

QUANTIFYING WATERSCAPE DESIGN IMPACT ON URBAN VISITOR PSYCHOLOGY IN DENPASAR

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ABSTRACT

Urban public spaces enhanced with waterscape features offer notable benefits for psychological well-being, particularly through multisensory and spatial engagement. Although theoretical frameworks on healing waterscapes have gained attention, empirical research examining user perceptions within real-world urban settings remains limited. This study investigates how visitors perceive four psychological variables of waterscape design (social, behavioral, cognitive, and emotional) in a prominent public space in Denpasar, Bali. Data were collected through a structured questionnaire, developed from established design sub-criteria, and distributed to visitors at Lapangan Puputan Badung. Responses were analyzed using JMP software to explore perceptual trends across the four variables. Findings indicate that emotional and behavioral aspects received the highest perception scores. Elements such as natural vegetation, organic materials, and ambient natural sounds like rustling leaves, bird songs, and flowing water were strongly associated with feelings of comfort, calmness, and restoration. On the other hand, social and cognitive aspects, including opportunities for interaction, spatial legibility, and acoustic clarity, were rated lower, suggesting areas where the current design may not fully support psychological needs. These insights highlight a perceptual imbalance in the spatial experience of the site. The study contributes practical implications for urban designers and landscape architects in enhancing the restorative qualities of waterscape environments.

Keywords: *denpasar-bali, perception, psychological well-being, urban public space, waterscape*

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INTRODUCTION

Urban public open spaces serve as multifaceted environments that promote ecological balance, facilitate social interaction, and contribute to mental health restoration (Grahn & Stigsdotter, 2003; Nielsen & Hansen, 2007). Among their key design elements, waterscapes landscapes structured around water features demonstrate unique potential for enhancing psychological comfort, reducing stress, and stimulating multisensory engagement (Zhu et al., 2023; Duzenli & Gökem Özkan, 2016). A robust body of research on blue spaces (fountains, rivers, ponds) highlights their consistent benefits for mood regulation, emotional balance, and cognitive functioning (Lu et al., 2025; Zhai et al., 2025). Auditory visual natural stimuli, such as flowing water, birdsong, and rustling vegetation, have been empirically linked to attention restoration, mood enhancement, and the reduction of mental fatigue (Zhu et al., 2023). These observations align with Attention Restoration Theory Kaplan (1995), which emphasizes the role of “soft fascination” and environmental compatibility in promoting psychological recovery (Hartig et al., 2011).

Despite growing evidence on the psychological benefits of nature-based design, most existing studies emphasize overall environmental exposure rather than the perceptual salience of distinct waterscape design variables namely social, behavioral, cognitive, and emotional. Prasandya (2023) previously conceptualized these four variables, each comprising validated sub-criteria that reflect diverse experiential and perceptual components (Prasandya et al., 2023). For example, the social variable includes dimensions such as activity variety, accessibility, and site characteristics; the behavioral variable encompasses spatial diversity and sense of control; the cognitive variable covers water shape and movement, signage and lighting, and spatial layout; while the emotional variable includes biotic and abiotic elements, waterscape feature diversity, and sense of nature. These sub-criteria were carefully derived from interdisciplinary literatures across landscape architecture, environmental psychology, and restorative design, and serve as a structured framework for capturing users’ psychological responses to waterscape design features.

This research gap is especially relevant in Denpasar, Bali, where adolescent mental health concerns are on the rise over 2.4 million Indonesian youth report psychological distress, and Denpasar ranks among the regions with the highest depression prevalence (Kementerian Kesehatan Republik Indonesia, 2020). In this context, public waterscapes may offer scalable, non-clinical strategies to promote urban psychological well-being. To address this, the present study aims to quantify visitor perceptions of the four waterscape design variables at Lapangan Puputan Badung Denpasar’s iconic civic open space known for its formal landscaping, cultural symbolism, and high visitation levels. Using a structured questionnaire derived from Prasandya's (2024) validated framework, this study collected user feedback on the perceived adequacy and psychological impact of each design variables.

By analyzing perception scores across social, behavioral, cognitive, and emotional variables, the study seeks to identify which variable are perceived as most psychologically restorative and which remain underrepresented and potentially limiting the site's therapeutic potential. The findings are expected to inform evidence-based design strategies

that enhance the psychological performance of urban public waterscapes, particularly in tropical city contexts.

METHODS

This study adopted a descriptive, mixed-methods design to assess how four waterscape design variables, social, behavioral, cognitive, and emotional, are perceived by users of an urban public space and how these perceptions relate to positive psychological comfort. The conceptual framework of these four variables and their sub-criteria was established through a systematic literature review and validated in a prior study (Prasandya et al., 2023). However, the extent to which each variable contributes to visitors' psychological well-being in real-world urban settings remains empirically underexplored.

