THE SYNTACTIC ANALYSIS OF TURKISH HOUSES BETWEEN 17TH AND 19TH CENTURIES

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41.1

0 Abstract

This paper explores the phenomenon of the circulation area in Turkish houses on the basis of spatial syntax principles. The development process of Anatolian vernacular houses demonstrates specific examples related to past civilizations. Different civilizations used different names for the circulation areas thus tracing significant stages in the development process. On the other hand, the location of the circulation area and its sequencing with other spaces and the notion of privacy are important parameters resulting in the integration or separation of the circulation space with the neighbouring cells. Therefore, the cellular form of the house, its being central or linear in layout, is the main theme of the paper. This assumption is mainly derived from the syntactic relations of cells.

The development process of vernacular houses in Anatolia brings by important results from the perspective of "depth value" and "integration value" between spaces. As a result of modernization and specification of functions, spaces become too integrated and especially in the latest versions of sofa houses, demonstrate a compact formation. Therefore, higher integration values result in compact solutions in the "inner" or "central" type sofa house designs. Conversely, the concept of low integration value in circulation spaces is rooted in the concept of permeability/ impermeability between spaces.

In light of these considerations, the paper discusses the depth, integration and compactness values in relation to the evolution process of "sofa houses". A total of 120 traditional Turkish houses are explored under seven typologies. The comparative analysis of the selected samples has shown that "inner sofa" and "central sofa" type houses have higher values compared to "outer sofa" examples. This comparative analysis concludes that the geometrical formation is not only casual, but it is primarily derived from the existence and location of the core (main circulation) space referred to as "sofa". The formation of space and their depth levels in relation to neighbouring spaces, the notion of accessibility and direction of circulation are other notions that should be considered.

Keywords: Space Syntax,Traditional Architecture, Domestic Space

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1 Introduction

The traditional Turkish house gains a formational enrichment as a result of the integration of the sofa with other spaces. The formation of neighbouring spaces around the "sofa" and the degree of accessibility of surrounding spaces from within the sofa result in such variations as linear or central formations in house typologies. The change in house type from linearity to centrality has become a trend after the 17th century and has continued to the end of the 19th century. In addition, later

versions in sofa houses show the importance of upgrading privacy and specification of functions in spaces.

This paper intends to explore typologies of Turkish houses and primarily the location and relation of the core space with neighbouring cells on the basis of syntactic rules. It also aims to investigate the geometrical formation of the house in accordance with the concepts of depth and integration values.

41.2

2 Diversifications of the core space

The civilizations of Anatolia label the houses according to the name of the main circulation area. "Prostas", "atrium", "portico" or "sofa" are names given to this space which has displayed physical, functional, and symbolic similarities over the ages (Ünlü, 1997).

These types of spaces not only play an integrative role between neighbouring spaces, but they differentiate activities occurring in public and private domains, and at the same time, they reveal a duality between the inside and the outside of the house. In other words, as Lawrence (1990) commented, a house is a symbolic place combining paradoxical concepts that can easily be recognized as "binary codes". Interior and exterior, female and male, private and public, sacred and profane, clean and dirty are some binary codes used to interpret activities and roles of people in spaces.

When we explore the phenomenon of the circulation area in Anatolian vernacular houses and its evolution on the basis of the rules of space syntax, the transition area represented by the "sofa" in the traditional Turkish house has an intrinsic regulatory role in the integration with surrounding cells (Ünlü, 1997). Other circulation areas like the "prostas" or "atrium" of ancient Greeks, and "corridor" in the Roman domus indicate similar integrative roles of the main circulation area with the surrounding cells.

