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USING BEHAVIOUR MAPPING TO EVALUATE THE USING EFFICIENCY OF PUBLIC SQUARE. CASE STUDY: NOVEMBER 1st, 1954 SQUARE IN M’SILA CITY

Abstract: Human behaviour and social interactions in public places are the results of mental processes that are affected by the different components of these spaces. These components may be physical, social, cultural or sensory, but they all have in common the ability to influence the behaviour of users in the public sphere. Consequently, human behaviour can be affected by the presence of physical and environmental features of public places such as buildings, streets, landforms and even occupation by other people. The physical components of public spaces can have a deep impact on how people behave, live and interact in public spaces. This paper aims to highlight the use of public squares in M’sila city, by relating the physical characteristics and behaviour of users within these squares. The analysis was based on the behavioural map approach, which combines two complementary research techniques: direct observation and the questionnaire. To achieve the results, the data was analysed by SPSS and represented by the GIS program. The study concluded that there is a mismatch in the reciprocal relationship between human behaviour and the physical environment of 1st November, 1954 Square, which has resulted in negative effects on human behaviour, which in turn has affected the physical environment of the square too.

Key words: behaviour mapping, public square, user’s behaviour, physical characteristics, M’sila city

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Introduction

The understanding of the relationship between man and his environment is a relatively old science that no one today can claim to be unaware of its importance in the life of societies. Indeed, environmental psychology is a field shared not only by psychologists, sociologists, geographers and anthropologists, but also by planners, designers and public authorities. (Canter, 1977; Morval, 2007). This science studies the relationship between people and their built environments, according to the understanding of the interrelation between the components of urban space and the behaviour of users. Behavioural mapping is not only the basic but also the most used method for exploring this relationship.

Since the second half of the twentieth century, and more precisely with the holding of the 8th International Congress of Modern Architecture (CIAM) in Hoddesdon, the actors of the city began to feel the interest and added value that the quality of the design of the city's public spaces could bring to the moral health and wellbeing of its inhabitants (Arab & Boutabba, 2022). Public places are increasingly playing an important role in the sustainability of urban space and are beginning to take centre stage in urban studies (Fezzai & Mazouz, 2018; Leroux et al., 2000). The number and quality of public squares in the city has become an unavoidable necessity in modern societies, given their consideration as places of social and psychological health and stress reduction (Carmona, 2019). In addition to their capacity to strengthen neighbourhood relations and social cohesion, these public spaces can even help to reduce crime and anti-social behaviour (Baulkwill, 2002).

In Algeria, this issue, which deals with the influence of urban and architectural physical components on user behaviour, is becoming increasingly considered, not only by practitioners responsible for the act of building, but also by academic theorists: city managers and urban planners (Bendjedidi et al., 2019; Bouarroudj & Aiche, 2017; Mili et al., 2019; Sakhri et al., 2020).

At present, this research is addressed according to several methodological approaches, all of which have a psychological anchor. The behavioural map was the first tool. In the late 1950s, researchers began to develop a method to study the effect of the physical environment on the behaviour of individuals and groups by recording the locations, actions and characteristics of people in pencil on printed maps (Cosco & Moore, 2010). Indeed, in 1958, Sommer and Ross had begun to develop a method for studying the effect of the physical environment on the behaviour of individuals and groups. The term behavioural map is based on two concepts developed by some of the pioneers of environmental psychology: Gibson's (1977) concept of affordances and Barker's (1968) idea of behavioural settings. The analysis of external relations aims to understand how the physical environment can affect the activities of individuals. Behaviour settings are also seen as regular patterns of behaviour, defined by time and place. These settings depend on the physical characteristics of the place as well as on the specific social roles that should take place there (Rigolon, 2013).

In this study we will use the behavioural map and the semi-structured interview technique to detect the relational mismatches between the quality of the layout and the effectiveness of the social use of the November 1st, 1954 square.

Literature Review

Many researchers in the human and behavioural sciences had tried to study the effect of the physical environment on the behaviour of individuals and groups. Sommer and Ross (1958) were the first to use this tool to understand social interactions in geriatric care units by focusing on the description of the participants, the observation of the behaviour and the determination of the position of the behaviour in space. However, the scientific use of this method would not emerge until after the work of Ittelson, Rivlin and Proshansky on behavioural mapping in the 1970s, where the theoretical and methodological foundations of behavioural mapping were defined. Since then, behavioural mapping had enabled the study of a wide range of behaviours in addition to the possibility of studying the dimensions of behaviour, including functional, cognitive and social aspects.

