shaped by time of day. At night, perceptions of safety shift considerably: trust in strangers during daylight can give way to caution and fear after dark (Hardley and Richardson 2021). Polko and Kimic (2021) stress that this change has a considerable impact on women's willingness to use public spaces at night, as heightened perceptions of vulnerability increase concerns about potential victimisation. These negative perceptions diminish inclusivity, outlining the imperative need to study gendered experiences during nighttime hours (Hardley and Richardson 2021). This is crucial when considering sensorial dimensions, which Luo, Miao, and Zhao (2021) note have been largely overlooked in nigh-time safety research. While visual elements such as lighting have received considerable attention (Navarrette-Hernandez, Vetro, and Concha 2021; Polko and Kimic 2021), other sensory cues have received far less focus. Yet, our bodies are immersed in various rhythms, smells, soundscapes, and touchscapes while walking through the city (Wunderlich 2008). Therefore, any study of gendered safety perceptions must therefore account for the significance of these sensorial experiences.

Spatial patterns of use and movement within the public realm are inherently gendered. According to Pucci, Vecchio, and Vega (2023), perceptions of unsafety can deter women from using public spaces, leading them to alter routes or avoid travel altogether. As a result, their presence in public spaces often reflects selective choices about where to go. This phenomenon is underscored by Whyte's (1980) observations, which highlight that spaces frequented by more women tend to feel safer and function more successfully. Analysing these patterns provides valuable insights into whether urban spaces effectively meet women's needs. This resonates with Beebeejaun's (2017) argument that theoretical and methodological frameworks grounded in women's spatial tactics and experiences can foster a fine-grained understanding of how gender shapes everyday experiences in public spaces.

The visual dimensions of women's safety in public space

This section discusses the visual aspects of women's safety in public spaces, focusing on functional mix, public/private interfaces, and access. It is worth noting that the visual cannot be separated from other senses (Tuan 1977). Hence, while exploring visual qualities, it is important to recognise their interplay with other sensorial experiences. The visual and morphological dimensions of public spaces, such as functional mix, public/private interfaces, and access, have a significant impact on the intensity of streetlife and, consequently, perceptions of safety (Peimani and Kamalipour 2020, 2022). This is seen in a prominent concept within urban design literature – Jacobs (1961) "eyes on the street," which argues that natural surveillance through human presence enhances street safety. She encourages this through the visual and morphological dimensions of public space, advocating for mixed-use areas that attract people (Peimani 2023). Short blocks that promote permeability further encourage pedestrian engagement and create more

opportunities for "eyes on the street," making this an important consideration for safety. Studies indicate well-connected, permeable streets can make women more visible and support surveillance, enhancing their sense of safety (Peimani and Kamalipour 2016; Roy et al. 2022).

This aligns with the concept of public/private interfaces, as Dameria and Fuad (2021) note that permeability can be visually identified through active building frontages and transparency, which support natural surveillance. Newman's (1972) "defensible space" expands on this idea, framing natural surveillance as a connection between interior and exterior spaces, with windows enabling residents to oversee public spaces. Active interfaces with high transparency can foster perceptions of a safe street by ensuring constant observation from building occupants (Dameria and Fuad 2021). Thus, the visual built environment, through its functions, interfaces, and permeability, is crucial to understanding perceived safety. The ground floor is where pedestrians interact with public space, making engagement at eye level critical to its success or failure (Peimani and Kamalipour 2024). The success of streets as daily destinations depends on how ground-floor interfaces stimulate the senses (Gehl, Kaefer, and Reigstad 2006). J. Simpson et al. (2022) argue that variations in social opportunities, interfaces, and functions affect street vitality, which in turn impacts people's emotions, well-being, and perceptions of safety. For example, hard, blank ground floors diminish quality of life, while low-quality street edges lacking openings undermine emotions (J. Simpson et al. 2022). Dividing street edges into active interfaces enables diversity, sensorial richness, and engagement, as noted by Ewing and Clemente (2013). Interfaces are inseparable from sensorial experiences and are important for vibrant streetlife. Active edges generate sounds through human presence, smells from uses such as bakeries, tactile experiences through materials, and influence the kinetic sensations of moving along the street (Hou 2010). As Gehl, Kaefer, and Reigstad (2006) stress, ground floors accommodating multiple functions and subdivisions encourage intense and prolonged interaction with street edges, enhancing the pedestrian experience – an important factor in assessing a space's safety.

It is important not only to explore how women move through streets, but also where they choose to stop. Gehl (2010) discusses the "edge effect" – when people pause, they tend to select locations along the edges of a space. This allows them to avoid obstructing pedestrian flow, stay quietly, and discreetly, maintain a clear view of their surroundings, protect their backs, and gain both physical and psychological comfort. Thus, "stopping" is often a selective act and can be crucial for feelings of safety. This behaviour is gendered and influenced by whether one is alone or in a group. Cao and Kang (2019) note that women are more sensitive to environmental conditions and more inclined to avoid being seen. They also found that single users tend to follow the edge effect, whilst groups distribute themselves more evenly across the street. In this way, women's spatial choices shape their perception of safety. For example, selecting a spot with one's back to an edge (Gehl 2010) is a purposeful safety decision. Yet the sensory dimensions of the edge effect remain underexplored, despite Gehl, Kaefer, and Reigstad (2006) stressing the importance of public/private interfaces for sensory engagement.

Exploring the relationships between visual dimensions and sensorial experiences is crucial for understanding women's safety perceptions. Luo, Miao, and Zhao (2021) argue that attracting people to a space not only establishes "eyes on the street" but also creates soundscapes, such as music, that signal human presence. Despite this, there is

a noticeable gap in the literature connecting the morphological and visual dimensions of urban space to sensorial considerations in women's safety. Urban design research has often prioritised the visual over other senses (Degen and Rose 2012). This does not diminish its importance, as Navarrette-Hernandez, Vetro, and Concha (2021) show: interventions such as providing public toilets, removing solid walls, and eliminating graffiti can enhance women's perceived safety. Roy et al. (2022) likewise underscore that permeable street edges improve visibility and safety. Jacobs (1961) further advocates for mixed-use functions to ensure eyes on the street as well as adequate lighting for safer environments. Nevertheless, an emphasis on visual dimensions often overshadows other sensory aspects. Examining women's perceived safety independently of other senses presents challenges, as Tuan (1977) notes that "the five senses constantly reinforce each other to provide the intricately ordered and emotion-charged world in which we live" (p. 11). Women's perceptions and experiences of public spaces are shaped by this interplay of visual and other sensorial qualities. For instance, Roy et al. (2022) link visibility not only to being seen but also to being heard, which can enable timely help – emphasising the importance of soundscapes. The interconnection between visual and other senses reinforces these safety considerations, yet literature exploring this specifically from women's perceptions remains somewhat limited.

