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Behavioral Patterns and Spatial-Activity Dynamics of Urban Park Users (A Behaviour Mapping Study of Prestasi Park, Surabaya)

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ABSTRACT

This study aims to analyze user behaviour in an urban park, where activities vary across different zones and time periods within the same area. Observations were conducted across eight time sessions, both on weekdays and weekends. A behavior mapping method that used place-centered mapping was used, and 1,899 users were recorded. The findings indicate that user behavior varies significantly across time and space. Most people visit in the morning and afternoon, but fewer people visit at noon due to thermal discomfort. Visits on the weekend are more common and have a higher percentage of active participation. In terms of space, Zones A and B are where people are actively involved in social and play activities, while Zones C and D are mostly where people are passively enjoying recreation and meals. The novelty of this study lies in the integration of temporal and spatial analysis. It demonstrates that behavioral variation occurs at a micro-scale across zones within a single park and changes over time. This study enhances user-oriented urban park planning by offering empirical evidence on the combined effects of spatial configuration and temporal rhythms on user behavior. The results show how important it is to design urban parks that can handle a wide range of activities, temporal dynamics, and spatial functions in order to enhance usage and inclusivity.

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Penelitian ini bertujuan untuk menganalisis perilaku pengguna di mana dalam satu taman yang sama aktivitas dapat berbeda antara zona taman dan waktu. Observasi dilakukan pada delapan waktu pengamatan selama hari kerja dan akhir pekan. Behaviour mapping dengan teknik place-centered mapping digunakan untuk menganalisis aktivitas dengan total 1.899 pengunjung tercatat. Hasil penelitian menunjukkan bahwa perilaku pengguna bervariasi secara signifikan menurut waktu dan ruang. Aktivitas tertinggi terjadi pada pagi dan sore hari, sementara aktivitas menurun pada siang hari akibat ketidaknyamanan termal. Kunjungan pada akhir pekan lebih tinggi dan didominasi oleh keterlibatan aktif. Secara spasial, Zona A dan B menunjukkan keterlibatan aktif dengan orientasi sosial dan bermain, sedangkan Zona C dan D didominasi oleh aktivitas pasif rekreasional dan kuliner. Kebaruan penelitian terletak pada integrasi analisis temporal dan spasial secara simultan yang menunjukkan bahwa variasi perilaku terjadi pada skala mikro antarzona dalam satu taman dan berubah menurut waktu. Temuan ini menegaskan pentingnya perancangan taman kota yang berorientasi pada pengguna dengan mempertimbangkan keragaman aktivitas, ritme temporal, dan fungsi spasial.

1. Introduction

Urban Park plays a crucial role in improving the environmental, social, and psychological well-being of urban residents (Paudel & States, 2023; Zhang & Qian, 2024; Cheng, 2025). From their ecological functions, urban parks function as a place for social interaction among urban residents (Cui et al., 2024; Dietz et al., 2025; Gong et al., 2024). As cities are experiencing rapid urbanization, green open spaces are under increasing pressure (Fuady et al., 2025). This results in an imbalance between built-up areas and accessible green open spaces (Zhu et al., 2020). Similarly, Adhitama et al. (2023) emphasized that the spatial and functional quality of urban parks plays a decisive role in shaping how people interact with and use it.

The rapid land use change in Surabaya is reducing the amount of public green spaces (Murtini et al., 2020). Many urban parks remain underused and fail to attract public engagement (Aghaloo & Sharifi, 2025). The design of the urban parks is often based on aesthetics rather than on empirical observations of how users behave (Bachtiar & Kusuma, 2019). Consequently, the urban parks' design may not align with the users' activity patterns. Understanding the users' behavioral patterns is crucial for designing urban parks that align with users' preferences (Cahyani et al., 2023; Kamilatuzzahroh et al., 2024). This gap between the design and how people behave underscores the urgent need to examine how individuals engage with urban parks (Pratomo et al., 2019).

