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Urban form and Psychological Sense of Community: The role of intermediate spaces in collective housing in Jijel, Algeria

Mounia Ouari[1]

Ammar Bouchair[2]*

[1] *Ferhat Abbes University Setif 1, Institute of Architecture and Earth Sciences, Setif, Algeria*

[2] *University of Jijel, Faculty of Sciences and Technology, Research laboratory "CBE", Jijel, Algeria*

***Corresponding author**
E-mail: abouchair@univ-jijel.dz, abouchair@gmail.com

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Abstract: This study explores the relationship between urban form and the psychological sense of community (PSC) in collective housing contexts, focusing on six residential complexes in Jijel, Algeria. While prior research has examined factors such as length of residency, functional diversity, and quality of living environments, less attention has been paid to how urban forms particularly the design and organisation of shared spaces affect social interactions and residents' sense of belonging. Urban form, including the layout of streets, buildings, and shared spaces such as courtyards and pathways, plays a crucial role in structuring social behaviours and strengthening neighbourhood relationships. By facilitating informal encounters, well-structured communal spaces foster interpersonal interactions and reinforce PSC. The study, based on data collected from 400 residents and analysed using ANOVA, hypothesised that well-designed intermediate spaces would encourage greater social engagement and a stronger PSC. Results showed that residents in neighbourhoods with structured and hierarchical intermediate spaces reported significantly higher PSC levels and more frequent social interactions. Conversely, those living in fragmented environments with limited shared spaces experienced greater social isolation. However, the study has limitations, including its focus on a single city and one type of collective housing, which may not fully reflect the diversity of urban experiences. Additionally, it does not account for long-term behavioural adaptations or variations in residents' personal preferences, underscoring the need for further research in other contexts and qualitative approaches to deepen understanding of social dynamics. These findings highlight the need to integrate well-structured intermediate spaces into residential planning. Urban planners should prioritise spatial hierarchies, pedestrian-friendly environments, and well-maintained common areas to strengthen PSC. In rapidly urbanising areas, aligning design with social needs can foster cohesive communities, reinforcing urban planning's role in social well-being.

Keywords: sense of community, urban form, intermediate space, collective housing

INTRODUCTION

The elements of a city are intimately interconnected, each action influencing the overall functioning of the urban environment (Silverman, 1982). Among these elements, collective housing complexes play an essential role in urban dynamics and contribute to the complexity of urban systems. This complexity, resulting from the diversity of spaces and uses, forces cities to adapt the services they offer to meet the unique needs of their inhabitants (Murimi, 2021). A major challenge arises: how to understand the functioning of the city in this context of interdependence? At the heart of this dynamic, the vitality of residential complexes relies on social interactions among the inhabitants (Cuthbert, 2011). For a long time, urban planning and design have focused on creating public spaces that promote these interactions and strengthen the sense of community (Inam, 2013; Kapoor and Putta, 2017; Liu, 2022). Numerous studies have explored various aspects of public spaces, neighbourhood forms, and social interactions in order to understand their implications for urban viability and sustainability (Talen, 1999; Jorgensen and Stedman, 2001; Can, 2012). Some research focuses on the health and well-being aspects related to these spaces (Blibli and Bouchair, 2023), while others evaluate the perception of comfort in outdoor environments and its impact on social interactions (Boutellis and Bouchair, 2022).

Urban public space is a broad concept that encompasses undeveloped areas, ranging from large green belts to small squares nestled in urban centres (Nochian et al., 2015). When an open space does not have a clearly defined identity, the term "intermediate space" is sometimes used to avoid any confusion with the notions of "semi-public" or "semi-private" spaces (Ouari, 2011). These spaces play an essential role in creating an environment conducive to social interactions and the emergence of a sense of belonging. The sense of community, although difficult to define universally, is central to discussions about urban life. Gusfield (1975) distinguishes two meanings of the term "community": one geographical, referring to a neighbourhood or a city, and the other relational, based on the quality of social ties. The first definition emphasises physical space, while the second focuses on common interests and interactions between individuals. Introduced by Seymour Sarason (1974), the concept of psychological sense of community (PSC) focuses on the relationship between the physical environment and the sense of belonging to a community. McMillan and Chavis (1986) defined four components of PSC: belonging, influence, integration and fulfil-

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ment of needs, as well as shared emotional bonds. These elements are reinforced by the proximity of residents and the opportunities for social interactions offered by a well-designed neighbourhood (Talen, 1999).

Many researchers have focused on the spatial conditions that promote these interactions. Jacobs (1961), Gehl (1986), and Hillier & Hanson (1989) studied how urban configuration influences social interactions and community formation. The accessibility of public spaces, the density of pedestrian streets, and the design of intermediate spaces are all determining factors (Madanipour, 2003). In particular, the presence of shared spaces, such as entry porches, small squares, and residential streets, plays a fundamental role in creating a sense of proximity and belonging (Plas and Lewis, 1996). Some studies have revealed that high-density environments can have a variable impact on the PSC. Weenig et al. (1990) found that neighbourhoods primarily composed of multi-storey buildings exhibited a lower PSC compared to neighbourhoods of single-family homes. Similarly, Buckner (1988) emphasised that residents of housing cooperatives forge stronger ties with their neighbourhood than temporary tenants of collective buildings. Moreover, the quality of neighbourly relations is influenced by the design of semi-private spaces and housing density (Skjaeveland and Garling, 1997).

However, despite these advances, many studies have been limited to analysing social interactions through pedestrian satisfaction surveys, without deeply considering the influence of the spatial configuration of open public spaces. An uncertainty persists regarding the design approaches that best promote the correlation between social interactions and the built environment. To fill this gap, our study adopts a quantitative approach by statistically analysing the results of a survey conducted among the residents of six residential neighbourhoods in Jijel, Algeria. Through ANOVA analyses and regressions, we evaluated the impact of the configuration of open spaces on social interactions and, consequently, on the psychological sense of community (PSC). We hypothesise that the spatial structure of residential neighbourhoods significantly influences the frequency and intensity of social interactions, thereby contributing to the strengthening or weakening of the residents' PSC. By focusing on the spatial composition and shared spaces of collective habitats, we examine how these elements shape the social dynamics of neighbourhoods. Our study emphasises the importance of residential design that promotes proximity and encounters to foster dynamic and socially active neighbourhoods.

