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Presence of Other People in Urban Parks: Exploring Psychological Effects Using Virtual Reality, Eye Tracking, and Qualitative Methods

Shuai Yuan
syuan2@g.clemson.edu

PRESENCE OF OTHER PEOPLE IN URBAN PARKS: EXPLORING PSYCHOLOGICAL EFFECTS USING VIRTUAL REALITY, EYE TRACKING, AND QUALITATIVE METHODS

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Shuai Yuan
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Accepted by:
Dr. Matthew H. E. M. Browning, Committee Chair
Dr. Andrew T. Duchowski
Dr. Jeffrey Hallo
Dr. Matthew Nicolette

ABSTRACT

Urban parks are vital public spaces and green spaces that offer a multitude of benefits. The presence of others in these spaces, however, introduces a complex interplay, influencing the natural and social benefits, such as privacy, restorative experiences, social relationships, and a sense of community, in different ways. Understanding these complex relationships requires bridging the divergent narratives between environmental design and nature and health and outdoor recreation. This dissertation addresses this critical gap and examines the multifaceted and context-dependent roles of the presence of people in urban parks by drawing on diverse disciplinary perspectives and employing multiple methodological approaches, including theoretical synthesis, virtual reality, eye tracking, and qualitative methods.

Chapter 2 develops an integrated theoretical framework that bridges social psychology, environmental psychology, and practice-based fields like parks and outdoor recreation management, tourism management, and environmental design. This framework classifies the impacts of human presence into perceptual, behavioral, cognitive-emotional, and symbolic domains, providing a comprehensive lens for understanding the diverse ways in which human presence can impact park users' experiences.

Chapter 3 employs eye-tracking and virtual reality to investigate the effects of visitor density on visual attention and specific urban park experience outcomes. Thirty-seven participants viewed 360° videos from four locations in well-managed parks in the Southeastern U.S. The findings reveal that higher visitor densities negatively impact willingness to visit and perceived restorativeness, while increasing perceived safety among female participants. The eye-tracking data indicate that higher visitor densities draw visual attention to people, and this change in attention can explain the impacts of density on willingness to visit.

Chapter 4 adopts a qualitative approach, exploring the diverse perceived functions of urban parks and the impact of other people on those functions from the past experiences of 26 university students with diverse cultural backgrounds. Thematic analysis identifies four broader park functions: being alone, appreciating nature, being with others, and appreciating urban-cultural life, as well as nuanced impacts of people's presence. Factors such as spatial layout, the self-focused behavior of others, personal characteristics, stress levels, and privacy preferences are considered crucial in understanding these dynamics.

The dissertation concludes by discussing the complexities surrounding the impacts of others' presence. It highlights the needs for developing a new concept beyond crowding, improving simulation, and addressing diverse and dynamic individual preferences, situational norms, and social milieu. Beyond the focus on urban parks, the dissertation also demonstrates the potential of eye tracking and multiple methods to enrich the understanding of social-physical contexts on environmental experiences.

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CHAPTER 1. INTRODUCTION

In urbanized environments, people often experience high levels of stress due to the fast-paced lifestyle and promote well-being. Natural elements like trees, water bodies, and open spaces help recover from stress and improve cognitive capacity and positive emotions (Berto, 2005; Nordh et al., 2011; Ulrich et al., 1991; White et al., 2010). A well-established theoretical perspective (Markevych et al., 2017) suggests that urban green spaces promote health and well-being through stress reduction and attention restoration, increased physical activity, better sleep, and stronger community ties through social cohesion.

Despite the recognition of these benefits, the knowledge of urban park benefits is often split between those who view parks primarily as natural environments promoting solitude and restoration and those who view them as social spaces that enhance community well-being and personal safety. This division creates a gap in interdisciplinary dialogue, leading to segmented and sometimes conflicting approaches in urban park management and design. Environmental psychology and outdoor recreation researchers emphasize urban parks as green spaces that allow individuals to escape social demands, thereby reducing stress and restoring cognitive capacities (Hammitt, 1982; Jacob & Schreyer, 1980; Kaplan, 1995; Kaplan & Berman, 2010; Korpela et al., 2001; Manning, 2007, 2022; Ulrich et al., 1991). Conversely, urban planning and design often focus on parks as vibrant social spaces essential for safety, social interaction, and community cohesion, supporting dense, mixed-use neighborhoods that foster social networks and enhance subjective well-being (Gehl, 1987; Jacobs, 1961; Kaźmierczak, 2013; Mehta, 2013; Mouratidis, 2018, 2019; Oldenburg, 1989; Whyte, 1980). Recently, Hartig (2021) critiqued the separation of natural and social pathways to health, stating: “One [significant risk] involves treating psychological restoration as a pathway from nature to health that works independently of pathways

that involve social resources, even though the pathways often work together." (p.125) These different views raise a question: Can urban parks effectively balance their social benefits with the solitude and mental health benefits, or are there inherent conflicts between the two aspects?

To address the complex interplay between the natural and social functions of urban parks and, ultimately, improving park users' psychological experiences, this dissertation focuses on the multifaceted roles of human presence in these spaces. The overarching research question guiding this inquiry is: *What are the influences of the presence of other people on park users' psychological experiences that are potentially related to mental health and well-being?* To answer this question, I employed multiple approaches, including an integrated theoretical framework (Chapter 2), an eye-tracking and virtual reality study on visual attention and experiential outcomes (Chapter 3), and a qualitative exploration of users' diverse past experiences (Chapter 4).

The presence of other people in urban parks can significantly influence various aspects of environmental experiences. Such aspects include perceived crowding (Dogru-Dastan, 2022; Vaske & Shelby, 2008), levels of privacy (Hammitt, 1982; Lis & Iwankowski, 2021), crime and safety (M. Felson, 1995; Jacobs, 1961), place attachment (Kyle et al., 2004), personal relations (Hartig, 2021; Peters et al., 2010), sense of community (Cattell et al., 2008), and interracial trust and social justice (Powers et al., 2022). While existing research in urban design and recreation has explored some of these aspects, psychological theories, such as social learning (Bandura, 1977), shared attention (Shteynberg, 2015), and situational norms (Bicchieri, 2005; Cialdini & Trost, 1998) could offer additional understanding on how the presence of others shapes individual experiences. However, a comprehensive review and integration of these diverse perspectives from social psychology, environmental psychology, and urban design are lacking. A broad understanding of

the theoretical mechanisms is crucial for applications in different urban park contexts and informs flexible park design and management practice (see Chapter 2).

At the surface level, the relationships between overall evaluations of urban park experiences and user density are often found to be non-linear, peaking at moderate densities but declining under conditions of higher densities (Kim & Shelby, 2011a; Nordh et al., 2011). Moderate levels of density may facilitate a vibrant and engaging atmosphere, but a small increase in density could turn the experience negative (Popp, 2012). However, many existing studies used static images to simulate different visitor densities and thus did not offer human motions, facial expressions, and body language, which are crucial for assessing safety and other intentions and behaviors (Davoudian & Raynham, 2012; Goffman, 1971; Judd et al., 2009). Compared with traditional static images, 360° videos in virtual reality may offer a more realistic simulation of environments with human presence. Also, as the presence of people may distract park visitors from engaging with natural elements that offer restorative experiences, the use of eye tracking could reveal the distribution of visual attention and provide insights that self-report methods may miss (see Chapter 3).

Many factors can further moderate the influences of the presence of people, including user motivations and other personal characteristics, environmental features, and characteristics of others. Research often finds that motivations for park users include fitness, relaxation, interaction with nature, and interaction with friends and family (Bertram & Rehdanz, 2015; Byun et al., 2022; Keith et al., 2018; Priess et al., 2021; Whiting et al., 2017; Zafri et al., 2019; Zhang et al., 2013). However, there seems to be a trend that social interaction is emphasized in Asian contexts, while fitness, nature appreciation, and relaxation are more prioritized in Western contexts (Keith et al., 2018; e.g., Priess et al., 2021). Older adults are more likely to visit urban parks to observe people

and make new acquaintances (Marcus & Francis, 2003), and young children are more likely to participate in outdoor physical play with social interaction opportunities, such as invitations from others, responses, and imitations (Bjørgen, 2016). Stressed individuals might seek relaxing and less socially stimulating environments than rested users (Grahn & Stigsdotter, 2010). Regarding environmental features, park environments with landscaped features were believed to be more suitable for social and recreational activities than natural areas (Sonti et al., 2020), therefore, could involve more positive effects of people's presence. The presence of other community members for people from the same racial or ethnic group can encourage individuals to use a park, particularly among racial and ethnic minorities (Powers & Son, 2024). Not just the number of people, but inappropriate behaviors, negative environmental impacts, and competing for limited recreational resources (e.g., parking) can diminish visitor experiences (Manning et al., 2005; Shelby et al., 1988). Conversely, those who demonstrate positive emotional cues could evolve positive emotions in the observers (Pugh, 2022; Whyte, 1980). Given the complexity of these contextual factors, a qualitative study could provide a more comprehensive view of perceptions of urban park functions and the roles of the presence of other park users that shape (or do not shape) these opportunities and benefits (see Chapter 4).

1.1 Structure of This Dissertation

This dissertation unfolds across three core chapters, each exploring different dimensions of the presence of people in urban parks (**Figure 1.1**). Chapter 2 develops a theoretical framework bridging diverse disciplinary perspectives that are potentially relevant to the influences of the presence of people in urban parks, Chapter 3 employs eye-tracking and virtual reality to investigate effect of two visitor densities on visual attention and specific park experience outcomes, and

Chapter 4 qualitatively explored the varied perceived functions (benefits) of urban parks and impact of other people on those functions from past experiences of young adults with different cultural backgrounds. Together, these chapters cumulatively build a comprehensive understanding of the multifaceted roles people play in urban green spaces across various scopes and contexts.

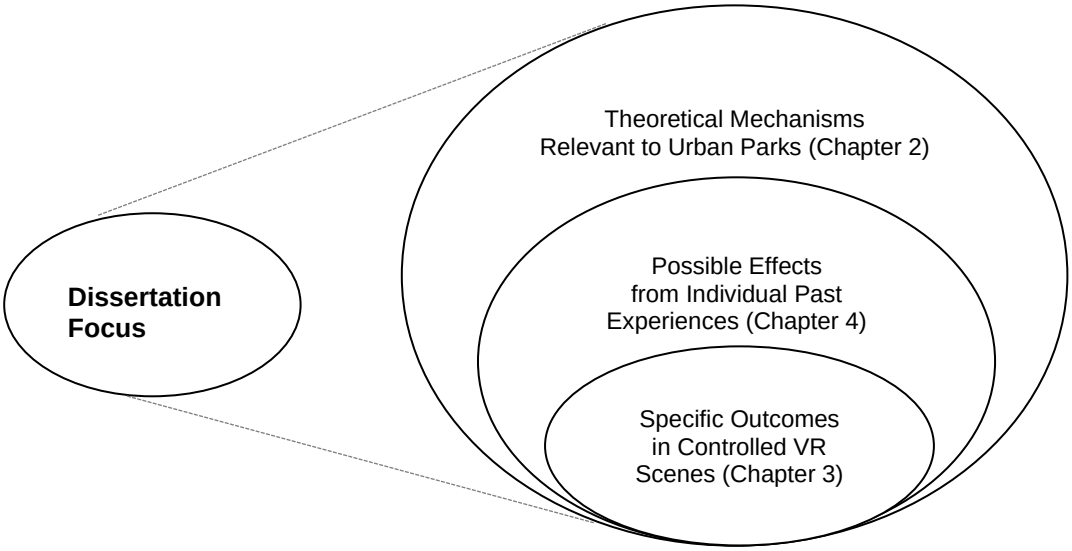

Figure 1.1 Relationships between the Three Chapters.

Chapter 2: Bridging Theoretical Perspectives on the Impacts of the Presence of People in Public, Recreational, and Green Spaces: A Narrative Review and Integrated Framework

Chapter 2 bridges theoretical perspectives on the impacts of human presence in public, recreational, and green spaces. It conducts the first integrated narrative review regarding the impact of others on users' experience, covering theories, perspectives, and concepts in social psychology, environmental psychology, and practice-based fields, including parks and outdoor recreation management, tourism management, and environmental design. This review aims to 1) provide a comprehensive understanding of the impact of the presence of other people on experiences and functional opportunities and 2) integrate those theoretical perspectives into a framework. The chapter develops a comprehensive framework that classifies the impacts of human presence into

perceptual functions and three core functional domains: behavioral, cognitive and emotional, and symbolic. This comprehensive model has the potential to inform future research and guide the design and management of urban parks to optimize visitor experiences and well-being.

Chapter 3: Can Visual Attention Help Uncover the Effects of Visitor Density on Urban Park Experience? An Eye-tracking and Virtual Reality Study.

Visual attention by providing objective, quantifiable insights into how park users visually engage with their environment, thereby offering an alternative understanding of the impacts of visitor density. Chapter 3 investigates the effects of visitor density on urban park experiences through a novel combination of 360° videos in virtual reality and eye-tracking to examine the effects of visitor density on park users' perceptions and behaviors. It formulates three research questions: 1) How does visitor density affect key urban park experience evaluations, including willingness to visit, perceived safety, and perceived restorativeness? 2) How does visitor density influence the distribution of visual attention to park features (represented as areas of interest [AOIs]), including people, greenery, water, sky, buildings, pavement, and street furniture? 3) How does the distribution of visual attention to park features relate to experience evaluations? The study found that higher visitor densities negatively impacted willingness to visit and perceived restorativeness while increasing perceived safety among women. Eye-tracking data revealed that higher densities drew attention to people but not at the expense of attention to greenery, and attention to people appeared to explain how visitor densities influenced willingness to visit.

Chapter Four: The Role of the Presence of People in Urban Parks Experiences: A Functional Approach

While prior research has explored the individual benefits of parks for solitude, nature connection, social interaction, and cultural engagement, the specific ways in which the presence

of others influences these experiences remain under-examined. Chapter Four addresses this gap through a qualitative exploration of how the presence of other people affects the perceived functions and experiences of urban parks, with "functions" defined as the opportunities and experiential aspects afforded by the setting to meet users' needs and motivations. Through semi-structured interviews with young adults from diverse cultural backgrounds, the study identifies four broader categories of park functions influenced by others: being alone, appreciating nature, being with others, and appreciating urban-cultural life. The research reveals that the impact of others varies across these broader and more specific functions. Contextual factors like spatial layout, self-focused behavior, and privacy preferences may play significant roles.

CHAPTER 2. BRIDGING THEORETICAL PERSPECTIVES ON THE IMPACTS OF THE PRESENCE OF PEOPLE IN PUBLIC, RECREATIONAL, AND GREEN SPACES: A NARRATIVE REVIEW AND INTEGRATED FRAMEWORK

Abstract: The presence of people in urban and natural settings has complex, context-dependent impacts. This narrative review bridges perspectives across social psychology, environmental psychology, and practice-based fields like recreation, tourism, and environmental design to provide an integrated view of when and how the presence of others improves or impedes positive person-environment transactions. We reviewed theories and concepts related to crowding, social learning, shared experiences, symbolic interactionism, self-regulation, values and norms, privacy, safety, restorative environments, place attachment, and recreational conflicts. An integrated framework was developed to classify the impacts of human presence into *perceptual* functions and three core functional domains: *behavioral* (space-based behaviors, facility and service-based behaviors, social interactions), *cognitive and emotional* (environmental appreciation and learning, safety and privacy, self-regulation), and *symbolic* (environmental meaning, relational resources, self-concepts). This framework offers new avenues for nuanced understanding and application across various fields, guiding future research and enhancing the design and management of public and recreational spaces.

Keywords: Presence of People, Public Spaces, Greenspaces, Crowding, Privacy, Restorative Environments, Shared Experiences

2.1 Introduction

The presence of people in urban and natural settings has complex, context-dependent impacts involving crowding, service resources, privacy regulation, social interaction opportunities, norms, sense of place, and atmosphere. (Abusaada & Elshater, 2021; Albrecht, 2016; Cattell et al., 2008; Dogru-Dastan, 2022; Nguyen & Rosmaninho Menezes, 2021; Popp, 2012; Vaske et al., 1995; Wu, 2007). For example, a crowded park may induce dissatisfaction due to environmental degradation, traffic, and noise (Manning et al., 2005), but an empty park may lack a sense of safety and opportunities to meet new people (Baran et al., 2018). Beyond density, appropriate behaviors and characteristics of others may play a more important role (R. (Raine) Cai et al., 2018). Disciplines like urban design, outdoor recreation, and tourism management often narrowly focus either on the benefits or drawbacks of others' presence, such as crowding and social life. This narrative review bridges perspectives across disciplines to provide an integrated view for determining when and how the presence of others improves or impedes positive person-environment transactions.

The investigation into the impact of people's presence benefits from applying various disciplinary lenses. For example, recreation and tourism management highlights how density levels interact with situational and personal factors to produce positive or negative outcomes, often studied under the topic of crowding (Manning, 2007; Vaske & Donnelly, 2002). Additionally, urban design theories highlight the social benefits, such as safety and social cohesion, provided by the presence of people and urban design (Francis et al., 2012; Mehta, 2014). Regarding the underlying psychological mechanisms, social psychology suggests a variety of interpersonal dynamics, such as social learning (Bandura, 1977), social norms (Cialdini & Trost, 1998), and

anxiety about evaluations from others (Henchy & Glass, 1968). Environmental psychology theories may have implications on the role of others in privacy regulation and psychological restoration from stress (Altman, 1975, 1976; Kaplan, 1995; Ulrich et al., 1991). However, comprehensively understanding the multifaceted impact of human presence in these areas remains a challenging endeavor due to the intricate web of interactions, perceptions, and behaviors that define our experience of public spaces.

While each perspective is valuable and seemingly represents the main values for broad types of settings, adopting them in isolation limits the scope of understanding to partial views and may miss important aspects. Green space researchers may emphasize the mental benefits of nature and ignore the social environment as a source of mental benefits and social resources as outcomes (Hartig, 2021), such as events in parks. On the other hand, assuming social interaction and functional diversity as primary values of urban spaces (Jacobs, 1961) may not be fully applicable to neighborhood spaces that are not in high-density areas.

In reply to this gap, we conducted the first integrated narrative review regarding the impact of others on users' experience, covering theories, perspectives, and concepts in social psychology, environmental psychology, and practice-based fields, including recreation, tourism, and environmental design. This review aims 1) to provide a comprehensive understanding of the impact of the presence of other people on experiences and functional opportunities, and 2) to integrate those theoretical perspectives into a framework.

2.2 Methods

We adopted a narrative review approach to uncover and synthesize a broad spectrum of both widely used and underexplored theories that elucidate how the presence of other people

influences experiences and functional opportunities in public spaces. The included works needed to directly relate to theories involving the impact of human presence or interactions between the presence of people and physical features. *Theories* were understood in their broadest sense, referring to concepts, relationships between concepts, and frameworks. Theories can be structured and formalized to different degrees, ranging from formal propositions to unstructured descriptions in books (e.g., Jacobs, 1961) and qualitative studies (e.g., Popp, 2012 on positive crowding).

Search strategies. To identify frequently used and underexplored theories across various fields, we developed an iterative and multifaceted search strategy, including personal libraries, backward reference searching, and keyword searches. This strategy intentionally diverges from traditional systematic reviews that primarily focus on frequency of use, methods, measurements, and findings within narrowly defined topics like crowding in tourism.

1. Classic and highly cited works: We leveraged the expertise of the authors and started with highly cited works and classic works from their personal libraries. This approach identified the most well-known theories, including Stokols' (1972) crowding framework, Altman's privacy regulation (1975), Milgram's stimulus overload (1970), social learning theory (Bandura, 1977), emotional contagion theory (Hatfield et al., 1994), symbolic interaction theory (Mead, 1902), social comparison theory (Festinger, 1954), Lazarus & Folkman’s (1984), prospect-refuge theory (Appleton, 1975), stress reduction theory (Ulrich, 1983), attention restoration theory (Kaplan, 1989), relational restoration theory (Hartig, 2021), place attachment theory (Low & Altman, 1992), Manning's crowding model (1986), Popp's good crowding (2012), the Extended model of retail crowding ((Eroglu & Harrell, 1986), Jacob and Schreyer's recreational conflict model (1980), wilderness solitude theory (Hammitt, 1982), Jane The Death and Life of Great American Cities (1961), Whyte's *social*

life of small urban spaces (1980), and Jan Gehl's (1987, 2010) works on social life and urban design.

2. Backward reference search: To complement the existing list of theories, the lead author conducted keyword searches and identified new theories and relationships from relevant articles. Search terms included those specific to environmental settings (e.g., green spaces), as well as human-presence-related terms such as "crowding," "presence of people," "presence of others," "social life," "atmosphere," and "social activities" on Google Scholar. These searches were conducted between October 2022 and March 2023. The lead author screened titles and abstracts for relevance and checked the full text if the article offered or cited new theories. This approach allowed us to identify a few newer theories, such as the mechanisms of social context on self-regulation (Finkel & Fitzsimons, 2011), joint attention (Friesen & Kingstone, 1998), value conflicts between wilderness users (Vaske et al., 1995), and the model of social norm activation (Bicchieri, 2005) that were not identified in the classic and highly cited works.
3. Reviews: To identify theories not often cited in studies on the presence of people, we also considered literature reviews on environmental psychology (Bechtel & Churchman, 2002; Devlin, 2018; Gifford et al., 2011; Moore, 1997; Steg & de Groot, 2018; Stokols, 1995) and social psychology (Chadee, 2022; Lange et al., 2012; Myers, 2012). This yielded several theories that could potentially be applied to and connect multiple fields, such as Altman's (1975, 1976) privacy regulation, social identity theory (Tajfel & Turner, 1979), objective self-awareness (Duval & Wicklund, 1972), and social comparison (Festinger, 1954).

4. Lastly, we used a top-down, "example-driven" approach alongside the other strategies. We collected a comprehensive list of 50 examples of subjective experiences concerning being with other people in parks and other recreation settings, with both positive and negative experiences represented. For example, “seeing a group of people floating in their inflatable boats sparked my excitement, because the people looked happy, and I learned this park could be a good spot to bring your own inflatable and begun to think about inviting friend to float together.” The lead author familiarized themselves with this list and used it as a target in readings from the other strategies. The lead author also checked which examples were explained by the theories previously collected. For examples not explainable by our existing theory set, the lead author attempted to identify relevant theories from the reviews of theories, as well as by searching for new keywords.

Data Extraction: The lead author retrieved key concepts and relationships regarding the direct or moderating effects of the presence of people on the potential benefits and constraints for users from relevant articles. The lead author also retrieved the underlying assumptions of the relevant concepts, relationships, and theories. For example, outdoor recreation theories may assume that the essential values in natural environments were natural beauty, solitude, and outdoor recreation activities, as these values diminished as the use level increased.

Framework Development: The development of a framework to unify existing theories and concepts involved a hybrid, inductive-deductive approach. The lead author developed several key domains based on the initial list of theories, list of examples, and established frameworks on human-environment interactions, including human crowding (Gramann, 1982; Schmidt & Keating, 1979), place (Canter, 1977), environmental appraisal (Lazarus & Folkman, 1984; Scherer, 1984) and environmental affordances (Hartson, 2003). Afterward, through an iterative

process, emerging concepts were integrated, and the framework was refined. To manage the complexity of this integration, tables were used to track and analyze the intersection of theories with different conceptual domains (for example, see **Table 1**). Theories and domains were continuously evaluated, refined, or removed based on their relevance, uniqueness, and academic impacts.

2.3 Theoretical Perspectives on the Presence of People

This section is organized by discipline and topic. It begins with 2.3.1 Social Psychology, covering basic perspectives on the impacts of the presence of people, followed by 2.3.2 Environmental Psychology, which mainly addresses the interaction between people's impacts and physical settings. Sections 2.3.3 and 2.3.4 explore presence theories in practice-based fields with varied foci and contexts.

2.3.1 Social psychology

2.3.1.1 Human Crowding Perspectives

Various psychological and applied fields have examined the predominantly negative psychological construct of high human density impacts in an environment, referred to as *human crowding* or simply *crowding*. For instance, Fredman (1976) considered crowding as amplifying existing social and physical environmental conditions, whether positive or negative. Stokols (1972) defines crowding as "a situation in which the constraining aspects of limited space are perceived by the individuals exposed to them" (p. 5), leading to stress and coping. Crowding can be moderated by physical and social factors, such as space and layout, stressors like noise and temperature, power dynamics, division of labor, and resource competition and coordination.

Stokols also recognized positive aspects, applying *undercrowding* to situations where excess space beyond needs causes a desire for enclosure and affiliation. Subsequent frameworks often denote negative impacts via a social-cognitive “dual process” model. Stokols' theory is often reframed as behavioral interference/constraints on control/freedom, while cognitive overload (Milgram, 1970), referring to stimulation exceeding one's processing capacity, captures the cognitive aspect. For example, Schmidt and Keating (1979) define crowding as density constraining personal control—behavioral interference/constraints limit behaviors and goals, and cognitive overload/constraints overwhelm through demands and stimulation. This behavioral-cognitive perspective categorizes human presence impacts and connects to related concepts like self-efficacy, perceived control, and affordances.

2.3.1.2 Social Learning

Social learning theory (Bandura, 1977) Provides a general framework supporting various impacts of the presence of others. This theory assumes humans have an innate ability to learn by observing others rather than by trial and error, which is called observational learning. As Bandura (2008) states, "Learning would be exceedingly laborious and hazardous if people had to rely solely on the effects of their own actions to inform them what to do" (p. 1). Observational learning involves acquiring attitudes, values, thinking styles, and behaviors from others (Bandura, 1977). For example, people can learn to “fear what frightened others, dislike what repulsed them, and like what gratified them" (Bandura, 2008, p. 2). According to social learning theory, visitors with limited experience can identify possible activities, outcomes, and suitable contexts, like the specific space, time, weather, characteristics of the people, rules, and outcome expectations.

Therefore, this on-site information helps one discover unknown resources and make adaptive decisions, such as evaluating items from a menu (Cai H. et al., 2009).

However, the presence of others may also provide misleading information and give rise to maladaptive behaviors, as shown in the concepts of *herd behavior* and *information cascades*, which are likely to happen with information overload and a crowd exhibiting similar behavior (Bikhchandani et al., 2021). For instance, sheer visitor numbers in popular restaurants and attractions may reinforce the perception of “must-see” despite potential downsides like high prices and long lines. Also, social learning may be less useful for experienced visitors with extensive knowledge (Popp, 2012). Overall, social learning theory is an extremely useful but underused resource in the practice-based fields for exploring the impact of others in public and recreational spaces.

