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## Exploring Public Urban Green Spaces: A Behavioral Analysis Of North And South Edough Parks In Annaba, Algeria

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### Abstract

*Public urban green space is an essential element of the urban environment, contributing to quality of life by creating a certain dynamic, places to live, meet and use, with multiple environmental and health benefits.*

*In recent years, people's behaviour has become of interest not only to psychologists and sociologists, but also to town planners, architects, landscape architects and all those involved in designing the environment. Behavioural mapping is an effective research tool for directly observing the interaction between users and places.*

*This study examines user behaviour in public urban green spaces, using the Edough North and South parks in Annaba, Algeria as a case study. Firstly, we suggest a mapping protocol that is anchored in five major stages, beginning with the exploration of users of the space through the creation of behavioural maps using observation codes, determining the elements that may influence their behaviour.*

*The results of the study show different uses of Edough North and South according to gender, age group and type of activity at different times.*

*The results presented could pave the way for future studies and inform urban planning and design of the effectiveness of new interventions, namely providing a more precise alignment between the design language of public urban green spaces and the needs of users.*

**Keywords:** *Public urban green space; Annaba; behavioural mapping; physical attributes; user behaviour*

## Introduction

Public urban green spaces serve a vital role as sources of connection between inhabitants and nature. These spaces are considered to be one of the main factors that improve the quality of life of citizens in different spheres; this has been demonstrated by many research in the fields of landscape architecture, urban planning, environmental psychology, etc. (O. Toubal et al., 2023). These spaces have the potential to provide a diverse range of benefits: climatic, environmental and social (Russell, 2011; Pinto et al., 2021).

Public urban green spaces can be considered as “the lungs of the city,” (Bo Mu et al., 2021) which are used by urban residents for outdoor leisure and recreation activities (Bedimo-Rung et al., 2005; Bertram and Rehdanz, 2015), thereby making a vital contribution to residents’ health and well-being (Dallimer et al., 2014).

Public urban green spaces have rich social benefits with cultural, educational, and aesthetic functions, communication, and leisure (Li, X. et al., 2021). Thus, Public urban green spaces have significant influences on people’s physical and mental health and are an important manifestation of the welfare level of residents (Hegetschweiler et al., 2017). Briefly, Public urban green spaces play an important role in the overall sustainability of the urban environment and the welfare of residents (Kabisch et al., 2015).

Green space is a key factor in human life, especially in urban areas (Jim and Chen, 2003). Understanding the categories of people that use an area and which activities they engage in can support specific programming or potential renovation. When accumulated, such information generates knowledge on people-place interaction in public urban green spaces, a foundation for evidence-based design and planning for landscape architects and planners (K. Park et al., 2020)

One of the most important aspects of developing urban public green spaces is better comprehending how users utilize or occupy these places. When researchers, designers, and public space managers have a better knowledge of the environmental characteristics and conditions that support user preferences and needs, they can create and maintain more inclusive environments. Observing users in these local surroundings is an excellent technique to measure use and create this understanding.

Behaviour Mapping is one of the few research tools which captures in-situ behaviour, simultaneously and systematically recording both observed behaviours and their specific environmental location. It was specifically developed to recognize the reciprocal nature of human behaviour and the environment, aiming to objectively record the actual use of a space, while also denoting how the environment is supporting or influencing that use (Loebach, Cox, Little, 2020)

Annaba, a Mediterranean city in north-eastern Algeria, contains a large variety of public urban spaces with a wide diversity of characteristics in terms of creation date, location, size, quality, use and frequentation. We have observed that Public urban green spaces in Annaba are not all used in the same manner, and this is why we have attempted through this study to understand the

different uses of these spaces and the factors that determine their use. This study is based on in situ observations of Edough North and South parks users at different times of the day and on different days of the week, the two parks are in a different state of maintenance, the Edough North Park is not maintained properly and suffers from degradation of both its artificial and natural components, while the Edough South Park is in good condition due to a rehabilitation initiative, allowing us to use it as a comparative tool. Consequently, three research questions guided the study:

- Are there fluctuations in the use of urban public green spaces during the day and the week, and how does it change?
- What factors influence the use of urban public green spaces?

According to our hypothesis, the physical characteristics of public space are the factor that determines the use and behaviour of users in urban public green spaces.

The aim is to improve the use of these spaces by analyzing the behaviour of users of urban public green spaces, relating it to the characteristics of each space and to the social categories of users, in order to provide reference data for designers and future efforts about the activities that the users practice or intends to engage in, and the infrastructure required for these activities to develop public urban green spaces.

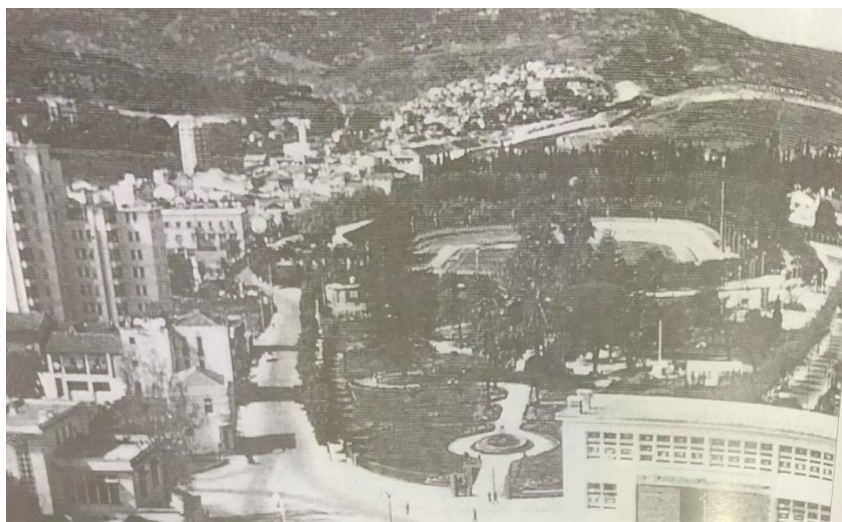
## Materials and methods

### Presentation of the case study:

The two public spaces that are the subject of this study are the Edough North and South parks, previously known as the plant nursery, built in 1841 (figure1), containing various types of trees, shrubs and plants. In 1941, the plant nursery was divided into three sections: the Jean Coggia Park (figure2), currently known as the Edough North Park, and the sports park, currently known as the Edough South Park, separated by the Akid Chabbou stadium, built in 1935.



