

Using Space Syntax Analysis in Detecting Privacy: A Comparative Study of Traditional and Modern House Layouts in Erbil City, Iraq

Faris Ali Mustafa (Corresponding author)

School of Housing, Building and Planning, Universiti Sains Malaysia

11700 Penang, Sunny Ville, 1E-16-07, Malaysia

Tel: 60-1-2931-7161 E-mail: farisyali@yahoo.com

Ahmad Sanusi Hassan

School of Housing, Building and Planning, Universiti Sains Malaysia

11800 Minden Penang, Malaysia

Tel: 60-4-653-2835 E-mail: sanusi@usm.my

Salahaddin Yasin Baper

School of Housing, Building and Planning, Universiti Sains Malaysia

11700 Penang, Sunny Ville, 1E-16-07, Malaysia

Tel: 60-1-7257-7549 E-mail: salahaddinbaper@yahoo.com

Abstract

The goals of this paper are first, to examine the parameters that have a role in achieving privacy in using interior domestic spaces and to what extent these influence the distribution of spaces; and second, to investigate the relationship between house layout morphology and the privacy of inhabitants. In this paper, space syntax theory is used to examine the spatial morphology of traditional and modern house layouts in Erbil City and detect the level of privacy in their configurations via an analytical comparative approach. After a sample of house layouts is analyzed morphologically, the degree to which house layout pattern affects the level of privacy and to what degree is determined. Results show that traditional house layouts offer better design solutions in terms of privacy because they carry a higher value of real relative asymmetry with a higher tendency toward asymmetry compared with modern house layouts. The data collected will be valuable in the design process of future house layouts at least in Erbil City.

Keywords: Privacy, Space syntax, House layout, Erbil City

1. Introduction

A house is a symbolic place combining paradoxical concepts that can easily be identified as “binary codes.” Internal and external, private and public, female and male, sacred and profane, clean and dirty are binary codes used to explain roles and activities of people in spaces (Lawrence, 1990; Ünlü, 1999). The spatial configuration of house layouts may be different in different periods, regions, cultures, and societies. Societies establish order in their livelihood spaces and reflect their personalities in these spaces.

There is a mutual relationship between space and human relations. The differences in social systems reveal morphological diversity in house layouts. The family contains the socio-economical structure of society; although it is a small element, it is the cornerstone that forms the future of society. The family needs a specific space, a house, to achieve this function based on their characteristics and the desired level of privacy (Sungur and Çagdas, 2003).

Privacy is a dynamic topological property of space; therefore, it should be approached in an analogous manner. Spaces could be categorized not only depending on their degree of privacy, but also according to their capacity to

regulate privacy. At the same time, complementary approach counters the strict categorization of spaces into either public or private. According to that point of view, architectural space and its various elements should act as regulators of privacy. Space and its elements should be able to increase or decrease privacy according to the customized needs of its occupants (Georgiou, 2006).

Robinson (2001) identified different zones of privacy within a single Midwestern house and pinpointed their importance for the individual. Robinson argues that through a series of spaces with different degrees of privacy, the autonomy of the resident within a small social group is provided. Furthermore, the individual is granted a large measure of control over time, space, activity, and social interaction.

The aim of this paper is to study the morphological characteristics of spatial configurations (house layouts) that have a role in the distribution of interior spaces and to examine its effects on the privacy level of these spaces. After a sample of house layouts is analyzed morphologically utilizing space syntax theory and its methods, the degree to which they affect privacy of space is determined. This paper provides which house layouts have more privacy, to which level, and in what ways the needs of house residents can be met successfully regarding their privacy. Data collected will be valuable in the design process of future house layouts at least in Erbil City.

For analysis and comparison, the layouts of both traditional (courtyard) and modern houses are analyzed in terms of their morphological characteristics by applying Hillier and Hanson's analysis method (Hillier and Hanson, 1988), called the Gamma Analysis method. This method develops some hypotheses about the relationship between essential syntactic characteristics of spatial configuration and social variables. Using the morphological measure obtained from these analyses, access graphs and numerical results are formed. Finally, the variety and orderliness of the spatial configuration regarding these house layouts are exposed particularly the level of privacy. This paper may contribute in providing an approach for dealing with the distribution of interior spaces in the house according to their level of privacy and its relationship in the process of house layout design.