2.3.1.3 Shared Experiences

Social psychology has a rich understanding of being around other people shape our experiences of an environment or event, which could referred to as *shared experience* (Boothby et al., 2014; Shteynberg, 2015). Shared experiences encompass several aspects, such as emotional contagion (and empathy), behavioral mimicry, joint attention, and goal contagion. Emotional contagion refers to "a process where a person or group influences the emotions or behavior of another person or group through the induction of emotion states and attitudes" (Schoenewolf, 1990, p. 50). The presence of people can "infect" us with their positive or negative emotions. Specific mechanisms include mimicry of facial expressions, voices, and postures (Hatfield et al., 1994), empathy (feeling similar emotions by imagining others' experiences), and recognizing emotional cues (Elfenbein, 2014). Behavioral mimicry emphasizes that people automatically

imitate others' behaviors through the “perception-behavior link,” which connects perception and motion systems related to perceived actions (Chartrand & Bargh, 1999; Dijksterhuis & Bargh, 2001; Tucker & Ellis, 1998). Joint attention describes others' gaze directions, and coordinated attention automatically leads us to follow (Birmingham & Kingstone, 2009; Friesen & Kingstone, 1998). Goal contagion posits that people may automatically adopt and pursue a goal that is implied by another person's behavior (Aarts et al., 2004).

Shared experience is believed to be moderated by the “closeness” of relationships or perspectives (Boothby et al., 2017; Elfenbein, 2014; Shteynberg, 2015). Such “closeness” can encompass intimacy, in-group status (versus out-group), similarity of viewpoints and goals, and shared stimuli. For instance, a family may share emotions when they see another family chatting and smiling, but a person with a mood of loneliness may evaluate themselves in comparison with the family.

There are several effects based on shared experience components. Social learning of important elements in stimuli and behavioral outcomes builds on shared attention and emotional contagion (or empathy) (Bandura, 1977). Shared experiences also often amplify an experience (positive or negative) by allocating one’s cognitive resources to attended stimuli and improving memories. (Boothby et al., 2014). Shared experiences can facilitate or impede behavioral performance depending on whether others have similar attention or emotions and compatible behaviors to one’s goals (Bargh & Williams, 2006; Hofmann et al., 2012). For leisure and public spaces, the shared experience can relate to the phenomenon of “atmosphere” - an ambiance with an abundance of shared emotional cues and meanings displayed through behaviors, words, or facial expressions (B. Anderson, 2009; Lupton, 2017; Stefansdottir, 2018; Uhrich & Koenigstorfer,

2009). Positive atmospheres link to “good crowding” (Popp, 2012), while the hectic, indifferent atmospheres link to Milgram’s (1970) urban experiences with overload.

2.3.1.4 Symbolic Interactionism

Theories grounded in symbolic interactionism concern how the presence of others changes the construction of meanings of environments, activities, and experiences, as well as how we perceive and present ourselves to others through repeated social interactions (Cooley, 1902; Mead, 1934). The use of symbolic meaning is ubiquitous, including for leisure and recreation (Colton, 1987; Kelly, 2019; Samdahl, 1988). Ervin Goffman’s (1959) offered a comprehensive theatrical metaphor to illustrate how social situations shape behavior and norms within an environment. He suggested that individuals adopt social roles and manage their impressions for an audience in "front stage" settings to make a favorable impression. Conversely, they are permitted to relax from social pressures and reveal a more authentic self in "backstage" environments. This "backstage" concept can be applied to recreational spaces, often seen as offering freedom from role obligations and self-presentation, unlike work environments (Kelly, 2019). The presence of people and social symbols could enrich the meaning but also limit one’s freedom to create meaning, values, and norms and make the negotiation of meaning necessary (Samdahl, 1988).

Social psychology offers several perspectives on how the presence of others can influence our self-concept. Social identity theory (Tajfel & Turner, 1979) posits that individuals seek to maintain or enhance a positive self-concept through their social group memberships, or social identities. In parks and leisure settings, the presence of others can help individuals define these group memberships, but it can also lead to exclusion or rejection Furthermore, the social comparison process, in which individuals evaluate themselves by comparing themselves to others,

can significantly impact their self-image in these settings (Festinger, 1954). Downward comparison and upward comparison result in positive and negative evaluations of others. Upward comparison with others about appearance and body image commonly happens during social encounters (Fardouly et al., 2017). Personal characteristics can moderate such comparisons or the extent to which individuals base their self-concept on comparison. Fourth, social situations may prompt one to be aware of themselves as the object of attention or evaluation, and focus one's attention on self-evaluation against standards (Duval & Wicklund, 1972; Silvia & Duval, 2001). This could cause an increase in arousal and anxiety regarding evaluations from others (Henchy & Glass, 1968) or seeing oneself from others' eye (R. B. Felson, 1981; Mead, 1934), which has an impact on one's self-concept. Conversely, congruency between self and one's standards and positive evaluations from others facilitate self-enhancement. In leisure settings, confidence in positive evaluation (e.g., "Instagram-ready" look) may facilitate leisure participation or the use of public spaces, and vice versa.

Beyond the effect on self-concepts, the symbols carried by the environment, including other people, influence our perception of it. We may perceive a place as safe when non-threatening, vulnerable people like children and older people are present. In contrast, the presence of those associated with violence and unpredictability, such as substance abusers or gang members, may evoke feelings of unsafety. Meanings can also be vaguer, requiring personal and environmental context. For example, police patrolling streets could signify either good social control or a concentration of crime.

2.3.1.5 Self-regulation

The presence of others can also facilitate behavioral performance and impact self-regulation. Self-regulation refers to controlling one's emotions and thoughts to achieve goals, rather than acting on internal desires or external stimuli (Baumeister et al., 2007). This phenomenon is also referred to as "self-control," "cognitive control," and "cognitive freedom." Baumeister and colleagues (Muraven & Baumeister, 2000) proposed a "muscle" metaphor, suggesting that self-regulation consumes limited resources, leading to short-term fatigue from exertion, but long-term improvement after repeated practice, similar to a muscle's ability to work. From this view, the presence of other people may reduce the need for self-regulation resources by focusing our cognition on anticipated evaluations, self-presentation, and suppressing desires (Baumeister, 1986; Hofmann et al., 2012). When the social settings' expectations align with one's goals, it can be more effective in suppressing conflicting desires or goals and improving the allocation of resources to the tasks, which is also known as social facilitation. In leisure contexts, the presence of others may help one concentrate on a performance-related activity (e.g., sports). However, when social settings are aligned with conflicting goals or involve effortful interactions, self-control resources can be impaired.

Self-regulation could be also facilitated by people who serve as *exemplary models*, conveying situational attitudes, norms, and behaviors that observers can learn through observation (Aarts & Dijksterhuis, 2003; Bandura, 1977; Carver & Scheier, 2000). For example, one can learn the social norm of being quiet in a library by observing others. Lower-level processes, such as goal contagion, joint attention, and behavioral mimicry, may assist or impede goal setting, attention direction, and effective behaviors (Finkel & Fitzsimons, 2011; Fitzsimons & Finkel, 2010;

Hofmann et al., 2012). For example, in leisure settings, hikers and climbers can stay aware of their surroundings by paying attention to where others look and imitating ideal pacing and techniques from more experienced peers.

2.3.1.6 Values and Norms

The presence of people in a particular environment can influence social norms, the belief about the appropriate and inappropriate attitudes and behaviors, within an environment. Norms can be classified as injuncted norms and descriptive norm (Cialdini & Trost, 1998). Injunctive norms refer to society's beliefs about what one should do and can involve the policies of managers and administrators of the environment. Descriptive norms refer to what most people actually do and can differ from the injunctive norm (e.g., littering in parks). While park management can influence norms through official policies, overly restrictive regulations can be counterproductive, and the behavior of others in the environment can also shape one's perceived norms.

There are theories on how others influence one's preference for a norm. The theory of planned behavior, for example, emphasizes the impact of significant others (e.g., friends and family) on behavior on "subjective norms." However, for research interested in the normative impact of people in a specific physical environment, the model of social norm activation (Bicchieri, 2005, 2016) offers directly relevant factors. Three key conditions are identified for a norm to be "activated" in a type of situation. First, individuals need to be aware of the norm and its application to the situation (i.e., *contingency condition*). Second, they need to believe that a large group of other people conforms to the norm in a similar situation (*normative expectations*, similar to descriptive norms). The last condition concerns whether individuals believe they are expected to conform to or face sanctions from a large group (i.e., *normative expectations*).

Collectively, these theories suggest that one may feel more comfortable performing a desired behavior or restriction, depending on the perception of whether a rule is applied, what others do, and whether they expect confirmation.

The presence of others who display values, attitudes, and behaviors against one's social norms and values can trigger negative emotions. According to appraisal theories of emotions, witnessing inappropriate behaviors related to harm, unfairness, and threats can provoke anger and related negative emotions such as disgust and frustration (Lazarus, 1991b, 1991a; Roseman et al., 1996). Notably, these moral emotions can arise even without the direct involvement of or relationship to one's interest or goal-attainment (e.g., seeing another person mistreated), described as a *disinterested elicitor* (Haidt, 2003), thus being more common in public and recreational settings. Expanding on these theories, it stands to reason that with the increasing number of people in a place, the likelihood of encountering events that contradict personal values and believed norms also rises. This implies a potential amplification of negative emotional experiences with an increased number of people.

2.3.2 Environmental Psychology Theories

2.3.2.1 Privacy

Privacy theories are explored by social psychology as well as the social-psychological approach in environmental psychology. Privacy involves controlling the information shared with or received from others and dynamically adjusting the optimal amount of contact with others. According to Altman's privacy regulation perspective (1975, 1976), privacy is the process through which a person or group regulates their accessibility and openness to others. It involves selectively controlling access to oneself or one's group. Altman links privacy to the physical environment,

using personal distance as the key physical mechanism for regulating privacy and viewing crowding as a flawed function of privacy regulation. As the desired level of privacy is not achieved, people use coping mechanisms, including verbal or nonverbal responses to adjust contact, territorial behaviors, and emotional coping that reduce response to intrusions.

Another classic work by Westin's (1970) classic work proposes four stages of privacy with different environmental conditions and functions. The first and the most complete stage, *solitude*, refers to being alone and completely free from observation by others. The second stage, *intimacy*, refers to being in a small group with seclusion from others to achieve a close relationship. The third stage, *anonymity*, means being in public places without expecting to be recognized or assuming a social role. Westin believes that anonymity is crucial for "the sense of relaxation and freedom" in open and public spaces. He also uses anonymity to explain the “phenomenon of the stranger,” one inclined to be more open to strangers compared to a more closely related person. The last and the most subtle stage, *reserve*, involves creating a psychological boundary to limit communication, which is supported by surrounding others. From Westin's work, it is suggested that the presence of people can hinder the attainment of solitude and may reduce intimacy if others interfere with interactions within close groups.

However, the relationship between the presence of others and privacy may differ for reserve and anonymity. The impact on reserve can depend on whether other people maintain a mental distance and respect a psychological boundary. Collective behaviors may establish a norm for the appropriate extent of reserve or openness. In contrast, anonymity is often supported by the presence of a larger density of people. This is partly because blending into a larger group can reduce social attention and curiosity from others. Also, acting in a crowd reduces self-awareness and evaluation apprehension (Diener, 1979; Diener & Wallbom, 1976; Zimbardo, 1969).

Therefore, the presence of others may surprisingly improve comfort in reducing the attention from and interaction with others, for example, a salesperson in a store (Uhrich & Tombs, 2014), with a teacher in a classroom, or anywhere we do not want to stand out and receive attention from others. The social context of the setting, particularly the presence of familiar others versus strangers, plays a role. Strangers may not recognize the person, expect a social role (self-presentation), or exert restraint. Although there may be competition relationships (Stokols, 1972), interaction situations with strangers are generally benign, based on samples in Europe (Van Lange & Columbus, 2021). Therefore, the type of leisure and spatial context moderates the positive effect of anonymity. For example, being in a busy urban park street or traveling in another city makes one less likely to be recognized by familiar people.

2.3.2.2 Safety

In environmental psychology, perceived safety is often linked to the spatial layout and social context. According to the classic prospect and refuge theory (Appleton, 1996), people feel safe in environments allowing them "to see without being seen," which is an adaptive response that allows humans to gather information from the environment without being detected by potential threats. This theory identifies two key elements: prospect (large open views) and refuge (hidden places). However, refuge is often found to be unfavorable (Herzog & Kutzli, 2002; Woodcock, 1983). Later theoretical work extends the concept of refuge in different social contexts. Nasar and colleagues suggested that in environments characterized by "a climate of fear" and incivilities, refuge is favored for potential offenders to await and attack, leading to reduced perceived safety (Nasar et al., 1993; Nasar & Jones, 1997). Conversely, Grahn and colleagues associated refuge with the presence of people in leisure (Grahn & Stigsdotter, 2010; Stoltz & Grahn, 2021). Hidden

places are seen as “a safe haven, a sanctuary,” a "pleasure garden," where “people can feel safe, play or simply watch other people being active.” (Grahn & Stigsdotter, 2010, p. 268)

2.3.2.3 Restorative Environment

Theories related to environments that help people recover human function resources from stress have also related to the presence of people indirectly. Stress reduction theory (Ulrich et al., 1991) posits that natural elements can induce an instinctive rapid stress response, which may be gained in the evolutionary period. In this regard, such a benefit can be reduced if the presence of people distracts the perception of natural elements. However, a special context addressed by Ulrich (1991) is the needs of people with diminished capabilities (e.g., patients, elderly people). For such populations, a supportive environment should involve distraction from stress (e.g., nature), controllability, and social support from others.

Attention restoration theory (ART) focuses on the role of attention and positive self-reflection in the recovery from stress (Kaplan, 1995; Kaplan & Berman, 2010). The core process of restoration, accordingly, involves engaging in mild and positive stimuli over time to inhibit negative thoughts, reflect on problems and solutions, and recover cognitive resources. Four environmental features are proposed. The environment should capture bottom-up, involuntary attention in a moderate manner, which is labeled as *soft fascination*; it should also be distinct from the everyday environment to afford a break from prolonged fatigue or rumination, which is labeled as *being away*. Also, to enable soft fascination and being away, the environment needs to be large in space or mental space (*extent*) and aligned with one’s goals (*compatibility*). In the context of leisure and recreation environments, the characteristics of others can either draw attention to or

away from everyday environments (e.g., seeing people dressed for work versus people walking dogs in a park) or influence the goal attainment of a user.

Moreover, to understand the role of the presence of people in ART, the special state of being effortlessly involved in instrumental thinking seemed to be the key. Kaplan and Berman (2010) linked this state to expressing emotions and experiences through writing, which was found to reduce stress. They also contrasted this with seeking temporary relief through distractions (e.g., TV and short videos). "Distraction was shown to have only short-term benefits, whereas self-distanced perspective taking (i.e., reflection) had both long-term and short-term benefits." (p. 49) In this regard, natural environments afford this special state "across a wide array of populations and situations," (p. 49) while environments with human activities tend to offer fascination/bottom-up stimulation as distractions from reflection. Borrowing Lazarus & Folkman's (1984) classification of stress coping, we can infer that ART suggests that the presence of human activities may help escape from stress and improve mood (emotional-focused coping) but hinder the thinking for problem-solving (problem-focused coping).

Relational restorative theory (RRT) suggests restorative experience "does not occur in a social vacuum" and situates it within supportive exchange between people (Hartig, 2021). On the one hand, the theory focuses on how environmental arrangements promote human interactions and relational resources that enable instrumental and emotional support, such as trust, love, and shared goals. Three aspects of the environmental arrangement were proposed *across* situations: First, *privacy regulation* enables people to spend time alone, in smaller groups, or in more public settings as needed for restoration or enhanced experience. Second, *reciprocity* allows people to provide and receive support in a way that maintains trust and resources over time. Third, *experiential interdependencies* connect experiences across past, present, and future situations through shared

memories, anticipations, and meanings, for example, using favorite or meaningful places for restoration and self-regulation. Experiential interdependencies may be related to place attachment. Of the three aspects, the presence of people outside one's group in nature or public spaces could affect privacy regulation (also see 2.3.2.1 Privacy). Also, in some situations, interdependencies may be affected if the presence of an outsider clashes with or helps construct the group's shared meanings, memories, and anticipated experiences tied to that place.

On the other hand, RRT highlights the interplay of shared experiences and environmental experiences in both individual and relational restoration in specific situations. For example, a couple hiking in a forest with earlier positive memories and being away from each other facilitate open communication, emotional expression, and intimate sharing between partners. Additionally, supportive interaction can support the restoration of individual mental resources. The presence of outsiders adds complexity. It may sometimes facilitate and other times hinder the desired activity, meaning-making, or spreading positive or negative emotions and mindsets.

2.3.2.4 Place Attachment

Place attachment refers to the emotional bond between people and their environment, involving a comprehensive and multidimensional understanding of people-environment relationships. Place has been conceptualized in multiple ways that revolve around meaningful locations with physical features, human activities, social characteristics, and attached meanings and emotions (Canter, 1977; Cresswell, 2004; Low & Altman, 1992; Scannell & Gifford, 2010). One common approach to place attachment is constructivist or phenomenological, adopted by geographers, urban planners, and architects. It highlights the subjective development of the sense of place over time by those who are “inside.” Resident develops a sense of place with rich and

symbolic meaning beyond the physical environment or "landscape," as in the quote used by Cresswell from Williams (1960), "*The visitor sees beauty, the inhabitants a place where he works and has his friends. Far away, closing his eyes, he had been seeing this valley, but as the visitor sees it, as the guidebook sees it*." Other people, whether physically present or not concurrently in the place, are important and complex in this line of work. For example, homes hold intimate meaning related to family relationships, shared experiences, and privacy and control (Marcus, 2006). Similarly, the meaning and norms of minority communities, like Chinatowns, result from negotiation with powerful agents such as the government, dominating groups, and tourists (K. J. Anderson, 1987). In this line of research, the social construction of meaning and subjectivity involves the social context, although a simplified summary of the role of people is not the focus.

Another approach, as seen in natural resources, recreation, and tourism, reduces the concept of place attachment to four main dimensions (B. S. Jorgensen & Stedman, 2001, 2006; Kyle et al., 2004; Kyle & Chick, 2007). *Affective attachment* reflects the positive emotional bond that develops between groups or individuals and a setting, which is focused on emotional content but may involve an interplay between emotions and actions. *Place dependence* refers to the goal-attainment potential of a place in relative to an existing range of alternatives. It focuses on functions of a setting like crowding. *Place identity* relates to the connection between the self and the place, the involvement of the self in a place. It is regarded as a type of identity similar to gender or other social roles. *Social bonding* refers to the bonding to a place as a result of meaningful social relationships formed and maintained in the place. Among these dimensions, social bonding explicitly highlights the role of the presence of others for both ends of attachment to place and social relationship. While focusing on different outcomes, place attachment and RRT share an understanding of the complexity of interaction with an environment with social context.

2.3.3 Parks, Recreation, Tourism, and Service Management

2.3.3.1 Crowding in Practice-based Fields

In park management and outdoor recreation, crowding is conceived as a serious concern that encompasses ecological and experiential aspects. Such aspects include vegetation decay, aesthetic degradation, long wait times, and loss of solitude. The research focus is "How much can we use the environment without spoiling what we find most valuable about it?" (Manning, 2007, p. 20) In this context, Manning (2022) defined crowding as the negative and subjective evaluation of visitor density perceived to interfere with one's activities and goals. His expanded crowding model links visitor density to domain-specific mediators, moderators, and overall satisfaction outcomes. For example, spatial and trip factors impact people's spatial distribution and encounters in parks. Visitor characteristics (e.g., motivation, expectation) and characteristics of other people (e.g., perceived similarity) are also considered.

In tourism and events management, Manning's factors are relatively applicable given the focus on personal, situational, and coarse physical factors. However, the model defines crowding solely as a negative experience, neglecting positive aspects that are intuitively vital in events and cultural attractions. In response to this issue, the concept of *positive crowding* has been developed to address the positive mechanisms of contextually optimized but not excessive visitor density in front country settings (Popp, 2012). These mechanisms include street performance and people watching, interaction opportunities, diverse "atmospheres" essential to a destination interacting with physical conditions like architecture, and a sense of belonging facilitated by people's presence.

In services and retail contexts, the extended model of retail crowding (Eroglu & Harrell, 1986; Eroglu & Machleit, 1990) addresses how the presence of people influences the service

experience by whether perceived human density supports or hinders one's goal attainment. This model differentiates *dysfunctional density* (crowding) and *functional density*. As a domain-specific model, it highlights unique factors such as time pressure and task-oriented versus recreational shopping motivation. To illustrate this model, "a task-oriented shopper with limited time perceives a highly dense mall as crowded, while a recreational shopper may find the same environment functional for achieving their primarily recreational goal" (p. 356). Moreover, this model also contributes the insight that the environment and presence of others influence attention to environmental cues, and this perceptual process influences the perception of density.

Overall, crowding perspectives address how the density of other people affects goal achievement, control, and freedom. They also provide moderators and mediators and distinguish between behavioral and cognitive interference. However, the lower density situations, the positives, and more detailed mechanisms are often overlooked.

2.3.3.2 Wilderness Solitude

The desired level of privacy of wilderness users, often referred to as *wilderness solitude*, is another specific concern. As suggested by Hammitt's (1982, 2000) perspective, wilderness solitude more frequently involves being in small groups separated from others (Westin's *intimacy*), as opposed to being completely alone (Westin's *solitude*). This special type of privacy involves four aspects: (1) a natural or remote setting, (2) freedom from paying voluntary attention (similar to *fascination* and *being away*), (3) interaction with a small group of people, and (4) withdrawal from complex social environments or difficult social interactions (free from self-presentation). Drawing from this perspective, the presence of others may not be inherently disruptive, but rather becomes so when it cues or exerts social demands, or undermines in-group intimacy.

2.3.3.3 Recreational Conflicts

Recreational conflict theories address conflicts between visitors regarding both behaviors and symbolic meanings. The most classic model, Jacob and Schreyer's (1980) recreation conflicts model proposed four types of conflicts that can be applied to both behavioral and values conflicts. The model proposed four major categories: (1) activity style, personal meanings assigned to an activity; (2) resource specificity, the significance attached to using a specific resource for a specific experience; (3) mode of experience, expectations of general vs. specific sensory input of the environment are acceptable; (4) lifestyle tolerance, the tendency to accept or reject a different lifestyle. These factors encompass norms, values, and expectations of experience and include factors beyond specific interference with behaviors. Later, Vaske et al. (1995) further differentiate interpersonal conflict that happens with actual encounters and social value conflict based on the values and norms of specific social groups (e.g., tourists and local residents), and can happen regardless of the actual encounter. The specificity and expectations related to activity and resources share similarities to place attachment but are categorized from a more recreational management perspective because activities and environments are manageable things in outdoor recreation. For example, despite conceptual misalignment, place identity and place dependence scales have been used as the operationalization of activity style and resource specificity.

Major implications from recreational conflicts compared to the goal conflict perspective of crowding indicate two clear implications. First, the goals indicated by visitors may not be behavioral and psychological goals but also value and moral motivations, which involve acting in ways one believes are correct, strengthening one’s self-concept, and regulating “inappropriate” values and norms. Second, the issues of visitor impact, as well as the benefits as an extension, may

not come with a number or density but are related to symbolic meanings attached to oneself and others. However, the highly outdoor recreation-aligned classification precludes convenient integration with other perspectives, even crowding perspectives within parks management and outdoor recreation.

2.3.4 Environmental Design

Environmental design theories address the presence of people in public spaces, based on the premise that public spaces are crucial for facilitating social interaction, fostering a sense of community, and enhancing social bonds. For design relevance, those theories often developed out of observation of successful places to conclude the combinations of physical environment and social conditions relevant for individual and community wellbeing. Formatted in books, major concepts and relationships in those theories often lack explicit definitions or propositions, thus requiring more intensive interpretation. Classic theorists like Jane Jacobs, William H. Whyte, and Jan Gehl have overlapping yet distinct emphases in their theories.

Jane Jacobs (1961) relates interactions with other people in high-quality public spaces to safety, privacy, and social relationship resources. She emphasizes that the benefits from the combination of physical and social settings are "a marvel of balance between its people's determination to have essential privacy and their simultaneous wishes for differing degrees of contact, enjoyment or help from the people around." (p. 57) Jacobs' description of privacy is between anonymity and reserve, as a level where people are not completely anonymous but "do not know each other in an intimate, private social fashion." The value of this balance was not for the sake of optimal experience in space but for residents' social well-being, safety, and trust in the community. For Jacobs, high-quality public spaces are irreplaceable for this end. It helps resolve

a "sharing much or nothing" problem - the lack of safe social spaces gives rise to the dilemma between excessive self-disclosure and withdrawal from casual support or friendly interaction. This assumption is a critical boundary for the theory, as in non-urban settings, social contact may be in greater conflict with privacy expectations and environmental appreciation.

Jacobs (1961) also posit that "public sidewalk contacts" over time help build a comfortable level of mutual understanding and trust for the community. Moreover, these trusts facilitate the involvement of street users and business owners in providing informal surveillance, deterring potential offenders and enhancing perceived safety, referred to as "eyes on the street". Jacobs argued that the positive side of human presence required not just space quality that attracts people, but also a mixed land use and an organically ordered community where different user groups utilize the space at different times. Despite the original focus on deterring offenders, such safety support of others may further extend to nature (e.g., wild animals) and situational challenges (e.g., getting lost).

William H. Whyte's (1980) works proposed concepts or relationships related to positive social interaction in urban public spaces. His work was based on unobtrusive observations and interpretation of interesting phenomena. The most important phenomenon was *self-congestion*, or people attracting people. People are likely to join and stay in a crowd, sit and stand in the traffic line, or use a crowded urban square despite the availability of vacant space nearby. Whyte speculated that the reason is for social interaction and people watching. He also observed behavioral norms in which sitters chose to occupy the traffic line, and walkers maneuvered through without any negative responses shown. Another phenomenon, named *secondary enjoyment*, was gained by the observation that half of the passers-by had a smile on their faces when they looked at a scene where people were eating, chatting, and reading in a small urban park. This may be

explained by emotional contagion. Whyte found secondary enjoyment causes *impulse use*, as people "do a double take as they pass by, pause, move a few steps, then, with a slight acceleration, go on up the steps." (p. 57)

Based on these findings, Whyte posited key environmental factors conducive to positive social interaction. Such factors include movable and ample seating, and triangulation. Whyte found seating spaces were a necessary condition for people to linger in areas with attractive features. Moreover, Whyte posited that providing various extra spaces can accommodate diverse needs, privacy preferences, and perceived functional opportunities – "more room for groups and individuals to sort themselves out, more choices and more perception of choices." (p. 3) Additionally, movable chairs provide a sense of control and privacy regulation. "If you know you can move if you want to, you feel more comfortable staying put." Moving chairs, for Whyte, are signals to others and result from reciprocal benign responses - "Sorry about the closeness, but there's no room elsewhere, and I am going to respect your privacy, as you will mine." (p. 35) These "exercises in civility" can become common and pleasing in his observation. *Triangulation* is a process "by which some external stimulus provides a linkage between people and prompts strangers to talk to each other as though they were not" (p. 94). Triangulation allows interaction in an easy and casual way "in a tone of voice usually reserved for close friends" (p. 94). Street performances, public art, and sculptures that people can appreciate in parallel may create triangulation effects. The aim is not to maximize these effects but to enable people to mingle and meet in an easier way.