The evolution process of traditional Turkish houses indicates that the outer sofa house is a very common typology especially in the small towns of the countryside (Eldem, 1955; Goodwin, 1971). This type of house also shows similarities with Syrian and Iraqi "riwaq" and "tarma" houses (Ünlü, 1998). This typology is very common in the area and basically originated from Hittite "hilanis" (Ragette, 1974; Naumann, 1978; Yagi,1983; Ünlü, 1992; Ünlü, 1998). This typology led to the realization of original examples by locating the "kiosk" and "lywan" spaces between rooms, especially in latest versions. The geometrical formation is basically linear and comprises many neighbouring cells opening up to the "sofa". The outer sofa is transformed into an "inner sofa" when glass is imported in the 18th century and in houses (Goodwin, 1971). The central sofa type house, where rooms mainly surround as centralized circulation area, becomes very common in the 19th century. This trend seems to be more convenient especially for houses in bigger cities.

3 Definition of syntactic rules

The relationship between the spaces in houses corresponding the period between 17th and 19th century can be examined in the light of three values. These values are indicated as below:

a- "The depth value" (dv) which mainly derived from the location of the cells and their relationship with the main core or circulation area,

b- The permeability of cells and integration of cells based on the notion of accessibility between the cells gives the "integration value" (iv),

c- The orientation of accesses between the cells, the direction and expansion of cells or aggregates gives the "value of compactness" (cv).

The transition space and surrounding cells can be compared to aggregates in mathematics. Each aggregate emphasizes the specific syntactic relationship between cells and each cell determines specification of activities and demarcation of the space. In other words, each spatial aggregate is part of an architectural lexicon. In this way, aggregates imply a relationship between cells and sequentially they can be considered parts of larger aggregates (Hillier, et. al. 1976). If we implement Hillier and Hanson's (1984) gamma-analysis, a cell can be conceptualized as a point and represented as a circle. The linkage with other cells can be indicated by lines. Thus, the cell with a single entrance can be conceptualized as a "unipermeable" point, and the cell with more than one entrance conceptualized as a "bipermeable" or "multipermeabile" unit as shown in Fig. 1 (Ünlü, 1997).

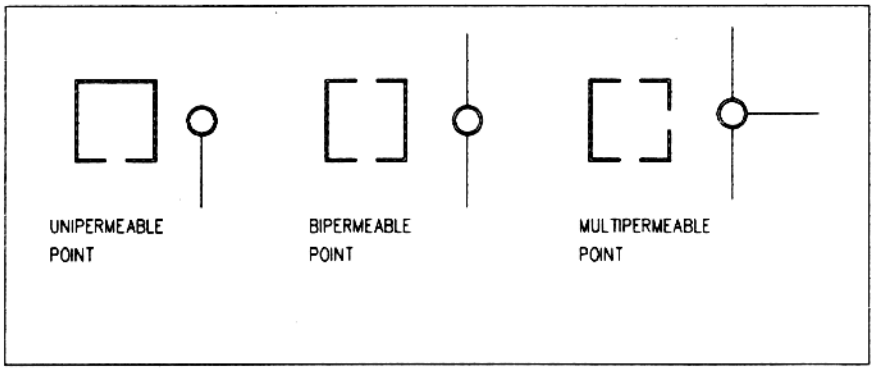

Figure 1. Permeability in Cells (adapted from Hillier, Hanson, 1984)

The starting point for the graph structure here is an area between cells which is assumed as the main circulation area represented as a circle 1. If we consider the sofa as a starting point, a house represents an aggregate comprised of cells. Here all cells are arranged in a linear sequence moving away from the sofa. The sofa here is a "starting point" regulating human movements on the surface and each cell corresponds to the "level of depth" from the sofa. By adding the depth values and dividing the total by the sum of cells in the system, we find the "mean depth of the system". If the mean depth is low, the system can be conceptualized as being, much more compact and considered unspecified in functionality. Higher values correspond to more depth levels according to the sofa as the starting point (1) (Ünlü, 1997).

