Original Research Article

A Technical Synergy of Cognitive Maps and Space Syntax in Recognition and Analysis of the Sociability of Physical Spaces Influenced by Spatial Territories
(Case Study: Ekbatan Town)*

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Abstract

Problem statement: Nowadays, the presence of neighborhood residents in physical spaces has become scarce as a result of the negligence of spatial territories and this issue has led to a decline in social communications specifically in the neighborhood sphere. Extensive studies have used qualitative methods to investigate the mutual relationship between physical space and social communications or to examine how the sociability of people in a physical space is influenced by the physical capabilities of public territories. Less research exists on the synergy of semi-private territory and social communications. Moreover, reviewing available studies shows that they have contributed to the advancement of quantitative methods that introduce strategies to improve physical conditions. These studies have offered strategies that have not been informed by the qualitative methods.

Research objective: The purpose of this study is to compare the outcomes of the quantitative and qualitative phases on evaluating the correlation of the features in spatial territories specifically semi-private territory with residents' sociability in physical spaces of a neighborhood to maintain a context for a more exact prediction of the probable behavior of the residents in the physical realm.

Research method: This research employed a case study method and was conducted in two phases; in the first phase, the qualitative variable of social communications was evaluated by using cognitive maps and, in the second phase, the same variable was evaluated through computational modeling of space syntax in a quantitative approach. Also, Ekbatan Town was selected as a context for this case study not only for its age but also for the existing variety in its spatial territories and its significant surfaces of public territory.

Conclusion: Apart from the integration and connectivity variables related to the public domain, the qualitative method helps to gather information on other variables such as geometry and vegetation that cannot be obtained by using a quantitative method. Moreover, the syntax of semi-public territory in blocks is considered a significant variable outside of the public territory in people's tendency to appear in spaces. Therefore, the quantitative and qualitative methods are complementary to each other in the analysis and study of the sociability of physical spaces.

Keywords: *Space syntax, Cognitive maps, Spatial territory, The sociability of space, Ekbatan Town.*

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Introduction

Physical territories in local spaces play an important role in the formation of social communications and the presence of residents in these territories increases the probability of social communications in the public territory and leads to liveliness in an atmosphere. Different spatial territories including private, semi-private, and public are in a close relationship to each other. Thus, not only the physical features of a public territory such as the features of form and shape, proportions, and geometry that are effective in its sociability but also the features of other territories are also effective in the sociability of territory as well. In other words, the physical features of a semi-private territory are effective in the sociability of territory in a public space.

Different features of spatial territories create different levels of sociability in physical spaces that are followed by social communications. Today, because of the change in people's lifestyles that resulted in a change in physical spaces, these social communications have reached a minimum.

These changes set the ground for a decline in social communications on a neighborhood level by a decline in the quality of life specifically in the private territory, negligence and elimination of semi-private territories, and merely by being concerned about the limited quality improvement in public territories. For instance, providing a shelter has taken the place of providing a home (private territory), and semi-private areas (thresholds, Sabats, blind alleys, and yards) have disappeared as well. On leaving their home, a person abruptly finds himself/herself in a public space; as a result, the interactions amongst the neighborhood residents have reached a minimum level due to this abrupt relationship between private and public spaces. On the other hand, the communication of people in shared spaces of a residential complex, that are viewed as semi-private spaces, is generally limited to economic matters and does not form any desirable social

communications. According to what was said and the mutual relationship between spatial territories and social communications, today, one witnesses a decline in social interactions and the disappearance of previous functions of social bonds. Trust-based social supports that were forming amongst the neighbors in the past have reached a zero level except for some limited cases so despite living in a community of humans, people do not enjoy the benefits of collective life. This decline in social interactions in a society leads to obstacles at different individual and collective levels, such as a lack of mental and physical health or a decrease in life expectancy on an individual level. Progress in these issues leads to a decreasing sense of belonging to the space and lower satisfaction in life that ultimately takes the social integrity away. Likewise, a decrease in social communications is followed by an increase in crime tendency, delinquency, and a lower sense of security on a collective level. In the long run, it results in a decrease in social participation and social stability.

Evaluation of social interactions in society is reached by applying different qualitative methods such as observing and interviewing in spatial territories presented as cognitive maps (Asadpour, Faizi, Mozaaffar, & Behzadfar, 2015). Over recent years, with the improvement in computational modeling systems, experts are also being aided by some new quantitative methods which essentially do not yield the same results from qualitative methods (Memarian, 2002). In this regard, Nortaqani (2011) believes that although private territories are an independent set in the environment, influenced by their surrounding environment, not only do they receive some features but also because of space syntax they affect their adjacent semi-private territory. Furthermore, the social rules are effective in their construction and appearance as well. Emphasizing this matter, Hillier & Hanson (1984) declares that in the construction of a

physical space what distinguishes architecture from construction is the utilization of principles rooted in social communications. He introduces the transformation of hidden social principles in life to the language of physicality as the specific job of an architect. Hillier & Hanson (1984) try to discover these social principles with the concept and quantitative tools of space configuration.

According to what has been said, the features of spatial territories (including semi-private and public) are in a mutual relationship with social communications evaluated by different methods (quantitative and qualitative). Also, it seems that recent changes in the formation of spatial territories, especially the negligence of a semi-private territory, have caused a rupture in this relationship. Thus, this study was conducted in search of finding an answer to the following main questions:

1. How does a semi-private territory influence the sociability of public territory and the principles of social communications?
2. How are the findings of the quantitative method on the evaluation of sociability in physical spaces related to the results of the qualitative method?

