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Research Article

Activity Mapping in Urban Space; Ankara/Kuğulu Park Case

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ABSTRACT

Maps are not merely tools for orientation but also function as expressive and analytical instruments that shape our understanding of place, culture, and urban dynamics. This study aims to explore how activity mapping—a method integrating direct observation and GIS technologies—can be used to understand the relationship between user behaviors and spatial features in urban public spaces. Taking Kuğulu Park in Ankara as a case study, the research applies activity mapping techniques to examine patterns of use, frequency, and distribution of activities across time. The study highlights the limitations of traditional static data collection methods and proposes mapping as a dynamic, user-centered alternative that enhances urban design processes. Key findings emphasize how spatial design elements correlate with behavior patterns, reinforcing the value of mapping in interpreting the lived experience of public spaces.

Keywords: *Mapping, activity mapping, GIS, urban public space, user behavior*

Kentsel Mekanlarda Aktivite Haritalaması; Ankara/Kuğulu Park Örneği

ÖZ

Haritalar yalnızca yön bulma araçları değil, aynı zamanda mekân, kültür ve kentsel dinamiklere dair anlayışımızı şekillendiren ifade ve analiz araçlarıdır. Bu çalışma, doğrudan gözlem ve CBS (Coğrafi Bilgi Sistemleri) teknolojilerini birleştiren bir yöntem olan etkinlik haritalamanın, kullanıcı davranışları ile kentsel kamusal mekânlardaki mekânsal özellikler arasındaki ilişkiyi anlamada nasıl kullanılabileceğini araştırmayı amaçlamaktadır. Ankara'daki Kuğulu Park'ı örnek olay olarak ele alan araştırma, kullanım biçimleri, sıklıkları ve zaman içinde faaliyetlerin dağılımını incelemek için etkinlik haritalama tekniklerini uygular. Çalışma, geleneksel statik veri toplama yöntemlerinin sınırlılıklarını ortaya koymakta ve haritalamayı, kentsel tasarım süreçlerini geliştiren dinamik ve kullanıcı odaklı bir alternatif olarak önermektedir. Temel bulgular, mekânsal tasarım öğelerinin davranış kalıplarıyla nasıl ilişkili olduğunu vurgulamakta ve kamusal mekânların yaşanmış deneyimlerinin yorumlanmasında haritalamanın değerini pekiştirmektedir.

Anahtar Kelimeler: *Haritalama, etkinlik haritalama, CBS, kentsel kamusal mekân, kullanıcı davranışı*

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I. INTRODUCTION

This paper aims to investigate how mapping methods, particularly activity mapping integrated with GIS, can reveal and evaluate the relationship between user behavior and spatial features in Kuğulu Park, Ankara. The study highlights how specific design elements influence types and intensities of activities, offering insights into how urban public spaces perform socially.

Despite growing academic interest, a gap remains in mapping methods that can bridge lived spatial experiences with physical design features. This research addresses that gap by posing key questions: How do people use urban spaces? What spatial configurations support or hinder certain behaviors? And how can mapping help designers interpret these relationships?

By structuring the introduction around key themes—perception of public space, critique of static data methods, mapping as a creative tool, and GIS as a methodological framework—the study provides a thorough entry point for understanding the empirical sections that follow.

The structure of the paper is as follows:
• defines the study area and outlines the observation and mapping methodology.
• presents the spatial behavior analysis through activity maps.
•discusses the results, elaborates on the implications of the mapping approach, and offers design-oriented recommendations for public spaces.

A. THE ROLE OF PUBLIC SPACES IN URBAN LIFE

In this context, as Habermas articulates, public space is the domain in which public opinion is formed within our social life [1]. Urban public spaces are essential for the vitality of cities, playing a significant role in urban living. They encompass social, cultural, and economic dimensions, offering settings for social interaction and gatherings in everyday urban life. Moreover, these spaces serve as reservoirs of community memory and identity [2, 3]. A city ought to be a place where everyone can live comfortably, and its design should foster and encourage public life, not only through its institutions but also symbolically and directly through its public spaces [4].

Public spaces have two essential dimensions: space and activities, both of which encompass physical and social aspects of the urban environment. The physical public realm consists of various spaces and settings that support and encourage public life and social interaction. The activities and events that take place within these urban spaces contribute to the socio-cultural public realm [5]. The city's public spaces belong to the people who use them and must be accessible. Diverse social activities also occur in public spaces like parks, squares, streets, etc. Well-designed public spaces can make city life more attractive and vibrant [3].

Cities have evolved into service-based centers after industrialization, leading to the transformation, fragmentation, and dispersion of the traditional centralized city form. Urban public spaces are vital elements that will bring cohesion and integrity to this new city model [2, 6]. The significance of urban public spaces makes their planning and design phases critical, along with the assessment of the location's success post-implementation. Activity patterns, physical settings, and meaning are the essential components [7-10], and evaluating the use of urban space relies on uncovering the interrelationship between physical aspects and activity patterns within that space [11]. Thus, the quantity and type of activities, along with their frequency and duration, can all be shaped by effective design [3]. Transform our understanding of how the built environment impacts people and influences our behavior. Mapping facilitates the concretization of data, enabling various users to engage with different information. The most distinguishing feature of mapping compared to other methods is its capacity to allow the discovery, structuring, and re-expression of spatial and social interactions. This method offers an alternative approach to interpreting the dynamic framework of urban spaces by visualizing both visible and hidden information and data through mapping in cities and urban areas.

Urban spaces are the most essential parts of cities. They reflect cities' social, economic, and cultural values and current situation. For this reason, examining the design and use of urban spaces, observing changes, and researching and discussing the purposes of use are valuable approaches to understanding physical spaces. Activity mapping, which involves evaluating the bodily patterns of urban spaces and the activity patterns of users together, is one of the methods used in urban space examinations and analyses [17].

B. MAPPING AS A METHODOLOGICAL AND CULTURAL TOOL

Mapping is a creative and constructive process used to measure or describe the world. As a cultural project, it has played a significant role in analyzing, planning, and designing cities and structures for many years. In the 20th century, mapping served as a quantitative and numerical investigation of existing conditions during the initial stages of design and planning [12]. Corner [13] refers to these spatial and statistical maps as survey maps. These maps, considered indisputable reflections of reality, have provided a foundation for numerous projects and initiatives. The maps we use in architecture and planning go beyond physical and geographical maps. Corner asserts that the discipline of architecture is experiencing a simultaneous transformation alongside mappings that add a different dimension to the place.

