QUALITATIVE ASSESSMENT OF URBAN DESIGN ELEMENTS FROM THE OLD AND NEW URBAN FABRICS IN AÏN-BEÏDA (ALGERIA)

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Abstract. The effects of the physical environment on people's active behaviour have been a central topic over the last decade, particularly in urban design, public health, and transportation. Research on the impact of the built environment attributes on walkability still needs to be completed in developing countries. Literature on walkability demonstrated the effectiveness of the studies, which consider micro-scale elements when evaluating pedestrian street environments. We are interested in assessing urban design qualities at the micro-scale level, which would give more evidence on the walking conditions of a developing country. This study explores whether the typo-morphological aspect of selected routes in a medium-sized African city is associated with urban design qualities related to walkability and compares the combined scores of urban design qualities with other cities. According to our findings, the typo-morphological aspect of urban routes correlates with the evaluated urban design qualities. The results revealed a significant difference in these qualities between the old colonial and the post-independence fabrics, with imageability and complexity appearing to be the most influential qualities. The results showed that urban design qualities related to walkability in a medium-sized African city scored lower than in other urban contexts. This study has several implications for city planners and decision-makers looking to improve the walking environment of the city.

Key words: urban design qualities, walkability, evaluation, route, urban fabric

1. Introduction

In a city, streets are the main public places (Jacobs, 1992). Llewelyn-Davies (2000) emphasized the importance of the street to promote walking: *"To give walking priority means putting the everyday experience of the street first on the agenda."* According to Forsyth and Southworth (2008), a walkable environment does not only promote physical activity; thus, it has other definitions. A walkable environment offers proximity

destinations, is safe, and has pedestrian infrastructure such as sidewalks, pedestrian passages, street furniture, and trees. A walkable place is where people can find coffee shops and stores, mixed housing, streets with remarkable architectural styles, green spaces, and public transportation. Over the past decade, the effects of the physical environment on the active behaviour of people have been a topic of great interest, particularly in urban design, public health, and transportation (Oka and Koohsari, 2020).

In recent years, research has investigated the relationship between the built environment and the walkability of urban streets on different scales and included several physical factors. The classifications of walkability research in the literature vary between studies. According to Blečić *et al*. (2020), the significant themes of walkability research are the relationship between walking behaviour and built-environment characteristics, the importance of subjective values and pedestrian preferences, and walkability based on its general definition and quality of life. Arellana *et al*. (2020) divided the factors used to measure walkability into several categories, including sidewalk quality, traffic safety, security, comfort, and attractiveness. Erturan and van der Spek (2021) stated that the research on walkability consists of three main themes, including physical conditions, perception, and studies that combine the two. Meanwhile, Fonseca *et al*. (2022) proposed categorizing research on the built environment's influence on walkability into land use, accessibility, connectivity, street network, pedestrian comfort, streetscape design, safety, and security. The study of Fonseca *et al*. (2022) revealed that studies focusing on streetscape design represent only 5% of measured attributes to evaluate walkability.

Previous research measured walkability on two different scales, the macro scale and the micro-scale. Several studies have highlighted the importance of micro-scale for measuring walkability using physical attributes at the street level (Arellana *et al*., 2020; Bartzokas-Tsiompras and Photis, 2021; Bereitschaft, 2017; Macdonald *et al*., 2018; Nunes and Vale, 2015; Rebecchi *et al*., 2019; Steinmetz-Wood *et al*., 2019). Macdonald *et al*. (2018) demonstrated that most of the prior research methods that aim to assess the quality of urban streets do not consider micro-scale elements of the streetscape that improve the pedestrian experience. Even existing methods are complex and time-consuming. Based on the study by Arellana *et al*. (2020), walkability research has widely used macro-scale variables, which assume that street-level characteristics of the built environment are homogeneous. According to Arellana *et al*. (2020), street-level characteristics may vary in a given urban area, and micro-scale studies can effectively measure these characteristics. Bartzokas-Tsiompras and Photos (2021) argued that not all macro-level built environment features translate into well-designed pedestrian environments. Steinmetz-Wood *et al.* (2019) noted that modifying micro-scale elements of the built environment at a low cost could promote mobility for a vulnerable population. These studies demonstrated the effectiveness of walkability studies, which consider micro-scale elements when evaluating pedestrian street environments.

Furthermore, the number of publications and data used in walkability research differs between developed and

developing countries. According to Shaaban (2019), current studies that evaluate walkability use methods such as GIS; however, in developing countries, public institutions lack qualified personnel and equipment to use such methods. In this regard, simple methods for examining the impact of built-environment factors on walkability are required, particularly in developing countries where walkability research is still limited (Kinyingi *et al*., 2020). The literature review of Fonseca *et al*. (2022) emphasized the difference between developed and developing countries in measuring walkability, indicating that built environment attributes are objectively measured in developed countries. In contrast, subjective measures are more prominent in developing countries. Given the abovementioned, the impact of built environment attributes on walkability in developing countries requires more research to collect evidence.