Literature review

The correlation between social communications of people and space physicality was discussed on different levels. These studies were conducted frequently under titles such as sociability and the social dimension of space in the public territory by using methods like observance, survey, statistical analysis software, or social communications analysis. It was referred to briefly in Table 1.

In addition to the theories referred to as primary sources above, in the same manner,

Table 1. Criteria for designing the physical space of early theorists. Source: Authors.

Theorist	Evaluation method	Sociable space design criteria	Explain the criteria proposed by the theorist
Clarence Perry (1927)	Qualitative	Developing a social network of friends and relatives in a common local territory	- Designing residential areas with single-family houses - Reducing the distance between different uses and resident households by providing service facilities in the neighborhood - Providing pedestrian safety (Einifar, 2007)
Le Corbusier (1953)	Qualitative	Paying attention to life in the local community, social equality, functionalism	- Designing high-rise residential buildings in a large green environment with high density (mass housing) - Equipping the middle floors for shopping facilities and other needs on the roof (Gehl & Svarre, 2017)
Jane Jacobs (1961)	Qualitative	The importance of living in public spaces and the local community	- Standing against functional division in regions - Emphasizing the user mingling and activities that make the spaces lively by creating variety in neighborhood streets - Paying attention to the streets as a space with important social dimensions and worrying about car traffic (Carmona & Matthew, 2015)
Jan Gehl (1971)	Qualitative	Paying attention to public life among buildings	- Strengthening social life by inviting people to spend more time in space - Paying Attention to the effect of environmental quality of public spaces on their frequency of use (ibid., 2015)
Donald Appleyard (1981)	Qualitative	Paying attention to public life on the streets	- Redefining the street as a soothing and livable place - Explaining the relationship between traffic and the flow of social life (Gehl & Svarre, 2017)
Bill Hillier (1984)	Quantitative	Paying attention to human behavior patterns and social activities and the role of each space with other spaces in the whole system	- Using Space Syntax or configuration technique using computer software and analyzes such as integrity, continuity, and intelligibility (Memarian, 2002)
Ray Oldenburg (1989)	Qualitative	Paying attention to informal public life in places called third places	- Explaining the qualitative characteristics of the third place such as cafes and bookstores for the socialization of people in them (Carmona & Matthew, 2015)
Tridib Benarji (2001)	Qualitative	Paying attention to public life means the public socio-cultural area of people and activities instead of public space	- Paying attention to the social dimension means social interaction and public life in public or private places (ibid., 2015)

some researches were conducted on smaller scales as secondary. For example, Najjari Nabi and Mehdinezhad (2020) in their study titled "Evaluating the Role of Physical and Functional Factors in the Socialization of Traditional Iranian Markets Using Space Syntax Technique" demonstrate that physical changes and segregation of functionalities in the bazaar decreased its integrity by a great scale and led to significant changes in spatial values and space syntax of different parts of bazaar compared to the past. As a result, one observes a decline in the sociability of physical spaces in a bazaar. The significant point in such researches is that most of them were performed in public spaces because public space is a context in which interactions among people are formed. Nonetheless, one should not ignore the impact of other features especially semi-private territory on social interactions. In the historical context of Yazd, Abbasi Harofteh and Sadeghian (2019, 5) studied the features of semi-private territory in a neighborhood. They introduced the threshold-axis, Darband-axis, and Sabat-axis models in the architectural context as the cause for an increase in people's sociability in physical spaces and the occurrence of social communications on a neighborhood scale. Also, among these three models, they considered the first two as more effective in increasing the neighborhood relationships by creating a semi-private territory and boosting privacy, boundary, and security indexes. In another study titled "Impact of residential environments on social capital and health outcomes among public rental housing residents in Seoul, South Korea" Jaewoong Won and Lee (2020) studied the qualities of different areas in a residential environment in enhancing the social communications of people. According to his statistics analysis, the residential environment was effective in increasing social interactions by providing daily needed such as water and electricity, appropriate obstacle-free equipment,

and installations namely by paying attention to private territory. In contrast, the impact of access to recreational facilities and public green spaces was not very significant.

As addressed in Table 1 and further to qualitative methods, various researches were conducted using Bill Hillier's suggested quantitative method to enhance the sociability in space. In Iran, Gholam Hossein Memarian (2002) introduced the quantitative method of syntax in architectural space for the first time. He addressed the negligence of some physical elements as the weak points of this method. Another related study in this regard was performed by Heidari and Farhadi (2018) with the title "Analysis of the relationship between the computer modeling the space syntax software and the cognitive maps in recognition of sociability behavioral camps". Researchers reached a holistic approach in recognition of sociable environments by comparing the quantitative and qualitative maps. Thus, they brought the existence of a meaningful relationship in both methods into the light.

Reviewing the conducted studies indicates a quantitative-oriented large-scale outlook, absence of using any qualitative methods, and negligence of the qualities of semi-private territory on an architectural scale. Thus, most recent studies lack any detailed information regarding the improvement of sociability in physical spaces. Thus, most recent studies fail to provide any detailed information regarding the improvement of sociability in physical spaces. Due to the lack of sufficient studies on social interactions and semi-private territories, this comparative study attempts to compare the results of sociability rate in cognitive maps with space syntax.

