The Influence of Immediate Common Space and Building Layout on Social Interaction in Residential Apartments: A Case Study in Sulaimani

Hawar Shawkat Karim [1],*, Abdulla Yousif Tayib [2]

Department of Architecture Engineering, College of Engineering, University of Sulaimani, Sulaimani, Iraq
hawar.hussain@univsul.edu.iq[1], Abdullah.tayib@univsul.edu.iq[2]

ABSTRACT

Numerous academics have demonstrated the value of immediate communal spaces in residential projects. In contemporary apartment site planning, these places are essential but sometimes ignored and categorized as leftover negative spaces rather than intentional interaction areas, diminishing the conventional forms of interpersonal communication. However, there is no proof of this relationship's causality. This study eliminates this gap and explores whether territoriality function-based building arrangement convex layouts can moderate the link between physical design and social interactions. Since culture and social interaction are closely related, what are the effects of these spaces and their layout on social interaction in Sulaimani City and other cities with similar cultural and social contexts? This study is a comparative analysis of four selected projects. They are selected according to their different building arrangement layout. This study used two methods: a physical analysis of arrangements design and a quantitative survey questionnaire, and the samples were taken from (40%) of the total selected units. Out of the 182 questionnaires randomly distributed to the households, only 156 were retrieved. The Kruskal-Wallis test by SPSS is used to analyze data. According to the findings, there are significant differences between cases. This discovery emphasizes how crucial constructive layout is in producing a convex positive social space. In conclusion, research reveals that the built environment, through convex positive building arrangements, influences social interactions indirectly by fostering territoriality and a sense of belonging, both of which positively affect social interactions.

Keywords: Common outdoor space, Social interaction, Building layout, Sense of belonging.

تأثير المساحة المشتركة المباشرة وتخطيط المباني على التفاعل الاجتماعي في الشقق السكنية: دراسة حالة في السليمانية

هوار شوكت كريم*، عبدالله يوسف طيب

قسم الهندسة المعمارية، كلية الهندسة، جامعة السليمانية، سليمانية، العراق

الخلاصة

أظهر العديد من الأكاديميين قيمة المساحات المجتمعية المباشرة للمشاريع السكنية. في تخطيط موقع الشقة المعاصر. تعتبر هذه الأماكن ضرورية ولكن في بعض الأحيان يتم تجاهلها وتصنيفها على أنها مساحات سلبية متبقية بدلاً من مناطق تفاعل مقصودة ، مما يؤدي إلى تقليل الأشكال التقليدية للتواصل بين الأشخاص. ومع ذلك ، لا يوجد دليل على سببية هذه العلاقة. تحاول الدراسة الحالية سد هذه الفجوة واستكشاف ما إذا كانت التخطيطات المحددة لترتيب المباني القائمة على الوظيفة الإقليمية يمكنها تعديل الارتباط بين التصميم المادي والتفاعلات الاجتماعية. بما أن الثقافة والتفاعل الاجتماعي مرتبطان ارتباطًا وثيقًا ، ما هي تأثيرات هذه المساحات وتخطيطها على التفاعل الاجتماعي؟ في مدينة السليمانية ، ومدن أخرى ذات سياقات ثقافية واجتماعية مماثلة. هذه الدراسة عبارة عن تحليل مقارن لأربعة مشاريع مختارة ، وقد تم اختيارها وفقًا لتخطيط المبنى المختلف. استخدمت هذه الدراسة طريقتين: التحليل المادي لتصميم الترتيبات واستبيان المسح الكمي ، تم أخذ العينات من (40٪) من مجموع الوحدات المختارة. من أصل 182 استبيانا وزعت عشوائيا على الأسر ، تم استرداد 156 فقط. تم استخدام اختبار Kruskal-Wallis بواسطة SPSS لتحليل البيانات. وفقا للنتائج ، هناك اختلافات كبيرة بين الحالات. يؤكد هذا الاكتشاف مدى أهمية التخطيط البناء في إنتاج مساحة اجتماعية إيجابية محددة. في الختام ، يكشف البحث أن البيئة المبنية من خلال ترتيبات البناء الإيجابية المحددة تؤثر على التفاعلات الاجتماعية بشكل غير مباشر من خلال تعزيز الإقليمية والشعور بالانتماء ، وكلاهما له آثار إيجابية على التفاعلات الاجتماعية.

الكلمات المفتاحية: مساحة خارجية مشتركة ، تفاعل اجتماعي ، تخطيط المباني ، الشعور بالانتماء.

1. INTRODUCTION

Advertisements for affordable and high-quality housing have accompanied the latest urban population and economic growth. Most housing models are designed as apartment buildings freely placed in large open spaces and constructed on periphery extensions. Those projects have been initially intended to contain all facilities required to satisfy the demands of residents. Yet, most housing models lack the necessary facilities for outdoor spaces. Also, such housing types foster anonymity among neighbours, which was a significant problem for environmental designers and social psychologists. Studies show that residents of multifamily residential apartment neighbourhoods rarely interact with one another. Outdoor spaces are typically just leftovers in residential developments. This phenomenon may be seen in high-end luxurious constructions and low-income dwellings. Due to the two-way interaction between spaces and humans, the physical characteristics of space influence how people behave in it, whereas the spatial behaviours regarding humans influence and change space. A process of social change is a problem of modernization. Common areas between the houses have been considered crucial aspects which promote