To evaluate urban design qualities related to the overall walkability of a street, the study by Ewing and Handy (2009) objectively measured the five subjective urban design qualities related to walkability: imageability, enclosure, human scale, transparency, and complexity. Many researchers have attempted to assess walkability using this method (Ameli *et al*., 2015; Hamidi and Moazzeni, 2019; Ho *et al*., 2021; Hooi and Pojani, 2019; Kumar *et al*., 2021; Parashar and Al-Bnayan, 2020). Following the same research approach, the current study uses the method of Ewing and Clemente (2013) in the context of a medium-sized city in Africa. We are primarily interested in evaluating urban design qualities at the micro-scale level in urban fabrics, which belongs to two periods. Furthermore, the study's findings will provide insights from a new geographical context.

Aïn-Beïda is a medium-sized city in the northeast of Algeria, whose landscape combines urban elements from two different urban typologies. One of the primary aims of this work is to investigate whether the typo-morphological aspect of the urban fabrics of the French colonial and post-independence periods influence the urban design qualities related to walkability, as well as to compare the urban design qualities of the studied city with those of other cities in terms of street walkability. We hypothesize that urban design qualities differ along routes with different typo-morphological aspects. We also assume that urban design qualities related to walkability in a medium-sized African city differ from those in other urban contexts.

3. Case Study

Aïn-Beïda is a city in the province of Oum El Bouaghi (Algeria) located on a plateau at the eastern edge of the plains of Setif. During the French presence in Algeria, Aïn-Beïda was planned as a colonial village based on the classic chessboard plan with two perpendicular streets. At first, the colonial village was composed of about a hundred houses and facilities for administration and community life, and later in 1817, the rural exodus caused the creation of peripheral neighbourhoods around the initial urban core (Bendada and Labii, 2017). The fragmented urban development of Algerian cities after independence led to a dysfunctional urban landscape (Chaouche, 2013). Meanwhile, Aïn-Beïda witnessed the establishment of several urban planning tools whose application did not always meet development plan guidelines. Since

the 2000s, Algerian cities have emerged as disorganized masses due to the juxtaposition of various urban fabrics. The consecutive re-appropriations, reconstructions, and new architectural developments have transformed the urban landscape (Belguidoum, 2018).

Aïn-Beïda is among the cities that combine colonial urban fabric and urban structures of the post-independence period, which resulted from urban planning policy implementation on the one hand and informal urbanization on the other.

Our study examines the perceptual qualities of urban design related to walkability. The evaluation focuses on the downtown area Fig. 1, where colonial and post-colonial fabrics are juxtaposed, in which the evaluation route selection will be based on their location in the identified typo morphological zones.

2. Methodology

2.1. Typo morphology technique

Cities expand through time and space by juxtaposing several urban elements. However, urban design focuses on the changing nature of these elements (Rowley, 1994). Therefore, typo morphology is an approach that can inform urban design by identifying types of urban elements (buildings, streets, neighbourhoods) (Moudon, 1997).

In order to analyse the characteristics of each urban typology, we used the typo morphology approach as a preliminary evaluation method for the study area (Table 1). This method allows an understanding of the city's evolution by categorising urban elements into types (Stojanovski and Axelsson, 2018).

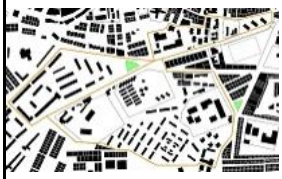
As a result of the typological classification of buildings, parcels, and streets, we can identify several zones within the study area with different typo morphological characteristics (Fig. 2). The colonial fabric comprises the original core of the former French village and peripheral neighbourhoods. In contrast, the post-colonial urban fabric comprises collective and individual housing districts.

Building forms and architectural details distinguish colonial from post-colonial urban typologies. The typical European 19th-century style characterizes buildings in the colonial fabric. Most colonial buildings have been adapted to different functions, while others have been destroyed and replaced by contemporary constructions. In the colonial peripheral quarters, there are traditional and mixed-style houses. Conversely, the post-independence urban fabric is dominated by new collective housing areas and individual housing, with no morphological homogeneity. The new collective housing areas consist of monotonous modern-style apartment buildings often separated by large open spaces. Individual housing neighbourhoods consist of self-built houses with modest facades.

Period and spatial planning logic define the parcel typology. Colonial fabric blocks are divided into regular plots. In contrast, the post-independence urban fabric parcels are irregularly shaped in the informal areas and regularly shaped in the planned areas.

The colonial village's streets form a grid with perpendicular intersections. Conversely, street patterns in the new urban area become less regularly shaped because of the juxtaposition of several spatial forms.

Table 1. Typo morphological characteristics of the two urban fabrics in Aïn-Beïda (Source: Authors).