Theoretical framework of the study

Social interactions received much attention in comparison to the mechanical approach to space in the late 60s. This approach shows that providing the social needs of humans and his

collective life needs a physical space and some spaces have a better capacity in this regard. Studying the spaces in historical neighborhoods reveals a significant level of social life there. These spaces have grown organically over time and have created a fairly accurate system of spatial territories.

Studying the experience of our ancestors in historical neighborhoods, Tavassoli considers three types of spatial territories recognizable: "private territory including a residential house accompanied by the yard and its surrounding elements, semi-private territory including a private blind alley or vestibule accessible from several houses, and public territory that existed as an alley or square" (Tavassoli, 2016, 76). Studying the present neighborhoods, he states that spatial territories specifically the semi-private territory have been forgotten in current designs. Therefore, designers generally have only paid attention to public spaces or how to access these spaces, especially by vehicles. Tavassoli (2016) expresses the importance of semi-private territory in the following cases:

- A semi-private space gave a sense of belonging and security to the residents inside a house and other houses whose door opened into the space of a vestibule platform or blind alley.

- A semi-private space provided the residents with a possibility to gather in and do counseling or to socialize with each other further than being active in their own fully private space without any disturbance from others; it was effective in strengthening social life.

- A semi-private space belonged to a number of households. This shared place helps the residents to get to know each other and take better care of that place.

- A semi-private space was generally used by the residents of that space. Therefore, it stayed away from crowding or crossing of other people.

As it is known, physical space is the context for the formation of social communications either semi-private or public. The onset of a relationship needs adjacency. Also, a degree of congruence is essential for the continuation of the relationship. Thus, the similarity of the physical structure and functional divisions of space (Talebi, 2004, 161), how the spaces are located next to each other, and their scale and proportions to one another can provide or limit opportunities for the creation or continuation of social communications in a neighborhood. The analysis of social communications in space is arrived at by different quantitative and qualitative methods. Architects such as Steadman, Bill Hillier, and Julian Hanson analyzed social communications based on morphological features. In their book called "The Social Logic of Space", Hillier and Hanson & Hanson (1984) declare that people's sociability in different spaces is influenced by behavioral (functional) and physical dimensions of space in spatial territories. Therefore, any changes in each of them would lead to a change in the social meaning of space. Using a quantitative method, Hillier and his colleagues review this issue and consider an accurate study of the features of space syntax as being significant in understanding the sociability of space. This new method is referred to as space syntax or "chideman-e-faza" in Persian. With recent innovations in the software industry, it is widely employed in the analysis of different spaces. Syntax means reviewing the relationship of each space unit in an adjacent space set and different indexes are used to evaluate the social communications in it. Amongst these factors, one can refer to the index of integration (integrity), connectivity (continuity), and intelligibility (ability to understand). The integration index is a local and general scale correlated to the manner of pedestrian movement. The ratio of this index in space is the average number of direction changes by which a person can arrive at all other spaces from that space. This ratio has a communicative concept, not a distant-based

one. The higher the value of integration is, the higher the accessibility of that space is in the system. The connectivity index is a local scale reviewing the relationship between space and its immediate neighbors. Intelligibility index is the ratio of the relationship between integration and connectivity indexes. When it approaches number 1, it indicates that it would be easier for people to form a general configuration of space in their minds. Accordingly, by understanding the structure of that space, they do not experience any problems when accessing it.

In addition to the quantitative indexes of space referred to by Hillier in his analysis of social communications, in his book "Cities for People", Jan Gehl (2015, 8) considers the best and most desirable physical spaces a result of paying attention to qualitative standards not taken generally into account in Hillier's computational simulation. These standards include facilities and suitable qualities for movement, sitting, playing and activity, stopping and standing, seeing, and hearing. Through physical features such as geometry and space dimensions, spatial order and readability, form and harmony of elements, and vegetation, they influence the social communications of the user by that creating a pleasant sensory experience for them. Cognitive maps are a tool to reach an inner representation of space for discovering these physical features. They include various methods (Asadpour et al., 2015, 17). In their study "Typology of models and comparative study of methods in recording mental images and cognitive maps from the environment", Asadpour et al. (2015) argue that weak points in each of these qualitative methods remove their potential for becoming an all-inclusive method. Therefore, a researcher should benefit from all available methods, either quantitative or qualitative, based on the purpose of research and in a conscious synthesis. In this study, the sociability in a physical space of a neighborhood influenced by different features of

semi-private and public territories was identified by simultaneous use of computational modeling and cognitive maps and then compared to each other (Fig. 1).