(1) mean of depth values (MD) = $\frac{\text{depth values in the system } (\Sigma \text{ dv})}{\text{number of cells in the structure (k)}}$

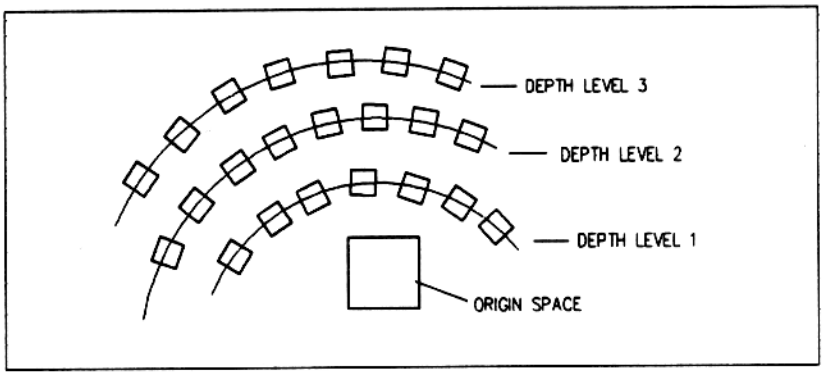

Figure 2 .Depth Levels in Cells

The notion of permeability or accessibility between cells gradually decreases as it moves away from the "sofa". According to this assumption, the integration value between cells is comparatively higher in cells situated on lower depth levels.

Contrarily, cells which are far from the "sofa" present lower integration values despite the fact that their depth levels comparatively are higher. The integration value between cells is not determined by depth levels and the origin space, but the value of permeability clarifies the notion of the integration value. The "value of permeability" between cells gives information about the number of accesses between cells and implies the general notion of integration value of cells in an aggregate.

The integration value for the cell is not significant unless we take into account the value of permeability of the cell. Each cell has a value of permeability, representing the number of entrances. The integration value should be multiplied by 1, 2, 3, ..., n, which represent the number of entrances. A unipermeable cell in this case should be multiplied by "1", a bipermeable unit by "2" and multipermeabilities 3, 4, 5, ..., n, according to number of entrances. If the integration value of cells is low, the general form of the house can be assumed to be a linear in form with a sofa a linear origin space. On the other hand, if the integration value of cells is high, the general form of the house can be assumed to be a compact form with a centrally located circulation area (Ünlü, 1997) (2).

(2) integration value (iv) = $\frac{k}{dv}$ (pv (value of permeability for each cell)

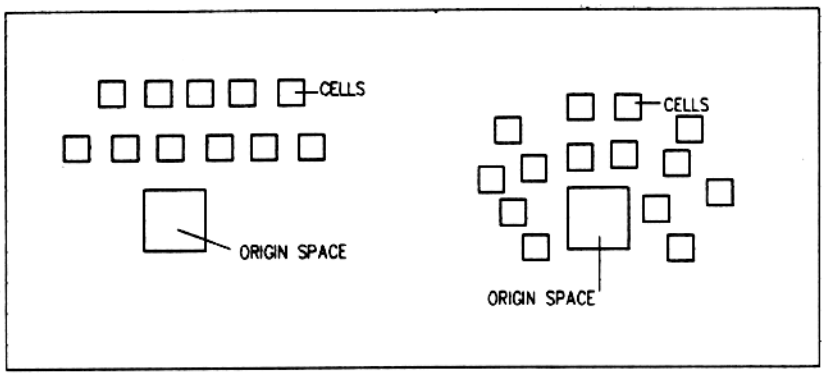

Figure 3. Linearity and Compactness

The geometric form of the house can also be determined by the orientation of the spaces. Each cell has an accessibility value which concords with orientation. With the value of permeability, each cell not only increases value of accessibility, but also emphasizes the value integration in relation to orientation of the cell. For instance, some cells have links in only one direction with each other, others may integrate with each other in four directions. If we assume a multipermeable relationship between cells in four directions, the cells of an aggregate are integrated in a compact form, rather than a linear form. The compact or central scheme of the house is mainly derived from the value of permeabilities and "value of orientation" for integration between spaces. The "value of compactness" can be attained using the formula below (3).

$$\text{(3)} \quad \text{value of compactness } (cv) = \frac{k}{dv} \left(ov \left(\text{value of orientation} \right) \right.$$