METHOD AND MATERIALS

Case study

This study focuses on six residential complexes located in the city of Jijel, Algeria. (Fig. 1) These neighbourhoods were selected due to their diversity in terms of spatial configuration (open vs semi-closed spaces), built density, and internal accessibility (Tab. 1). They reflect different forms of collective housing widely spread across the country. The six neighbourhoods studied are as follows:

1. 1,000 housing units: High-density neighbourhood with a high degree of enclosure. The buildings have a height of four to five storeys. It features a functional mix mainly concentrated along the main axes.
2. 375 housing units: Semi-closed neighbourhood, consisting of four-storey apartment buildings. It has a moderate density with more limited intermediate spaces.
3. 450 housing units: Linear neighbourhood, with buildings of three to four storeys. It presents a brutal transition between public and private spaces.
4. Belle Vue: a neighbourhood without enclosure, characterised by an open morphology and a particular topography (located at the foot of a wooded hill). The buildings are three to four storeys high with a spatial organisation that encourages informal interactions. Each building has two access doors, one on the main facade and the other on the rear facade.
5. Moussaoui Messaouda: Dense neighbourhood, comprising five-storey buildings. It presents a certain degree of functional diversity, although this is limited to commercial spaces located on the periphery.
6. Colonial city centre: A composite neighbourhood that mixes collective, semi-collective, and individual housing. It is distinguished by the presence of buildings of varying heights (ranging from two to five storeys and a strong functional mix, particularly due to its central location.

These neighbourhoods exhibit variations in terms of morphological structure, density, and organisation of intermediate spaces, thereby influencing social interactions and the psychological sense of community among residents (Fig. 2).

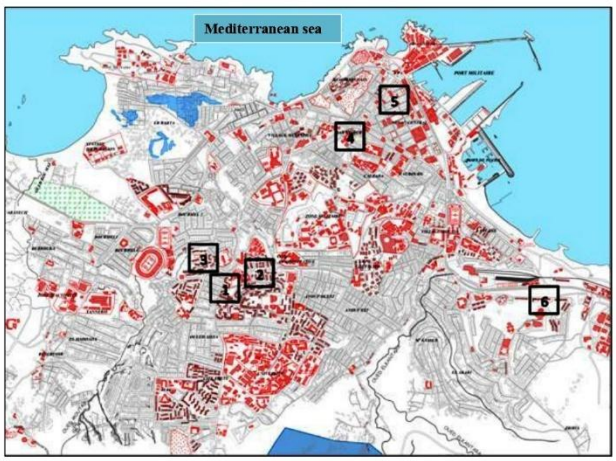

Fig. 1. Situation of the six neighbourhoods used in this study. (Source: adapted from Google maps, 2024)

Tab. 1. Physical attributes of case studies. (Source: Authors, 2024)

Case study	Neighbourhood	Density	Number of floors	Year of production	Degree of enclosure
Case study n°1	1,000 housing units	0.014 unit/m²	Gf +4	1980	1.81
Case study n°2	450 housing units	0.011 unit/m²	Gf +4	1980	1.1
Case study n°3	375 housing units	0.012 unit/m²	Gf+4/ Gf +5	2000	1.15
Case study n°4	Moussaoui Messaouda	0.017 unit/m²	Gf +4/ Gf +3	1970	2.05

Case study n°5	Colonial city centre	0.018 unit/m²	Gf +1/ Gf +2/ Gf +3/ Gf +4/ Gf +5	Colonial period /contemporary	0.77
Case study n°6	Belle Vue	0.0041 unit/m²	Gf +4/ Gf +2	2008	0.25

