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Walkable Urban Environment: Sensory Experiencing in Bechar City (Algeria)

Abdelouahab Ziani*, Ratiba Wided Biara

ARCHIPEL Laboratory, Architecture Department, Tahri Mohamed University, Bechar (Algeria)

*Corresponding author: ziani.abdelouahab@univ-bechar.dz

Walkability is becoming one of the central themes in urban research. It is among concerns of city's designers. Several studies have shown that walking in the city preserves the environment and people's health. Walkers merge into the city in a total, i.e., effective, sensory, cultural, etc. They perceive the city with their senses. So then, the urban morphology of the street as well as the architecture of the buildings that delimit them influence the sensory perception of the pedestrian. On the other hand, another notion having a considerable development in the last decades is the urban atmosphere. It highlights the other sensory dimensions (thermal, sound, olfactory, tactile, etc.) of the urban space and goes beyond its visual aspect. This research aims to study the walkability in one of the most frequented streets by pedestrians in Bechar city (south of Algeria). Its main objective is to know how walkers perceive the urban environment of the street by focusing on their sensory experience. It combines two notions: walkability and atmospheres in the urban space. We used several research techniques: morphological and sensory analysis of the street, participant observation, photo-elicitation interview and survey. The research results attest that there is a strong relationship between the urban environment of the city and walkability. The components of the street such as dimensions, architecture of the buildings that limit it and the prevailing atmospheres have a direct impact on walking in the city and sensory perception of pedestrians. Then, this research is not limited to the visual aspect of urban environment of the street but it emphasizes other sensory dimensions which are often neglected by architects and urban designers of Bechar city.

Keywords: walkability, urban environment, sensory experiencing, street, Bechar city.

Introduction

In the latter decades, walkability has been the subject of several studies in different disciplines such as architecture, scenography, urban planning, psychology, public health, etc. Special issues of international journals are dedicated to the walking environment. It also is at the heart of thinking about the city as a response to the challenges of sustainable development. Recent studies in urban space have demonstrated the benefits of walkability. It has a health benefit because it helps fight chronic diseases and obesity of adults and children (Sulaiman, 2020; Sallis et al., 2020; Bont et al., 2021; Yang et al., 2021). It also has an environmental benefit; it reduces congestion and negative impact of motorized vehicles that produce air pollution (Southworth, 2005; Zahran et al., 2008). In addition, an accessible and pedestrian city promotes tourism and enriches the tourist's experience by encouraging them to discover the places (Ujang & Muslim, 2015; Hall & Ram, 2019; Noraffendi et al., 2019). Socially, walkability promotes a social mix and social interaction (Jun & Hur, 2015). To encourage walking in urban space, several pedestrian plans are elaborated to facilitate people's accessibility to urban spaces by creating a shared space (Kaparias & Wang, 2020). The quality of urban space affects walkability. Several researchers have shown that the built environment has an impact on walkability (Clifton et al., 2007; Rafiemanzelat et al., 2017; Howell et al., 2019; He al., 2020). The challenge for cities is not only to create urban spaces where people can meet, but also to think about their sensory quality. The urban space is multi-sensory but it is essentially approached by its visual aspects, and sometimes the auditory aspects (Lucas & Romice, 2014; Thibaud, 2015; Dai & Zheng, 2021). Consequently, its design requires the consideration of the sensory relations between the user and its environment. In recent decades, city designers (architects and urban planners) have started to consider the other sensory dimensions in their design process, namely temperature, sound, touch, and smell (Spence, 2020). Faced with modern urbanism and the radical changes that affect cities, the architect J. Ferrier proposes a new concept which is "the sensual