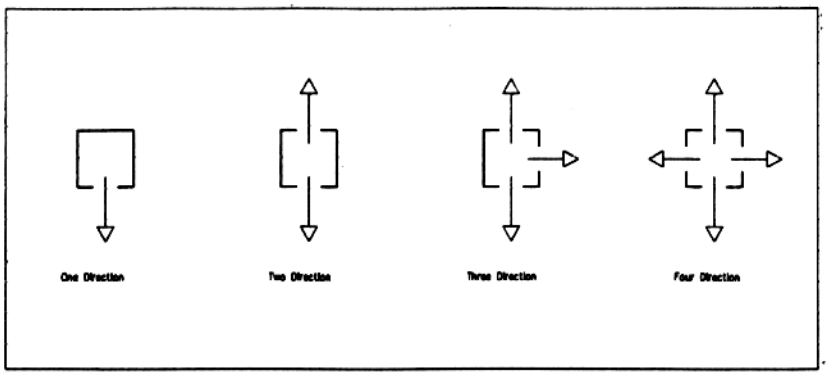

Figure 4. Orientation Values of the Cell for Integration

4 The Research

This research covers 120 traditional Turkish houses. The date of construction for these houses corresponds 17th and 19th centuries. The basic documents for the drawings have been obtained from Eldem's (1955) and Goodwin's (1971) books on traditional houses which were documented in accordance with actual sizes. The graph structure of 77 houses is primarily obtained to investigate outer sofa houses. However, as result of the common typology in Anatolia, we may group five subtypologies in outer sofa houses.

A1- outer sofa houses with two rooms,
A2- outer sofa houses with multi rooms,
A3- outer sofa houses with lywans,
A4- outer sofa houses with kiosks,
A5- outer sofa houses with kiosks and lywans.

The graph structures of 22 houses are analysed in inner sofa houses, and 21 houses are taken as sample for central sofa houses. As indicated in syntactic rules, graph structures for each typology are primarily obtained, and then the depth values (dv), integration values (iv) and values of compactness (cv) are determined. The typologies present the results indicate below.

4.1 A1- Outer sofa house with two rooms

This typology is the most common in Anatolia. It shows a linear expansion and development. The mean score of depth values is 1.80, integration value is 3.72, and compactness value is 3.09. The ideal scheme for this typology and mean scores of the analysis are indicated in Fig. 5 and Table 1.

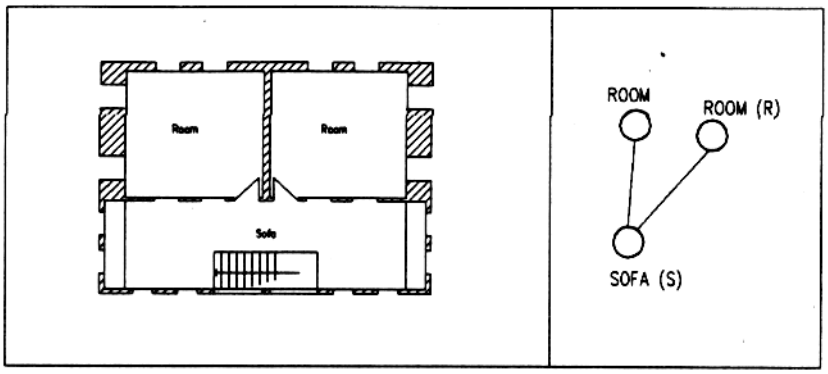

Figure 5. A house in Mudanya, 17th century

TABLE 1

Sample No:	*Century*	*Location*	*dv Depth Value*	*(k/dv) x pv Integration Value*	*(k/dv) x ov Compactness Value*
1	18	Antalya	2.0	3.83	3.83
2	18	Kula	1.8	6.0	5.0
3	19	Istanbul	2.0	3.83	3.83
4	17	Ankara	1.66	3.0	2.0
5	17	Mudanya	1.66	3.0	2.0
6		Bursa	1.66	3.0	2.0
7	17	Bursa	1.66	3.0	2.0
8		Bursa	1.66	3.0	2.0
9	18	Izmit	2.2	4.67	6.67
10	18	Sapanca	2.0	5.33	4.33
11		Antalya	1.66	3.0	2.0
12	18	Gebze	1.66	3.0	2.0
13	18	Manisa	1.66	3.0	2.0
14	18	Bergama	1.66	3.0	2.0
15	18	Istanbul	1.66	3.0	3.0
16		Rodos	2.33	5.92	4.92
n=16		MEAN	1.80	3.72	3.09