Some studies have focused on the functional relationship of work practices to the workplace. An example is a work of Kates and Adams (1982) who demonstrated how users of commercial offices distribute their activities in different parts of the building, allowing them to analyse the functions of these parts. Other research has attempted to elucidate the distribution of social interactions in a particular space in order to determine the environmental conditions associated with the emergence and continuation of interactions (Beeken & Janzen, 1978). This research has highlighted not only on how people distribute their social behaviours according to the composition of space, but has also examined how social relationships are expressed through the patterns of use of these spaces. These examples show that behavioural mapping allows the identification of places where different types of social interactions take place and facilitate the examination of the relative positions that group members occupy in a place. The use of this method is therefore particularly suited to studies aimed at better understanding the social use of place, for example, the study by Morrison et al. (1997), which looked at the incidents that led to the placement of some patients in seclusion, found that the accidents occurred in specific areas of high social density, and that patients were confined to these areas at certain times of the day without sufficient seclusion space to reduce anxiety and aggressive behaviour, which led to proposals for new forms of space management. In an attempt to understand the relationship between outdoor activities and urban outdoor spaces, taking as a case study the Place de la Liberté in Biskra, Algeria, Sakhri et al. (2020) had demonstrated, through a method of investigation of the quality of urban outdoor space based on the study of user patterns, that there is a separation in the continuity of outdoor activities during the day, due to the poor quality of the square. Therefore, this study had confirmed the strong dependence between the continuity of outdoor activities and the quality of the outdoor urban space on which this activity takes place. In summary, these empirical studies demonstrate that the behavioural map is a promising research tool by collecting integrated information on spatial location and behaviour, it can help researchers answer questions in the field of environment and behaviour studies, i.e. how and to what extent do the physical and spatial factors of the built environment affect people's perception and behaviour?

Tools and Methods

Study Area

The city of M'sila is located in the northwest of the shot Al-Hodna basin, in the heart of a semi-arid and steppe region, which covers an area of 6,951 Km² (Boutabba et al., 2019;

Benkhaled et al., 2022; Mezrag et al., 2018). M'sila is the crossroads of two important national roads (RN 40 and 45) and a waterway (Wadi Al-Qsob), making it an important commercial and economic exchange area (see Figure 1).

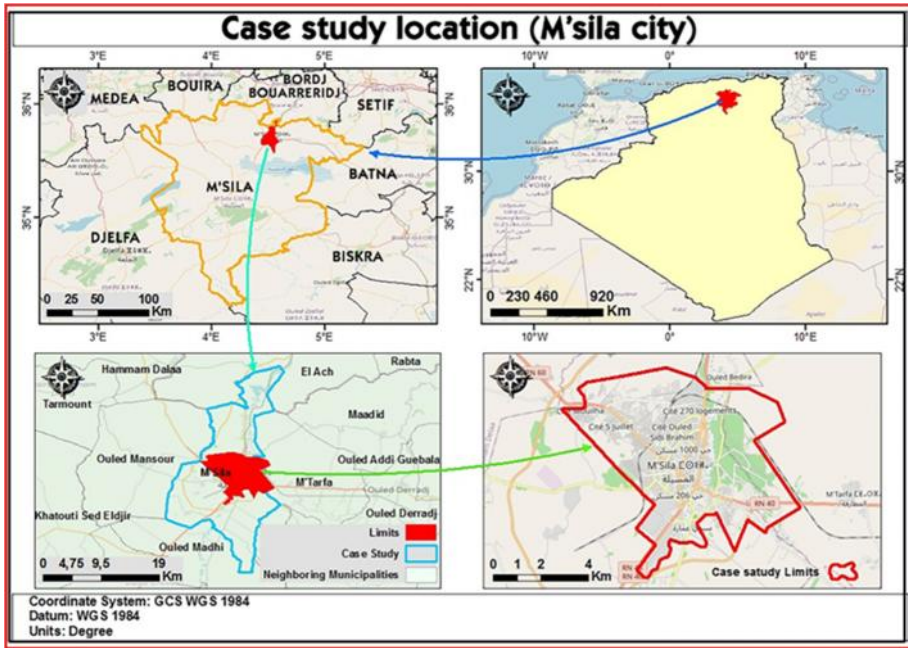


Fig. 1. Location of the case study in the national territory (Source: Authors, 2022)

Known as a crossroads of various commercial caravans linking the northern region of the country (the Tell) to its southern region (the Sahara), the urban core of M'sila was born following the construction of several forts called Ksar (Despois, 1953) probably deriving from the Latin castrum, which is an urban space, often fortified, containing the dwellings of the members of the tribe, structured around a main axis linking the Mosque and the main square called Rahba (Boutabba et al., 2016). The urban layout followed the principles of Arab-Muslim cities (Grandet, 1988). Narrow, winding, hierarchical streets served the housing blocks of the different groups 'Chetawa', 'Keraghla' and 'Kharbet Tellis' (Boutabba et al., 2014). Each urban grouping had its own public square, its own Rahba. With the advent of French colonialism, three other squares were created, representing the spatial junction between the indigenous and colonial towns: Place Aristide Laussel, Bachagua Boudial and the mixed commune (see Figure 2).