city" (Bell & Buckley, 2010; Picon, 2015; Tzonis & Powell, 2016). He criticized the urban and architectural products without quality whose major concern was the cost. Ferrier tries to revalorize the notion of sensuality that already existed in historic architectures. However, he stipulates that it is necessary to exceed the functionalism and to put the user in the center of the reflections on the city. Zardini, in turn, insists on a sensory urbanism where urban planners must take into consideration other sensory modalities than the visual in their urban design (Zardini, 2012). He defines the notion of character as the specificity of place that refers not only to visual dimensions but also to other sensory dimensions that can be experienced in a place (Zardini, 2005). Walkability is a sensory experience (Hassan & Elkhateeb, 2021); it is a philosophy (Gros, 2014). When we walk on the street, we see buildings, objects, colors, people, etc., we hear voices and car noises, we smell different smells, we brush against the ground treatments of the sidewalk, etc. This research examines the walkable urban environment in the Algerian south, namely Bechar city. Its objective is to study the relationship between walkability, urban environment and atmospheres that exist in the street. It also highlights the role that walkability plays in the preservation of the environment and people's health.

Case Study

To study walkability in the city of Bechar in southern Algeria, we chose one of the oldest streets that were part of the colonial city (*Fig. 1*). The case study is commonly called "La Grande Rue"; it is one of the axes that structure the city of Bechar. It connects the railway station and the historical Square of Camels, called today the Square of the Republic, through the famous 1 November Square (*Fig. 2*). It is worth noting that this street is the first colonial street that has been transformed and new functions have been created. The street is one of the most frequented urban courses by walkers in the city. As for the Square of the Republic, it is the landmark of the city. People meet there in the daytime and at night. This public space is surrounded by shops that create attractiveness.

Fig. 1. Older photos of the street (old photographer)



Fig. 2. The two public squares in the case study (authors, 2021)



Materials and Methods

Impregnation period

The period of impregnation is indispensable in research on urban space. Its objective is to familiarize with the case study and to identify the important elements that will be deepened and explained later. In this phase, the researcher frequents the case study several times at random like a user and notes in a logbook everything that seems of interest, even certain details that may seem unimportant at the first time.

Morphological and sensory analysis

In this part, we opt for a morphological and sensory analysis of the street (Table 1). First, we will highlight the importance of the street and the different existing urban functions. Then, a morphological reading will be adopted to identify the dimensions of the sidewalks, the lanes, the heights of the buildings, the presence or not of urban furniture, etc. This reading aims to understand the morphological characteristics of the street and its impact on walkability. Afterwards, a sensory analysis will be established to identify the different generators of atmosphere in the street. In this part, we will list the different components of the street in order to highlight the different architectural and urban devices providing urban atmospheres (visual, sound, olfactory, tactile, etc.).

Table 1. Morphological and sensory analysis of street (authors, 2021)

Morphological analysis	Sensory analysis
Urban form	Visual analysis: colours, materials, visual field, etc.
Urban functions	Sound analysis: sound sources (trees, traffic flow, etc.)
Dimensions (sidewalks, lanes)	Thermal analysis: shaded passages, trees, colours, building heights, etc.
Forms and heights of buildings	Tactile analysis: floor treatment, wall materials, etc.
Vegetation	Olfactory analysis: odorant sources
Street furniture	

Photo-elicitation interview

Photo-elicitation interview is one of the most widely used techniques in qualitative research. It is a qualitative interview technique where the researcher uses photos to get responses, reactions, and ideas of the interviewees

(Copes et al., 2018). The integration of visual methods such as photos into the interview is to make the interviews fun and not like a test at school (Epstein et al., 2006). This technique evokes feelings and memories (Harper, 2002). Several photos (sequences) were shown to the interviewees to describe their sensory experiences (Table 2). People were asked to talk about sounds, smells, colours, shaded passages, urban furniture, etc.

Table 2. The table used during photo-elicitation interview: the example of olfactory atmospheres (authors, 2021)

Sequences	Qualification of olfactory atmospheres	Olfactory atmospheres generators	Comments
Sequence 01			
Sequence 02			
Sequence 03			

Survey

The survey is used in walkability research (Suarez-Balcazar et al., 2020; King et al., 2020; Carvalho, 2019). To evaluate the quality of the street and how people perceive the different elements that compose the street (building, sidewalk design, street furniture, atmospheres, etc.), we opted for a semi-structured interview. The survey form consists of several sections as follows: (1) the respondents' profile (sex, age, etc.); (2) the degree of frequentation of the street; (3) the degree of satisfaction of people (sound atmosphere, olfactory atmosphere, colours, cleanliness, sidewalk design, etc.); (4) the presence or absence of obstacles that impede walking; (5) people's proposals. Psychometric scales (Table 3) and yes or no questions were used in this interview to evaluate people's satisfaction, preferences, impressions, judgments, etc.