This study is integrating spatial-functional zoning with comprehensive temporal analysis across both weekdays and weekends, while previous research has mostly concentrated on spatial patterns. It gives a better understanding of how people behave in a public urban park over time and space. This study aims to: (1) identify the spatial distribution of user activities across functional zones; (2) analyze temporal variations in urban parks' usage; and (3) examine the level of user active and passive engagement.

This study is urgently needed to provide empirical evidence for user-oriented park planning in rapidly urbanizing cities. This research is further supported by a large observational dataset, providing a better representation of user behavior. Furthermore, examining user behavior offers practical implications for designing urban parks that foster social, spatial, and ecological sustainability.

2. Materials and Methods

This study focuses on identifying and analyzing user behavior in Prestasi Park, an urban park in Surabaya, Indonesia. A behavior mapping approach was used to capture spatial and temporal variations in park usage (Table 1). According to Zhang and Lawson (2009), in Nurhamsyah (2019), activities in public spaces can be categorized as process, physical contact, or transition activities. The mapping technique adopted in this study is place-centered mapping, which enables observers to systematically record how users use the urban park (Pradani & Nurini, 2020).

Table 1. Research variable

Variable	Sub Variable	Indicator	Parameter
Park user characteristics	User activity	Gender	1. Male 2. Female
		Age	1. Children 2. Teenagers 3. Adults 4. Elderly
		Activity type	1. Process activity 2. Physical contact 3. Transition activity
		Day type	1. Weekday 2. Weekend
		Time of day	1. Morning 2. Noon 3. Afternoon 4. Evening

(Source: Pramudito & Kurnial, 2020; Nizar & Sasmito, 2021)

Behavior mapping was conducted across eight observation periods (Table 2). Four observers did the observation, with one observer assigned to each zone. To make sure that no one was counted twice, each person was only recorded once during each observation period. People who moved between zones in the same time period were not counted as separate entries

Table 2. Observation schedule

Observation Type	Time Schedule
Weekday (Friday)	1. Morning (09:00 – 10:00 WIB) 2. Noon (14:00 – 15:00 WIB) 3. Afternoon (17:00 – 18:00 WIB) 4. Evening (19:00 – 20:00 WIB)
Weekend (Sunday)	1. Morning (10:00 – 11:00 WIB) 2. Noon (11:00 – 12:00 WIB) 3. Afternoon (17:00 – 18:00 WIB) 4. Evening (19:00 – 20:00 WIB)

The study site, Prestasi Park, is located on Jalan Ketabang Kali No. 6, Genteng District, Surabaya. It's located along the Kalimas River and serves multiple functions, including recreational, educational, and social purposes (Nurany & Fitriawardhani, 2024). It features a variety of facilities, including a children's playground, a plaza, a riverfront promenade, and a culinary zone (Rosanti & Setyono, 2026). The park covers an area of 1.4 hectares and is divided into four zones based on functional and spatial characteristics (Figure 1).