Fig. 2. Public squares during the colonial period. Left: Place Aristide Laussel. Middle: Place de la commune mixte. Right: Bachagua Boudial. (Source: Albert Star Collection, from Mili et al., 2019)

During the post-independence period, the town, like other medium-sized Algerian towns, developed several other squares. In 1972, the city acquired the “Ahmed Madghri” garden, which occupied a vast area of 1600m² and contained a wide variety of plants (jasmine, cypress, Japanese privet, etc.), but its use was diverted after it was used by delinquents, which led the authorities to close it. The city authorities were then forced to open up other green spaces and squares to the city’s inhabitants. It is in this perspective that the square of the “Municipal People’s Council”, which occupies an area of 1,500m², the November 1st Square in the early 1980s and the square of Martyrs in 1995, which occupies an area of 4,200m², were planned and developed. It was therefore at the beginning of the 1980s, and after the construction of new land use plans, within the framework of urban development, that the town of M’sila acquired the November 1st Square. It was built near the largest collective residential grouping: the 1000 neighbourhood, in order to offer the tenants of these dwellings a space for entertainment. This square was inaugurated during the commemorations of the Algerian national liberation war and consequently took the date of November 1st, as its name, in order to glorify the Algerian martyrs.

The November 1st Square, 1954 was chosen as a case study because of its strategic location near the city centre. The square is characterised by frequent use on weekdays and during all months of the year and occupies an entire block, it is surrounded by three important mechanical axes and a pedestrian street. It was built in 1984 and has a surface area of 8,200m². It is limited to the north by a large housing estate (1000 collective social housing units), to the south and west, it is bordered by public facilities and services of various kinds (cafés, restaurants and shops), to the east, it is limited by a museum, the great mosque and an open-air market (see Figure 3).

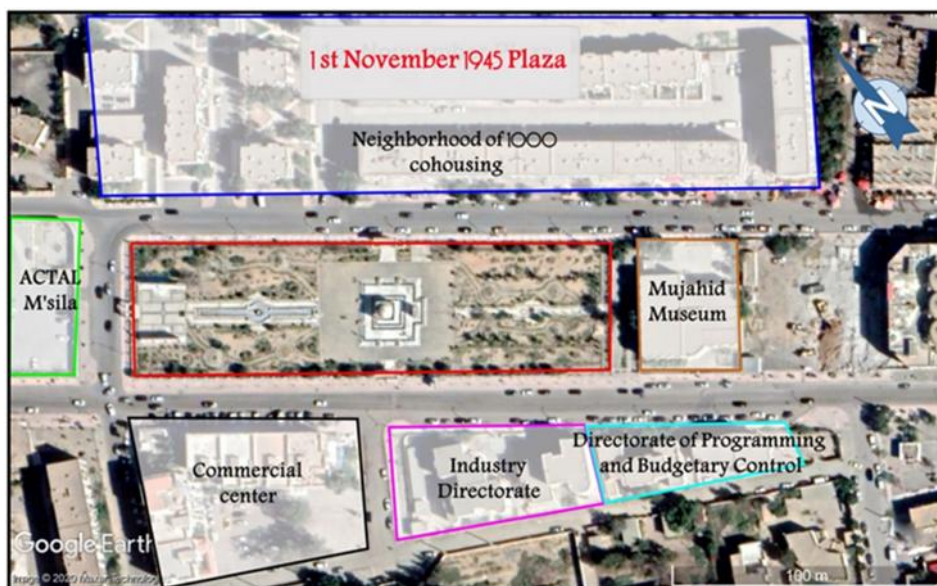


Fig. 3. Location of the November 1st, 1954 square in M'sila city (Source: Authors, based on Google Earth, 2022)

Approach methodology

In the present study, the methodological approach used combines the elements of the behavioural map (Figure 4) with the questionnaire survey technique. The aim was to highlight on the gap between actual practices and subjective representations of these practices in the November 1st square. We therefore opted to design investigation protocols combining several methodological approaches. Our choice to study user behaviour refers to the work of Moser and Karine (2003), Cosco and Moore (2010) and Zhang et al. (2020). These authors indicate that the study of human behaviour should be based on direct observation, mapping of users' gestures, movements and photography at different times of the day, using a paper: the map. The aim is to collect behavioural patterns and data during occupancy. The data collection was carried out during the peak periods of the space, specifically during the beginning and end of the week. The survey took place over a period of one month, from 25 March to 25 April 2022, including the student period and the spring school holidays. Data collection was spread over four weeks. The reading was taken on four days per week: two working days and one day at the weekend, and in two periods of 10 to 30 minutes per day: in the morning from 8:30 to 10:30 and in the afternoon from 17:00 to 19:00. It should be noted that the temperature in April is mild, around 24 degrees Celsius, which favours the use of this outdoor space by the population.

