

Balancing Enclosure and Openness: Effect of Tree Spatial Features on Safety and Restorative Perceptions in Bandung Urban Parks

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ABSTRACT

Many urban spaces, including green areas, often fail to provide safety or relaxation, especially when enclosure elements are present. This study investigates the impact of the spatial configuration of trees, influenced by their density, arrangement, and scale, on visitors' perceptions of safety and restorativeness in urban parks. Data were collected by photographing selected parks, manipulating the photos into 12 different tree configurations, and distributing them in a questionnaire survey (N = 272). A one-way ANOVA was used to determine the significance of tree spatial features on perceived safety and restoration. The results reveal that tree configurations with high density, distant placement from pathways, and a medium-scale level foster the highest levels of perceived safety. In contrast, high-density and distant configurations with larger-scale trees maximize the sense of restoration. These findings highlight the key considerations for tree enclosures and management in urban parks in Bandung, aiming to provide safety and restorative potential during activities. This study contributes to the spatial composition of trees to achieve a balanced green enclosure, promoting prospect-refuge and restorative balance, which enhances visitors' comfort and spatial experiences.

INTRODUCTION

Recently, urban people with low mental health conditions due to overwhelming stimulations and information overload have increasingly sought refuge in social media and by sticking to their phones and scrolling through constantly streaming information. In contrast, others prefer to take refuge in additional outside activities to mitigate feelings of being overwhelmed. Korpela *et al.* (2010) emphasized reducing stress for urban residents as they usually experienced more severe stress than those in secluded areas due to their occupations, earnings, or other stressors, such as loud noise, waste management systems, and living in slum areas. In Indonesia, this urge should be learned seriously because 6.1% of the total population has depression, while only 9% of depressed people have sought care for the illness (Kementerian Kesehatan Republik Indonesia 2018). It means that some people might be unaware of their mental health, while others might express feelings of deprivation. Meanwhile, obtaining information on how to reduce stress without engaging in specific activities has a negligible impact on restoring mental health.

While many people seek stress-relieving activities, they often turn to urban parks for solace in green spaces to rejuvenate their mental state. However, some green spaces in Indonesia, specifically in Bandung, are abandoned, unused, and found in unsafe environments. Abandoned places would have a significant effect on inhabitants' perception of personal safety and the feeling of fear in their surroundings (Kurzi 2022) because the blocked view has a significant impact on perceived openness and visual accessibility. Meanwhile, visual restriction in green spaces is correlated with the perception of refuge or hidden places (Appleton 1984) and a prospect or the possibility of predicting upcoming events (Rutledge 1985). Those factors are

related to the spatial composition of green areas, which contribute to personal safety and well-being. High-prospect and low-refuge spaces are more desirable for visitors to promote safety in urban forests than low-prospect and high-refuge areas (Jansson *et al.* 2013; Akbar *et al.* 2025) and panoramic view with clear prospects would foster visitors' perceived safety (El-Metwally *et al.* 2021). Meanwhile, some studies argued that visitors prefer enclosed green spaces with medium density to do recreational activities for relaxing (Bjerke *et al.* 2006) and fostering the feeling of restoration (Hauru *et al.* 2012; Chiang *et al.* 2017; Tabrizian *et al.* 2018). On the other hand, this dichotomous perspective leads to some unanswered questions about the extent to which green enclosures should foster benefits for visitors and obstruct the feeling of fear in public areas.

People prefer to use green spaces as public places for rejuvenating and relaxing from daily stress because they have many components, such as vegetation, water sources, and sky, that can restore depleted attention resources (Li *et al.* 2023). Green elements, such as trees, grass, and bushes, constitute the spatial composition in green areas. Although the park's biodiversity promotes mental restoration potential, the tree composition and enclosure have been the main issues for this potential, as they can control people's perceived safety (Stamps III 2005; Jansson *et al.* 2013; Hashim *et al.* 2016) and restorative feeling (Milligan and Bingley 2007; Chiang *et al.* 2017; Tomao *et al.* 2018). Most studies on tree enclosures have demonstrated the green composition by considering tree density in relation to mental restoration, while other factors, such as tree scale, arrangement, and characteristics or morphology, have been rarely discussed. While tree density may enhance the feeling of fear, other factors also contribute to the perception of the enclosure, creating horizontal and vertical boundaries (Stamps III 2011), and can impact people's affective and cognitive

responses (Stamps III 2005). Therefore, the extent to which the spatial configuration of trees, including density, scale, and arrangement, influences perceived safety and restorativeness is a crucial consideration in park studies and park management.

Kaplan dan Kaplan (1989) reported four key elements of nature contributing to regenerative people's physiology, called restoration factors, that could only be obtained by people-nature interaction to release negative emotion. Those factors are 1) *fascination*, a space with lots or a medium amount of information and complexity, and an emerging mystery (Herzog and Bryce 2007); 2) *being away*, an escape place from daily routine, and is perceived in a distinct context (Gidlof-Gunnarsson and Ohrstrom 2007; Van den Berg *et al.* 2010); 3) *coherence (extent)*, a place with a great deal of distraction (Hartig *et al.* 1997) that is perceived as in a whole different world, and 4) *compatibility*, a place where people feel they belong and suit their personality (Kaplan and Kaplan 1989; Hartig *et al.* 1997). Previous studies used fascination and being away attributes to measure restorative qualities in green spaces (Hauru *et al.* 2012; Lindal and Hartig 2015) contributing to relaxation, while others used the overall perceived restorativeness attribute to predict restoration effects (Gatersleben and Andrews 2013; Jiang *et al.* 2014; Tabrizian *et al.* 2018). Other studies have revealed that the combination of tree enclosures is perceived as either restorative or non-restorative environments, based on respondents' responses (Bachtiar *et al.* 2021). Only a few studies have revealed how all factors of the restorative environment contribute to people's perceived restorativeness, and this has not been sufficiently explained.