*Figure 1: The palm alley in the plant nursery 1882. Source: Delcampe*



*Figure 2: The Jean Coggia Park, two pictures taken from different angles. Source: Hubert Cataldo, Bone de ma jeunesse 1935-1962*

The Edough North and South parks are situated in Annaba, a coastal city in northeastern Algeria (figure 2), surrounded by the mountains of Edough with a coastline of 8 km. More precisely, it is located at 36°54'00,00" of North latitude and 7°46', 00,00" of longitude East, at a minimum altitude of 03 meters.

Annaba is the fourth-largest city in Algeria after the capital Algiers, Oran and Constantine, it covers an area of more than 4848 hectares and a population density of approximately 257.359 inhabitants per km<sup>2</sup>, according to the most recent data available (R.G.P.H. 2008). it is renowned for the variety of its public spaces, which include gardens, squares, parks, etc.

The city has a Mediterranean climate with seasonal fluctuations characterized by a hot summer and a cold, wet winter.



*Figure 3: Geographical location of Annaba city. Source: Google maps*

The investigation's sites were primarily chosen because they are in a different state of preservation, the Edough North Park is poorly maintained and is suffering from degradation of its artificial and natural components, while the Edough South Park is in very good condition since it has benefited from a rehabilitation operation (table 1), which will enable us to use it as a comparative tool in order to understand the influence of physical components on the use of the public urban green spaces. Also to their proximity, their advantageous locations in connection to the city center (figure 4), that provides great movement for pedestrians and visitors to the city, the location in a residential area, and the presence of an important tertiary activities, including the wilaya's administrative offices, the education administration, the stadium El Akid Chabbou, a polyclinic, the high school Saint Augustine, as well as the longevity of these two parks, which have been around since the 19th century are the subject of their choice.

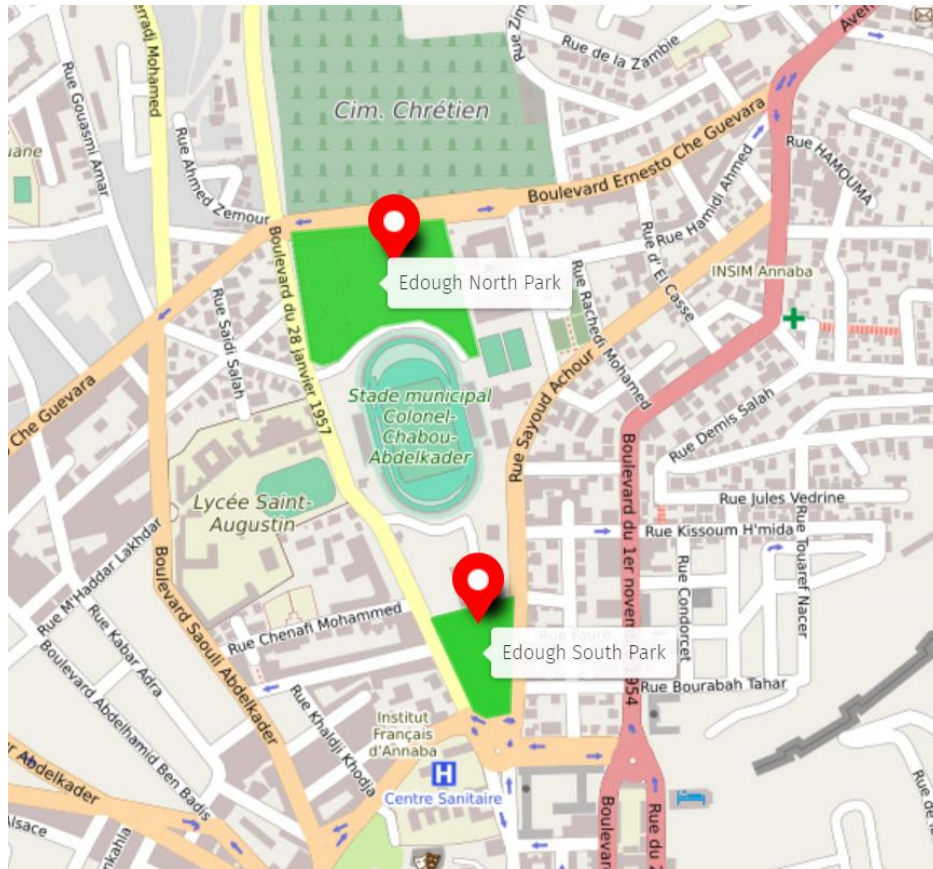


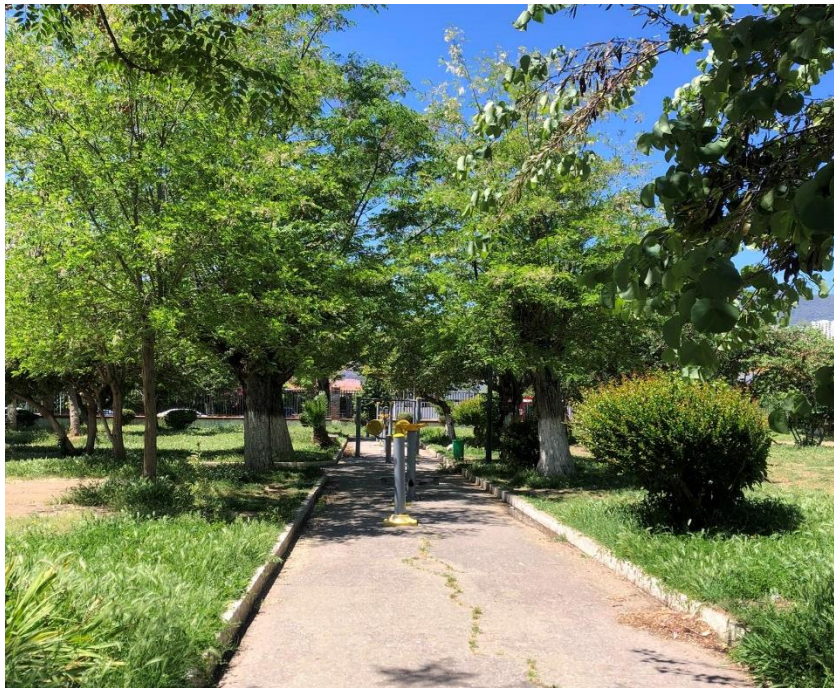
Figure 4: Situation of the two parks in Annaba city. Source: uMap

### The Edough North Park:

The Park "Jean Coggia", known today as the park of Edough Nord, has exists since the 19th century, and is one of the oldest parks in the city. it has an area of 2.75 ha, located in the northern part of Annaba, in the Beausejour residential neighborhood which is characterized by an intense mechanical and pedestrian flow, and the presence of major public services such as: the general consulate of France in Annaba, the central police station, the Saint Augustine high school, as well as the presence of a sports complex consisting of a stadium, a bowling alley and a sport hall. delimited to the north by Ernesto Che Guevara Boulevard, to the south by Akid Chabbou Stadium, to the east by the Consulate General of France and to the west by Ayachi Salah Street.