Study Site

The study was conducted at Lapangan Puputan Badung I Gusti Ngurah Made Agung, a historically and culturally significant civic open space located in central Denpasar, Bali. This site was selected based on its high visitor activity, spatial vibrancy, presence of waterscape features, and its strategic role as an urban green lung and symbolic public arena. Denpasar was also identified as having the highest reported prevalence of depression in Bali Province (3,348 cases), reinforcing the relevance of assessing the site's potential for psychological restoration.

Instrumentation

A structured questionnaire was developed based on a validated framework consisting of eleven assessment criteria and twenty-four sub-indicators distributed across four variables:

- a) Social: Activity variety, site accessibility, and spatial character.
- b) Behavioral: Sense of control and spatial variety, including sensory stimulation, movement freedom, and thermal comfort.
- c) Cognitive: Layout clarity, water shape and flow, signage presence.
- d) Emotional: Biotic and abiotic components, diversity of water features, sense of nature.

Each item was rated using a five-point Likert scale to gauge perceived adequacy and psychological impact. The questionnaire underwent internal review by a multidisciplinary expert panel comprising urban designers, environmental psychologists, and landscape architects to ensure validity and contextual relevance. The full list of 24 sub indicators to 11 dimensions across four design variables is presented in Table 1.

Data Collection and Participants

Primary data collection involved on-site observations, visitor surveys, and semi-structured interviews. Observations documented environmental conditions and user behavior during peak usage periods, while interviews explored participants' emotional, sensory, and attentional experiences. A total of 100 respondents, aged 15 years and above, were recruited through purposive sampling based on their active engagement within the site. Informed consent was obtained from all participants, and anonymity was maintained throughout the process. Secondary data, including mental health statistics and urban

planning documents, were used to contextualize site selection and inform the instrument design.

Table 1. Sub Indicators of Healing Waterscape

No	Dimension	Sub Indicators	Sources
Variable : Social			
1	Activity Variety	The water features at the study site are perceived as entertaining, encouraging prolonged engagement and extended time spent in their immediate surroundings	(Düzenli et al., 2014) (Langie et al., 2022) (Zhang et al., 2021)
		The design of the waterscape elements at the study site evokes a sense of relaxation and encourages positive engagement in outdoor activities	(Krasilnikova et al., 2021)
2	Accessibility	The accessibility of the study site generates enthusiasm and motivates me to visit the location.	(Zaki et al., 2020)
		The design and spatial dimensions of the pedestrian pathways at the study site encourage a pleasant experience and motivate me to engage in activities within the space	(Zhang et al., 2021) (Kara & Oruç, 2021)
3	Spatial Characteristic	The location and topographical characteristics of the study site contribute to a sense of calmness and comfort during my presence in the space.	(Zhang et al., 2021)
		The aesthetically pleasing and visually accessible landscape of the site, as seen from the entrance, draws my attention and encourages me to visit.	(Kaźmierczak, 2013)
		The spatial qualities of the site's surroundings foster a sense of openness rather than restriction	(Sakici, 2015) (Göker & Kahveci, 2020)
Variable : Behavioral			
4	Spatial Variety	The presence of garden spaces within the study site stimulated my interest and contributed to a sense of sensory delight	(Göker & Kahveci, 2020)
		The diverse spatial configurations within the site enriched my visit, contributing to a pleasant and stimulating experience	(Zaki et al., 2020) (Langie et al., 2022) (Zhang et al., 2021)
		The multisensory stimulation provided by the site's diverse landscape elements enhanced my sense of joy, ease, and relaxation	(Razmara et al., 2020)
5	Sense of Control	I perceive the water features at the study site as effective in enhancing the thermal comfort of the environment.	(Krasilnikova et al., 2021)
		I perceive the natural sounds present at the study site such as birdsong, water trickling, and rustling leaves as effective in masking ambient urban noise and enhancing my sense of comfort	(Zhang et al., 2021) (Zhu et al., 2023) (Mahmoud et al., 2022) (Duzenli & Görkem Özkan, 2016)
Variable : Cognitive			
1	Water Shape, Movement & Flow	The water elements at the study site have a calm surface, allowing me to engage with their reflective qualities in a contemplative manner.	(Göker & Kahveci, 2020)
		The clarity of the water elements at the study site evokes a sense of tranquility and inspires a feeling of motivation	(Zhu et al., 2023) (Mahmoud et al., 2022) (Duzenli & Görkem Özkan, 2016)
2	Lighting & Signage	The integration of water lighting at the study site enhances visual comfort and evokes a sense of aesthetic engagement and emotional uplift.	(Langie et al., 2022) (Razmara et al., 2020)
		Signage and wayfinding elements at the site facilitate spatial orientation and reduce navigational anxiety	(Göker & Kahveci, 2020) (Zaki et al., 2020)
3	Layout Clarity	The well-articulated circulation paths and spatial configuration support intuitive navigation and mitigate spatial disorientation	(Göker & Kahveci, 2020) (Zhu et al., 2023)
Variable Emotional:			
1	Biotic & Abiotic Component	I perceive the integration of trees, vegetation, and water features within the site as restorative, aiding stress recovery, mental fatigue, and attentional	(Krasilnikova et al., 2021) (Zaki et al., 2020) (Kara & Oruç, 2021)