Table 3. Psychometric scales to assess people's satisfaction (authors, 2021)

	Very satisfied	Not very satisfied	Neutral	Not satisfied	Not at all satisfied
Noise and quiet					
Smells					
Warmth and coolness					
Cleanliness					
Colours					
Shade (shaded passage, etc.)					
Public lighting					
Vegetation					
Urban functions					
Sidewalk treatment					
Safety					

Results and Discussion

The level of pedestrian presence in street

The period of impregnation allowed us to have some information on the case study. This participant observation, which is considered as the heart of ethnographic fieldwork, allows the researcher to live the same experience

of the studied society (McGrath & Rudman, 2019). We also used the note-taking method which consists of systematically describing the case study, its degree of frequentation by the pedestrians, the use of spaces, social interactions, etc. This street is one of the most frequented streets in Bechar city because it is the first street

that is built by the French settlers. Also, it connects other streets. The presence of administrative and commercial buildings and two important squares make it a lively street. According to the architectural and urban configuration, the pedestrian flow and the urban functions in the street, it can be decomposed into three parts (Fig. 3). The presence of pedestrians changes at different times of

the day. The moments in which the street is lively are the following: from 09:00 to 12:30 and from 16:30 to 22:00. In the morning of weekend days, the pedestrian presence is low compared with other weekdays. This is because of the closure of public buildings (banks and administrative buildings). In the winter and spring seasons, the pedestrian flow increases, and the street becomes alive.

Fig. 3. Decomposition of the street in 3 parts according to the generators of urban atmospheres (authors, 2021)



Morphological characteristics

As mentioned before, the street chosen for this study is the first street in the Bechar city. It is also the most frequented by the city's residents and visitors. It gathers several urban functions: commercial, administrative, military, residential, etc. (Fig. 4). This plurality of

functions makes it more frequented, especially in the morning period. Our case study is the street that is both pedestrian and mechanical. Cars circulate in one direction only. The lane measures between 9 and 10 m. For the sidewalks, the dimensions are different (Fig. 5). In the first part, they are wider than in the other two

Fig. 4. Urban functions in the street (authors, 2021)