Sensorial experiences and safety perceptions in public space

Establishing an appropriate sensory environment is vital for promoting well-being and perceived safety (Adams 2014). This section explores safety through sensorial experiences – touchscapes, co-presence, and soundscapes. Through physical movement, touch allows us to understand spatial configurations in urban environments, a dimension often overlooked in urban design (Townshend 2022). As we walk, our haptic senses engage, influencing our perception of surroundings (Wunderlich 2008). Rodaway (1994) conceptualises scales of touch, from global-touch (body's general contact with the environment) to reach-touch (navigation through limbs). Walking allows women to experience the rhythms of urban space through touch (Wunderlich 2008), making it a crucial element in understanding safety perceptions.

The presence of others in public spaces is an aspect of safety that enhances natural surveillance. Hillier (1996) discusses the role of urban design in fostering "co-presence," encouraging social interactions. Stevens (2007) observes that people often reduce interpersonal distance in certain contexts, such as bars or restaurants. Public space is experienced through bodily encounters with others and their activities (Lefebvre 1991). For instance, street performances can generate both sociability and an engaging acoustic environment that draws people together (P. Simpson 2011). Such dynamics operate through visual dimensions that promote "eyes on the street" and foster social interaction, both of which contribute to natural surveillance. In turn, proximity to others influences tactile engagement with space and contributes to the creation of soundscapes, such as those generated by street performances. Together, these elements play a significant role in shaping women's sense of safety.

Soundscapes also shape how public spaces are perceived. Hearing provides information about our surroundings (Hou 2010), and Adams (2014) highlights its profound impact on quality of life. Tranquil spaces can facilitate thinking and

contemplation, whereas noisy spaces may hinder these activities. In some contexts, busy, noisy places can provide opportunities for social interaction, while quieter environments can indicate diminished natural surveillance due to fewer "eyes on the street." Luo, Miao, and Zhao (2021) found that music in urban green and built spaces during the evening can improve perceived safety, noting the importance of carefully selecting natural sounds, with traditional music often preferable. Similarly, Cao and Kang (2019) found that human activity sounds can contribute to social sounds among companions, while individuals alone may prefer privacy and quieter settings. Guo et al. (2022) also highlight the benefits of pleasant and eventful soundscapes for public spaces.

As people move through the city and register its soundscapes, their perceptions are shaped by the interplay of various socio-political factors (Makismovic, Joksimovic, and Utvic 2020), including gendered vulnerability in public space. Adams et al. (2015) note that negative sensory stimuli, such as traffic noise, constant human movement, and unpleasant sights and smells, often surface as consequences of the very features that attract people to public spaces. The experience of these soundscapes differs between those who appreciate their positive aspects and those affected by their less favourable aftermath. As Stevens (2007) observes, urban life produces an array of sounds that have the potential to impact an individual's actions yet are challenging to mitigate. These auditory cues act involuntarily on everyone within their range (Hou 2010) and convey the character of a space, thereby influencing perceptions (Adams et al. 2015). Understanding these dynamics can help avoid less favourable soundscapes and inform public space design interventions that improve women's sense of safety.

Wunderlich (2008) discusses how individuals engage subconsciously in sensory interactions with their environment, which strengthens their connection to it, and consequently influences their future use. If an experience is unpleasant, return visits are unlikely. Accordingly, Degen and Rose (2012), sensory accounts of the city must consider both the sensing body and its movement through space. For women, these interactions are central to walkability and their broader right to urban life. Whilst Guo et al. (2022) found both men and women benefit from positive soundscapes, females often pay closer attention to them, likely due to cognitive and perceptual differences. Olofsson (2017) extends this discussion by framing sound production as a gendered practice, where the same sounds may be interpreted as nuisance or skill depending on the gender of the individual involved. These findings underscore the need for more empirical research on how gender shapes sensory experience and, consequently, safety perceptions.

Research methods

This paper adopts a case study methodology utilising an "information-oriented" selection approach (Flyvbjerg 2006). To collect data on different circumstances for comparing sensorial experiences, maximum variation cases were selected (ibid.). Two study areas, namely Broad Street and Minster Street within Reading's town centre (Berkshire, UK) were chosen to facilitate comparative analysis. Accessibility to the field was also among the key case study selection criteria. Selecting our study areas within Reading's town centre offers the advantage of reflecting conditions common to many UK town centres, thereby increasing the broader

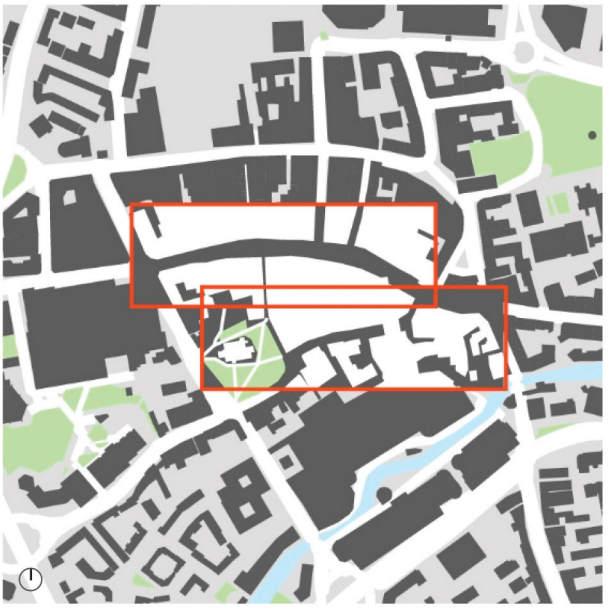

Figure 1. Study areas within Reading's town centre in relation to building footprints, green open spaces and street network (top square: Broad Street; bottom square: Minster Street). Scale: 800m x 800m. Map: Bethany Henty.

applicability of the findings. Figure 1 shows the locations of the selected case studies – Broad Street (A) and Minster Street (B) on the map of Reading's town centre.