To support the results of the behavioural mapping, a questionnaire survey was carried out with the aim of understanding the user's perception of the square and subsequently comparing these results with those obtained from the behavioural map. The questionnaire was divided into three axes. The first axis deals with personal data related to the respondents such as age, gender and type of activity. The second axis consists of the characteristics of the physical environment of the square (location, suitability of building materials, attractive elements of the square), while the third axis focuses on the preferred times for its use by the users and the means to access it. The data processing will be done by means of SPSS software (Statistical Package for the Social Science).

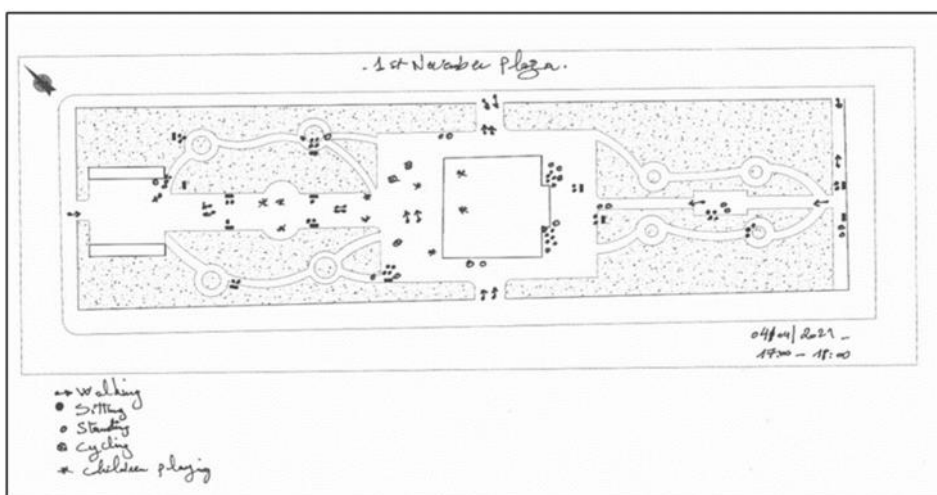


Fig. 4. Behavioural map of the study square. Date: 4 April 2022 (Source: Authors, 2022)

Results

Behavioural map: Users observation

Behavioural mapping, which was chosen as the basic analysis tool for this study, makes it possible to identify precisely the locations where certain behaviours happen. By locating behaviours in space, it is possible to examine their spatial distribution and to verify if this distribution is random or selective. The aim of the method is to determine the extent to which the expression of different behaviours is favoured, hindered or largely independent of the physical and social characteristics that define the different areas of the study site (Legendre & Depeau, 2003).

We started by counting the users of the November 1st, 1954 Square according to their age and gender. The most important observation recorded is related to gender. Indeed, the observation showed that only adult males use the square. No female use was recorded, not even for passing. The number of users in one day varies from one period to another. From 8 am to 12 pm, the average daily attendance is between 25 and 48 people, i.e. between 13 and 25% of the total number of users of the square per day. The majority of users in this period belong to the retired category. The period between midday and 4 pm shows a clear decrease in the number of users, with an average of 32 to 36 people recorded, which represents 16 to 17% of the total number of users of the square per day. During this period of the day, the square is used exclusively by young people aged between 18 and 27. The use of the square peaks during the period from 4 pm to 8 pm. This is due to the appropriate climatic conditions on the one hand, and the emergence of other behavioural patterns such as children's play behaviour on the other. The number of registered users varies from 123 to 158 people per day, i.e. 58% to 81% of the total users (See Table 1).

Tab. 1. Number of users of the November 1st, 1954 Square at different periods

Timing	From 8am to 12pm	12 noon to 4 pm	From 4pm to 8pm	Total
Beginning of the week (Sunday)	48 people	36 people	123 people	207
Midweek (Tuesday)	50 people	32 people	115 people	197
Weekend (Friday)	25 people	32 people	158 people	215

Source: Authors, 1990

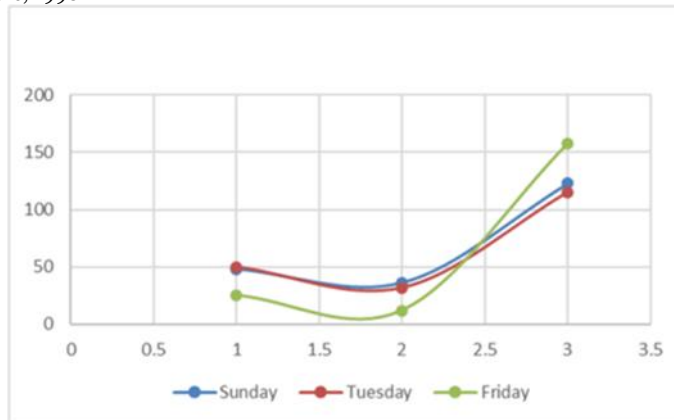


Fig. 5. Number of users of the square at different periods (Source: Authors, 2022)