No	Dimension	Sub Indicators	Sources
2	Water Feature Diversity	focus. The availability of fauna such as fish, birds, insects, and small animals enhances the site's natural identity and contributes to my feelings of comfort and enjoyment The location and form of water features at the site function as a central attraction, inspiring motivation and active engagement within the space.	(Langie et al., 2022)
		The diversity of waterscape elements present at the site draws my attention and contributes to feelings of comfort, calmness, and emotional well-being The dominance of natural materials in the site's landscape composition significantly enhances its attractiveness and fosters emotional responses characterized by tranquility, comfort, and contentment.	(Duzenli & Görkem Özkan, 2016) (Mahmoud et al., 2022) (Langie et al., 2022)
3	Sense of Nature	The organically shaped water features at the site, which emulate natural contours, contribute to a calming spatial experience and support psychological relaxation. The limited presence of artificial features within the site supports its potential as a restorative environment, fostering psychological recovery from stress and fatigue while aiding cognitive focus	(Krasilnikova et al., 2021) (Zaki et al., 2020) (Sakici, 2015) (Langie et al., 2022) (Mahmoud et al., 2022)

Source : Author, 2025

Data Analysis

Quantitative data derived from questionnaire responses were analyzed using JMP Pro 17 statistical software. Descriptive statistics were used to determine mean perception scores across each psychological sub indicators. Subsequent inferential analysis, including correlation and regression modeling, was conducted to examine the relative influence of each sub indicators on perceived psychological comfort and restoration. Qualitative interview data were transcribed and analyzed using thematic coding, allowing the identification of emergent patterns in participants' subjective experiences. These qualitative insights were used to interpret and triangulate the quantitative results, ensuring methodological robustness.

Ethical Considerations

All participants provided informed consent prior to data collection. Anonymity and confidentiality were maintained throughout the research process. The study adhered to ethical research standards and was approved by the internal ethics board of the lead institution.

RESULT AND DISCUSSION

This section presents and interprets the findings of the study in relation to the four waterscape design variables, social, behavioral, cognitive, and emotional as perceived by visitors to Lapangan Puputan Badung. The results are organized into three interrelated subsections to provide a comprehensive analysis. First, the Quantitative Findings on Waterscape Design Variables outlines statistical patterns in user perception scores across the identified variables and sub-criteria, which are then integrated with the Perceptual

Interpretation Based on Questionnaire Responses to examine how user feedback reflects experiential and psychological impressions associated with specific waterscape attributes. Second, Interpreting the Role of Waterscape Design in Psychological Comfort connects the empirical results to broader theoretical and empirical insights from the existing literature. Finally, the Implications for Design and Policy distills key takeaways for urban designers and policy makers seeking to enhance the restorative potential of public open spaces through evidence-based waterscape interventions.

Quantitative Findings on Waterscape Design Variables

The social variable of waterscape design was evaluated through three primary indicators, activity variety (S1-S2), site accessibility (S3-S4), and spatial characteristics (S5-S7). Among these, as shown in Figure 1, activity variety received a moderately high mean score, suggesting that visitors perceived the waterscape as sufficiently engaging and conducive to recreational or passive social interaction. This aligns with prior research emphasizing the role of water features as activity attractors in public spaces (Zhang et al., 2021; Duzenli & Gökem Özkan, 2016). In contrast, site accessibility and spatial characteristics were rated relatively lower, particularly items S3 ($M = 3.81$), S5 ($M = 3.81$), S6 ($M = 3.82$), and S7 ($M = 3.85$). These results indicate that several sub-criteria such as the clarity of routes to the site, the site's location and topography are conducive, the legibility of entrance vistas, and perceived openness may not fully support intuitive access or spatial comfort. Specifically, the statement “the accessibility of the site encourages my enthusiasm to visit” and items related to the site's locational and topographical attributes are conducive to promoting environmental calmness and user comfort, scenic topography from the entrance invites visitation, and surrounding spatial qualities promote openness scored below the social variable's overall mean. This discrepancy reflects that while users may engage once inside the public open space, the initial approach experience and visual permeability are not optimized for inviting psychological responses.