Gf: ground floor

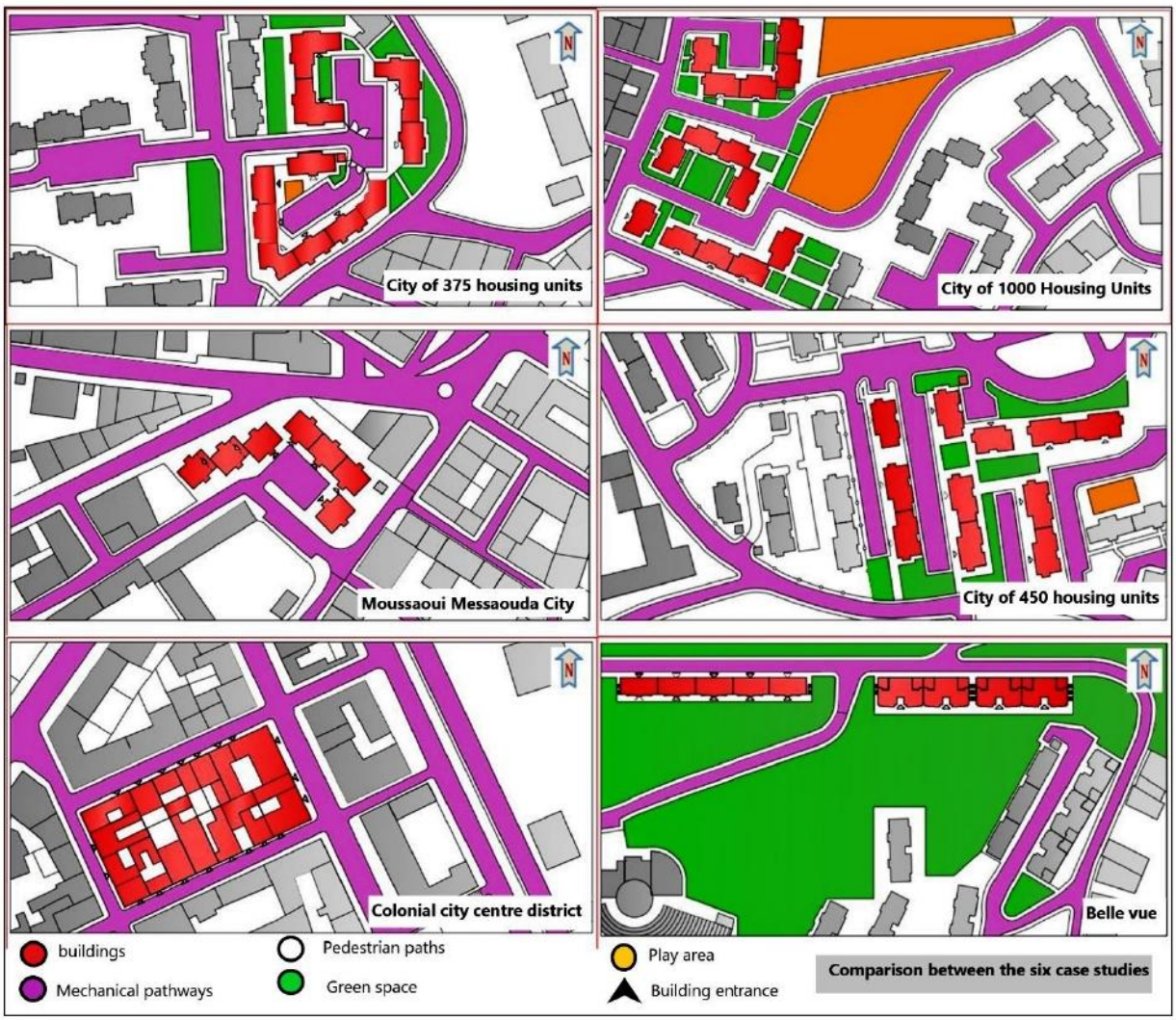

Fig. 2. Spatial composition of the six case studies. (Source: Authors, 2024)

Method of investigation and data collection

The study is based on a quantitative approach combining a questionnaire survey and a statistical analysis of the collected data. A total of 540 questionnaires were distributed, of which 479 were completed and analysed. The distribution of responses is as follows: 85 for the 1,000 housing-unit neighbourhoods, 83 for the 375 housing-unit neighbourhoods, 85 for the 450 housing-unit neighbourhoods, 88 for Belle Vue, 71 for Moussaoui Messaouda, and 75 for the Colonial city centre. The instrument used to measure the psychological sense of community is based on the scale developed by McMillan and Chavis, supplemented by indicators from two other assessment tools. Eight subscales were initially established to measure the different dimensions of the psychological sense of community, but following a reliability test based on Cronbach's Alpha, two of them were eliminated: neighbourhood and needs satisfaction, whose reliability coefficients were 0.44 and 0.49, respectively, below the acceptable threshold of 0.6 (See Tab. 2). The evaluation was based on a five-point Likert scale, ranging from 1 to 5 (Tab. 3).

Tab. 2. PSC subscale indicators. (Source: Authors, 2024)

Developed scales	Cronbach's Alpha	
Satisfaction of needs	0.44 (after revision)	Eliminated
Influence	0.75	
Membership	0.65 (after revision)	
Shared emotional connection	0.79	
Neighbourhood attraction	-0.47	
Neighbourly relations	0.74 (after revision)	Eliminated
PSC	0.90	

Tab. 3. LIKERT scale values. (Source: Authors, 2024)

Likert Scale	Interval Range	Difference	Description
1	1.00–1.79	0.79	Strongly Disagree
2	1.80–2.59	0.79	Disagree
3	2.60–3.39	0.79	Neutral

4	3.40–4.19	0.79	Agree
5	4.20–5.00	0.80	Strongly Agree

Data analysis and statistical modelling

The study also explored the relationship between the quality of intermediate spaces and social interactions, as well as their impact on the psychological sense of community. Thirteen variables were correlated with the psychological sense of community indicator using Pearson's correlation coefficient. Next, an analysis of variance (ANOVA) was conducted to evaluate the differences in means between the six neighbourhoods studied. Finally, a multiple regression analysis was conducted using psychological sense of community as the dependent variable. The regression model used is as follows:

$$PSC_i = a + \beta_1.Encl_i + \beta_2.Surf_i + \beta_3.Entr_i + \beta_4.IndEntr_i + \beta_5.NHHold_i + \beta_6.NPU_i + \beta_7.NPR_i + \beta_8.NBRH_i + \beta_9.NBRHQual_i$$

Where, PSC_i is a dependent variable and represents the six different case studies. $Encl_i$ denotes enclosure, $Surf_i$ denotes the surface of the intermediate space. $Entr_i$ is the degree of opening, $IndEntr_i$ is the number of individual entrances. $NHHold_i$ is the number of households. NPU_i is the number of people per housing unit. NPR_i is the number of people per room. $NBRH_i$ is the neighbourhood. $NBRHQual_i$ is the quality of neighbourhood relations.

The variables included in the analysis were selected based on their theoretical relevance to explain the social and spatial dynamics of the studied neighbourhoods. For example, the number of people per housing unit and per room allows for the evaluation of residential density and its potential effect on social interactions and the sense of belonging. Similarly, the quality of neighbourly relations is considered a key indicator influencing the psychological sense of community. The results of this analysis allow for the evaluation of the influence of spatial characteristics on social interactions and the psychological sense of community among residents, highlighting the most determining factors. These results will contribute to a better understanding of the relationship between the configuration of intermediate spaces and social cohesion within residential neighbourhoods.