	French period urban fabric		Post-independence urban fabric	
	Old colonial village	Peripheral colonial quarters	(Collective housing area)	(Individual housing area)
Aerial view				
Buildings (typology)				
Parcel (typology)		 	 	 
Urban fabric (Street typology)		 	 	 

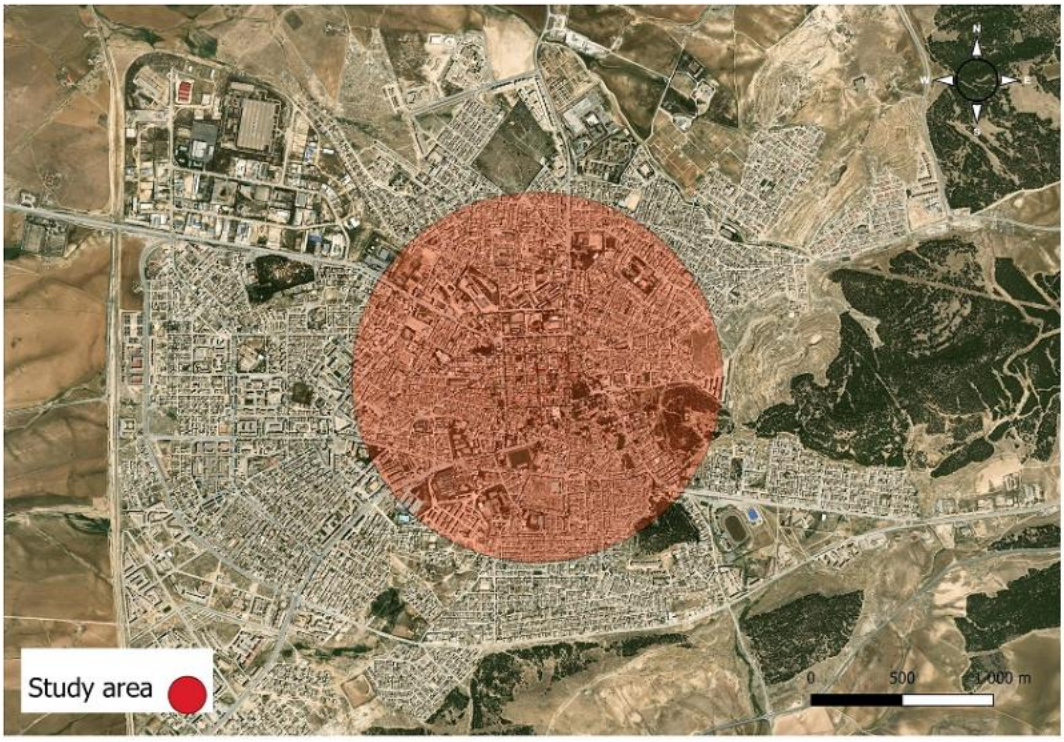


Fig. 1. Map showing the study area in downtown Aïn-Beïda (Source: QGIS and Authors).

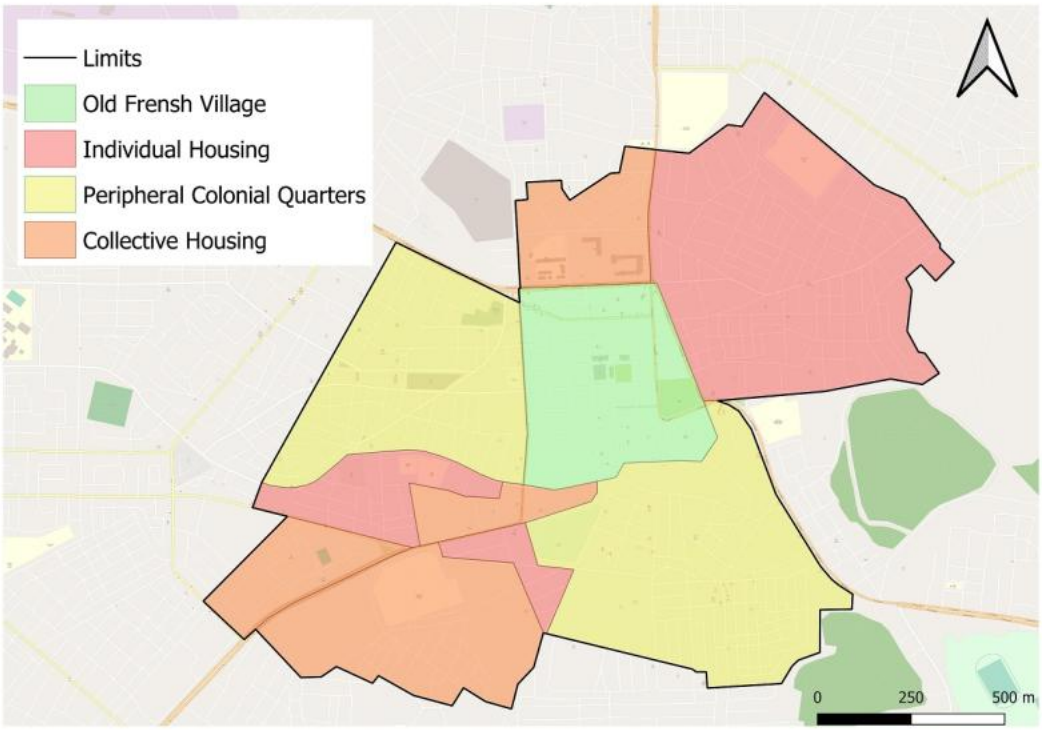


Fig. 2. Identified typo morphological zones within the downtown area (Source: QGIS and Authors).