In order to understand the behaviour of users and the nature of the activities they carry out, as well as their distribution in the November 1st, 1954 Square during the day, several means and media of recording were used: observation booklet with notes, sketches and photos. We began by counting the users according to whether their activities were stationary or passing through. In order to get a precise idea of how the space of the square was occupied, we spatialised the uses and activities by means of an “instantaneous” survey at regular intervals in order to capture the changes over the course of the day. Several behavioural patterns were recorded. Six patterns were identified: social interaction (presence in the space while standing alone or in a group), walking, sitting, playing dominoes, cycling and children's games. The analysis reveals the predominance of stable patterns (sitting, playing dominoes) over moving patterns (walking, cycling and playing with children). This diversity of patterns leads to an increase in the efficiency of the social use of the square (see Figure 6 and Figure 7).



Fig. 6. Behaviour patterns in the November 1st, 1954 square (Source: Authors, 2022)

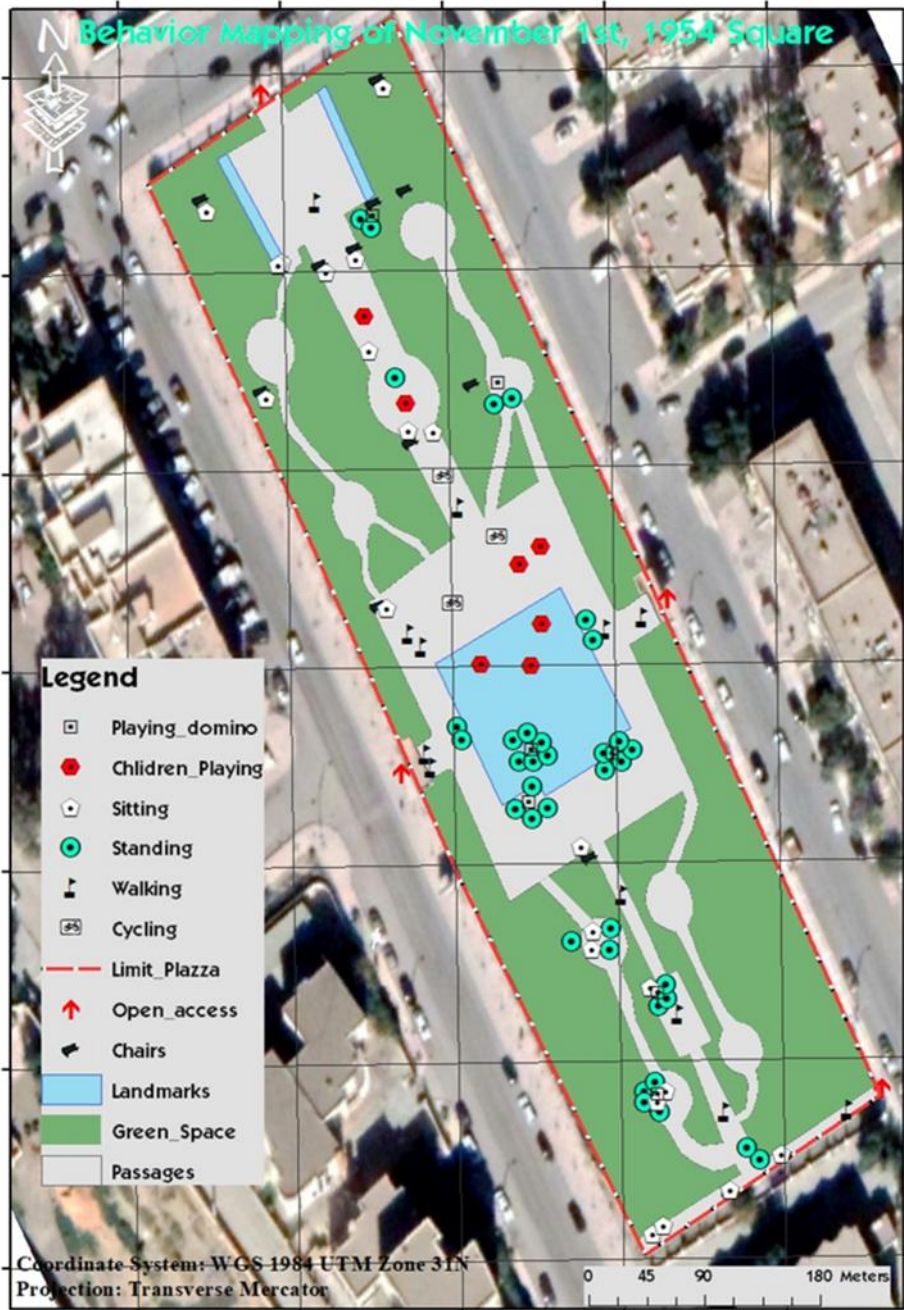


Fig. 7. Behavioural mapping (Source: Authors, 2022)