RESULTS

Socio-demographic characteristics of the six neighbourhoods

In order to develop the correlation between the socio-demographic characteristics and sense of community, the results of Tab. 4 are obtained based on the interviewed residents. The average age of the residents surveyed ranged from 17 to 60 years, and they were mainly women. The oldest neighbourhood is the city centre block, distinguished from other residential areas by a greater proportion of residents living in the neighbourhood for more than 30 years. Then, 20% in the 1,000 housing unit neighbourhood, and 15% in the Moussaoui Messaouda neighbourhood, while 51% of people surveyed in Belle Vue have lived there for less than 15 years. 48% of residents surveyed in the 375-unit neighbourhood and 54% of residents in the 1,000-unit neighbourhood have lived there for 11 to 20 years. All the study neighbourhoods included families (couples with one or more children) and childless couples, sometimes with two households sharing an apartment. Most respondents worked primarily in the service sector, including health and education.

Tab. 4. Socio-demographic characteristics of respondents. (Source: Authors, 2024)

Category	1,000 housing units	450 housing units	375 housing units	M. Moussaoui	Ilot Colonial city centre	Belle Vue
Number of children						
1	9.8%	–	34.1%	–	56.1%	–
2	2.4%	8.3%	21.4%	28.6%	–	39.3%
3	13.7%	15.8%	21.9%	14.4%	24.0%	10.3%
4	28.2%	26.2%	14.4%	5.9%	19.8%	5.4%
Number of people per housing unit						
1	17.2%	21.7%	20.6%	16.2%	7.0%	17.2%
2	17.7%	–	9.4%	50.0%	–	22.9%
3	17.3%	17.3%	16.5%	14.8%	15.7%	18.4%
Type of occupancy						
Owner	20.7%	20.1%	9.6%	14.9%	19.2%	15.5%
Tenant	12.1%	10.1%	26.3%	20.2%	9.1%	22.2%
Borrower	–	10.8%	54.1%	–	–	35.1%
Number of households per housing unit						
1	17.2%	21.7%	20.6%	16.2%	7.0%	17.2%
2	17.7%	–	9.4%	50.0%	–	22.9%
Do you want to settle here permanently?						
Yes	–	16.8%	17.4%	6.5%	29.9%	29.3%
No	28.1%	17.6%	15.9%	20.0%	6.8%	11.5%
Total	17.3%	17.3%	16.5%	14.8%	15.7%	18.4%
Neighbours (building, adjacent buildings, no neighbours)						
Those in the same block	14.9%	29.8%	7.5%	16.1%	11.8%	19.9%
Those in the block and adjacent buildings	19.1%	12.2%	22.2%	10.1%	19.4%	17.0%
No relationship with adjacent blocks	13.3%	–	10.0%	53.3%	–	23.3%
Quality of neighbourhood relations						
Yes	19.9%	20.2%	16.9%	6.6%	15.9%	20.5%
No	–	–	16.7%	–	54.2%	29.2%
Neutral	7.8%	6.3%	14.1%	70.3%	–	1.6%
Shopping locations						
Near my residence	22.8%	–	20.7%	25.3%	31.1%	–
Outside the neighbourhood	11.8%	34.9%	12.2%	4.2%	–	37.0%
Children's play areas						
Playground	19.3%	21.6%	21.6%	10.4%	15.6%	11.5%
Street	17.0%	–	–	14.2%	31.1%	37.7%
Parking lot	16.3%	25.6%	32.6%	23.3%	–	2.3%
Outside the neighbourhood	9.8%	23.0%	11.5%	29.5%	–	26.2%

The socio-demographic characteristics of the respondents in the six case studies did not vary significantly, with the exception of the length of residency and access to property. The six cases exhibited differences in terms of PSC. Regarding the satisfaction with outdoor spaces, only the residents of Moussaoui Messaouda, Colonial city centre, and Belle Vue neighbourhoods, acknowledged that there were enough green spaces for children and landscaping close to their building. Residents say that social interactions occur in the stairwell (80% of women). While men interact in the intermediate space or at the entrance of the building.

PSC correlations and predictors

The Kolmogorov-Smirnov (0.2) and Shapiro-Wilk (0.2) normality test reveal an added value greater than 5%, which implies a normal distribution of the sample.

Pearson indicator concerning PSC and socio-demographic characteristic correlation

Tab. 5 shows the correlations between the different variables and the PSC in the six case studies. Correlations were found between the PSC and intermediate space characteristics. Including its various indicators such as the surface area, perimeter, enclosure or the number of collective and individual accesses. Correlations were also significant between the sense of community and the number of people per dwelling in the four cases. It was also significant for three cases concerning the variable: quality of the neighbourhood relationship, and for the neighbourhood sphere, meeting places, and children's play areas. However, correlations were not significant for variables such as: number of households and number of people per room. This can be explained by the fact that these variables are similar across the different case studies.

Tab. 5. Result of the correlation between PSC and socio-demographic characteristics. (Source: Authors, 2024)

		1,000 housing unit	450 housing unit	375 housing unit	Moussaoui Messaouda	Colonial city centre	Belle Vue	
Number of households per unit	Correlation	-.035			-.079	**.372****	.031	
Number of families per unit	Correlation	-.075	.059	-.185	.008	.140	**.230***	
Number of people per unit	Correlation	**.222***	-.007	**-.304****	.022	**.519****	.216*	
Occupation owner, tenant, other	Correlation	-.112	-.496 **	.122	-.015	-.066	-.188	
Number of children	Correlation	-.078	.155	-.086	.064	.150	**.363****	
Quality of neighbourly relations	Correlation	-.100	**-.311****	**-.296****	-.229	**-.554****	.006	
Neighbour (building, neighbouring buildings, no neighbour)	Correlation	.153	**.241***	-.038	.025	**.555****	-.014	
Do you want to settle here for good?	Correlation		-.192	-.015	-.125	-.061	**-.385****	
Meeting places	Correlation	-.028	-.008	**-.238***	.176	**-.259***	**-.282****	
Shopping locations	Correlation	.084		**-.302***	-.164			
Children's play areas	Correlation	.106	.042	**-.292****	-.165	**-.341****	**.295****	

Pearson PSC correlation and physical characteristics of the intermediate space

The correlation analysis between the qualitative variables and the psychological sense of community revealed a strong correlation of 0.22 with the number of people per household and a weak correlation with the number of households per dwelling. There is no correlation with the rest of the qualitative variables. The Pearson correlation analysis found strong correlations between the psychological sense of community and various urban form characteristics. These include the number of apartments, entrances to the collective housing blocks, enclosure, surface area, and perimeter of open space (see Tab. 6). The quality of neighbourly relations results showed a negative coefficient in the 450 housing unit neighbourhood, the 375 housing neighbourhood, and the downtown block, which can be explained by the absence of outdoor spaces dedicated to social interaction.