In addition to being physical, maps in architecture possess mental, design, theoretical, and functional features. Initially, tools of representation, these mappings have evolved into design tools in architecture due to their creative aspects. They harmonize technique with aesthetics. Consequently, mappings ceased to function only as a base and began to express relational networks [14]. Additionally, they serve as a research tool to make social and spatial practices and interactions in space visual and tangible [15].

Maps exemplify mapping by integrating quantitative information through the processing of various data combined with topography. Most of these mapping examples are created using Geographic Information Systems (GIS). For many years, data on topographic maps has been utilized to interpret or design cities and urban spaces. GIS also encompasses information not represented spatially in these maps and assigns specific symbology values. It enables data to be displayed as points, lines, or areas, and represented with a range of color values [16].

C. BEHAVIORAL OBSERVATION AND ACTIVITY MAPPING

Activity mapping is a method used to observe the actions and movements of individuals while considering their interactions with the surrounding environment. This technique enables users to analyse the types of activities taking place, as well as their frequency and distribution within a specific area. The relationship between the physical characteristics of the studied area and the activity patterns can be expressed through graphical, numerical, and verbal means. Generally, this method aims to explore the relationship between individual activities and urban space. Research conducted by Conzen, Lynch, Montgomery, and Golicnik has developed activity mappings aimed at investigating multiple locations [18].

Various criteria have been considered when evaluating activity patterns. Gehl [3] categorizes outdoor activities into three types: optional, mandatory, and social. Carmona [5] distinguishes between passive and active participation in activities. Montgomery [10] relates activities to the principles of liveliness and diversity. In addition to activity patterns, physical patterns are also essential criteria used to organize a city or urban space. Lynch [20] identifies physical patterns through specific design principles, including density and accessibility. The urban images created by Lynch serve as a bridge between activity and physical patterns. In a well-organized city designed in this manner, users are granted rights in space management, allowing them to contribute to and shape the development of the space [17].

D. GIS AND URBAN DATA VISUALIZATION

Geographic Information Systems (GIS) are digital information systems that facilitate the collection, processing, storage, and visualisation of data based on location. They support various functions, including data entry, digitisation, coding, processing, classification, spatial-statistical analysis, visualisation, and data management. GIS simplifies the creation of diverse parameters, facilitates the investigation of their interactions, and helps identify common or differing values. Through this process, recorded data is transformed into empirical information, making it easier to categorize and analyze large, complex datasets [19].

The significance of having appropriate knowledge in urban design is emphasized by several scholars [20-23]. However, research on people-environment interactions has primarily focused on visual perception and wayfinding. Kevin Lynch [20] particularly concentrated on human perception, exploring how individuals perceive, learn, and remember urban spaces. He discovered that maps result from a two-way process between the environment and the individual, where the environment highlights distinctions and relationships among various physical elements of the city. At the same time, the observer meaningfully selects and organizes them while creating a cognitive map, which is a generalized mental representation of the external physical world based on their experiences.

Some researchers have specifically examined human behaviour in public open spaces, employing cameras to record activities [11], counting individuals, and diagramming their movements [11]. Lynch famously concluded, “What attracts people most, it would appear, is other people” [20]. Similarly, Gehl asserted this sentiment by quoting Icelandic proverbs: “Man is man’s greatest joy” and “People go where people are” [24]. Whyte [11] observed that when people are in a square, they tend to position themselves close to fixed objects like a statue or flagpole. Occasionally, they prefer specific edge locations, such as steps, walls, and ledges, for sitting, and are rarely chosen for the undefined centre of a large open area [11]. These observations reflect what Gehl referred to as the edge effect [24], a concept noted by thinkers ranging from Sitte to Chris Alexander [25, 26].

Moreover, this research significantly advances methodological development by encouraging innovative thinking that transcends traditional disciplinary boundaries. It is intricately connected to key concepts and emphasises the effective didactic mediation of mapping tools. The findings empower architects and urban designers to confidently ensure that the spaces they create for specific purposes will not only benefit and delight residents but also meet anticipated usage patterns. Geographic Information System (GIS) has become an indispensable tool in urban studies [27-29], offering a streamlined approach to data analysis within the urban planning process. Despite this, its application for detailed mapping of open space usage remains underutilised [29], highlighting an opportunity for enhanced implementation. This paper examines the effectiveness of Geographic Information Systems (GIS) in visualising observation and behavioural mapping data, advocating for more comprehensive approaches to understanding the usage–spatial relationship. As urban studies increasingly incorporate GPS technology, the study of behavioural patterns among city dwellers is gaining traction [30-32]. Certain studies have involved pre-selecting citizens who are then equipped with GPS devices, which provide direct data for GIS mapping. However, this pre-selection can result in a narrowed sample, thereby limiting the scope of the findings. The relationships between behaviour and environment can only be assessed within the context of the selected individuals wearing GPS devices, in contrast to unaffected observations and behavioural mapping, where any individual present during the observation period is recorded [29]. Nonetheless, recent advancements in remote sensing techniques may facilitate the examination of urban behaviour without the need for individuals to carry GPS devices [33]. In the meantime, more traditional observation methods continue to provide valuable insights into the dynamics of environment–behaviour relationships.

II. METHODOLOGY/STUDY AREA

A. STUDY AREA

Urban public spaces are both physical and social constructs shaped by users' interactions, cultural practices, and design features. Kuğulu Park, located in the Kavaklıdere neighborhood of Ankara, provides a rich setting for observing these dynamics. With its central location and diverse user base—including families, students, tourists, and elderly residents—the park functions not only as a leisure site but also as a symbolic and socio-political gathering space.

Originally conceptualized within the Jansen Plan as part of Ankara's green infrastructure, Kuğulu Park has undergone several transformations in design, functionality, and symbolic meaning. Features such as its iconic sculptures, playgrounds, pedestrian paths, and natural elements (waterfalls, trees, grasslands) make it a complex and heterogeneous environment.

These qualities make Kuğulu Park an ideal case study for examining how design features influence user behavior. Instead of selecting the site solely based on its popularity, the choice is grounded in its ability to represent diverse urban experiences, accommodate a variety of user groups, and reflect dynamic interactions that can be visualized and analyzed through mapping.

Kuğulu Park is situated in the Kavaklıdere neighborhood of the city center. Tunalı Hilmi Street, Atatürk Boulevard, and Poland Street determine its borders. This park, initially named Kavaklıdere Park, was created as one of the urban green areas in the Jansen Plan; however, only a part of it was preserved. The borders of Kuğulu Park have evolved, resulting in its current form [34]. The park gained its current border and activity after 1973-77. It took its current name from the swans gifted by Vienna. Today's black swans are a gift from China [35]. The Park was accepted as a natural protected area in 1974 [34].