Primary data collection was carried out using a pragmatic mixed-methods approach, including both qualitative and quantitative methods (Creswell and Creswell 2022). To collect data, we conducted an online survey, which is recognised in the literature as an effective method for capturing safety perceptions in public spaces (Peters 2017). Using Google Forms, a freely accessible online platform, we collected a total of 40 responses. We acknowledge the potential bias associated with online surveys. However, to mitigate this challenge and enhance the reliability of the answers, several measures were implemented. For instance, the survey was carefully designed around specific themes such as "use of streets" (e.g. time spent and activities), "spatial patterns" (e.g. lingering locations), "temporal patterns" (e.g. differences between day and night), "co-presence" (e.g. safety perceptions relative to the number of people on the streets, from very quiet to very busy), visual and morphological dimensions of the built environment (e.g. public/private interfaces, natural features, outdoor seating, markets), and existing soundscapes (e.g. pleasantness and safety). These themes, aligned with concepts and variables in Table 1, were explored mainly through closed-ended questions to facilitate quantitative comparisons while minimising completion time (Jackson 2001). Selected open-ended questions allowed participants to share personal experiences and reasons for feeling safer on the chosen streets. Anonymity was maintained by sharing the survey link via local Facebook community groups, helping to reduce researcher bias. Although online surveys have

Table 1. Summary of primary concepts and variables in the study.

Primary Concepts	Variables
Perceptions of safety Understanding individual's comfort and perceived risk within the built environment (Guo et al. 2022; Navarrette-Hernandez, Vetro, and Concha 2021)	Women's experience of public spaces
Visual, morphological dimensions of the built environment Analysing public/private interfaces and ground floors accommodating multiple functions and subdivisions as key to sensory engagement and the kinetic experience of traversing the street (Gehl, Kaefer, and Reigstad 2006; Hou 2010). Analysing how permeability, identified through active building frontages and transparency, supports natural surveillance and increases the presence of eyes on the street for safety (Dameria and Fuad 2021; Roy et al. 2022). Understanding how variation in social opportunities, interfaces and functions influences street vitality (Peimani 2023; J. Simpson et al. 2022).	- Patterns of functional mix at ground floor - Types of public/private interfaces based on permeability, transparency, pedestrian or car access, directness, or setback
Temporality Understanding that women's experience of public spaces is profoundly influenced by the temporal dimension (Hardley and Richardson 2021; Polko and Kimic 2021). Sensorial experiences, particularly during the evening, remain underexplored (Luo, Miao, and Zhao 2021).	- Perceptions of safety during daytime and nighttime - Stationary activities during day and night - Movement patterns during day and night
Sensorial experiences Exploring how sensorial engagement impacts safety perceptions in public spaces (Degen and Rose 2012; Wunderlich 2008).	Touchscapes, soundscapes and visual cues
Gender Understanding the impact of gender on perceived safety (Pucci et al. 2021; Olofsson 2017; Whyte 1980).	- Women's spatial patterns of use and movement - Women's safety perceptions shaped by touchscapes, soundscapes and visual interventions

inherent limitations (Kamalipour, Aelbrecht, and Peimani 2023), careful design and the integration of multiple methods helped ensure a more comprehensive understanding of women's safety perceptions in the study areas.

The audio-visual and photo simulation methodology was adapted from Navarette-Hernandez et al. (Navarrette-Hernandez, Vetro, and Concha 2021), who studied women's experiences in public spaces using built environment photo simulations. This approach involved capturing photos of the streets during both daytime and nighttime, followed by the creation of photo simulations (Figure 2) through making changes to interfaces, outdoor seating, markets, and natural features including water fountains and trees. To better accommodate for safety in relation to sound, the approach was extended following Jewitt, Price, and Sedo (2017), who highlight the importance of integrating sensorial experiences into the study. Daytime and nighttime videos of both streets were recorded, and participants (the same individuals who participated in the online survey) viewed them with audio, noting how safe they felt. Videos helped immerse the participants in the space, giving them an experience of being there. This is important as research indicates that audio-visual simulations tend to elicit higher engagement than single-sensory formats (Guo et al. 2022). While participants' familiarity with the streets may have influenced their safety perceptions, using the same individuals across methods enabled consistent comparison. This, in turn, allowed for direct correlation between survey findings and audio-visual simulation results, enhancing the depth and reliability of the analysis.

Figure 2. Example of photo simulation used in the survey. Photos: Bethany Henty.

Non-participant direct observation, photographic survey, archival records, and urban mapping were other key research methods. To understand women's use of the streets, site visits were conducted during both lunchtime (12 pm) and nighttime (10 pm) on three weekdays. Weekends and special events were avoided to capture typical conditions, and fieldwork was carried out between June and July 2023, the early summer months, to avoid periods of unfavourable climatic conditions. This approach was chosen because women's safety is affected by time of day (Hardley and Richardson 2021). Comparing the lunch rush, when women might be visiting or on lunch break, with 10 pm, when it was dark but still moderately active, provided insights into safety perceptions across different times. Activities were recorded following Mehta's (2023) methodology, exploring different types and locations of stationary activities to account for the edge effect. Women's movements were also traced, according to Gehl and Svarre (2013), to explore whether the edge effect influenced movement patterns. Photographs documented both the streets and women's activities, serving as a visual record and "diary" of observations (Gehl and Svarre 2013). In addition, Google Earth was used to map interfaces, functional mix, access, and soundscapes, contributing to a clearer understanding of Reading's existing urban morphology.

Each method was analysed to identify key themes related to women's behaviours and perceptions. Surveys including the audio-visual simulations were initially analysed quantitatively through Google Forms, with results presented as annotated pie charts and bar graphs for direct comparison between the streets. Open-ended answers were coded thematically to capture qualitative insights. Non-participant observational analysis involved mapping streetlife by whether women were alone or accompanied, their

activities, and locations. Pedestrian flows were analysed to trace movement patterns. Photographs were processed to highlight women for behaviour-focused analysis. Finally, morphological mapping was compared and layered with streetlife and sensory data to reveal patterns at multiple spatial scales.

Findings

The following section is organised around three key areas of discussion: (1) visual, morphological dimensions of the study areas, (2) safety in touchscapes, and (3) safety in soundscapes.

Visual, morphological dimensions of study areas

Before delving into an analysis of the functional mix and public/private interface typology of the streets, it is important to recognise the distinct characteristics of the studied areas. Broad Street stands out as a fully pedestrianised main high street, whereas Minster Street functions as a side road with shared vehicular and pedestrian access, predominantly facilitating bus access. This distinction is particularly relevant for soundscapes, as will be discussed later in the findings. It echoes the research of Adams et al. (2015), which suggests that vehicle noise tends to be a negative sensory stimulus, whilst human sounds are generally more positive – a contrast more evident on Broad Street. This therefore holds significant implications for perceptions of safety.