The relationship between tree configuration, perceived safety, and restorative has not yet been fully understood. The high density of greenery could promote stress relief and align with perceived restorativeness (Chiang *et al.* 2017). In contrast, this process could also be blocked by the dark atmosphere in the green areas that intensifies stress (Milligan and Bingley 2007). Dark green areas would decrease restoration impact and raise attention fatigue (Gatersleben and Andrews 2013), so people tend to focus on the surrounding area. Likewise, green areas with low prospects and high refuge also decline in perceived safety (Gatersleben and Andrews 2013). However, some studies suggest that the low density of greenery and exposure to urban areas are perceived as low restorative places due to the lack of green element variations. People also obtained the highest perceived safety in high-prospect areas with no refuge space, whether in woodlands (Jansson *et al.* 2013; Tyrväinen *et al.* 2014) or the city center (El-Metwally *et al.* 2021). According to previous studies, the configuration of greenery plays a significant role in determining perceived safety and restoration.

This study examines how the enclosure configurations of trees, based on density, scale, and arrangement, foster restoration and maintain perceived safety in urban parks. Density, scale, and arrangement are critical factors in determining tree enclosure, as previous studies have not considered these attributes in a single experiment. We proposed a research hypothesis (H_1): *The configuration of medium density, far arrangement from the walkway, and medium-level scale of trees in green spaces significantly influences visitors' perceived safety and restoration.* This hypothesis will be examined



Figure 1. Spot photo collection in Maluku Park, Bandung



Figure 2. Spot photo collection in Lalu Lintas Park, Bandung



Figure 4. Spot photo collection in Cilaki Park, Bandung

through quasi-experimental research, which will employ adjustment factors related to tree configuration in the settings. The results of this study can be considered a guideline for planning and planting tree arrangements in urban parks to maximize tree performance in restoring people's mental capacity.

METHODS

This quasi-experimental study design combined both experimental and non-experimental study designs (Kumar 2005), which controlled some factors related to visual restoration and safety environments, and observed other factors through visitors' perspectives to examine their correlation with these factors.

Research Design

Site Location

This study was conducted by collecting samples from urban parks in Bandung, one of Indonesia's largest cities. Recently, Bandung has gained recognition for its rapid development in public facilities, particularly in urban green spaces, through diverse theme park designs and the introduction of new green experiences. To determine the quasi-experiment, sample attributes such as medium enclosure, variety of green elements, vegetation index, and field observation were used to eliminate the settings. Of 23 parks in Bandung, only three parks were used as samples for base green background photos. Those parks were Maluku Park (Figure 1), Lalu Lintas Park (Figure 2), and Cilaki Park (Figure 3), located in the Bandung city center. All parks had unique characteristics, but some spots matched study-determined factors, such as no exposure to urban life, no fences, no contour, availability of pedestrian ways, diffused sunlight, park facilities, and a diversity of landscape elements (ground cover,

shrubs, and trees). Then, we took two photo spots in each park at noon to represent the quality of green space performance in safety and restoration.

Photo Editing for Tree Enclosure

We took as many photos as possible to discern the similarities in condition, greenery, and perceived quality of atmosphere from the photos. Those photos were collected at midday in February 2020 to perform sunlight diffusing to the inner side of each sample point. All images were captured with a DSLR camera, featuring a resolution of 300 dpi and a dimension of 6016 x 4000 pixels, to ensure the clarity of objects and green elements in the environment. We obtained more than 20 photos of each park, and then we selected two photos from each spot to be sent for photo editing to add controlled green element factors (Figure 4-6).

Then, the edited photos were processed by adding native trees as a factor that determined the tree enclosure and by incorporating a walking person as a scale comparison to the images. Some native trees are chosen based on tree data in each park. Husodo *et al.* (2014) organized trees in Bandung parks based on height level, called a stratum. Therefore, we chose a tree in Stratum C, which had a height of around 4-20 meters, for scale modification. We also chose the likelihood similarity of tree morphology as an independent factor for tree density. Based on these circumstances, we suggested adding native trees in each park, such as the Ketapang Kencana tree (*Terminalia mantaly* sp.) for Maluku Park, the Nyamplung tree (*Calophyllum inophyllum* sp.) for Lalu Lintas Park, and the Jambu air tree (*Syzigium aqueum* sp.) for Cilaki Park.

This study had three leading indicators for tree enclosure: density, scale, and arrangement. We proposed two indicators for density (medium and high density), three indicators for scale or height (low, medium, and high), and two indicators for tree arrangement (far and nearby). Therefore,

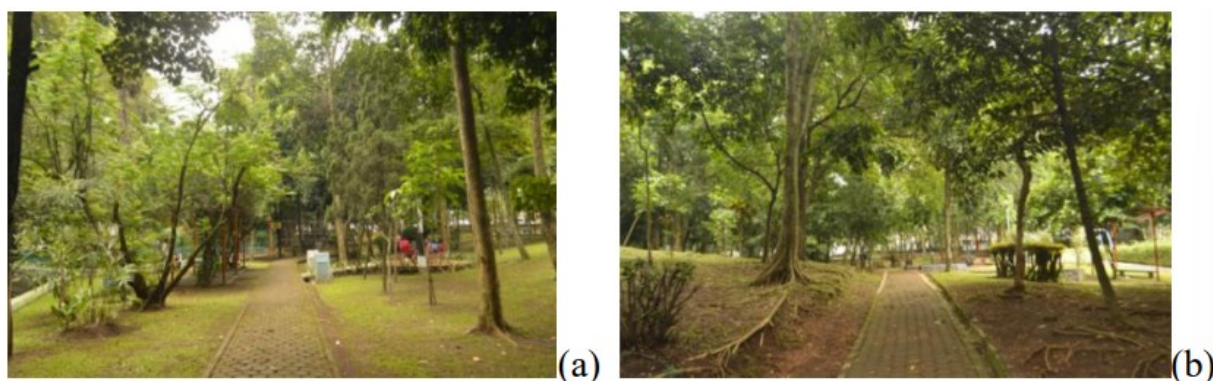


Figure 3. The selected base background photos from (a) A and (b) B spots in Maluku Park



Figure 5. The selected base background photos from (a) C and (b) D spots in Lalu Lintas Park