Methodology

This research study employs the case study method to examine the sociability of people in spatial territories. It does so through a quantitative and a qualitative approach and compares the results taken from these two approaches. Ekbatan Town was selected as a desirable case study[1] due to its significant distinction between the spatial territories of Phase 1 and Phase 2 in Tehran. Amongst the unique features of Ekbatan Town, one can mention the significant level of areas dedicated to public territories and green spaces, as well as a diversity in semi-private territories that is the basis of comparison in this study. This Town is located in area 6 in District 5 of Tehran municipality; Jordan Gruzen, the American architect, designed it, and Starrett, the American company, built it. Phase 1 and Phase 2 of Ekbatan Town are different from each other regarding the shape of blocks, the medial space of units (semi-private territory), and public space territories. Phase 1 and Phase 2 in the middle, with a public service-based function, is divided into
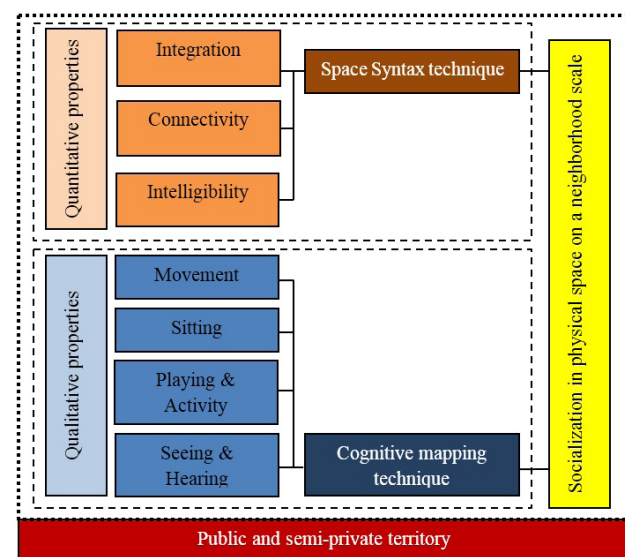

Fig. 1. Conceptual model of research. Source: Authors.

two relatively symmetrical parts, northern and southern (Fig. 2). In this study, due to the existing similarity between the northern and southern parts, the sociability of people in the southern part of Phase 1 and 2 was analyzed and compared to each other based on the physical features of semi-private and public territories. It is noteworthy that what is meant by a semi-private territory is the connecting space of residential units in floors (closed space) and public territory of all defined spaces in the vicinity of blocks in an open space. Data for the preliminary part of this research was provided via document studies and library sources. In a qualitative approach, the social communications were analyzed using cognitive maps and reviewing the variables of action, sitting and stopping, play and activity, seeing and hearing. Some physical factors influencing these variables include readability, vegetation, geometry, spatial dimensions, and proportions. Data collected from the cognitive maps was arrived at by surveying the stational activities and enumerating the movement of pedestrians

Fig. 2. The southern part of Phase one and two of Ekbatan town.
Source: www.google.com/maps.

(Gehl, 2010). The survey period was conducted in a desirable weather condition on Thursday and Friday, 20th and 21st of May in 2021 from 8 a.m. to 10 p.m. Complimentary survey was repeated on 10th and 11th of June in 2021 at the same period to correct and prove the primary information. The enumerating of pedestrians was performed in the medial station of the walking path of Phase 1 and Phase 2 (southern part) in two seven-hour sessions (first 15 minutes of every hour) from 8 a.m. to 10 p.m. It was noteworthy to mention that this path in Phase 1 was defined with an extensive commercial margin but in Phase 2, it found an identity on a smaller scale and with a surrounding green margin.

In a quantitative method, the social communications of people are reviewed in two parts: the first part is based on the syntax of private residential units in proximity of each other and the creation of a semi-private territory inside the blocks while the second part is based on the syntax of blocks in a public space context. Accordingly, the qualities and syntax of semi-private spaces inside the blocks, and the qualities and space syntax in the public territory are analyzed, and then the sociability scale in these spaces is evaluated. A quantitative analysis is performed using the space syntax technique and Depth Map software. Used variables for evaluating the sociability in space are integration, connectivity, and readability on the axial diagram. If the colors become warmer (red and orange) on the acquired axial maps, it indicates a higher degree in under-evaluation indexes.

Analysis and discussion

Findings from field surveys and space syntax technique in the southern area of Phases 1 and 2 in Ekbatan Town are expressed in the following sections.

• Findings resulted from cognitive maps in the public territory with a qualitative

approach

- Pedestrian movement

Results obtained from field surveys indicate the crossing of 80 pedestrians through the medial walking path of Phase 1 during the first session and 147 participants through the medial walking path of Phase 2. According to this field survey, for the second observation session, the number of pedestrians was 123 and 209 respectively in Phase 1 and Phase 2 (Fig. 3). Therefore, it seems that the crossing of pedestrians increased in both cases of study after 3 p.m., especially during the hours that the intensity of heat diminished. Fewer pedestrians in the medial walking path of Phase 1 with a commercial margin compared to Phase 2 reveals that people spend less time window-shopping or shopping as they prefer to enjoy their leisure time in a natural environment (in Phase 2).

- Sitting and stopping of the pedestrians

Those spaces of Ekbatan Town in which the probability of pausing (sitting and stopping) is higher include the adjacent spaces to the blocks (Phase 1 and 2), public spaces in the vicinity of the walking paths with a green margin (Phase 2), the walking path with a commercial margin (Phase 1), cafes and shops (Phase 1 and 2). The black circles demonstrated in Fig. 4 portray the sociable centers with between 1-[3] active users. This data was estimated in 15-minute intervals between 6 p.m.-[8] p.m. that there is a maximum chance of sociability due to the more pleasant condition of weather. As observed in the cognitive maps, the density of population in adjacent centers to the blocks of Phase 2, and cafes located in the middle of the medial walking path of this Phase is by far higher than similar spaces in Phase 1. The bodies and furniture suitable for sitting in edges or focal spots leading to the joining paths of the pedestrians are the same in both Phases. So, to find the reason for this density difference, it is necessary to study the physical qualities of these centers, such as dimensions, geometry and
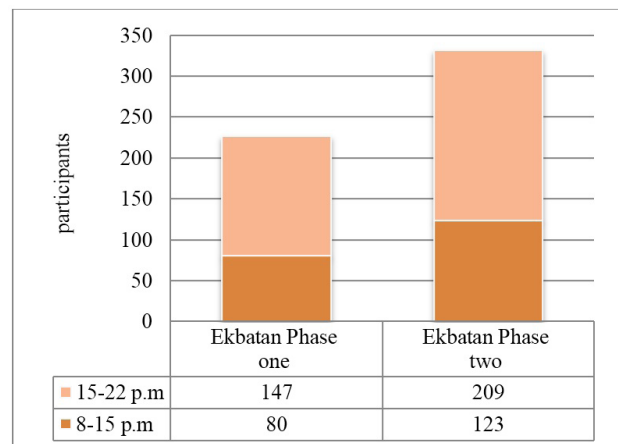