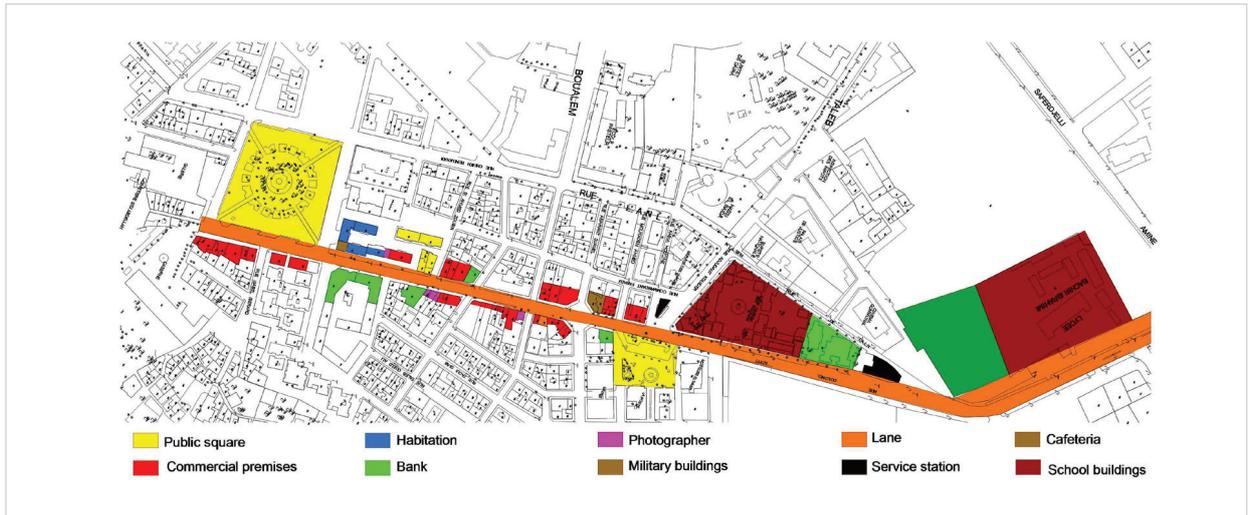
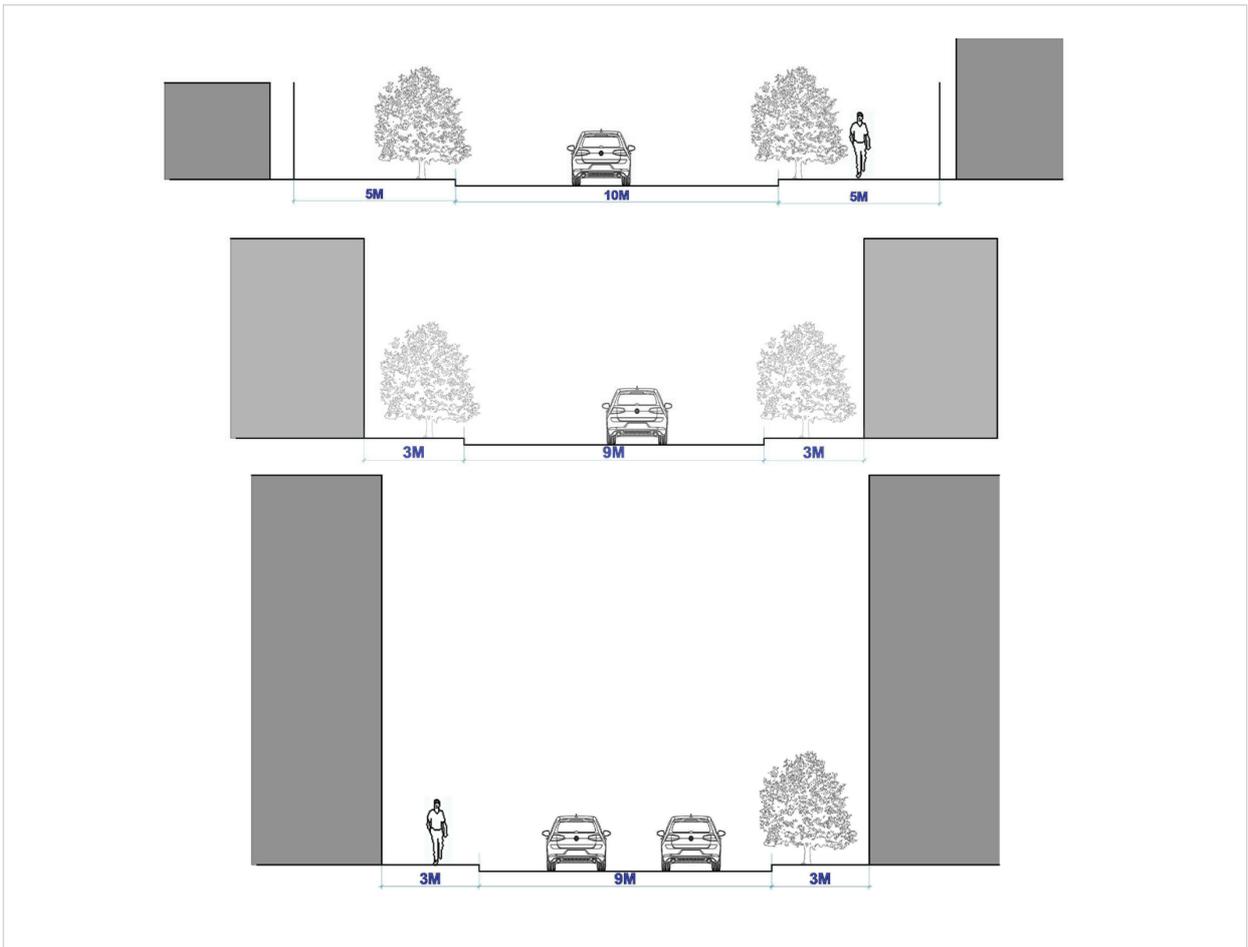