From a perceptual standpoint, many respondents described the site's arrival experience as hidden or insufficiently open, indicating a spatial disconnect between urban context and interior landscape identity. This perceptual finding supports the lower mean scores observed in S3, S5, S6, and S7. Overall, these findings suggest that the social variable of Lapangan Puputan Badung's waterscape partially fulfills its intended psychological function. While the presence of water stimulates engagement, its integration with accessible and spatially legible design remains limited. These perceptual gaps suggest potential for enhancing the public open space's entry experience particularly through improving reinforcing spatial cues that convey openness to strengthen both user orientation and visual appeal.

The behavioral variable of waterscape design, which encompasses dimensions of spatial variety and sense of control, revealed a nuanced pattern of visitor perception. As shown in Figure 2, perceptual scores for items B1 through B5 ranged from 3.87 to 4.17. While elements associated with thermal and auditory comfort (B4 and B5) recorded the highest mean ratings (4.16 and 4.17 respectively), spatial variety indicators (B2 and B3) were rated the lowest, each at 3.87 below the overall mean of the behavioral dimension.

This suggests that Lapangan Puputan Badung is perceived to adequately support visitors' behavioral comfort particularly in terms of thermal regulation and auditory relief through natural soundscapes, but appears to fall short in providing sufficiently multisensory and spatially diverse experiences. Underperforming sub-criteria included the capacity of open public spaces to capture interest and evoke sensory delight, the richness of spatial configurations to offer varied engagement opportunities, and the extent to which the site's landscape elements stimulate multiple senses (visual, auditory, olfactory, tactile) to enhance psychological comfort.

These results indicate that while visitors generally report high levels of physical comfort particularly in terms of thermal regulation and auditory relief, they experience comparatively lower levels of sensorial immersion and spatial variety, elements typically associated with restorative environments. This discrepancy could limit the site's potential to foster deeper behavioral engagement and sustained psychological restoration, aligning with evidence that underscores the role of spatial complexity and sensory diversity in therapeutic landscapes (Duzenli & Görkem Özkan, 2016; Langie et al., 2022). Design interventions that enrich spatial variety and multisensory stimulation such as incorporating diverse textures, enhancing garden spaces, expanding spatial configurations, and integrating nuanced soundscapes could strengthen the site's behavioral affordances. These improvements would not only reinforce physical comfort but also promote dynamic interaction and longer visitation, critical for activating waterscape design as a behavioral catalyst for urban well-being.

The cognitive variable in waterscape design encompasses the extent to which spatial configurations and water-related features such as surface calmness, clarity, and lighting support user orientation, enhance environmental legibility, and promote visual order, thereby facilitating contemplative engagement and cognitive restoration. In this study,

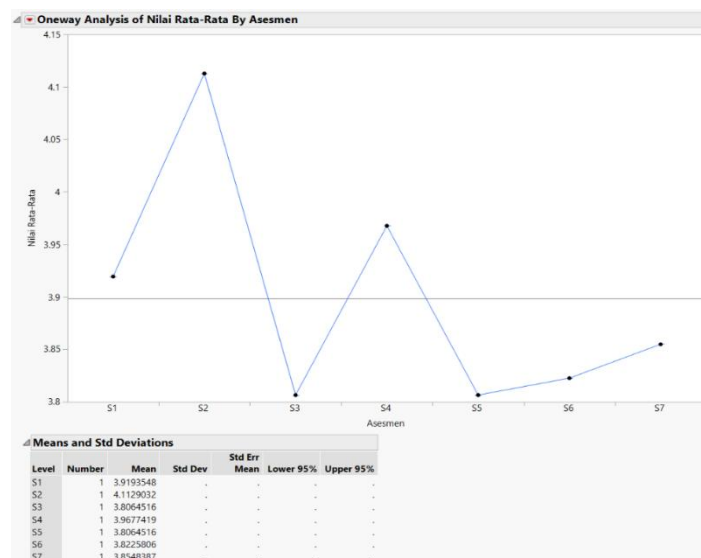


Figure 1. Bivariate analysis results of social variable of waterscape
(Source: Prasandya, 2025)

three key cognitive dimensions were assessed water shape and flow (C1-2), the presence of signage and lighting (C3-4), and layout clarity (C5). As shown in Figure 3 and summarized in the perception score table, respondents gave the highest average score to the integration of water lighting (C3 = 4.16), noting that it enhanced visual comfort and evoked a sense of aesthetic engagement and emotional uplift. However, other sub-criteria namely calm water surfaces that enable reflective engagement (C1 = 3.84), signage and wayfinding elements that facilitate spatial orientation and reduce navigational anxiety (C4 = 3.94), and circulation paths and spatial configurations that support intuitive navigation (C5 = 3.82) received below-average scores, indicating suboptimal support for cognitive comfort and wayfinding.