Edough North Park is fenced, with a main entrance to the south and three secondary entrances to the north overlooking the main axis (boulevard Ernesto Che Guevara) which are currently closed. The Park has at its entrance a kiosk, sanitary facilities and a shelter for cats, it also has sports equipment, various centenary trees such as: Araucaria, palm trees, Eucalyptus, plane trees, pine trees, and other types of shrubs. Unfortunately, Edough Nord Park is poorly maintained it is experiencing a degradation of the natural components: the presence of weeds, the absence of pruning and maintenance of trees, as well as a degradation of the artificial components: the

paths, the borders, part of the fence and also a deterioration of urban furniture: garbage cans, benches and lampposts that becomes non-functional to users.



*Figure 5: The North Edough Park. Source: Author, 2023*

### **The Edough South Park:**

Edough Sud Park is a triangular-shaped area covering 9976. 21 m<sup>2</sup>, located in the town center, 300 m south of Edough North Park, in a district characterized by intense road traffic and major

tertiary activities, such as the wilaya headquarters, the health administration, the education administration and the health center. The Park is bounded to the north by the bowling alley and sports hall, to the south by the wilaya roundabout, to the east by rue Sayoud Achour and to the west by rue Layachi Salah.

The Park benefited from a rehabilitation operation in 2018, including the repair of the fence, the resurfacing of paths, the installation of a children's play area, a waterfall and a water fountain, the weeding of weeds, the pruning and trimming of trees and shrubs, the planting of hedges and flowerbeds, a watering system was added, the placement of new urban furniture such as: benches, waste sorting garbage cans, lampposts, installation of sanitary facilities and signage panels. Finally, a ramp at the entrance for people with reduced mobility (PRM) is being built.





*Figure 6: The South Edough Park. Source: Author, 2023*

*Table 1: Main features of the two studied parks. Source: Author, 2023*

Characteristics	The Edough North Park:	The Edough South Park:
<b>Situation</b>	City center	City center
<b>Enclosed/Unclosed space</b>	Enclosed Park	Enclosed Park
<b>Size (m<sup>2</sup>)</b>	27570.23	9976.21
<b>Shape</b>	Irregular	Triangular
<b>Vegetation</b>	A high density of grass, a large variety of century-old trees: Ficus, plane trees, palm trees, fir trees, eucalyptus, shrubs	Trees like: palm trees, Araucaria trees, various types of shrubs such as rose bushes, hibiscus, geranium, flower beds: lantana, daisy, and lawns
<b>Urban furniture</b>	Concrete benches, toilets, plastic trash cans, sports equipment, kiosk	Children's playground, wooden benches, toilets, water fountain, ramp for Persons with Reduced Mobility (PRMs). toilets, water fountain, ramp for Persons with Reduced Mobility (PRMs), artificial waterfall, plastic recycling garbage can, signage panels, steel garbage cans, streetlights
<b>The use</b>	Sports, meeting and recreation areas	Playground, meeting place, place of relaxation and recreation.
<b>Surroundings</b>	-A very busy area with a high mechanical flow. -The existence of a variety of facilities, including a high school, a polyclinic, and the wilaya's administrative offices. -The presence of a sports complex composed of: a stadium, a bowling alley and a sports hall.	

## Protocol design

Behavioural mapping is not a new research technique. Environmental psychologists began experimenting with intensive observation techniques to capture the behaviour of people in a particular environment in the late 1960s (Ng, 2016; Bechtel & Zeisel, 1987). Behavioural mapping was introduced more formally as a research tool in the field of environmental psychology in 1970 by Ittelson, Rivlin and Proshansky of the City University of New York.

Early users of the tool used it to study the behaviour of adult patients in psychiatric wards (Ittelson, Rivlin & Proshansky, 1970), the behaviour of visitors to museums (Bechtel, 1967; Winkel & Sanoff, 1966), the movements of pedestrians in and through urban public spaces (Whyte, 1980). the behaviour of children in their neighborhoods and playgrounds (Sanoff &

Coates, 1971; Björklid, 1982; van Andel, 1984; Moore & Wong, 1997), and also the behaviour of users in public spaces (Hampton, Livio, & Goulet, 2010; Zacharias, Stathopoulos, & Wu, 2004).

As researchers gained experience in using behaviour mapping techniques, Sommer and Sommer (1991, 2002) delineated the approach into two different types: person-centered mapping and place-centered mapping. Person-centered mapping, which has also been called Behavior Tracking (Ng, 2016), maps the behaviours of a single individual or group in one or more environmental contexts over time. And the place-centered approach, which is based on understanding how a given environment supports a diverse range of uses and behaviours, for all users of the space (Janet Loebach, Adina Cox, and Sarah Little 2020). Concerning urban green spaces, Goličnik and Ward Thompson (2010) applied behavioural mapping to urban green spaces in two European cities to identify patterns of behaviour and how they are correlated with layouts and details, providing useful information to designers (D.G. Vidal et al. 2022). Rodrigues (2015) mapped the occupation pattern of the five contemporary urban parks to suggest which kind of model is the most appropriate regarding users. D.T. Do et al. (2019) aim to understand how users perceive open space in 29-3 Park in Da Nang, Vietnam.

This understanding may help to adopt a better approach to development and improvements. More specifically, it focuses on identifying roles and attributes of the space and determining those elements which affect how users of the space gather, based on their perspective. Residents' behaviour parameters were identified and classified based on activities that occurred in this space and were collected using a behavioural mapping survey method. D.G Vidal et al. (2022) identified patterns of human behaviour in public urban green spaces in the city of Porto by associating them with user profiles and the surrounding environment through the application of behavioural maps.