2. Definition of privacy

Analyzing diverse interpretations of human privacy shows a common core definition: It is a process that aims to control transactions between persons, and its objective is to enhance autonomy and/or minimize vulnerability. From this perspective, privacy serves three main functions: limiting social interaction, establishing plans and strategies to manage interaction, and maintaining and developing self-identity (Abu-Gazzeh, 1996). People are engaged in a dialectic relationship between the need for privacy and the need for social interaction (Altman, 1975).

Physical environments can help or hinder people's need to find solitude and identify their own personal private "territory." Territory is defined as the "degree and permanence of ownership." People use two mechanisms—personal space and territorial behavior—to regulate their need for privacy. Primary territory, over which we attempt to have complete control, includes homes and gardens, or personal space within shared accommodation. Secondary territory refers to spaces under partial control of the occupant, such as the space outside an apartment or house. Public territories are less easy to define. Entrances, play areas, and hallways are all secondary or public territories. Intrusion can result when territory has been inappropriately defined. Therefore, clear delineation is essential to maintaining harmony in high-density housing. Environments need to be designed that are responsive to people's needs for both privacy and social interaction (Altman, 1975).

Privacy is often misconstrued as the shutting out of interaction. However, it is a dialectic process of regulating contact with others, seeking and limiting interaction. The desire for interaction is dynamic and varying, shifting through time and from person to person. People will act to achieve their desired level of interaction. Behavioral mechanisms such as personal space, verbal and preverbal communications, and possession of territory are used to regulate privacy. The importance of privacy for human development, human experience, and moral choice has been established in psychological, philosophical, and legal discourses (Witte, 2003). In the same context, and to define privacy, we should define space into two types: public and private. Public space is defined as the space that applies no restriction to interaction and communication, whereas isolated space (private space) is the one that completely constrains communication. In between are other intermediate levels of privacy (Georgiou, 2006).

2.1 The duality of space and privacy

The concept of privacy as a characteristic of the built environment is synonymous with the emergence of the human race. The integration of a clearly defined area occupied by a specific group of people has been a dominant instinctive interest of early humans. People need to shield themselves from environmental circumstances and enemies (people and animals), as well as withdrawal from larger groups.

The ability of space to provide security and privacy has been one of the main priorities of communities since

then. This type of private space takes many shapes, and different types of layouts have succeeded other over time, always regarding technology and society. Humans moved straight from caves to private houses, which has become one of the basic entities of modern society (Riley, 1999). Privacy not only remained a physical human need, but with current technological evolutions, it has acquired different multiple layers.

The theme of privacy and private space has been addressed by contemporary architectural thoughts. Nevertheless, different studies and approaches regarding privacy have often comprised the contrast between term and another entity, which is the space. Their consideration as two contradictory worlds has resulted in comparable outcomes for the design process (Hertzberger, 2005).

2.2 The privacy of space from the architectural viewpoint

Several research and studies address the concepts of privacy and space. This paper aims to develop the current work in a wide range of related academic work, as evidenced by their contribution. Studies on the privacy of space from the architectural viewpoint are presented by researchers such as Nathan Witte, regarding privacy as an implicit dynamic property. He considered space as the aggregation of interconnected communicating units, characterized by their different degree of privacy. Witte suggested that space should be supportive of the user's desire for privacy, *"The environment must allow for one's dynamic closed and open permeability, creating options or places of release from contact and observation"* (Witte, 2003).

Another approach was conducted by Julia W. Robinson (2001) perceiving privacy as a static, inherent property possessed by different kinds of spaces. By observing typical Midwestern single house plans and using space syntax methods (accessibility graphs), she initially stated, *"Their distinctive arrangements seem to reflect three distinct spatial categories and territorial types, public-linking to the outside world, private-relating to community activities within the residence, and intimate-activities linked to the individual"* (Robinson, 2001). Robinson has expanded these three territorial types to seven. She calls the seven levels of privacy (zones) as a *territorial gradient* (public civic domain, public neighborhood domain, semi-public or collective domain, semi-private domain, private domain, semi-intimate domain, and intimate domain). Accordingly, the layers of space within the house and between the house and the street create a gradient from the most intimate space of the individual to the public arena where the life of the urban community takes place (Figure 1).