Table 1. Outer Sofa Type Houses - (Two-Room Type)

4.2 A2- Outer sofa house with many rooms

This typology is the expanded model of A1, and also shows linear expansion and development. The mean score of the depth value is 1.81, integration value 5.65, and compactness value is 4.1. The ideal scheme for this typology and mean scores of the analyses are indicated in Fig. 6 and Table 2.

Figure 6 . A house in Aksehir, 19th century

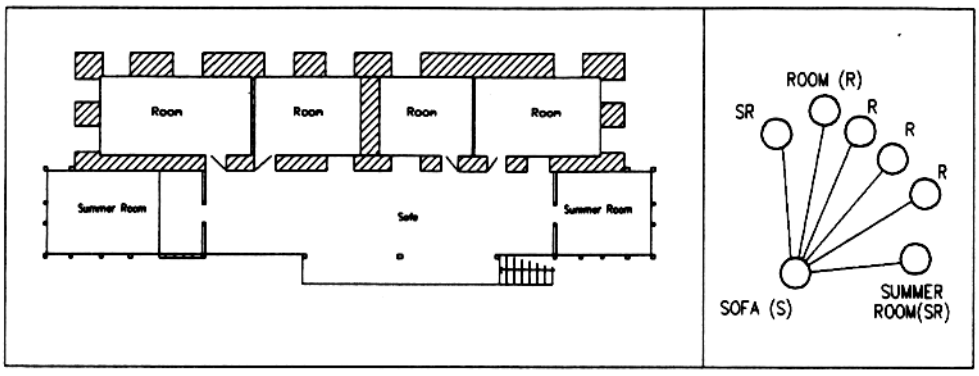

TABLE 2:

Sample	*Century*	*Location*	*(dv) Depth Value*	*(k/dv) x pv Integration Value*	*(k/dv) x ov Compactness Valueness*
1		Tarsus	1.75	4.5	2.5
2	18	Rodos	1.75	4.5	2.5
3	19	Antalya	1.75	4.5	2.5
4	19	Ak¸ehir	1.86	9.0	6.0
5		Diyarbak˝r	1.75	4.5	4.5
6	17	Vezirk˛pr¸	1.75	4.5	4.5
7		Tire	1.75	4.5	4.5
8	18	Bergama	1.80	6.0	5.0
9	18	Kula	1.80	6.0	5.0
10		›zmir	1.75	4.5	4.5
11	19	›stanbul	2.14	7.67	6.17
12	19	Bergama	1.75	4.5	4.5
13		Zagora	1.80	6.0	5.0
14		÷demi¸	1.75	4.5	2.5
15	18	Tekirda	1.80	6.8	3.8
16	19	Yenik˛y	1.83	8.5	4.5
17	17	Tekirda	2.0	6.83	3.33
18		K¸tahya	1.75	4.5	2.5
n=18		MEAN	1.81	5.65	4.1

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Table 2. Outer Sofa Type Houses - (Multi-Room Type)

4.3 A3- Outer sofa house with lywan

This typology contains semi-closed spaces between rooms. These spaces are mostly raised platforms, and they are the expanded part of the origin space, the sofa. The mean score of depth value especially for this typology is 1.89, integration value 4.38, and compactness value is 3.6. This typology shows higher depth values (Fig. 7 and Table 3).