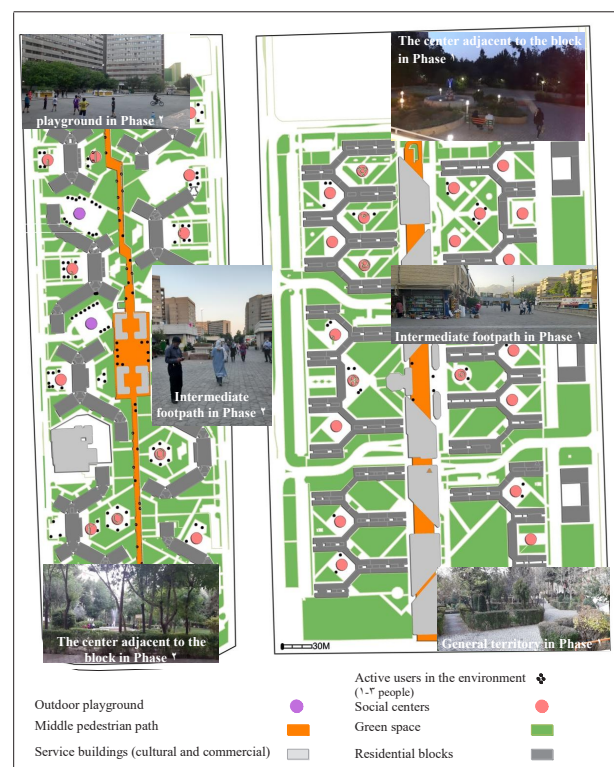Fig. 3. A graph of pedestrian movement count in the middle two-Phase routes. Source: Authors.

Fig. 4. Right: A cognitive map of Phase one, Left: Phase two. Source: Authors.

proportions, perspective, and casting a shadow. Field surveys reveal that the sociable centers of these two Phases are different from each other in centripetal geometry. According to the studies of Lawson (2012), centripetal geometries are more effective in the sociability of space. The other difference between these spaces is in their vegetation. Vegetation in Phase 2 is younger and denser compared to Phase 1, and hearing the

singing of birds on the trees of Phase 2, due to their closeness to the surface of the ground, has created a pleasant environment in this Phase. Thus, it seems that the centripetal geometry of Phase 2, added to the youth of its trees and their shorter height, is effective in the audience-attracting of this Phase in public spaces.

- Play and activity
Field survey from the public and semi-private spaces in Ekbatan Town indicates the assigning of several open playgrounds in Phase 2. As it was specified in picture 4, two playgrounds in Phase 2 provided a possibility for free activity and play, while Phase 1 lacks in such grounds with a similar function. Accordingly, the number of children observed playing a group game is higher in Phase 2 than in Phase 1.

- Seeing and hearing
Desired visual corridors with vegetation are observed in both Phases, especially in centers adjacent to the blocks, while only in Phase 2, one can hear the birds singing in these spaces. Moreover, in Phase 2, the medial walking path between the blocks with a green margin has created a pleasant space for activity, stopping, and sitting. Meanwhile, the extensive medial path, between the blocks of Phase 1, due to its commercial function and lack of desired vegetation, is merely used for movement and seeing (window-shopping), and cycling and skating of children (only in the medial part of the path).