Fig. 5. Dimensions of the lane and the sidewalk of the three parts (authors, 2021)



parts. Therefore, the dimensions of the sidewalks and the quality of their treatment affect the walkability, which is seen in the second part with its degraded sidewalks. Recently, the street has undergone several transformations and new buildings have appeared. In the first part, the street is delimited by the fences of the military and school building, which affect its visual aspect. In the second part, some colonial buildings are destroyed and replaced by commercial buildings. We notice the opening of the visual field towards other parts of the street. In the third part, the presence of the large square allows visibility by providing other atmospheres different from the other parts.

At the beginning of the first part, there are residential buildings with a height that exceeds 12 m. Then, we find buildings that do not exceed 6 m. The sidewalks are wider and the residential buildings are separated from each other. The colours of the facades are red ochre and dark beige. Regarding street furniture, there are chairs in the setback of the high school, which is a meeting and resting space for the students. On both sides of the road, there are public lighting devices. The second part of the street begins with a small square with chairs, palm trees and a monument in the middle. The sidewalks are small compared with the first part. The buildings have different heights. Yellow, blue and red ochre are the existing colours in this part. The presence of the large square allows visibility and opens the visual field towards the other districts of the city. The square is landscaped with a water fountain, chairs, palm trees, children's playground and cafeteria chairs.

Sensory characteristics

As a generator of multiple atmospheres, vegetation is present in the street. The first part is more vegetated. This natural element provides a sound, thermal, olfactory and aerualic atmospheres. It reduces noise and generates freshness. In the second part, shading is provided by the high buildings. The covered passages exist in the third part, which facilitates walkability in the hot period. Regarding the aerualic atmospheres, the third part is the most open, which generates air circulation. This makes it colder in the winter and more exposed to the sun in the summer. The facades of the buildings delimiting the street are

painted with light colours that reflect the sun's rays towards the street. This reflection causes glare and increases the air temperature. The varieties of colours, the opening of the visual field, the vegetation are the elements that provide visual atmospheres.

The street is rich in terms of sound atmospheres. Several natural and artificial generators exist. Road noise is the first type that is found in the street. Traffic and pedestrian flow are too reliable in the first part. They increase in the second and third parts. The presence of cafeterias and some administrative building that receive a large number of the public makes the street noisier. The third part is less noisy than the second part despite the presence of pedestrians, cafeterias and administrative and public facilities. Its open urban configuration with large lanes allows the attenuation of noise. As for the olfactory atmospheres, they are multiple. The smell of car and cigarette smoke, the smell of cafeterias and restaurants, the smell of trees, etc. are the prevailing smells in the street. The street is devoid of tactile atmospheres. There is only one treatment of the sidewalks.

Sensitive memory

For the method of a photo-elicitation interview, it allows us to question the sensitive memory of people through the exhibition of some photos. Most respondents distinguish three different environments on the street (*Table 4*). According to them, the first part is characterized by the strong presence of vegetation and the almost total absence of public buildings. They add that this part is cleaner, quieter and shaded in the hot periods compared with the other parts, which makes it more favourable to walk in all seasons of the year. The presence of vegetation provides an olfactory atmosphere and a cool thermal atmosphere in the hot period. For the second sequence, the majority of the interviewees declare that it is more eventful than the first one because of the presence of administrative and commercial buildings. They also see that the dimensions of the sidewalks do not facilitate walking. This puts the pedestrian in a dangerous situation in front of the heavy traffic. In the third part, pedestrians walk freely because of the size of the sidewalks and some covered passages. In this phase, people inform us about their sensory experience by telling us about different atmospheres generators (*Table 5*).