After identifying four zones with different typo-morphological characteristics, we chose four routes to evaluate their urban design qualities. The routes were chosen based on their location in the identified zones. The selection included a variety of typo morphological characteristics. The first route is between the old colonial village and the post-independence area. It comprises French-period residential buildings with commercial activity on the ground floor in one segment. It also includes collective and individual housing with some shops and facilities in other segments. The second route traverses the new urban area. The third route traverses the old colonial village. The fourth route has a landscape that combines colonial and post-independence urban typologies. The field manual used to evaluate urban design qualities was designed to measure 100 m segments. Since the routes were much longer than 100 m, we identified three segments of 100 m at three locations on each route, as shown in Fig. 3, to get a representative score from the evaluated routes.

2.2. Evaluation of urban design qualities

We evaluated the urban design qualities of the four identified routes using the field manual provided in the book of Ewing and Clemente (2013) entitled "Measuring Urban Design." In their book, they aimed to transform subjective definitions of urban design qualities (imageability, enclosure, human scale, transparency, and complexity) into operational definitions to measure urban design's five abstract qualities. These qualities that make a street more walkable were identified according to the classic urban design literature. The five urban design qualities will be defined in the section below, based on the operational definitions in the book (Ewing and Clemente, 2013):

Imageability: Refers to the degree to which a physical environment can evoke a mental image in the observer; one of the critical features of this quality is landmarks.

Enclosure: Refers to the degree to which outdoor spaces are defined by vertical elements, giving the impression of a room-like space, with buildings as "the walls" and streets and sidewalks as "the ground".

Human scale: Refers to the size and proportions of physical elements related to human beings, such as building details, pavement textures, and street furniture.

Transparency: Refers to the degree to which people can see what resides beyond the street edge. People can perceive indoor activities through windows, glazed walls and fences.

Complexity: Refers to the degree to which the street scene offers visual richness and variety to the pedestrians through architecture, people's activity, signage and urban furniture.

A panel of experts was assembled to define the perceptual qualities of urban design of various urban scenes. The panel members assessed the qualities of various urban scenes through a visual evaluation and interviews. The 32 video clips used for evaluation were selected among two thousand video clips filmed in 22 cities across the United States. The relationship between urban design qualities, walkability and physical features of the streets was quantified using statistics. The final instrument provides detailed procedures to measure these qualities and coefficients for each physical.

Table 2. Summary of the evaluation model (Source: Ewing & Clemente, 2013).

Design Quality	Significant Physical Features	Coefficient	p-value
Imageability	People (#)	0.0239	< 0.001
	Proportion of historic buildings	0.970	< 0.001
	Courtyards/plazas/parks (#)	0.414	< 0.001
	Outdoor dining (y/n)	0.644	< 0.001
	Buildings with nonrectangular silhouettes (#)	0.0795	0.036
	Noise level (rating)	–0.183	0.045
	Major landscape features (#)	0.722	0.049
	Buildings with identifiers (#)	0.111	0.083
Enclosure	Proportion of street wall—same side	0.716	0.001
	Proportion of street wall—opposite side	0.940	0.002
	Proportion of sky across	–2.193	0.021
	Long sight lines (#)	–0.308	0.035
	Proportion of sky ahead	–1.418	0.055
Human scale	Long sight lines (#)	–0.744	< 0.001
	All street furniture and other street items (#)	0.0364	< 0.001
	Proportion of first floor with windows	1.099	< 0.001
	Building height—same side	–0.00304	0.033
	Small planters (#)	0.0496	0.047
	Urban designer (y/n)	0.382	0.066
Transparency	Proportion of first floor with windows	1.219	0.002
	Proportion of active use	0.533	0.004
	Proportion of street wall—same side	0.666	0.011
Complexity	People (#)	0.0268	< 0.001
	Buildings (#)	0.0510	0.008
	Dominant building colors (#)	0.177	0.031
	Accent colors (#)	0.108	0.043
	Outdoor dining (y/n)	0.367	0.045
	Public art (#)	0.272	0.066