• Findings resulted from the space syntax technique with a quantitative approach
- The semi-private territory inside the blocks of Phase 1 and Phase 2
The analysis of axial maps in Phase 2 blocks shows more integration in the connection place of
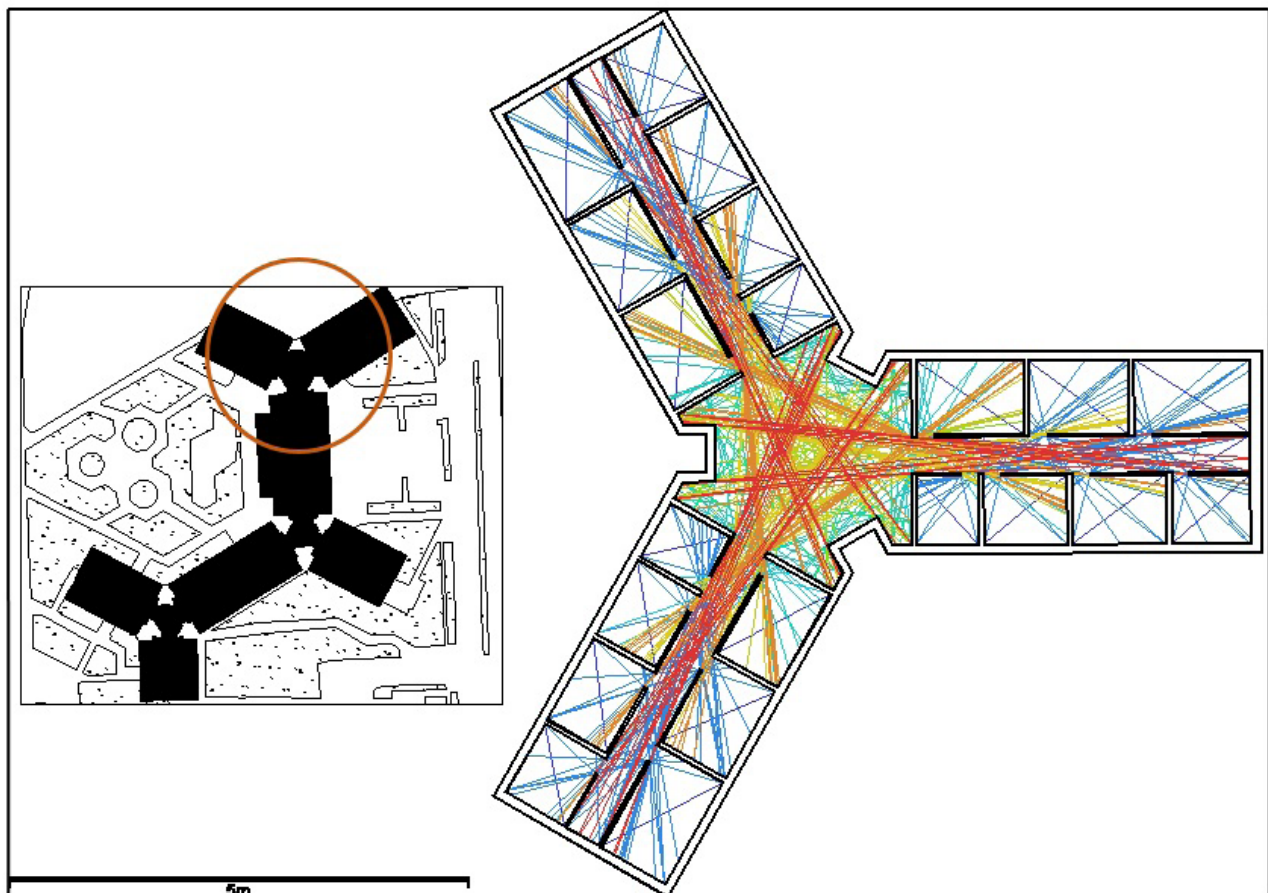

Fig. 5. Right: An axial map of Phase two-block entrances, Left: The position of the block at the site. Source: Authors.
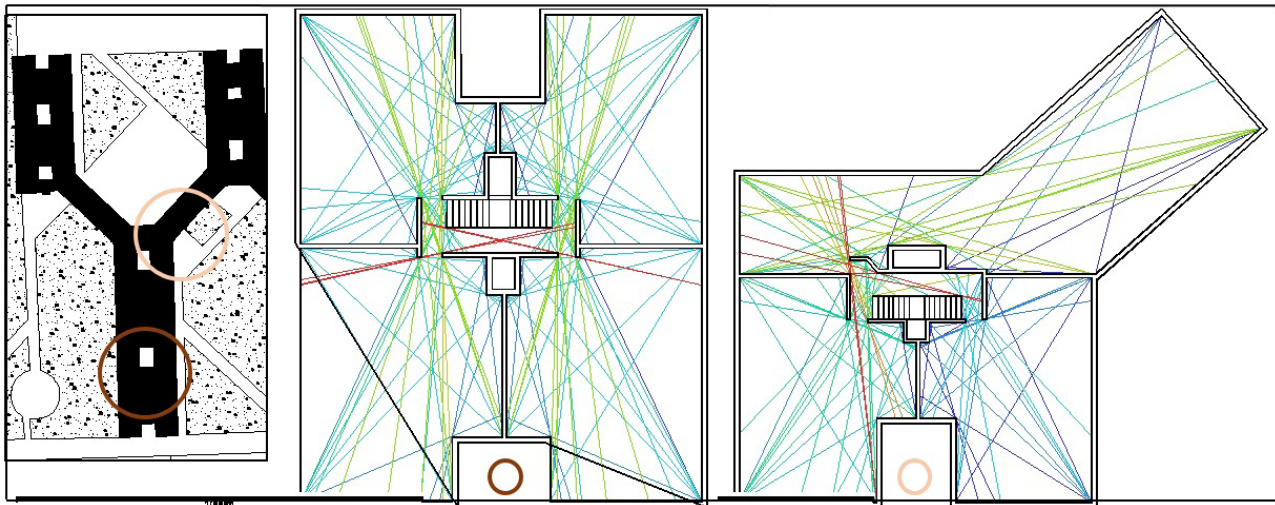
Fig. 6. Right: An axial map of two input types from Phase one block, Left: The position of the block at the site. Source: Authors.

private units (semi-private territory) to each other (Fig. 5), while in Phase 1 this integration is by far less (Fig. 6). Indeed, it seems that the syntax form of private units in the block floors of Phase 2 around a central space increases the possibility of an encounter amongst the people in this shared semi-private territory. It is worth mentioning that the number of residential units in Phase 1 blocks is more than Phase 2 and only in five blocks of Phase 2 this number is the same as Phase 1, but the principle of providing more privacy which became possible by reducing the number of residential units on the floors and increasing the related entrances in Phase 1 has led to a decrease in the possible encounters amongst the neighbors. It means that a higher density in population has not essentially led to an increase in the possible encounters in this Phase.