In order to use behavioural mapping, it is necessary to clearly define the area of observation (behavioural framework) and the types of activities (D.G. Vidal et al. 2022). The design of the protocol is based on the five elements proposed by Ittelson et al (1970) :

#### **I. Creation of the base map:**

According to Sommer and Sommer (2002), the map must contain all the elements that can influence or determine the behaviour of users; therefore, a map was created with the different parameters and physical attributes for each park; which are a set of natural elements and urban furniture: trees, shrubs, lawns, flowerbeds, paths, benches, playground, water fountain, built elements, decorative elements, toilets and trash cans (figure 7 and 8).

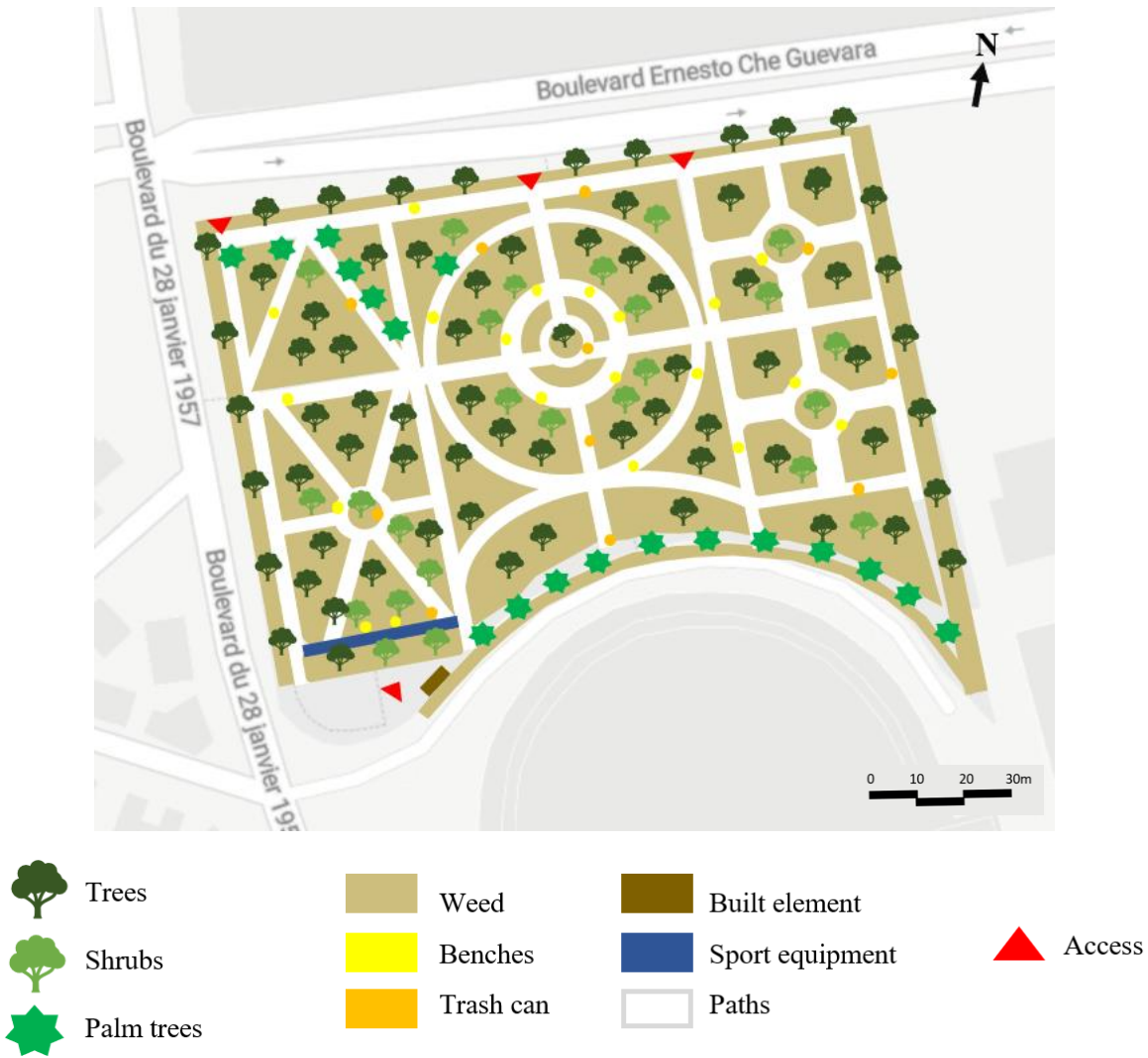


Figure 7: urban furniture and natural elements in the Edough North Park. Source: Author, 2023

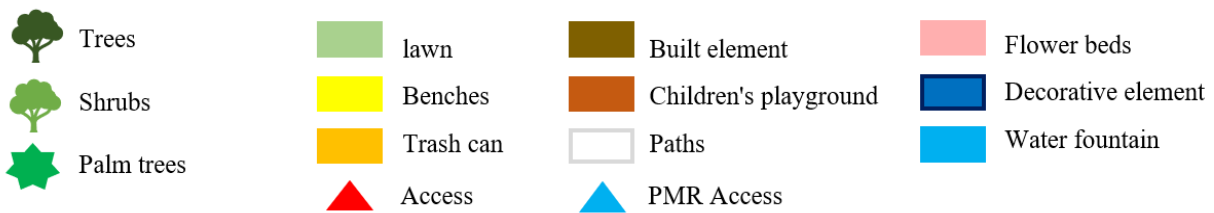


Figure 8: urban furniture and natural elements in the Edough South Park. Source: Author, 2023

## II. Defining behaviour categories and observation codes:

This stage consists of defining the behaviour categories and the corresponding codes. This process will facilitate in situ recording, allowing more observations to be made in a short space of time. Each category should correspond to a code to be used at the time of observation (example: Female = F; Male = H) Once the categories and observation codes have been defined, a grid must be drawn up to record the observations. Each user is marked by a number on the base map and then in the grid by identifying certain predefined characteristics in the categories, it is essential to record the date of observation, the time (time of day) and the environmental variables; those that are important for the research objectives (example: weather conditions; a sunny, cloudy, misty or rainy day).

### III. Establishing an observation schedule:

This stage consists of carrying out an observation schedule, in the present study, we carried out our in-situ observations during the month of May 2023, all days were practically sunny, each space was observed 4 times a week (2 weekdays and 2 weekend days), at three different times of the day early morning 9-11am, early afternoon 12-2pm and late afternoon 3-5pm; as recommended by Cohen et al. (2011) carry out observations four days a week and four times a day to obtain a robust estimate of the characteristics of users of public spaces and an excellent level of reliability.