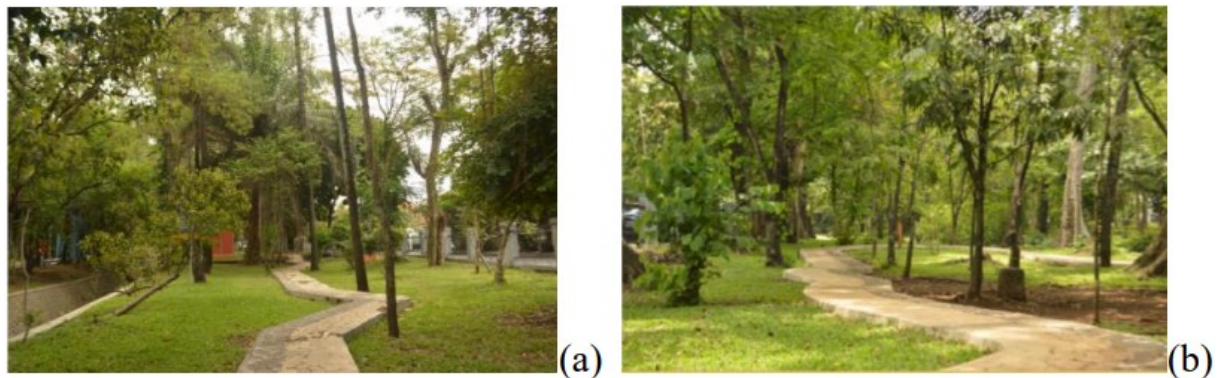


Figure 6. The selected base background photos from (a) E and (b) F spots in Cilaki Park

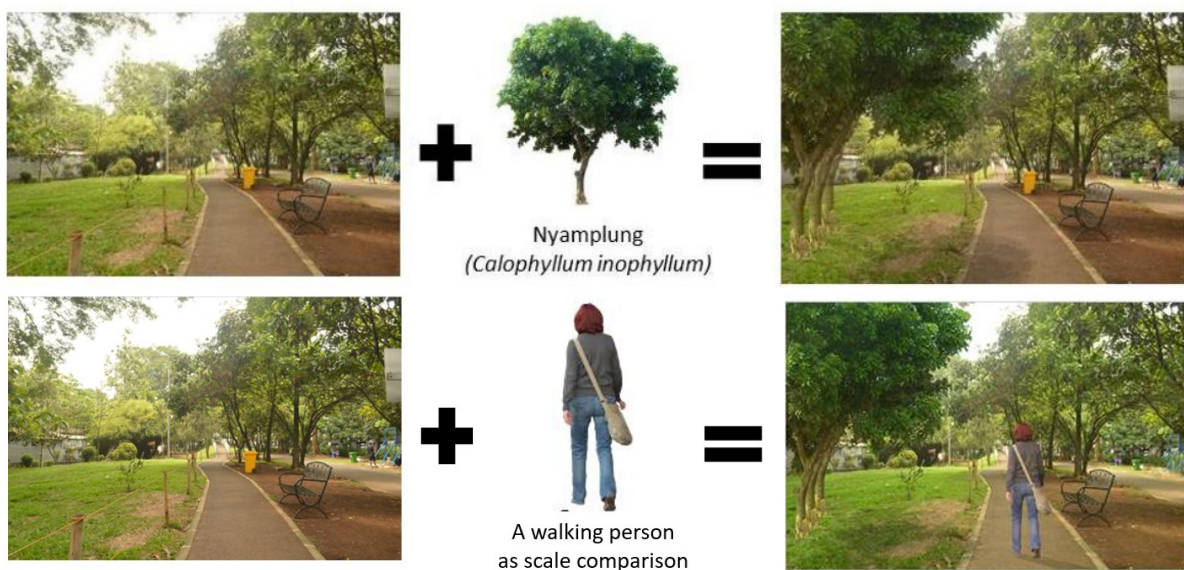


Figure 7. Photo editing by adding a tree enclosure indicator and a walking person in a pedestrian way

this study proposed 12 tree configurations in each spot as one photo had three different indicators; for instance, one photo included a tree enclosure with high density, medium-level (scale), and located near a pedestrian way (arrangement) (Figure 7). Then, the photo was added with a walking person as a scale object (Figure 7). The final editing result included 12 configuration photos of tree enclosures, which would be shown to participants randomly, and they were required to complete questions regarding safety and restoration (Figure 8). Therefore, this study consisted of 72 different photos, each containing 12 pictures, in each spot.

Those photos were randomly selected to post on each questionnaire, so each respondent was shown only six randomly chosen images. We limited the photos to avoid respondents' bias and fatigue in answering the questions. This method gave us 12 questionnaire types with six spots and 72

random tree enclosure combinations. Each respondent completed a kind of questionnaire and answered it once for some questions related to perceived restorativeness, developed by Korpela (1991), and some questions about perceived safety.

Before filling in the form, respondents are encouraged to imagine themselves walking alone by giving a scenario: "Imagine when you are in the park, and it is midday, you are walking through the pedestrian way alone in urban parks Bandung. At that time, you feel exhausted because you have put all your concentration into your work. Moreover, right now, you are walking and looking for somewhere in the park to sit and rest for a while before going to work again" (Nordh *et al.* 2009). This scenario was previously used to describe the atmosphere and type of activity in the parks based on the researchers' intention. This method was used in landscape studies (Bjerke *et al.* 2006; Hauru *et al.* 2012; Lindal and Hartig 2015; Tabrizian *et al.* 2018; Liu and Schroth 2019) to reduce the bias from respondents' perspectives.



Figure 8. Tree enclosure indicators based on density, scale, and arrangement

After that, respondents were asked to complete a form with seven questions regarding demographics, five questions about park daily usage, seven questions about perceived safety, and 15 questions about perceived restorativeness. For image questions, respondents were asked to give their attention to each photo for 10 seconds before answering. All the image questions were on a 7-point Likert scale, with one scale for 'strongly disagree' and seven scales for 'strongly agree', which were completed in approximately 10 minutes. Then, they assessed the remaining images with different spatial features.

Data Collection Method

The data collection from questionnaires took place over three weeks, from March 15 to April 4, 2020. The questionnaires were distributed directly to visitors sitting in the parks and indirectly by providing some in-relation individuals with a link to access the questionnaires online. The sample of this study was conducted by snowball sampling, in which one person gave the link to other people based on their relationships (Kumar 2005), and by accidental sampling, in which the surveyors met the people in the park accidentally.