At the interior of the dwelling, control of territory within the house occurs differently in the private and the intimate areas. While shared private areas are controlled by the group in a general way, and temporarily by individuals, intimate areas are controlled by individuals, some spaces temporarily (bathrooms), others exclusively (bedrooms). Household community control is exerted at some periods of the day when, in a given area, household members do something together such as eat a meal or watch television, or do different things at the same time, for example, one person reading a book and another sewing. Due to the relatively open spatial structure, many regularly occurring community activities tend to evolve gradually rather than having to be scheduled (Robinson, 2001), (Figure 2).

The structure of the house contributes to the demarcation of the household as a private community, the development of community cohesion and individual territory, and the pattern of informal relations between people, spaces, and time. Applying space syntax methods to the single-family house, we find that three characteristic spatial arrangements we call linear, connected, and fan-shaped relate to specific parts of the territorial gradient and to three different social purposes (shown as interpreted by syntax diagrams in Figure 3).

- 1) **The spaces connected in a linear pattern** relate to patterns of movement, such as the separation of the public outdoor areas from the dwelling.
- 2) **The connected arrangements** link the shared private living areas, typically living room, dining room, and sometimes kitchen.
- 3) **Fan-shaped arrangements** link the intimate spaces, typically bedroom and bathroom. In the Midwestern domestic building, these distinctive arrangements seem to reflect three distinct spatial categories and territorial types as clarified by Robinson (2001), **public**-linking to the outside world, **private**-relating to community activities within the residence, and **intimate**-activities linked to the individual.

Accordingly, three general realms of socio-spatial concern can be defined as **public**, where anyone has a right to be; **private**, which is under the jurisdiction (dominion) of ownership or other more limited control; and **intimate**, which is the area of the individual. Research and observation suggest that these realms relate to the numbers of people that any one person could know or recognize. This varies from person to person and from context to context (Robinson, 2001).

3. The case and the sample

When planning to study the privacy level of interior space of houses in Erbil City, the initial question is what sample of houses may be appropriate as data. Both traditional and modern house layouts have been chosen from 1900 to 1930 (traditional type) and from 1930-1960 (modern type) as two different cases for analysis and comparison. Both are documented and re-drawn by the author. The main strategy for sampling is to select 10 house layouts from both periods. This selection is done according to the type of house layouts from two different styles of the way of distribution and configuration of their interior spaces.

For both space syntax analysis based on justified permeability graphs, floor plan drawings are the basic source of information. A floor plan drawing is an abstraction of architecture that captures essential characteristics of the interior space. Moreover, floor plan drawings are a relevant, reliable, and easily accessible source for the study (Manum, 2005).

4. Morphological analysis of house layouts (space syntax analysis)

The most prevalent view about space is that spatial configuration is an indication of the common attitudes and the hierarchy of their different levels (Hillier and Hanson, 1988). In the context of this paper, morphology deals with access between rooms, the relationship between spaces, and the diagrams of these relationships (Hanson, 2001; 2003). The focus is access diagrams between separate spaces within a set of spaces. These diagrams of relations between interior spaces form the “permeability” structure within the house. The building itself or drawings may hide morphological diagrams and make the perception of that diagram difficult. Thus, morphology has a clearer and more abstract form of revealing the relations between spaces (Kirsan, 1996).