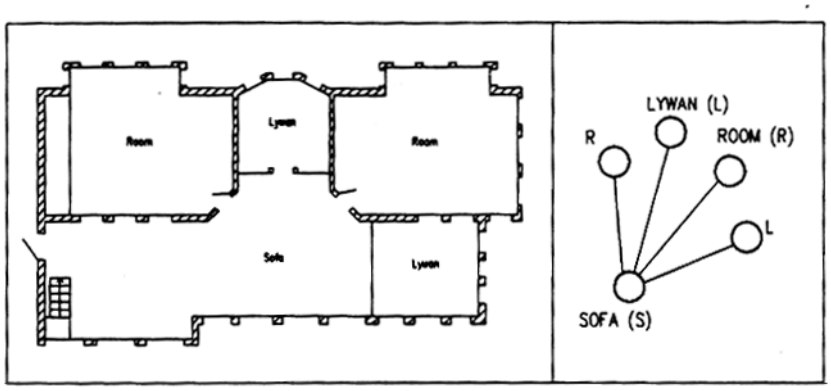

Figure 7. A house in Edirne, 18th century

TABLE 3

Sample No:	*Century*	*Location*	*(dv) Depth Value*	*(k/dv) x pv Integration Value*	*(k/dv) x ov Compactness Value*
1	17	Bursa	1.66	3.0	3.0
2	17	Mudanya	1.66	3.0	3.0
3		Yeni¸ehir	1.66	3.0	3.0
4		Zagora	1.75	4.5	4.5
5		Adana	1.75	4.5	3.5
6		Diyarbak˝r	1.66	3.0	3.0
7		Tarsus	1.66	3.0	2.0
8		Adana	1.66	3.0	3.0
9	17	Tire	1.66	3.0	3.0
10	17	›stanbul	1.83	7.5	4.5
11	18	Edirne	1.75	4.5	4.5
12		Bursa	1.66	3.0	3.0
13	19	›stanbul	2.0	5.33	4.33
14		Edremit	1.75	4.5	4.5
15		›zmir	1.66	3.0	3.0
16	17	›stanbul	2.5	8.92	5.92
17		Urfa	1.83	7.5	3.5
n=17		MEAN	1.89	4.38	3.60

Table 3. Outer Sofa - Lywan Type Houses

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4.4 A4- Outer sofa house with kiosk

The geometric form of this typology presents compactness characteristics. The main circulation area, sofa is formed as a deep space between rooms, and there is always a protruding or cantilevered semi-open space referred to as "kiosk". This typology is very common especially in the traditional houses of West Anatolia in the 18th and 19th centuries. The mean score of the depth value for this typology is 1.93, integration value 8.19, and compactness value is 5.53 (Fig. 8 and Table 4).