Jan Gehl and colleagues (Gehl, 1987, 2010; Gehl & Svarre, 2013) used a behavioral approach to study public spaces, suggesting that the presence of spontaneous social and recreational activities indicates well-designed and inviting public places, leading to positive user

experiences. He argued that poorly designed spaces lead people to pass through rather than enjoy leisure. Although he did not critically evaluate overcrowding and privacy preferences, his view implies that a crowded but well-designed space may offer a better experience than an uncrowded and unsatisfying public space. Additionally, Gehl also stressed the importance of providing rich, multi-sensory experiences in urban environments, particularly from people and everyday activities. He believed that such sensory inputs encourage people to linger, think differently, and promote spontaneous social interaction. Both social interaction and sensory stimulation contribute to creating lively and meaningful public spaces to which people are attached.

Furthermore, Gehl proposed that strategically manipulating physical distances between people, based on Hall's (1990) research on proxemics is key to facilitating positive experiences in the presence of others. By comparing modern cities and historic towns in Europe, Gehl criticized the overly large interpersonal distances caused by design scales, which did not meet people's needs for vibrant and engaging public spaces. He argued that carefully reducing spatial and furniture placement could enhance emotional experiences, establish a social norm where more intimate interactions are acceptable and preferred, and create a sense of welcome and intimacy. Specific design features include a compact spatial layout, usable and permeable boundaries between private and public spaces, and furnishings that encourage proximity, fostering an inviting atmosphere for casual social engagement.

However, urban design theories often rely on field observation and may be affected by self-selection bias. These theories are often based on the idea that public space is valuable for social life and community benefits, leading to a design paradigm that prioritizes positive social interactions over potentially more optimized experiences without social interaction in some

contexts. Therefore, it is important to carefully evaluate the extent to which a specific setting aligns with this premise.

2.4 An Integrated Framework

2.4.1 Integrated Framework Overview

Here, we propose an integrated framework based on our best attempt to understand and integrate the theories reviewed (**Figure 2.1**; **Table 2.1**). We took a functional perspective based on the abilities or opportunities of users within a given environment. We regard those opportunities as mutual properties of the person-environment relation that are neither exclusively in the environment nor "in" the person. Such a perspective is similar to environmental affordances in environmental psychology, outdoor recreation, and urban design (Gibson, 2015; Heft, 2010; Manning, 2022; Mehta, 2013).

We categorized the impact of the presence of people into three functional opportunity domains and the perceptual process. These three domains are behavioral domains, cognitive and emotional domains, and symbolic domains. Such a classification scheme is drawn from classifications of crowding (Gramann, 1982; Schmidt & Keating, 1979), affordances (Hartson, 2003), and cognitive models of environmental appraisal (Scherer, 1984; Scherer et al., 2001). We think those categories are layered instead of mutually exclusive, consistent with Scherer and colleagues' idea on multiple appraisal components, such as intrinsic pleasantness, goal relevance and congruence, and norm/self-compatibility.

Table 2.1. Intersection of Reviewed Theories/Theory Groups with Proposed Functional Domains.

		Perceptual		**Behavioral**			**Cognitive and emotional**			**Symbolic**		
	Theoretical perspectives	Attention	Interpreta-tion	Space-based	Facility and service-based	Socially interactive	Appreciation and learning	Safety and privacy	Self-regulation	Environ-mental Meanings	Social relationships	Self-concept
Social Psychology	Stokols's crowding model			●	●							
	Milgram's stimulus overload	○					●		○	●	●	
	Social learning	●	●				●		●	●		
	Shared experiences, emotional contagion, goal contagion, joint attention, behavioral mimicry	●					●		○			
	Symbolic interactionism, self-presentation		●				●	○	●	○		●
	Social Comparison							●				●
	Social identity theory							●				●
	Self-regulation								●			
	Situational norm								●	●		
	Moral emotions						●			●		
Environmental Psychology	Altman's and Westin's privacy					●		●		●	●	○
	Prospect-refuge theory						●	●				
	Stress reduction theory, attention restoration theory	○		○	○	○	●	●	●			
	Relational restoration theory						●				●	
	Place attachment						●	●		●	●	●
Parks, Recreation, and tourism	Manning's Expanded Crowding Model			●	●		●			●		
	Popp's Good Crowding				●	●	●			●		
	Extended Model of Retail Crowding				●		●					
	Recreation conflicts						●			●		●
	Wilderness solitude							●		●	●	
Design	Jacobs on privacy, safety, and sense of community					●		●			●	
	Whyte on the social life			●	●	●	●	○		●	●	
	Jan Gehl's Life Between Cities			○	●	●	●			●	●	

Note: ● denotes to a strong or direct connection; ○ denotes a weaker or peripheral connection.

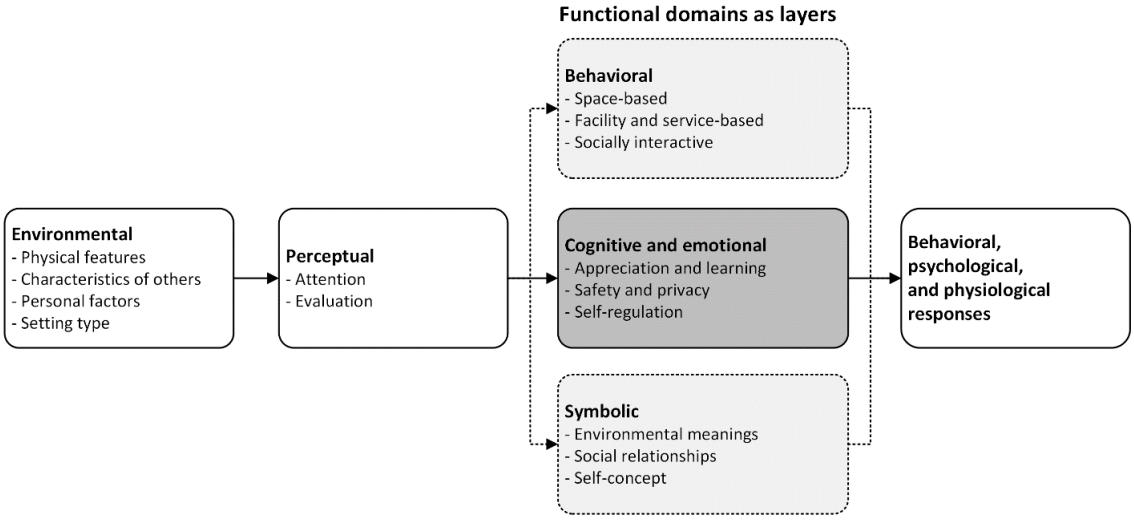

Figure 2.1 The integrated framework with three functional domains and subdomains.

2.4.2 Perceptual Process

Discrepancy between "objective" and perceived functional opportunities often exists, and effective perception of resources and challenges is crucial for effective actions and coping (Lazarus, 1991b; Lazarus & Folkman, 1984). The perceptual process involves the subjective cognitive process of evaluating functional opportunities. As the first step, the presence of other people may attract involuntary attention (Judd et al., 2009; Kaplan, 1995), cause inhibition of attention on low-priority stimuli (Milgram, 1970), give rise to joint attention (Birmingham & Kingstone, 2009; Friesen & Kingstone, 1998), and activate goals (Aarts et al., 2004), which may, in turn, impact the deployment of voluntary attention. Then, the presence of others may influence the appraisal or evaluation of the features that are attended. This may be through the symbolized meaning and the observation of the dominant behaviors, behavioral outcomes, and descriptive norms (Bandura, 1977).

2.4.3 Behavioral Functions

The behavioral function domain involves the physical and social activities enabled or facilitated by the environment. These functions may be the most observable and operatable for planning, design, and management. We developed three sub-domains: space-based behavior, facility and service-based behavior, and social interaction.

Space-based behaviors. The first sub-domain refers to the opportunities for activities requiring physical space and spatial layouts, such as picnicking, lying, and hiking. Human presence can bring spatial constraints to behaviors (Stokols, 1972) while seating design strategies may mitigate this impact (Whyte, 1980). The strength of impact may depend on the setting and activity characteristics (Gehl, 1987; Manning, 2007). Urban settings may be less impacted than outdoor recreation, and static and lower-speed activities may also be less impacted.

Facility and service-based behaviors. This sub-domain refers to the opportunities for activities requiring amenities, provisions, staffing, and programs, for example, waiting time to enter a museum. Crowding perspectives regard others as competitors for natural resources (Manning, 2007, 2022) or provider of resources essential for activities, particularly for urban, cultural tourism, and service settings (Eroglu & Harrell, 1986; Gehl, 1987; Popp, 2012; Whyte, 1980), such as people-watching, leisure shopping, and or cultural atmosphere. Overall, the impact depends on varying resources that others provide and consume in a specific context.

Social interactions. Intuitively, people provide opportunities for instrumental and hedonic interactions, such as chatting, group activities, and help. The direction of the impacts can depend on many moderators to these affordances, including desired privacy (Altman, 1976; Westin, 1970), the design features for privacy regulation (e.g., public space, movable seating) (Jacobs, 1961; Whyte, 1980), characteristics of others (e.g., other tourists vs. local residents) (Popp, 2012).

Suggested by emotional contagion (Elfenbein, 2014) and *triangulation* (Whyte, 1980), such interactions can be more pleasant and easier with shared stimuli, such as performance and food. In addition, people may need to seek help from others or collaboration in group activities (McGrath & Otnes, 1995).

2.4.4 Cognitive and Emotional Functions

Cognitive and emotional functions represent varied mental processes and emotions enabled by the environment. Such mental processes can occur alone or accompanied by behavioral and symbolic processes. We developed three sub-domains from the literature, one being an externally focused activity, *environmental appreciation and learning*, and the other two being generally essential conditions for behavioral and mental actions, which are *safety and privacy* and *self-regulation*.

Environmental appreciation and learning. This sub-domain refers to the admiration, learning, and emotional experiences related to environmental features, such as plants, wildlife, cultural elements, and human activities. These experiences are sometimes labeled as aesthetic experiences or sensory experiences and involve many theories. While varied in desirability, the presence of others generally adds variation, stimuli, and complexity. Existing theories have addressed both the positive potential of social stimulation for aesthetic experiences in otherwise boring and empty urban spaces with modernist designs (Gehl, 1987; Whyte, 1980) and the negative impacts of degraded beauty of nature (Manning, 2007) and cognitive overload (Milgram, 1970). Shared experiences explain underlying mechanisms such as joint attention, emotional contagion, and intensification of memories (Boothby et al., 2014; Shteynberg, 2015). In addition, the presence of others may influence appreciation by changing the meaning and affective bonds to the environment (B. S. Jorgensen & Stedman, 2001; Kyle et al., 2004), social norms (Bicchieri, 2005),

moral emotions (Haidt, 2003; Roseman et al., 1996), attention and evaluation of self (Duval & Wicklund, 1972; Festinger, 1954; Goffman, 1959). Regarding learning, the presence of irrelevant others may be less impactful, and people with relevant skills and knowledge may facilitate social learning (Bandura, 1977). The compatibility of those variations and meaning to the setting, one's goals, and one's openness to experience (Jacob & Schreyer, 1980) can moderate the impact.

Safety and privacy. Safety and privacy refer to a sense of personal safety and the control of information release and contact with others. For personal safety, the consistent presence of benign others helps against threats in public and community spaces, with mixed land use or functional diversity as a facilitator (Jacobs, 1961). Also, the concept of refuge suggests that a moderate density of friendly others (e.g., intimates, families) enjoying leisure can improve perceived safety facilitated by an enclosed or partly enclosed space (Appleton, 1996; Grahn & Stigsdotter, 2010). Conversely, marginalized or underrepresented groups may perceive the dominant presence of other groups as hostile and the place as unwelcoming (Powers et al., 2022; Powers & Son, 2024). The presence of others may threaten solitude and intimacy (Westin, 1970), increasing self-awareness (Duval & Wicklund, 1972). Conversely, a positive impact on psychological safety and privacy may exist in high human-density settings through diluted social attention and self-awareness (Diener & Wallbom, 1976; Diener, 1979) and improved anonymity (Westin, 1970).

Self-regulation. An environment can facilitate the regulation of emotions and thoughts to attain specific goals, as opposed to self or stimuli-driven impulses. This concept is related to stress coping and restoration. In general, the presence of others may evoke self-awareness and sensitivity to social norms, which could block desires and impulses (Baumeister, 1986; Hofmann et al., 2012). In addition, soft fascination suggests a cross-situation condition for self-regulation, which gently

captures bottom-up attention, blocking unwanted concerns and allowing ease of goal-directed reflection (Kaplan, 1995; Kaplan & Berman, 2010). People can facilitate soft fascination in an under-stimulation setting or pose a distraction or stressors in a more stimulating setting. Also, exemplary models (Bandura, 1977) facilitate ease of self-control while "counter-models" and effortful social interactions can reduce self-regulation resources (Aarts & Dijksterhuis, 2003; Finkel & Fitzsimons, 2011; Hofmann et al., 2012).

2.4.5 Symbolic Functions

People seek and create meaning in everyday life. The symbolic functions domain concerns the construction of meanings, values, norms, and connections enabled by a setting. Such processes can happen together with behaviors or feelings but can be impactful without overt behavior. From the reviewed theories, we identified three subdomains concerning environmental meanings, relational resources, and self-concept, respectively.

Environmental meaning. This subdomain refers to the reinforcement or challenge of one's recognized social norms, values, and meanings related to the environment and leisure activities. In a general sense, people negotiate such meaning through their interaction with other people (Mead, 1934; Samdahl, 1988). Also, meaningful social relationships formed and maintained in the place may contribute to one's affective bonding to a place (Kyle & Chick, 2007; Low & Altman, 1992). Moreover, perception of the beliefs and behaviors of others can influence the meaning and situational norms in a place (Bandura, 1977; Bicchieri, 2005). Conflicts regarding such meaning and norms can happen between users in-person or cognitively without encounter (Jacob & Schreyer, 1980; Vaske et al., 1995), which can cause negative feelings (e.g. anger) and arousal (Roseman et al., 1996). Conversely, the presence of other people may bring or symbolize diverse values and norms, which may facilitate mutual learning and inclusiveness (Powers & Son, 2024).

Relational resources. The subdomain refers to developing and maintaining social relationships or relational resources that enable social support. Regarding relationships with new people, an environment with human presence may afford relational resources through repeated encounters and interaction (Jacobs, 1961), especially for those with social interests (e.g., community members). However, an overcrowded or overstimulating setting can trigger coping responses that keep people away from social contact (Altman, 1976; Milgram, 1970), and hinder the development of social bonds. Urban design theories stress the synergy of encounters and environmental features could facilitate positive social interaction, such as using a focal point for friendly and easy chatting (i.e., "triangulation") (Gehl, 1987, 2010; Whyte, 1980). For people in close groups (e.g., friends, romantic partners), the presence of others may impede the restoration of relational resources with intimate others when it leads to distraction and conflict and interferes with privacy regulation (Hartig, 2021).

Self-concepts. This subdomain refers to the environment's potential to affirm one's positive self-concept and social identity. In comparison to privacy states without external pressure on self-evaluation (Westin, 1970), social situations can impact one's self-concept in various ways (Mead, 1934). These impacts may include direct or reflected evaluations (R. B. Felson, 1981), role obligations (Goffman, 1959), upward and downward social comparison (Festinger, 1954), and social identity shaped by others' approval or rejection (Tajfel & Turner, 2001). Such processes may be more relevant to recreational settings involving groups, performance, appearance, and display of status. Personal factors such as motivational states and perceived similarity may also play a role.

2.5 Discussion

Given the conflicting thoughts regarding the presence of people in public and recreational spaces, a flexible and comprehensive understanding of the impacts of others can allow design and management research practices. This study reviewed theoretical contributions spanning social psychology, environmental psychology, urban design, park and recreation management, and tourism and service management. This narrative analyzed the relevant relationships illustrated by each discipline and the different facets of human-environment interactions. We also described the underlying values and premise under each practice-based field that led to conflicts between their attitudes toward the presence of people. To facilitate a comprehensive understanding and interdisciplinary crosstalk, this integrated framework seeks to synthesize these varied insights into a cohesive understanding of human presence in public and recreational environments.

2.5.1 Reviewed Theories by Discipline

We found diverse disciplinary perspectives to understand the multifaceted impacts of human presence across various settings. Although concepts such as density and privacy were used in both psychological and professional fields, different implications were made around specific settings and assumptions of their values. Social psychology theories identify basic mechanisms such as Bandura's (1977) social learning and Bicchieri's (2005, 2016) situational norms. Theories can be widely used such as crowding and norm, or underused in environmental design and management, such as social learning. However, perspectives in this field often involve minimal environmental contexts in which these mechanisms operate, highlighting a need for studies that specify the public and leisure environments in which the mechanism occurs.

Environmental psychology theories on the presence of people are often interrelated with social psychology but generally focus on how environmental factors and human presence intersect to influence experience. For example, Altman's (1975) privacy and Kaplan's (1989) attention restoration theory illustrate these interactions, demonstrating varied outcomes based on differing value orientations (e.g., social vs. nature). As such, environmental psychology theories can explain positive and negative impacts from the presence of others, but considerations are needed on the environmental values and needs of the population to select the mechanisms of interest.

Practice-based fields such as urban design, park and recreation management, and tourism and service management integrate psychological insights but highlight distinct impacts of human presence tailored to their specific goals. Urban design theories, for instance, emphasize design features that enhance social interactions in public spaces. As explained by Jacobs (1961), this orientation assumes the greatest and irreplaceable values of public spaces, suggesting that community well-being might be enhanced by social interaction rather than other experiences. However, this assumption might need to be qualified in this social media era, in which virtual environments may share some functions attributed to physical public spaces (Misra & Stokols, 2012). Conversely, park management prioritizes the intrinsic worth of natural resources and the experience of solitude and developing views on reducing human impacts to avoid the "tragedy of the commons" (Manning, 2007). However, such views can overlook the diversity of natural settings, including different values of 'man-made nature' in cities. Meanwhile, tourism and service management adopt a more adaptable approach, considering a human presence in terms of contextualized goal attainment (e.g., Eroglu & Harrell, 1986). We interpret this flexibility as acknowledging the heterogeneity of experience. Collectively, these diverse perspectives suggest

the value of interdisciplinary approaches for a comprehensive and relevant understanding but also underscore the necessity for a holistic view as an essential step toward future research.

2.5.2 Integrated framework

We have developed an integrated framework that classifies the impacts of human presence into perceptual functions and three core functional domains: behavioral, cognitive, emotional, and symbolic. Perceptual functions play a crucial role in how individuals perceive and interpret their environments, which can align or misalign with actual opportunities and constraints. Potential misalignments, often unreported in environmental experience research, may stem from a lack of awareness of unknown factors. We identified two sub-processes, including the overarching topic of attention, alongside evaluation, which draws on appraisal theories (Lazarus & Folkman, 1984; Scherer, 1984). Such appraisal theories emphasize components such as novelty checks, goal relevance and congruence, coping potential, and connecting the role of other people to social learning and shared experiences.

The behavior domain reflects the most tangible and manipulable functions in the practice-based fields. The separation of behaviors from psychological experience is common in frameworks on affordances (Hartson, 2003), crowding (Gramann, 1982; Schmidt & Keating, 1979), and self-control (Averill, 1973). Subdomains within this category relate to spatial arrangements, programming and services, and social interactions, each aligning with different potential interventions.

The cognitive and emotional domain focuses on external-focused activities, labeled as appreciation and learning, along with mental conditions that enhance psychological experiences, including perceived safety, privacy, and self-regulation. Safety and privacy are overarching topics across the theories reviewed and fundamentally involve other people (e.g., Altman, 1975;

Appleton, 1996; Hammitt, 1982; Jacobs, 1961; Westin, 1970). Self-regulation captures how others may influence the cognitive control that holds significance in goal attainment behaviors or cognitive activities, which are addressed tangibly or stressed by multiple theories such as cognitive overload (Milgram, 1970), self-regulation (Finkel & Fitzsimons, 2011), and attentional restoration theory (Kaplan & Berman, 2010).

Symbolic functions reflect subjective and intersubjective meanings and values associated with experiences in public and leisure places. This domain is grounded in the symbolic interactionism framework (Cooley, 1902; Mead, 1934), with specific connections with multiple reviewed theories, such as place attachment (Low & Altman, 1992), relational restoration theory (Hartig, 2021), and social comparison (Festinger, 1954). Subdomains within this area focus on the leisure environments/activities, other people, and oneself, respectively. A notable consideration is the treatment of place attachment, which involves "place identity" and affective bonds between individuals and their environments. We categorize such affective bonds under environmental meanings to reflect the theories' original fields.

2.5.3 Implications for Future Research

In examining the interplay between human presence and environmental settings, our integrated framework offers new avenues for nuanced understanding and application across various fields. In environmental psychology, this framework serves as a foundation for developing concepts that integrate social and physical factors, enhancing environmental appreciation and social interaction. For instance, William Whyte's (1980) classic concept of 'triangulation' could be further explored and operationalized. Also, new concepts like 'social fascination' could be defined and explored to address human presence that enhances or moderates involuntary attention in urban and cultural scenarios. Researchers might also draw on Gehl's (1987, 2010) multi-sensory urban

experiences, Kaplan's (1989) notion of 'soft fascination, and shared experience (Boothby et al., 2014; Shteynberg, 2015).

Further investigation is needed into how the presence of others involves conflict or ignored impacts in different settings. For instance, the way visitor density and diversity of activities influence perceptions of function and satisfaction at tourism destinations warrants examination. Paradoxically, while higher visitor density may diminish the current experience (Dogru-Dastan, 2022), they could potentially inspire suitable activities in a setting (Choudhry, 2015). Another potential area could be the role of people in privacy, anonymity, and self-consciousness. Though greater numbers tend to decrease privacy, blending into a group in service settings may actually reduce fears of being judged or drawing unwanted attention (Uhrich & Tombs, 2014). The potential for "group anonymity" to enhance comfort levels merits further investigation.

Additionally, delineating the settings and cross-situational factors under which these understudied mechanisms occur can help further the application of less studied theories, echoing Stokols' call for exploring high-impact scenarios or environmental psychology mechanisms (Stokols, 1997) . Moreover, the differential effects of human presence on individual versus group settings or across different demographic groups offer fertile ground for exploration. For example, researchers may explore how older adults or minority groups experience environments with human presence differently, influencing aesthetic experience, psychological safety, and a sense of belonging (Marcus & Francis, 2003; Powers & Son, 2024).

Within practice-based fields, expanding the discourse to less conventional contexts, such as under-visited destinations and public spaces in tourism neighborhoods, could provide insights into flexible research narratives and targeted practical solutions. For instance, examining the positive relationships between local place attachment and attitudes toward crowding (Wickham &

Kerstetter, 2000) may reveal how place identity, environmental experience, and self-concept are affected by crowding, offering new perspectives on managing human-environment interactions.

2.5.4 Limitations

Our narrative review carries several limitations. First, despite the use of multiple search techniques, the challenge of cross-disciplinary theory exploration and our broad theoretical focus may have led to the omission of pertinent theories within each field. Second, the narrative and exploratory nature of our review introduces the risk of misinterpreting and overextending theories. The broad range of theories examined precluded a detailed evaluation of the assumptions underlying each theory and the inclusion of empirical evidence necessary for assessing the applicability or generalizability of these theories. Future research should consider applying systematic evaluation criteria to theories, as suggested by Parse (2005), and complement a review of empirical evidence.

Furthermore, our synthesis and synthesis aimed to integrate extensive mechanisms into a few domains and subdomains, which may have resulted in ambiguous domain labels that obscure their connection to the original mechanisms. Additionally, the complexity and heterogeneity of human impact outcomes within each subdomain might complicate the direct application of the framework structure in formulating research hypotheses. The extensive scope and large number of theories included may also have led to inadequate consideration of moderating factors and specific applicable settings. To address these issues, future theoretical frameworks should aim to refine the categorization of domains and enhance the clarity of theoretical connections. Implementing a more granular approach to the categorization and analysis of theories could also help elucidate the nuances of human presence impacts and the moderators, facilitating the application of research hypotheses and practical cases.

2.6 Conclusion

In conclusion, we conducted the first narrative review that synthesizes interdisciplinary perspectives on the impacts of the presence of people in public and recreational spaces, offering a novel framework that highlights perceptual, behavioral, cognitive, emotional, and symbolic functions. This integrated approach not only fills a significant gap in the literature but also provides a structured lens through which urban planners and policymakers can better understand human presence and enhance the functions and quality of public and recreational spaces. Moving forward, it is crucial to leverage this integrative approach, focusing on the pragmatic application of previously ignored theories to further refine our understanding of social contexts in these spaces. It is also essential to adapt and apply these insights across different urban and natural contexts, advancing more focused theories and frameworks. Additionally, fostering multidisciplinary collaborations can enhance the framework's applicability and advance the methodologies that are effective in the complex interplay of social and environmental factors.

CHAPTER 3. CAN VISUAL ATTENTION HELP UNCOVER THE EFFECTS OF VISITOR DENSITY ON URBAN PARK EXPERIENCE? AN EYE-TRACKING AND VIRTUAL REALITY STUDY

Abstract: Urban parks play a crucial role in public health and well-being. This study examined the multifaceted impacts of the presence of people on urban park experiences using a novel combination of virtual reality and eye-tracking technology. Thirty-seven participants viewed eight 40-second 360° videos with sounds reflecting two visitor density levels. Results showed that higher visitor densities reduced willingness to visit and perceived restorativeness. Higher visitor densities also increased perceived safety among female participants. Unexpectedly, although increased visitor densities drew visual attention to people and away from the sky, buildings, and street furniture, no change in visual attention to greenery was observed at higher vs. lower visitor densities. Distribution of visual attention to people was found to explain how visitor density influences the willingness to visit. These findings underscore the importance of visual attention in visitor use management. Methodological and practical implications for urban planning and park management are discussed.

Keywords: Urban Green Spaces, Presence of People, Crowding, Eye Tracking, Virtual Reality

3.1 Introduction

Urban green spaces are increasingly recognized as vital for enhancing public health and well-being (Markevych et al., 2017). As an important aspect of a place, the presence of users can play a multifaceted role in the environmental experience and is connected with crowding (Dogru-Dastan, 2022; Vaske & Shelby, 2008), privacy and solitude (Hammitt, 1982; Lis & Iwankowski, 2021), place attachment (Kyle et al., 2004), service experience (Brocato et al., 2012), crime and safety (M. Felson, 1995; Jacobs, 1961), sense of community (Cattell et al., 2008), and social cohesion and relational resources (Hartig, 2021; Peters et al., 2010; Wan et al., 2021). Within the context of greenspace and mental health, research examining the effects of the presence of people on restorativeness, preference, perceived safety, and privacy have yielded mixed findings (Grahn & Stigsdotter, 2010; Lis, Pardela, Can, et al., 2019; Lis & Iwankowski, 2021; Nordh et al., 2011; Ríos-Rodríguez et al., 2021, 2021; Twedt et al., 2019; White et al., 2010; Peschardt & Stigsdotter, 2013; also see review by Korpela & Staats, 2013). These findings may be due to the complex ways in which other people may alter how individuals perceive and interact with the environment (Brocato et al., 2012; Cattell et al., 2008; Colm et al., 2017; Popp, 2012).