### IV. Definition of the systematic observation procedure

**Observation points:** for this stage we first carried out a preliminary visit to the target area to define the observation points in each space; this visit enabled us to identify 5 observation points in Edough North Park and 3 points in Edough South Park, depending on the shape of the space and the physical obstacles encountered: trees, built elements, and also to minimise the risk of the observer being identified as an intruder, which could lead to a change in the behaviour of the person being observed (Bechtel, 1967); (Ittelson et al. 1970).

**Observation tools:** to carry out the field research the observer was provided with a base map, a grid of behaviour categories and observation codes, and recording sheets.

### V. A coding and counting system\_ data collection and analysis

The acquired data was initially hand-mapped, then drawn using AutoCAD 2016 software, and the statistical procedures were executed out using IBM®SPSS® Statistics 25.0.

## Results

### Overview of users:

Table 2 shows the data for the 459 users observed in the 2 Edough South and North parks. Overall, there were more users in Edough Sud Park (n=247) in an area of almost 1 ha than in Edough Nord Park (n=212) in an area of 2.7 ha.

Users were mainly male (63.20%) in the Edough Nord park, whereas in the Edough Sud park there were more female users (57.08%) than male (42.91%). Young adults were more numerous in both parks (41.51%) in Edough North and (32.39%) in Edough South.

In Edough North, teenagers were in 2nd place (20.75%), followed by adults and children (12.73%) and finally the elderly (12.26%).

In Edough south, children came 2nd (29.96%), followed by teenagers (17.81%), adults (10.12%) and the elderly (9.71%).

the majority of users visited the parks in groups and fewer were alone. In terms of the number of people in the group, more than half of users (52.86%) were in large groups (more than 10 people) at Edough North Park, and the other half were 2 people (25.48%) and in small groups (between 3

and 10 people) (21.65%). Unlike Edough South, small groups were the most common (41.38%), followed by groups of 2 people (35.63%) and large groups (22.98%).

Parameters	Edough North Park	Edough South Park
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Concerning user's behaviours, in Edough North Park users tended to do physical exercises (14.62%), play football (13.21%) and play (12.26%) were the most frequent behaviours, followed by eating and running (11.32%), sitting and watching (9.43%), meeting

and talking (8.01%), walking (5.19%), using the mobile phone (3.77%), reading the newspaper (3.30%), smoking and accompanying a pet (2.83%), studying or reading a book (1.89%).

In Edough Sud Park, the most common behaviours are: playing (22.67%), sitting and watching (18.22%), meeting and talking (16.60%), eating (10.53%), walking (10.12%), using a mobile phone (6.88%), smoking (4.85%), reading a newspaper (4.45%), running (3.24%) and reading a book (2.43%). We notice the absence of some behaviors at the Edough South Park like: doing physical exercises, playing football and accompanying the pet.

	(n= 212) n (%)	(n=247) n (%)
<b>Gender</b>		
Male	134 (63,20%)	106 (42,91%)
Female	78 (36,79%)	141 (57,08%)
<b>Age</b>		
Child (<10 y)	27 (12,73%)	74 (29,96%)
Teenager (<20 y)	44 (20,75%)	44 (17,81%)
Young adult (21y- 40 y)	88 (41,51%)	80 (32,39%)
Adult (41y-60 y)	27 (12,73%)	25 (10,12%)
Elderly (>60 y)	26 (12,26%)	24 (9,71%)
<b>Status</b>		
Alone	55 (25,94%)	73 (29,55%)
Accompanied	157(74,06%)	174 (70,45%)
<b>Social interaction</b>		
Two persons	40 (25,48%)	62 (35,63%)
Smal group (between 3 and 10 persons)	34 (21,65%)	72 (41,38%)
Big group (more than 10 persons)	83 (52,86%)	40 (22,98%)
<b>Category of behaviour</b>		
Sitting/ Watching	20 (9,43%)	45 (18,22%)
Using the mobile phone	8 (3,77%)	17 (6,88%)
Reading newspaper	7 (3,30%)	11 (4,45%)
Reading a book/ Studying	4 (1,89%)	06 (2,43%)
Meeting/ Talking	17 (8,01%)	41 (16,60%)
Eating	24 (11,32%)	26 (10,53%)
Walking	11 (5,19%)	25 (10,12%)
Physical exercise	31 (14,62%)	00
Playing	26 (12,26%)	56 (22,67%)
Running	24 (11,32%)	08 (3,24%)
Accompanying his pet	6 (2,83%)	00
Smoke	6 (2,83%)	12 (4,85%)
Playing football	28 (13,21%)	00

*Table 2:  
Data from  
users  
observed  
in South  
and North  
Edough  
Parks.  
Source:  
Author  
2023 by  
using SPSS  
® 21.0,  
inspired by  
D.G. Vidal  
et al., 2022*

### **Fluctuations over time:**

Checking variations in user numbers according to their age provides a way of measuring the use of a space over time. The results can be compared with the facilities on site. This tool can also be used to determine the type of population using a public space.

Figure 9 shows the variations in users of Edough North Park during the day period (morning, midday, afternoon), and during the week (weekday/weekend).

On weekdays, in the morning the park is rarely used by the 4 categories of user, at midday the number of users increases, children and young adults are more pronounced, in the afternoon the number of young adults in the park peaks, followed by teenagers, and a slight increase in the number of adults and elderly users, while the number of children has decreased

During the weekend, in the morning the park is used by teenagers, young adults and children, with a small presence of adults and an absence of elderly users. At midday, there were no children, teenagers or young adults in the park, which appeared to be empty, although it was used slightly by adults and the elderly. In the afternoon, the number of users increased, young adults in 1st place, then adults, followed by teenagers and the elderly, lastly children.

Figure 10 presents the fluctuations in the age groups of users observed at Edough Park South during the day (morning, midday, afternoon) on different days of the week (weekday, weekend).

During weekdays, young adults are the most frequent visitors to the park in the mornings, followed by adults, the elderly and teenagers, while children are absent. At noon, the attendance of the 4 age groups begins to increase until it reaches its maximum for children and adolescents during the afternoon and a decrease in use for young adults

During the weekend, children and young adults make up a large proportion of park users in the mornings, while the number of elderly users is very low. At midday, a decreasing curve for the number of users in the 3 age categories (children, teenagers, young adults, adults) and a slight presence of the elderly. In the afternoon, the park is heavily used by children and young adults, with a moderate presence of teenagers, adults and the elderly.