The respondents were over 17 years old and had visited the park in Bandung City at least once. The total number of respondents was 272 people, with the ratio of women and men is 2:1. Most of the respondents are students (48.90%), some of them are workers as lecturers (5.51%), in architecture firms or consultants (3.58%), entrepreneurs (9.56%), civil servants (3.31%), and other (29.04%). Additionally, they had diverse educational backgrounds, with most being undergraduates (57.72%), followed by graduates (25.37%), high school graduates (15.44%), primary school graduates (1.10%), and diploma holders (0.37%), respectively.

Of all three parks, respondents were more familiar with visiting Lalu Lintas parks than other parks, accounting for 43.01%. They rarely visited other parks, such as Maluku and Cilaki parks, which account for 33.09% and 30.51%, respectively, for various reasons. Meanwhile, some respondents also frequently visit other spaces in Bandung, such as Balai Kota Park, Ganesha Park, and Vanda Park,

among others. The data revealed that some respondents had experienced spatial environments in Bandung green spaces, which may have influenced their perception of the atmosphere depicted in the photos presented in this study.

Data Analysis Method

The data collected from respondents were normally distributed with a mean range of 4.54 to 4.95, and the diagrams showed some negative skew for restoration and safety factors. However, we analyzed the validity and reliability of each factor and found that all factors had a Cronbach's alpha (α) value greater than 0.9, indicating the reliability of the instruments was excellent and could be used for this research (Table 1).

Table 1. The result of cronbach's alpha value of the instruments

Items	α value
<i>Perceived Safety</i>	0.9145
1. The surrounding area appears spacious	0.9090
2. Trees are well-organized and well-maintained	0.9103
3. The visibility of tree lines remains unobstructed	0.8956
4. I feel safe when walking through the area	0.8951
5. There are no trees obstructing the view	0.8957
6. There are no hiding places in the area	0.9032
7. I experience no sense of threat	0.9017
<i>Perceived Restorativeness</i>	0.9479
<i>Fascination</i>	
1. There are interesting views I can enjoy here	0.9438
2. I want to explore the area further	0.9430
3. I want to spend extended time here	0.9421
4. I have an interest in a landscape element	0.9441
<i>Being Away</i>	
1. I feel free from daily routines	0.9419
2. I have a new experience to escape from routine	0.9429
3. I feel able to rest from daily routines here	0.9419
<i>Extent</i>	
1. The surrounding area is complex or diverse	0.9469
2. There are no disturbing elements that cause disorientation	0.9581

Table 1. The result of cronbach's alpha value of the instruments

Items	α value
3. I perceive unity among landscape elements	0.9436
Compatibility	
1. I can engage in activities of my own desire	0.9430
2. I feel this place belongs to me	0.9451
3. I can engage in self-reflection while in here	0.9422
4. I feel highly compatible with this environment	0.9417
5. I enjoy the time spent in this place	0.9413

We used one-way ANOVA (analysis of variance) to identify significant differences between factors in tree enclosures and conducted a means comparison between overall perceived safety and restorativeness to predict the best tree combination for safety and restoration performance. If the p-value of the mean differences was less than 0.05 (<0.05), we assumed that 95% of respondents reported a significant difference in visitors' perception regarding the factor. After analyzing each factor using one-way ANOVA, we employed mean comparison to identify the optimal tree combination factors for maximum safety and restoration. All analyses will be conducted using JMP Pro version 13 software. The output of this study will be the criteria for tree spatial configuration that enhance perceived safety and restorativeness.

RESULT AND DISCUSSION

The impact of tree enclosure features on perceived safety

Three main factors in this study were identified as determining safety in green spaces: tree density, arrangement or position, and scale or height. Those attributes had different spatial configurations that might affect perceived safety in place-people relationships. Some studies suggested that high vegetation density correlated with negative impacts on the preference to visit green spaces (Lis and Iwankowski 2021), and it also lowered perceived safety, as density could create darker spaces in woodland areas (Gatersleben and Andrews 2013).

However, this study used two density levels, with medium (2 trees on one side) and high density (3 trees on one side), to compare their effects on safety. Previous studies have employed various spatial configurations to assess vegetation density, particularly in restoration studies; however, most have not prioritized safety as a primary factor. Therefore, based on Figure 9, there is no notable difference between medium and high density in terms of perceived safety (p-value = 0.6907). This finding challenges the assumption that high and medium density do not have distinct effects on perceived safety, whereas previously reported that higher environmental enclosure did compromise perceived safety (Tabrizian *et al.* 2018) as it served a darker space inside the green spaces (Gatersleben and Andrews 2013). However, the study did not consider lighting as a safety factor, although we added more trees to the picture for different density types. Gatersleben and Andrews (2013) examined the perception of safety by real picture evaluation in the forest, while Tabrizian *et al.* (2018) examined it through experimental panoramic pictures in a spacious urban park, where the perception showed dissimilar results with this finding. Hence, the green space condition and the lightning effect on pictures can significantly influence the perceived safety in picture evaluations.

In addition, perceived safety was also depicted through the arrangement of trees, as indicated by the distance of the trees from the person walking in the photos. This study suggested two parameters for tree arrangements: those

located far away (approximately 2.0 m) and those near the pathway (approximately 0.5 m). Previously, Tabrizian *et al.* (2018) used a tree arrangement for 1-sided, 2-sided, and 4-sided to determine safety in square green space and found that an increase in spatial arrangement could drop perceived restorativeness. Still, no studies have revealed its relation to safety. As this study used only one 1-sided, the spatial distance variation from the pathway was determined by tree arrangement. Figure 10 illustrates a significant gap between two parameters related to safety, where the far trees from the pathway are perceived as fostering more safety in green areas than the near trees (p-value = 0.0054). This finding supports other studies that reported a clear view with high prospect enhanced visibility to forecast the upcoming events in the surroundings (Rutledge 1985), which promotes safety in dense green areas (Jansson *et al.* 2013). The far trees create a spacious and open area, decreasing the feeling of enclosure on the walkway (Tara *et al.* 2019) and allowing visitors to enjoy walking without fear of hiding places.