Given the complexity of interactions within urban parks, eye tracking offers a valuable method for understanding how park users behave and perceive the environment. This technology allows researchers to study not only the presence of park features that can influence psychological experiences, such as greenery, artificial structures, and the presence of other people (de Vries et al., 2012; Nordh et al., 2009), but also identify how individuals visually engage with these features (Nordh et al., 2011; Simpson, Freeth, et al., 2019) and the dynamics of human activity. Despite eye tracking's potential, screen-based eye-tracking approaches using static images were limited in their ability to address the complex and dynamic nature of park activities. This study addresses

these limitations by integrating 360° videos within a virtual reality headset with add-on eye tracking to enhance insights into how the density of park visitors affects the urban park experience.

3.1.1 Impacts of People

The specific effects of human presence on the experience of urban green spaces are multifaceted and have yielded conflicting results. For example, one study has shown that images of scenes containing water features, greenery, or built structures are rated higher in willingness to visit, willingness to pay, pleasantness, and perceived restorativeness when the scenes include people compared to when they do not (White et al., 2010). However, the influences of people's presence are moderated by several factors. A notable aspect is the density of people, where an inverted U-shaped relationship is frequently observed in urban green spaces or non-wilderness settings, indicating that preference for the number of people increases to a peak with moderate visitor densities before decreasing (Kim & Shelby, 2011a; Nordh et al., 2011). This pattern recurs across various contexts, such as cultural heritage sites (Alazaizeh et al., 2016) and festivals (Cheng et al., 2021). Different settings can also influence visitor preferences. For example, Kim and Shelby (2011b) found that the same set of images with varying contextual information (e.g., a nature preserve, transition/buffer area, or developed area) could alter visitor preferences towards the density of people. The complexity of human preferences is further exemplified by findings from Arnberger et al. (2010), which identified three distinct urban park user segments with varying preferences for the presence of people: those who prefer solitude, the company of a few others, or high visitor densities.

Safety is another frequently examined aspect related to the presence of people. Jane Jacobs' (1961) "eyes on the street" posits that the presence of regular users, such as shop workers and pedestrians, provides informal social control and deters criminal activity. Urban green spaces may

be perceived as dangerous because understory greenery can obstruct views and movements (see review by Jansson et al., 2013). The presence of other people helps people evaluate perceived safety (Baran et al., 2018) or alleviate perceived dangers (Lis, Pardela, & Iwankowski, 2019). Research also reveals gender differences in perceived safety in urban parks (Sonti et al., 2020; van den Bosch & Ode Sang, 2017). Two experimental studies indicate that the presence of people can alleviate the gender gap in perceived safety (Jiang et al., 2017; L. J. Jorgensen et al., 2013).

The restorative potential of the environment poses another aspect of mixed results regarding human presence. According to attention restoration theory (ART), environments that moderately captivate involuntary, bottom-up attention without interfering with other thoughts can help restore emotions and cognitive capacities (Kaplan, 1995; Kaplan & Berman, 2010). This central component, referred to as *soft fascination*, is most effective when it occurs together with three other favorable conditions of human-environment transaction: being away from daily concerns (*being away*), being large and coherent for remaining engaged (*extent*), and fitting with one's needs and goals (*compatibility*). Human activities in urban environments can be non-restorative, as "urban environments tend to contain bottom-up stimulation that preempts capacity for other thoughts and also requires directed attention to overcome that stimulation (e.g., avoiding traffic, ignoring advertising)" (Kaplan & Berman, 2010, p. 49). Despite the theoretical rationale for the presence of people reducing restorative experience, an earlier review by Korpela & Staats (2013) has found that empirical studies often had insignificant results, including a survey study on wilderness trail users in the U.S. (Cole & Hall, 2010). Similarly insignificant findings emerged from later video-based lab studies from the U.S. and China (Neale et al., 2021; X. Wang et al., 2016). An individual's level of stress may also serve as a crucial factor in moderating these responses. Konings (2012, cited by Korpela & Staats, 2013) discovered that fatigued individuals

found environments without people more pleasant, whereas rested individuals reported the opposite. Two studies on environmental feature categories ("perceived sensory dimensions") diverged on favorite features (i.e., nature and tranquility for the Swedish study vs. social interaction for the Danish study) but shared the trend that people reporting stress are more likely to prefer environments featured by nature and safety (refuge) (Grahn & Stigsdotter, 2010; Peschardt & Stigsdotter, 2013).

3.1.2 Visual Attention

The distribution of visual attention offers a promising approach to understanding the complete influence of the presence of others, although it presents several challenges. One type of visual attention, top-down, voluntary attention, is relevant to cognitive processes or tasks. For example, research has shown that pedestrians devoted longer fixation times to their street environment during utilitarian walking (e.g., rushing to work) compared to leisure walking (e.g., break time stroll), suggesting that people were less focused on their immediate surroundings during utilitarian walks (Simpson, Freeth, et al., 2019; Simpson, Thwaites, et al., 2019). Another type of attention is bottom-up and involuntary attention, driven by salient environmental features. These salient features generally include low-level features such as brightness ("intensity"), color, orientation, size, edges, and motion (Duchowski, 2017; Friedenberg, 2013), high-level features including texts, animals, humans, human faces (Judd et al., 2009), and other features with higher information densities (Henderson & Hollingworth, 1998). Extending this understanding to urban and natural settings, research has demonstrated that bottom-up attention often focuses on contrasts of building styles or elements (Hollander et al., 2019), traffic and store signs (Hollander et al., 2020; Q. Li et al., 2016), spatial layout properties like prominent elements/landmarks (e.g., the top

of a tower) (de la Fuente Suárez, 2020; Wenczel et al., 2017) and intersection areas of floor lines and skylines (Emo, 2018).

Objective measures of the fixation time or distribution of attention on people could potentially reflect the influence of the presence of people. This approach is particularly justified as park visitors often underestimate the number of their actual encounters and remain unaware of the extent of their social interactions, highlighting a gap between self-reported and actual social interaction (Bell et al., 2011; R. G. Lee, 1977; Shelby & Colvin, 1982). Existing eye-tracking research on the presence of other people has primarily been concentrated on roadway and traffic studies, revealing pedestrians' attention. For example, one study found that pedestrians on sidewalks look at others for 4% of the time (Davoudian & Raynham, 2012). Another study reported variations in gaze time ranged from 3% to 26% across different settings, such as drive lanes, bike lanes, and sidewalks (Yue et al., 2022). Furthermore, 73% of visible pedestrians were fixated on at least once (Fotios et al., 2015), with higher proportions of fixations on people at night (Davoudian & Raynham, 2012). Prolonged visual attention during free viewing does not indicate whether focusing on an environmental feature is positive or negative (Cottet et al., 2018).

Evidence on the relationships between experience evaluations and fixation duration on people versus greenery is also mixed. Two studies using images of natural and urban environments, without adjusting visitor density, revealed differing results. One study demonstrated a positive relationship between preference and fixation duration on greenery (J. Li et al., 2020) , while the other found no significant relationship (Nordh et al., 2009). However, a third study manipulating visitor density across a wide range of densities found benefits of fixating on greenery for psychological experiences but negative effects of fixating on people (P. Li et al., 2022). As such, more controlled experimental studies are needed to further elucidate these relationships.

3.1.3 Eye Tracking with 360° Videos

Employing eye-tracking technology with 360° videos showing the presence of people in park settings offers significant advantages over the traditional approach that displaying static images on monitors. Static images are unable to capture human motions, which is an important aspect of the visual saliency of humans (Judd et al., 2009). These images are also limited in conveying facial expressions and body language that pedestrians rely on to assess their safety and strangers' intentions (Davoudian & Raynham, 2012). This loss of information can also impede the transfer of emotions between people (i.e., emotional contagion; Pugh, 2022; Volonte et al., 2019) or the learning of suitable behaviors and outcome expectations in a specific situation (i.e., social learning theory; Bandura, 1977).

The stimulus viewpoint has raised validity concerns in visual methods research on crowding. While Manning and Freimund (2004) found no difference in visitor density acceptability between photos depicting the same direction and location on the trail between "up" vs. "down" perspectives, T.-H. Wang et al. (2021) demonstrated that 360° imagery in VR can yield crowding evaluations that closely resemble those from on-site observations and prove more sensitive than photos. In contrast to VR stimuli, the partial views in photos may not accurately depict the surrounding environment or situation. This issue is exemplified by Lis and Iwankowski (2021), who showed that photos of non-threatening individuals taken from behind trees or bushes unexpectedly conveyed a sense of potential danger, as the limited view failed to capture other legitimate users walking nearby, implying a scene where an offender could suddenly appear. By including the entire view, 360° imagery may help address the potential confounds caused by the selective framing of the salient features that capture visual attention, such as visual ends of trails or streets (Emo, 2018). This feature may also address central fixation biases present in photograph-

based eye-tracking studies. This bias is partly caused by fixed head positions (Nakashima et al., 2015), which could lead to prolonged viewing of the central area in a picture, especially during free-viewing tasks or the first few seconds of viewing (Bindemann, 2010; Tatler et al., 2005). Furthermore, 360° imagery allows viewers to look away from undesirable sights (e.g., crowds) or focus on the elements they prefer, generating viewing behaviors similar to real-world activities.

3.1.4 Current Study Overview

The role of the presence of people in urban parks on users' experiences is unclear and complex. Visual attention could provide insights into how users engage with urban park features and the subsequent effects on park experience evaluations. Our study utilizes an innovative combination of 360° videos with sounds in VR and eye tracking to explore the impact of human presence in urban parks. We have formulated three research questions (RQ):

1. How does visitor density affect key urban park experience evaluations, including willingness to visit, perceived safety, and perceived restorativeness? We also investigated how these relationships differ by participant gender.
2. How does visitor density influence the distribution of visual attention to park features (represented as areas of interest [AOIs]) including people, greenery, water, sky, buildings, pavement, and street furniture?
3. How does the distribution of visual attention to park features relate to experience evaluations? Specifically, we investigate questions involving how a) visual attention distributions relate to park experience evaluations and b) how differences in visual attention distributions can potentially explain the effects of visitor density level on park experience evaluations.

3.2 Methods

3.2.1 Overview

This study employed a within-subject design to investigate the effect of two visitor density levels (lower visitor density vs. higher visitor density) in urban park settings. Each of the 37 participants watched eight 40-second 360° videos and recorded eye movements, filled out a survey to evaluate urban park experiences. A machine learning-aided approach was developed to annotate park features (AOIs). Linear-mixed effects models and correlational analysis were used to analyze the effects of visitor density.

3.2.2 Stimuli

We selected four locations in urban parks or greenways (trails) in downtown Greenville, SC, including two locations in Falls Park on the Reedy, one in Unity Park, and one in Swamp Rabbit Trail. These locations varied in the amount of greenery and degree of openness to represent a larger range of urban park conditions. Each location was represented in the VR experiment with videos showcasing two different visitor density levels, allowing for a controlled comparison (**Figure 3.1**). Following the practices of a normative approach and visual methods in park management research (Cribbs et al., 2022; Hallo et al., 2018; Manning, 2009), the operation of visitor density was based on actual or potential density on-site instead of designated numbers of people per view (PPV). Our condition of higher visitor density represents the visitor density during peak hours on weekends in spring and summer. Lower visitor density refers to the low density of that site, usually only including no or only a couple of users. For practical reasons, we did not include potential higher density during special events or holidays. To investigate use conditions in

peak and off-peak hours, we made direct site observations and/or used time-lapse trail cameras for each location.

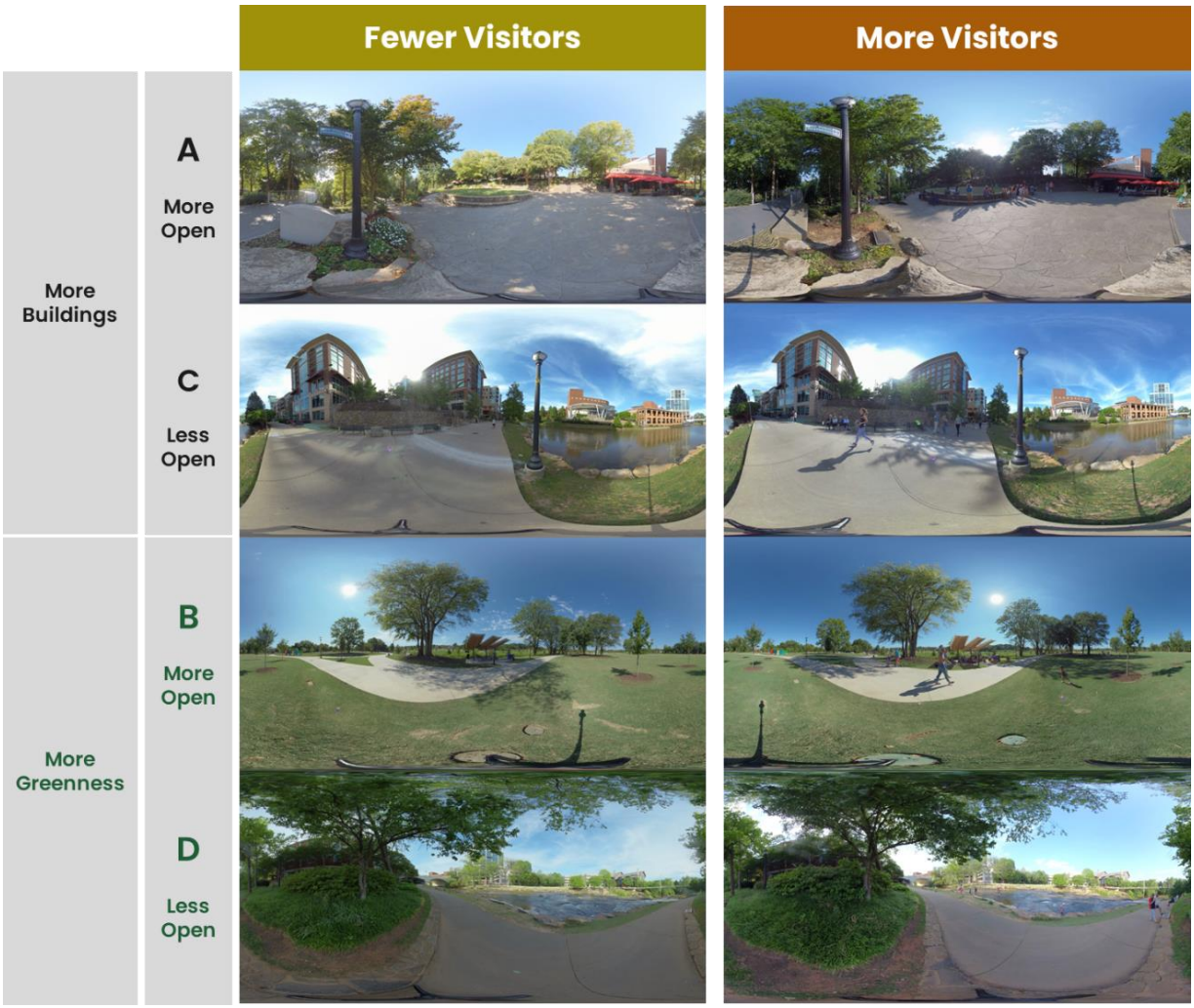

Figure 3.1. Equirectangular (flattened) screenshots of 360° videos taken in four locations (A, B, C, and D) with varied environmental features.

360° videos were filmed from May to August 2023 using an Insta360 Pro 2 camera (8K resolution at 30fps) at an eye level of 1.7 m on sunny or partly cloudy days. The original footage was encoded to 3840*1920, 29.97 fps to suit the VR device's performance. We selected and extracted 40-second video clips excluding instances where people looked directly at the camera or

stayed too close to it, except the more-visitors-condition of scene D with an 8-second instance of someone looking from 5 m away. The on-site audio was recorded by a Zoom H3-VR 360º Audio Recorder. However, because on-site sound conditions and quality varied, we used a mix of on-site audio (mainly human noise) and added audio, such as water sounds, leaf sounds, and traffic sounds. The initial viewing direction was adjusted, and brightness and sound volume were adjusted to control potential confounding factors.

3.2.3 Participants

A total of 37 undergraduate and graduate students from Clemson University were recruited and included in the analysis (see **Table 3.1**). Only 33 participants were included in the visual attention analysis (RQ2 and RQ3), as 4 were excluded due to incomplete or low-accuracy eye tracking data. We also excluded students who have been enrolled in any program in the School of Architecture or Department of Parks, Recreation and Tourism Management due to their professional training potentially affecting urban park evaluation. All participants had good vision or corrected vision, except thick and large-frame eyeglasses users were precluded due to incompatibility with the VR eye tracker. Participants were recruited in person, in general education courses, and from posters on campus. The study was approved by Clemson IRB (IRB2023-0211).

3.2.4 Apparatus

The HTC VIVE Focus 3 with a Tobii eye tracker accessory was used to present 360° videos and eye tracking (**Figure 3.2**). The headset has a combined field of view of 120°, visual accuracy of 0.5°~1.1° degrees within a FOV of 20°, and a 90 HZ for the current study. A Windows desktop with the Unity program was used as the base for video playing and data logging. A Shimmer3

GSR sensor was used as the electrodermal activity sensor (EDA, galvanic skin response, or GSR), but the data were not included in the current analysis.

Figure 3.2. Experiment environment and the VR and eye tracking devices

3.2.5 Procedure

Figure 3.3 demonstrates the data collection procedure. Upon arriving at the testing location, participants first read and signed an informed consent form and were briefed about the study procedure. They then completed the initial section of a Qualtrics survey on an iPad, which included questions on demographics and personal factors. Following the survey, participants were equipped with the VIVE Focus 3 headset with the add-on eye tracker. They adjusted the headset for optimal viewing comfort and underwent a calibration process to ensure accurate eye tracking. This calibration was performed in the headset and tested in the Unity environment. The calibration was

repeated as necessary until it was successful. Participants who could not calibrate the eye tracker were withdrawn from the study.

Afterward, the experiment commenced with a practice phase with a demonstration video in another urban park location to familiarize themselves with watching videos in a VR headset to reduce the novelty effect of VR. Participants were given the following prompt throughout the practice: "*During the video watching, you need to remain seated and keep your hands on the armrests, but you can move your head and rotate the chair to explore the scene. Before each video starts, a white image with a black cross will appear. Look at the black cross as the initial viewing direction. Once a video begins, spin the chair in a 360-degree circle to get an overview of the scene. After that, you can freely explore the video, but keep this question in mind: How much would you like to visit this place at the time shown in the video? You don't need to speak aloud while watching, but you will be asked to answer this question for each video in the second part of the survey*." Then they were asked to repeat the requirements to ensure understanding.

Next, the formal viewing began with eight 40-second 360° videos, each following a 5-second transition, making up a total viewing time of six minutes. The videos were shown in one of four different sequences, and participants were evenly assigned to each sequence to control order effects. After the VR session, participants completed the second part of the survey, evaluating their experiences in the park settings shown in the 360° videos. The survey replicated the sequences of the videos and included interactive 360° images corresponding to each scene. Two open-ended questions about the factors influencing their evaluations were also included. The entire experiment lasted between 30-40 minutes, primarily depending on the time required for eye tracker calibration.

Figure 3.3. Data Collection Procedure

3.2.6 Measures

Primary survey outcomes. The survey (APPENDIX A) included six questions for each video to evaluate urban park experiences. The first measure *willingness to visit,* was adapted from White et al. (2010). This single item asked, "*How willing would you be to visit this scene?*" The second measure was a single-item measure of perceived safety, asking, "How *safe and secure would you feel for this scene?"*. The third outcome was *perceived restorativeness*, measured through the short version of Korpela and Hartig's (1996) *Perceived Restorativeness Scale* (PRS), a scale used for with-in-subject design with multiple images (Berto, 2005; White et al., 2010). We used four of the five items in the scale, including fascination ("*That place is fascinating; it is large enough for me to discover and be curious about things*"), being away ("*That is a place which is away from everyday demands and where I would be able to relax and think about what interests me"*), scope ("*That is a place which is very large, with no restrictions to movements; it is a world of its own*"), and compatibility ("*In that place, it is easy to orient and move around so that I could do what I like*"). The coherence item was omitted due to poor correlations with the other four items (White et al., 2010) and its absence in the original attention restoration theory. All the measures were based on five-point Likert scales from "1 not at all" to "5 extremely".

Secondary survey measures. Participant characteristics related to park experience evaluations were gathered, including the *frequency of visits in the past 6 months*, *park visit*

motivations, and *nature relatedness*. Visit motivations incorporated the five items from Keith et al. (2018) regarding urban trail visitor motivations in the U.S., along with another key motivator (proximity/accessibility) from Priess et al. (2021) and Sonti et al. (2020). Such items were rated using Likert scales from "1 not at all" to "5 extremely." A short-form version of the Nature Relatedness Scale (NR-6; Nisbet & Zelenski, 2013) was also employed, rated from "1 strongly disagree" to "5 strongly agree." Participant characteristics were obtained but not analyzed (except for gender) to maintain the focus of this study on the relationship between visual attention and park experience evaluations.

Eye tracking measures. *Total fixation durations* on each AOI per 40-second video were calculated to measure the distribution of visual attention to each environmental feature. The 90 Hz raw eye-tracking data were smoothed using a 2nd order Butterworth filter with a 5 Hz cutoff frequency. Fixation detection employed a velocity-based method (30 degrees/second threshold). Area of interest (AOI) measures were defined according to environmental features (Chen et al., 2022; Cottet et al., 2018; J. Li et al., 2020), and annotated with the aid of semantic segmentation, a machine learning technique commonly used in street view image-based studies (Helbich et al., 2019; R. Wang et al., 2019) and mobile eye tracker research (Amati et al., 2018). Our machine-learning-aided approach (**Figure 3.4**) integrated: a) manual annotations for static features (e.g., buildings, trees) on one image per video, and b) machine learning-based annotations for dynamic AOIs (pedestrians, bikers) on each video frame (1,200 frames per video; 9,600 total). We used two segmentation models pre-trained on Cityscape (Cordts et al., 2016) and ADE20k datasets (Zhou et al., 2017), which have been widely for semantic segmentation in urban environments. These pre-trained models were accessed on the Hugging Face Hub, a large registry of pre-trained deep learning models and based on the SegFormer b4 model (Xie et al., 2021). The final annotation

results used the manual annotations as the base, overlayed with dynamic annotations from both segmentation models on both datasets. To improve the recognition of gaze on dynamic features, we expanded human object AOIs using the OpenCV library (Bradski, 2000). The defined AOIs include people (including pedestrians, bikers, and bikes), greenery (ground vegetation and trees), sky, water, buildings, pavement, and street furniture (APPENDIX B). All annotations and data preparations related to eye tracking were conducted in Python 3.11.8.

3.2.7 Data Analysis

We used linear mixed-effects models, using the package *lme4* 1.1-35.3 (Bates et al., 2024a) for parameter estimates and *lmerTest* 3.1-3 (Kuznetsova et al., 2020) for degrees of freedom and p-values. This approach is well-suited for repeated measures designs in experimental psychology (Magezi, 2015), as it does not require collapsing observations within an experimental condition, thus avoiding information loss and improving statistical power (Gelman & Hill, 2007). Following existing work on repeated measure study designs (Barr, 2008; Brown, 2021), we initially included participants and video locations as random factors. As recommended by Matuschek et al. (2017) for experiments with a relatively small number of participants and repeated observations, we only included random intercepts in the models. To ensure proper model fit, we addressed singular fit warnings by removing the random factor with a zero variance estimate (Bates et al., 2024b).

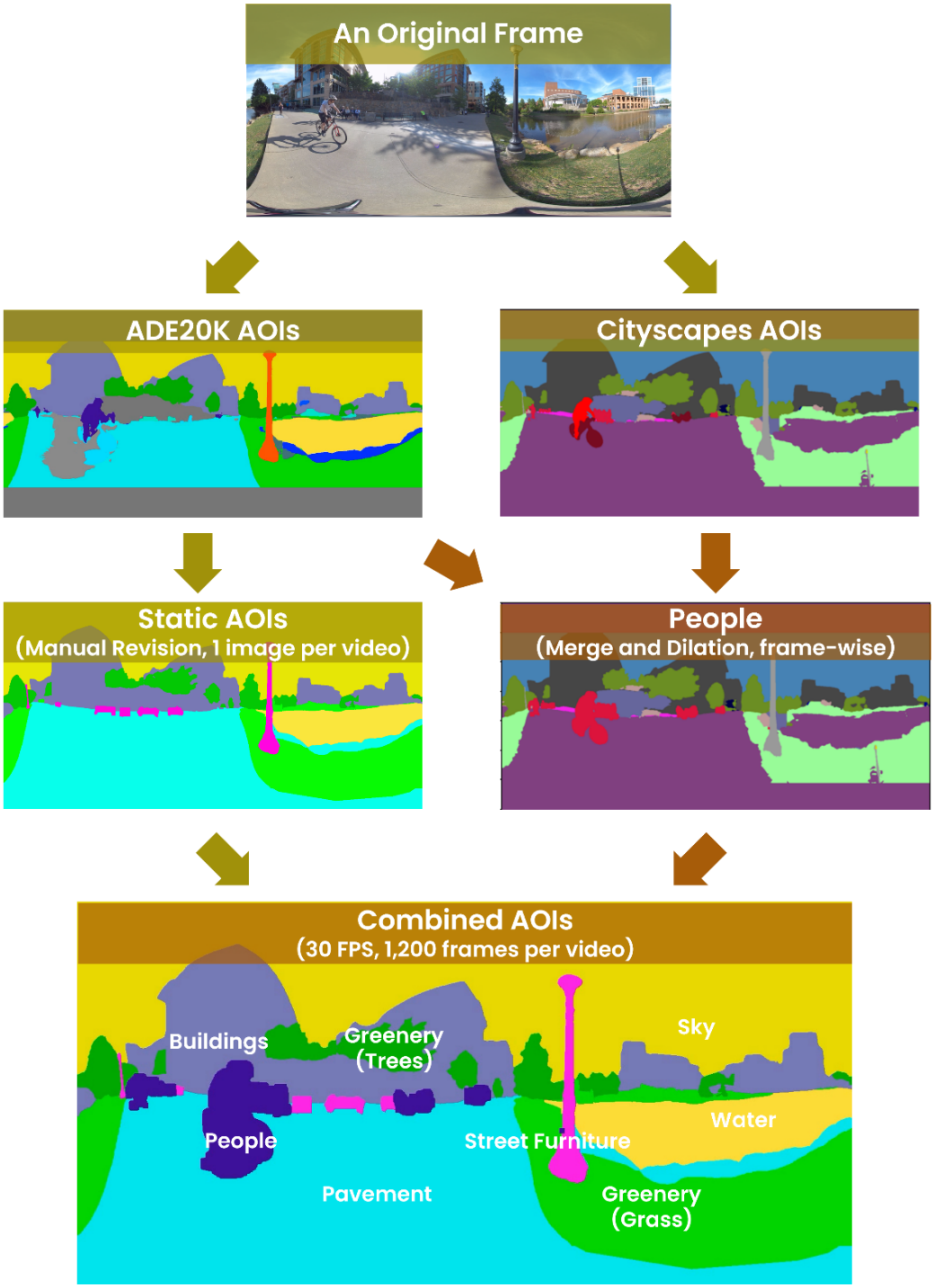

Figure 3.4. AOI classes integrating manual annotation on static AOIs (areas of interest) and machine learning annotation on people. ADE20k and Cityscapes datasets were used for the segmentation of environmental features.