social activities in residential communities. Due to the adoption of ineffective spatial organization at the residential units, contemporary residential neighbourhoods suffer from inadequate sustainability of urban residential environments **(Al-Kindy, 2023).** according to urban research, the design of communal outdoor spaces significantly impacts social life changes in housing estates **(Farida, 2013)**. according to **(Zerouati and Bellal, 2019)**, such spaces were intended to serve as gathering places for interactions, social activities, and socialization among residents. But, the spatial arrangement regarding apartment blocks decreases the residents' social interaction and impacts their patterns of activity **(Abu-ghazzeh, 1999)**. to foster the social impact in a residential area for individual and community security should be taken into account when planning the public common space in the residential area regarding the location, achieving safety for the residents, preventing the entry of strangers, and forming a gathering space for the residents of the residential neighbourhood is important to strengthen social ties between them **(Khaza'al Hasson and Dhumad, 2018).**

Maslow's hierarchy of needs lists social contact as a need along with other behaviours and emotions such as belonging and attachment, group membership, love, acceptance, and so on youth development depends significantly on socialization and forming social connections **(Maslow, 1943)**. in Gibson's "affordance theory," there are significant hints concerning space and social interaction. Gibson looked into how people and their physical surroundings interact this suggests that a person's physical surroundings and living circumstances allow him to interact with the environment **(Gibson, 1979)**. many works have shown the impact of outdoor space design by the layout of residential buildings on reducing or increasing social interactions between the inhabitants. Various Sulaimani housing models face an increasing number of these issues, just like those in other nations. From the study perspective of the relationship between people's social relationships and their built environment, these areas are situated between the residential buildings of the mass housing developments. First, this study provides information on the most efficient building arrangements and layouts for social practices. Second, this work adds to analyzing these unexplored areas from the physical, perceptual, and behavioural standpoints, particularly in Sulaimani City. Finally, the information gained will give designers more knowledge about space use. Consequently, as a result, designers can create promoted outdoor common spaces and satisfy the residents' need for socialization. Decision-makers and designers will be able to identify this influence according to the research findings, condemn the urban development of mass housing, and look into alternative forms that can encourage social contact.

1.1 The Relationship between Social Interaction and Space

Relationships and social life are built on interactions. It produces a group which forms the foundation of society. Providing appropriate possibilities for social interactions is one of the most crucial elements regarding a successful collective and outdoor space. In actuality, sociable spaces are considered locations where interactions occur **(Karimi et al., 2018)**.
A sociable space is necessary for social interactions to meet and cover this demand. According to social interaction theory, the interactive, motivating, and structural components are the keys to understanding the social structure **(Memon et al., 2015).** additionally, "social interactions take place more readily when an individual's social requirements are balanced through a sense of individual autonomy which results from privacy, whether gained by reserve or via territorial control"**(Lang, 1987)**. the orientation

and proximity of dwelling units to one another, their organization concerning the open spaces and site, and their transition to community spaces and streets all affect social interactions in a neighbourhood **(Gulati, 2019)**. two theories of how the residential built environment affects residents' social interaction have been developed in Western literature: the theory of civility and a sense of community **(Alahmed et al., 2014).**

• The Theory of Incivility, or (territorial function): which looks into how to construct the physical environment to stop people from acting in an impolite or disorderly manner, is the first social interaction theory. the theory of incivilities describes several variables that have a big impact on disorders and incivilities in societies **(Wilson and Kelling, 1982)**. Those elements include undesirable territorial spatial arrangements, a perceived drop in people's sense of safety, and a deterioration of unofficial social norms. by creating a constructed environment with features like yards, and crime prevention signs, it is possible to improve interactions and communication among residents **(Perkins and Taylor, 1996)**.

• Sense of Community (sense of belonging) is the second social interaction theory. One of the issues facing contemporary society is the loss of the sense of community **(duany and Plater-cyber, 1992)**. in psychology science studies, the notion of a sense of community aims to analyze and determine the connections between individuals and groups and the psychological sense of community that a specific individual shares with the group **(Alahmed et al., 2014).** psychology sense of community was defined by **(McMillan and Chavis, 1986)** it is a feeling of trust between groups and individuals and a sense of belonging that individuals share. Those elements include the members' collective influence, satisfaction of those demands, integration of their needs, feelings, and memberships **(Alahmed et al., 2014)**. Human satisfaction is represented through a sense of community. The aforementioned behaviours are based on a sense of place or belonging. Laying Belonging to the place is at the center of place identity; the cognitive and social dimensions also play The term "belonging to a place" alludes to the person's own home and any associated physical environs. It consists of a strong desire and attachment to the senses People with positive cognitions experience belonging and place identification more than negative experiences **(Proshansky and Fabian, 1987)**.

1.2 Common Outdoor Spaces Function for Social Interaction

Buildings arranged around common areas (such as courtyards and/or walk paths) are key elements of social space **(Jordao, 2016)**. the little, well-designed square feet near a dwelling will frequently be more functional and utilized than the larger spaces farther away **(Gehl, 2011)**. Designing housing areas, without a doubt, involves the design of outdoor spaces, too. The success of the blocks is correlated with how spaces between them are designed instead of the quality of the interior spaces, according to results of research done in many nations to gauge resident satisfaction with urban housing blocks **(Marcus and Sarkissian, 1988)**. the common activity spaces within clusters and work communities from which the neighborhoods are derived are the most significant components of a social system; these common lands serve as the heart and soul of each cluster **(Alexander, 1977)**. no social structure might endure without common land. It creates a set of helpful relations by fusing social behaviour patterns with geometry. The cluster could be formed by rows and the apartment building's wings. The size of this common land might range from a path to a big green **(Alexander, 1977)**.