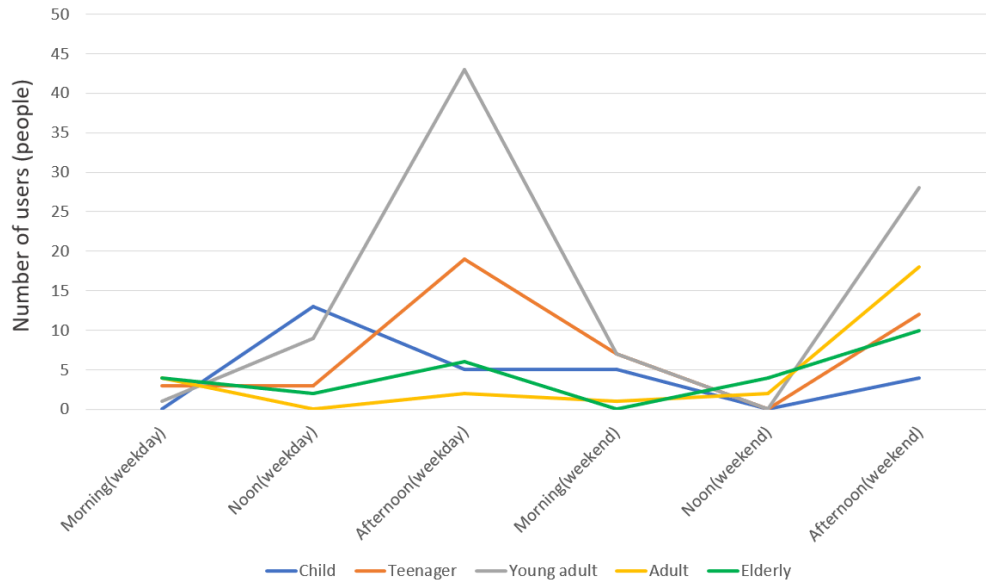


Figure 9: Number of users at the Edough North Park on weekdays and weekends, by age group.  
 Source: Author, 2023

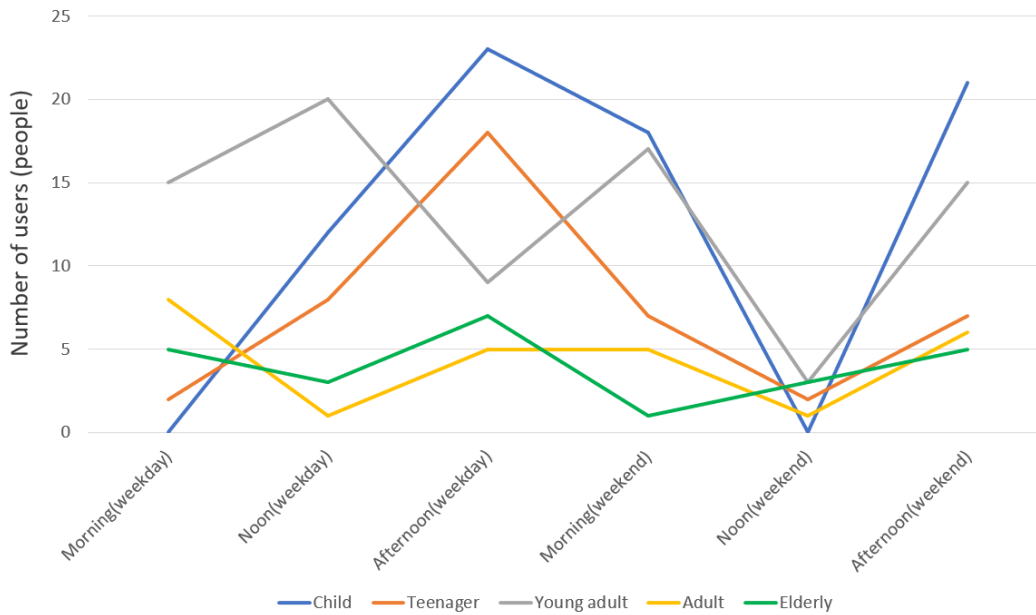


Figure 10: Number of users at the Edough South Park on weekdays and weekends, by age group.  
 Source: Author, 2023

## Discussions

### Uses of public spaces:

The aim of this study is to show how the characteristics of public space can influence user behaviour. Figures 11, 12, 13 and 14 show user behaviour in North and South Edough Park on weekdays and at weekends.

They demonstrate that the most frequented places are those with the most trees, probably due to the shade, as shown in figures 11 and 12, where we can see that the west side of park Edough north is more used than the east side, which is less exposed, due to the presence of large trees that provide shade for users, the most used areas are paths, areas with furniture and areas with children's play areas (figures 13 and 14).

Although children are very present in south Edough Park, they are less present in north Edough Park due to the lack of playgrounds, whereas teenagers are very present in north Edough Park due to the limited area available for playing football on the other side, the elderly are the least observed category in both parks. Young adults are the social category that is most frequently observed in both North and South Edough Parks.

In terms of user behaviour (figures 11 and 13) during weekdays, eating, physical exercise and playing football are the most common behaviours in Edough north park; it was also observed that the following behaviours: sitting, talking and meeting took place in the middle of Edough north park, in quiet areas avoiding the noisier borders, which were used for running

Exercising and football seem to be uncommon behaviors in the south Edough park, due to the lack of adequate elements for these activities, and the lack of shade, which makes the park very exposed to the sun. Playing is the most pronounced behaviour, due to the presence of play grounds for children, and we can also see that a large number of users come to sit around the play areas to watch and supervise their children, even sitting on the edges when the benches are insufficient. Eating in groups is also a very common behavior at Edough south park.