Perceptual interpretations drawn from participant feedback suggest that although the spatial layout offers a basic navigational framework, the subdued character of the water elements and the limited effectiveness of wayfinding features may constrain the site's cognitive restorative potential. Several visitors remarked that the calm water surfaces, while conducive to contemplation, lacked focal interest or visual dynamism, reducing opportunities for sustained mental engagement and reflective observation. This aligns with findings that visible movement, reflective qualities, and focal water features can significantly enhance visual fascination and cognitive recovery in urban environments (Zhai et al., 2025). In parallel, the insufficient clarity and distribution of directional signage and navigational cues may undermine environmental legibility a factor Kaplan and Kaplan (1989) identify as fundamental to restorative settings. Their preference matrix underscores the role of environmental clarity in fostering mental orientation and psychological ease. Complementary insights reinforce this notion, highlighting that effective wayfinding systems play a critical role in reducing spatial ambiguity and bolstering user confidence in public spaces (Jahani & Saffariha, 2020).

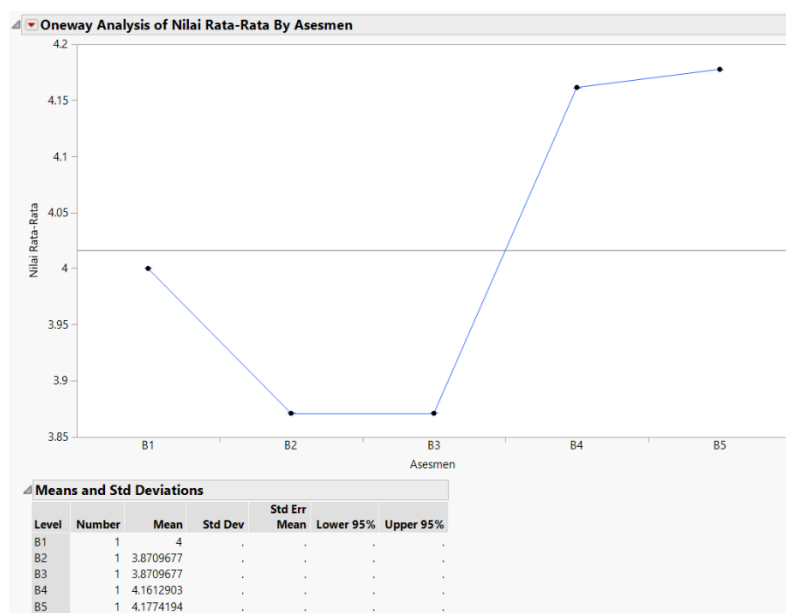


Figure 2. Bivariate analysis results of behavioral variable of waterscape
(Source: Prasandya, 2025)

The below average evaluation of calm water surfaces suggests that, while conducive to contemplation, these features may lack the visual dynamism or focal quality needed to sustain cognitive engagement. Several visitors remarked that the water elements, though present, did not evoke strong psychological or aesthetic responses, indicating a missed opportunity to use water design as a catalyst for reflective attention and mental clarity. These results highlight the need for strategic enhancements to the cognitive dimension, particularly in the articulation of water features and the spatial communication of the site. Improving the visual richness of reflective surfaces and strengthening wayfinding through well-integrated signage and circulation cues could substantially elevate users' cognitive comfort, environmental orientation, and the site's overall therapeutic potential.

The emotional variable in waterscape design encompasses users' affective responses shaped by sensory immersion, aesthetic appreciation, perceived naturalness, and the presence of biotic and abiotic elements. It reflects how vegetation, fauna, water feature diversity, material authenticity, and organic forms collectively contribute to emotional states such as tranquility, comfort, and psychological restoration. In this study, emotional responses were assessed through three core dimensions, biotic and abiotic components (E1–E2), diversity of water features (E3–E4), and perceived naturalness or “sense of nature” (E5–E7). As shown in Figure 4 and the descriptive statistics table, participants gave the highest emotional score to biotic and abiotic components ($E1 = 4.32$), indicating that the integration of trees, vegetation, and water features was perceived as restorative, aiding stress recovery, mental fatigue reduction, and attentional focus. This finding is consistent with research emphasized that natural components such as greenery and sun exposure foster positive emotional states in urban open space (Nielsen & Hansen, 2007). Likewise, E5 (“The dominance of natural materials in the site's landscape composition significantly enhances its attractiveness and fosters emotional responses characterized by tranquility, comfort, and contentment”) was also rated relatively high (mean = 4.17), indicating that the prevalence of authentic, nature-based materials contributed positively to visitors' emotional engagement.