The common land serves two distinct social purposes. The land enables people to feel secure outside of their private territory and buildings, which allows them to feel a part of a greater social order. Second, common land serves as a venue for gatherings of people **(Alexander, 1977; Gehl, 2011)**. the primary purpose of communal spaces is to act as a gathering place for daily unplanned activities, including brief stays, pedestrian traffic, play, and basic social spaces from which more elaborate communal life could emerge as the residents desire it **(Gehl, 2011; Alexander, 1977)**. with the same thinking, Lewis Mumford states that the mothers lacked common gathering spots where, on a nice day, they could gather beneath a large tree or pergola to sew or gab while their infant babies napped in a stroller or their runabout kids played in a play pit **(Mumford, 1968)**.

Design is essential to the socialization of a community in the spatial arrangement of a neighbourhood **(Abu-ghazzeh, 1999).** The layout of housing estates might encourage interaction among residents and, ultimately, the development of social ties **(Farida, 2013)**. Behaviour is significantly influenced by the physical layout related to residential neighbourhoods. Designers must pay close attention to the orientation and positioning of dwellings when creating site designs because this might also define how people will interact. One could anticipate that individuals might feel possessive toward open areas if they were surrounded by residential buildings and had edges delineated by those buildings because areas of various outdoor spaces which so continuous and large that individuals share them diminished one's sense of privacy, as a result, will be to avoid using large areas from users behave **(Abu-ghazzeh, 1999)**. symbolic or physical barriers preventing mobility between private and public spaces are used to create territorial markers and signs zones of control **(Farida, 2013)**. This topic, which Newman refers to as the "defensibility of spaces," is also explored. In the author's opinion, defensible spaces are those where the physical layout enables residents to exert preservation and control. Defensible spaces could help deter crime, unite a community, and increase citizens' sense of pride and belonging in their neighbourhoods. Defensible spaces allow individuals to walk from and to their houses without worrying about being followed **(Newman, 1972)**. Individuals are more likely to participate in spontaneous activities on a small spatial scale. Alexander, in his book A Pattern Language, describes, generally, outdoor spaces that are just "leftover" between buildings won't be exploited and used. According to him, there are two primary sorts of outdoor space **(Alexander, 1977)**:

• Negative space: outdoor space is negative where it's shapeless. The residue left behind when the buildings are generally viewed as positive is placed on the land **(Alexander, 1977).**

• Positive space: an outdoor space can be considered positive in the case where it has a definite and distinct shape, as definite as the shape of a room, and when such, the shape is as important as the shapes of buildings surrounding it **(Alexander, 1977)**. The continuity of its borders can identify an urban space, and these borders show how enclosed or open space is. A space's enclosure is emphasized by continuity, and the more clearly defined its boundary is, the more it is referred to as a convex or positive space **(Gabr et al., 2019)**.

At the same time, the degree of convexity and the degree of the enclosure are two more ways to distinguish between "negative" and "positive" outdoor spaces.

• Convex Space: The hidden characteristic that distinguishes an area as a crucial and distinct spatial unit is convexity **(Gabr et al., 2019).** Where a line connecting any two points inside the actual space completely encircles the space, the space is convex in mathematics. When at least a virtual line connecting a pair of points lies partially outside the space, it is

non-convex. The square space is convex and hence positive by this definition; however, the L-shaped space is neither convex nor positive since the line connecting its two endpoints cuts through the corner and thus leaves the space **(Alexander, 1977)**. people feel comparatively uneasy in "negative" spaces, which are less likely to be used by individuals **(Alexander, 1977).** In contrast, people feel relatively at ease in "positive" spaces.

As Newman said, as well as a well-defined and small neighborhood with specified boundaries that could foster neighbor ship. Avoid the "confused spaces" around blocs, where land use and regulation are ambiguous **(Newman, 1972)**. Finally, Territorial can be:

•   Symbolic and real barriers that provide control and accountability over the physical space constitute territoriality **(Rollwagen, 2016)**.

•   The defense phenomenon focuses on making residents distinct and identifiable zones inside communities. As a result, territoriality, defined as "the ability of the physical environment to offer perceived zones of the territorial influences," is a crucial characteristic of defensible space that makes people feel connected and make an effort to defend their community, which asserts that a sense of personal necessity, control, independence, and identity are all closely related to territoriality **(Reynald and Elffers, 2009; Newman, 1972).**

To reach the study purpose regarding arrangements design layout in housing apartment projects to improve residents' social interaction in the immediate outdoor space, this work will look at building layout effects on users of the common outdoor space to develop social contact. We hypothesize that the configurations of free-standing buildings or blocks that have shapeless arrangements gave negative and nonconvex space could be less encouraging for social interaction amongst the inhabitants compared to those given a strong geometry space shape due to the high degree of lack of sense of belonging, the territory that resulted from these buildings arrangements layouts between outdoor spaces. The aim is to know:

•   How residential building layout affects increasing social relationships among residents. Is there a relationship between building arrangements and social interaction?

•   Why are some spaces used and others are not?