We applied these linear mixed-effects models to outcomes including park experience evaluations (RQ1) and the distribution of visual attention for AOIs (RQ2). We also applied these models in stepwise analyses to assess how the total fixation duration on three AOIs (i.e., people, greenery, and buildings) may explain the effects of visitor density on park experience evaluations (RQ3). For each of the outcomes (willingness to visit, perceived safety, and perceived restorativeness), Model 1 (the baseline model) was adjusted for visitor density; Model 2 added total fixation duration for the AOI "people"; Model 3 alternatively added total fixation durations for greenery and buildings into the baseline; and Model 4 (the full model) included all three AOI outcomes simultaneously. No multicollinearity was found with a threshold of variance inflation factor of 5 (APPENDIX C).

Additionally, we used Spearman's rank correlation tests to examine how the total fixation durations for AOIs correlated with park experience evaluations (RQ3). The statistical significance level was defined as $p < .05$. R 4.3.1 (R Core Team, 2024) was used for all statistical analyses.

3.3 Results

3.3.1 Participants

Our sample showed diverse backgrounds and a relatively high connection with urban parks and nature. The sample had a balanced representation of gender (54% female, 46% male) and student status (43% international students). Their racial/ethnic backgrounds were moderately diverse, with the largest groups being White/Caucasian (43%) and Black/African American (22%). Academic backgrounds spanned the social sciences (38%), engineering (32%), natural sciences (19%), and arts/humanities (5%). Most participants reported "occasionally" (41%) or "frequently" (43%) visiting urban parks in the past 6 months. Motivations for park visits were generally

moderate to high across considerations such as relaxation/escape (4.03), nature interaction (3.70), and socializing with friends/family (3.70). The overall nature relatedness score among our sample was also moderate to high (3.73).

Table 3.1. Characteristics of Participants

Participant Characteristics (N = 37)	Mean (SD); n (%)
Age	24.22 (6.63)
Gender	
Female	20 (54%)
Male	17 (46%)
Race and Ethnicity	
White/Caucasian	16 (43%)
Black/African American	8 (22%)
East Asian	6 (16%)
South Asian	4 (11%)
Hispanic/Latina/o/x	1 (3%)
Other	2 (5%)
International Students	16 (43%)
Academic Background	
Social Sciences	14 (38%)
Engineering	12 (32%)
Natural Sciences	7 (19%)
Arts and Humanities	2 (5%)
Unknown	2 (5%)
Frequency of Visit in Past 6 Months	
Rarely/Never	4 (11%)
Occasionally/Once a month	15 (41%)
A few times a month	16 (43%)
Several times a week	2 (5.4%)
Visit Motivations (Low 1 - High 5)	
Friends and family	3.70 (0.85)
Relax and escape	4.03 (0.93)
Physical activity	3.57 (1.32)
Nature interaction	3.70 (1.18)
Transport	3.08 (1.16)
Accessible	3.08 (1.16)
Nature Relatedness Mean (Low 1 - High 5)	3.73 (0.85)

3.3.2 RQ1 - How Does Visitor Density Affect Park Experience Evaluations?

We found that higher visitor density negatively affects willingness to visit (b= -0.23, 95% CI: -0.43–-0.03, p < 0.05) and perceived restorativeness (b= -0.34, 95% CI: -0.51–-0.17, p < 0.001), after adjusting for each participant and video location (**Table 3.2**; full models see APPENDIX D). There were no significant effects of visitor density on perceived safety (b = 0.02, 95% CI: -0.16–0.20). However, this relationship was moderated by gender (**Figure 3.6**). Only women felt safer in the higher visitor density scenes than in lower visitor density scenes (b = 0.50, 95% CI: 0.15 - 0.85, p < 0.01). We observed no significant interaction of gender on how visitor density affects willingness to visit or perceived restorativeness (APPENDIX E).

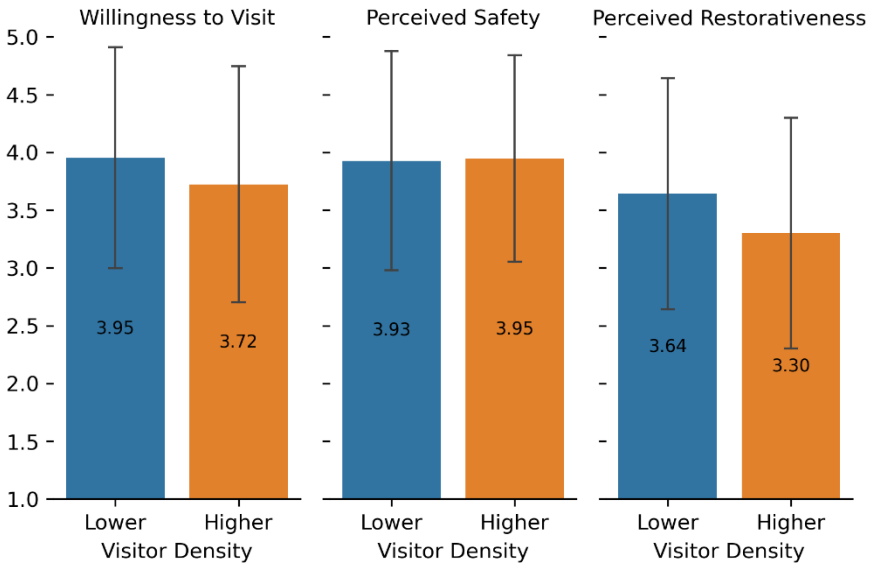

Figure 3.5. Park Experience Evaluations by Visitor Density. Error bars represent ±1 SD.

Table 3.2. Park Experience Evaluations by Visitor Density (Lower vs. Higher)

	Willingness to Visit			**Perceived Safety**			**Perceived Restorativeness**		
Fixed Effects	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*
(Intercept)	3.95	0.12	**<0.001**	3.93	0.1	**<0.001**	3.64	0.15	**<0.001**

Visitor density [Higher]	-0.23	0.1	**0.022**	0.02	0.09	0.823	-0.34	0.09	**<0.001**
Variances of Random Effects									
Participants	0.25			0.25			0.43		
Locations	0.01			0			0.03		
Marginal R^2 / Conditional R^2	0.013 / 0.269			0.000 / 0.291			0.028 / 0.465		

Notes: Analysis based on linear mixed effects models with participants and locations as random effects. Number of observations: 296; 37 participants; 4 locations.

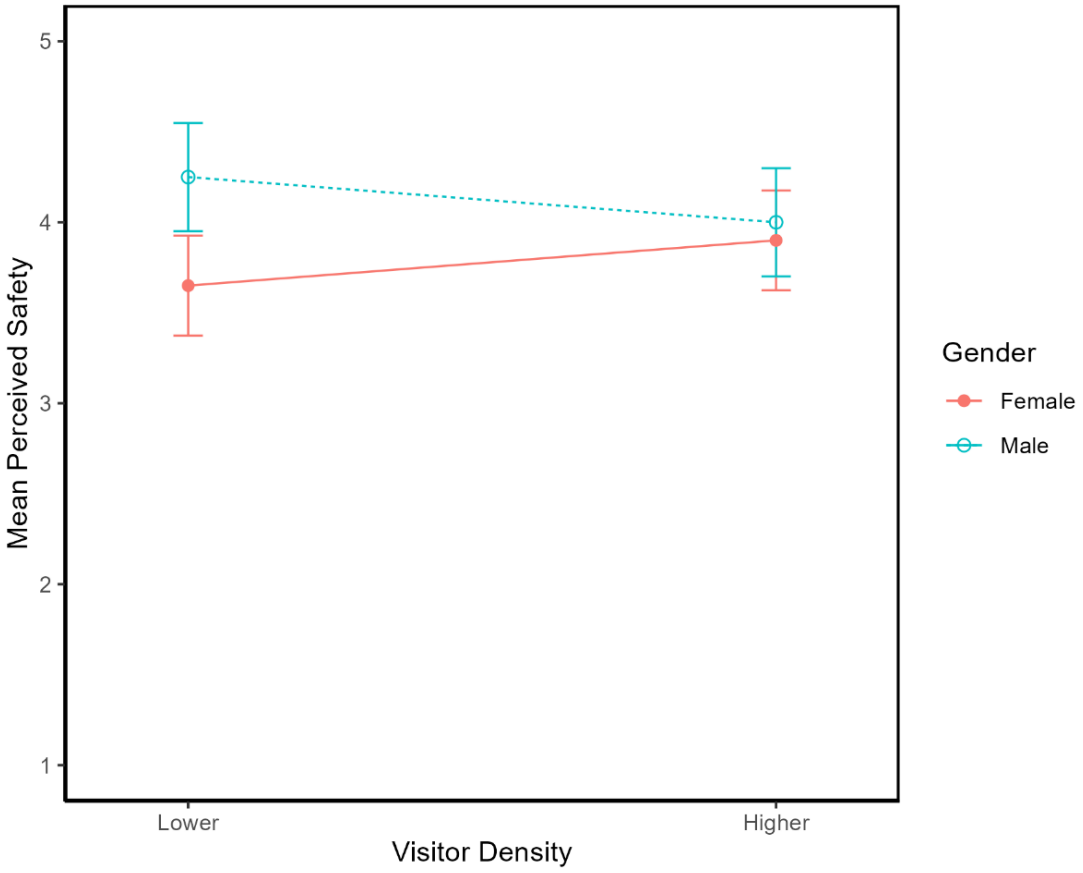

Figure 3.6. Interaction of Gender on Visitor Density and Perceived Safety. Error Bars Represent 95% CI.

3.3.3 RQ2 - How Does Visitor Density Affect Visual Attention Focus?

We found that increased visitor density draws visual attention to people and reduces attention to other park features (**Table 3.3**; also see **Figure 3.7**). Higher levels of visitor density led to increased total fixation durations on the people (b = 2.96, 95% CI: 2.58–3.35, p < 0.001), and decreased fixation durations on the sky (b = -0.67, 95% CI: -1.02–-0.33, p < 0.001), buildings (b = -0.75, 95% CI: -1.15–-0.35, p < 0.001), and street furniture (b = -0.26, 95% CI: -0.35–-0.16, p < 0.001). No significant differences between visitor density levels were observed for greenery, water, and pavement AOIs. Fixation durations for each video location were included in APPENDIX E.

Table 3.3. Total Fixation Durations on Seven Park Features (AOIs) by Visitor Density

	People	**Greenery**	**Sky**	**Water**	**Buildings**	**Pavement**	**Street Furniture**
Estimates of Fixed Effects							
(Intercept)	0.5	**14.31** ***	**1.73** ***	0.52	**1.73** ***	0.52	**0.53** ***
Visitor density [Higher]	**2.96** ***	0.53	**-0.67** ***	0.04	**-0.67** ***	0.04	**-0.26** ***
Variances of Random Effects							
Participants	-	8.93	0.18	-	0.45	0.76	0.01
Locations	2.02	32.92	0.79	0.47	10.61	1.52	0.05
Marginal R^2 / Conditional R^2	0.327 / 0.626	0.001 / 0.821	0.037 / 0.348	0.000 / 0.410	0.037 / 0.348	0.000 / 0.410	0.072 / 0.311

Notes: Analysis based on linear mixed effects models with participants and locations as random effects. Number of observations: 262; 33 participants; 4 locations. "Participants" were removed from water and pavement models due to zero variance estimates. Marginal R^2 / Conditional R^2 denotes variance exp.lained by only the fixed effects/all predictors. Significance levels are denoted as *p < .05, **p < .01, and ***p < .001.

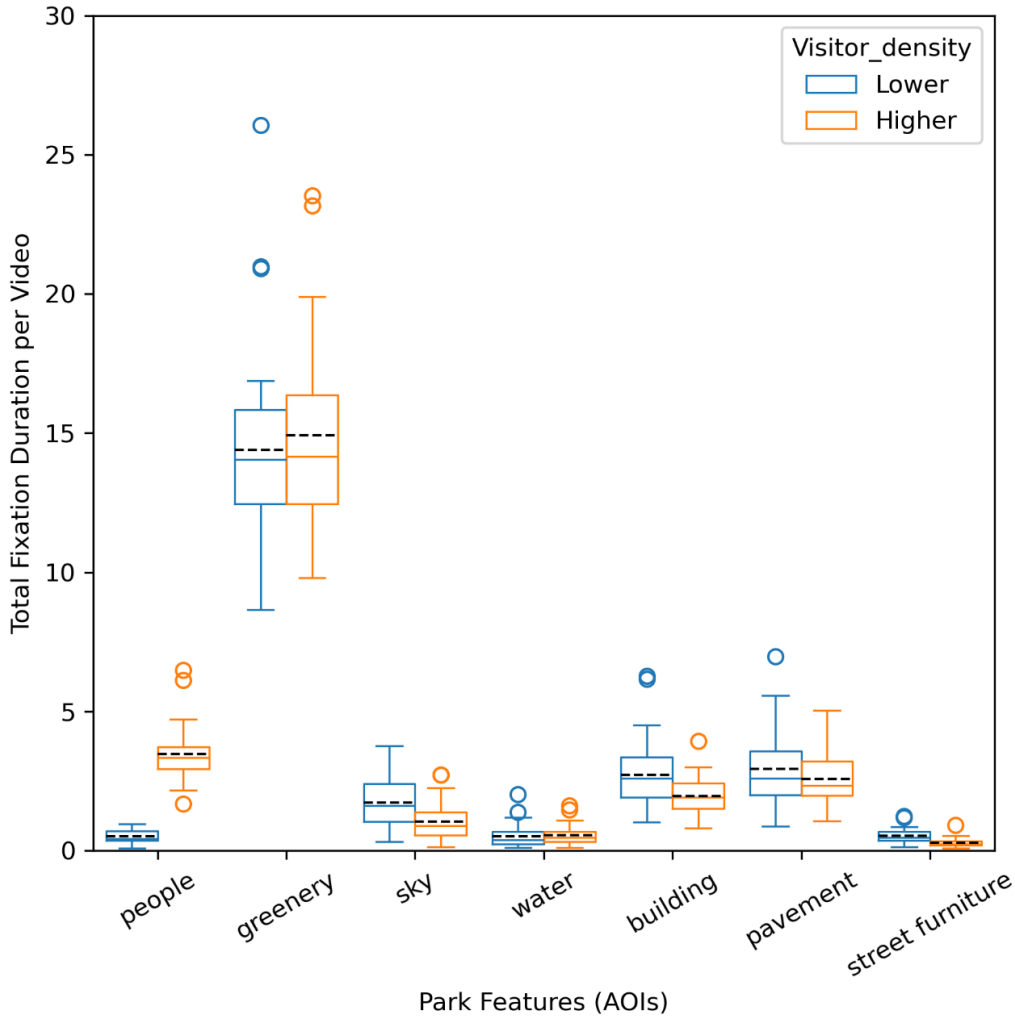

Figure 3.7. Total Fixation Durations on 7 Park Features (AOIs) by Visitor Density. Black Dashed Lines Denote the Mean Values.

3.3.4 RQ3 - How Does Visual Attention Relate to Experience?

Correlations also suggested that increased visual attention on other people may detract from willingness to visit and perceived restorativeness (**Table 3.4**). Total fixation durations on people were negatively correlated with willingness to visit ($r = -0.19$, $p < .01$) and perceived restorativeness ($r = -0.20$, $p < .01$). For other environmental features, total fixation durations on the sky ($r = 0.18$, $p < .01$), water ($r = 0.15$, $p < .05$) and buildings ($r = 0.15$, $p < .05$) were positively

correlated with willingness to visit, though these correlations were weaker than the correlations for the attention on people and willingness to visit. In addition, total fixation duration on pavement was negatively correlated with perceived restorativeness ($r = 0.13$, $p < .05$).

Table 3.4. Effects of Visitor Density and Total Fixation Durations on People and Other Environmental Features (AOIs) on Willingness to Visit

	People	**Greenery**	**Sky**	**Water**	**Building**	**Pavement**	**Street Furniture**
Willing to Visit	**-0.19****	-0.12	**0.18****	**0.15***	**0.15***	-0.01	-0.01
Perceived Safety	-0.08	-0.04	0.04	0.05	0.07	-0.11	-0.04
Perceived Restorativeness	**-0.20****	0.08	0.07	-0.05	-0.01	**-0.13***	-0.01

Note: Correlations were based on Spearman's rank. Significance levels are denoted as *p < .05, **p < .01, and ***p < .001.

From stepwise linear mixed effect models, we found that the distribution of visual attention to other people, but not to buildings and greenery, played an important role in explaining the effects of visitor density on willingness to visit (**Table 3.5**). Model 1 (baseline) demonstrated that a higher visitor density significantly reduced willingness to visit ($b = -0.24$, $p < .05$). When controlling for total fixation duration on people, model 2 increased the variance explained by the fixed effects (marginal R^2) from 0.015 to 0.029. Total fixation duration on people could significantly predict willingness to visit ($b = -0.06$, $p < .05$). The effect of visitor density was attenuated and became non-significant. Models 3 and 4 added total fixation durations on greenery and buildings. However, these two newly added AOI measures showed no significant effects on willingness to visit. The addition of these two AOI measures did not change the direction or statistical significance of the effects of visitor density or total fixation duration on people in Model 1 and Model 2.

Meanwhile, the four models showed smaller marginal R^2 values than conditional R^2 values (0.015-0.041 vs. 0.216-0.239), suggesting that the random effects of participants and video locations accounted for a significant portion of the variance in willingness to visit.

In contrast, stepwise analysis for perceived safety and perceived restorativeness as outcome variables showed no significant relationships between these outcomes and total fixation duration measures for people, greenery, or buildings (APPENDIX G). The addition of all three AOI measures into the baseline models resulted in marginal increases in marginal R^2 (0.008 for perceived safety, 0.005 for perceived restorativeness).

Table 3.5. Stepwise Analyses on Willingness to Visit, Predicted by Visitor Density and Total Fixation Durations on Environmental Features (AOIs)

DV: Willingness to Visit	Model 1: Baseline			Model 2: Baseline + Total Fixation Duration on People			Model 3: Baseline + Total Fixation Durations on Greenery and Buildings			Model 4: Full		
	b	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*
Visitor density [Higher]	**-0.24** *	0.11	-0.46 – -0.03	-0.08	0.14	-0.34 – 0.19	**-0.23** *	0.11	-0.45 – -0.02	-0.05	0.14	-0.31 – 0.22
Total Fixation Duration on People				**-0.06** *	0.03	-0.11 – -0.00				**-0.07** *	0.03	-0.12 – -0.01
Total Fixation Duration on Buildings							0.01	0.02	-0.04 – 0.05	-0.01	0.02	-0.06 – 0.04
Total Fixation Duration on Greenery							-0.01	0.01	-0.04 – 0.02	-0.02	0.01	-0.05 – 0.01
Marginal R^2 / Conditional R^2	0.015 / 0.216			0.029 / 0.225			0.022 / 0.221			0.041 / 0.239		

Notes: Analysis based on linear mixed effects models with participants as random effects. Number of observations: 262; 33 participants; 4 locations. * *p<0.05* ** *p<0.01* *** *p<0.001.*

3.4 Discussions

3.4.1 Overview of Main Findings

This study aimed to advance the understanding effects of the presence of people in urban park experiences by employing an innovative methodology integrating 360° videos with sounds in a virtual reality headset with add-on eye tracking. We found that higher visitor densities negatively affected the willingness to visit and the perceived restorativeness of urban parks. Gender-specific effects were observed, with women feeling safer in parks with higher visitor densities. Eye-tracking data revealed that higher visitor densities increased the visual focus on people, reducing attention to other features like the sky, buildings, and street furniture. This fixation on people appeared to explain how visitor densities influenced willingness to visit, but not perceived safety or perceived restorativeness.

3.4.2 Park Experience Evaluations

We found that in the context of well-maintained urban parks in the Southeastern U.S., the presence of other people generally decreases willingness to visit a park, albeit the difference was substantively small. This implies that our participants slightly prefer a very low density of people over the typical weekend density levels. Given the earlier evidence for an inverted U-shaped relationship, where a few people are preferred over no people, and many people are least preferred (Kim & Shelby, 2011a, 2011b; Nordh et al., 2011), our study could not conclusively interpolate the impact of untested visitor density levels on the willingness to visit. The perceived restorativeness was also significantly lower in the higher density condition. This finding aligns with the prediction of the attention restoration theory, suggesting that compared with a very low visitor density level, the typical weekend levels reduced the opportunities to recover from

emotional and cognitive stress. However, this finding contradicts three studies that found no differences in perceived restorativeness at different visitor densities (Neale et al., 2021; X. Wang et al., 2016).

Gender differences were found in perceived safety at lower visitor densities reduced and were reduced at higher densities aligning with existing research (Jiang et al., 2017; L. J. Jorgensen et al., 2013). However, only women's perceived safety increased with more people present, and men's perceived safety was not affected by visitor density and was very high even at lower visitor densities (4.25 out of 1-5). These results may be attributed to the well-maintained and well-designed green spaces in the current study, which can convey a high level of informal social control and perceived safety (Foster et al., 2010; Jiang et al., 2018). While these physical environmental cues seemed to be adequate for men's sense of safety, women might require additional cues from the presence of others.

3.4.3 Visual Attention

We discovered that at high visitor densities, participants looked less at the sky, buildings, and street furniture for a small amount of time (less than 1 second) and looked more at other people. The fixation duration on greenery was found to be unaffected by visitor density. These results suggest that the presence of more people captured participants' attention but did not strongly interfere with their visual engagement with greenery. Compared to existing research, our result of about 9% (3.46s out of 40s) time looking at others is in line with two urban street studies using mobile eye trackers (Davoudian & Raynham, 2012; Simpson, Freeth, et al., 2019), but is less than photo-based studies where attention to people ranged from 20% to 50% of fixation durations (J. Li et al., 2020, Scene 20; P. Li et al., 2022, 6 people-per-view scenes; Yue et al., 2022, sidewalk scenes). These mixed findings likely reflect methodological influences. The VR approach in the

current study allowed individuals to focus on or avoid observing people per one's preference, whereas the traditional approach that attaches eye trackers on desktop monitors may concentrate gazes around the center of each image during free viewing (Nakashima et al., 2015; Tatler et al., 2005). With the sounds, 360° view, and human motions provided in this study, it could be easier for participants evaluate other people's intentions or movements, reducing the need to directly fixate on people for extended periods.

3.4.4 Visual Attention and Park Experience

We found weak negative correlations between total fixation duration on people and willingness to use or perceived restorativeness, and weak positive correlations between total fixation duration on water, sky and building and willingness to visit. Although fixation duration on greenery has been found positively related to perceived restorativeness and aesthetic preference (J. Li et al., 2020; Nordh et al., 2011), we did not find this measure relevant to any experience evaluations. All the correlations were weak, suggesting translation of the findings to practice need to be careful.

Revisiting this study's aim, we also assessed whether eye-tracking can provide relevant insights into park visitors' experiences concerning visitor density. The stepwise regression analysis revealed that only total fixation duration on people could explain the effect of visitor density on willingness to visit, but the time individuals looked at greenery or buildings could not explain such an effect of visitor density. This finding should be explained by the result that participants in this study did not spend significantly different time looking at greenery or buildings between the visitor density conditions. In extremely high density settings (e.g., 30 and 36 people-per-view scenes in P. Li et al., 2022), the fixation duration on greenery may hold more importance in visitor experience evaluation.

Interestingly, the significant impact of visitor density on perceived restorativeness was not able to be explained by the duration of observing people, buildings, or greenery. Existing research on the relationship between overall preference and restorativeness shows these two outcomes are often correlated (Nordh et al., 2009; Staats et al., 2003; van den Berg et al., 2003). Why did these two outcomes have different relationships to eye-tracking measures? We note that a well-known limitation of eye-tracking is that it only measures overt visual attention that is accompanied by eye movement and involves information gained through foveal vision (Duchowski, 2017). Perhaps the assessment of restorative potential is more sensitive to information that is not reflected in eye-tracking. Such information could include the video sounds (e.g., leave sounds, children's noise, and traffic noises) as well as the setting atmosphere or meaning shown in the peripheral vision. For example, whether a video location is more "natural" or "urban" (**Figure 3.1**) or whether other people are enjoying themselves or relaxing can be perceived without directly gazing at specific elements. Alternatively, the experiment instruction of evaluating preference during eye-tracking may have induced top-down attention to features that are relevant to willingness to visit. This phenomenon called task relevance has been shown in many scene viewing studies (de la Fuente Suárez, 2020; DeAngelus & Pelz, 2009; Yarbus, 1967). Future research may test different viewing tasks or manipulate ambient information to further verify the effect.

3.4.5 Strengths and Limitations

Our study holds several strengths. First, our innovative stimuli involving dynamic imagery in VR with varied visitor density levels could provide surrounding information, freedom to look around, and human motion and emotional cues, potentially leading to more naturalistic viewing patterns and psychological responses. Second, we employed linear mixed-effect models which controlled participant and location effects while estimating the relative importance of visitor

density, visual attention measures, and the effects of individual or video location differences. Third, we employed a stepwise analysis to explore the potential role of visual attention in how the presence of people may affect urban park experiences, confirming the potential applicability of eye tracking measures.

Despite its strengths, our study has several weaknesses. Given the small, relatively homogenous student sample, our exploratory findings have limited transferability to other demographics (e.g., families, older adults, and non-students) and precluded examination of individual differences in traits and motivational states known to influence perception of others (e.g., stress levels). Also, this study included four park locations which could not address how different recreational opportunities may be influenced by the presence of people. Future studies should incorporate diverse park locations, participant samples and explore the effects of individual differences (Korpela et al., 2008; Twedt et al., 2019).

The visitor density range did not cover multiple or very high-density levels due to the technical difficulty of obtaining these conditions for all the video locations. Future study may use boarder density ranges, multiple conditions, and bipolar scales to explore the potential non-linear relationships between visitor density and experience evaluations, including possible optimum densities that improving visitor experiences and minimal acceptable densities (Alazaizeh et al., 2016; Arnberger et al., 2010).