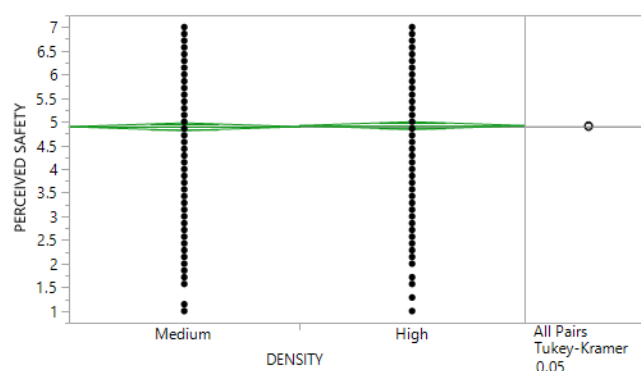


Figure 9. Types of tree density influencing visitors' perceived safety

In addition to this study, the low-level tree was perceived as unsafe because it blocked the visual connection to the surrounding area (low prospect) and fostered the perception of hidden spaces behind the trees (high refuge) (Figure 11). The scale was related to tree canopy height; a low-level tree had its leaves blocking people's vision, and a high-level tree had a canopy above the height of ordinary people. However, the finding elucidated that high-scale trees were preferable to embed in urban spaces, particularly those near pathways (p-value = 0.0061). The result extends previous studies that the vertical scale would have more impact on the feeling of enclosure than the horizontal scale (Stamps III 2011). That suggests dense trees, as vertical elements, should be planted far from the walkway to undermine the enclosure perception by enhancing high prospect and low refuge in pathway areas. Although the tree scale varies as it grows taller, regulating trees with various canopy heights was essential for creating a safe environment within parks.

The finding showed that tree spatial enclosure significantly impacted perceived safety, particularly in relation to tree position and canopy level. In contrast, density did not play a leading role in defining tree enclosure for perceived safety, as some people can adapt to medium to high densities. In Bandung urban park contexts, many parks have high to low tree density that may influence how people responded in this study. They also may perceive urban parks as safe places to do any activities solely and limited information about vandalism in parks. However, some spots of parks should be evaluated to enhance a greater visual connection, but less exposure to urban areas was preferable for fostering maximum perceived safety.

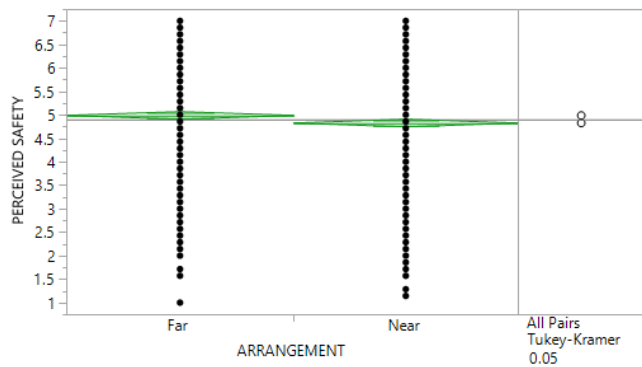


Figure 10. Types of tree position influencing visitors' perceived safety

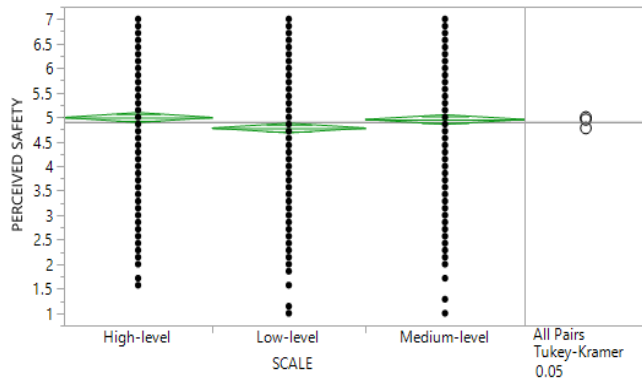


Figure 11. Types of tree scale influencing visitors' perceived safety

The impact of tree enclosure features on perceived restorativeness

Previous studies found that being in a woodland area boosted the feeling of rejuvenation (Chiang *et al.* 2017) and lessened fatigue, as the enclosure to the urban scape significantly impacted restoration (Jiang *et al.* 2014). However, the finding shows that variation in tree density has no different impact on visitors' restoration, as medium and high densities had the same influence on perception ($p\text{-value} = 0.1470$) (Figure 12). This finding extends a previous study on the increasing rate of stress recovery, which remained constant at densities ranging from 24% to 34%, and the process became slower for densities above 34% (Jiang *et al.* 2014). The effect of medium to high density in restoration did not show a significant difference, as there was no notable change in the given environment. Although the visitors may perceive the medium density of tree enclosure as slightly better to give the restorative benefit, as not too dense a closure view of the urban matrix (Hauru *et al.* 2012), the significance of the high-density restoration benefit is not remarkably different.

Variety in tree position did not compromise the influence on perceived restorativeness. The visitors' recognition of the tree arrangement, whether it was located far or near the pathway, did not have a notable impact on creating a restorative effect ($p\text{-value} = 0.0806$). Based on Figure 13, there was a subtle difference in restoration likelihood, but it was still insignificant. In addition, people may prefer a far tree arrangement from the walkway inside the parks, as it provides a slightly better perception than the near one. It also suggests that a tree located far from sight and captured in low density was preferable in woodland (Hauru *et al.* 2012), as it boosted the feeling of relaxation to an extent.

Furthermore, the variety of vegetation scales in green spaces did not align with restoration likelihood ($p\text{-value} = 0.2643$), as the variation in tree height was perceived to have the

same restorative value (Figure 14). While planted trees and buildings are elements of the built environment, people have different responses toward these. A Study by Lindal dan Hartig (2013) reported that the variation in building height significantly contributes to perceived restorativeness in neighborhood areas, while this study suggests that the variation in tree height does not comprise the variety of restoration benefits to visitors. Although the vertical height can influence the sense of safety, it has no impact on restoration. However, people tended to feel relaxed in a variety of tree heights.