2.   METHODS AND MATERIALS

2.1   Data Collection and Measurement of Variables

The focus of the present study has been directed towards the nature of the relationship between severable key variables like the layout of the residential buildings, social interaction of people, and the use of resulting open spaces between buildings to know are the residents use the space and why some space use other not. The selected areas have represented various arrangements and conditions of residential multistory apartment buildings in Sulaimani city. Four majority patterns in the multifamily apartment residential projects open spaces in Sulaimani city selected.

Two methods were used to obtain the data: first, a physical site observation (apartment outdoor space visits), which included counting and recording the design characteristics of building arrangements, taking photos and notes to analyze the spaces; and second, a questionnaire that gathered information on people's use, perceptions, behaves, and social interaction. Based on the previous studies, survey questions were created to ensure the reliability of the questions. The questionnaire's questions were modified to be

straightforward, uncomplicated, and familiar to respondents. There were five primary sections to the questionnaire:

The first set of questions aimed to collect information about socio-demographic characteristics. A neighborhood's Socio-demographic characteristics impact how the neighbors interact with others and who is an outdoor space user **(Liu et al., 2017; Memon et al., 2015)**. Factors like (age, gender, and educational attainment) are relevant socio-demographic features that are presumably related to social interaction in this study and are presented in **Table 2.**

The second set of questions was about the social relationships of respondents. Questions that are related to the community interactions aimed at providing information about the degree residents know each other and have friends, reciprocal help among residents, and the type of support offered and received, activities like the exchange of favours, visiting informally, asking advice; caring for kids; helping; borrowing or lending are the indicators of knowing people's social relationships **(Abu-ghazzeh, 1999; Liu et al., 2017; Wilkerson et al., 2012; Zhu and Fu, 2016; Farida, 2013)**. These questions are shown in **Table 3.**

The third set of questions' purpose was to collect information about the use and activity of outdoor space. This question aims to know how neighborhood uses their space, for which activity, and why some spaces are used and others are not. For this, and based on a previous study, some types of the main activities identified: transit, socializing with people or escorting kids, resting, going for a walk, and practicing a sport **(Farida, 2013),** which clarified in **Tables 4 and 5.**

The last two questions were about the sense of belonging and territoriality function to obtain residents' perceptions and feelings toward their space. The goal of these questions was to know the effect of the building layout on the sense of belonging to a group territoriality function and user behavior. Sense of belonging and territoriality function on residential environments in the literature and based on a previous study identified some indicators to measure it: for a sense of belonging (sense of community), these questions were asked: I feel like I belong to this housing group; I have very good familiarity and associations with the people of this place; Living in this housing area gives me a sense of community; Being a member of this housing makes me feel good; I feel at home in this housing group., and for territoriality function, these questions were asked: I feel a very high degree of personal ownership for this outdoor space; I can modify or decorate a part of my apartment's private outdoor space; there is hierarchy access to communal space; I can watch who is in the open space and what happens there **(Brown and Zhu, 2016; Mousavinia et al., 2019; Muhuri and Basu, 2021; Abu-ghazzeh, 2000)**. These questions' findings are given in **Tables 6 and 7.**

For all study variables, questions using a Likert-type scale were used.   Statistics are used to analyze the data for each variable by (SPSS). The Kruskal-Wallis test was applied. The Kruskal-Wallis test is a statistical method for examining differences between two or more groups of variables.

2.2   Study Site

The study focuses on housing apartment projects in a Sulaimani city -Kurdistan, in northeast Iraq. Like most of the towns, Sulaimani experienced a rapid urbanization rate following the growth of the economy of the country and to satisfy increasing demands for apartments, many apartment projects were created in the city between 2003 – 2023. The location of the project according to Sulaimani city, which is shown in **Fig. 1.** For the present study, 16

residential blocks and four majority layout patterns of grouped residential buildings are present in the design of site plans have been defined. Every residential block has either been surrounded by a loop-collector street or had streets on three sides, and the selected group housing complexes are 3-12 floors. The four layout patterns of grouping residential buildings are shown in **Figs. 2 to 5**. based on extensive visits conducted within Sulaimani housing developments, selection criteria were determined based on a variety of major arrangements, the quotient of gross acres divided by the number of units, and the sort of community open space found in each block, such as small and limited areas or vast resident spaces. The physical link of residential structures to neighboring open spaces, which means the availability of clusters of buildings to create shared spaces, which includes:

• Pattern number 1: apartment buildings three floors in height, grouped mass building L shape in form and contains a central, courtyard-like, open space.

• Pattern number 2: apartment buildings 12 floors in height, free-standing buildings arranged in rows line.

• Pattern number 3: apartment buildings three floors in height, free-standing buildings arranged in a cluster pattern.

• Pattern number 4**:** apartment buildings 12 floors in height, free-standing open L-shaped buildings arranged around open space.