The tea garden in Kuğulu Park was completed in 1976, and the surrounding terrace structure was completed in 1979. This tea garden was converted into a two-story café in the 1980s, and subsequently, a restaurant section was added. This situation has been interpreted as a reflection of the commercial concentration around the park. In the 1990s, some changes were made to the pool and landscaping arrangements. In addition, the pedestrian path connecting Atatürk Boulevard and Tunalı Hilmi Street was added to the park's borders in these years [35].

Figure 1. *Kuğulu Park Plan [35] (Revised by the authors).*

The park, revised in 2014, has undergone various changes. Figure 1 shows its current plan.

The Tunalı Hilmi Statue (Figure 2 (c)) by Ümit Öztürk, erected in 2006, defines the main entrance. Other urban facilities in the park that symbolically represent the park are the Kissing Statue and the April 23 Monument (Figure 2 (a) and (b)[35].

Figure 2. (a) *23 Nisan Tomb* ***(b)*** *Sculpture of Öpüşenler* ***(c)*** *Sculpture of Tunalı Hilmi.*

Due to the difference in elevation in the areas indicated with numbers 1, 2, and 3, the entrance to the park is provided by staircases. The waterfall next to staircase number 1 has been landscaped with natural stones. Bridges provide access at many points in the park (Figure 3).

Figure 3. *Entrance number 1 and the waterfall are shown in the Kuğulu Park plan.*

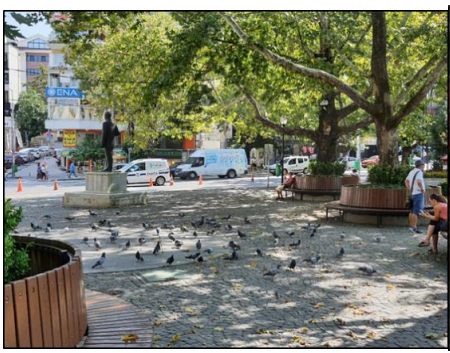

Figure 4. *Tunalı Hilmi Street Entrance.* ***Figure 5.*** *Dog Walking / Pet Area.*

Zone number 4 constitutes the entrance section provided by Tunalı Hilmi Street (Figure 4). It has multiple seating areas and a groundwater feature as equipment. The Tunalı Hilmi Statue, numbered 10, is also located in this section. Area Five is known as the dog-walking area. This area generally serves as both an activity space for those who spend time with their pets and a viewing area for those who observe them (Figure 5). Area 6 features a playground for children aged 2-4, while Area 7 has a playground for children aged 4-12. A wall at varying elevations connects the pedestrian path from Tunalı Hilmi Street to Atatürk Boulevard and the children's playground. In this section of the park, the walls with benches serve as designated seating areas (Figure 6).

Figure 6*. Playground and seating areas.*

The Kissers Statue is located at number 8, and the 23 April Monument is at number 9. Additionally, the park features green areas, a pool, a restaurant, a cafe, a police station, and a taxi center within its borders. The study area is one of the most active areas of the city. Its heterogeneous structure has enabled many social and political activities to this day. Reasons such as its dynamic structure, becoming the city's symbol over time, and appealing to various users due to its design and location effectively chose Kuğulu Park as a study area (Figure 7).

Figure 7. *Views from Kuğulu Park.*

B. METHODOLOGY

Although people design the physical environment, examining it from a social perspective is essential. One element that shapes human relations and interactions is the physical environment. As can be understood from this, the human-environment relationship operates in a cycle that affects both [36]. The primary reason for the renewal of urban planning over the years has been the neglect of the user factor. What these plans that shape the city have in common is that they are created with the same language and stereotypical signs.

The most crucial factor in cities is their users. Users shape habits and form the economic and social foundation of the urban environment. The movements and behaviors of users define the character of the city and its daily life patterns. These user dynamics are critical during the design, development, and

implementation stages of urban planning. If user behavior is overlooked in these processes, the resulting spaces may fail to meet the actual needs of the community. This can lead to underused or abandoned public areas, increased maintenance costs, loss of social interaction opportunities, and even the reinforcement of inequality and exclusion within the urban fabric. Therefore, incorporating user behavior and spatial experience into the design process is essential for creating functional, inclusive, and sustainable urban spaces. Current maps include location, green areas, directions, size, distance, place names, place locations, and roads. However, it is insufficient to include the user factor and examine heterogeneous cities and urban spaces. For this reason, mapping methods need to come into play. This point is emphasized by Alanyalı Aral (2016) [37], who notes that urban designs developed without adequately observing user practices often fail to meet the daily behavioral patterns of individuals, resulting in alienation from public spaces and a decrease in spatial belonging [38]. Current maps include location, green areas, directions, size, distance, place names, place locations, and roads. However, it is insufficient to include the user factor and examine heterogeneous cities and urban spaces. For this reason, mapping methods need to come into play.

The research employs an interdisciplinary methodology combining direct field observation, activity mapping, and Geographic Information Systems (GIS). The goal is to visualize and interpret how users engage with public space, revealing behavioral patterns, spatial preferences, and temporal variations.
Data were collected during four observation sessions: two on weekdays and two on weekends. Each session included three time slots: morning (10:00 AM), noon (1:00 PM), and evening (5:00 PM) to capture temporal variability. Observers recorded user activities through field notes, photographs, and videos. Activities were manually plotted on hand-drawn base maps and later digitized using ArcMap software.

A separate activity map was created for each period, allowing for a clear visual comparison. Activities were classified as either passive (e.g., sitting, watching, reading) or active (e.g., walking, playing, taking photos). The mapping also incorporated spatial attributes such as design features (paths, edges, benches, sculptures) and natural elements (green spaces, water bodies).

Once the observation data were collected, activity points were geocoded into a GIS database. Each point was annotated with attributes including time, gender, activity type, intensity level, and spatial context. These attributes were managed through ArcCatalog and structured into attribute tables for further analysis.

However, it is essential to reflect critically on the methodology. While using GIS and visual mapping enables a high degree of spatial accuracy and representational richness, certain limitations persist. The manual observation process introduces subjective bias, and environmental conditions (e.g., weather, noise, events) may have influenced user behavior during the observation days. Additionally, the lack of continuous tracking (such as GPS-enabled movement data) limits temporal granularity.