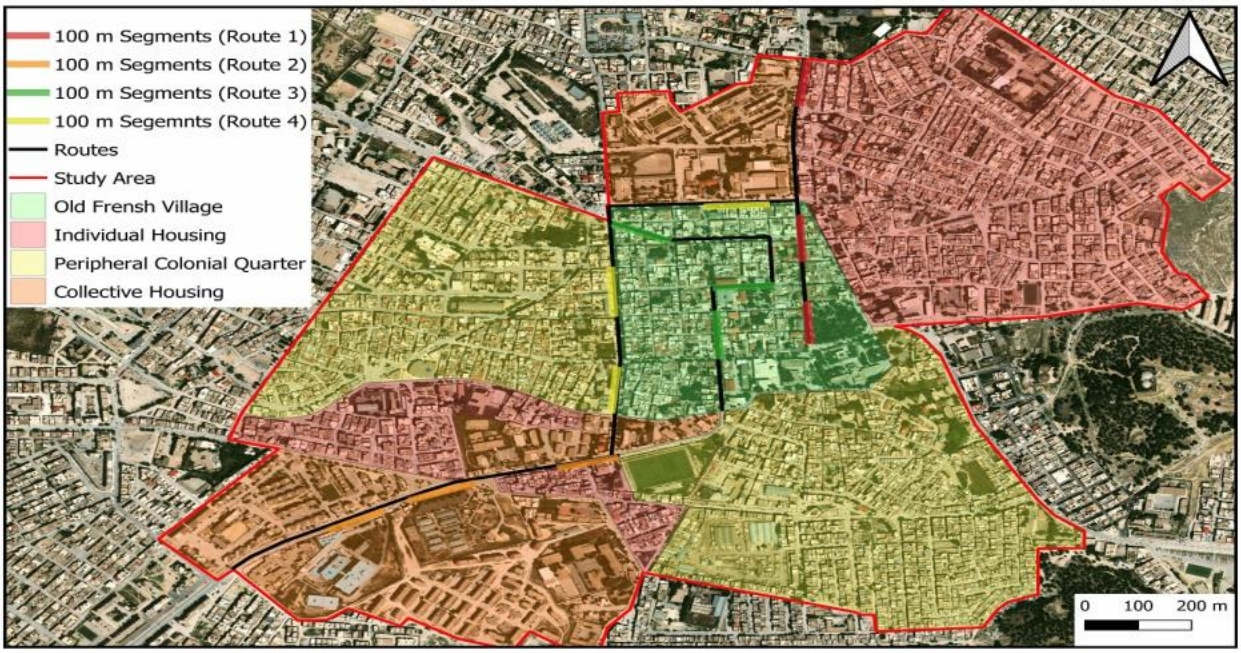


Fig. 3. Location of evaluation streets in the identified typo morphological zones (Source: QGIS and Authors).

Field data collection took place between May and June 2022. We used the measurement sheet from the original study to measure the physical characteristics of each urban design quality while walking within the study area. We multiplied the field measurement values with the coefficients shown in Table 2 to obtain the final scores. The average score of the three segments that belong to the same route represented the final score of each evaluated route.

3. Results

Table 3 shows the results for the five urban design qualities. We classified the routes according to the score of the combined urban design qualities. The route traversing the old colonial village scored 18.93, followed by the route with an urban landscape that combines both colonial and recent urban typologies, with a score of 14.61. Then the route between the colonial urban fabric and the post-independence fabric scored 12.35. Finally, the route of the new urban area scored 5.86. The highest scores for urban design qualities vary from one route to another.

The route that traverses the old colonial fabric had the highest score of imageability across the city, at 7.39. The number of people and the historical building's proportion were the physical attributes that most influenced imageability along this route. The enclosure quality had the highest score at 0.79 in the route whose urban landscape combines both colonial and recent urban typologies, in which the proportion of the street wall on both sides significantly influenced the enclosure. The route between the colonial urban fabric and the post-independence urban fabric had the highest human scale, transparency, and complexity values, respectively: 1.10, 1.63, and 8.48. Street elements and small planters were the physical features that contributed the most to the human scale. The proportions of the Windows and street wall contributed significantly to the transparency of the route. People's numbers and buildings' colours had a significant impact on complexity. The route of the new urban area had the lowest urban design qualities among all the studied routes. Fig. 4 depicts urban design qualities differences between some of the evaluated streets.

Aïn-Beïda scored respectively: 4.75, 0.17, 0.67, 1.25, and 6.06 for imageability, enclosure, human scale, transparency, and complexity. Table 4 summarizes the average score of urban design qualities for the city of Aïn-Beïda and the scores of New York, Brisbane, Gurgaon, and Hanoi. Gurgaon (India) received the highest score for urban design qualities, 25.54. Then, the city of Hanoi was in the second position with a score of 23.92, followed by the cities of Brisbane and New York with very similar scores of 17.69 and 17.04. The city of Aïn-Beïda came in last place with a score of 12.90.

4. Discussion

From the above results, it is clear that urban design qualities varied according to the evaluated routes, which indicated that the urban design qualities reflect the typo-morphological aspect of urban fabrics. These findings are consistent with the results of (Ho *et al.*, 2021), which revealed that urban typology affects urban design quality. The city of Aïn-Beïda ranked in the last position in terms of the combined urban design qualities score, preceded by more walkable cities, Brisbane and New York, then Hanoi and Gurgaon in the first position. It may be the case, therefore, that scores variation

between cities suggests that urban design qualities related to walkability vary from one urban context to another. This finding aligns with the results of (Ameli *et al.*, 2015; Hamidi and Moazzeni, 2019), which indicated that urban design qualities are different among cities. To explain the difference between the urban routes, we will discuss the variation in urban design qualities.

Table 3. The score of the combined urban design qualities of each route (Source: Authors).