The behavioural pattern 'sitting' obtained the highest value among the other models, with a rate of 51%, due to the fact that all categories of users of the square do so. The second most practised behaviour pattern is 'dominoes' with 14.8%, which is considered to be a

game that attracts both the retired and the young category, and lasts for quite a long time, while the third position is jointly attributed to the two behaviour patterns 'walking' and 'standing', which account for about 11%. This is due to the strategic location of the November 1st Square. Indeed, this square is considered as a central link between different urban entities: residential areas, collective social housing estates, different types of facilities, shopping centres. For the “social interaction” pattern (presence in the space in a standing position alone or in a group), most of those who adopt it do so to watch the different groups playing dominoes. The behavioural patterns 'playing with children' and 'cycling ' are patterns that the square does not encourage. In fact, they occupy the last positions with 8% and 3% respectively, due to the absence of spaces designed for this purpose in the square on the one hand, and the bypassing of the square, on its three sides, by heavily trafficked mechanical lanes (see Table 2 and Figure 4). Children who visit the Square are usually accompanied by their fathers or grandfathers and only stay there for 30 minutes to an hour.

Tab. 2. Behaviour patterns in the November 1st, 1954 square

Behavioural model	Duration Users	User category	Period of activity	Number of users	Percentage
Walking	10 to 20 minutes	all categories	the entire observation period	23	11.0 %
Standing	20 to 45 minutes	Young people	the entire observation period	24	11.4%
Sitting down	30 min to 1 hour	all categories	the entire observation period	107	51.0 %
Children's games	30 min to 1 hour	Children from 5 to 15 years old	16:00 to 21:20	17	8.1%
Cycling	20 to 30 minutes	Children from 5 to 15 years	4pm to 8pm	08	3.8%
Playing dominoes	1h to 4h30 1h to 2h45	Retirees Young people	4pm to 8pm 16:00 to 00:00	31	14.8%

Source: Authors, 2022

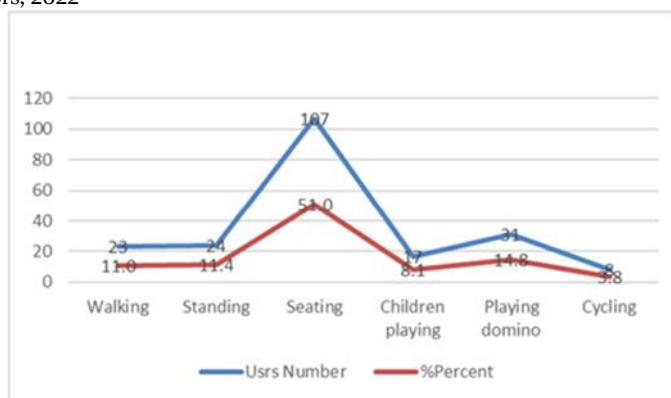


Fig. 8. Behaviour patterns in the November 1st, 1954 square (Source: Authors, 2022)

We also asked the users to draw up thematic maps to identify the favourite sections for walking by groups of children and young people within the square. The central area seems to be the most suitable for young people. Children prefer the longitudinal sides of the square for their walks. The users have marked on their maps the places that are not very pleasant and the places that need to be improved. Using Russell and Snodgrass' (1989) dimensions

of affective evaluation, users ranked the different areas of the square in order of importance and relevance (Figure 9).

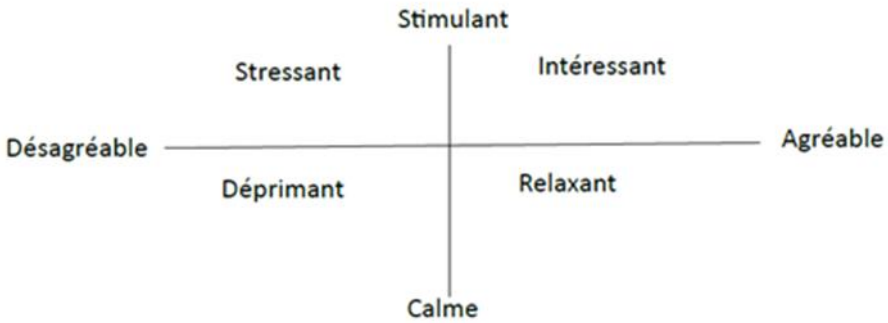


Fig. 9. The dimensions of the affective evaluation used for the 1st November Square (Source: Russel & Snodgrass, 1989)