The finding suggested that visitors felt relaxed and rejuvenated in all the given environmental images, without any intervention on the tree enclosure components. They can not distinguish the positive-negative or distinct impacts of tree spatial enclosures on self-reported restoration, as all restorative elements (grass, bushes, and trees) were included in those photos, and they felt comfortable with the view. The findings contradict previous research, which highlighted the necessity of accounting for tree densities inside parks to boost the restoration impacts, where high density is perceived as a

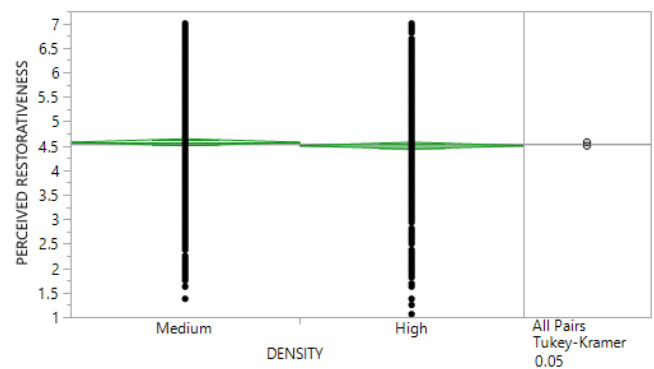


Figure 12. Types of tree density influencing visitors' restoration

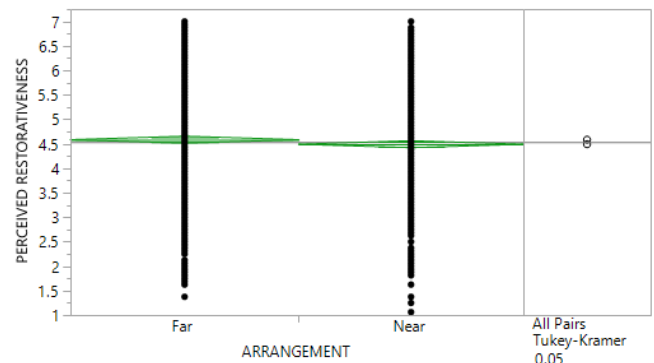


Figure 13. Types of tree position influencing visitors' restoration

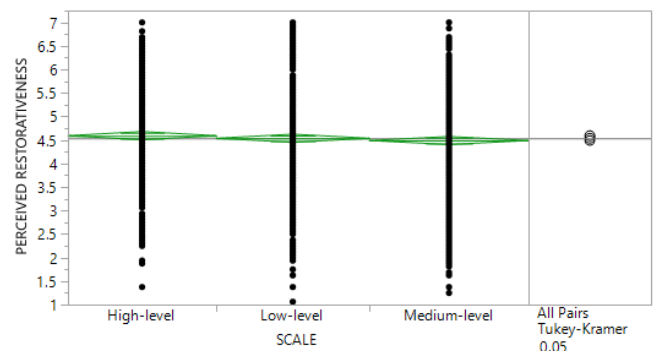


Figure 14. Types of tree scale influencing visitors' restoration

stressful environment and preferred over medium density in green areas (Jiang *et al.* 2015; Chiang *et al.* 2017). This study also highlights the importance of considering the variety of tree enclosures for achieving the highest restorative potential in green areas.

The spatial configuration criteria for feeling safe and restorative in green spaces

The composure of density, position, and scale established spatial configuration criteria for tree composition in green areas. Based on one-way ANOVA analysis, some enclosure factors are not perceived as different by people for safety and restorative, as the edited pictures show equal quality on both safety and restorativeness. Table 2 shows the F-value and p-value results for factor significance, as the F-ratio is used to measure and test observed variation between group variation and random variance in each group, and the p-value is used to determine the results by providing significance. Although the position and scale show statistically significant differences in their influence on safety, the very small effect size for the η^2 value indicates limited practical significance. However, this result contributes to the safe and restorative theory in urban parks, particularly for tropical landscapes in Indonesia.

Table 2. The summary of key one-way ANOVA for safety

Items	Effect-size (η^2)	F-value	p-value
Density – safety	0.00010	0.1584	0.6907
Position – safety	0.00475	7.7519	0.0054*
Scale – safety	0.00627	5.1191	0.0061*
Density – restoration	0.00129	2.1051	0.1470
Position – restoration	0.00188	3.0558	0.0806
Scale – restoration	0.00164	1.3316	0.2643

Note = * significance; as p-value < 0.05

However, the spatial configuration of tree enclosures is necessary for enhancing the quality of green areas and for planting management inside urban parks, although some determining factors are not significantly different as perceived by visitors. The requirements for a safe and restorative environment in an enclosed space differ; as the restoration means increase, the safety means decrease, but only by a subtle difference. Based on the findings in Figure 15, a **safe**

environment criterion consists of a high, far, or medium-level enclosure, while a **restorative environment** requires a high, far, or high-level enclosure. A proposed safe environment required a spatial configuration with high tree density, arranged far from the pathway, and a tree canopy at a height just above people's heads (Figures 16-17). In contrast, a proposed guideline for a restorative environment was designed through a tree configuration with high tree density, positioned far from the pedestrian walkway, and featuring a tree canopy that is way above people's height (Figures 18-19). The key dissimilarity between restorative and safety spaces was on the tree scale, which requires high-scale trees for restoration and medium-scale trees for safety. However, to bridge the feeling of safety and restorativeness, a medium-density tree configuration arranged near a pathway and a tree height way above people is the best alternative (Figure 15). Then, the new formula for the tree enclosure would provide additional prospects and a sense of relaxation in the green area.

The tree configuration for the highest perceived safety has slightly distinct criteria, with a restoration effect, such as a medium level of tree scale, which intensifies safety more than the restoration effect. Figure 16 depicts a tree spatial combination that enhances safety, characterized by high density in a far arrangement from the pathway and at a medium-scale tree level. High density was perceived as safe because the tree was located far enough to be out of sight and did not obscure the surrounding vertical and horizontal views, which encouraged the prospect visually. Moreover, medium-scale trees were also preferable for achieving a sense of safety, as they were perceived to maintain a human scale and not become a dominating factor in green areas (Bachtar *et al.* 2021). Prospect and refuge in green spaces were attainable as a person could walk easily without obstructions.