Analysing the ground-floor functions demonstrates that although both streets exhibit "active" functions during the day, these significantly decline at night (Figure 3). This correlates with reduced streetlife activities and pedestrian flows after dark (Figures 4 and 7), raising concerns about perceived safety during nighttime hours, particularly for women (Hardley and Richardson 2021). Despite apparent daytime visit functions on Minster Street, these predominantly serve as "back" entrances or are entirely closed off, as evident in the public/private interface analysis (Figure 4), potentially deterring movement and social presence. The clustering of activities on Broad Street creates a contrast in

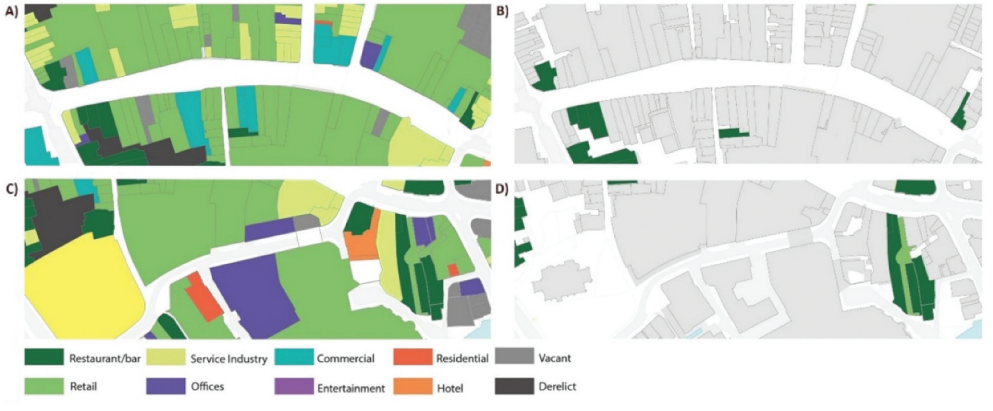

Figure 3. Active functional mix during the day (A: Broad Street; C: Minster Street) and at night (B: Broad Street; D: Minster Street). Scale: 400 m ×130 m. Maps: Bethany Henty.

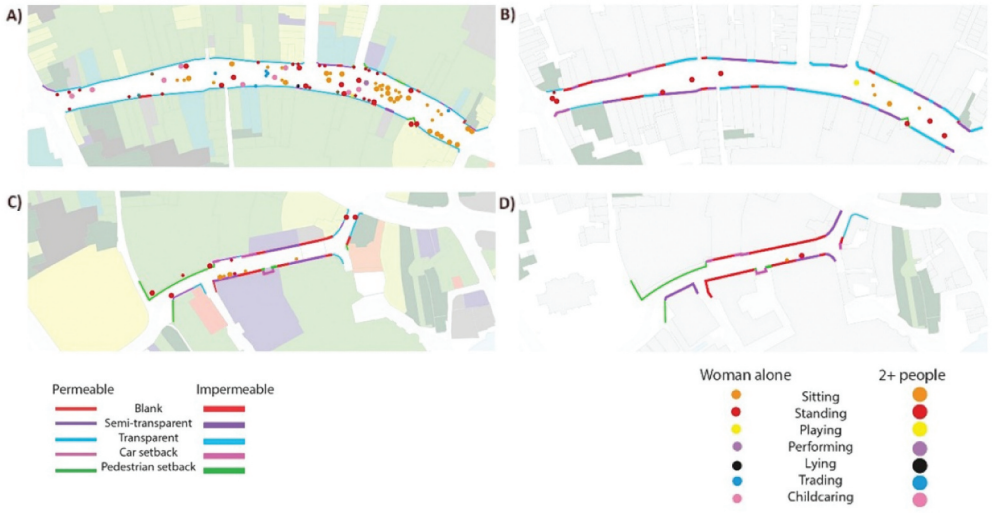

Figure 4. Public/Private interfaces and stationary activities during day and night (A and B: Broad Street; C and D: Minster Street). Maps: Bethany Henty.

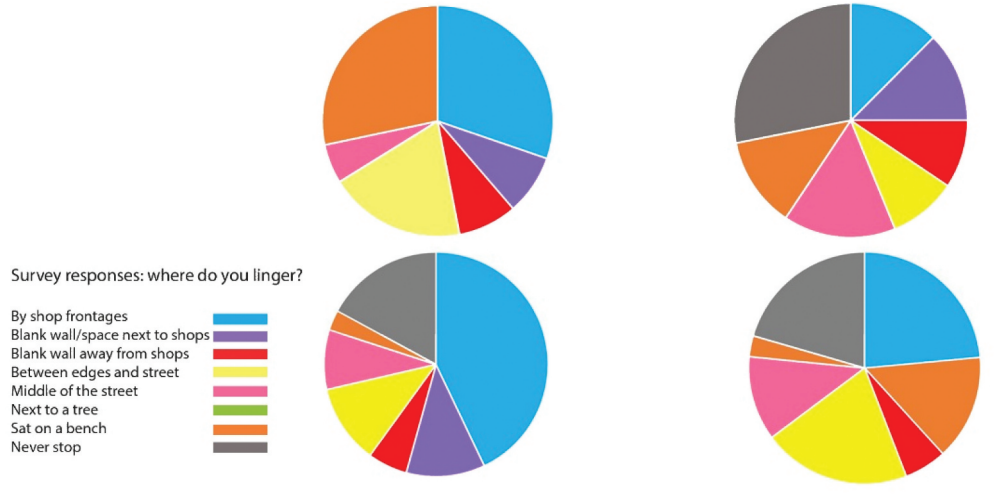

Figure 5. Women's survey responses to where they would choose to linger in each street in the day (top left: Broad Street, top right: Minster Street) and at night (bottom left: Broad Street, bottom right: Minster Street). Figure created by Bethany Henty.

streetlife intensity, hindering daily rhythms, as seen in observed activity patterns. This stresses the importance of engaging ground-floor uses in attracting people and supporting natural surveillance, as advocated by Newman (1972). A lack of "eyes on the street" reduces perceived safety not only on Minster Street during the day but also across both streets at night. Uninviting, impermeable interfaces further reinforce this effect (Newman 1972). Both streets undergo a noticeable drop in permeability and transparency after dark, with a more pronounced decline on Minster Street. This plays a crucial role in diminishing

Figure 6. Photographs demonstrating edge effect in the day and night (left: Broad Street; right: Minster Street). Photos: Bethany Henty.