In Hillier and Hanson’s analysis method (Hillier and Hanson, 1988), the morphological characteristics of a plan layout are analyzed with the help of graphs called “justified access graphs.” In these graphs, all spaces of the house are appointed depth values according to a chosen space called “the carrier.” The carrier space in the analysis is the outside of the dwelling. According to their depth values, all the spaces are placed on a horizontal line numbered with the depth of that space. All the spaces that have the same depth values are placed on the same line. After the graphs are formed (see Figures 4 and 5), the analysis shows that some numeric measurements related to the properties of spatial configuration should be made. These measurements are mean depth (MD) of spaces within the spatial system (house layout), the integration value of space (relative asymmetry (RA)), and the integration value of space [real RA (RRA)]. These properties have a significant role in detecting the privacy level of interior spaces within the house. The integration and permeability are influential predictors of how “busy” or how “quiet” a space will be (Hanson, 2003). Spaces are usually connected together in ways that vary the distribution of integration throughout the structure, making some spaces of a house more accessible (public spaces) than others (private spaces). This sequencing of integration organizes interactions among inhabitants and between inhabitants and visitors (Dawson, 2002). The morphological properties of a house layout can be specified with these terms according to numerical values: symmetric-asymmetric, and distributed/nondistributed. These properties are related with the permeability and depth of the spatial configuration. This paper focuses on the property symmetry/asymmetry because it gives tangible results regarding the theme of privacy. Symmetry/Asymmetry reflects the relative depth of space in relation to the rest of spaces in the system (Hillier, 1993).

The MD of space from all other spaces in the configuration (house layout) is integration (RRA), which describes how permeable that particular space is. The low values mean higher integration and, the high values mean high segregation (Manum, 1999). The depth of each space is calculated in the graph from the root space, where the depth of each space is represented by the number of spaces that should pass through to transition from the root space to any space in the system. The least depth can be achieved when all spaces are directly connected to the original space (root space), while the highest depth exists when all spaces are arranged in a linear sequence away from the original space. In the first case, space can be symmetric with respect to other spaces in the system and asymmetric in the second case (Hillier et al., 1987; Hillier and Hanson, 1988; Hillier, 2007), (Figures 6 a, b).

Symmetry/Asymmetry is about the integrating/segregating (less private/more private) effects of a space regarding the house layout. This property can be described by RA, which has a range from 0 to 1. A low value indicates that a space tends to integrate the system in its entirety, and a high value indicates that a space tends to be segregated from the space. Thus, if it is low, the plan has a quality of symmetry and the spaces are equal in terms of permeability control. RRA is a more sensitive measure of symmetry or asymmetry, taking into account the variation in the number of spaces in a house layout. This value extends from 0 to above 1. Values of less than (1) refer to the most integrated spaces and less segregation (less private/privacy) in the system, while values that are more than (1) refers to the most segregated spaces (more private/privacy) (Shoul, 1993; Sungur and Çağdaş, 2003).

5. Discussion and interpretation of results

When the results of the analyses are examined, the following data are obtained. For traditional (courtyard) house layouts, the MD is (2.949); for modern house layouts, it is (2.892). This indicates that the overall traditional house layouts appear in symmetric order, which refers to spaces connected to the original space (root space) directly. In contrast, the overall modern house layouts appear in asymmetric order and refer to all spaces in these layouts that are arranged in a linear sequence away from the original space.

In the case of traditional house layouts, the overall spaces are more segregated (more private/more privacy) than the overall spaces in the case of modern house layouts (more integrated spaces/less privacy). This is supported by a high mean value of (RA) regarding traditional houses with (0.311), which refers to the tendency of the system to be more segregated (more private/ more controlled). Modern houses carry a low mean value of (RA) with (0.234), which indicates that the spatial configuration of these type of layouts tends to be more integrated (less private/more accessible) (see Table 1).

6. Conclusion

In this paper, a sample of both (traditional and modern) house layouts in Erbil City was analyzed in terms of their morphological characteristics. The mean value of (RRA), which exhibits the symmetry/asymmetry of layouts, ranges from 1.163 to 1.005. A low value (modern house layouts) indicates that spaces have an integrated syntactical characteristic; generally, the entrance space controls the permeability to the rest of other spaces in the system. In contrast, a high mean value of RRA (traditional house layouts) indicates that spaces have segregated syntactical characteristics. Both types (traditional and modern) of house layouts carry a mean value of (RRA) higher than 1, which means that the spatial configuration for both tends to be asymmetric. However, traditional house layouts offer better design solutions in terms of privacy because it carries a higher value of (RRA) with a higher tendency toward an asymmetrical structure compared with modern house layouts. The house with asymmetric configurations has more than one control space, therefore access to spaces is carried out by passing through the control spaces, and the deepest spaces have more privacy, particularly the spaces of bedrooms. A higher mean value of (RRA) indicates greater control over movement and increasing the degree of social hierarchy, which increases privacy.