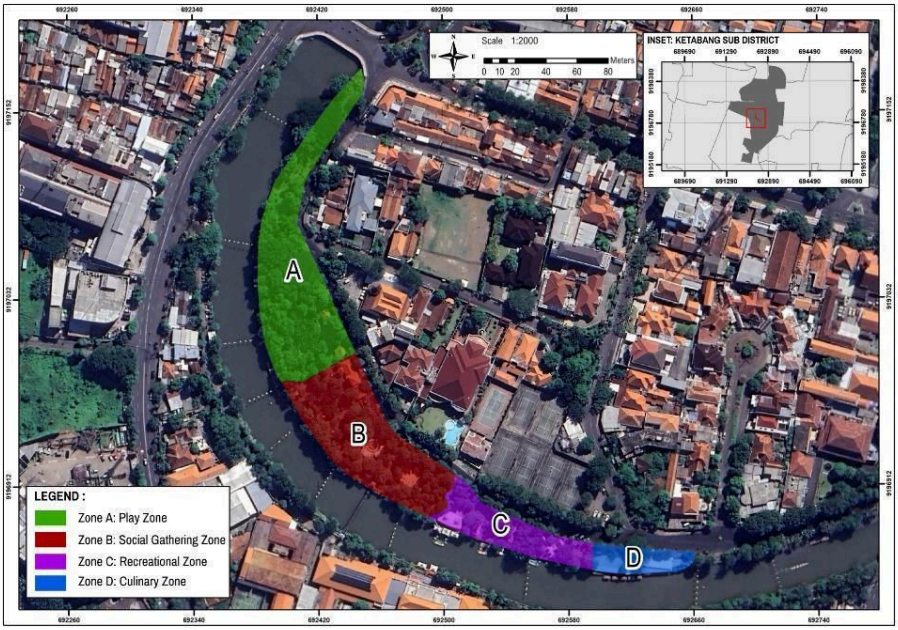

Figure 1. Study area

3. Results and Discussion

3.1 Temporal Variation of Park Activities

A total of 1,899 users were recorded throughout the observation period. It reflects the multifunctional role of Prestasi Park as a recreational and social space. Figure 2 shows that total activity in different times and zones revealed distinct behavioral rhythms that corresponded with environmental conditions and social routines.

As shown in Figure 2, weekday observations showed that the morning period (09:00–10:00) was the busiest time of day, with 279 users recorded. Family-oriented activities dominated the park during this period, with children playing in Zones A and C while their accompanying adults did. However, Zone B facilitates pedestrian movement and short-term rest. Similar findings have been reported in studies of urban public spaces where users choose to visit an urban park with the family (Maruthaveeran, 2017) and to seek a place for relaxation (Hardilla et al., 2025).

As the temperature rose towards noon, the number of visitors declined to 165. It is reflecting the impact of thermal discomfort on outdoor activity (Handoyo et al., 2020; Elnabawi & Hamza, 2020; Li et al., 2024). The increased temperatures significantly reduce the users' activity, especially in tropical settings (Song & Wei, 2024; Jia et al., 2025). Behavioral activities shifted from active to passive forms of engagement, such as sitting, chatting, eating, or observing, particularly in shaded areas.

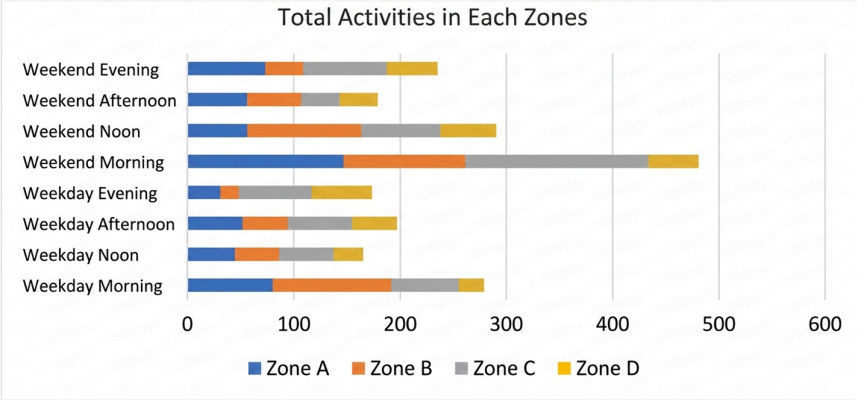

Figure 2. Total activities in each zone

Activity levels began to rise again by the afternoon (17:00–18:00), reaching 197 users. It's happened because the ambient temperatures in the park became more comfortable (Hu & Zhao, 2022). This session was characterized by a variety of active and passive behaviors, such as children playing, walking, taking photos, and socializing with other people. The increasing number of users in the afternoon hours shows that users avoid the heat of the sun (Hardilla et al., 2025). In the evening (19:00–20:00), the total number of visitors reached 173. This was supported by riverfront boat tours and informal street vendors (Rosanti & Setyono, 2025; Nurany & Fitriawardhani, 2024). Meanwhile, Zone D, as a culinary area, experienced a significant increase in activity due to the availability of food stalls and families enjoying meals.