Despite these constraints, the methodological framework remains effective in identifying key behavioral trends and their spatial correlates. By combining analog observation techniques with digital visualization tools, the study demonstrates the analytical power of mapping in urban design research.

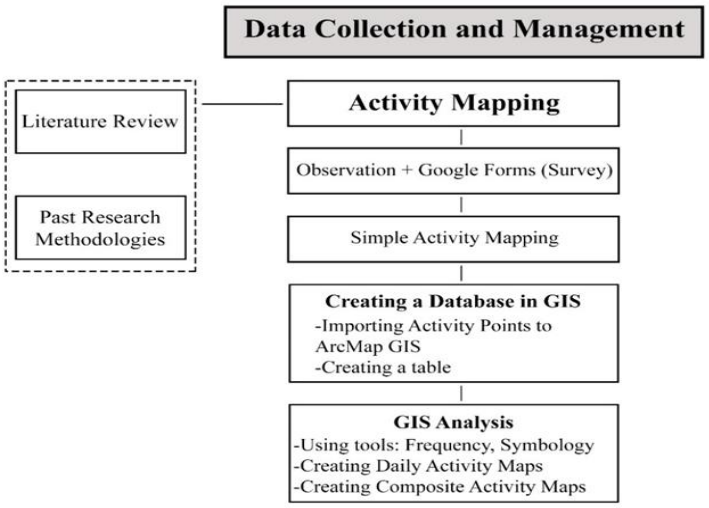

Figure 8. *The Path Followed in Data Collection and Management.*

This framework would be tested by using the proposed research methodology, which combines field direct observation [11] and activity mapping [39] by using GPS to capture activity points and GIS analysis [29].

B.1. Data Preparation Process

This section evaluates physical and activity patterns in Kuğulu Park urban space using the activity mapping method, making the activity patterns visible. The interaction between physical patterns and activity patterns in the determined space, passive/active user activities, usage patterns, and design features of the space were examined. Table 1 gives the principles used in collecting information and data within the conceptual framework. This data was used as a reference when creating mappings that included activity types and design features.

The number of users determines the density of the space and affects its liveliness. The variety of uses of the area and the attractiveness of the place keep individuals in the place [18]. For this reason, activity principles such as density, liveliness, things that attract people to places, and diversity of space use were examined.

Active and passive activities in urban spaces were determined through survey and observation. Passive activities include sitting, standing/watching, listening to music, lying down, and reading a book. Active activities include walking, taking photos, eating/drinking, cycling, and playing games.

Design features encourage users to stay in and use the space. Roads, edges, equipment, and natural beauties constitute design features. These features are derived from certain physical principles such as design layouts, green space, and water space that characterise the sign elements in the area (Table 2). Roads and edges, Lynch's physical components, are included in the design features [18].

Roads include walking paths within urban spaces. The edges represent places such as the seating wall in the playground, the paving stones framing the park, the stairs, the surroundings of the Tunali Hilmi Statue, and the park border. In addition, benches, round seating elements, children's playgrounds, pet playgrounds, fountains, statues, water features/fences, and bridges throughout the urban space symbolise urban facilities, while lawns symbolise natural features.

Table 1. *Principles of Activity Components and Physical Components [18].*

<table>
<tr><th colspan="2">Activity Component</th><th>Activity Principles</th></tr>
<tr><th>Activity Level</th><th>Activity Types</th><td rowspan="17">● Vitality and Density of population: Number of people using the space
● People attractors
● Diversity of space use</td></tr>
<tr><td rowspan="8">Passive engagement</td><td>Sitting</td></tr>
<tr><td>Sitting-Child</td></tr>
<tr><td>Sitting-Pram</td></tr>
<tr><td>Sitting-Wheelchair</td></tr>
<tr><td>Standing/Watching</td></tr>
<tr><td>Laying down</td></tr>
<tr><td>Listen to music</td></tr>
<tr><td>Reading Books</td></tr>
<tr><td rowspan="9">Active engagement</td><td>Walking</td></tr>
<tr><td>Walking-Child</td></tr>
<tr><td>Walking-Pram</td></tr>
<tr><td>Walking -Wheelchair</td></tr>
<tr><td>Taking Photo</td></tr>
<tr><td>Eating/Drinking</td></tr>
<tr><td>Cycling</td></tr>
<tr><td>Playing</td></tr>
<tr><th colspan="2">Physical Component</th><th>Physical Principles</th></tr>
<tr><th colspan="2">Design Features</th><td rowspan="2">● Design layout
● Landmark
● Grass and water space</td></tr>
<tr><td colspan="2">Paths, Edges, Furniture, Natural Features</td></tr>
</table>

Table 2. *Design Features in Urban Space.*

Design Features	
Paths	Walkway
Edges	Edges
Furniture	Bench
	Round Table
	Children’s Playgrounds
	Pet Playground
	Fountain
	Sculptures
	Water Features/Fence
	Bridges
Natural Features	Grass Space

The information and data collected in the study were evaluated using direct observation, activity mapping, and Geographic Information Systems (GIS). After the activities were determined, field work began, and simple activity maps were created with the help of observations, field photographs, and videos. As a result of this four-day process, activity points were transferred to the plans using the ArcMap application in GIS. A database was created in the ArcCatalog interface, and a numerical ID was entered for each activity point. An attribute table was created by assigning information such as shape, day, time, date, gender, activity type, level and design features, and the identity (ID) value to these points. Three sessions were observed in one day, and different attribute tables were entered for those sessions (Figure 9).

Figure 9. *Data Entry and create Attribute Tables.*

III. RESEARCH FINDINGS AND DISCUSSION

A. ACTIVITY MAPPING

A. 1. Activity Level and Type

The first observation of the study was recorded on August 5, 2022, at 10:00, 13:00, and 17:00, using photography, video, and simple activity mapping. A total of 571 people were marked on simple activity mapping: 96 people (16.8%) in the morning, 219 people (38.3%) in the afternoon, and 256 people (44.8%) in the evening. These mappings digitised in GIS are shown in Figure 10.

Figure 10. *Daily Activity Patterns Mapping – Friday.*

When the data collected on Friday were examined according to activity level, 399 people (69.87%) were classified as passive, and 172 people (30.12%) were classified as active. 84% of the active activities

involve walking groups (walking, walking with children, walking with a baby stroller, and walking with a wheelchair), 8% are taking photographs, and 6% are playing games (Table 3). Eating/drinking in the park was the least preferred activity, accounting for 0.17% (1 person) of all activities.