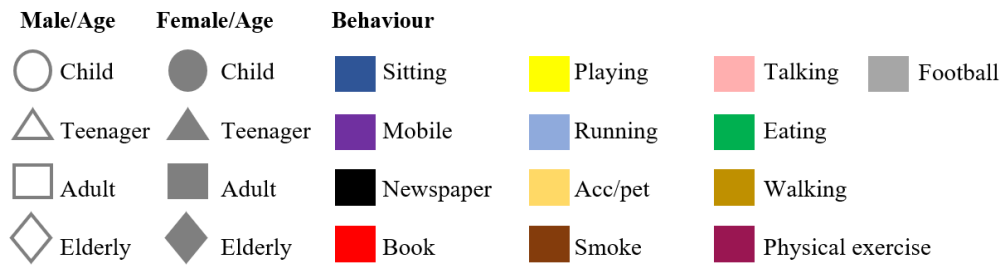
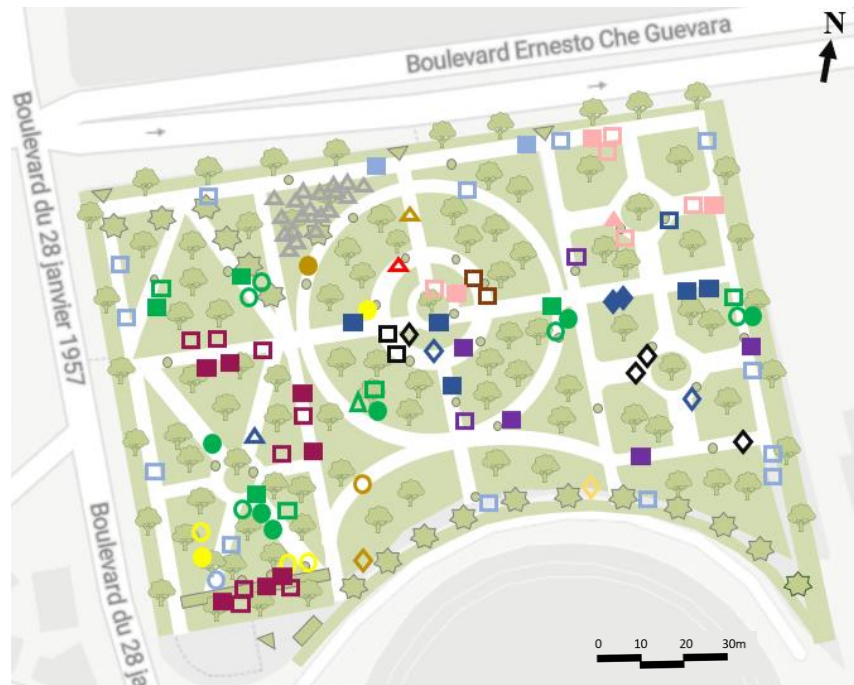


Figure 11: User's behaviour map for the Edough North Park during weekdays. Source: Author, 2023

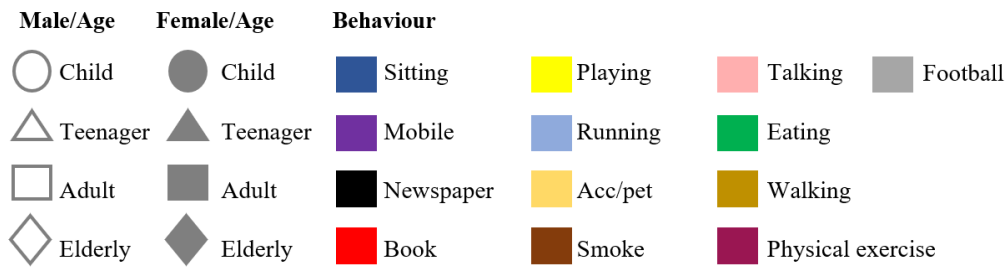
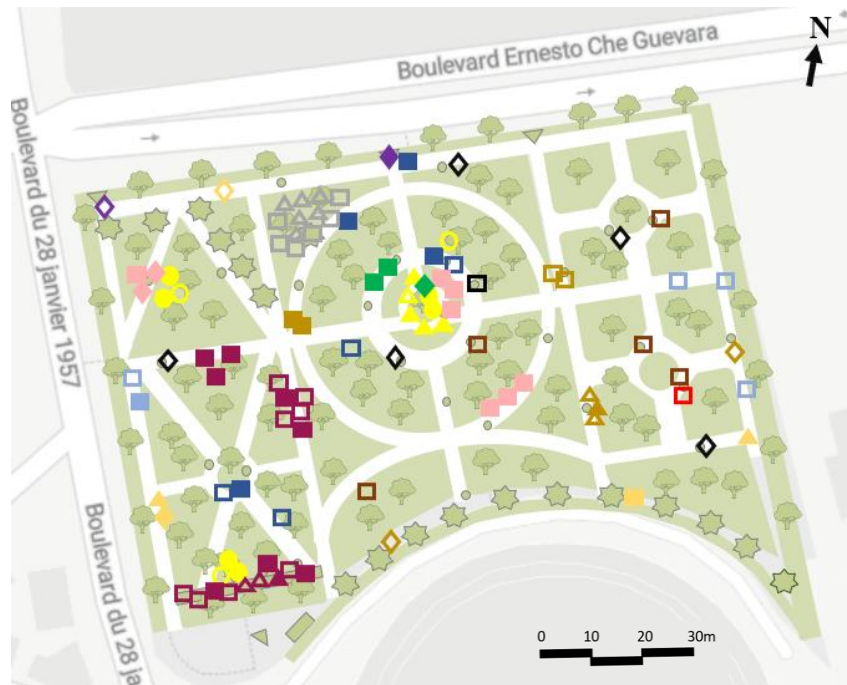


Figure 12: User's behaviour map for the Edough North Park over the weekend. Source: Author, 2023

Concerning the level of physical activity of users, the two parks are distinct: Edough south park is mainly used for immobility activities, such as sitting, talking on the phone, reading the newspaper, reading a book, eating, meeting and talking, smoking and fewer movement activities: playing, walking, whereas Edough north park is primarily used for movement activities: physical exercise, running, walking, playing and accompanying pets which is only observed in Edough north park because in Edough south park there are signage panels that prohibit it.