As perceived safety is a necessary factor in urban parks to foster restorative benefits besides green and blue attributes, living animals, and space and activities (Azmi *et al.* 2025), its role remains obscure in previous literature for Indonesian urban park contexts. Some studies reported the visitors' vandalism inside parks, as many areas were enclosed and had low surveillance (Utaminigtyas *et al.* 2012; Ainun *et al.* 2018; Witami *et al.* 2018), but they rarely discussed to what extent some visitors perceived the space as closed, particularly for green element designs that are often neglected due to safety

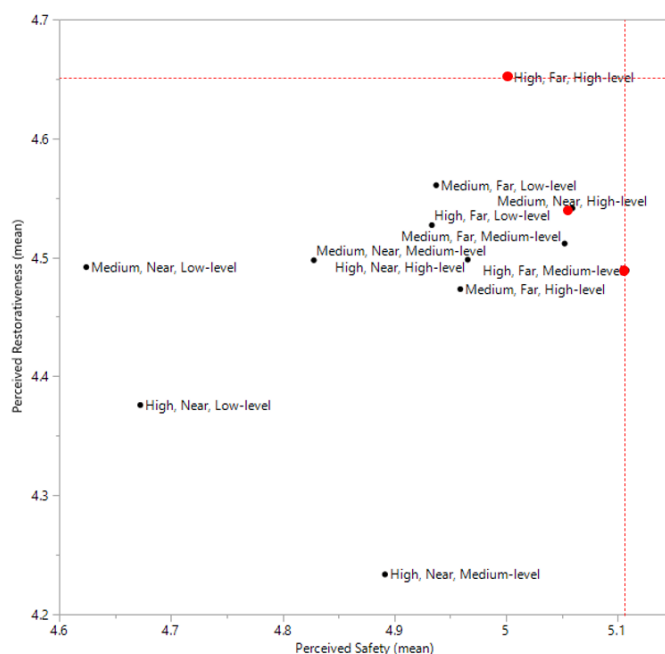


Figure 15. Tree spatial configuration for the highest perceived level of restorativeness and safety



Figure 16. Tree spatial configuration for the highest level of perceived safety

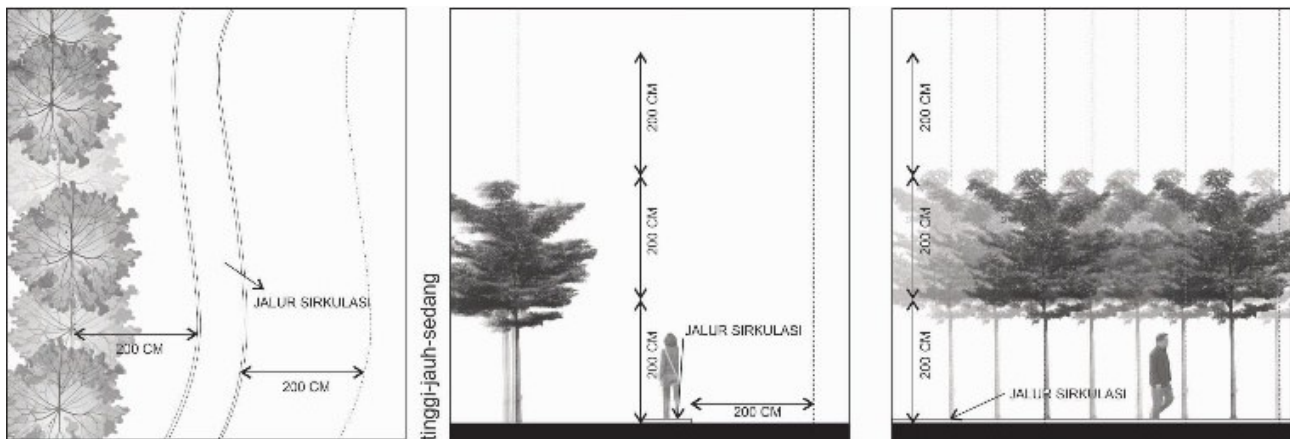


Figure 17. The composition of the tree enclosure for ideal perceived safety inside the parks

concerns. This study extends the Indonesian urban parks literature to the criterion of tree enclosure inside green areas, where a walkway with a clear view of the surroundings is perceived as safe, by combining high density, a far position, and a medium scale of tree height (Figure 17). As this study only focuses on trees as one green element influencing safety, further research is needed to include other green elements in safety perception.

Additionally, the tree configuration with the highest restorative effect is illustrated in Figure 18-19. With high and dense trees blocking the surrounding view, people felt as if they were in a green space or another world and tended to focus on the greenery and its complexity. In addition to greenery, the composition of enclosed and open areas also matters in determining restorative potential (Azmi *et al.* 2025). A high dose of greenery is supplied in areas with high tree density. Tabrizian *et al.* (2018) stated that green density was fostered to achieve the highest restoration effect without compromising perceived safety. In addition, being located far away from the pathway also imbued a restoration effect, as the trees did not impede the view, which also aligned with previous studies (Hauru *et al.* 2012). Additionally, the tree height could become uncontrolled over time; however, trees with high-level scale categories are recommended to be planted far from the pathway for mental rejuvenation benefits.

The restorative environment demands high trees over other scales, as it creates a forest-like atmosphere with well-maintained green elements (Azmi *et al.* 2025). Although

different combinations are provided in this study, all pictures are perceived as restorative environments because they all feature the main green elements (Bachtiar *et al.* 2021), and people hardly differentiate between them precisely. Besides nature, the other equipment for activities is also needed to do outdoor activities, so that they can feel safe and do many activities they like for compatibility experience with green areas (Yakınlar dan Akpınar 2022). While this study only uses tree compositions as the main element, other park features should be included in further research.

Furthermore, this study partially extends the knowledge of how the criteria for spatial configuration, particularly for trees in green spaces, should be arranged or designed, as illustrated in case studies from Indonesia. Some previous studies evaluated green space facilities or characteristics aligned with their support of therapeutic experiences (Hidayah dan Pramukanto 2011), visitors' sense of place, and their duration of stay in parks (Bachtiar dan Kusuma 2019), and visitors' thermal comfort for outdoor activities which trees play a significant role in determining visitors' perceived thermal condition (Mariski *et al.* 2017). This study utilized tree configuration as the primary attribute that impacts visitors' psychological perception of restoration benefits, aiming to extend the understanding of the therapeutic experience, and restoration benefits.