Additionally, the 360° videos and eye tracking approach did not deliver subtle nonverbal communication regarding strangers' intentions (e.g., brief eye contact, body language). This absence of information could influence both participants' gaze behavior and perception of others regarding safety, obtrusiveness, privacy, or potential interaction opportunities (Davoudian & Raynham, 2012; Goffman, 1971; Whyte, 1980). There was also a person looking at the camera for

a 10-second period in one video (Video D, higher visitor density), which could be obtrusive. Furthermore, unlike real-world encounters, prolonged staring at others in the videos was not perceived as inappropriate, which potentially increased fixation durations on people. Future studies may use mobile eye-tracking (Amati et al., 2018; Hollander et al., 2019) and think-aloud protocols (Elling et al., 2011; Ericsson & Simon, 1980; Guan et al., 2006) to investigate the dynamics in visual attention and underlying motivations in real-world scenarios. Given the cost-effectiveness and control offered by simulations (photos, 360 videos, three-dimensional models), future research should also compare various perceived features (e.g., interpersonal distance, perceived intention of others, perceived interaction quality) between simulations and field experiments.

3.4.6 Implications for Future Research and Practice

There is a need to balance between enhancing perceived safety through higher visitor densities and preserving an overall experience that both is preferred and restorative. Perspectives on the nonlinearity between overall experience quality and individual factors suggest that safety may be considered a "basic factor" where meeting minimum requirements is essential, but "high performance" on this factor is less crucial (Matzler & Sauerwein, 2002; Raymore, 2002; J. Yuan et al., 2018). Future research may explore optimal visitor densities that ensure basic safety needs without compromising the restorative potential of green spaces.

Future studies may also leverage eye-tracking in post occupancy evaluations to assess whether design facilities visual engagement patterns fit with the intended experiences. For example, researchers may use eye-tracking to examine whether a designated seating area in a square attracts attention and facilitates social gatherings as predicted. It is also possible to test whether visitor use and facilities affect the intended engagement with natural attractions like stone arches in the Arches National Park.

For park design and management, visual attention's role in shaping the effects of visitor density on experience quality underscores the potential of using design strategies that direct attention or facilitate or block enhance visual connections. For example, designing curved trails to align sightlines to activity areas may deliver a lively, social atmosphere; while strategically placing big trees, public art installations or interactive displays as focal points may distract attention from other people. The effectiveness of specific design solutions in manipulating attention distribution within greenspaces merits further exploration.

3.5 Conclusion

This study leverages 360° video, virtual reality, and eye-tracking to demonstrate how the distribution of visual attention can illuminate interactions within urban parks and clarify the impact of visitor density on park experiences. The results indicate that higher visitor densities tend to decrease willingness to visit and perceived restorativeness, while enhancing perceived safety among women. Notably, the presence of more people draws attention but does not detract from the attention to greenery, revealing a nuanced pattern of visual engagement. This study also highlights the need to evaluate methodological biases inherent in using stimuli and eye-tracking technologies for studies related to greenspaces, mental health, and crowding. Urban planners and park managers are encouraged to manage visitors' use to balance safety with overall experience. They may also manage visual connections either to mitigate crowding effects or to promote social life.

CHAPTER 4. THE ROLE OF THE PRESENCE OF PEOPLE IN URBAN PARKS EXPERIENCES: A FUNCTIONAL APPROACH

Abstract: Urban parks serve as public spaces for social interaction and as natural havens for restoration and connection with nature. Balancing diverse functions requires an understanding of the specific impact of the presence of other people on specific functions and experiences. This qualitative study explores how the presence of others affects perceived park functions and experiences with 26 semi-structured interviews with university students from diverse cultural backgrounds. Thematic analysis revealed four broad categories of park functions affected by others: being alone, appreciating nature, being with others, and appreciating urban/cultural life. Specific functions or experiences such as escaping social distress, biophilic connections, parallel shared experiences, and cultural events were variably impacted. Factors like spatial layout, the self-focused behavior of others (civil inattention), personal characteristics, stress levels, and privacy preferences also played a role. These findings highlight diverse user needs and suggest management strategies to accommodate the multidimensional impacts of user co-presence on urban park experiences.

Keywords: Urban parks; public spaces; social interaction; health and wellbeing; restorative environment; urban experiences; privacy regulation; crowding

4.1 Introduction

Urban green spaces are vital to city life, providing health, well-being and social and environmental benefits (Hunter et al., 2019; Markevych et al., 2017). Urban parks, as key components of these green spaces, offer such advantages by allowing contact with nature, aesthetic experiences, relaxation opportunities, avenues for physical activity, and settings for social interaction. This multifunctionality highlights urban parks' potential but also presents design and management challenges in balancing these varied functions and the tensions between them (Feng & Tan, 2017; Lovell & Taylor, 2013).

A critical aspect in finding this balance concerns the presence of park users. Benefits-based management (Driver, Brown, et al., 1987; Driver, Nash, et al., 1987; Driver & Brown, 1978) highlights the importance of naturalness and social contexts in satisfying different users motivations and shaping park benefits. Urban parks, which encompass a variety of settings from urban squares and neighborhood parks to larger natural areas, can vary in naturalness and user characteristics and density, and be selectively considered as places for social benefits or personal well-being benefits. As urban public spaces, urban parks can enable social interaction, community gathering, and social cohesion (Gehl, 1987; Jacobs, 1961; Oldenburg, 1989), with successful parks often characterized by their ability to draw diverse users engaged in varied activities (Evans et al., 2019; Mehta, 2014; Whyte, 1980). By contrast, as natural environments in the "concrete jungle," parks can offer a refuge from social concerns, restoration from stress, and contact with nature (Kaplan, 1995; Korpela & Staats, 2013; Svendsen et al., 2016), and these functions could be diminished by high user densities and crowding. This qualitative study aimed to provide a more comprehensive view of young adults' perceptions of urban park functions and the roles of the presence of other park users that shape (or do not shape) these opportunities and benefits.

4.1.1 Functions of Urban Parks

Urban parks serve as vital natural and public spaces within cities. Research comparing the health benefits of natural vs. built environments (Hartig et al., 2003; Kaplan, 1995; N. Lee, 2022; Meidenbauer et al., 2020; Rosenbaum, 2009; van den Berg et al., 2007) and the influences of social contexts (Altman, 1975; Cattell et al., 2008; Hammitt & Brown Jr., 1984; Korpela & Staats, 2013; Mouratidis, 2018; Staats et al., 2010; Staats & Hartig, 2004) could help us understand urban park functions. In Western contexts, natural environments are highly valued for relaxation and enjoyment, often reported as favorite places by people; in contrast, disliked places are usually associated with unpleasant people and social atmospheres (Korpela et al., 2001, 2010; Korpela & Hartig, 1996). Also, in cities, people associated peaceful and quiet atmospheres with green spaces, but other atmospheres such as vibrant, consumerism, historic, and local, to other urban settings (Stefansdottir, 2018). These findings suggest a strong connection between urban parks and nature and restorative experiences, distinguishing them from other urban environments.

Research has also shown that urban green spaces are valued for meeting diverse needs. A review by Matsuoka and Kaplan (2008) on urban green spaces pointed out that these spaces could fulfill multiple people's needs simultaneously and identified six main "need" categories: contact with nature, aesthetic preference, recreation, social interaction-privacy, citizen participation, and a sense of community. Grahn and colleagues (Grahn & Stigsdotter, 2010; Memari et al., 2017; Stoltz & Grahn, 2021) conducted a collection of research on the perceived qualities of urban green spaces and highlighted contrasting qualities including natural-cultural (the extent of human intervention) and serene-social (disturbances and human presence). Preferences for urban park functions are also varied and context-dependent. Another study by Sampaio Costa et al. (2024) on Portugal Park found users preferred multifunctionality that caters to varied needs, depending on

the time of use and interpersonal factors, such as the company of friends and families. Bertram et al. (2017) found that German residents preferred small, nearby parks for nature contact during weekdays and larger parks with social and recreational facilities during weekends. Another study in Shanghai, China found residents rate recreational functions as the most important and privacy and noise as important (Yu et al., 2018). Despite extensive research on the diverse functions of parks, the specific impact of the presence of others on these functions remains unclear.

4.1.2 Influence of the Presence of People

Some research on urban park functions and experiences has highlighted the multifaceted role of the presence of people in shaping social interactions and overall experiences. Cattell et al. (2008) offered a detailed view of social relations in public spaces in an ethnically diverse area in London, UK. This study found parks were, in general, a less socially intensive environment compared to other urban public spaces, but routine encounters with neighbors or familiar strangers helped residents build loose ties with others and improved their attachment to the place and well-being. However, the study also found that this less intensive social environment in parks could make ethical minority groups feel more scrutinized by others and less comfortable than in higher density places, such as food markets. Another study in Dutch urban parks (Peters et al., 2010) reveals a preference for interacting with familiar people in smaller groups. Notably, Dutch users expressed less interest in interacting with strangers than non-Western immigrants. Interactions with strangers were often catalyzed by shared external stimuli like returning balls, children playing, and dogs, a phenomenon similar to Whyte's (1980) concept of “triangulation.” Interestingly, this study found that one small park with higher user density than others demonstrated a sense of comfort and intimacy where individuals focus on themselves and their groups, avoiding disruptively initiating contact with others. This special case was connected to “civil inattention”

(Goffman, 1971), a social norm that could enable strangers to maintain a social order in public spaces.

Despite the scarcity of studies in urban parks, research in related settings may suggest that the presence of people could also have specific positive and negative impacts on different aspects of experiences. In busy, vibrant public spaces, such as urban markets and streets, the existence of human activities could offer a feeling of energy and enjoyment and become a source of fascination and being away from domestic stress (Cattell et al., 2008). This contrasts with service settings, where interactions between strangers are more common and surround purchase-related information and values (McGrath & Otnes, 1995). The presence of others might offer help, compete for services, and express admiration for others or services. Even without direct interaction, observing others could inform purchase decisions and involve the observer in the evaluation of others' purchases based on their values. Conversely, observing others violate norms or values could negatively impact one's experiences. One study on positive and negative crowding for urban tourists found that moderate visitor densities in urban tourist areas foster positive experiences by creating a sense of belonging, safety, and a lively atmosphere (Popp, 2012). This positive crowding effect was enhanced by street performers, architecture, and the presence of other audiences. However, Popp observed and proposed a fine line between positive and negative crowding; a small increase in density could shift the experience into negative, creating a hectic atmosphere that leads to exhaustion and discomfort, or making the street feel "lifeless" and devoid of perceived authenticity and the local everyday life. However, the extent to which these tentative conclusions about the presence of people in other settings translate to urban parks is largely unknown.

4.1.3 Current Study Overview

This study addressed the research question: How does the presence of other people affect the functions of urban parks as perceived and experienced by users? We define "functions" as the opportunities and experiential aspects afforded by the setting to satisfy users' needs and motivations. We employed a qualitative approach to answer this question by interviewing participants who were young adults living in Clemson, SC, and from diverse cultural backgrounds.

4.2 Methods

4.2.1 Participants

Twenty-six university students, both undergraduate and graduate, from cultural and academic backgrounds participated in this study. These participants were part of a larger project on how the presence of people impacts urban park experiences using controlled simulations with different visitor densities and interviews exploring perceptions of others in past experiences. We oversampled international students to bring varied perspectives on park features, activities, and perceptions of people. Given our focus on users rather than professionals, we excluded students with academic backgrounds related to environmental design and parks, recreation, and tourism management.

Recruitment was conducted via flyers, posters, large general education courses, and verbal invitations. The sample had an average age of 25.4 (SD=7.2) and was balanced in terms of gender (54% female). There were more international (58%) than domestic participants (42%) students. Origin region of international students included Africa (19.2%), Esat Asia (15.4%), West Asia (7.7%), South Asia (7.7%), Europe (3.9%), and North America (3.9%). Most participants reported visiting parks one to a few times a month in the past six months (84%) and a moderate to high

subjective connection with nature, as indicated by a mean nature relatedness score of 3.73. All participants provided informed consent prior to starting the study. This study was approved by the Clemson Institutional Review Board (IRB2023-0211).

4.2.2 Data Collection

The first author conducted semi-structured interviews in person with 26 participants at a university campus from November 2023 to February 2024. Each interview lasted 15 to 30 minutes and was audio recorded. Interviews began by establishing a shared understanding of "urban parks," inviting participants to describe their past experiences in urban parks. The conversation then shifted to focused questions about specific situations where the presence of others in urban parks was perceived positively or negatively, and the factors that influenced these perceptions (**Table 4.1**).

Table 4.1. Interview Topics and Prompts

Topics	Prompts
Past park visits	• What are the urban parks that you have been to most frequently? What was the park like? • What made you go there? Did going there fit with your routine? What did you usually do there? What was your experience like? What were the people like? • (Optional) Could you share why you didn't visit urban parks very often? Were there other places where you preferred to spend your free time? Why? • (Optional) What was your best/worst experience in any urban parks like?
Perception of unknown others	• Have you ever enjoyed being in an urban park when other people were around? What was that experience like? Any other situations? • Have you ever felt uncomfortable or bothered by the presence of other people in an urban park? What was that experience like? Any other situations?

	• (Optional) When you go to an urban park, do you generally like having others around, or not having them around, or does it not really matter? Why?
Relevant factors	• Is there anything about yourself that could help me understand your preferences and perceptions that we just talked about? • Is there any aspect of the park that could make sharing the space with others feel more enjoyable/less negative? Any design or management actions that you could think of?

4.2.3 Data Analysis

The first author conducted a thematic analysis of the interview transcripts using a hybrid deductive-inductive approach. Transcripts were initially created with the assistance of Otter AI and were coded verbatim. Coding was done manually in MAXQDA 2024, with the assistance of generative AI, for describing and summarizing transcripts to facilitate an initial understanding (Morgan, 2023; Wachinger et al., 2024), exploring potential coding approaches, and exploring alternative theme structures for triangulation (Hamilton et al., 2023; S. Yuan et al., 2024). MAXQDA's AI assistant and other tools such as ChatGPT were used.

The first cycle of coding involved applying deductive codes to and incorporating emerging codes from 10 transcripts, resulting in an initial coding scheme. Initial deductive codes were derived from existing literature on urban public life (Jacobs, 1961; Whyte, 1980), green space and mental health (Hartig, 2021; Kaplan, 1995; Kaplan & Berman, 2010; Markevych et al., 2017), and privacy regulation and social context (Altman, 1975; Hammitt, 1982; Hammitt & Brown Jr., 1984; Korpela & Staats, 2013; Westin, 1970). Initial deductive codes included, for example, privacy-socialization preference, solitude, close groups, community, natural appreciation, stress coping, lively city vibes, and sense of belonging/place identity. The first author went through an iterative process involving creating document summaries, incorporating new codes, and revising the

tentative topics to code (e.g., whether to code "reasons for liking/disliking others" separately from park functions). The coding was selective on paragraphs relevant to the relationship between park functions and the presence of others, or potential factors influencing those relationships. For example, we excluded discussions on whether a place was an urban park and detailed descriptions of a park's physical environments. The resulting coding scheme focused on park functions/constraints (both related or not related to other people), impact attributions to people (positive, negative, and no impact), and contextual factors. This coding scheme was applied to the 10 transcripts.

In the second cycle of coding, the initial coding scheme was iteratively applied to the remaining transcripts, incorporating emerging codes and revising the themes and subthemes grouped from the codes after every three to five transcripts. The first 10 coded transcripts were also adjusted with the updated coding schemes. The initial deductive codes were intensively revised or discarded, but higher-level considerations, i.e., nature and urban, various privacy levels, and internal vs. external focus, were maintained. During this cycle, the author actively reflected on personal assumptions and expectations of the role of the presence of people in public spaces. Finally, the author re-examined impact attributions on coded park function segments to verify their alignment with participant descriptions. Memos were written to document exceptions and variations for the roles of other people within each park function theme.

4.3 Results

4.3.1 Key Themes

We identified four broad types of functions related to users' motivations to visit urban parks: being alone, being with others, appreciating nature, and appreciating urban and cultural life.

There were overlaps between being alone and appreciating nature, as well as between being with others and appreciating urban and cultural life. However, these overlaps were only a portion of the broader functions, so merging these functions would risk losing rich information about the unique aspects of each board function. We also identified factors relevant to preference on functions or the impact of others across functions, including safety, spatial arrangement, self-focused others, personal characteristics, and situational factors. Specific subthemes under each theme are shown in Table 4.2. As we did not focus on the personal and situational factors, such as stress states, familiarity with the environment, and personal characteristics influencing how broad or narrow one's preferences are, we illustrate some of these factors in section 4.3.6.

Table 4.2. Themes and Subthemes Related to the Presence of Other People

Theme	Subtheme
Being alone	Being away from tasks and social distress, fostering creative and focused thinking
Appreciating nature	Being alone in nature, appreciating nature for pleasure and relaxation, biophilic connection
Being with others	Interaction with familiar people, interaction with unfamiliar others, parallel shared experience
Appreciating urban-cultural life	Appreciating architectural features, livable experience, engaging with cultural life
Relevant Factors	Safety, spatial arrangement, Self-focused other, personal characteristics, situational factors

4.3.2 Being Alone

Urban parks may serve a distinct function of providing the opportunities of "being alone." This function included two subthemes: "being away from tasks and social distress" and "fostering creative and focused thinking". Participants sought to be alone away from the concerns and stress

of everyday tasks, such as homework, environments governed by role obligations, such as schools, as well as constant demands from technological connections. As P03 described: "*I'm totally by myself, with no homework or phone, just me and the landscape around me.*" P10 also shared the need for solitude related to research work:

> *When I get back from work, from the lab, it's like eight hours of work. And when I turn back, the WiFi, or sometimes I feel like I need to go somewhere there is no internet, no WiFi, no people, just me and my partner, or just to me, that there's no people from out of this context.*

When participants sought to be alone to be away from the distress of encountering others, whether known or unknown, people's presence was in extreme conflict with this function. P03 noted needing to avoid others while playing tennis to avoid negative self-conscious emotions:

> *When I'm at Nettles Park and I'm playing tennis poorly, I don't want people watching me. I'd rather have the tennis court to myself or just be with the person I'm playing with… I feel more self-conscious about my tennis because I feel like they're watching me even if they're not.*

She also shared a need for complete solitude during emotional turmoil:

> *I've literally hit myself, like at my beach and part of the embankment, I was like, I don't want anybody to see me … I'd rather just deal with it myself. So far, it's worked not always well, but that's why it's easier for me to process it on my own first, and then be able to talk about it with people later.*

Some participants connected being alone to facilitating focused and creative thinking. This function seemed related to the absence of interaction and disturbance instead of the mere presence of others, and nature's tranquility and inspiration seemed to be conducive. P14 exemplified this,

stating: "*Whenever I was walking beside this river in the green space, thinking about plans for my life, my exams, what can I do to do my best for my life."* She found the natural sounds and rivers without technological distractions more conducive to focused thought than libraries. Being in nature could also support creativity and reflection; as P17 mentioned, "*I like to be in areas where I can think, so I feel some of my best ideas come either when I'm in the shower or when I'm just walking by myself and taking in all the sights.*" Similarly, P06, who admired nature and disliked crowding, noted, "*Spaces like that [natural and uncrowded] help me to be creative enough. And when writing, coming out with new ideas*."

4.3.3 Appreciating Nature

Urban parks may also provide positive experiences of nature, a core aspect that participants recognized and valued, referred to as "appreciating nature." Specific functions included "being alone in nature" (also see the theme "being alone"), "appreciating nature for pleasure and relax", and "biophilic connection" (protecting and connecting with nature). In general, participants had neutral to negative attitudes toward the presence of others, varying with specific functions or motivations.

Some participants associated nature with being alone rather than socializing because there were other settings for social interaction, such as bars, downtown areas, and spending time with family at home. As P25 explained: "*I go to the park to be out in nature, not to be around a ton of people. If I want to be around people, I can go downtown."* P09 shared a similar idea about social and non-social settings: "*It's [a park is] not meant to be a social setting for me unless I bring a few friends … Downtown at a bar, if I end up talking to someone new for three hours, that's part of why I went.*"

Most participants connected appreciating nature to pleasure, beauty, and relaxation. Such experiences could be diminished by crowding, noise, or disturbance. P23 commented on a campus green space: "*During peak season when a lot of students are getting out, it tends to get a little dirty and pretty crowded.*" However, for those enjoying nature's beauty and peace, the presence of a few others was typically not bothersome. They were more likely to highlight opportunities to take photographs, multi-sensory experiences such as the blue sky, gentle breezes, and bird songs, the delight of unexpected wildlife encounters, and the enjoyment of learning about plants in botanical gardens. P13, who liked staying with other people, valued solely the enjoyment or activities within the natural environment but not the deeper meanings. She expressed, "*Nature is really important for me...but I don't feel connected...I really like to spend time in nature, do sports in nature, go skiing, go for a walk, but I'm not connected to it.*" However, such pleasure could be the participant's favorite experience with rich emotional experiences, such as relaxation, beauty, novelty, and excitement. P17 shared such a memorable experience on a lakeside where others did not disrupt or seem relevant:

> *It was just magical... The perfect combination of water, greenery, and weather. Sunny weather hitting the blue waters. And it just made me feel like I was in heaven. And the place is big enough so that even if you have a lot of people, they can all be spread apart. Yes. I even saw a snake there... I was walking with my friend, and she was the one who spotted the snake...I don't know what kind of snake it was, whether it was poisonous... I was just happy, lost in my surroundings... I don't think it was scary at all, just because the environment was so pleasing. I felt so happy there, and I want to keep going back. But it's best viewed in the summer when the flowers are in full bloom. Especially loved the Rose Garden. The presence of ducks and geese next to the lake.*

For a small number of participants, urban parks may serve as essential spaces for restoring nature and connecting with the 'authentic' nature within a city. This function transcended hedonic motivations and could be referred to as a "biophilic connection." Participants expressed a desire for nature to be pristine, admirable, awe-inspiring, awe-inspiring, finding satisfaction in being "one with nature" in cities and appreciating natural "creations" and processes like fallen leaves. They also shared dissatisfaction with the amount of unnatural material in urban parks. The impact of "people" seemed to be broad, including both behaviors and density that interfered with a connection with nature (e.g., crowding), as well as influence from visitors and management that degraded the environment, such as littering, artificial materials, and wider paths. P10 expressed concerns about the degradation of pristine nature by high visitor use level:

> *Because nature is so pristine, you know, literally, nature is shining and better. The more crowded, the more it will be noisy…There shouldn't be plastic bags and big banners, just small, natural-looking markings…even the side bars, it could be made from wood.*

However, an exception for P10 was enjoying nature together alongside strangers, which brought a sense of belonging:

> *There are some people fishing there too. Look, I didn't fish, but I love to see fishing. I don't see many people... the teenagers there are enjoying the nature as a good thing, like they just want to be together outside. And the older people, they just always spend time together, like for physical exercises, it's always very good. We feel very comforted and relaxed when we see those.*

4.3.4 Being with Others

Urban parks may provide opportunities for "being with others," encompassing "interaction with familiar people," "interaction with unfamiliar others," and "parallel shared experience,"

where one enjoys being around others even without direct interaction. The most common specific function was spending time with familiar people – friends, intimate partners, and families. Participants noted reconnecting with friends and families in urban parks during summer months, having regular post-dinner walks with family while *not* enjoying a park, and exploring new and interesting park destinations to "hang out" with friends. P17, who prefers in-person interaction, underscores the importance of relational goals: "*I don't use social media...So if I were to meet a long-lost friend, someone I hadn't seen in a long time, in a park, I would just chat with them. And that would really make my day.*" Sometimes, being with friends is used for the regulation of thoughts and stress, as P18 noted: " *I use the word distraction. Maybe I need to focus on something else other than what I was thinking at the moment*." The environment could also ease interaction or deepen joy, but the main goals were often socializing and relations. P24 and friends used urban parks for their meetings and play during childhood summertime:

> *We could fish in the little lake thing, catch some fish, small fish. There was a field, so we play some soccer or pass a football around. We would get lunch because it was urban, so there were some stores… It wasn't so much the park as it was being with my friend. It was like a meeting place.*

Most participants did not frequently interact with unfamiliar others, such as community acquaintances and strangers. Some enjoyed brief greetings and conversations, while more engaging interactions typically occurred during shared activities such as dog walking, picnics, sports games, or holiday celebrations. These provided opportunities for socializing, play, and even the formation of friendships. For example, P26, who regularly walked her dog and played tennis, preferred a balance of social interaction and space: "*I like it when there are a few other people, so*

I have someone to talk to, but if it's too busy, then I can't really play with my dogs." P14 shared her experiences during "Nature Day" in Iran:

> *Every people at that time went to parks to have lunch and sometimes even dinner. So, if there are other people, other families sitting near us, we can laugh together, talk together, make friendships, and sometimes even borrow something like salt or extra plates or other tools. I made some friendships this way, planning outings together.*

It was more common that seeing and being around others, with no verbal communication, enhanced the experience. We refer to this function as a "parallel shared experience." P05 shared:

> *I always prefer there to be people around, I prefer the community to be around me where you can see all generations coming together just enjoying the space...It's like you're seeing the heart of the city, because everybody's out there, enjoying the space, being active, doing their own thing, but as a community, and it's just a really positive experience for us.*

Some participants enjoyed people-watching and liked to find strangers with diverse, intriguing behaviors and appearances to satisfy curiosity, as P13 shared, "*I always enjoy the company of others and somewhat crowded places, because even though I don't talk to them or know them, I like to observe them and see what they're doing, what they're wearing, and how they behave.*" P15 particularly disliked being alone or watching the "boring" scenic beauty, and she found joy from the dynamics brought by others. An exceptionally desirable opportunity was "*watching people do the zipline, shouting and screaming, and getting that excitement*. "

Parallel shared experiences may extend to vicarious and perspective-taking experiences. Some participants liked to see families, mothers, community members, and those who focused on their own leisure, such as fishing, walking, and chatting. Observing others who appeared to be enjoying their time transmitted a sense of relaxation and pleasure to the observers. These vicarious

experiences sometimes extend to sensing social bonds and imagining personal futures. For example, P12 appreciated the noise from families not as a disturbance but as a reminder of familial bonds: "*It's about enjoying what we have, the bonds, the light, just quiet, serene, and the bonding it creates...They have this vibe, whatever it is, just like talking, eating, and still as a family.*" P15 reflected how a couple inspired her imagination:

> *A couple pushing their baby, in my mind, I'm like, oh, I wish I could do that when I get married, have a kid. It just makes you wish to do some more. You see old couples holding hands and walking, just gives you that kind of imagination, 'Oh, this could be me in the next 20 or 30 years.'*

4.3.5 Appreciating Urban-Cultural Life

In contrast to appreciating nature, the function of appreciating urban-cultural life in urban parks is often compatible and even enhanced by other people's presence. These opportunities include "appreciating architectural features," "livable experience," and "engaging with cultural life." Some participants, especially those with European and Asian backgrounds, expressed enjoyment of architectural elements and cityscapes within parks. As a German-American, P18 enjoyed sightseeing the monuments in Berlin's urban parks alongside other activities during summer visits. P14 from Iran valued historic architecture in Tehran's urban parks: "*The main reason for me was that river. And the other thing is the historic building near that river. So every time I visited them, it was like the first time.*" Appreciating architecture did not seem to have an obvious relationship with the presence of people. Although some enjoyed appreciating architecture and the amenities for livable experiences, there were also participants who preferred the combination of solitude and architecture. For example, as an introverted and indoor person, P01 sometimes visited a waterfront park primarily to enjoy being alone and view the Manhattan skyline.