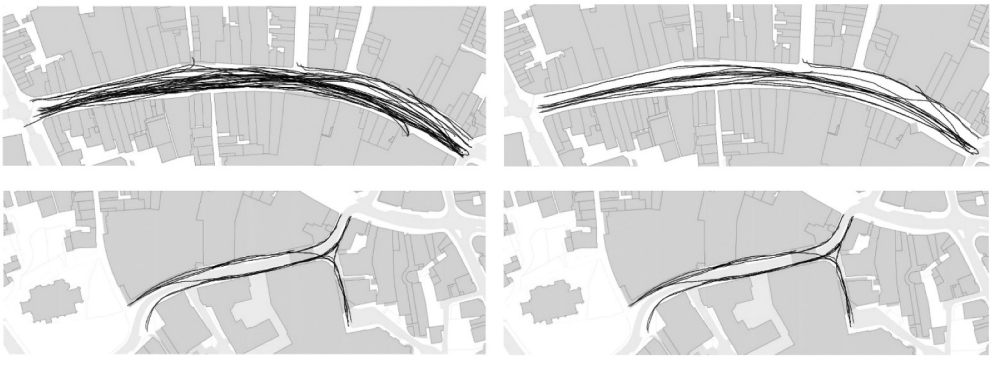

Figure 7. Women's pedestrian flows through tracing in the day (top left: Broad Street; bottom left: Minster Street) and night (bottom left: Broad Street, bottom right: Minster Street). Scale: 400 m ×130 m. Maps: Bethany Henty.

perceived safety as opportunities for natural surveillance decrease. Broad Street, in contrast, features more permeable and transparent interfaces, creating greater opportunities for sensory engagement and vitality in accordance with Gehl et al.'s (2006) findings.

Taking photographs on a "visual walk" allows one to observe urban interfaces and gain a sense of direction as if one is moving like the images (Bosselmann 1998). This reveals the abundance of transparent, active interfaces along Broad Street, making the walk seem "fast" while actively engaging the senses (Ewing and Handy 2009; Gehl 2010). For reference, this perceived speed of walking refers to a subjective, psychological phenomenon where women's perception of the walk feels faster, rather than the physical walking pace actually changing. These interfaces invite what Rodaway (1994) calls "reach-touch" experiences, encouraging exploration through texture and frontage. Their activity and openness imply the presence of others (Figure 4), improving safety perceptions through the touchscape concept of "co-presence" (Hillier 1996). In contrast, a stroll along Minster Street exposes individuals to inhospitable edges, slowing their walk. The absence of transparency seems to dull sensorial engagement, supporting Degen and Rose's (2012)

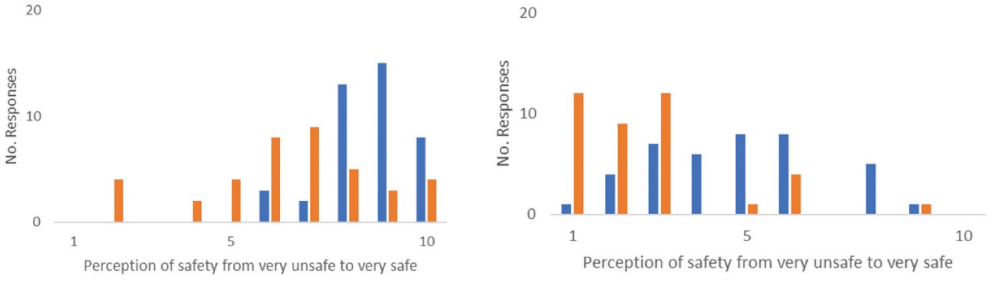

Figure 8. Perception of safety when viewing videos of Broad Street and Minster Street in day (left blue bars: Broad Street, left orange bars: Minster Street) and night (right blue bars: Broad Street, right orange bars: Minster Street). Figure created by Bethany Henty.

argument that the sensory body understands space through movement. We experience streets by walking past and either engaging or disengaging with the public/private interfaces. At night, Broad Street emits more light and maintains visual connectivity, offering more to engage with and contributing to a perceived faster walk (Gehl, Kaefer, and Reigstad 2006). In contrast, the limited transparency and lighting on Minster Street evoke hostility, reinforcing its role in promoting natural surveillance (Newman 1972). Nevertheless, it is noteworthy that 15 women stated they would "never" stop on either street at night (Figure 5), indicating that perceptions of safety and street use go beyond transparency alone, contrary to Dameria and Fuad's (2021) emphasis on its significance. While these 15 responses show hesitation, others expressed willingness to stop – contradicting observational data, which recorded minimal engagement in streetlife activities at night on both streets. While perceptions of safety appear higher on Broad Street (Figure 8) supporting Dameria and Fuad in part, the lack of active functions reduces the practical reasons to linger. Therefore, fewer chances arise for tactile experiences at night, limiting haptic relationships to place and reducing "reach-touch" interactions.

It is important to acknowledge that this paper is part of a broader study. Due to the scope and word limit, we have primarily focused on the analysis of morphological aspects of functional mix and public/private interfaces, specifically the street-building transitional zone or the threshold between public and private space. While this is not an exhaustive analysis, it provides valuable insights into the relationships between key morphological aspects – such as public/private interfaces and functional mix – and women's perceptions of public spaces. We acknowledge that further analysis of other morphological dimensions, such as building shapes, heights, among others, could enrich the study and should be explored in future research.