Questionnaires: Listening to users

In order to collect qualitative information on the perception of the users of the public square 1st November, we used, in addition to the behavioural map, the technique of semi-directive interview. Particular attention was paid to collecting the words of pensioners and young people (age group 18-22), who are important current users of the public square analysed. To this end, two events were organized. Firstly, and in partnership with some voluntary members of the 'youth sport' association, a survey was conducted among the young people who use the square quite often. Secondly, as part of the country's Independence Day, activities were organized by the town's local radio station, inviting citizens to talk about the urban environment of their town. This opportunity allowed us to talk to a large number of pensioners. The main opening question of our interview was “What do you think of the urban design of the November 1st, 1954 Square and what changes do you think are necessary to make it more pleasant to use”? These events were also an opportunity to discuss directly with the inhabitants their current practices in the square and their wishes for future developments. Each participant was asked to describe and explain their choices in a short interview. Three main points guided our interview: the position of the square in relation to the city, its urban design and the time of its use in relation to social use and weather conditions.

With regard to the study of the physical characteristics and position of the square, 85.8% of the users confirmed that the location of the square is good in relation to the city, given its central geographical position and its proximity to different types of facilities, as well as its proximity to private and collective residential areas (see Table 3, Figure 10).

Tab. 3. Users' opinions on the quality of the location of the plot in relation to the city

Answers	Frequency	Percentage	Valid percentage	Cumulative percentage
Good	109	85.8	85.8	85.8 %
Not good	18	14.2	14.2	100.00 %
total	127	100	100	

Source: Authors, 2022

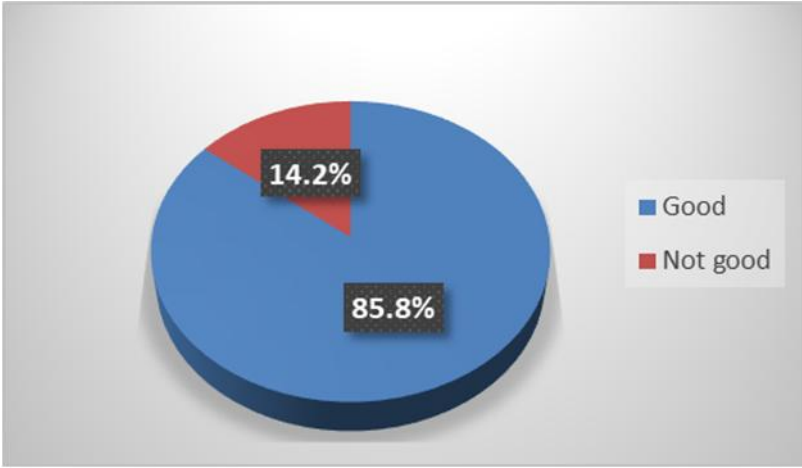


Fig. 10. Users' opinions on the quality of the location of the square in relation to the city (Source: Authors, 2022)

The quality of the urban design of the square was also discussed. 78% of users confirm the poor quality of the paving used, leading to the creation of puddles after each rainfall during the winter period, which strongly discourages its use; while during the summer period, 86% of users think that it is the lack of shaded areas due to the lack of trees, which leads to its non-use. In the same vein, 59% of users say that the square lacks green spaces and water features. As for the play areas, 98% prefer the integration of some slides and cycle tracks for children to play on. 55% also deplore the lack of petanque and dominoes areas for adults (see Table 4 and Figure 11).

Tab. 4: Users' opinions on the quality of the urban design of the square.

Answers	Frequency	Percentage
Paving quality	99	78 %
Shaded area	111	86 %
Green spaces	75	59 %
Play areas (Children)	125	98 %
Play areas (Adults)	70	55 %