Table 3. *Activity Level and Type – Friday.*

Activity Level	Frequency (No)	Percent (%)	Activity Type	Morning		Noon		Evening	
				No	%	No	%	No	%
Active	172	30,12	Taking Photo	1	0,17	5	0,87	9	1,57
			Walking	24	4,20	56	9,80	52	9,10
			Walking-Pram	1	0.17	-	-	2	0,35
			Walking-Child	1	0,17	4	0,70	5	0,87
			Playing	-	-	4	0,70	7	1,22
			Eating/Drinking	-	-	-	-	1	0,17
Passive	399	69,87	Standing/Watching	8	1,40	15	2,62	14	2,45
			Sitting	52	9,10	127	22,2	154	26,9
			Sitting-Pram	1	0,17	2	0,35	2	0,35
			Sitting-Child	8	1,40	1	0,17	8	1,40
			Reading Books	-	-	2	0,35	-	-
			Listen to music	-	-	1	0,17	1	0,17
			Laying down	-	-	2	0,35	1	0,17
Total	571	100	**Total**	96	16,8	219	38,3	256	44,8

The second field study day was held on Saturday, August 6, 2022. During the observation period, 709 people were found in the area (Table 4). The third observation was determined on Tuesday, August 23, 2022, the second weekday of the study. Seven hundred forty-three people, 376 men and 367 women, used the area during the sessions (Figure 11). However, according to the activity mapping, Tuesday was the second day with the highest frequency value (Table 5).

Table 4. *Activity Level and Type – Saturday.*

Activity Level	Frequency (No)	Percent (%)	Activity Type	Morning		Noon		Evening	
				No	%	No	%	No	%
Active	235	33,14	Taking Photo	1	0,14	2	0,28	4	0,56
			Walking	27	3,80	40	5,64	70	9,87
			Walking-Pram	1	0,14	4	0,56	2	0,28
			Walking-Child	6	0,84	10	1,41	19	2,67
			Walking-Wheelchair	-	-	1	0,14	-	-
			Eating/Drinking	-	-	4	0,56	3	0,42
			Playing	5	0,70	13	1,83	22	3,10
			Cycling	-	-	-	-	1	0,14
Passive	474	66,85	Standing/Watch-ing	12	1,69	27	3,80	33	4,65
			Sitting	56	7,89	99	13,9	212	29,9
			Sitting-Pram	1	0,14	1	0,14	3	0,42
			Sitting-Child	4	0,56	6	0,84	12	1,69
			Reading Books	2	0,28	-	-	-	-
			Listen to music	-	-	-	-	1	0,14
			Laying down	1	0,14	-	-	4	0,56
Total	709	100	**Total**	116	16,3	207	29,1	386	54,4

Figure 11. *Daily Activity Patterns Mapping – Tuesday.*

Figure 12. *Daily Activity Patterns Mapping – Sunday.*

Table 5. *Activity Level and Type – Tuesday.*

Activity Level	Frequency (No)	Percent (%)	Activity Type	Morning		Noon		Evening	
				No	%	No	%	No	%
Active	235	31,62	Taking Photo	2	0,26	6	0,80	7	0,94
			Walking	35	4,71	64	8,61	56	7,53
			Walking-Pram	1	0,13	-	-	3	0,40
			Walking-Child	5	0,67	4	0,53	13	1,74
			Eating/Drinking	4	0,53	-	-	4	0,53
			Playing	4	0,53	11	1,48	15	2,01
			Cycling	-	-	1	0,13	-	-
Passive	508	68,37	Standing/Watching	13	1,74	42	5,65	38	5,11
			Sitting	63	8,47	161	21,6	171	23,0
			Sitting-Pram	1	0,13	2	0,26	-	-
			Sitting-Child	1	0,13	5	0,67	3	0,40
			Sitting-Wheelchair	-	-	-	-	1	0,13
			Listening to music	1	0,13	-	-	-	-
			Laying down	-	-	1	0,13	5	0,67
Total	743	100	**Total**	130	17,4	297	39,9	316	42,5

The activity level was determined to be 68.37% passive, with 508 people participating (Table 5). It has been observed that users sit in the morning to relax in a quiet area and spend time together later.

The designed activity mappings make visible the change, frequency, location, and level of activity types during the sessions. The last observation session was held on Sunday, August 28, 2022. Today's activity mapping is shown in Figure 12. Because it was a weekend, Sunday had the highest population, 821 people. While 61.2% of this population was in Kuğulu Park in the evening, 318 people were in the area in the morning and noon (Table 6). Considering all observation periods on Sunday, it was observed that the area was used by fewer people in the morning hours.

When the variable concept was evaluated as gender in all sessions, it was determined that 51.6% of the users were male. The 10:00 session was determined to be the only observation hour where the frequency of female users was higher, with 43 men and 45 women in the area.

Table 6*. Activity Level and Type – Sunday.*

Activity Level	Frequency (No)	Percent (%)	Activity Type	Morning		Noon		Evening	
				No	%	No	%	No	%
Active	327	39,82	Taking Photo	4	0,48	6	0,73	17	2,07
			Walking	20	2,43	62	7,55	131	15,9
			Walking-Pram	-	-	1	0,12	2	0,24
			Walking-Child	3	0,36	10	1,21	11	1,33
			Eating/Drinking	2	0,24	1	0,12	7	0,85
			Playing	5	0,60	20	2,43	24	2,92
			Cycling	-	-	1	0,12	-	-

***Table 6 (cont)**. Activity Level and Type – Sunday.*

Passive	494	60,17	Standing/Watching	7	0,85	29	3,53	71	8,64
			Sitting	40	4,87	91	11,0	220	26,7
			Sitting-Pram	1	0,12	4	0,48	4	0,48
			Sitting-Child	2	0,24	4	0,48	10	1,21
			Reading Books	2	0,24	1	0,12	3	0,36
			Listen to music	1	0,12	-	-	2	0,24
			Laying down	1	0,12	-	-	1	0,12
Total	821	100	**Total**	88	10,7	230	28,0	503	61,2

A. 2. Use of Design Features

Examining Kuğulu Park at various times and on different days resulted in usage mappings of the design features. These observation sessions provide information about the usage time, frequency, and location of the design elements in the area.

***Figure 13.** Use of Design Features – Friday.*

Figure 13 shows the mapping for Friday, August 5, 2022, the first observation day. 37.82% (216 people) of the users preferred to sit on a bench, and 10.50% (60 people) preferred to sit on a round seating element. In the park, where green is the dominant color, 48 people (8.40%) use the grass areas, and 55 people (9.63%) use the edges. The playground was generally not a preferred design product on this observation day. When Friday mapping was examined at 13.00 and 17.00, it was observed that all urban facilities, except for round seating elements and walking paths, increased over time (Table 7).