Safety in touchscapes

Exploring streetlife patterns and activities is crucial to understanding how women use public space and adapt their behaviour to feel safest. This paper found that activity locations conform to Gehl's (2010) "edge effect," which involves stopping at frontages or objects, such as trees, to lean on. These spaces are considered as "softer" and more

inviting, demonstrating that women's spatial practices tend to favour them. Despite activities occurring in the middle of Broad Street (primarily involving trading or sitting), certain seating locations were consistently preferred, aligning with Rodaway's (1994) idea that tactile engagement gravitates toward less harsh environments. In Minster Street, standing activities were mostly concentrated at the edges, such as at bus stops (Figure 6). These field observations are generally supported by survey data. For example, in Broad Street, most women were observed standing by shop windows. However, inconsistencies arose in Minster Street, where 15% of respondents claimed to have stood in the middle – an account not fully supported by observational data. This discrepancy is likely due to the fact that Minster Street functions as a road. Furthermore, women's activities tended to cluster during street performances on Broad Street, reflecting the role of the haptic sense – manifested through decreased interpersonal distance and increased co-presence. This supports the findings presented by P. Simpson (2011). Figure 4 shows that single users were mostly positioned near the edges, while groups appeared more scattered. This supports Cao and Kang's (2019) argument that women's spatial behaviours may vary depending on whether they are alone or with others, highlighting significant safety-related insights. Nevertheless, streetlife is temporal, with activity levels declining notably in Minster Street. Although 20% of survey responses indicated "never stopping" at night in Minster, a higher percentage (28%) reported this during the day, again conflicting with observations. The only visible daytime activities there involved groups sitting and waiting for the bus. In Broad Street, activities shifted more towards the middle, possibly to enhance visibility (Roy et al. 2022), yet this was not consistently reflected in survey responses. While some individuals conformed to the "edge effect" by situating themselves next to objects they could lean or sit on, many stood in central areas without engaging tactilely with their surroundings. This suggests that interaction with touchscapes is not constant, as individuals at times positioned themselves away from objects that would stimulate the haptic sense. It implies that Gehl's (2010) edge effect – and, by extension, touchscapes – are temporal, applying to both single and group users. This also indicates that Cao and Kang's (2019) observation of single users tending to stay near edges may be context-dependent. Additionally, as the touchscapes in Minster Street were "harder," characterised by blank interfaces and limited street furniture or greenery, fewer people stopped and engaged with them. In contrast, the more frequent "softscapes" in Broad Street correlated with a higher proportion of women occupying the space, enhancing the presence and use of touchscapes.

Tracing women's movements (Figure 7) reveals no significant pattern during the day, but at night, movements tend to shift towards the middle of Broad Street, particularly where pedestrianisation allows for it. This is significant for perceived safety, as individuals often position themselves where they feel most at ease – suggesting that women are selective in their streetlife patterns (Whyte 1980). Additionally, greater pedestrian flow on Broad Street indicates a stronger sense of safety, as more successful urban spaces tend to attract more women (ibid.). The street's width and largely straight layout improve visibility compared to the middle of Minster Street. This suggests that women may favour Broad Street for visibility-related reasons (Roy et al. 2022), indicating deliberate spatial choices tied to safety considerations.

The role of touchscapes through co-presence is reflected in survey results (Figure 9). Responses to photo-simulations revealed that the busiest environments were generally

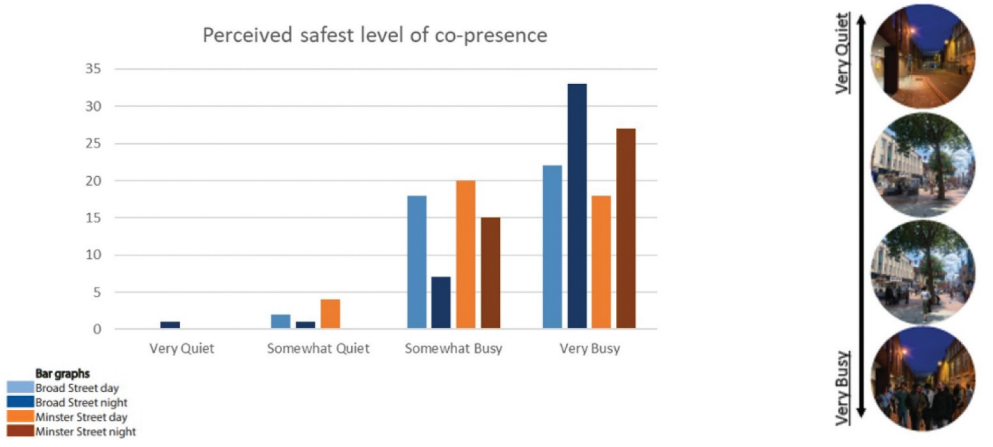

Figure 9. Results from survey question asking about the levels of people women felt the safest in, with images of the most popular response. Figure created by Bethany Henty.

seen as the safest, with one exception: during the day, a "somewhat busy" Broad Street was preferred. One respondent cited "pickpockets" as a concern, emphasising the need for balanced crowd levels to encourage safety, especially for women. When comparing overall safety perceptions, all respondents reported feeling safer on Broad Street, both during the day and at night. Key themes identified from these responses point to the presence of people in the day and lighting at night as the most influential factors, supporting the importance of "co-presence" and "eyes on the street" (Table 2). Five responses also mentioned "shops and windows," despite the limited number of shops open at night. Visibility also emerged as an important factor, as Broad Street's openness supports Roy et al.'s (2022) emphasis on the value of both seeing and being seen. Although only four respondents referred to others' behaviour at night, it was a noteworthy point. This suggests that while the presence of others generally contributes to a sense of safety, negative behaviour can produce the opposite effect, resonating with Adams et al. (2015), who point out that soundscapes can turn hostile depending on how public space is used. An increased number of people in a space inevitably activates the haptic sense, as the body becomes immersed in shared presence, which in turn shapes perceptions of safety. This feeling of co-presence is further reinforced by lighting and visibility – conditions that contribute to our subconscious awareness of being seen by others, aligning with Jacobs (1961) notion of "eyes on the street." Together, these factors

Table 2. Themes mentioned when asked in surveys "why do you feel safer in Broad Street?".

Theme	Day	Night
Presence of people	38	14
Visibility/open street	16	14
Lighting	2	24
Shops/windows	6	5
Pedestrianised	3	2
Behaviour of others	0	4
Greenery and street furniture	3	0

affect both haptic and visual perception, and as will be explored later, also influence auditory experience.

Safety in soundscapes

The survey responses indicate that soundscapes on Broad Street are generally perceived as more pleasant than those on Minster Street (Figure 10), contributing to overall feelings of safety. Soundscapes should be considered alongside co-presence, as they are shaped by human activity – such as talking and footsteps. These sounds contribute to the place-tempo where background noise includes quiet conversations and occasional bursts of foreground sound like street performances (Wunderlich 2008) – sounds that would not exist without people in the street. These soundscapes contribute to the more pleasant and safer experience of Broad Street. By contrast, Minster Street's background noise is dominated by machinery, creating a less inviting experience (Adams et al. 2015). These man-made noises also tend to overshadow nature sounds, which were only noted by three respondents during the day and appeared less crucial compared to other auditory cues. The limited greenery in both spaces may explain the lack of emphasis on natural sound. At night, perceptions of soundscapes declined in both streets, though Broad Street remained more positively regarded (Figure 10). Nighttime brings increased mechanical noise – linked to reduced pedestrian activity and fewer talkscapes (Figure 11). Without these conversational sounds, which typically signal human presence, negative auditory experiences become more pronounced. The survey thus provides evidence for the role of others' presence (Hillier 1996; Jacobs 1961) in improving women's safety perceptions. Co-presence remains crucial throughout the day and night, as talkscapes are central to the overall soundscapes. The decline in people-generated sounds at night contributes to diminished feelings of safety in both locations.