Source: Authors, 2022

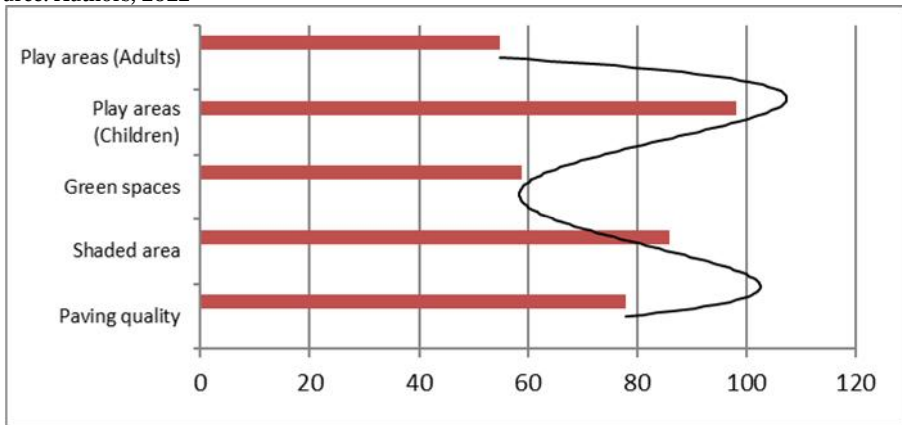


Fig. 11. Users' opinions on the quality of the urban design of the square (Authors, 2022)

Concerning the influence of social time and weather conditions, 90% of the respondents confirmed that they prefer to use the November 1st, 1954 Square in the evening from 10 pm to 8 pm, while 10% of them prefer to use it in the morning from 8 am to 12 am (see Table 5 and Figure 12).

Tab. 5. Frequency of use of November 1st, 1954 square

Answers	Frequency	Percentage	Percentage valid	Percentage cumulative
16h - 20h	114	90	90	90
08h - 12h	13	10	10	100
total	127	100	100	

Source: Authors, 2022

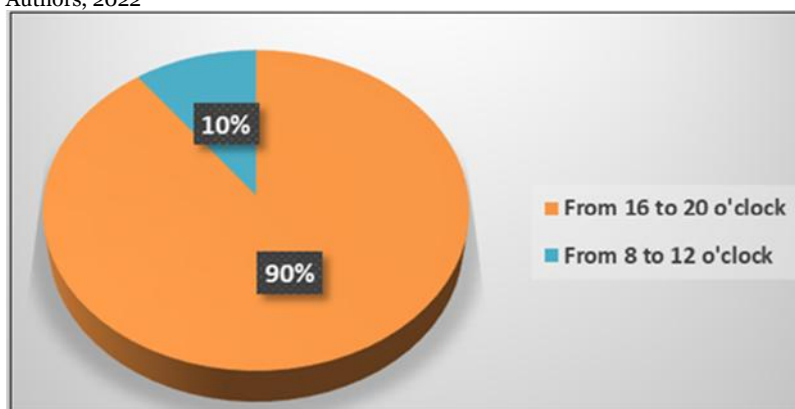


Fig. 12. Frequency of the square use (Authors, 2022)

The predominant behaviour is “sitting down”, which peaks at 56%, confirming the results obtained from the behavioural map. The use of the square as a place of passage and transition to go to nearby facilities or to other places in the city is the answer given by 81% of respondents, which also confirms its good location. As for the frequency of use of the square, 50% of users visit it more than once a week, while 43% visit it more than once a month.

Conclusion

This study is intended for planners, designers and decision-makers. It combined several techniques and analytical methods to investigate user behaviour in the November 1st, 1954 Square in M'sila. This research contributed to understanding the relationship between user behaviour and the spaces they use. The expected outcome is to enable specialists in the act of building in this city to achieve a successful design that meets the real needs of all its users.

The study revealed a mismatch in the reciprocal relationship between the human behaviour of M'silians and the physical environment of the November 1st, 1954 Square, which resulted in negative effects on the effectiveness of its social use. The behavioural map and the semi-structured interview allowed for a clear description and explanation of the users' choices. This revealed a strong desire to significantly reduce the space taken up by the car. Indeed, the fact that the square is bypassed on all three sides by roads, as well as the absence of a direct relationship between it and the entrances to the surrounding social housing

complexes, led to the restriction of “children's play” behaviour to their parents' free time only. “Children's play” is also restricted by the lack of cycle paths and the absence of slides. The analysis revealed the users' wish to increase the area of green spaces and water points in the form of fountains or water mirrors. The planting of large-leafed trees that are resistant to the hot climate of the study area will greatly contribute to the increase of shaded areas. This will increase the number of people using the square per day and per season. For adults, petanque and domino games seem to be the most popular, and the creation of specialised areas for this purpose is highly recommended by users.

The relationship between urban spaces and human behaviour is a reciprocal relationship that must be symbiotic. The presence of gaps in human architectural studies hinders the social, economic, recreational and cultural performance of these spaces.

To ensure the effectiveness of social use of public squares, they must contain spaces with diverse functions that allow for the interaction of a large number of users, which will provide many opportunities for users to strengthen the sense of community. These studies become even more effective when users are involved at an early stage in the design and decision-making process, so that their views and suggestions can be fairly incorporated. Planners, designers and public authorities should apply the principles of environmental psychology to create clear public spaces that improve the quality of the built environment.

Conflicts of Interest: The authors declare no conflict of interest.

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