Tab. 6. Correlations between PSC and physical characteristics of the intermediate space. (Source: Authors, 2024)

	Sig.	PSC Pearson correlation
Number of apartments	**.000**	**.399****
Accessibility	.938	.004
Number of collective block entrances	**.000**	**.412****
Enclosure	**,000**	**-.271****
Entrance	**.392**	**-.039**
Surface	**.000**	**-.377****
Perimeter	**.000**	**.371****
Number of households per unit	**,000**	**.229****
Number of families per unit	**.044**	**-.092***
Number of people per unit	.175	-.065

Number of children	.061	-.086
Neighbour (building, neighbouring buildings, no neighbour)	.445	.035
Quality of neighbourly relations	**.000**	**-.252****

ANOVA analysis

A Kolmogorov-Smirnov normality test with a significance rate of 0.2 was conducted to assess normality for the ANOVA test between the psychological sense of community and eight urban form variables. The homogeneity of variances was confirmed through the Levine test, with values ranging from 0.4 to 0.9 across the eight variables, including enclosure, open space surface, perimeter, individual entrances, open space entrances, and collective entrances, which collectively indicate accessibility. At a 5% threshold, the ANOVA analysis revealed an added value of 0. This proves that there are differences between the different groups. This led us to perform a Bost hoc test to identify the groups affected by the difference (Tab. 7).

Tab. 7. ANOVA analysis results. (Source: Authors, 2024)

Dependent variable	(I) Neighbourhood name	(J) Neighbourhood name	Average difference (IJ)	Sig.
		375 housing units	**.84199***	.000
		Moussaoui Messaouda	-.25266	.807
		Colonial city centre	**1.14129***	.000
		Belle Vue	**1.86966***	.000
		375 housing units	.22334	.863
		Moussaoui Messaouda	**-.87131***	.000
		Colonial city centre	.52264	.074
		Belle Vue	**1.25102***	.000
		Colonial city centre	.29929	.663
		Belle Vue	**1.02767***	.000
		375 housing units	**1.09465***	.000
		Colonial city centre	**1.39395***	.000
		Belle Vue	**2.12232***	.000
		Belle Vue	**.72838***	.001
	1000 housing units	450 housing units	.46844	.143
		375 housing units	.22163	.874
		Moussaoui Messaouda	-.05492	1,000
		Colonial city centre	**-.86175***	.000
		Belle Vue	**-.84846***	.000
		375 housing units	-.24681	.814
		Moussaoui Messaouda	-.52336	.091
		Colonial city centre	**-1.33019***	.000
		Belle Vue	**-1.31690***	.000
		Moussaoui Messaouda	-.27655	.760
		Colonial city centre	**-1.08338***	.000
		Belle Vue	**-1.07009***	.000
		Colonial city centre	**-.80683***	.001
		Belle Vue	**-.79354***	.001
		Belle Vue	.01329	1.00

Multiple linear regression analysis

A multiple linear regression analysis was performed with the psychological sense of community as the independent variable and 13 dependent variables: neighbourhood relationship quality, area, building vicinity, people per dwelling, households per dwelling, people per room, neighbourhood enclosure, dwellings count, children count, perimeter, accessibility to residential area, and collective and individual entrances count. The results showed a correlation coefficient of 0.9, indicating a strong correlation since it exceeds 0.7. The R-squared coefficient demonstrates that these 13 variables have an effect of 87% on the independent variable, namely the psychological sense of community. As for the ANOVA analysis, it demonstrated significance at the 1% level, but analysis of the table of regression coefficients showed that only nine of the 13 dependent variables demonstrated effective significance on the psychological sense of community, i.e. this leads us to write the following formula:

$$Y = b_0 + b_1.x_1 + b_2.x_2 + \cdots . + b_n.x_n \quad (1)$$

$$PSC_i = a + \beta_1.Encl_i + \beta_2.Surf_i + \beta_3.Entr_i + \beta_4.IndEntr_i + \beta_5.NHHold_i + \beta_6.NPU_i + \beta_7.NPR_i + \beta_8.NBRH_i + \beta_9.NBRHQual_i \quad (2)$$

Where, a = 2.95, β_1= 0.91, β_2= - 0.001, β_3 = - 0.005, β_4 = 0.022, β_5 = 0.25, β_6 = - 0.53, β_7 = 0.9, β_8= 0.13, β_9 = - 0.47

The enclosure was calculated on the basis of the division of the open space length divided by the mean height of the surrounding buildings. Additionally, the comparison of the psychological sense of the community score in different case studies was established (Fig. 8). Enclosure: The higher the enclosure, the higher the social interactions (PSC) seem to be. For example, the 450 housing (PSC = 7) and 375 housing (PSC = 8) have a higher enclosure than Belle Vue or Moussaoui Messaouda (PSC = 3) (Fig. 3 and 8).