Urban design qualities	The evaluated routes			
	Route 1	Route 2	Route 3	Route 4
Imageability				
Courtyards/plazas/parks (#)	0.37	0.414	0.276	0
Major landscape features (#)	0	0	0	0
Proportion of historic buildings	0.59	0	0.9	0.3
Buildings with identifiers (#)	0.99	0.5	0.77	0.85
Buildings with nonrectangular silhouettes (#)	0.34	0.079	0.4	0.24
Outdoor dining (y/n)	0.43	0.2	0.644	0
People (#)	2.52	2.23	5.25	3.94
Noise level (rating)	-0.79	-0.91	-0.85	-0.66
Total score	4.45	2.513	7.39	4.67
Enclosure				
Long sight lines (#)	0	-0.308	-0.1	0
Proportion of street wall—same side	0.716	0.24	0.62	0.716
Proportion of street wall—opposite side	0.57	0.01	0.25	0.78
Proportion of sky ahead	-0.568	-0.52	-0.23	-0.2
Proportion of sky across	-0.292	-0.36	-0.11	-0.5
Total score	0.426	-0.938	0.43	0.79
Human scale				
Long sight lines (#)	0	-0.74	-0.25	0
Proportion of first floor with windows	0.208	0.03	0.55	0.34
Building height—same side	-0.01	-0.01	-0.02	-0.01
Small planters (#)	0.381	0.2	0.2	0.26
All street furniture and other street items (#)	0.52	0.3	0.52	0.28
Total score	1.099	-0.22	1	0.87
Transparency				
Proportion of first floor with windows	0.233	0.04	0.6	0.4
Proportion of street wall—same side	0.62	0.22	0.54	0.66
Proportion of active use	0.32	0.391	0.49	0.49
Total score	1.173	0.651	1.63	1.55
Complexity				
Buildings (#)	0.64	0.37	0.54	0.7
Dominant building colors (#)	0.77	0.39	0.76	0.82
Accent colors (#)	0.65	0.47	0.6	0.79
Outdoor dining (y/n)	0.24	0.12	0.367	0
Public art (#)	0.09	0	0.18	0
People (#)	2.82	2.51	6.04	4.42
Total score	5.21	3.86	8.487	6.73
Combined urban design qualities score	12.5	5.86	18.93	14.61

Good quality imageability in a street with high proportion of historical buildings

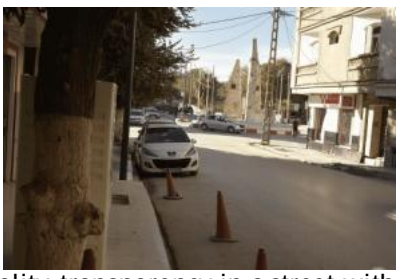
Poor quality imageability in a street without historical buildings

Good quality enclosure “Enclosed Street”

Low quality enclosure in a street with high proportion of sky and long sightlines

Good quality human scale in a street with a variety of elements

Low quality human scale in a street with less street elements



Low quality transparency in a street with fencing walls

Good quality transparency in a street with windows in the first floor showing human

Good quality complexity in a street market with high number of people

Low quality complexity in a street with less people

Fig. 4. Examples of streets with high and low perceptual qualities of urban design (Source: Author)

Table 4. Values of urban design qualities in Aïn-Beïda (Algeria) are compared to cities in other urban contexts. Adapted from (Ho *et al*., 2021).

Urban design qualities	New York (USA)	Brisbane (Australia)	Hanoi (Vietnam)	Gurgaon (India)	Aïn-Beïda (Algeria)
Imageability	3.58	4.68	8.05	10.01	4.75
Enclosure	3.06	2.09	2.5	0.93	0.17
Human scale	2.93	3.21	2.91	1.69	0.67
Transparency	2.66	3.28	3.21	2.84	1.25
Complexity	4.81	4.43	7.24	10.07	6.06
Total score	17.04	17.69	23.92	25.54	12.90

4.1. Imageability

Imageability scores varied by route; Lynch defines this attribute as "the mental image of the environment created from the shape, colour, and arrangement of physical objects" (Lynch, 1964). The old colonial fabric route received the highest imageability score at 7.39; this may be due to the numerous colonial buildings with distinctive architectural styles, buildings with identifiers, outdoor dining, public squares, and garden, which give the street a memorable character. The critical number of pedestrians that reflect the street market's commercial activity is another aspect that enhances imageability by contributing to the vibrant atmosphere of the street. The route between the colonial urban fabric and the post-independence fabric and the route whose landscape contains both colonial and post-independence urban typologies received roughly equal imageability scores. We can explain these results by the mix of both architectural styles. These, namely colonial and post-independence typologies, create more visual interest and diversity in the streetscape of these streets. In addition to the significant pedestrian traffic in these areas, the abundance of buildings with identifiers that speak to the vibrancy of the local streets is contributing factor to these findings.