In contrast, weekend observations revealed significantly higher visitor densities. It suggests that temporal patterns were also influenced by work–life rhythms and social preferences (Wang & Shi, 2023; Doğru & Kaya, 2025). The weekend morning session (10:00–11:00) saw the highest visitor numbers (481), highlighting the park's function as a destination for family recreation and community exercise. It is transforming Zones A and B into highly active social areas. However, visitation declined to 290 during the noon session (11:00–12:00), reflecting the thermal avoidance pattern observed on weekdays.

Activity intensity increased again during the weekend evening (17:00–20:00), when the park functioned as a community gathering and live music venue, primarily in Zones C and D. Entertainment extended visitor stay duration and encouraged more diverse social interactions (Duignan et al., 2023; Fansurya et al., 2024; Manojlović et al., 2025). Table 3 shows a temporal difference in users' intensity and engagement during weekdays and weekends in Prestasi Park. The average number of visitors per session increases from 204 on weekdays to 296 on weekends. This shows that urban parks are more visited on weekends during non-working periods (Pusparani et al., 2025). Active participation also goes up from 42% on weekdays to 54% on weekends. On the weekends, parks not only attract more users but also promote more active and social activities (Hardilla et al., 2025).

Table 3. Summary of temporal users' activity and engagement patterns

Category	Weekday Average	Weekend Average	Overall Average
Total Users per Session	204	296	250
Peak Period	Morning (279 visitors)	Morning (481 visitors)	Weekend Morning
Lowest Period	Noon (165 visitors)	Afternoon (179 visitors)	Weekday Noon
Active Engagement (%)	42%	54%	–
Passive Engagement (%)	58%	46%	–

3.2 Spatial Behaviour and Functional Differentiation

The spatial configuration of Prestasi Park produced distinct activity patterns, reflecting clear differences in functional use and behavioral engagement across its four zones. These patterns demonstrate how the physical layout of each zone influences the type and intensity of user behavior (Karasu & Kirli Özer, 2026). This finding supports the concept that the physical features affect how people behave in it (Do et al., 2020). The analysis confirms that spatial affordances, defined as the perceived opportunities for action offered by an environment (Bishop et al., 2024), play a central role in influencing how visitors occupy and interact with park spaces.

Zone A (the play zone) exhibited the highest levels of active engagement. The presence of playground equipment, shaded seating, and an open space encourages visitors to stay for longer (Chen & Marzbali, 2024). Parental supervision was a consistent behavioral activity, with adults tending to sit or stand in public. The zone remained heavily used throughout the observation period, suggesting that children also encourage continued family participation (Wiguna et al., 2022).

Zone B (the social gathering zone) was transitional. Its open layout and proximity to pedestrian routes encouraged active and passive behaviors. During the morning and noon, walking and short-term rest were predominant. In the afternoon, the zone transformed into a social environment featuring group discussions, community exercise, and users who were taking photos. This is where spatial meaning is continuously shaped by user practices rather than fixed physical functions (Esperanza et al., 2025).

Zone C (the recreational zone) was a major attraction due to its riverfront setting, boat dock, and performance space. Despite the high visitor density, activities were largely passive, including sitting, watching, or waiting for boat rides. This behavioral tendency reflects the area's spatial affordances and the influence of recreational activities. The concentration of informal street vendors further reinforces its leisurely character and also occasionally causes congestion. Zone C, therefore, functions to facilitate visual and social engagement rather than physical activity.

Zone D (the culinary zone) served as the park's social hub, primarily operating as a dining area. The activities in this zone are centered around eating, conversing and resting, which are classified as passive engagement behaviors. Live music performances and social dining enhanced the area's attractiveness during the weekend afternoon. The

Sentra Wisata Kuliner (SWK) provided a stable setting for economic activity, thereby reinforcing the multifunctionality of the park by integrating the leisure dimensions (Yang et al., 2025).

These behavioral distinctions reveal a spatial-functional hierarchy within Prestasi Park. Zones A and B encourage dynamic, socially interactive engagement, whereas Zones C and D facilitate more passive activities. A comparison between zones shows a clear change in behavior. Zones A and B show more active engagement because they have interactive spatial features. Zones C and D are mostly passive. This difference shows that the way the park is designed has a big impact on how engaged users are and how they use the park (Esperanza et al., 2025; Sadeghi & Haghighat Bin, 2023).