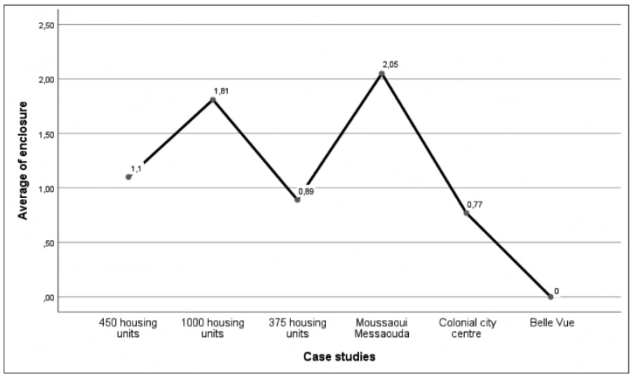

Fig. 3. Comparison of enclosure averages. (Source: Authors, 2024)

Surface and perimeter: Larger intermediate spaces seem to favour a higher PSC. 1000 housing, with the largest area (60) and the largest perimeter (35), has a relatively high PSC (6) (Fig. 4 and 5). The area and the perimeter also play a role, but to a lesser extent. More open and accessible spaces tend to have lower PSC.

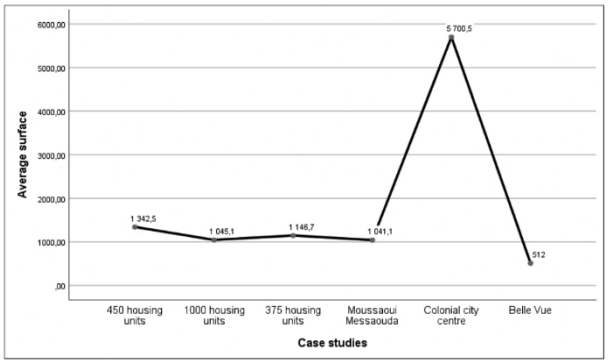

Fig. 4. Comparison of intermediate open space average surfaces. (Source: Authors, 2024)

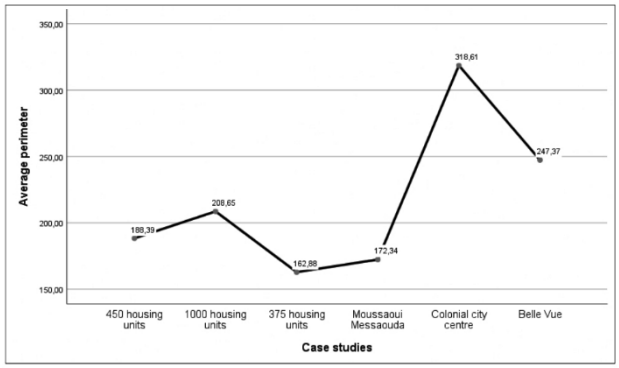

Fig. 5. Comparison of perimeter averages. (Source: Authors, 2024)

Number of entries: The higher the number of entries, the more social interactions are favoured. The 450 housing and the 1,000 housing have more entries (Fig. 6, 7) and show a more significant PSC. The enclosure and the number of entries are the determining factors for the PSC (Fig. 3, 8).

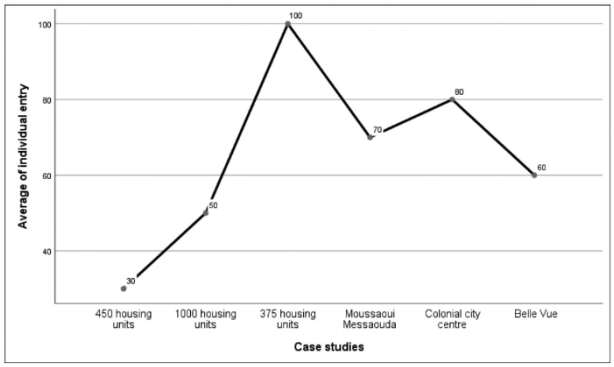

Fig. 6. Comparison of number of individual entries averages. (Source: Authors, 2024)

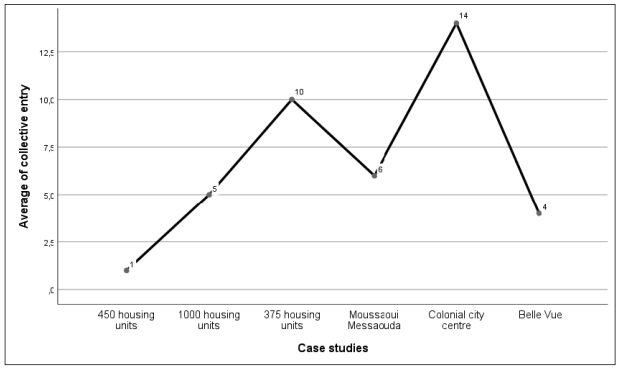

Fig. 7. Comparison of number of collective entries averages. (Source: Authors, 2024)

The diagram illustrates that the bus is the most frequently used mode of transport across the six cases, with the car coming in second, while cycling is nearly non-existent in all instances (Fig. 8). However, the preference for different transport modes varies by neighbourhood. Because dependency is most pronounced in Belle Vue and the 450 housing units, while areas like the 1,000 housing units and Moussaoui Messaouda exhibit much lower car usage. Bus ridership is highest in the 1,000 housing units, followed by the 450 housing units and the 375 housing units, indicating a strong reliance on public transportation. The Colonial city centre neighbourhood boasts the largest percentage of pedestrians, likely due to its superior accessibility and urban design, whereas Moussaoui Messaouda and the 450 housing units show lower walking rates (Fig. 9).