Table 4. Description of people's sensory experience for each sequence: the example of sound atmospheres (authors, 2021)

Sequence	Qualification of sound atmospheres	Sound atmosphere generators	Comments
Sequence 01	Quiet	Traffic noise Birds sounds People conservation	<i>This part of the street is quiet during the whole day compared to the other parts. You can only hear the noise of cars passing by from time to time. This part is suitable for walking.</i>
Sequence 02	Noisy	Traffic noise People conservation Cell phone ringing Music	<i>The second part is noisier than the first part. This is due to the heavy traffic and the presence of commerce and some administrative buildings. I have a difficulty to walk comfortably.</i>
Sequence 03	Noisier	Traffic noise People conversation Cell phone ringing Music Wastewater networks	<i>The third part is noisier than the first and second part. The presence of administrative facilities, commerce and cafeterias generates noise. This part is conducive to walking because of the size of the sidewalks and the presence of a large public square.</i>

Table 5. Different atmosphere generators that exist in the street according to the interviewees (authors, 2021)

Part	Luminous atmospheres	Thermal atmospheres	Sound atmospheres	Olfactory atmospheres
Part 01	Natural light Shade from trees Shade from buildings Colours of building	Outside temperature Rays of the sun Coolness generated by the trees	Traffic noise Birds sounds People conservation	Smell of the trees Smell of the gasoline pump Smell of car smoke
Part 02	Natural light Shade from building Colours of building	Outside temperature Rays of the sun	Traffic noise People conservation	Smell of the trees Smell of car smoke Smells from cafeterias and restaurants Smell of cigarettes
Part 03	Natural light Shade from trees Shade from building Colours of building	Outside temperature Rays of the sun	Traffic noise People conservation Children's cries	Smell of car smoke Smells from cafeterias and restaurants Smell of cigarettes Wastewater networks

Sensory perception of pedestrians

One hundred people were interviewed to find out how they perceived the street. Several questions were asked about satisfaction, preference, judgment etc. The interviewees are inhabitants of Bechar city and foreigners. The majority of the people interviewed frequent the street at least five times a week. This allows us to have

more information about their sensory experience because there is a great attachment to this place.

Satisfaction

Pedestrian satisfaction was measured in terms of noise, vegetation, shade, quality of sidewalks, cleanliness, olfactory environment, urban functions, etc. (Fig. 6). In the first part of the street, 80% of the

surveyed population is very satisfied with the sound environment which is described as quiet almost all day. The strong presence of trees and the low traffic flow generate a sound environment that favours walking on the street. On the second part, 53% of the interviewees are not satisfied and consider that the street is noisy because of the heavy mechanical and pedestrian traffic especially in the morning. The same result is observed for the third part, of which 43% are not satisfied. Regarding the olfactory environment, 65% are very satisfied with the first part where there is presence of vegetation and absence of generators of bad smells. 68% are satisfied (between satisfied and very satisfied) with the cleanliness of this part. For the second and third part, the majority are not satisfied with the smells that are unpleasant like the smell of car smoke, cigarettes, etc. For the quality of the sidewalks, most are not satisfied with the three parts of the street. They see that the floor treatments are obstacles that prevent people from walking freely. People also consider the third part to be the most illuminated at night. The presence of the large square with good exterior lighting facilitates walkability and provides security. In the summer period, people cannot walk in the street because of the sun rays and the outside temperature that reaches 50°C. The lack of covered passages in the second part makes people not satisfied. The strong presence of trees in the first part and the few covered passages in the third part protect the pedestrians from the sun.

Preference and judgment

In this section, we asked people about their preferred elements for promoting walkability in the city. Respondents prefer several elements at once. The results are as follows: 60% prefer a shaded street, 45% prefer a quiet street, 40% prefer a street with good sidewalk treatment, and 30% prefer a street with a good olfactory atmosphere. For the colours of the buildings, the people who prefer the white and blue colour represent 60%; 25% prefer the red and green colour and 15% prefer grey, orange and black.