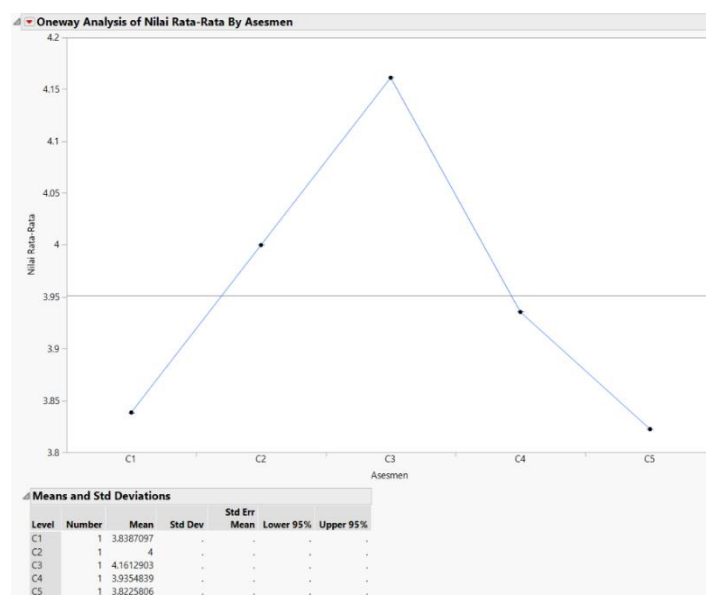


Figure 3. Bivariate analysis results of cognitive variable of waterscape
(Source: Prasandya, 2025)

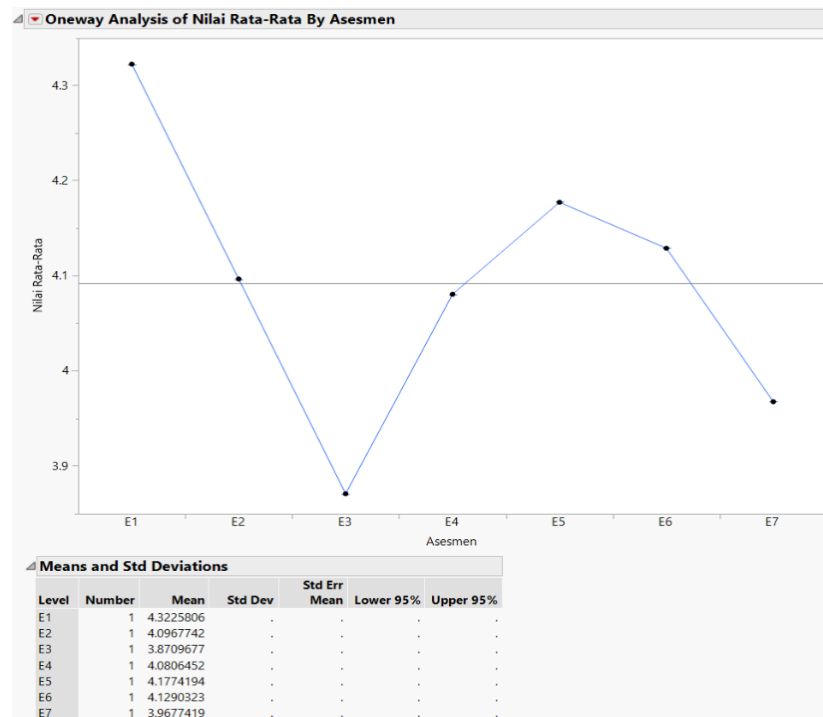


Figure 4. Bivariate analysis results of emotional variable of waterscape
(Source: Prasandya, 2025)

However, several sub-criteria fell below the average psychological comfort line (mean < 4.1), notably the location and form of water features as a central attraction (E3 = 3.87), the diversity of waterscape elements (E4 = 4.08), and the perceived naturalness of the site (E7 = 3.96). Participants indicated that while water was present, its placement and design did not create a compelling focal point, nor did it offer sufficient variety to evoke sustained interest or restorative experiences. Regarding naturalness, some visitors felt that the site appeared overly constructed, noting 'It felt somewhat artificial, not like being in nature.' These observations align with findings that design quality including variation, scale, and integration of water features is critical to eliciting positive emotional responses such as tranquility and joy (Zhang et al., 2021), while perceived naturalness strongly contributes to affective restoration, especially when users perceive minimal artificial interference in spatial composition (Mahmoud et al., 2022).

The below-average score for E3 suggests that while the public open space incorporates some water features, they are neither functionally prominent nor emotionally resonant. This may result from insufficient spatial hierarchy, weak sensory dynamics, or lack of integration with biophilic principles. Similarly, the suboptimal rating for E7 (sense of nature) indicates that the public open space's emotional efficacy may be limited by design interventions that appear overly constructed or lack natural rhythm, limiting its restorative potential (Langie et al., 2022; Lu et al., 2025). These results underscore a partial mismatch between design intent and user emotional engagement. Although Lapangan Puputan Badung provides essential urban green functions, its waterscape configuration may fall short in delivering immersive emotional experiences typically associated with healing environments. Design interventions focusing on enhancing water feature diversity, incorporating multi-sensory layering (sound reflectivity), and minimizing artificiality may strengthen the site's restorative capacity.