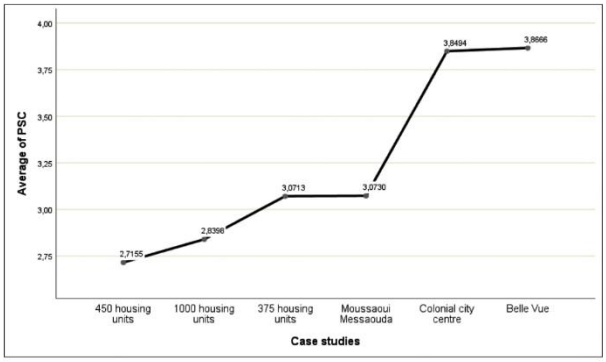

Fig. 8. Comparison of the mean PSC across six case studies. (Source: Authors, 2024)

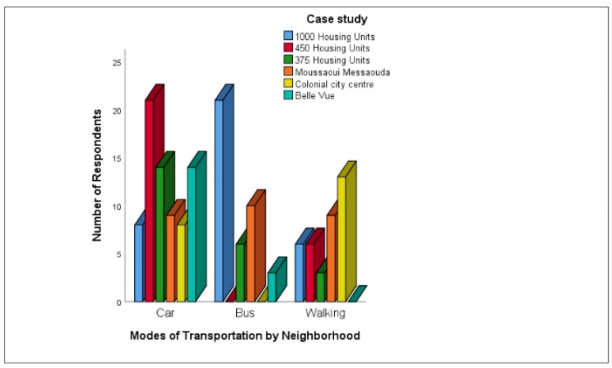

Fig. 9. Preferred modes of transportation by neighbourhood. (Source: Authors, 2024)

In addition to mobility preferences, residents highlighted various issues related to urban conditions. Noise disturbances are notably reported in the 1,000 housing units, Colonial city centre,

and Moussaoui Messaouda. Furthermore, concerns about poor management, cleanliness, and waste disposal are frequently raised in the neighbourhoods of the 1,000 and 450 housing units. These observations indicate that urban planning, accessibility, and environmental factors significantly influence transportation choices and the overall satisfaction of residents with their living conditions. Belle Vue residents mentioned the inconvenience generated by renting apartments for a considerable percentage of residents during the summer season. Therefore, it can be concluded that the surveyed individuals in Belle Vue and the 375 housing unit are more satisfied with their neighbourhood environment. Additionally, when asked where they would like to live if they did not have financial constraints, 54% of respondents expressed a desire to remain in Belle Vue, which is slightly higher than that of Colonial city centre (55%). In contrast, 83% of the residents of the 1,000 housing units expressed the desire to move to another neighbourhood.

DISCUSSION

This study hypothesised that the shape of outdoor space in the residential neighbourhoods of collective housing in Jijel, Algeria—which is the main base of social interaction and exhibits a hierarchical and structured topology between private space and public space—would be more conducive to social interaction and consequently, the development of a higher sense of community. The urban form criteria supported in this study are: first the surface area, the perimeter of this intermediate space, its enclosure, and of course the density, alongside some socio-cultural factors that are also determinants in the formation of a sense of community. However, this hypothesis was refuted by the results. The data showed that neighbourhoods with high enclosure were generally correlated with a strong psychological sense of community, except for Belle Vue.

Despite lacking enclosure, Belle Vue exhibited the highest degree of community sense. This was attributed to its high level of maintenance, vast open spaces, natural environment, and well-structured pedestrian paths, all influenced by the area's topography. Thus, providing a greater chance for positive social interaction, it also promoted the development of a greater PSC. The study highlighted a significant relationship between intense social interaction and PSC, however, it takes into account all predictors of PSC, for instance, studies should consider the socio-demographic structure of a neighbourhood, residents' personal preferences and behaviours, as well as their level of involvement in neighbourhood organisations.

As stated by (McKenzie, 1921) the stability of residents is crucial in developing a sense of belonging to the neighbourhood. People who live in a neighbourhood by choice rather than economic reasons tend to be more attached to that place. According to the observations of this study, the 1,000 housing units seem to be changing, and tenants and residents of the neighbourhood are more willing to move and are more unsatisfied with the physical environment, management, and maintenance of the neighbourhood. The duration of residence is not necessarily significantly related to the development of PSC in contemporary residential neighbourhoods (Lund, 2002). The results of this study confirm this postulate. While there is a significant relationship between the psychological sense of community (PSC) and the length of residency in the Colonial city centre and the 1,000 housing unit neighbourhoods, this is not the case with other neighbourhoods. Specifically, the 375 housing unit and Belle Vue neighbourhoods, which are more recent than the 450 housing unit neighbourhood, exhibit a higher PSC despite their shorter length of residency.

As shown by Zehner and Marans, 1973; Skjaeveland and Garling, 1997; Lund, 2002 housing density is also an important predictor for personal contacts and neighbourhood relationships. One would expect that people know less of their neighbours in the 1,000 housing unit, 450 housing unit, and Moussaoui Messaouda neighbourhoods, however, despite the higher population density, the percentage of respondents stating that they know their neighbours was rather high. The Belle Vue neighbourhood is not as central as the other neighbourhoods, but it is increasingly integrated as the city has experienced a large expansion toward the east side; hence, while a few years ago, Belle Vue was located on the outskirts of the city, this is no longer true today.

The layout of the intermediate space, including playgrounds suitable for children, relaxation areas where people can sit and chat, and landscaped areas, was significantly linked to the psychological sense of community (PSC). Additionally, various indicators of the intermediate space's shape developed by the study—such as the surface area, perimeter, and degree of enclosure, as well as the number of individual and collective building entrances—were also closely associated with PSC. However, two indicators, entrance and accessibility, did not show a significant link to PSC. This suggests that beyond the mere physical characteristics of the intermediate space, its hierarchical organisation plays a crucial role in shaping social interactions and fostering a sense of community. A well-structured transition between private, semi-private, semi-public, and public spaces allows for a progressive appropriation of space by residents, encouraging both spontaneous and habitual social interactions.

Hierarchy in the intermediate space organisation

The presence of distinct levels within intermediate spaces ensures that social interactions occur in a structured way, offering varying degrees of intimacy and engagement. The private sphere (individual dwellings) transitions into semi-private areas (balconies, entryways, shared courtyards), which in turn lead to semi-public and public spaces (streets, plazas, and parks). This gradual transition facilitates informal interactions, strengthens neighbourhood ties, and reinforces the feeling of belonging. For instance, in neighbourhoods with clear spatial transitions, such as Colonial city centre and Moussaoui Messaouda, interactions are concentrated in designated transition zones like street cafés and commercial frontages, benefiting from a structured pedestrian environment. Conversely, Belle Vue, despite its open spatial layout, compensates with a topographically structured circulation system that naturally organises pedestrian flows and social exchanges.