Figure 1. Location of the selected residential apartments in Sulaimani city Satellite image city (Google Earth)

The study population included groups of citizens in Sulaimani. The samples have been taken from 456 flat units identified within the study area. (40%) of total flat units have been selected. Out of the 182 questionnaires randomly distributed to the households who have been the respondents, only 156 have been retrieved for analysis. This process produced a sample that was made up of 40.4% men and 59.6% women, most of whom were between the ages of 20 and 35. results also showed a high proportion of 76.9 % of the residents are educated and obtained a university degree, and the minority 5.6 % of the respondents with

no formal education. For all four space case studies, the distribution of participants by sociodemographic traits is shown in **Table 1.**
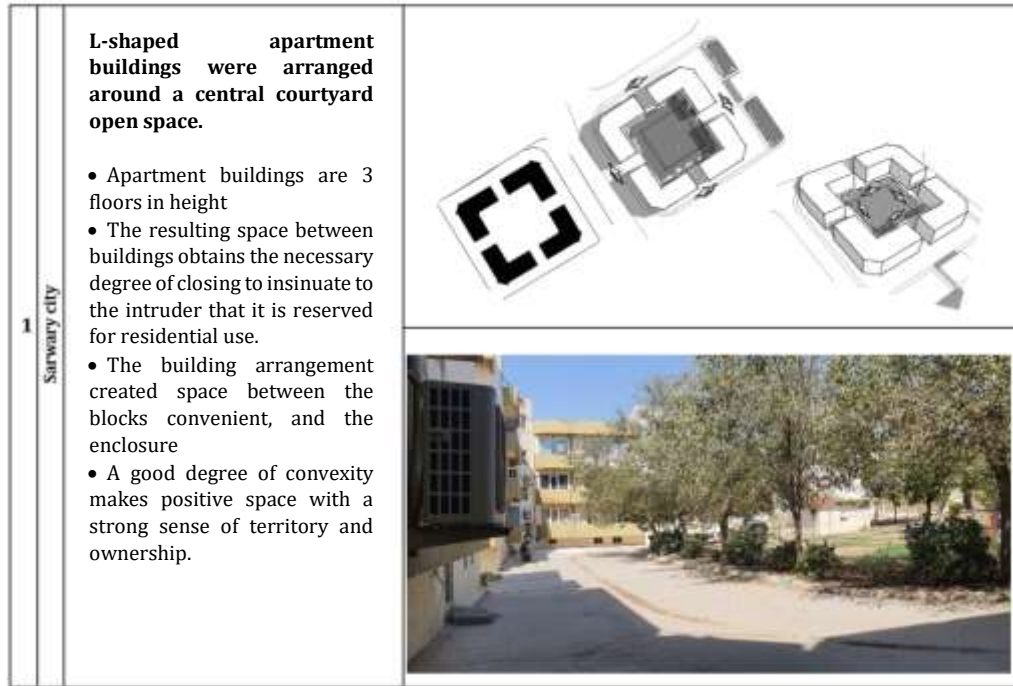

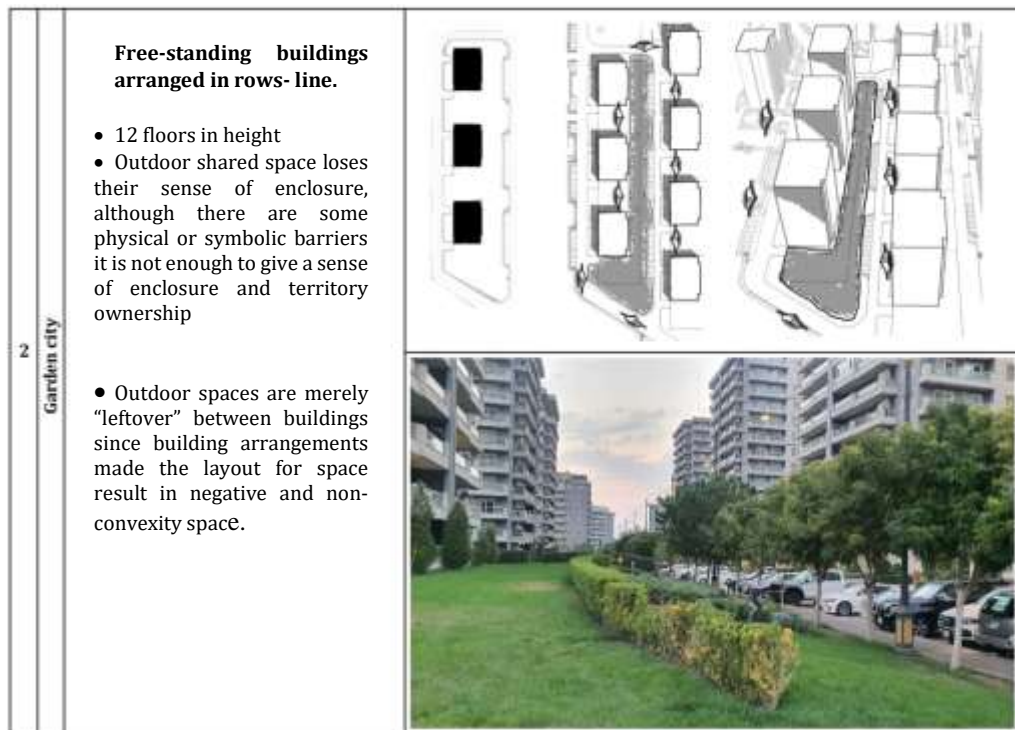**Figure 2.** Layout patterns of Sarwary City residential apartment buildings in Sulaimani city.

Figure 3. Layout patterns of Garden City residential apartment buildings in Sulaimani city.

3 Dilan city1	**Free-standing buildings arranged in cluster patterns.** • Apartment buildings are 3 floors in height. • The space is semi-closed, visitors don't feel private or safe, the urban form of the buildings is Shapeless and creating many negative spaces. • The area behind buildings that results from such an arrangement is vague and not clearly identifiable and the area between buildings tends to form an internal car parking than a common space.	

Figure 5. Layout patterns of Dilan city1 residential apartment buildings in Sulaimani city.