Interpreting the Role of Waterscape Design in Psychological Comfort

The interpretation of psychological comfort in urban waterscapes requires a multidimensional lens that incorporates spatial, perceptual, and emotional feedback. Synthesizing the full scope of data in this study reveals that while certain aspects of the design at Lapangan Puputan Badung support user well-being, others particularly within the cognitive and social variables are less effectively accommodated, as evidenced by the patterns illustrated in Figure 5. The cognitive dimension, for instance, displays consistently suboptimal scores in three critical sub-criteria the reflective quality of calm water surfaces (C1), the clarity of directional signage (C4), and the legibility of circulation patterns (C5). These findings indicate a spatial environment that lacks navigational affordance and cognitive engagement, potentially diminishing users' ability to interpret and comfortably interact with the space. This aligns with Kaplan and Kaplan's (1989) theory of legibility in restorative environments, where environments that lack coherent spatial cues tend to inhibit mental restoration. In similar waterscape studies, reflective water surfaces and kinetic flow features significantly enhance cognitive fascination and contemplative clarity both of which are underutilized in the observed site (Zhang et al., 2021).

The social variable also reveals notable limitations. Except for the single sub-criterion indicating relaxation and positive engagement (S2), all other social items scored below the overall mean. These include statements related to place identity, activity-based social interaction, and perceived spatial accessibility (S1, S3, S4–S7). Successful social engagement in urban public space relies heavily on symbolic resonance and the facilitation of informal interaction, neither of which is strongly represented in the case site (Kaźmierczak, 2013). With most social sub-criteria scoring below the psychological comfort average except for relaxation and positive engagement (S2) the site appears limited in fostering sustained social interaction, accessible engagement, and spatial appeal. The lack of compelling waterscape experiences that encourage prolonged social use may, therefore, constrain the development of social cohesion and place attachment among visitors (Souter-Brown, 2015; Völker & Kistemann, 2011). The perceptual interpretation data adds another layer to this understanding. Respondents often described difficulties with spatial orientation due to insufficient wayfinding cues and noted that certain water elements appeared visually static and lacked engaging qualities. These observations are consistent with the view that waterscapes without sensory dynamism or layered experiential cues may struggle to evoke desired psychological responses (Langie et al., 2022). Furthermore, the bivariate analysis indicates that the mere physical presence of water features does not guarantee positive impact unless paired with clear interpretive structure and coherent experiential design. Collectively, the data suggest a performance gap in dimensions requiring more than physical provision such as aesthetic resonance, cognitive affordance, and multisensory engagement supporting the notion that 'active psychological ingredients' like movement, narrative, and sensory layering are critical to enhancing user experience (Lu et al., 2025).

Without these improvements, the restorative potential of waterscapes may remain constrained. In conclusion, while Lapangan Puputan Badung possesses a foundational spatial structure capable of supporting psychological comfort, the underperformance in

cognitive and social variables limits its overall therapeutic function. Design interventions that introduce more visually dynamic and varied water features, improve spatial legibility, and enhance socially engaging design elements could substantially strengthen the site's ability to support emotional well-being and mental clarity. Future planning should consider frameworks that advocate for participatory, sensory-rich, and contextually responsive waterscape strategies (Bringslimark et al., 2009; Duzenli & Gökem Özkan, 2016).

Implications for Design and Policy

The findings of this study offer significant implications for both urban design and policy formulation, particularly regarding the integration of psychologically restorative waterscapes in public open spaces. With several sub-criteria from the cognitive and social variables scoring below average particularly those related to spatial orientation, wayfinding signage, the visual dynamism of water surfaces, and social engagement affordances the results reveal notable gaps in environmental features that support psychological comfort and cognitive clarity in the studied space. From a design perspective, the low perceptual scores on orientation and signage highlight the need for improved spatial legibility, echoing findings that clear spatial articulation and visual cues enhance users' cognitive mapping and reduce disorientation in therapeutic settings (Taheri et al., 2021). The limited presence of dynamic or varied water features, evident across cognitive and emotional variables, suggests a missed opportunity to trigger multisensory engagement, which plays a pivotal role in fostering emotional resonance and cognitive clarity in therapeutic landscapes (Zhang et al., 2021). Design interventions such as kinetic water features, shallow rills with rhythmic flow, and reflective surfaces may increase visual fascination and promote restorative attention, aligning with the principles of attention restoration theory.