A percentage of 75% represents people who confirm the presence of obstacles in the street (Fig. 7). The obstacles are cars parked everywhere, trees that are not topped, merchandise tables, cafeteria chairs, the

Fig. 6. Walkers' satisfaction with 11 items listed in Table 3 (authors, 2021)

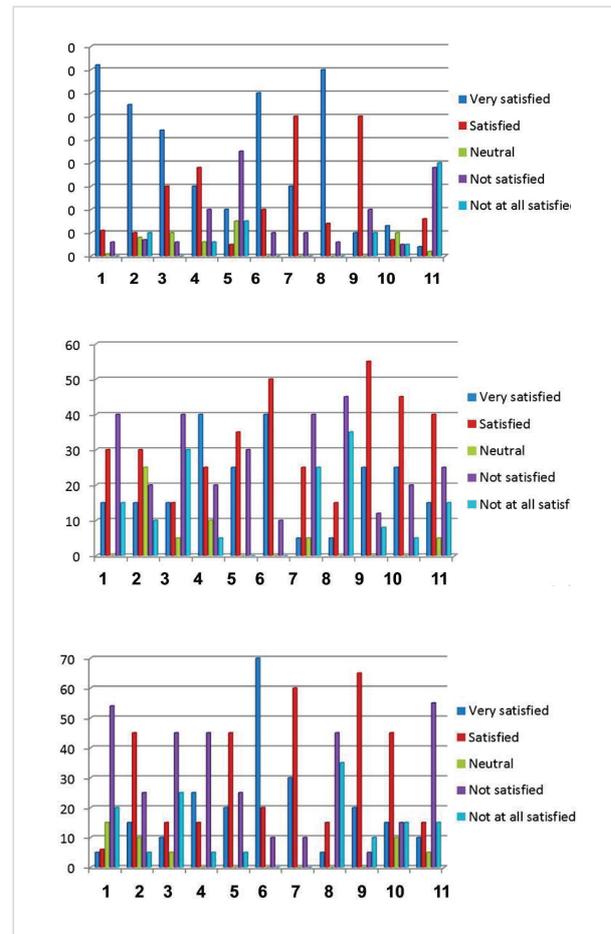
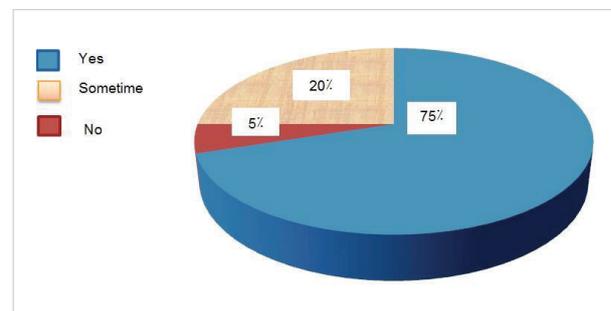


Fig. 7. Presence or not of obstacles that prevent people from walking in the street (authors, 2021)



degraded state and dimensions of the sidewalks, etc. Among the problems that arise in the case of study, the lack of parking areas especially in the first and second part. People are forced to park their cars next to

the sidewalks, which prevents pedestrians from walking comfortably. Regarding sidewalks, 90% of the interviewees see them as being in a degraded condition and 65% find that crosswalks are narrow, which affects walkability. On the other hand, 85% prefer to go through this street while 15% prefer to go through other streets.

Emotions

For the outside air temperature, the majority of people feel that the street is hot in the summer period. The first and third part are hottest compared with the second part. This is the result of the morphology of the buildings and the dimensions of the lane. The large open square in the third part is exposed to the sun, which escapes people walking. In this case, they use the arched covered passages that surround the square. The second part is less hot because of the heights of the buildings and the dimensions of the lane. The buildings provide shade for the sidewalks, which reduces the air temperature. In the winter period, people feel that the street is cold, especially the third part because of the presence of the square. Most of the interviewees feel that the colours of the buildings are demotivating. According to them, architects do not give importance to the colours of the facades. Only one colour is used, which affects the urban landscape of the street. Also, they see that the existence of some unfinished constructions affects the visual atmospheres. In terms of sound atmospheres, the second part of the street is considered the noisiest because of its morphology.