References

- Abu-Gazze, T. (1996). Privacy as the basis of architectural planning in the Islamic culture of Saudi Arabia. *Architecture & Compartments / Architecture & Behavior*, 11 (3-4), 269 -288.
- Altman, I. (1975). *The environment and social behavior*. Monterey, California: Brooks/Cole Publishing.
- Dawson, P. C. (2002). Space Syntax Analysis of Central Inuit Snow Houses. *Anthropological Archaeology*, 21 (4), 464-480.
- Georgiou, M. (2006). Architectural privacy: A topological approach to relational design problems. *M.Sc. thesis*, London: University College London (UCL).
- Hanson, J. (2001). Morphology and design: Reconciling intellect, intuition, and ethics in the reflective practice of architecture. *Proceedings of the third International Space Syntax Symposium*, Atlanta: Georgia Institute of Technology, 06:1-06:18.
- Hanson, J. (2003). *Decoding Homes and Houses*. Cambridge: Cambridge University Press.
- Hertzberger, H. (2005). *Lessons for students in architecture*. 010 Publishers.
- Hillier, B., Hanson, J. & Peponis, J. (1987). Syntactic Analysis of Settlements. *Architecture and Behavior*, 3 (3), 217-231.
- Hillier, B., & Hanson, J. (1988). *The social logic of space*. Cambridge: Cambridge University Press.
- Hillier, B. (1993). Specifically Architectural Theory: A Partial Account of the Ascent from Building as Cultural Transmission to Architecture as Theoretical Concretion. *Harvard Architectural Review*, Rizzoli International Publications, Inc., Volume 9.
- Hillier, B. (2007). *Space is the machine: A configurational theory of architecture*. London: Space Syntax Laboratory.
- Kırsan, C. (1996). Knowledge-based design model depending on the morphological analysis of 19th century row houses in Istanbul, *M.Sc. Thesis*, Istanbul: Turkey, Institute of Science and Technology (İ.T.Ü).
- Lawrence, R. J. (1990). *Translating anthropological concepts into architectural practice*. In Low, S. M., & Chambers, E. (Eds.), *Housing, Culture and Design: A Comparative Perspective*. University of Pennsylvania

Press.

Manum, B. (1999). Spatial themes among the traditional houses of Turkey. *Proceedings of the second International Space Syntax Symposium*, Brasilia, Vol. 1, 40.1-40.12.

Manum, B. (2005). Generality versus specificity: A Study on the interior space of apartments. *Proceedings of the Fifth International Space Syntax Symposium*. Delft, Holland.

Riley, T. (1999). *The Un-private house*. New York: The Museum of Modern Arts Press.

Robinson, J. W. (2001). Institutional space, domestic space, and power relations: Revisiting territoriality with space syntax. *Proceedings of the third International Space Syntax Symposium*, Atlanta: Georgia Institute of Technology, s2:1-s2:10.

Shoul, M. (1993). The Spatial Arrangements of Ordinary English Houses. *Environment and Behavior*, 25, Jan., 22-69.

Sungur, C. A., & Çağdaş, G. (2003). Effect of Housing Morphology on User Satisfaction. *Proceeding of the fourth International Space Syntax Symposium*, London: University College London, 114:1-114:7.

Ünlü, A. (1999). The syntactic analysis of Turkish houses between 17th and 19th centuries. *Proceeding of the second International Space Syntax Symposium*. Brasilia, Vol. 1, 41:1-41:12.

Witte, N. (2003). *Privacy: Architecture in support of privacy regulation*. M.Sc. thesis, USA: University of Cincinnati.