Similar to Friday, the most common equipment observed in the field study conducted on Saturday, August 6, 2022, was benches (251 people) (Table 7). Considering the whole day, walking paths were used by 27.50% (195 people) and became the most preferred mode of transportation after benches. However, bridges (0.70%), pet playgrounds (0.56%), and fountains (0.42%) were found to have the lowest usage frequency on Saturday.

Table 7. *Use of Design Features.*

Time	Design Features	Friday		Saturday		Tuesday		Sunday	
		No	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Morning	Pet Playground	-	-	2	0,28	-	-	1	0,12
	Fountain	1	0,17	-	-	-	-	-	-
	Bridges	-	-	1	0,14	-	-	-	-
	Children Playgrounds	-	-	5	0,70	4	0,53	3	0,36
	Grass Space	-	-	-	-	-	-	3	0,36
	Water Features/Fence	3	0,52	2	0,28	8	1,07	7	0,85
	Round Table	15	2,62	7	0,98	11	1,48	6	0,73
	Edges	2	0,35	8	1,12	8	1,07	5	0,60
	Walkway	30	5,25	38	5,35	43	5,78	26	3,16
	Bench	45	7,88	53	7,47	56	7,53	37	4,50
	Total	**96**	**16,8**	**116**	**16,3**	**130**	**17,4**	**88**	**10,7**
Noon	Sculptures	-	-	-	-	-	-	2	0,24
	Fountain	1	0,17	1	0,14	3	0,40	1	0,12
	Bridges	2	0,35	1	0,14	3	0,40	-	-
	Children Playgrounds	2	0,35	11	1,55	10	1,34	16	1,94
	Grass Space	17	2,97	6	0,84	17	2,28	1	0,12
	Water Features/Fence	12	2,10	17	2,39	18	2,42	13	1,58
	Round Table	25	4,37	14	1,97	33	4,44	19	2,31
	Edges	24	4,20	23	3,24	41	5,51	32	3,89
	Walkway	63	11,0	63	8,88	82	11.0	82	9,98
	Bench	73	12,7	71	10,0	90	12,1	64	7,79
	Total	**219**	**38,3**	**207**	**29,1**	**297**	**39,9**	**230**	**28,0**
Evening	Pet Playground	-	-	2	0,28	-	-	5	0,60
	Fountain	1	0,17	2	0,28	-	-	2	0,24
	Bridges	-	-	3	0,42	-	-	5	0,60
	Children Playgrounds	3	0,52	17	2,39	10	1,34	16	1,94
	Grass Space	31	5,42	35	4,93	24	3,23	23	2,80
	Water Features/Fence	18	3,15	18	2,53	20	2,69	48	5,84
	Round Table	20	3,50	31	4,37	31	4,17	43	5,23
	Edges	29	5,07	57	8,03	30	4,03	45	5,48
	Walkway	56	9,80	94	13,2	88	11,8	174	21,1
	Bench	98	17,1	127	17,9	113	15,2	142	17,2
	Total	**256**	**44,8**	**386**	**54,4**	**316**	**42,5**	**503**	**61,2**
	TOTAL	**571**	**100**	**709**	**100**	**743**	**100**	**821**	**100**

During the observation made on Tuesday, August 23, 2022, 259 people (34.85%) sat on benches, and 75 people (10.09%) sat on round seating elements (Table 7). It was determined that 43.11% of these 334 people used the design elements at 17.00. Walking paths were preferred at a higher rate (28.66%) than on other working days. At 13.00, 17 people used the grass areas, and at 17.00, 24 used the children's playgrounds, serving one person (5.51%). However, 79 people (10.63%) used the borders, 24 people (3.23%) used the children's playgrounds, and 46 people (6.19%) used the water features/fences. Although there are three bridges as design elements in Kuğulu Park, they were observed to have a lower usage rate (0.40%) than expected (Figure 14).

Figure 14. *Use of Design Features – Tuesday.*

Figure 15*. Use of Design Features – Sunday.*

On Sunday, August 28, 2022, the most crowded observation day, the most popular design element was walking paths, with a usage rate of 34.34% (282 people) (Table 7). Due to the intensity of the weekend, water elements attracted more people's attention (68 people) than on other observation days (Figure 15).

Children's playgrounds are not preferred in the morning (3 people). It was observed that the same number of people (16) used the equipment at 1:00 and 5:00 p.m. Of the observation sessions, it was determined that 27 people spent time on the grass areas. However, one of the most critical design features distinguishing this park from others is the reserved area for pets. However, Sunday's analysis of this area showed that it had one of the lowest usage rates at 0.73%.

A. 3. Examining the Relationship between Activity Type and Design Features

Mixed activity mappings were designed by combining the Symbology and Frequency feature fields of daily activity mappings (Figure 16,17).