Figure 3. Behaviour mapping on weekend afternoon

3.3 Comparison of Visitor Activity Patterns Across Park Zones

As summarized in Table 4, each zone of Prestasi Park has its own unique functions and attractions, which determine how it is used. The spatial configuration significantly influences activity diversity and user behavior in public spaces (Do et al., 2020; Zhu et al., 2020). Understanding these comparative activity patterns is crucial for improving the functionality and user satisfaction of the park as a whole.

Zones with more interactive elements and facilities tend to generate active behaviors (Do et al., 2020; Zhu et al., 2020). The contrast between Zone B and Zone C highlights how flexibility influences behavioral diversity. While both zones attract significant numbers of visitors, Zone B accommodates a wider range of activities. Furthermore, the presence of active (Zones A and B) and passive (Zones C and D) areas

within a single park reflects an urban park design that supports different user needs simultaneously.

Table 4. Comparison of visitor activity patterns across park zones

Zone	Activity Pattern	Conclusion
Zone A	Zone A is primarily used as a children's play area. During both weekdays and weekends, children play individually or in groups, accompanied by parents who sit or stand nearby.	Zone A shows high levels of engagement, with most visitors being children who are actively playing.
Zone B	Zone B is widely used for socializing. Most activities observed in the morning and noon are walking and sitting. In the afternoon and in the evening, the range of activities increases to include socializing, photography, dining, group exercise, and community meetings.	Zone B is an active engagement zone due to its role as a flexible space for social interaction.
Zone C	Zone C serves as a recreational hub, particularly around the boat dock and performance stage. Visitors engage in activities such as sitting, waiting for boats, standing, playing, socializing, and taking photographs. Informal street vendors (PKL) often gather in this zone, further shaping its recreational use.	Zone C leans towards passive engagement, as most activities involve sitting and waiting for boat rides.
Zone D	Zone D functions as a culinary center. Activities observed include eating, communal dining, and vendor operations. Live music performances also occasionally take place on weekend afternoons.	Zone D is characterized by passive engagement, with activities primarily focused on dining and remaining stationary.

Similar findings have been studied about the importance of functional diversity in enhancing overall park inclusivity (Cui et al., 2024; Aghaloo & Sharifi, 2025). This reinforces the importance of integrating active and passive zones to maximize both engagement and usage.

This study has several limitations. First, the observations occurred over just two days. It is perhaps insufficient to represent long-term behavioral variability. Second, environmental factors like temperature and weather weren't measured with instruments, which made it hard to figure out how they affected thermal comfort. Third, the study examines a singular urban park, potentially limiting the applicability of the findings to other contexts. Even with these limitations, the study gives us useful information about how people behave in an urban park over time and space. Future research is recommended to include longer observation periods, multiple study sites, and the integration of microclimate measurements to enhance analytical depth.

4. Conclusion

This study shows that the way people behave in Prestasi Park is affected by the interaction between times and zones. Most activity happens in the morning and evening, while it decreases at noon due to thermal discomfort. Weekends attract more visitors and active social interaction. It shows how work time affects how people use parks.

From the spatial zones, the park has clear functional differences between its zones. Zones A and B have more interactive spatial features that encourage more active and social behaviors. However, Zones C and D tend to encourage passive behaviors. This suggests that spatial affordances play a critical role in shaping user engagement.

By integrating temporal and spatial analysis, this study provides a more comprehensive understanding of users' interaction throughout the urban park. The main contribution is showing that behavioral patterns are not the same in one park. It is affected by small-scale spatial differences that change over time.

These results have important implications for urban park design. Improving thermal comfort during noon, making flexible spaces for enhancing social interaction. Making sure that active and passive zones are balanced can make a big difference in how engaged and included users feel. This study shows that urban parks need to be designed with users considering and be able to respond to changes over time. They should also be socially active, efficient, and environmentally friendly.

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