Implications for urban policies

Understanding how the hierarchy of intermediate spaces influences social dynamics provides valuable insights for urban planning. Encouraging designs that integrate clear spatial transitions, support collective appropriation, and facilitate natural interactions can enhance community life. This is particularly relevant in areas where enclosure is low, as seen in Belle Vue, where other spatial qualities compensate for the lack of defined thresholds. Interestingly, for the socio-demographic variables only the number of households per dwelling and the number of family members per dwelling and the quality of the neighbourhood relationship demonstrated a correlation with PSC. However, in the regression analysis, several variables were found to be non-significant, these results confirm those of other authors (Gehl, 1986; Skjaeveland and Garling, 1997), affirming pedestrian environments and outdoor spaces must be user-friendly and structured (with features and niches for security) and attractive (Lund, 2002).

While the 375 housing unit, 1,000 housing unit, Moussaoui Messaouda, and the Colonial city centre neighbourhoods offer out-door spaces with a significant degree of enclosure, which

facilitates the structuring of pedestrian paths, the Belle Vue neighbourhood offers a pleasant landscape for walking and relaxation despite having no degree of enclosure and total dispersal due to the linearity of its urban configuration. The topography of the land necessitates a certain structuring of paths, even in the absence of enclosure. Notably, Belle Vue showed the highest sense of community, confirming Herzog (1992) conclusions regarding the positive impact of well-structured environments on community sense. Cafés and other businesses located on the ground floor play an important role in urban life by allowing people to have close contact with the buildings and other inhabitants of the neighbourhood. Nooks, corners, or extensions provide a feeling of emotional support for individuals whether sitting or standing. People prefer to stand at the edges of a space, where they are discreet while having a view of the street or public space (the so-called "edge effect"), and the transition areas between buildings and public space provide such opportunities.

"It is precisely these edges and transition zones between urban spaces and buildings that become the natural location for a wide variety of potential activities that connect the functions of the building interior with the life of the street: leisure, games, relaxation, commerce, exhibition, smoking breaks, etc." (Gehl, 1986) Given the mixed-use nature of the Colonial city centre and Moussaoui Messaouda neighbourhoods, the frequency of social interactions outside is higher. In contrast, at Belle Vue, children's play primarily occurs behind the buildings, providing a safer environment close to the second building's entrance. Meanwhile, adults' interactions take place in front of the buildings and on café terraces, which offer a panoramic view. The 450 housing unit neighbourhood had the lowest PSC rate, with low enclosure and no functional mix and a non-hierarchical intermediate space without niches or relaxation areas.

Limits and perspectives

This study explores the relationship between the urban form and social interactions in six collective residential neighbourhoods in Jijel, Algeria. While offering valuable insights, it has certain limitations that suggest avenues for future research. First, the focus on Jijel allows for an in-depth local analysis but limits generalisation. Comparative studies in other cities could refine the understanding of the socio-cultural influences on social interactions. Additionally, the sample, though diverse in urban design, does not cover all possible configurations. A longitudinal study could further capture the evolution of these dynamics over time.

The study prioritises urban morphology and intermediate space enclosures as key determinants of social interactions, but other factors—such as socio-economic contexts and informal exchanges—deserve further exploration. Future research could examine how these elements interact with urban forms to shape social cohesion. Methodologically, while efforts were made to minimise biases, subjective perceptions and access constraints posed challenges. This study primarily relies on surveys and statistical analysis, while a complementary qualitative investigation has been addressed in a separate article. Finally, the findings provide insights for urban planning and architecture, emphasising the role of intermediate spaces and functional diversity in fostering social cohesion. A discussion on policy implications guides decision-makers in shaping more inclusive residential environments. This study thus lays the groundwork for further interdisciplinary and comparative research on urban forms and social interactions.

CONCLUSION

This study examined how the spatial layout of urban residential areas influences social interactions and the psychological sense of community (PSC) in six collective housing neighbourhoods in Jijel, Algeria. These neighbourhoods varied in enclosure, spatial hierarchy, size, location, and density. The findings confirm the hypothesis that PSC tends to be lower in neighbourhoods with poorly enclosed intermediate spaces and fragmented block layouts, as these configurations create open, unstructured areas that lack human-scale gathering points. This was particularly evident in the 450 and 1,000 housing unit neighbourhoods. However, an unexpected result emerged: Belle Vue, despite having limited functional diversity (besides some local businesses), exhibited a strong PSC. This suggests that, under certain conditions, mono-functional neighbourhoods can foster a strong sense of community, sometimes even more effectively than older, well-established areas. While spatial configuration plays a key role, urban design alone cannot fully account for variations in the PSC. Other factors, such as neighbourhood characteristics (both physical and social), residents' socio-demographic profiles, walkability, safety, maintenance, and management practices, also significantly influence social cohesion. A unique interplay of spatial and social dynamics shapes each urban context.

These findings highlight important implications for urban planning and neighbourhood design: Enhancing spatial hierarchy: Ensuring a smooth transition between private, semi-private, semi-public, and public spaces to support different levels of interaction. Promoting human-scale design: Creating pedestrian-friendly environments with well-defined, visually connected spaces to strengthen social ties. Encouraging mixed-use planning: While functional diversity is not always a prerequisite for a strong PSC, integrating local businesses, green spaces, and communal facilities can provide more opportunities for social interactions. Prioritising maintenance and management: Well-maintained public and semi-public spaces can compensate for weaknesses in spatial enclosure and sustain a strong community atmosphere over time. Further research in diverse urban settings is needed to deepen our understanding of how spatial configurations interact with social factors to influence PSC. By exploring different environments, future studies can develop more effective planning strategies that integrate both the physical and social dimensions of urban life.

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