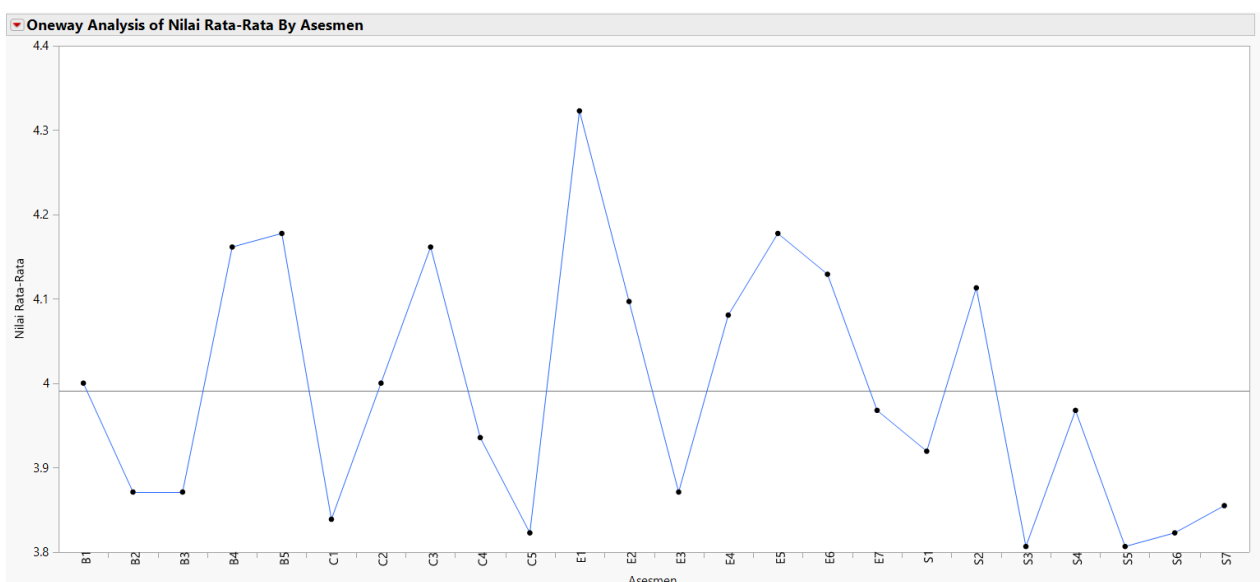


Figure 5. Bivariat analysis results of social, cognitive, behavioral, emotional variable of waterscape
(Source: Prasandya, 2025)

Regarding the social variable, the consistently low perceptual ratings apart from the sub-criterion linked to relaxation and positive behavioral engagement (S2) highlight the lack of socially engaging water features that encourage interaction, collective use, and participatory experiences. This reinforces the view that therapeutic landscapes should function as communal anchors rather than solely as aesthetic additions (Krasilnikova et al., 2021). Accordingly, spatial strategies that introduce communal seating areas, interactive water features, or design elements that naturally invite group activities could cultivate shared meaning and emotional connection among visitors. For urban design policy, this underscores the importance of recognizing waterscapes not merely as decorative amenities but as components of mental health infrastructure. Integrating psychological performance indicators such as emotional resonance, stress-reduction potential, and opportunities for social interaction into public space regulations can ensure that waterscapes contribute meaningfully to urban well-being. This approach aligns with emerging well-being-oriented urban policy frameworks, which advocate the inclusion of environmental psychology metrics in post-pandemic city planning (Lin et al., 2024).

In addition, cross-sectoral collaboration involving urban designers, environmental psychologists, public health professionals, and local cultural authorities is crucial, as interprofessional frameworks have been shown to produce more adaptive and socially engaging waterscape strategies, particularly in diverse urban contexts (Cao et al., 2024). The Lapangan Puputan Badung case exemplifies a setting where the spatial prominence and civic significance of the site call for both environmental sensitivity and contextually responsive design. While this study relied on perceptual and quantitative assessment tools, future research could incorporate bio-physiological validation methods (eye tracking, EEG, or cortisol monitoring) to empirically substantiate psychological responses to water features. Likewise, longitudinal or cross-cultural comparative studies may further illuminate how restorative perceptions of water vary and evolve. Ultimately, waterscape design should move beyond static aesthetic artifacts toward interactive, socially engaging, and psychologically resonant landscapes. Positioning psychological restoration as a central design imperative will contribute to more inclusive and mentally supportive urban environments.

CONCLUSION

This study demonstrates that the psychological comfort of urban public space users is influenced to varying degrees by four waterscape design variables: emotional, behavioral, cognitive, and social. Emotional and behavioral dimensions were rated most positively, emphasizing the restorative role of biophilic elements, multi-sensory engagement, and a perceived freedom of movement. Conversely, cognitive and social dimensions, particularly those linked to spatial legibility, wayfinding, and opportunities for interaction, received lower average ratings, indicating unrealized design potential. These results suggest that the presence of waterscape elements alone is insufficient; their spatial articulation, clarity of interpretation, and ability to foster interaction are equally crucial for restorative outcomes. In light of Denpasar's high prevalence of psychological distress, there is an urgent need for urban design strategies that treat waterscapes not merely as visual amenities but as therapeutic infrastructures. Future research should include cross-cultural comparisons and

physiological measures to deepen understanding of how waterscape design influences mental well-being across diverse contexts

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