Despite the presence of open spaces and buildings with identifiers in the route of the new urban area, it presents the lowest score for imageability at 2.513. We can explain this score by the dullness of the architecture of the collective housing buildings and the lack of visually appealing physical attributes, which minimize the memorable character of the streets. The presence of pedestrians, old buildings, and buildings with identifiers all contribute significantly to the imageability of Aïn-Beïda; these features reflect the distinct character of the streets, particularly in the old colonial village. Nevertheless, the modest architectural style, the buildings' cubic forms, the lack of landscape elements such as squares and public gardens, and the high level of noise from car traffic cause the monotonous appearance of streets and thus low imageability scores.

4.2. Enclosure

The assessment of the four routes in terms of enclosure revealed significant differences. According to Cullen (1995), enclosure is a powerful tool for creating a sense of identity and position in the environment. The width of the space divided by the height of the exterior walls reflects the amount of enclosure (Carmona, 2010). On the route, whose landscape combines both colonial and recent urban typologies, the visual continuity of the buildings' facades along the route enhances the feelings of protection and intimacy, explaining the higher quality of enclosure with a score

of 0.79. Despite the typo morphological differences, the enclosure score of the route between the colonial and post-independence urban fabrics is relatively similar to the score obtained in the route of the old colonial urban fabric, which could be related to the proportion of the street wall and the presence of tree lines, which create the illusion of an enclosed street. The low enclosure score of -0.938 obtained in the new urban area is most likely due to the wide streets and the large buildings set back, which create empty spaces with high visual openness that negatively impact the visual definition of the street and thus diminish the sense of enclosure.

4.3. Human scale

Human scale refers to the quality of urban design concerning physical elements of the built environment, like building details, sidewalk texture, street trees, and street furniture (Ewing and Handy, 2009). As a result, the human scale scores vary depending on the building's characteristics and physical elements of each route. The human scale scores were almost equivalent on all routes except the route through the new urban area, with a score of -0.22. The possible causes of this disparity are building height and the proportion of windows on the ground floor, which is relatively similar in colonial residential buildings and modern individual houses with commercial storefronts on the ground floor. The route between the colonial and post-independence urban fabrics had the highest human scale score at 1.099 due to the high number of street elements and small planters corresponding to human proportions and contributing to pleasantness and comfort in the pedestrian environment. The building's height, lack of details in the facades, and limited street furniture and trees create a less human-scaled environment.

4.4. Transparency

According to Llewelyn-Davies (2000), the transparency of windows contributes to the animation of the façade, enhancing security and creating visual interest and making the function of the building obvious. The route that traverses the old colonial fabric and the route whose landscape combines both colonial and post-independence urban typologies had very similar transparency scores, followed by the route between the colonial and post-independence urban fabrics; however, the characteristics contributing to transparency quality differed from one route to another. The route through the old colonial village had the highest transparency score at 1.63, with the proportion of street windows being the most prominent feature that ensures the relationship between the interior and exterior of the buildings, reflecting the commercial activity on the street. The transparent effect of windows and visual connection significantly improve street transparency. The route of the new urban area had the lowest transparency quality at 0.651. The score reflects the blind facades of several collective housing buildings, which significantly reduce visual permeability and, thus, street transparency.

4.5. Complexity

The number of people and buildings significantly influenced the complexity score in all routes. A variety of factors contribute to making the street more appealing to pedestrians. Boeing (2018) pointed out that variations in building types, design details, street furniture, signage, human activity, sunlight patterns, and the rich textural details of street trees and urban forests are

associated with high visual complexity. The route of the old colonial fabric obtained the highest score for this quality at 8.487, which reflects the intense human activity in this urban fabric. In the new urban fabric, the small number of collective housing buildings, the lack of ornamentation on the facades, and their placement in empty urban spaces significantly affect the visual richness and the variety of the streetscape, thus explaining the poor quality of complexity with a score of 3.86. Despite the significance of public art in the urban scene, it is almost nonexistent at the city level, negatively affecting complexity.

4.6. The comparison of the combined scores of urban design qualities between the city of Aïn-Beïda and other urban contexts

The combined scores of urban design qualities allowed us to compare the city of Aïn-Beïda, a medium-sized city in Africa that combine a checkerboard pattern inherited from the period of the French presence in Algeria as well as the urban patterns of the post-independence era with other cities worldwide. According to Ho *et al*. (2021), cities in the same urban context have similar scores for urban design qualities. However, our study sheds light on a new urban context. Aïn-Beïda's urban design score is considerably lower than that of low- and middle-income Asian cities (Hanoi, Gurgaon) as well as high-income cities representative of Western urbanism such as New York and Brisbane, which demonstrate a high level of urban design quality.

The overall score of Aïn-Beïda may refer to the juxtaposition of the checkerboard pattern inherited from the period of the French presence in Algeria and post-independence urban patterns. This combination created a less cohesive urban environment, leading to perceptual qualities related to walkability that received lower scores than in other urban contexts. When comparing urban design qualities related to walkability, it is crucial to consider similarities and differences between urban contexts and their impact on walkability.

Although Aïn-Beïda ranked last concerning combined scores, it achieved higher imageability and complexity than New York and Brisbane. We can explain this finding by various street activities that profoundly impact imageability and complexity. The presence of street markets, food stalls, and commercial activity on the ground floor level, along with the variety of colors and signs on building facades and the number of pedestrians, reflects the unique local culture that distinguishes Aïn-Beïda from Western cultures.