Another function was the "livable experience," where services and amenities available in urban parks could bring comfort and convenience for everyday activities such as drinking, eating, parking, wayfinding, and using restrooms. Some viewed amenities as a welcome additional layer of experience, a few expressed a stronger need. As the mom of a two-year-old daughter, P19 highlighted the importance of clear signage to locate food when her daughter expressed hunger at unexpected times. Due to personal health conditions, P20 stressed, "The *most important infrastructure within a park is restrooms, lots of restrooms*." P15's narrative illustrated how aesthetically appealing architecture, a nearby café, and informal shows combined to offer a livable experience:

> *Towards the bridge. The bridge was beautiful. I particularly videoed the footbridge…and I liked the location also. From the park, you could just walk to the road and go to Spill the Beans [a café], walk down and watch another show. So, it was in a centralized place, well-located.*

The most frequently mentioned aspect of urban-cultural life engaging with cultural life, from appreciating a vibrant atmosphere to actively participating in events. These opportunities are enriched by the presence of other people. Participants shared several examples, including seeing passersby and feeling vibrancy, observing community gatherings, and gaining a sense of community. P02 expressed his preference for a vibrant "city feeling":

> *Generally, I like being surrounded by people because it gives me more of a city feel... It feels very safe...When I want to take a picture, I like to find something more lively, like a bit more scenery. An aesthetic image with trees, grass, or maybe some animals or people in the image.*

The most active role of people is in the culturally distinctive activities and events that occur in urban parks. For example, P02's favorite experience in urban parks was in a Japanese tea garden where he noted that "people with a beard, especially a costume like Yamato clothing," were a highlight. P08 highlighted the beer experience in German parks:

> *In the English Garden, there's a beer garden, which is like a large open facility with lots of open tables, beer, and food. It's essential to it. They have a huge bulk barrel where several hundred people can sit down, and you can get some traditional food and beer. There's usually live music, and it's very nice. You can spend the whole day walking around, tubing, and then sit down for good beer and food and go home happy.*

4.3.6 Relevant Factors Across Functions

Safety. Most participants agreed that the presence of a few people can enhance the safety of a place. Safety is a basic need for park users, as even those who prefer solitude and dislike crowding in nature, such as P10, acknowledged the need for some human presence for safety reasons, "*I would say two to three people at least on-site because having fewer people makes it feel unsafe*." Participants have a general belief that the presence of others around can provide immediate help during potential danger. As P04 shared, *"If I'm in a new area, I'm kind of like, 'Oh, I hope there are more people here. So like, if God forbid, something happened, like there are people around to help."*" Another aspect is the social learning of whether a park area is safe, which guides participants to avoid unsafe areas. P15 shared:

> *Going to a park that is empty, I would assume that maybe something's wrong with it. Because if it was a good park, people would be there. It would be crowded. It's like going to Chick-fil-A [a fast-food chain]; if you go and it's empty, you wouldn't want to buy anything because you would think, is the food bad?*

However, there are also variations in the perception of the role of others in safety. For some participants, the need for others depends on interpersonal and situational factors, such as unfamiliar environments, nighttime, and open vs. closed views due to vegetation. "*I don't know if I'm in a bad part of a city or town*" (P04) reflects a common concern regarding unfamiliarity with the environment. P19 emphasized that safety took precedence when going out with her two-year-old daughter. Male participants tended to describe the need for others for safety more generally without detailed considerations. A few participants shared encounters with threatening people, including those asking for money, signaling women, homeless people, and suspected drug dealers. When encountering threatening others, one may have to move to more crowded areas. The presence of non-threatening and threatening people can change between day and night, making the effects of others on safety more situational: "*The atmosphere changes, and not everyone in the English Garden is good*." (P13).

Cultural backgrounds involve ideas about who can be trusted; a few international participants shared that difficulties in evaluating who is non-threatening in the U.S. led to increased vigilance and more conservative judgments about "good people." As reflected by P16, a female international student:

> *In my country, maybe because of the culture, you can't trust everybody just by talking with a stranger. I'm comfortable with women if I see them in the park, but here, with so many nationalities, it's hard for me to make a rule." Also, "you can't tell some people that you maybe you judge incorrectly but you think, okay those people look like those groups [drug dealers], and I don't want to be around them.*

Spatial Arrangement. The ability to move and run, increase and decrease direct interactions, proximity to others, and noticing and being noticed by others are influenced by spatial arrangement.

When discussing crowded situations, participants mentioned the benefits of certain micro-scale designs and zoning, such as wider trails to accommodate side-by-side walking, larger spaces to maintain personal space, and separated playgrounds to limit unexpected children's movements and sounds. For example, P25 explained "*I like my space… When it's really crowded, especially when I'm running and there are so many people on the path, and I'm trying to get through but have to weave through them*." In a stronger need for solitude, P03 preferred a waterfront spot on a slope where she could view a lake without being seen by passersby. When discussing optimal levels of contact, neither too low nor too high, a few shared how spatial arrangements helped manage desirable proximity and psychological experiences. P07 liked the designated seating areas next to the trail as it helped him to obtain his *"own private space" to* observe "*people come around and then spend time with their family."* He further shared a nuanced view on desirable distance and the stimulation from others: "*You can see them, but they're not sitting right beside you talking, nor you hear their conversations in detail. So, it will make you think properly, like you'll get the quiet peace that you want.*"

Self-Focused Others. In addition to physical arrangement, participants often highlighted the importance of others' appropriate, non-intrusive, self-focused behavior with descriptions like "Everybody was doing their thing" shared by a few people. P09 explained that even for higher density in a smaller park, "*if they're just doing their own thing, if they're being a little bit louder, playing music, having fun, I've never really cared about that. I don't think my parents did either*." However, growing up in a coastal tourist city, P09 disliked tourists who were "*always loud, always trying to do crazy*." This motivated him to use a neighborhood park without tourists and with an atmosphere where strangers did not bother each other. He stated, *"I just want to chill, maybe go on the swing set, climb the tree…It's a small, secluded area where the few other people aren't*

bothering you, and you're not bothering them." However, the standards for appropriate and non-intrusive varies by participant. Those strongly desiring solitude were distracted by human movement could be disruptive. P12 shared:

> *The movement of people in front of me, it doesn't allow me to really enjoy this... like people just sitting down in different groups, different, you know, that kind of gives me that sense of people is relaxing compared to everybody just walking around.*

Children were often believed to not follow the norm and become "overwhelming":

> *So many kids running around... they don't know how to be patient or anything like that... There's definitely a point of capacity, I guess you could say, where it's just not fun for anyone.*

Personal characteristics. Several personal characteristics were mentioned by participants as reasons for preferring certain functions and the presence of people. Some of these factors have been previously discussed. The most common was their orientation towards different environments, including orientation to or fear of nature, orientation to urban life, being an "indoor person" vs. "outdoor person," introversion vs. extraversion, or a focus primarily on recreational activities rather than the environment. For example, P23, who grew up in a rural southeastern U.S., developed a personal orientation to outdoor recreation, forests, and freedom and solitude:

> *I am a rock climber, ... I don't really go to urban parks. ... I just walk into the woods for two miles to a rock and I sit there by myself with this rock, just enjoying nature. I can read my book, I can climb, I can do whatever I want. But I'm just out in the middle of the woods all by myself, and that's the most peaceful to me. And I grew up in the woods, so I feel very safe there, you know, I don't think a bear is gonna run out and tag me.*

A few participants self-identified an openness to different experiences and social contexts. They used labels like "adventurous" and "casual" to describe themselves. One expressed being alert and aware, preferring more crowded parks to prioritize safety: *"I'm a very aware person. So I feel like the more people there are, the better for me, because other people are aware as well."* (P04)

Situational Factors. According to some participants, mood and motivational states may a greater impact than personality in preference for urban park experience. The most frequently mentioned factor was stress, which determined whether they preferred a relaxed environment, including nature and fewer people, especially fewer noisy, running children. P16 shared how mood determined his preferences between two distinct experiences:

> *"It depends on my mood. Maybe when I'm tired and I don't like a lot of children just screaming. ... I'm looking for some quiet place. ... But sometimes you need some excitement. And children, yeah, and it's nice to watch them play... the reason that you go to the park is important. Sometimes you go to be distracted by people, but sometimes you just want to relax.*

Stress levels could be embedded in students' routines and role obligations, such as exams, assignments, classes, and research. A graduate student, P17, mentioned how his activities and daily schedule shift his preferences periodically, and how different environments help his productivity and mental well-being:

> *I generally enjoy talking with people, meeting new faces. ... And sometimes, you might find them in a park … families doing funny things, things that you can just watch and laugh at… But in the daytime, I make sure to be as productive as possible. I make sure that I talk to as many people as possible… And if they can help my research in some way, I make sure*

that I understand their viewpoints. But at the end of the day, sometimes I feel like I might just want to relax. ... That may be my number one reason for going to a park, just to be with myself.

Motivations were also sometimes evoked by a park's features, such as whether it was a quiet forest and trail or an open lawn with activity facilities. Interpersonal factors also determined preferences for functions. For example, going out with dogs or children made participants appreciate having others in the park.

I think it encourages social interactions for the kids. You know, kids are not like us; we see people we don't want to see or work. But kids ... just say hi, bye. ... I like my daughter to say hi, to say hello, to say bye-bye to those people." (P19)

Participating in group activities could also reduce the attention to and disturbance from others:

I don't really like it when there are a lot of kids in the park. But if I go with some friends to have a picnic I enjoy it ... a lot of people, a lot of noise. But when I'm with my friends, it's people I enjoy. (P22)

4.4 Discussion

This qualitative research explored young adults' perceptions of how the presence of other people influences or does not influence urban park functions. We identified four broad functions that could be influenced by the presence of others: being alone, appreciating nature, being with others, and appreciating urban-cultural life. The influence of other people varied across these functions, as being with others and experiencing urban life inherently involves human presence. These findings also complement common views of seeing nature as a refuge from social stress (Hammitt, 1982, 2000; Kaplan, 1995; Ulrich, 1983; Wohlwill, 1983) and seeing public spaces for

their social values (Jacobs, 1961; Mehta, 2013), such as appreciating nature alongside others or enjoying urban scenery in a quiet park. At a less detailed level, these findings echo the separation of 'social-serene' and 'nature-culture' aspects (Grahn & Stigsdotter, 2010; Memari et al., 2017; Stoltz & Grahn, 2021).

Perhaps more importantly, when delving deeper into specific functions, our results illustrate where the presence of others has more or less influence. Our results highlight where the presence of others has more or less impact. The theme of "being alone" involved being away from tasks and social distress and fostering creative and focused thinking. These functions aligned with studies on the benefits of privacy ("privacy functions") for wilderness users (Hammitt, 1982; Hammitt & Brown Jr., 1984). In our study, the specific function that was strongly conflicted with the presence of others was escaping from social distress, the strong negative emotions associated with social encounters, such as contact with others or being seen, especially by familiar people. This function is similar to Westin's (1970) concept of "solitude," complete isolation, which differs from "intimacy," involving blocking contact to focus on close others. We also found that this need seemed to arise during troubles, emotional stress, and self-consciousness related to sports performance. This suggests that certain recreational activities involving evaluations or competitions in parks may require moments free from feeling judged by others.

For the theme "appreciating nature," participants frequently associated it with being alone, for enjoyment, pleasure and relaxation, and biophilic connection. This finding was similar to research on the connection between nature, aesthetics, and mental health (Browning et al., 2023; Meidenbauer et al., 2020; van den Berg & ter Heijne, 2005). The effects of the presence of others were largely absent in participants' narratives, except for crowding and noise. More negative responses came from narratives concerning the connection with a "pristine," "sacred," or authentic

nature – the biophilic connection function. This function would be impeded by broader human influences that deteriorated or artificialized park environments, such as litter, manicured plants, and non-natural materials. Outdoor recreation research indicated that conflicts could arise from both direct encounters between user groups and the perception of fundamentally different values; conflict involving environmental values was prevalent in wilderness parks (Reis & Higham, 2009; Vaske et al., 1995, 2007). Our study suggested that urban parks could serve environmental protection and biophilic connection, which could be important for those valuing nature intrinsically, and these functions could be highly susceptible to human impact.

Specific and varied influences of the presence of people also emerged in appreciation of urban-cultural life and being with others. Similar to existing urban park and social interaction studies (Peters et al., 2010; Sampaio Costa et al., 2024), the theme "being with others" involved both direct interaction with familiar people, unfamiliar others, and the shared experiences of being around others without direct interaction (parallel shared experience). Time spent with families and friends was common and perceived as engaging and meaningful for social bonds, especially for reunions. However, narratives of these experiences rarely involved strangers, whether positively or negatively. This could be understood with perspectives on a shared experience in the environment. Such experiences involve complex dynamics between direct interaction within a group and parallel interaction with the environment, as emphasized in relational restoration theory (Hartig, 2021) and family leisure patterns (Flora & Segrin, 1998; Holman & Epperson, 1984; Orthner, 1975). Being in a close group may make experiences more similar across settings with varying amounts of activities of others (Staats & Hartig, 2004).

Regarding interaction with unfamiliar others, while their presence could be beneficial, only a few participants shared this experience in urban parks. Such interactions were typically light or

coarse (e.g., greetings) or under shared activities (e.g., group recreation and cultural events). Past research suggested that more intensive interactions with strangers were rare and might violate privacy norms in public spaces, especially for people with a Western, individualist background (Goffman, 1971; Peters et al., 2010). Shared stimuli could ease friendly communication between strangers ("triangulation"; Whyte, 1980). Meaningful social interaction in parks might require regular encounters to gradually build social relationships and a sense of community (Cattell et al., 2008; Peters et al., 2010).

Contrary to direct interaction, "parallel shared experiences" seemed to be a more common function where people's co-presence without interaction brought various positive feelings and thoughts. This occurred both in engagement with nature and cultural life. Previous studies have identified this function in various settings, such as customers observing others for purchase-related information (Colm et al., 2017; McGrath & Otnes, 1995), tourists perceiving authenticity with the presence of locals (Popp, 2012), and e-sports audiences experiencing the energy and excitement from others' cosplay and cheering (Jang et al., 2020). In comparison, less intense feelings could be more common in nature experiences (S. Yuan et al., 2023). Our participants shared relaxation, "laughing together," sensing family ties, and a sense of belonging from enjoying nature together. While these feelings varied, there was a transmission of others' feelings to the observers. This could be explained by emotional contagion—the automatic synchronization of emotions through non-verbal cues (Hatfield et al., 1994) and facilitated by shared similar perspectives (Elfenbein, 2014). However, those who shared the richest parallel shared experiences (e.g., getting inspiration to imagine one's future) seemed to be limited to participants who generally preferred being with others across situations. This echoes a study finding positive encounters with others in green spaces related to individuals' social orientation, such as introversion/extraversion (Six, 2018).

The theme “appreciating urban-cultural life” could involve appreciating architectural features, particularly well-designed and historic buildings, using amenities for comfort and convenience for everyday activities (“livable experience”), and engaging with cultural life. Research on public spaces values the presence of people for creating a vibrant atmosphere, fostering social cohesion, and encouraging citizen participation (Gehl, 1987; Jacobs, 1961; Lofland, 1998; Oldenburg, 1989). However, participants in our study were likely to mention the presence of others in supporting place-based experiences serving multiple needs and pleasure - a “livable” experience (Whyte, 1980). Their descriptions include appealing environmental elements, eating and drinking, small animals, passersby, and informal shows and performances, which seemed to contribute to livability. While some livable elements were not found influential in simulated public spaces (Abdulkarim & Nasar, 2014), Barros et al. (2021) have described a more embodied, place-based experience in commercial streets, using the label “hospitable” and highlighting “rest, entertainment, and comfort” and opportunities for eating, drinking, laughter, meeting others, and people-watching.

Cultural life – atmospheres and events largely required the presence of people, which some participants mentioned as their best urban park experiences. They mentioned communal cooking during outdoor festivals, observing people wearing traditional kimonos during international travel and the importance of others in beer festivals in German parks. These findings echo the positive effects of crowding observed in various events across Western and non-Western contexts (Cheng et al., 2021; Harrington et al., 2017; H. Lee & Graefe, 2003).

4.4.1 Relevant Factors Across Functions

Similar to previous studies, we found several factors influencing urban park function preferences, including personal characteristics, mood and motivational states, and interpersonal

factors. Regarding nature vs. urban-cultural life, participants commonly expressed their orientation towards urban or natural environments and sometimes an openness to diverse experiences (i.e., self-described as "adventurous" or "casual"). Despite these findings, we note that a study based on the Big Five personality traits did not find the positive or negative reactions to others' presence in nature connected with openness to experience, but only with social anxiety and extraversion (Six, 2018).

Stress was the most commonly mentioned factor for a preference for urban parks and privacy level. Some participants described stress and privacy preference changes based on their school and research schedules, illustrating Altman's (1975) idea of the "dialectic nature of privacy," where preferences for interaction vs. non-interaction are driven by two opposing "forces" that move people apart or together, and these processes often occur daily or over a longer-term basis. Overall, these factors help explain the complexity of determining which urban park functions were more valuable and when the presence of others was beneficial, problematic, or inconsequential.

Despite this complexity, participants seemed to consistently mention spatial layout and self-focused and appropriate behavior of others across specific functions or experience aspects, including interaction with intimate others, appreciating nature, and relaxing in nature. From a privacy regulation perspective, furniture and pavement layouts could help regulate interpersonal distances; visual barriers can help control the opportunities for seeing and being seen by others, and zoning could separate quiet areas from the noisier ones (e.g., playground). In addition, participants often describe that the self-focus behavior of others (e.g., people who "just enjoy themselves") could prevent disturbances, excessive noise, and inappropriate behavior. As for Altman (1975), the regulation of privacy is an interpersonal process ("interpersonal boundary regulation") where the achievement of desired privacy levels depends on others correctly

understanding and cooperating. In public spaces, successful privacy regulation relies on non-verbal communication through the social norm of 'civil inattention' (Goffman, 1971). Strangers typically make brief eye contact or nod to acknowledge each other's presence, then withdraw their attention. Similarly, Whyte (1980) also observed urban square users symbolically adjusting their seat positions, even without room to physically move, to signal respect for others' personal space. This symbolic adjustment was reciprocated, allowing users to feel comfortable at higher densities. Therefore, participants might understand through subtle, unconscious communication the willingness to conform to a mutually respectful privacy norm.

4.4.2 Research Implications

Based on these study findings, future research may focus on the impact of other people on satisfaction with specific functions of urban parks. Regarding social interaction and social cohesion, participants rarely mentioned developing deeper relationships with new people in parks based on their past experiences. This warrants research on scenarios and contextual factors affecting social cohesion mechanisms and preferences for privacy/user density levels (Kim & Shelby, 2011a), such as visit time, familiarity, and location.

Additionally, the self-focused behavior and "civil inattention" (Goffman, 1971), indicating non-verbal communication of how others respect privacy/social interaction norms seems to be important across settings. Similarly, Peters et al. (2010) observed an unusual case where a small, crowded urban park had a comfortable and intimate atmosphere, despite the high density. This unexpected phenomenon was likely due to a situational, place-based norm of 'civil inattention'. This raises questions about how this norm was facilitated and developed in a specific park, as well as how simulation research on the presence of people could address this factor and transfer findings into real parks. Future research could attempt to manipulate micro-scale interactions through field

observations, experiments, and measuring anticipated social interaction quality (Cheng et al., 2021).

Parallel shared experiences, a positive form of co-presence, may relate to the soft fascination of restorative experience (Kaplan, 1995) warranting future research. Social stimulation from others could enrich the sensory experiences of urban environments (Gehl, 1987) or be over-stimulating (Milgram, 1970), which could also be contingent on the dynamic desired levels of privacy and stimulation (Altman, 1975; Wohlwill, 1966). Additional research may better define and operationalize the parallel shared experiences and explore relevant personal, interpersonal, and environmental factors to understand overlooked sources of restoration and contribute to the discussion of when the urban environment could be restorative (Hartig, 2021).

As this study only invited university students, future research may address other populations, such as families, older adults, ethnic and racial minorities, and low-income populations, or compare residents and tourists.

4.4.3 Practical Implications

People's preferences for social interaction and natural settings vary based on personal characteristics and situations, making it challenging to determine the optimal designs with homogeneous environments or strictly according to user segments. Park designs may accommodate diverse needs by providing lively social zones with amenities for performances and gatherings, as well as more naturalistic, tranquil areas. Flexible layouts with movable seating and spaces of varying scale and enclosure allow visitors to manage visibility and interpersonal distances.

Temporal factors appear to also be important, as stress levels and social needs fluctuate with daily routines. Safe trails and nighttime-activated spaces can cater to different use patterns.

Beyond green spaces, urban design should integrate the entire community as an interconnected "structure of opportunities" blending natural, social, and livable experiences.

In addressing overcrowding, park managers may focus on promoting a respectful and friendly social atmosphere. Low-use levels may also need to be addressed to ensure safety and inclusiveness for minor and female users. Improving accessibility, mixed land use with amenities, and designing linear parks as connective spaces can promote continuous use patterns.

4.5 Conclusion

Urban parks are vital components of urban green spaces, offering a multitude of benefits. This study identified four broad categories of park functions affected by the presence of other people: being alone, appreciating nature, being with others, and appreciating urban and cultural life. The findings reveal a nuanced picture, with the role of other people varying within specific functions or experiences, such as being alone to escape social distress, biophilic connections, parallel shared experiences, and appreciating cultural life. Relevant factors influencing these functions include spatial layout, the self-focused behavior of others, stress levels, and privacy preferences. Research implications on the impact of others, social cohesion benefits, civil inattention, and restorative experiences were discussed. For environmental designers and park managers, we suggest avoiding a "one-size-fits-all" approach and instead catering to different needs across user types and use situations. For visitor use management, we recommend implementing strategies that regulate user density during peak times and foster a culture of mutual respect and consideration among park users.

CHAPTER 5. GENERAL DISCUSSION AND CONCLUSIONS

Understanding the complex interplay between the natural and social benefits of urban parks requires an understanding of the multifaceted roles of human presence in these spaces. This dissertation answered this overarching question: *What are the influences of the presence of other people on park users' psychological experiences that are potentially related to mental health and well-being?* Chapter 2 developed a theoretical foundation by integrating diverse perspectives from social psychology, environmental psychology, and practice-based fields like parks, outdoor recreation, and tourism management, and environmental design. This foundation served as a conceptual tool to categorize the impacts of human presence into three core functional domains: behavioral, cognitive, emotional, and symbolic, each with perceptual functions. Chapter 3 applied eye-tracking and virtual reality to explore the specific effects of two visitor densities on the experience evaluations of four locations in well-designed and managed parks in a Southeastern U.S. city. The findings revealed that higher visitor densities negatively affected willingness to visit (to a small extent) and perceived restorativeness. The research suggested that visual attention to other visitors could explain how visitor density affects willingness to visit. Chapter 4 adopted a qualitative approach in which university students from diverse cultural backgrounds described the diverse roles of other people in relation to the broader and specific park functions. These broader functions included being alone, appreciating nature, being with others, and appreciating urban-cultural life. This chapter also suggested personal and situational factors relevant to the impact of others, such as spatial layout, the self-focused behavior of others, stress levels, and privacy preferences.

When viewed together, the findings from Chapters 2, 3, and 4 present a complex and nuanced picture of how the presence of other people influences park users' psychological experiences. For example, Chapters 2 and 4 collectively established the diverse and heterogeneous nature of park benefits and the roles of other people. Theories within the theoretical framework were also reflected in the interviews on participants' past experiences, such as evaluating safety through others' reactions (social learning) and experiencing conflicts concerning environmental values.

While we can find additional interconnected findings across chapters, it is perhaps more pertinent to discuss the complexities surrounding the impacts of other people's presence and the associated research and practical implications. Several aspects may contribute to these complexities. First, the findings of Chapters 2, 3, and 4 collectively illustrate that the presence of other people can influence different aspects of urban park experiences in different ways. Second, the impacts of visitor density on different aspects of the experience may occur at different levels of density. For example, a few people could improve safety and create a shared experience of enjoying nature (Chapter 2, Chapter 4), while too many people could be distracting noise, unwanted contact, and even restricted movement (Chapter 4). Third, park users' preferences for park functions may change due to personal traits, life situations, motivational states, and the company of others (Chapter 4). Fourth, it is important to consider the relationship between the characteristics of others and the functions of the setting relative to individual need satisfaction. Examples of positive impacts in Chapter 4 include strangers enjoying nature together and focusing on themselves, people chatting with others and offering help during festive events. Fifth, social and cultural contexts can influence the types of benefits derived from parks, the characteristics and behaviors of others, and the fixed and temporal patterns of individual needs (Chapter 4). These

aspects collectively suggest the relevance of the complexities regarding human presence to the transactional perspective (Altman, 1992; Hartig, 1993). As suggested by this perspective, “people and psychological processes are embedded in and inseparable from their physical and social contexts,” and “time, continuity, and change are intrinsic aspects of psychological phenomena.” (Altman, 1992; pp.268-269)

The findings also highlight the complementary strengths and weaknesses of different methodological approaches. The use of 360° videos and eye-tracking, combined with surveys, offered a sensitive way to capture the impact of human presence on visual engagement with environmental features such as people, greenery, and buildings. Incorporating human movement and sounds provided a more immersive shared experience than static images. The use of machine learning to annotate eye movements alleviated the intensive workload of manual annotation, offering a scalable solution for diverse environmental settings. This approach revealed subtle influences on visual attention responses that were potentially common in everyday life but less likely to be recalled in open-ended questions or interviews. It also suggested potential changes in environmental experiences (in terms of attention) that did not necessarily alter overall evaluation levels, a phenomenon known as product shift (Heberlein & Shelby, 1977; Manning & Valliere, 2001).

However, these findings were limited in suggesting underlying reasons behind the variance in ratings and the contextual factors relevant to the transferability of the results. In contrast, interviews with university students with diverse cultural backgrounds in Chapter 4 uncovered a wide range of responses across different contexts. However, caution was needed when transferring these qualitative results to a specific park. For instance, although many participants in Chapter 4 (who were also participants in Chapter 3) emphasized that the presence of a few people was

important for safety, Chapter 3 did not find an overall influence on perceived safety for the entire sample. The video locations in well-designed and inherently safe parks could explain this difference. These findings resonate with Altman (1992) and Hartig (1993), who posited that interactional research, which models or manipulates discrete factors, might only suggest modifications of specific environmental factors and offer a plan of action with limited practical value. In contrast, translational research, as was partially involved in Chapter 4, could embed meanings and qualities of environmental experiences in the pattern of relationships involving people, places, and psychological processes. Aligned with this idea, our findings highlight the limitations and complementary nature of both approaches.