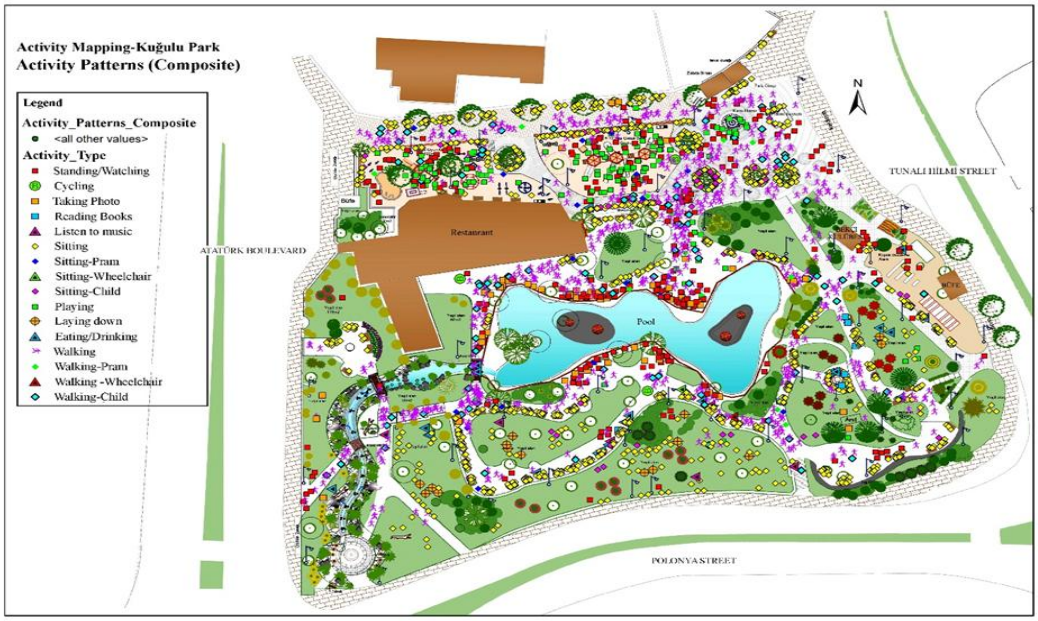

Figure 16. *Activity Patterns Mapping – Composite.*

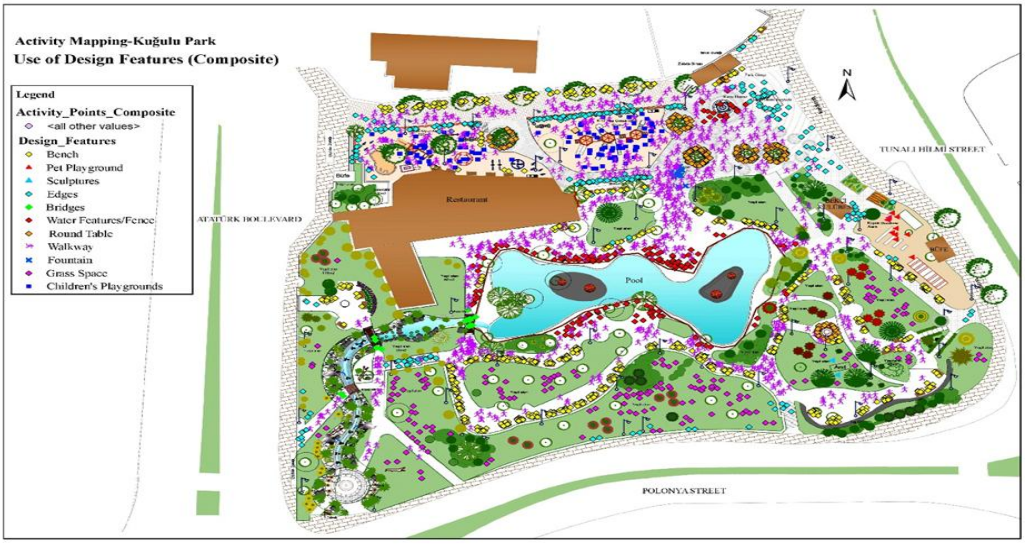

Figure 17. *Use of Design Features – Composite.*

According to these mappings, Tables 8 and 9 were created to understand the relationship between Kuğulu Park's design features and activity types. Examining what users do, where they do it, and their frequency values enabled the determination of everyday activity typologies in the field. Additionally, this method provides the opportunity to examine how design features influence the typology of activities. The created hybrid mappings revealed both different and similar aspects of space use in terms of design features.

Table 8. *Active Activity Types and Design Features.*

Activity Level	Activity Type	Design Features	Frequency (No)	Percent (%)
Active	Taking Photo	Bench	4	0,14
		Grass Space	3	0,10
		Sculptures	2	0,07
		Edges	1	0,03
		Water Features/Fence	51	1,79
		Walkway	3	0,10
	Walking	Grass Space	8	0,28
		Edges	53	1,86
		Bridges	10	0,35
		Walkway	566	19,9
	Walking-Pram	Walkway	17	0,59
	Walking-Child	Grass Space	1	0,03
		Pet Playground	1	0,03
		Edges	7	0,24
		Bridges	2	0,07
		Walkway	80	2,81
	Walking-Wheelchair	Walkway	1	0,03
	Eating/Drinking	Bench	10	0,35
		Grass Space	7	0,24
		Edges	1	0,03
		Bridges	2	0,07
		Round Table	5	0,17
		Walkway	1	0,03
	Playing	Grass Space	5	0,17
		Children Playgrounds	97	3,41
		Edges	1	0,03
		Water Features/Fence	13	0,45
		Walkway	14	0,49
	Cycling	Walkway	3	0,10
	Total		**969**	**34,07**
TOTAL			**2844**	**100**

According to the information obtained from mixed mappings, the activity points are 34.07% active (969 points) and 65.92% passive (1875 points). Sitting, which is a passive activity when calculated in general, has the highest rate of occurrence (53.90% (1533 people) (Table 9). This is followed by walking activity (26.23% (746 people) (Table 8).

Accordingly, the most preferred design elements were benches, with a total frequency value of 969 (34.07%), and walking paths, with a frequency value of 839 (29.50%). Usage frequencies of other design elements are as follows: edges (304), round seating (255), water features/fence (184), lawn (157), children's playgrounds (97), bridges (15), fountain (12), pet play area (10) and the statues are in the form of (2).

Sitting activity, which accounts for the most significant percentage, is performed by 5.60% (86 people) of children and 94.39% (1,447 people) of adult users. The seating rates are 33.22% on the bench, 8.68%

on the round seating element, 7.17% on the edges, 3.90% on the grass area, 0.80% on the walkways, and 0.10% on the pet play area.

Table 9. *Passive Activity Types and Design Features.*

Activity Level	Activity Type	Design Features	Frequency (No)	Percent (%)
Passive	Standing/Watching	Fountain	12	0,42
		Grass Space	5	0,17
		Pet Playground	5	0,17
		Edges	36	1,26
		Bridges	1	0,03
		Water Features/Fence	120	4,21
		Walkway	130	4,57
	Sitting	Bench	932	32,7
		Grass Space	102	3,58
		Pet Playground	3	0,10
		Edges	182	6,39
		Round Table	227	7,98
	Sitting-Pram	Edges	1	0,03
		Walkway	21	0,73
	Sitting-Child	Bench	13	0,45
		Grass Space	9	0,31
		Edges	21	0,73
		Round Table	20	0,70
		Walkway	1	0,03
	Sitting-Wheelchair	Walkway	1	0,03
	Reading Books	Bench	7	0,24
		Round Table	3	0,10
	Listening to music	Bench	2	0,07
		Grass Space	2	0,07
		Pet Playground	1	0,03
		Edges	1	0,03
		Walkway	1	0,03
	Laying down	Bench	1	0,03
		Grass Space	15	0,52
	Total		**1875**	**65,92**
TOTAL			**2844**	**100**

Walking paths (130 people) and water features/fences (120 people) were the most preferred design elements in the standing and watching activity. It has been observed that the pool's symbolic value and calming structure effectively gather users around it. The fact that parents do not want to leave their children alone in children's playgrounds has been identified as one of the primary reasons for the increased frequency of walking paths.