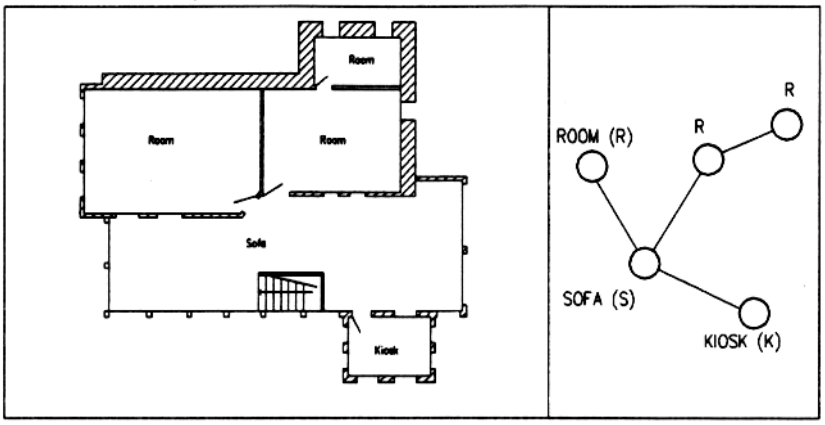

Figure 8. A house in Kula in 18th century

TABLE 4

Sample No:	*Century*	*(dv) Location*	*(k/dv) x pv Depth Value*	*(k/dv) x ov Integration Value*	*Compactness Value*
1	18	Kula	2.0	6.83	4.83
2		Kula	1.75	5.0	3.5
3		Keraiye ?	1.80	6.0	4.0
4	18	Kula	2.0	4.83	4.33
5	19	›stanbul	2.36	12.42	8.92
6	18	Eski¸ehir	1.80	6.0	4.0
7	19	Bergama	1.86	10.5	7.5
8	18	Bursa	1.80	6.0	5.0
9	19	›stanbul	2.25	9.83	8.83
10		U¸ak	1.88	10.5	5.5
11	19	U¸ak	1.89	12.0	6.0
12	18	Kula	1.83	7.5	4.5
13	18	Kula	1.86	9.0	5.0
n=13		MEAN	1.93	8.19	5.53

TABLE 4
Outer Sofa - Kiosk Type Houses

4.5 A5- Outer sofa house with lywans and kiosk

This is the most developed typology of outer sofa examples in Anatolia. The "L" or "U" types with more than five rooms are typical examples mostly found in west and central Anatolia. The mean score of the depth value for this typology is 1.90, integration value 9.2, and compactness value is 6.56 (Fig. 9 and Table 5).

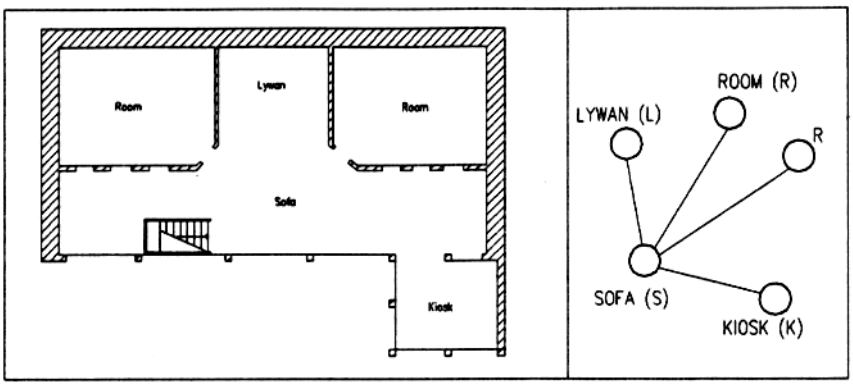

Figure 8. A house in Tire, 18th century

Table 5

Sample No:	*Century*	*Location*	*(dv) Depth Value*	*(k/dv) x pv Integration Value*	*(k/dv) x ov Compactness Value*
1	19	Mara¸	1.75	4.5	4.5
2	19	Bursa	1.75	4.5	4.5
3		Tire	1.80	6.0	6.0
4		Kula	1.75	4.5	4.5
5	18	Ambekkia	1.86	9.0	7.0
6	17	Keraiye	1.83	7.5	6.5
7	17	Keraiye	1.83	7.5	5.5
8		Tire	2.33	9.75	7.75
9	19	Kula	1.89	8.0	4.67
10	18	Birgi	1.88	10.5	7.5
11		Antalya	2.10	12.17	9.17
12	19	Antalya	1.90	14.5	7.5
13	19	Usak	2.06	21.16	10.16
n=13		MEAN	1.90	9.20	6.56

41.9

Table 5. Outer Sofa - Kiosk / Lywan Type Houses

4.6 B. Inner sofa houses

This typology is the most developed and common one especially in bigger cities of the 19th century. The integration between spaces is comparatively higher. There is an upgrading in privacy and functional specification in spaces from the sofa to neighbouring spaces. The mean score of depth value is 2.13, integration value 10.14, and compactness value is 6.79 (Fig.10 and Table 6)