5.1 Overall Limitations

The primary limitation of this dissertation is the potential for sample and cultural biases. The focus on university students as participants precludes the exploration of experiences of other demographic groups, such as older adults, families, and ethnic minorities. Similarly, the theories reviewed and the choice of specific park scenes predominantly reflect Western perspectives and U.S. urban experiences, potentially overlooking cultural variations in how nature and social relationships are perceived and the interplay of cultural perspective and actual urban environments (e.g., accessibility of parks and other leisure and public spaces).

A major limitation is the subjectivity inherent in theoretical synthesis and qualitative research. Integrating broad theories required simplifying complex concepts and creating new categorization, inevitably influenced by my personal perspectives and knowledge. As an East Asian researcher with an architectural/urban design background and considerable living experience in bustling Asian cities, I have limited understanding of rural/small-town life in the U.S. My background predisposed me to confirm the benefits of social interaction and crowds,

potentially introducing confirmation bias when interpreting participants' park experiences. Completing the theoretical framework before thematic analysis also created a strong temptation to align themes with existing theories and concepts, making a purely inductive approach challenging and resulting in a hybrid approach. I acknowledge that this coding approach has led to overlooking some codes or subsuming them into broader categories (e.g., varied meanings of urban parks/nature and their relation to everyday life, especially for non-Western participants).

The dissertation study also relies heavily on simulations and interviews, which have inherent limitations. Notably, the 360° videos used in Chapter 3 could not fully capture the subtle nonverbal social cues crucial in shaping social interactions and privacy regulation in parks, as highlighted by Goffman (1971), Whyte (1980), and discussed in Chapter 4. Furthermore, participants could engage in prolonged staring at others in the videos, a behavior that might be considered impolite in real-world settings, potentially leading to an overestimation of the distribution of visual attention toward people. In Chapter 4, the interviews relied on participants' recollections of past experiences, which might be subject to memory biases and social desirability effects (e.g., not mentioning perceived “unpopular people” to avoid looking unethical).

While the dissertation aimed to integrate broad methodologies and disciplinary perspectives, this breadth compromised depth and richness in the study of Greenville's urban parks and practical relevance. More in-depth on-site interviews, observations, and importance-performance analysis could have provided richer contextual factors to situate and interpret the park experience evaluations. In Chapter 3, lacking this analysis means significant results like "reduced restorative potential" cannot be clearly attributed to specific conditions, such as season, weather conditions, time of day, specific areas within the park, specific user groups, or applied more generally, limiting practical insights. Across chapters, this lack of rich contextual factors on

Greenville’s urban parks limits the possibility of further connecting the impacts of people’s presence in Chapter 3 to the broader park experiences discussed in Chapter 4.

5.2 Research Implications

As specific implications were covered in each chapter, in this general discussion, I would like to focus on how future research can address the complexity of human presence. Theoretically, there is a clear need for a new term or concept that distinctly captures the positive aspects of higher density environments across various contexts. The existing theoretical perspectives define density or use level (measured by people or activities per unit of space) as neutral, while crowding is understood as a negative perception or motivational state related to higher densities (Manning, 2022; Stokols, 1972). Although the term "positive crowding" exists (Popp, 2012), it still carries the negative connotation of "crowding" and is primarily associated with specific fields like tourism and event management. Future research should propose a new concept that encapsulates the positive aspects of human presence, such as social interaction, sensory stimulation, sense of welcome, and social learning opportunities. This research should define the structure of this new concept and establish connections with existing theories or concepts related to the positive impacts of people's presence.

Empirically, micro-level investigations within specific locations face the challenge of accurately describing people through visuals, words, or scenarios. When asked to evaluate human presence, individuals may rely on heuristics based on past experiences, potentially impacting the accuracy of their judgments and reducing the internal validity of study. Research on crowding and carrying capacity has evolved from using numerical encounter counts to incorporating photos to depict the distribution and characteristics of people (Manning et al., 1996; Manning & Freimund,

2004). As a further extension, it may be helpful to include information about the quality of social interaction and situational norms in research, such as using video recordings or textual descriptions.

At a broader level, we may consider the interplay between individual motivations, behaviors, and perceptions of others' presence, and recurrent patterns within social contexts, as such contexts act as milieus in which relationships are embedded and cannot be viewed through simplistic cause-effect lenses (Altman, 1992). For example, Jiang et al. (2019) used a participatory smartphone photography survey to investigate how the outdoor environment within the vast Foxconn factory complex - where workers both lived and worked - influenced their stress coping mechanisms in the face of demanding workloads, harsh work discipline, and limited leisure opportunities. Environment and health research have applied varied techniques to address how individuals interact with their surroundings in the real world, such as ecological momentary assessment (Mennis et al., 2018), experience sampling methods (Doherty et al., 2014), participatory photo mapping (Dennis et al., 2009; Jiang et al., 2019), and photo voice (Downey & Anyaegbunam, 2010). Future research may leverage these techniques to explore the potentially important roles of the presence of others in everyday stress and coping.

5.3 Practical Implications

While most implications focus on specific solutions, our study mainly discovered the complexity of human presence in parks. Strategically, park managers should explore or survey the differences among users and locations within urban parks. For users in relatively crowded or non-crowded areas, as well as non-users, managers should understand their preferred functions and satisfaction levels. They may tailor specific spaces to varied atmospheres—quieter, more active, or more vibrant. Additionally, park managers may collect indicators of qualities for urban parks, similar to the approach in national parks (Manning, 2001). Similar to the use of crowding norms

in wilderness park management, norms on safety and interpersonal distance may be explored for urban parks. Varied priorities by local contexts should be considered (e.g., Yu et al., 2018; J. Yuan et al., 2018). Balancing multiple aspects of people's impacts can be another challenge. Park managers may adopt the three-factor theory of satisfaction (also known as "Kano model") (Matzler & Sauerwein, 2002; J. Yuan et al., 2018) to address the non-linear relationship between visitor satisfaction and indicators of quality. This model suggests that "basic factors" like safety, if inadequate, can significantly decrease satisfaction, but beyond a certain threshold, further improvements do not proportionally increase satisfaction. Therefore, managers should identify the minimum acceptable levels for basic factors and prioritize meeting those levels, but not exceeding them unnecessarily. They may also consider that the presence of people might influence "excitement factors" necessary but highly impactful qualities, such as the quality of the experience of informal performances, events, and wildlife viewing.

Environmental design can also create diverse environments catering to different privacy needs. This could involve incorporating secluded areas for solitude, semi-private spaces for comfortable shared experiences, and large open areas for a sense of open, welcoming, and unrestricted. Design analyses like Space Syntax (Hillier et al., 1993; Koohsari et al., 2016) can help analyze how spatial layout influences human movement patterns, allowing designers to align the layout with various expected levels of privacy. Additionally, designating quiet zones during specific hours could facilitate relatively quiet places for reading, enjoying scenery, or meditation. While zoning strategies might be suitable for larger parks, small to medium-sized parks may consider flexible design elements, such as movable seating that could allow users to adjust their personal spaces. Strategically placed vegetation and structures can create visual barriers, offering opportunities for solitude and reducing visual clutter. Encouraging respectful behavior and

adherence to social norms can lessen perceived crowding and distractions in higher-density situations.

Park designers and managers should consider a combination of factors, including physical layout, park functions, user activities, and social norms, to facilitate a positive social atmosphere. When referencing successful cases, it's crucial to assess the extent to which these factors are dependent on specific physical and social contexts and evaluate if positive patterns can be transferred to new environments.

APPENDIX A

Survey

Q1.1 Participant ID

_____

Q1.2 First name

_____

Q1.3 Choose your video sequence

- ○ Seq 1: Low-Med-BE-LA
- ○ Seq 2: Low-Med-LA-BE
- ○ Seq 3: Med-Low-BE-LA
- ○ Seq 4: Med-Low-LA-BE

Part I Basic information

Q2.2 What is your age (in years)?

_____

Q2.3 What gender do you most identify with?

- ○ Male
- ○ Female
- ○ Nonbinary
- ○ Not Listed _____
- ○ Prefer not to answer

Q2.4 Which of the following best describes your family heritage? Please select all that apply.

- ☐ White/Caucasian
- ☐ African American/Black
- ☐ American Indian/Alaska Native

- [ ] East Asian (e.g., Chinese, Japanese, Korean, Taiwanese)
- [ ] Filipina/o/x
- [ ] Southeast Asian (e.g., Cambodian, Vietnamese, Hmong)
- [ ] South Asian (e.g., Indian, Pakistani, Nepalese, Sri Lankan)
- [ ] Other Asian
- [ ] Native Hawaiian/Pacific Islander
- [ ] Mexican American/Chicana/o/x
- [ ] Puerto Rican
- [ ] Central American
- [ ] South American
- [ ] Other Hispanic or Latina/o/x Other
- [ ] Other _____
- [ ] Prefer not to disclose

Q2.5 Which country are you from? Note: if you have dual nationality, please indicate where you are primarily from.

- ○ I am a domestic student
- ○ I am an international student; I am from _____

Q2.6 Which Clemson <u>school</u> or <u>department</u> are you in?

_____

Q3.1 In the past six months, how often did you visit urban parks on average?
(Urban parks: Parks located in cities, ranging from small neighborhood greenspaces, trails, and to larger parks with more amenities)

- ○ Almost daily

- ○ Several times a week
- ○ A few times a month
- ○ Occasionally/Once a month
- ○ Rarely/Never

Q3.2 What activities do you usually do in urban parks. Please select <u>all activities</u> that apply.

- ☐ Walking
- ☐ Dog Walking
- ☐ Nature recreation (e.g., fishing, gathering flowers, feeding animals, nature photography)
- ☐ Relaxing
- ☐ Exercise (e.g., running)
- ☐ Enjoying nature-outdoor (e.g., fresh air, open space)
- ☐ Bringing Kids
- ☐ Socializing (e.g., picnic, talking)
- ☐ Biking
- ☐ Arts & Culture
- ☐ Sports-Recreation (e.g., soccer)
- ☐ Other _____

Q3.3 How important are the following reasons in explaining why you visit an urban park?

	Not at all	Slightly	Moderately	Very	Extremely
To spend time with family and/or friends	○	○	○	○	○
To rest, relax, and escape from city life	○	○	○	○	○
To exercise and be physically active	○	○	○	○	○

To discover and experience nature	○	○	○	○	○
To get to and from places I want to be	○	○	○	○	○
The park is close to my home/workplace/school or easy to access	○	○	○	○	○

Q3.4 Please rate the extent to which you agree with each statement. Please respond as you really feel, rather than how you think "most people" feel.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
My ideal vacation spot would be a remote, wilderness area.	○	○	○	○	○
I always think about how my actions affect the environment.	○	○	○	○	○
My connection to nature and the environment is a part of my spirituality.	○	○	○	○	○
I take notice of wildlife wherever I am.	○	○	○	○	○
My relationship to nature is an important part of who I am.	○	○	○	○	○
I feel very connected to all living things and the earth.	○	○	○	○	○

Part II

You will be evaluating 360° video scenes from various locations and times. The questions will be presented in the same order as the videos. You can also refer to the accompanying picture to help identify each video. When rating a scene, please consider your overall impression of each 360° video.

Note: In Qualtrics, the same questions as Q5.1-5.3 repeat for each video and for 8 times in total

Q5.1 Scene A - time 1 An entrance square (*Note: In Qualtrics this is an interactive 360 image*)

Q5.2 Please evaluate the video scene base on the following questions:

	Not at all	Slightly	Moderately	Very	Extremely
How willing would you be to visit this scene?	○	○	○	○	○
How safe and secure do you feel if you are in this scene alone?	○	○	○	○	○

Q5.3 How much does this statement apply to how I would experience the place?

	Not at all	Slightly	Moderately	Very	Extremely

That is a place which is away from everyday demands and where I would be able to relax and think about what interests me	○	○	○	○	○
That place is fascinating; it is large enough for me to discover and be curious about things	○	○	○	○	○
That is a place which is very large, with no restrictions to movements; it is a world of its own	○	○	○	○	○
In that place, it is easy to orient and move around so that I could do what I like	○	○	○	○	○

Note: In Qualtrics, the same questions as Q9.1 repeat for every 4 videos and for 2 times in total

Q9.1 To help us understand your ratings, please briefly describe 2-3 factors you considered when evaluating your willingness in visiting places within urban parks.

_____

_____

APPENDIX B

Table B-1 Mapping to AOI classes from ADE20k and Cityscapes Datasets

	ADE20K Classes Before Merge	Cityscapes Classes
Dynamic AOI (People)	2 - person, 117 - minibike, 128 - bicycle	12 - person, 13 - rider, 18 - motorcycle, 19 - bicycle
Static AOIs		
Greenery	17 - mountain, 73 - palm, 69 - hill, 107 - canopy, 5 - tree, 10 - grass, 14 - earth, 18 - plant, 30 - field, 47 - sand, 67 - flower, 95 – land	X
Sky	3 – sky	X
Water	22 - water, 61 - river, 114 - waterfall, 27 - sea, 129 – lake	X
Building	1 - wall, 2 - building, 6 - ceiling, 9 - window, 15 - door, 26 - house, 33 - fence, 39 - railing, 43 - column, 49 - skyscraper, 54 - stairs, 62 - bridge, 85 - tower, 87 - awning, 96 – bannister	X
Pavement	4 - floor, 7 - road, 12 - sidewalk, 35 - rock, 53 - path, 55 - runway, 60 - stairway, 141 – pier	X
Street Furniture	11 - cabinet, 32 - seat, 44 - signboard, 70 - bench, 88 - streetlight, 94 - pole, 105 - fountain, 133 - sculpture, 137 - traffic light, 139 - ashcan, 150 - flag	X

Note: Static AOIs from machine learning classification were used as the basis for manual annotation. The “people” AOI includes pixels classified as people from both datasets.

APPENDIX C

Table C-1. Variance Inflation Factors (VIF) for the linear mixed-effects model predicting willingness to visit.

DV	VIF Value
Visitor Density	1.602208
People	1.753736
Building	2.204798
Greenery	2.167801

APPENDIX D

Table D-1. Effects of Visitor Density on Willingness to Visit, Perceived Safety, and Restorativeness

	Willingness to Visit			Safety			Restorativeness		
Predictors	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*
(Intercept)	3.95 ***	0.12	3.72 – 4.19	3.93 ***	0.10	3.72 – 4.13	3.64 ***	0.15	3.35 – 3.94
Visitor density [More visitors]	-0.23 *	0.10	-0.43 – -0.03	0.02	0.09	-0.16 – 0.20	-0.34 ***	0.09	-0.51 – -0.17
Random Effects									
τ_{00}	0.25 $_{SubjectID}$			0.25 $_{SubjectID}$			0.43 $_{SubjectID}$		
	0.01 $_{Scene}$			0.00 $_{Scene}$			0.03 $_{Scene}$		
Marginal R^2 / Conditional R^2	0.013 / 0.269			0.000 / 0.291			0.028 / 0.465		

Notes: Analysis based on linear mixed effects models with participants and locations as random effects. Number of observations: 296; 37 participants; 4 locations. * *p<0.05* ** *p<0.01* *** *p<0.001*.

APPENDIX E

Table E-1. Effects of Visitor Density and Gender on Willingness to Visit, Perceived Safety, and Restorativeness

	Willingness to Visit			Safety			Restorativeness		
Predictors	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*
(Intercept)	3.94 ***	0.17	3.61 – 4.27	4.25 ***	0.15	3.96 – 4.54	3.55 ***	0.20	3.15 – 3.94
Visitor density [More visitors]	-0.40 **	0.15	-0.69 – -0.11	-0.25	0.13	-0.51 – 0.01	-0.39 **	0.13	-0.65 – -0.14
Gender [Female]	0.02	0.22	-0.40 – 0.45	-0.60 **	0.20	-1.00 – -0.20	0.17	0.25	-0.32 – 0.66
Visitor density [More visitors] × Gender [Female]	0.31	0.20	-0.08 – 0.70	0.50 **	0.18	0.15 – 0.85	0.10	0.17	-0.25 – 0.44
Random Effects									
τ_{00}	0.25 $_{SubjectID}$			0.23 $_{SubjectID}$			0.43 $_{SubjectID}$		
	0.01 $_{Scene}$			0.00 $_{Scene}$			0.03 $_{Scene}$		
Marginal R^2 / Conditional R^2	0.027 / 0.282			0.073 / NA			0.040 / 0.471		

Notes: Analysis based on linear mixed effects models with participants and locations as random effects. Number of observations: 296; 37 participants; 4 locations. * *p<0.05* ** *p<0.01* *** *p<0.001*.

APPENDIX F

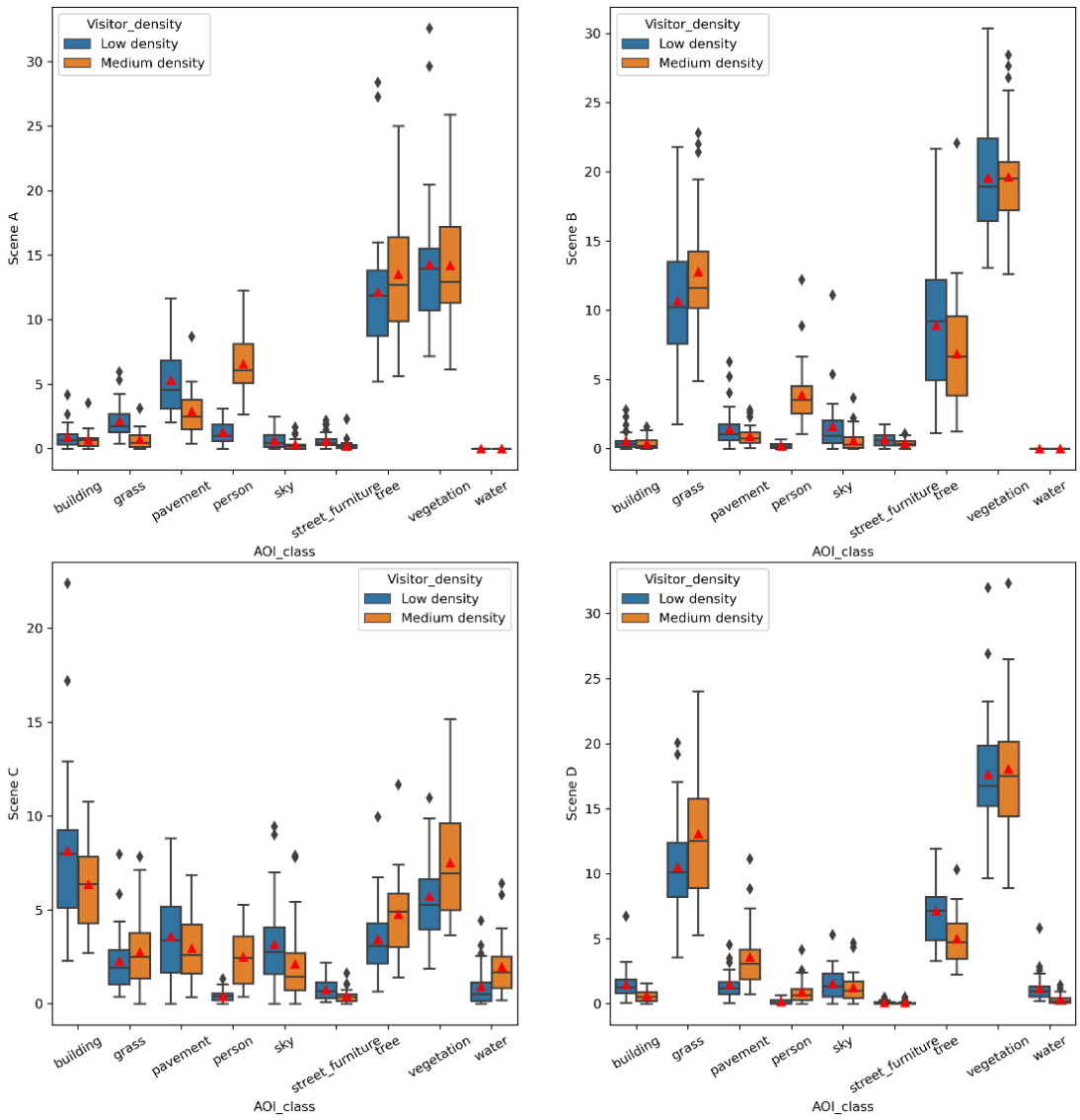

Figure F-1. Total Fixation Durations by Visitor Density for Each Video Location

APPENDIX G

Table G-1. Stepwise Analyses on Willingness to Visit, Predicted by Visitor Density and Fixation Durations (AOIs)

DV: Willingness to Visit	Model 1: Baseline			Model 2: Baseline + Total Fixation Duration on People			Model 3: Baseline + Total Fixation Durations on Greenery and Buildings			Model 4: Baseline + All Three Total Fixation Durations		
	b	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*
(Intercept)	4.00 ***	0.12	3.77 – 4.23	4.03 ***	0.11	3.81 – 4.24	4.15 ***	0.27	3.62 – 4.67	4.33 ***	0.27	3.80 – 4.87
Visitor density [Higher visitor density]	-0.24 *	0.11	-0.46 – -0.03	-0.08	0.14	-0.34 – 0.19	-0.24 *	0.11	-0.45 – -0.02	-0.05	0.14	-0.31 – 0.22
Total Fixation Duration on People				-0.06 *	0.03	-0.11 – -0.00				-0.07 *	0.03	-0.12 – -0.01
Total Fixation Duration on Buildings							0.00	0.02	-0.05 – 0.05	-0.01	0.02	-0.06 – 0.04
Total Fixation Duration on Greenery							-0.01	0.01	-0.04 – 0.02	-0.02	0.01	-0.05 – 0.01
Random Effects												
τ_{00}	0.20 $_{SubjectID}$			0.19 $_{SubjectID}$			0.20 $_{SubjectID}$			0.20 $_{SubjectID}$		
	0.01 $_{Scene}$			0.00 $_{Scene}$			0.01 $_{Scene}$			0.00 $_{Scene}$		
Marginal R^2 / Conditional R^2	0.015 / 0.224			0.029 / 0.226			0.021 / 0.226			0.051 / NA		

Notes: Analysis based on linear mixed effects models with participants and locations as random effects. Number of observations: 262; 33 participants; 4 locations. Three participants were removed due to inaccurate or missing eye-tracking data. * *p<0.05* ** *p<0.01* *** *p<0.001.*

Table G-2. Stepwise Analyses on Perceived Safety, Predicted by Visitor Density and Fixation Durations (AOIs)

DV: Perceived Safety	Model 1: Baseline			Model 2: Baseline + Total Fixation Duration on People			Model 3: Baseline + Total Fixation Durations on Greenery and Buildings			Model 4: Baseline + All Three Total Fixation Durations		
	b	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*
(Intercept)	3.93 ***	0.11	3.70 – 4.15	3.93 ***	0.11	3.70 – 4.15	3.93 ***	0.25	3.44 – 4.42	4.03 ***	0.27	3.51 – 4.56
Visitor density [Higher visitor density]	-0.03	0.10	-0.23 – 0.17	-0.03	0.10	-0.23 – 0.17	-0.02	0.10	-0.22 – 0.18	0.06	0.13	-0.19 – 0.31
Total Fixation Duration on People							0.01	0.02	-0.03 – 0.05	0.00	0.02	-0.05 – 0.05
Total Fixation Duration on Buildings							-0.00	0.01	-0.03 – 0.02	-0.01	0.01	-0.03 – 0.02
Total Fixation Duration on Greenery										-0.03	0.03	-0.08 – 0.02
Random Effects												
τ_{00}	0.26 $_{SubjectID}$			0.26 $_{SubjectID}$			0.26 $_{SubjectID}$			0.25 $_{SubjectID}$		
	0.00 $_{Scene}$			0.00 $_{Scene}$			0.00 $_{Scene}$			0.00 $_{Scene}$		
Marginal R^2 / Conditional R^2	0.000 / NA			0.000 / NA			0.002 / 0.282			0.008 / NA		

Notes: Analysis based on linear mixed effects models with participants and locations as random effects. Number of observations: 262; 33 participants; 4 locations. Three participants were removed due to inaccurate or missing eye-tracking data. * *p<0.05* ** *p<0.01* *** *p<0.001*.

Table G-3. Stepwise Analyses on Perceived Restorativeness, Predicted by Visitor Density and Fixation Durations (AOIs)

DV: Perceived Restorativeness	Model 1: Baseline			Model 2: Baseline + Total Fixation Duration on People			Model 3: Baseline + Total Fixation Durations on Greenery and Buildings			Model 4: Baseline + All Three Total Fixation Durations		
	b	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*	*b*	*SE*	*95% CI*
(Intercept)	3.66 ***	0.15	3.37 – 3.96	3.67 ***	0.15	3.37 – 3.97	3.67 ***	0.28	3.11 – 4.23	3.69 ***	0.30	3.11 – 4.28
Visitor density [Higher visitor density]	-0.35 ***	0.10	-0.54 – -0.16	-0.33 *	0.13	-0.59 – -0.08	-0.37 ***	0.10	-0.56 – -0.17	-0.34 **	0.13	-0.60 – -0.08
Total Fixation Duration on People				-0.01	0.03	-0.06 – 0.05				-0.01	0.03	-0.07 – 0.05
Total Fixation Duration on Buildings							-0.02	0.03	-0.07 – 0.03	-0.02	0.03	-0.07 – 0.03
Total Fixation Duration on Greenery							0.00	0.01	-0.02 – 0.03	0.00	0.01	-0.03 – 0.03
Random Effects												
τ_{00}	0.39 $_{SubjectID}$			0.39 $_{SubjectID}$			0.39 $_{SubjectID}$			0.39 $_{SubjectID}$		
	0.03 $_{Scene}$			0.03 $_{Scene}$			0.02 $_{Scene}$			0.02 $_{Scene}$		
Marginal R^2 / Conditional R^2	0.029 / 0.424			0.030 / 0.423			0.034 / 0.425			0.034 / 0.424		

Notes: Analysis based on linear mixed effects models with participants and locations as random effects. Number of observations: 262; 33 participants; 4 locations. Three participants were removed due to inaccurate or missing eye-tracking data. * *p<0.05* ** *p<0.01* *** *p<0.001*.

APPENDIX H

Table H-1. Country of Origin for Participants (N = 26)

Country	Count	Percentage
US	11	42.31%
Nigeria	4	15.38%
China	4	15.38%
Iran	2	7.69%
Ghana	1	3.85%
Germany	1	3.85%
India	1	3.85%
Mexico	1	3.85%
Nepal	1	3.85%

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