Compared to Asian cities such as Hanoi and Gurgaon, the scores of imageability and complexity were lower in Aïn-Beïda. Although African and Asian cities may have some cultural similarities, including food stalls and street markets, the results revealed that Asian cities have a more lively street atmosphere and vibrant commercial activities, profoundly impacting walkability. In addition, comparing Aïn-Beïda with cities representing Western urbanism, namely New York and Brisbane, demonstrates the importance of urban planning policies and design strategies in generating more walkable streets. The overall score of urban design qualities related to walkability in Aïn-Beïda was lower than in these cities. This finding is related to the fact that, as a medium-sized city in Africa, Aïn-Beïda's urban planning tools do not fully incorporate urban design guidelines. In contrast, Over the years,

urban design principles have been the focus of planning systems in Western cities, significantly contributing to better walkability.

5. Conclusion

The purpose of the current study was to objectively evaluate the five qualities of urban design in the city of Aïn-Beïda (Algeria) following the method of Ewing and Clemente (2013) in routes with different typo morphological characteristics. This study attempted to address the lack of research on street walkability assessment by using micro-scale streetscape elements, providing new data from a developing country's urban context on the one hand and contributing to the development of an international database on the other (Hooi and Pojani, 2019).

Urban design qualities provide a great deal about the walking conditions in the evaluated streets in Aïn-Beïda. There is a significant difference in these qualities between the old colonial urban fabric and the post-independence urban fabric represented by collective and individual housing. The collective housing area in the post-independence urban fabric has poor urban design qualities, particularly the enclosure and human scale, due to the monotonous architectural form and style of buildings, the street wall being frequently discontinuous, and the insufficient number of street furniture and tree lines. These features negatively affect the overall walkability of the street and the pedestrian experience.

Compared to streets in new urban areas, streets with higher urban design scores have a better-designed pedestrian environment. Remarkably the presence of interesting architectural features, outdoor restaurants, windows on the ground floor, and the number of pedestrians had a significant effect on imageability and complexity in the streets of the route that traverses the old colonial village, the route between the old colonial fabric and the new urban fabric, and the one whose landscape combines colonial and post-independence urban typologies, which makes them more walkable.

In the city of Aïn-Beïda, imageability and complexity appeared to be the most influential urban design qualities, aligning with the findings of studies conducted in Gurgaon by Kumar *et al.* (2021) and in Hanoi by Ho *et al.* (2021). We can interpret these findings regarding cultural similarities between Asian and African contexts. Moreover, some physical characteristics, such as the presence of street markets, a wide range of uses at street level, and the number of pedestrians in the streets, reflect the similarity.

The comparison between cities demonstrates the strong connection between urban design qualities related to walkability and the city's urban context, shaped by its cultural and historical background and urban planning policy. While cities may benefit from each other experiences and strategies to promote walkability, the creation of walkable streets and pedestrian-friendly environments needs a strong comprehension of the urban context and the existing walking conditions.

These findings contribute to our understanding of urban design qualities related to walkability in the urban routes of Aïn-Beïda and provide a basis for comparing the city's overall score with other urban contexts. Our findings support the hypothesis that the typo morphological aspect of urban fabrics

correlates with the variation of urban design qualities. The results of each route and the comparison of the combined urban design qualities results with those of other cities reveal that all the assessed streets, even those performing well, require intervention to improve the design of the pedestrian environment and, thus, walkability.

Several factors of the built environment at different scales influence walkability (Erturan & van der Spek, 2021). Built environment modifications through macro-scale elements such as land use characteristics and street connectivity to design walkable cities can be expensive and time-consuming. However, streetscape improvements at the micro-scale level through urban design qualities could significantly contribute to promoting walkability in less time and at a lower cost (Hamidi and Moazzeni, 2019).

In this regard, the findings of this study have several significant implications for city decision-makers and urban planners. Including more outdoor restaurants, public squares, and gardens enrich the urban landscape, attracting more pedestrians and thus improving its imageability and complexity. Increasing the proportions of active uses and windows on the ground floor gives the street more transparency and human scale. Integrating public art in the city adds visual complexity to the street environment. The reconsideration of street design in the urban fabric of the post-independence area is necessary to create more walkable places. Improving human scale and transparency can be achieved by increasing the proportion of windows on the ground floor, adding details to the facade, and incorporating micro-scale street elements. On wider streets, the implementation of tree lines contributes to both human scale and enclosure.

One of the limitations of our study is the sample size, as including several randomly selected streets from each urban fabric could improve the precision of our findings. Another limitation is the subjectivity of some characteristics in the fieldwork evaluation manual, which affects the reliability of the results.

Regardless, future research could continue to explore the urban design qualities in other larger cities in Algeria and Africa and compare walkability in these cities. Combining this assessment tool with a survey of street users may provide a more comprehensive picture of the walking experience and thus helps to suggest specific interventions to improve walkability through urban design.

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