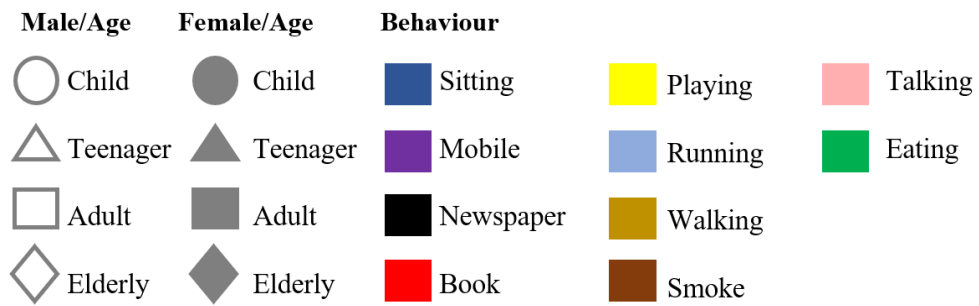
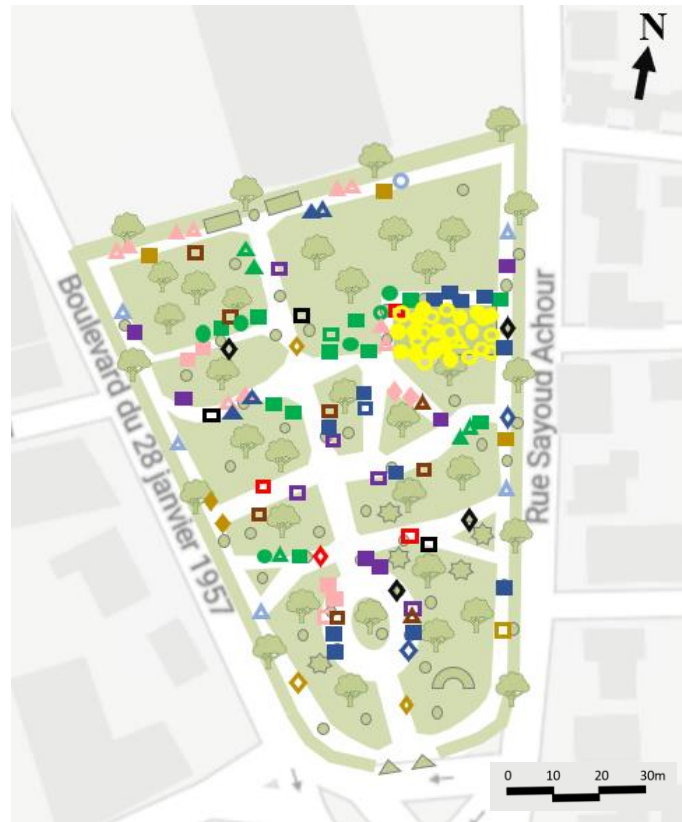


Figure 13: User's behaviour map for the Edough South Park during weekdays. Source: Author, 2023

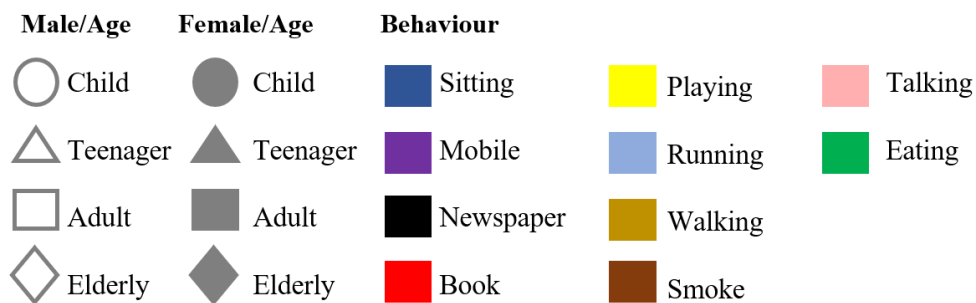


Figure 14: User's behaviour map for the Edough South Park over the weekend. Source: Author, 2023

### Variations over time:

According to Pushkarev and Zupan (1975), public spaces are used less in the morning, more around midday, and even more in the afternoon (D.G. Vidal et al. 2022), and this peaking phenomenon perfectly confirmed in the two public spaces studied just on the weekdays, considering that on the weekend, the use of the two parks reduces in the morning and rises during the afternoon. the use of the two parks decreases at midday compared to the morning and rises in the afternoon.

The use and the users of the parks fluctuate throughout the course of the day. Edough Park North and South are mostly used by elderly persons and adults in the morning for immobility activities such as meeting, conversing, sitting, talking on the phone, and reading in the morning.

At lunchtime, there are essentially two categories of users: those who sit on the benches or on the borders of Edough South Park, and those who sit on the benches and grass of Edough North Park. Adults come to eat and rest before returning to work with their children. The two parks' placement in a tertiary zone (near the administration, schools, secondary schools, and so on) makes them a place of rest and relaxation during the lunch break for adults (parents and workers) as well as children and teens (schoolchildren, secondary school students).

In the afternoons, the parks are used for mobility activities: physical exercise, running, walking, and playing football are the behaviors that are most prevalent in Edough North Park, because the park is spacious and promotes this type of activity through the presence of sports equipment, the football ground, and shaded areas, while immobility activities are the most common in Edough South Park, since it contains well-maintained street furniture, attractive vegetative surroundings, and playground equipment.

This study demonstrates that uses of public space change according to two parameters (factors): the physical attributes of public space, which influence the behaviour and categories of users, and social time, such as school time, work time, days of the week or weekends, etc.

## **Conclusion**

The findings of this study show the diverse uses of the public green spaces investigated by different age groups, through demonstrating the influence of the physical attributes of the space on user behavior, using the in-situ observation approach for different users during their frequentation, this observation was translated and represented using behavioural maps in order to facilitate the reading and interpretation of the results. This technique seems useful because it allows to establish a very precise mapping of the different user behaviours. Moreover, the presented results may provide an important step to making users' needs and design language closer (D.G. Vidal et al. 2022).

The results reveal that the use of green spaces evolves and changes depending on the physical characteristics of each space and depending on the time: morning, noon, afternoon, weekdays, weekends, free time, etc., defined as social time. The data obtained can be used to provide design recommendations or suggest modifications to the green spaces evaluated.

If the interest is to promote the use of green spaces by children and adolescents, it is essential to integrate play areas, sports fields as well as the installation of appropriate and sufficient urban furniture for use (of benches and tables) for lunch breaks; because we have observed that the location of spaces in a specific environment favors particular uses: as in our two case studies, the situation in a tertiary and residential activity zone favors the use of parks during lunch breaks as places of rest and relaxation. the presence of sports equipment favors young adults and adults as main users. The arrangement of shaded paths supports the behavior of walking and running, so it is necessary to ensure strategic placement of trees to ensure shaded places. The arrangement of flower beds, the establishment of flowering trees, as well as good maintenance of the vegetation of green spaces, improves the quality and aesthetic value of the space which gives it the appearance of being more secure and pleasant popular this encourages the use of space by women accompanied by their children.

Finally, behaviour mapping is a valuable tool because it assists architects, designers and planners to create public urban green spaces that respond to users' needs and preferences. By analyzing behaviours and understanding how people interact with their surroundings, they can produce spaces that are more functional and pleasant to use.

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