Table 1. Syntactic resulted data of both traditional and modern house layouts

Traditional (courtyard) houses			
H. L.	MD	RA	RRA
1	2.436	0.291	1.082
2	3.762	0.331	1.322
3	2.821	0.338	1.199
4	3.272	0.303	1.242
5	2.308	0.358	0.861
6	2.788	0.306	1.255
7	2.731	0.204	0.882
8	3.602	0.265	1.325
9	2.724	0.409	1.024
10	3.045	0.302	1.436
	Mean	Mean	Mean
	2.949	0.311	1.163
Modern houses			
H. L.	MD	RA	RRA
1	2.6	0.253	0.95
2	2.892	0.27	1.077
3	3.152	0.251	1.096
4	3.351	0.238	1.197
5	3.258	0.217	1.115
6	2.667	0.215	0.949
7	2.848	0.252	0.941
8	2.719	0.199	0.907
9	2.62	0.213	0.825
10	2.809	0.231	0.988
	Mean	Mean	Mean
	2.892	0.234	1.005

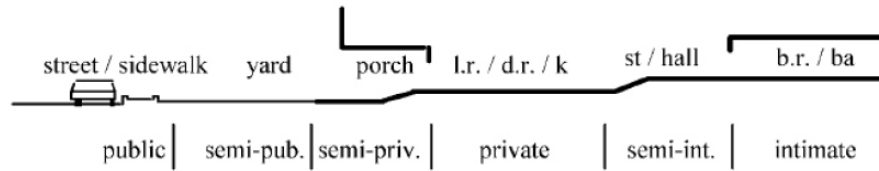


Figure 1. The layers of space within the house and between the house and the street

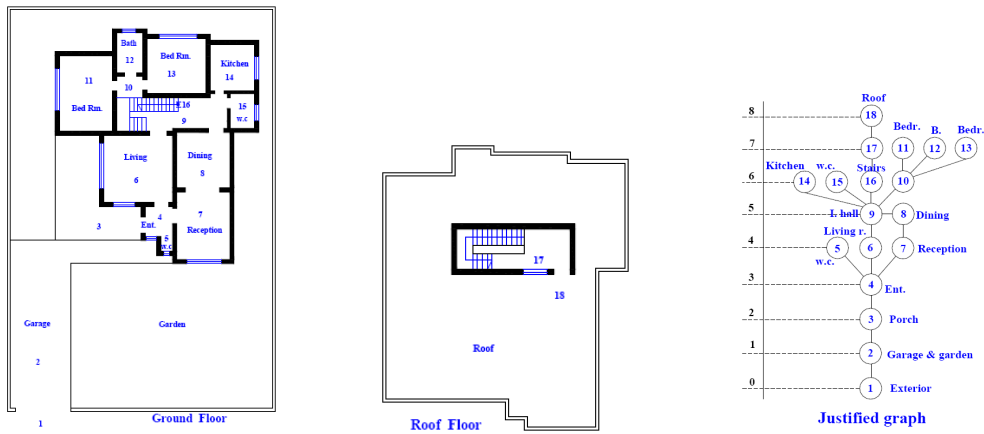


Figure 2. Space Syntax diagram (justified graph) of a house layout in Erbil City

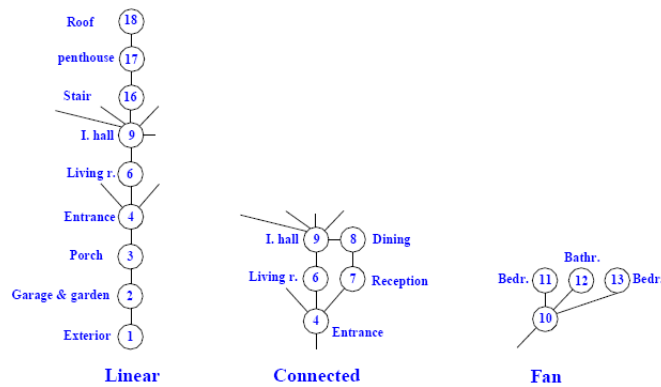


Figure 3. Detailed space syntax diagram of interior spaces within the house showing the sequence of spaces from public to private



Figure 4. Justified permeability graphs of traditional house layouts (Gamma analysis method)



Figure 5. Justified permeability graphs of modern house layouts (Gamma analysis method)



- a) Connecting the spaces directly to the root space : minimum depth
- b) Linear sequence of spaces: maximum depth

Figure 6 (a, b). Symmetry-Asymmetry in spatial relationships
Source: Hillier et al. (1987)