In addition, some studies reported that green spaces in Indonesia were not well-maintained and not well-designed based on observation and human perception inquiry (Hidayah



Figure 18. Tree spatial configuration for the highest level of perceived restorativeness

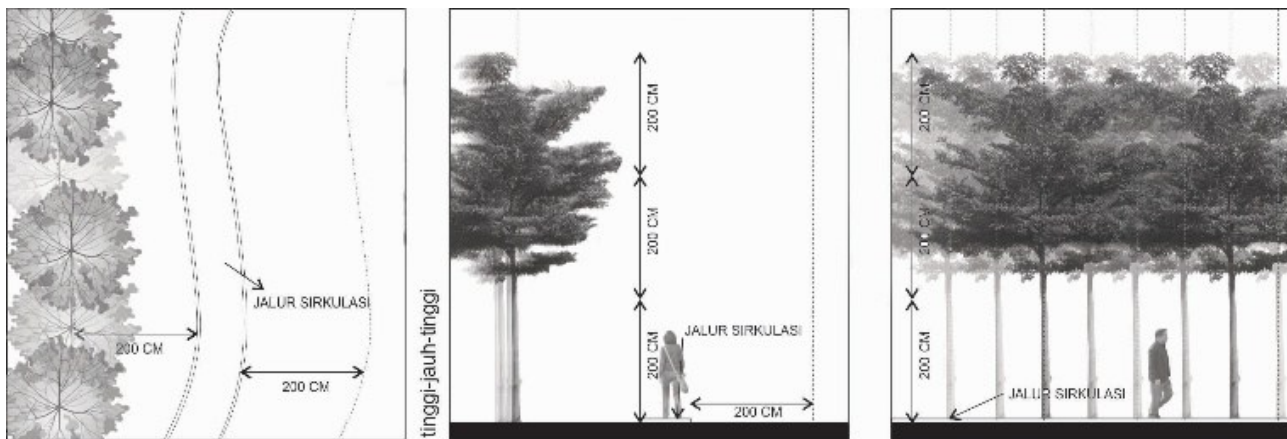


Figure 19. The composition of the tree enclosure for ideal perceived restorativeness inside the parks

dan Pramukanto 2011; Suciyan *et al.* 2023). Although there is a guideline on how to count park workers and their skills according to park size areas, some strategies are needed to maintain urban parks by considering hardscape maintenance and softscape ecological processes (Pertami *et al.* 2021; Faisal *et al.* 2022). This study also contributes to how the spatial design of trees in urban parks should be designed and maintained to foster restorative experiences

Some parks were typically used only on weekends or for business and culinary purposes, providing visitors with no spatial value or mental well-being benefits. Moreover, some government regulations also failed to consider the impact of park development on visitors or local communities, which could weaken the bond between people and place and hinder motivation to visit parks. Urban parks were often developed with more grey areas and were rarely concerned with nature's life and conservation. Therefore, designing parks with more value for livable spaces could sustain parks and visitors in the future. Conserving parks by maintaining user activity, providing restorative and safe places for visitors, and promoting green practices and mental rejuvenation could foster a healthy lifestyle in Indonesia.

However, this study still has some limitations that suggest further research directions. First, visitors' marks in the given images and questionnaires were used to judge the value of perceived restorativeness and safety, although we conducted validity analysis before using the primary source data. However, the marking through images still has

limitations compared to the original situation, as being in parks also involves other visitors, sounds, and distractions. Further study should be conducted in an in-site questionnaire to obtain a real restorative experience in the parks. Second, this study analyzed the perceptual statistical data collected from people's perceptions; further studies are encouraged to obtain more direct observed data from the site for greater objectivity in data collection. Third, the study of perceived safety and its relationship to perceived restorativeness has not yet been fully established, and further studies are encouraged to explore this area with various factors affecting green spaces, particularly in Indonesian contexts. Many green elements were not explored in this study, while they may play significant roles in determining safety and restoration. However, this study contributed to improving the quality of greenery in Indonesia's development and designing more sustainable urban parks. Further studies on mental restoration and safety concerns were called to address the gap in Indonesia's landscape studies.

CONCLUSION AND RECOMMENDATION

Conclusion

The green area in urban parks has diverse characteristics that create desirable visitor spaces. Trees, as one of the main elements in the landscape, play a significant role in enhancing visitors' well-being, as they can foster a sense of rejuvenation through their natural complexity and diversity. However, some tree characters do not promote people's sense

of restoration, as their combinations will construct a perceived enclosure in green spaces. This study reveals that certain tree enclosure configurations, particularly in terms of density, arrangement, and scale, can influence the highest levels of perceived safety and restorativeness. The spatial configuration of a tree enclosure with high density, a distant position from the pathway, and a medium-scale will enhance the highest level of perceived safety. In contrast, the same configuration with a high-level scale tree contributes to perceived restorativeness. The scale plays a role in maintaining safety and restoration, as other enclosure attributes show similar impacts on people's mental health benefits. This study extends the prospect-refuge theory to the tree enclosure in a small space, which can be perceived as safe if the tree height is not too tall, allowing for diffused skylight inside the park and a clear view of the surrounding areas. It also contributes to the restorative environment theory, which posits that the presence of green elements in nature is perceived as restorative, even when arranged in various combinations. However, restorative judgment is highly valued by tall trees in parks, as they enhance the park atmosphere and add to the layered complexity within the parks.

Those spatial configuration tree enclosures demonstrate how tree performance, particularly in terms of perceived enclosure, can enhance visitors' perceived well-being in urban green spaces, particularly in tropical landscapes. While the tree enclosure has not been addressed as the main issue in Indonesian parks, its role in determining restorative judgments may enhance the well-being of visitors in nearby pocket parks on a neighborhood scale. Therefore, designers, landscape architects, and the government should be more aware of the feeling of enclosure in green areas, as it could be one of the motivational factors for visitors to visit green spaces in urban areas or cities.

Recommendation

This study called for more landscape studies and research to promote the sustainability of urban green spaces, with a focus on visitors' perceptions and the performance of greenery. The proposed tree design alternatives from this study could serve as design criteria and guidelines for thoughtfully designing tree landscapes in parks, creating a sense of restoration and safety. Additionally, this study also suggests conducting an in-situ behaviour study for the restoration experience study, and including many other green elements interventions for a quasi-experimental study. Therefore, architects, landscape planners, city planners, academics, and government officials should collaborate to create a sustainable and desirable city.

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