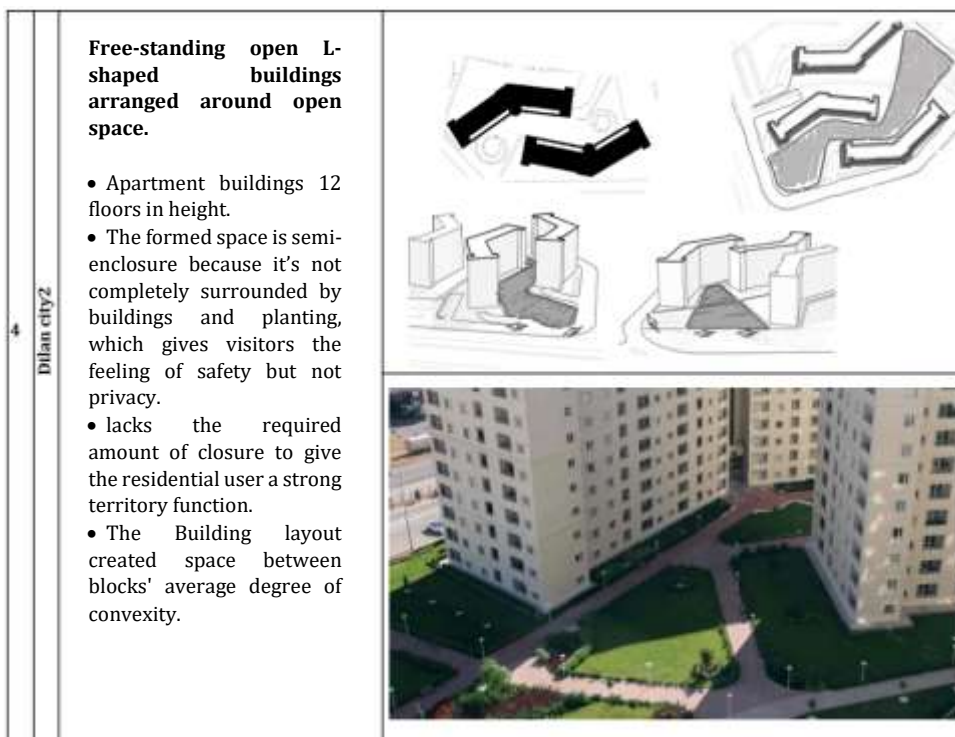|		
4 Dilan city2	**Free-standing open L-shaped buildings arranged around open space.** • Apartment buildings 12 floors in height. • The formed space is semi-enclosure because it's not completely surrounded by buildings and planting, which gives visitors the feeling of safety but not privacy. • lacks the required amount of closure to give the residential user a strong territory function. • The Building layout created space between blocks' average degree of convexity.	

Figure 6. Layout patterns of Dilan city2 residential apartment buildings
in Sulaimani city.

Table 1. Residents socio-demographic characteristics.

Residents' socio-demographic characteristics	Frequency	Percent %	Cumulative Percent
Gender			
Male	63	40.4	40.4
Female	93	59.6	100
Education of the household head			
No formal education	27	17.3	17.3
Degree	120	76.9	94.2
Postgraduate	9	5.8	100
Age Range			
20-35	71	45.5	45.5
36-50	55	35.3	80.8
50- above	30	19.2	100
Apartments (Cases)			
Sarwary City	33	21.2	21.2
Dilan City 1	28	17.9	39.1
Dilan City 2	55	35.3	74.4
Garden City	40	25.6	100

3 RESULTS AND DISCUSSIONS

3.1   Comparison of Four Cases

3.1.1   Social Interaction and Using of Outdoor Space

All social activities depend on other people being present in common public areas, and occur when individuals come together in the same place, see each other, and converse. **(Gehl, 2011)**. In **Table 2.** the test shows differences in social interaction based on apartment types out of the 156 respondents in four different types of spaces we investigated for opportunities for social contact with neighbors.

Table 2. The differences in resident social interaction based on apartment types.

Social interaction	Mean Rank				Chi-Square
	Sarwary	Dilan1	Dilan 2	Garden	
	n= 33	n= 28	n= 55	n=40	
Number of people you know by name in your building?	136.3	102.54	39.58	67.5	115.6
Number of people you know by name in a different building?	127.91	115.86	48.23	53.21	110.34
Do you have friends in this housing complex?	100.05	87.21	74.05	60.75	21.23

If you have a problem, do you have a neighbor to talk to?	107.55	80.79	74.45	58.5	29.32
Frequency of visits to people living in your housing complex Often	123.67	94.86	61.91	52.6	65.05
nature of exchanges and supports asked/received Loan of items	101.29	104.02	74.23	47.71	45.36

*The p-value= 0.00 for all cases, which means it was significant.

The respondents were asked in Sarwary city about social relationships that got a higher degree, according to question order between (136.3, 101.29). Conversely, Garden City gets a lower degree (mean rank) for the same questions, namely between : (67.50, 47.71).   As we can see, the residents' response in Sarwary City is much higher than in the other three cases. They have a perfect relationship. Also, (Dilan city1 and Dilan city2) come in medium order. The findings indicated that the respondents have wide-ranging networks of relationships, there were regular encounters and visits, and neighbors frequently traded favors in some cases and lacked in others, according to different building arrangements. As a result, we can confirm that our predictions about the level of social communication among the residents were accurate, according to different building arrangements and their layout.