Findings resulted from the analysis of axial maps on a local scale within a 10-km radius in public spaces between the blocks of Phase 1 and Phase 2 according to Fig. 7 include:

- The surrounding streets of both Phases have more integration when compared to the internal paths that were dedicated to the commuting of vehicles. Also, according to the field observations of the researcher fewer pedestrians cross through these paths.

- The eastern street of Phase 2 has more integration compared to the other surrounding streets of this Phase, although this integration has led more to facilitation in commuting of vehicles than pedestrians.
- The surrounding streets of Phase 1 have provided a relatively similar integration (less in comparison to Phase 2) for the crossing of vehicles in this Phase.
- The medial walking path of Phase 2 has more integration when compared to the medial walking path of Phase 1.
- The adjacent centers to the blocks in both Phases have a low integration.
- Playgrounds in Phase 2 have a high integration in comparison to the other public spaces in this Phase.
- The focal space which has been defined in the middle of the walking path in Phase 2 with more opening and several cafes and shops has a significant integration in comparison to the other public spaces in Phase 2.
- Readability is calculated based on the R^2 index that means the ratio of integration and connectivity. As it is clear in picture 8, the value of this variable is (R2=0/66) for Phase 1 which is more than Phase 2 (R2=0/59).
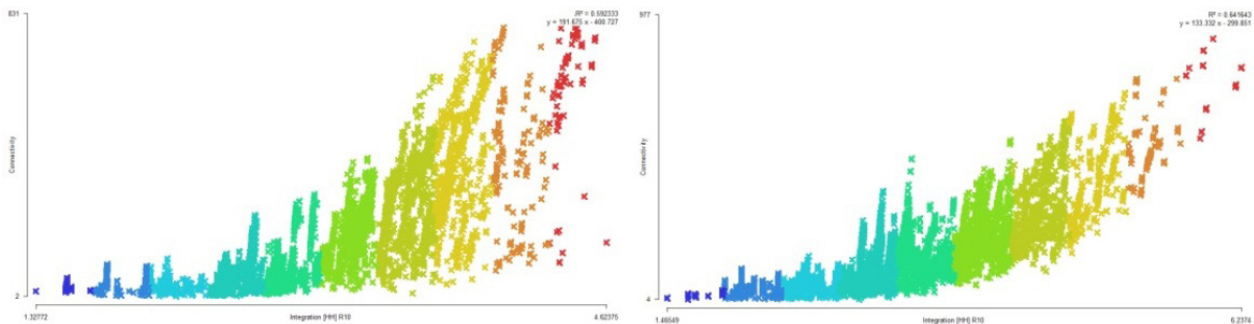• **Findings resulted from reviewing and**

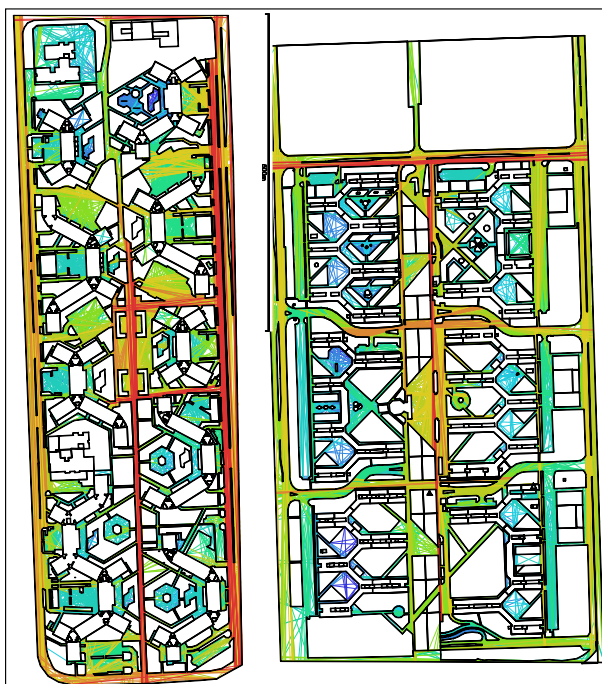Fig. 7. Right: A readability chart in Phase one (R2 = 0.66), Left: Phase two (R2 = 0.59). Source: Authors.

Fig. 8. Right: An axial map of the general territory of Phase one, Left: Phase two. Source: Authors.

comparing the two quantitative and qualitative approaches

According to the field surveys, the public spaces of Ekbatan Town classified by their degree of privacy include the centers adjacent to the blocks, playgrounds for group games, and the medial walking paths of the Phases. The analysis of sociability in these spaces influenced by territory features with a quantitative and qualitative approach and space syntax technique shows that the medial walking path in Phase 2 has the maximum users and the centers adjacent to the blocks in both Phases have the minimum rate of people's sociability. After the walking path of Phase 2, the medial walking path of Phase 1 and then those two playgrounds for group games in Phase 2 indicate a higher integration rate.

Reviewing the integration of semi-private spaces inside the blocks shows a higher chance of people's encounter in central shared spaces between the private units in Phase 2 (Table 2). In addition, the dispersion of integration and connectivity diagrams that show the readability rate of space by the R^2 index displays that Phase 2 has less readability compared to Phase 1.