People's proposals

People were asked an open-ended question about their suggestions for improving walkability on the street. The proposals are as follows: widening of sidewalks; creation of shaded passages; creation of parking and rest areas; creation of green spaces; improvement of the ground treatment to enrich the tactile experience; animating the street with light effects in the night period; designing the street with urban furniture (chairs, public lighting etc.); repainting the buildings in lively and stimulating colours.

Methodological crossing

The results of this research show that there is a strong relationship between walkability, urban morphology of

the city and atmospheres prevailing in it. The three parts of the street have a different configuration. The dimensions of the street and sidewalks are not the same. We found that the configuration of the street and building that limit them influence people's perception, which is noted in the answers of the interviewees. Also, the atmospheres are not the same in three parts. Each part is characterized by a different atmosphere which is generated by several generators. The results of the survey and participant observation show that walkability depends on the season and the time of the day (morning, evening). People say that there are preferred times to walk in the street. They add that each part of the street is different from the other. From them, the first part is most favourable for walkability all year round because of the dimensions of the sidewalks, the quietness and the shade provided by the trees. It is also worth mentioning that the colours and textures of the buildings have an impact not only on the visual perception of walkers, but also on the luminous and thermal atmospheres because of reflection and diffusion of the solar rays. For sound, open spaces such as public squares are less noisy than closed spaces. In the first case, the sound waves propagate in the air where obstacles are far from each other, while in the second case, there is a reflection of sound waves on the walls of buildings which are on both sides of the street. The urban morphology also influences the aerolic and olfactory atmospheres. People smell less odours in open spaces with large dimensions than in urban space limited by buildings close to each other. The renewal of the air in open spaces allows the evacuation of odours.

Conclusions

The present research focuses on walkability in urban space. It aims to study the relationship between the quality of this space and the perception and behaviour of people. The literature review showed the importance of walkability in urban space. Several strategies have been developed to improve walkability because of the benefits it provides to the city and its residents. Therefore, walkability becomes one of the major challenges of the sustainable city. Our research focuses on walkability in one of the busiest streets in the city of Bechar,

located in western Algeria. It combines two concepts that have developed considerably in urban research, namely, walkability and atmospheres. The results confirm the influence of the urban space on the perception of walkers. The atmospheres depend on the urban morphology of the city and the different architectural and urban generators put in place. Therefore, it is time to rethink the Saharan city by adopting new strategies to improve the walkability and quality of urban atmospheres. The Saharan urban environment could be studied from several angles. Several planning policies must be adopted to promote walkability in the city. The proper design of urban spaces plays an important role. Sidewalk treatments and the avoidance of obstacles that impede people are also important. Street dimensions (sidewalks, lanes and building heights) must be studied. On the other hand, the street must be accessible to all people. Therefore, it must be designed to facilitate accessibility for people with special needs. The Saharan city is known for its hot climate in the summer period. It will be interesting to design streets

with covered passages that protect people from the sun's rays. The widening of the streets also allows for the renewal of the air and creates freshness. The impact of urban morphology on urban atmospheres, the quality of night-time atmospheres, walkability in the night period, characterization of the urban thermal atmospheres in the summer period, are the axes that we propose for further research. In this study, we limit ourselves to the sensory experience of walkers in a single case study in the city of Bechar. We used purely qualitative research techniques. Computer simulation of the external physical environments (luminous, thermal, sound, etc.) could be a technique used in future research. Also, a comparative study of two different case studies could be conducted as future research. It would allow for understanding the influence of the urban build environment and the prevailing atmospheres on walkability. The studies that simultaneously focus on three notions of walkability, sustainability and tourism are current issues to be addressed by researchers on the city.

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