With the same thinking, and to reassure this finding, if we look at the data regarding the use of outdoor and quality, for outdoor space quality, the (p-value) for all cases overall = 0.24, which means there is not a noticeable difference between cases from the response. It means everyone likes and needs to use their outdoor space. For kinds of activities would be used most by the household members. The outcome demonstrates that communal outdoor spaces are generally used for transit rather than entertainment or socializing in Garden City, where transit gets 70 %. In contrast, in Sarwary city, the response takes the highest degree, 39% for socializing with others, and responses in (Dilan city1 and Dilan city2) get medium grades compared to other cases. The data were gathered to gain a comprehensive understanding of space usage according to a different layout. This is clarified in **Tables 3 and 4.** Based on

Table 3. Differences in the use of outdoor spaces based on apartment types.

Use of outdoor spaces	Mean Rank				Chi-Square	P-Value
	Sarwary	Dilan1	Dilan 2	Garden		
	n= 33	n= 28	n= 55	n=40		
If the quality of outdoor spaces is good, will you use them?	87.41	77.79	73.23	78.9	4.17	0.24
Activities in common outdoor spaces	92.41	67.39	94.21	53.2	25.71	0

Table 4. Differences in activities in outdoor spaces based on Apartment types.

	Sarwary City	Garden City	Dilan City 1	Dilan City 2

Activities in outdoor spaces	Percent %	Cumulative Percent	Percent %	Cumulative Percent	Percent %	Cumulative Percent	Percent %	Cumulative Percent
Transit	9.1	9.1	70	70	42.9	42.9	16.4	16.4
socializing with people or escorting kids	39.4	48.5	5	75	21.4	64.3	27.3	43.6
Resting	30.3	78.8	12.5	87.5	28.6	92.9	27.3	70.9
Going for a walk	15.2	93.9	7.5	95	3.6	96.4	16.4	87.3
Practicing a sport	6.1	100	5	100	3.6	100	12.7	100

these data, we can confirm that it's clear why some space has been used more and others, due to the availability of proper space with the quality that fills their need and attracts them to be used for socializing and other activity rather than be used just a transition space.

3.1.2 Territoriality function and sense of belonging to a group for social interaction

(Tables 5 and 6) The Kruskal-Wallis test shows differences in the sense of belonging and territoriality function based on apartment types. To better understand whether there have been differences between cases on reported variables, a Kruskal-Wallis test was conducted. The mean rank, chi-square, and p-value of variables were analyzed, P-value = (0.00), when P-value equal to zero, this indicates that there is a clear difference between cases, which means that there has been a significant effect of layout on perceived social relationship between residents in the questions that are indicated for belonging and territory refer to **Table 3.** it can see how residents feel about their space through the question that they were asked as follows: in Sarwary city, the mean rank for territory questions was between (64.08-122.71) which gets the highest grade. It means the pattern design layout for Sarwary City creates a strong feeling of space and this arrangement gets a better territoriality function than other spaces. At the same time, for the sense of belonging to a group, in **Table 4**. The ranks for the same residential group were between (102.64-130.02) which also gets the highest degree, which reinsures the success of the territorial function of this space. In contrast, the mean rank for the same questions for Garden City was between (64.78-72.49)

Table 5. Shows differences in the sense of belonging based on apartment types.

Sense of belonging to group	Mean Rank				Chi-Square
	Sarwary n=33	Dilan1 n=28	Dilan 2 n=55	Garden n=42	
I feel like I belong to this housing group	118.39	107.95	75.23	29.48	91.01
I have very good familiarity and associations with the people of this place	118.94	104.16	72.68	35.18	79.47
Living in this housing area gives me a sense of community	130.02	85.39	58.58	58.56	65.62
Being a member of this housing makes me feel good	102.64	101.54	63.78	62.7	29.88

| I feel at home in this housing group | 125.02 | 83.93 | 71.41 | 46.08 | 61.04 |

*The p-value= 0.00 for all cases, which means it was significant.

Table 6. Illustrate differences in territoriality function based on apartment types.

Territoriality function	Mean Rank				Chi-Square
	Sarwary n=33	Dilan1 n=28	Dilan 2 n=55	Garden n=42	
I feel a very high degree of personal ownership of this outdoor space	122.71	114.91	46.55	60.48	87.72
I can modify or decorate a part of my apartment's private outdoor space	64.08	107.82	76.6	72.49	17.41
There is hierarchy access to communal space	116	67.2	71.14	65.6	30.57
I can watch who is in the open space and what happens there	109.67	74.29	71.93	64.78	22.72

*The p-value= 0.00 for all cases, which means it was significant.

for territoriality function and (29.48-62.7) for sense belonging to a group, which means that the Garden City measured the lowest number compared to the three other cases.