The result of field surveys and cognitive maps at Ekbatan Town confirm the above results from a quantitative approach to a great extent. It means that maximum sociability occurs in the medial walking path f Phase 2 and then the medial walking path of Phase 1. The centrality[2] of these two paths in under-study Phases shows the significance of this issue in people's sociability. The distinction point of quantitative and qualitative approaches in maps is a rate difference in the presence of Ekbatan Town residents in centers adjacent to the blocks of Phase 2 and Phase 1. Unlike axial maps, cognitive maps indicate the presence of a high percent of Phase 2 residents in centers adjacent to the blocks while the field surveys in Phase 1, as well as the axial map of this Phase, report a low population density in the same centers. Indeed, it seems that social communications are high in most public spaces of Phase 2 including the medial walking

Table 2. Study of spatial territory in two quantitative and qualitative methods, Source: Authors

Method	Spatial territory	The space understudy	Phase 1	Phase 2
Quantitative method	General territory	Middle footpath	Medium integration, all integration in the north due to proximity to the northern pass	High integration, especially in the middle and south
		Adjacent centers of blocks	Low integration	Low integration
		Playground	Does not have	Medium integration
		Surrounding streets (vehicle traffic)	High integration on North Street Medium integration on another street	High integration on East Street Medium integration on the rest of the streets
		Inner streets (pedestrian traffic)	Low integration	Low integration
		Total spaces examined	Higher readability	Lower readability
	Semi-private territory	The space between residential units on the floors	Medium and low traffic	high traffic
Qualitative method	General territory	Middle footpath	Medium traffic only in the middle	Busy especially in the middle
		Adjacent centers of blocks	Low pause and stillness	Lots of stops and stillness
		Playground	Does not have	Lots of stops and stillness
	Semi-private territory	The space between residential units on the floors	Medium and low traffic	High traffic

path, playground for group games, and centers adjacent to the blocks. In contrast, in Phase 1 only the medial walking path between the blocks shows a significant presence of Ekbatan Town residents and in other public spaces of this Phase, a small population is observed.

According to higher integration results of semi-private spaces inside the blocks of Phase 2, it can be inferred that in addition to the physical features of a public space derived from cognitive maps, the syntax type of private units around a central space provides a higher chance of acquaintance and encounters of people in this shared space. As a result, the tendency of those residents inhabited in Phase 2 for social communications in all public spaces of Ekbatan Town is higher than in Phase 1. In fact, despite the higher number of private units in Phase 1 compared to Phase 2, the considered privacy for the residents in blocks of Phase 1 and it is observable in axial maps, has kept the chance of people's encounter and therefore the occurrence of any social communications to a minimum. The other significant point is the low readability of public spaces in Phase 2 compared

to Phase 1 despite having a higher percentage of people's sociability that shows a lack of correlation between these two variables.

Conclusion

As it was stated in the findings argument, in Phase 2 field surveys that resulted from a qualitative approach indicate a significant presence of people in these spaces despite the low integration results of centers adjacent to the blocks (derived from a quantitative approach). According to what is observed as a distinction in findings of quantitative and qualitative methods in Phase 2, it can be concluded that merely relying on one method, especially quantitative simulation methods that have recently become a standard in the evaluation and prescription of designing instructions for sociable spaces is not advisable but simultaneous use of quantitative and qualitative methods is essential in the analysis of similar researches because these two methods are complementary to one another. It is noteworthy that the results of the quantitative part of this study are consistent with Memarian's

article "Space syntax" (2002). They are also complementary to the results of Heidari and Farhadi (2018) in their article "Analysis of the relationship between the computer modeling the space syntax software and the cognitive maps in recognition of sociability behavioral camps" and other articles that merely study the sociability of space by a quantitative approach.

Another significant point is the high integration of semi-private territories and the notable presence of people in the public territories of Phase 2 in comparison to the low integration of semi-private and public territories in Phase 1 that shows the impact of features of semi-private territory on the sociability of public territory. In other words, the syntax form of private units and the creation of semi-private territories with appropriate dimensions and population density in Phase 2 increases the possibility of encountering and familiarizing the residents. Therefore, the probability of their tendency for presence in public spaces and boosting social communications increases. In other similar studies that have been elaborated on in the literature review of this subject, sociability difference is generally explained by comparing the physical features of a public territory such as geometry, proportions, scale, readability, or mixed-use planning. Since these physical features are relatively the same in both Phases except for readability and geometry, thus the higher sociability of Phase 2 residents compared to Phase 1 reinforces the influence of semi-private territories in this matter. Regarding the readability, although the readability of Phase 1 is higher than Phase 2, the higher sociability of Phase 2 shows that these two variables are not correlated with each other in this study. Moreover, the centripetal shape of sociable centers in Phase 2 and their more people-like scale, younger and denser vegetation with shorter height, also the advantage of hearing the birds singing from a nearer height to the ground surface are among the factors leading to the tendency of

a higher number of Phase 2 residents for presence in public spaces. Therefore, it is recommended that the impact of these background variables be studied more accurately in future researches.

Endnote

1. The unique characteristics of Ekbatan town in public, semi-private and private territory compared to similar towns are mentioned in the article "Measuring the impact of the three territory of physical space on the social capital of the case example: Ekbatan Town of Tehran" from the same authors in the Quarterly Journal of Physical Development Planning.
2. Salehinia and Memarian (2009) consider spatial proximity and functional distance effective in influencing people's socialization.

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