Results from survey photo simulations reveal that the most significant visual design intervention for perceived safety was outdoor restaurant seating, particularly in Minster Street at night, with 66% support (Figure 12 left). This correlates with soundscape preferences, as women ranked restaurant/bar ambiance highest, followed by talking, when asked which sounds would enhance their sense of safety (Figure 12 right). These findings support the concepts of co-presence and interpersonal distance, with the haptic sense activated through proximity to others. While nature and greenery improved

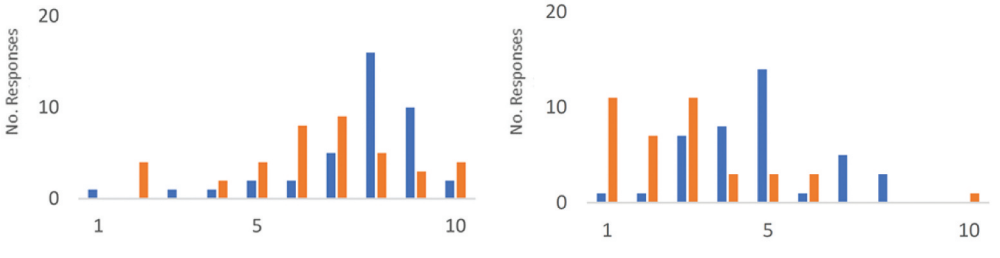

Figure 10. Survey responses on the perception of pleasantness of sounds during the day (left blue bars: Broad Street, left orange bars: Minster Street) and night (right blue bars: Broad Street, right orange bars: Minster Street), ordered from very unpleasant (left) to very pleasant (right). Figure created by Bethany Henty.

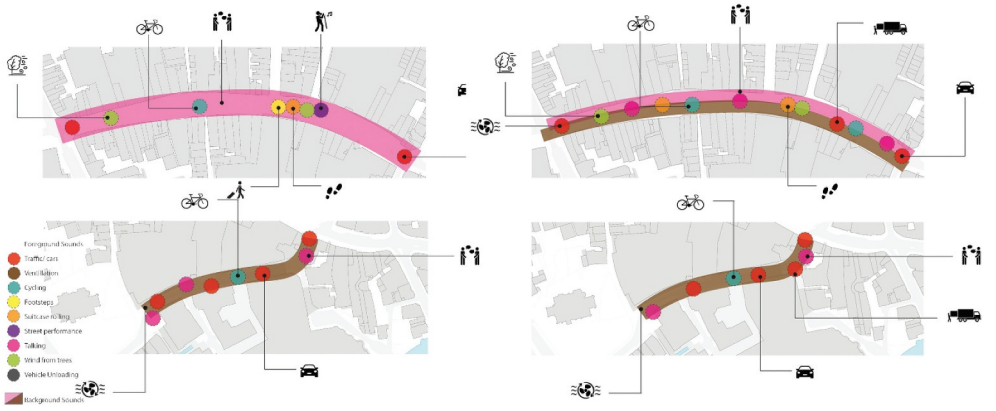

Figure 11. Soundscapes in the day (top left: Broad Street; bottom left: Minster Street) and night (top right: Broad Street; bottom right: Minster Street). Scale: 400 m x 130 m. Maps: Bethany Henty.

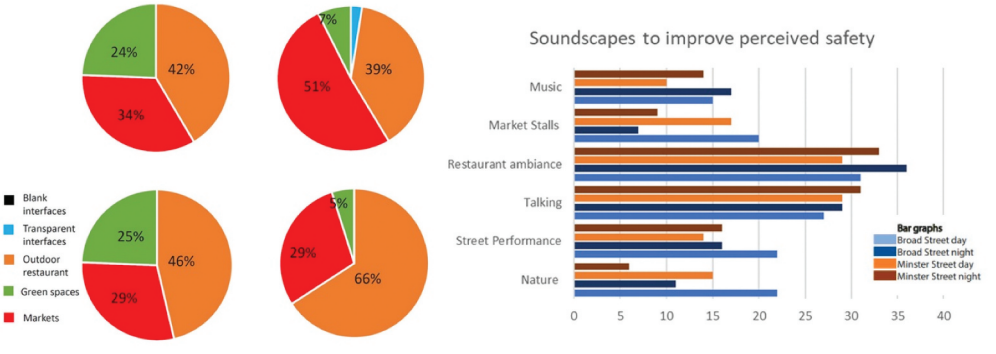

Figure 12. Results from photo-simulation in survey asking women which design interventions they would feel the most safe during the day (top left: Broad Street, bottom left: Minster Street) and night (top right: Broad Street, bottom right: Minster Street); survey results from asking women which sounds improve perceived safety (right). Figure created by Bethany Henty.

perceived safety during daytime through both visual and soundscape, their significance decreased at night, supporting Luo, Miao, and Zhao (2021) who argue that green spaces do not consistently improve safety. However, 11 responses for Broad Street at night and 6 for Minster Street still suggested that greenery can have a positive impact, though it was not among the most influential factors. This effect appears temporal. For example, markets were rated as a consistently significant visual feature across both streets and times (29%–51% of responses), yet their importance in soundscapes was limited to the daytime. Hence, perceived safety across different senses (visual and sound) may yield different outcomes. Notably, markets were the second least preferred auditory feature after nature, reinforcing the idea that safety cannot be solely measured by a single sense but is instead shaped by a combination of all sensory experiences.