For the four cases, the comparison test indicated that the mean rank for a sense of belonging and territory in space Sarwary City was significantly different from other spaces, and this space's response recorded the highest degree. This demonstrates that territoriality is a key strategy for maintaining privacy and the space between others and ourselves in residential multifamily apartment communities. The strong indirect effect of territoriality to promote the sense of belonging can be used by shedding light on the psychological processes involving the perception and behavior signals influencing the inhabitants to foster social contact. According to Maslow, one of a person's basic needs and a critical factor in determining their social behaviors is a sense of belonging **(Maslow, 1943)**. when this need is unmet, the person develops feelings of rootlessness, isolation, and loneliness **(Alexander, 1977)**. The functioning of the territorial is significantly influenced indirectly by social ties. More social interactions will strengthen people's desire and capacity to cooperate to exert control and influence over their environment **(Reynald and Elffers, 2009)**. defining their own space and enhancing a sense of territoriality by using territory and building layout **(Perkins and Taylor, 1996)**. consequently, the success of territorial functioning depends on social contact **(Mousavinia et al., 2019)**. Hence the designers should consider their design concerning territorial space for people to increase their sense of belonging and express themselves besides safety issues **(Abu-Ghazzeh, 2000).**

3.1.3 Immediate outdoor space based on building arrangement type

To understand the impact of various layout and arrangement types on the social interaction of the inhabitants who gather and engage around the blocks, four configuration types of the common areas were differentiated and then analyzed, and the amount of the inhabitants' utilization of social space and social interaction was compared among the four types of arrangements. This study comprises different configurations of its member blocks in

Sulaimani city: blocks arranged in (a central courtyard, free-standing buildings set as a row line, free-standing buildings arranged as a cluster, and two L shapes around open space arrangements). All the blocks have been organized around spaces designed to serve as parklands or playgrounds, as analyzed in **(Figs. 2 to 5)**. The spaces between the blocks can be categorized into three groups based on the degree enclosed or convexity:

• The high enclosure degree (convex space) resulting from the arrangement of four L-shaped blocks creates a central courtyard space (Sarwary City).

• The average degree of enclosure (semi-enclosed): resulting from two types of arrangement, cluster (Dilan City1) and two L shape (Dilan City2) blocks (Dilan City2).

• Low enclosure degree (non-convex space): which results from the arrangement of the blocks in a row line shape (Garden City).

The blocks that created a central courtyard space shape layout, like Sarwary City, are supposed to increase interaction since it provides a common entry point for everyone with territory function, and residents' response in this space was the same expectation with hypotheses, which means the resulting space between buildings obtains the necessary degree of closing to insinuate to the intruder that it is reserved for residential use. Additionally, the building arrangement created space between the blocks, and enclosure and a certain degree of convexity make positive space with a strong sense of territory and ownership, as shown in the analysis **(Fig. 2)**. In the opposite case, for the row line arrangement pattern like Garden City, outdoor shared space loses its sense of enclosure. However, there are some physical or symbolic barriers. However, there is not enough to give a sense of territory ownership due to outdoor spaces, which are merely "leftover" between buildings or "no man's land" due to building arrangements making such the layout for space that results in negative and non-convexity in space. This could be why the low social interaction rates and use gained in this space, as in analysis **(Fig. 3)**. In the last two cases pattern that takes average response (Dilan city1, Dilan city2), concerning Dilan city1, the urban form of the buildings is creating many negative spaces. The resultant outdoor space is a shapeless and ambiguous configuration, which leads to total confusion for the users. But still, there is an average feeling of territory or ownership. Consequently, Dilan City space is semi-enclosure because it's not surrounded by buildings or planting, which gives visitors the feeling of safety but not privacy, as shown in the analysis **(Figs. 4 and 5)**.

4. CONCLUSIONS

The study findings emphasize that immediate common space between residential apartment buildings and its layout can significantly promote or hinder residents' social interaction through building arrangements, giving territory marking and function in the initial site design process. The important factor to consider is the common space's positivity and convexity layout. Buildings that are too spread out may make it difficult for residents to interact with one another and may be overwhelming and challenging to create a sense of belonging to a community and control, while buildings that are too close together may not provide enough privacy. In the case of Sulaimani, Iraq, the comparison of results of the four case studies has demonstrated, as we hypothesized, that the configurations in free-standing buildings or blocks that arrangements were shapeless and gave negative and nonconvex space, less encouraging for use and social interaction amongst the inhabitants compared to those given a strong geometry space shape. Meanwhile, residents with higher levels of social interaction had a greater sense of community belonging, enhanced emotional support, and a

better quality of life. In conclusion, the spatial patterns of buildings and their surrounding environments must be carefully taken into account to create an intimate enclosure space and give strong territory function, both of which have an impact on how residents perceive a sense of belonging in their surroundings and thus, they have control over their space.

The present study has the potential to make an essential contribution to academic research and the growing body of knowledge on the value and roles of immediate common space in social life and interaction. The focus on Sulaimani Kurdistan City residential modern apartment spaces is rare and contributes to addressing the Western and North European bias in academic literature. The study findings have important implications for urban and landscape design and planning decisions in Sulaimani and other cities with similar cultural and social contexts. The practical impact of the study is also important, as it highlights the necessity to develop, think and create immediate, cheerful, common open spaces design in the essential planning and on-site building arrangements designed to meet residents' daily social needs better.

This work has several limitations in addition to its theoretical and practical contributions, that must be acknowledged. First, the study was limited to a specific case study in Sulaimani, Iraq. Therefore, caution should be exercised in generalizing the findings to other contexts. In this regard, Alexander thought that socio-cultural aspects influenced residential perception, and their effects on residents' behaviors were likely diverse within different cultural backgrounds based on their characteristics **(Alexander, 1977)**.

Second, Future research on this topic needs to include more cases and samples, as well as more profound exploration and alternative methods, such as Situ Observation of people's behavior. Due to urbanization and population growth, the multifamily apartment complex is the focus of housing development nowadays, which is increasing rapidly. To avoid troublesome environments that push toward individualization.

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