The edges are shown with a light blue symbology value. It allowed various activities to be carried out at the borders, on the seating walls separating the children's playgrounds and the walking path, around the Tunalı Hilmi Statue, on the stairs, and at the exits close to the stop (Figure 17).

The photo-taking activity with the orange legend indicates that the most frequently used equipment consists of water elements and fences (51 people) (Figure 16). The data suggest that the April 23 Monument has not been a popular backdrop for photographs taken by visitors; only two people utilized it during the observed sessions. When examining the design elements for play activities, it was found

that children's playgrounds were used at a rate of 3.41% (97 people), walking paths were used at a rate of 0.49% (14 people), and water elements and fences were used at a rate of 0.45% (13 people). The high percentage of children's playground usage indicates that these areas are designed for their intended purpose. The use of water elements and fences as design elements for play activities is justified by the presence of a dry pool that is active during evening hours near the playground. However, eating and drinking are generally not widely preferred activities in the area. The most frequently used design elements are benches (0.35%) and grass areas (0.24%). Approximately 94% of lounging activity occurs in grass areas. During the observation periods, the area's general density and elevation differences revealed that it did not provide an ideal environment for cycling. For this reason, among all activities, only 0.10% (3 people) cycled on walking paths.

B. ACTIVITY MAPPING RESULTS

The field study conducted in Kuğulu Park generated data from four separate days—two weekdays and two weekends—capturing morning, noon, and evening sessions. A total of 2,844 individual activity instances were recorded and mapped. These instances were classified into passive and active categories and visualized through a series of digital maps created in ArcMap.

The resulting maps reveal distinct patterns of space use across time. For example, passive activities, such as sitting and watching, were most concentrated in shaded and semi-enclosed areas during the morning and early afternoon, while active behaviors, such as walking and playing, were more prominent in the late afternoon and evening. The physical design features—such as proximity to green areas, the presence of benches, or visual openness—significantly influenced the distribution of activity.

To facilitate interpretation, three separate maps were produced for each day, corresponding to the three time periods. This approach improved visual clarity and allowed for better temporal comparisons, as recommended.

C. BEHAVIORAL AND SPATIAL CORRELATION

Table-based frequency data were used to support visual analysis. For instance, on Friday, 69.87% of activities were passive, while 30.12% were active. Among the active behaviors, walking constituted 84%, followed by taking photos and playing. These ratios suggest that the park design strongly encourages walking as the primary mode of movement.

While percentages alone can highlight proportional use, they fall short in explaining why certain behaviors dominate specific areas or periods. To address this, each data segment was interpreted in light of design accessibility and spatial configuration. For example, shaded areas with multiple seating options recorded higher morning usage due to sun exposure and comfort preferences.

Additionally, areas near statues, fountains, or interactive features such as the pet zone consistently attracted both active and passive use. This aligns with Whyte's "edge effect," where individuals naturally gravitate toward defined boundaries, symbolic landmarks, or peripheral seating, confirming that spatial layout influences behavioral clustering.

D. DATA INTERPRETATION AND LIMITATIONS

Behavioral mapping across different days revealed strong consistency in spatial preference patterns, particularly in areas that support both individual and group activities. However, variations in the number of users, higher on weekends and during evenings, reflected temporal social rhythms.

Each mapped observation was accompanied by a contextual question: "Why might this activity have occurred here at this time?" This helped uncover hidden behavioral logic. For instance, elevated evening activity near the children's play area likely correlates with usage patterns after school and work.

While the study effectively visualizes urban dynamics, some limitations should be recognized. Weather conditions, user diversity on particular days, and unrecorded short-duration behaviors may have introduced data bias. Additionally, the reliance on manual observations instead of GPS or automated tracking restricted continuous behavioral monitoring, although it maintained user anonymity and spontaneity.

IV. CONCLUSION

This study explored the potential of activity mapping, supported by GIS technologies, as a tool for understanding the complex relationship between spatial design and user behavior in urban public spaces. Using Kuğulu Park in Ankara as a case study, the research revealed how specific design features, such as seating arrangements, visual openness, accessibility, and symbolic elements, influence both the type and frequency of activities throughout different times of the day and days of the week.

The findings underscore three major conclusions:

1. Design-Behavior Relationship

Public space usage is not random but follows distinct patterns based on spatial affordances. Echoing Lynch's emphasis on legibility and Gehl's categorization of outdoor activities, this study confirmed that well-defined, accessible, and amenity-rich areas promote higher user engagement.

2. Temporal Variation in Urban Use

Activity levels vary significantly across time, with evenings and weekends showing higher usage density. These patterns reflect broader urban rhythms and can inform decisions about infrastructure timing, maintenance scheduling, and lighting.

3. Mapping as an Analytical and Creative Tool

Unlike static surveys, the mapping methodology provided a dynamic and spatially explicit representation of user behavior. It enabled the integration of qualitative observations with quantitative visualizations, transforming invisible interactions into visible patterns.

The findings of this study reaffirm the importance of considering user behavior in urban public space design, as emphasized by scholars like Jan Gehl and Alanyalı Aral. The spatial practices observed in Kuğulu Park demonstrate that design elements aligned with everyday behaviors, such as seating near pathways, shaded areas, and interactive zones, significantly contribute to both the functionality and sociability of public spaces. In line with Gehl's (2011) principle of "life before space," this study underscores that spatial configurations should emerge from the actual needs and rhythms of users rather than abstract design ideals. Therefore, activity mapping supported by GIS not only provides measurable insights but also fosters a more responsive and inclusive approach to urban design.

A. PRACTICAL RECOMMENDATIONS

- Design interventions should consider behavioral patterns. For instance, benches placed near symbolic landmarks or in shaded areas will likely attract more passive engagement.
- Policy-makers and urban designers can utilize activity mapping techniques to evaluate the post-occupancy performance of public spaces.
- GIS-based mapping can be integrated into early planning stages as a predictive tool, guiding decisions on spatial layout and functional zoning.

- Simplified, user-centered mapping tools should be developed to democratize data collection, enabling communities to participate in assessing their own public spaces and making informed decisions.

B. THEORETICAL AND METHODOLOGICAL CONTRIBUTIONS

- This research contributes to urban design scholarship by:
- Reaffirming the value of public space as a domain of everyday life, memory, and identity.
- Demonstrating the efficacy of combining observational techniques with GIS for behavioral analysis.
- Offering a replicable methodology for activity mapping that balances descriptive clarity with analytical depth.

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