While transparent interfaces were found to be crucial in the visual analysis, they received only one mention in the photo simulation, suggesting that other interventions were seen as more significant. Daytime functions can accommodate active interfaces and

spaces for outdoor seating – both identified as essential in the survey. However, reducing transparency and removing seating at night diminishes opportunities for co-presence and minimises soundscapes, which are vital for women's perceived safety. This is significant, as talking and restaurant/bar ambiance were considered the most beneficial auditory features in both visual and soundscape surveys, each receiving at least 29 responses for street and time. The absence of active functions at night not only reduces talkscapes and touchscapes through proximity to restaurant ambiance but also decreases lighting – an important safety factor, highlighted by 24 respondents. Semi-transparent and opaque interfaces, when lacking functional mix, create a "dead" landscape, reinforcing the potential for a "defensible space" (Newman 1972). This further impacts other senses, as such landscapes reduce opportunities for positive soundscapes and touchscapes. This effect is even more pronounced in Minster Street, where the scarcity of active functions/interfaces during the day worsens at night, with minimal lighting and transparency, making the area feel "hostile." Additionally, soundscapes from human presence, enabled through active uses, were seen as more beneficial than those from nature, emphasising the importance of human-driven sound and touchscapes over greenscapes in supporting perceived safety.

Concluding discussion

Drawing on empirical research from case studies in Reading, this paper explored how interfaces, access, and functional mix impact the sensorial perception of women's safety and their subsequent streetlife activities. We found that women's visual perception was central, influencing how they engaged with both touch and sound. For example, the attraction of visit functions, made apparent through transparent interfaces, facilitated tactile contact by bringing people into proximity, engaging the haptic sense, and supporting the concept of "eyes on the street." This was evident on Broad Street, where greater pedestrian flows coincided with more transparent interfaces, visit functions, permeability, and visibility, allowing women to both see and be seen (Roy et al. 2022). The edge effect was strongest near transparent interfaces or spaces that allowed for "leaning on" or touching, such as trees and seating. Stationary activities frequently occurred in these areas, supporting the case for more active interfaces to promote sociability in public space. These visual features contributed to a sense of co-presence, eyes on the street, and interpersonal distance (Stevens 2007). Such environments offered women a sense of safety through "reach-touch" (Rodaway 1994), reinforced by soundscapes and talkscapes indicating human activity. This resonates with Tuan's (1977) argument that the visual cannot be separated from other senses. Soundscapes, generated by active functions, in turn created touchscapes via "soft" elements conducive to tactile experience. These sensory layers worked together in a cyclical way, showing that women's perception of safety is shaped by multisensory engagement – not isolated visual input.

This paper is among the earliest empirical attempts to explore the impact of touchscapes and soundscapes on safety perception. We argued that tactile experience is dependent on interfaces, particularly transparent ones, for sensorial engagement, and on "edges" to cover women's backs (Gehl 2010). Features such as outdoor seating and greater footfall activate the haptic sense, influencing the feeling of being among others. Moreover, touchscapes remained important through continuous co-presence across day

and night, while women's spatial positioning shifted temporally. During the day, they often gravitated toward the edges, seeking a sense of enclosure, whereas at night, they tended to occupy more central areas to maintain visibility. This highlights the need for design interventions that enhance visibility for women, ensuring they can continue to "be seen" (Roy et al. 2022). Through co-presence and eyes on the street, soundscapes were also shaped, influencing perceptions of safety. Our findings indicated that sounds such as restaurant ambiance, street performances, and human conversation improved women's sense of safety, whilst machinery, ventilation, and road noise diminished it. Soundscapes were also found to be temporal – sounds that improved safety during the day, such as nature or market stalls, did not have the same effect at night. This suggests they must be adaptable over time to minimise unwanted noise. Therefore, this research has proved the hypothesis that women's perceived safety is shaped by sensorial experiences – particularly touch and sound. In Reading, these effects were evident through the edge effect, co-presence/interpersonal distance, and "eyes on the street," which, although outcomes of the visual, also have consequences for touchscapes and soundscapes. Notably, the presence of others emerged as a key factor in enhancing safety, as seen in the contrast between the busy Broad Street and the sparsely populated Minster Street. Talkscapes contribute to safety by sustaining co-presence, supported by visual measures such as active interfaces and transparency. Designing for perceived safety should place people at the forefront, providing touchscapes and soundscapes that enhance safety while enabling women's "freedom" of the street (Adams 2014).

This paper addresses a significant gap in urban design research by exploring how sensorial experiences impact women's sense of safety, particularly in Reading. We found that prioritising pedestrians and creating connected, walkable environments through touch/sound-based interventions enhanced perceived safety. These should include spaces for co-presence such as outdoor restaurant and bar seating used day and night, as well as adaptable areas for activities like street performances. While nature sounds scored lower for safety at night, water features and greenery can still add value when paired with other activities that create a rhythmic, dynamic streetlife. Interfaces should be activated where possible, fostering active functions and transparency to enhance visibility for women. Where this is not feasible, temporary appropriation should be encouraged to provide activities such as markets and to accommodate women's changing needs over time.

This article has provided insight into how the visual, touchscapes, and soundscapes work together to shape women's perception of safety through multisensory engagement. While the visual tends to be the first aspect noticed when walking down a street, the combination of multiple senses – especially the sound of others before they are seen – plays a critical role. These ultimately influence spatial positioning, drawing women toward softer edges and objects such as trees, which provide both haptic and auditory engagement. Hence, a multisensory approach is important for understanding perceived safety and for designing environments that support it, and should not be overlooked. Future research could further explore the interaction of multiple senses, including smell, to further enhance women's comfort in public space.

The paper concludes by acknowledging some limitations. First, the observation of streetlife was conducted over a brief period of 3 days and nights, suggesting the need for a more extensive analysis. Reliance on surveys posed another challenge, as the

predominantly closed-ended questions limited the depth of responses compared to interviews. Some participants left questions unanswered, creating gaps in the data, and in certain areas, survey responses contradicted direct observations. This highlights the importance of recognising differences between women's perceptions of street use and observed reality. The study also faced challenges in reaching a diverse demographic, underscoring the need for future research across age groups and ethnicities. The research further focused mainly on visual and auditory experiences, overlooking other senses such as smell. Future studies are recommended to explore these sensory dimensions to gain a better understanding of how women's safety perceptions are shaped. Due to the scope of the research, our study of touchscape was limited to women's experiences in relation to where they stood. Further research could explore the relationship between edge effects and "soft" versus "hard" elements. In this study, we build on the idea that women's positions vary depending on these interfaces and objects – for example, transparent interfaces, street furniture, or greenery as "soft" elements, and blank interfaces as "hard" elements. The soundscape analysis noted occasional natural sounds, such as rustling trees but due to limited landscaping, man-made sounds dominated and therefore received greater attention. The consistently dry weather during the analysis also excluded weather-related noises, which could be explored in future studies. Additionally, nature sounds were overlaid in the audio-visual simulations to assess perception, though responses were not always positive.

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