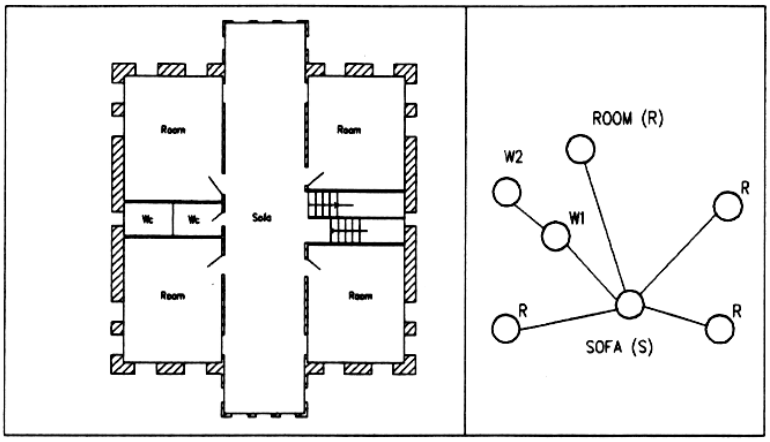

Figure 10. A house in Konya, 19th century

TABLE 6

Sample No:	Century	Location	(dv) Depth Value	(k/dv) x pv Integration Value	(k/dv) x ov Compactness Value
1		‹sk¸p	1.89	12.0	8.0
2		Vezirk^pr¸	2.62	14.75	10.67
3		Ere li	1.86	9.0	5.0
4	18	›stanbul	1.83	7.5	4.5
5	19	Usak	1.83	7.5	4.5
6	19	Konya	1.83	7.5	4.5
7	19	Ankara	2.13	9.17	5.67
8	19	›stanbul	2.50	12.58	8.58
9	19	Ankara	2.57	7.67	5.67
10	19	›stanbul	1.86	9.0	5.0
11	19	›stanbul	2.72	13.92	10.75
12	19	›stanbul	2.0	14.33	6.83
13		›stanbul	2.29	7.0	6.0
14	18	‹sk¸p	1.9	13.5	7.5
15		›zmit	2.0	8.33	5.33
16	19	Bolu	2.0	9.83	5.83
17	18	Edirne	2.75	8.74	5.74
18		Istanbul	1.86	6.5	6.5
19	19	Istanbul	2.0	15.83	9.33
20	19	Istanbul	2.63	12.03	10.03
21	19	Kula	1.86	9.0	7.0
22	18	Izmit	1.83	7.5	6.5
n=22		MEAN	2.13	10.14	6.79

Table 6. Inner Sofa Type Houses

41.10

4.7 C. Central sofa houses

This is the most developed example in which the design philosophy emerges as a central circulation area and surrounding spaces. In some examples, the core space, sofa is elliptical in shape. The mean score of the depth value is 2.07, the integration value 12.70, and compactness value 8.51 (Fig.11 and Table 7).

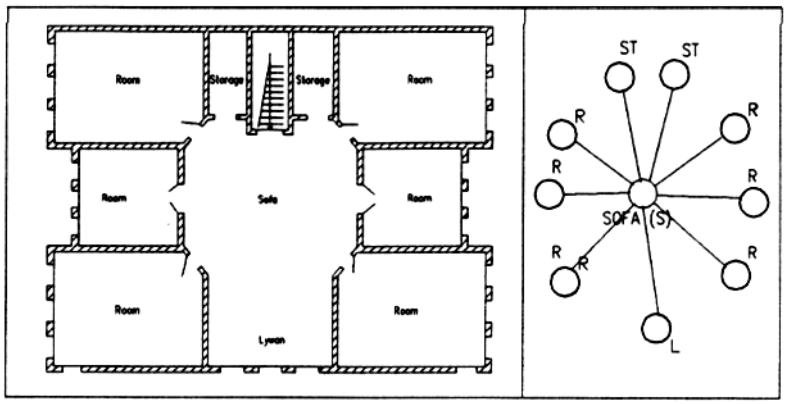

Figure 11. A house in Istanbul, 19th century

Table 7

Sample No:	*Century*	*Location*	*(dv) Depth Value*	*(k/dv) x pv Integration Value*	*(k/dv) x ov Compactness Value*
1	19	›stanbul	1.88	10.5	6.5
2	19	Bolu	2.09	13.17	9.17
3	19	›stanbul	1.89	18.0	10.0
4	18	›stanbul	1.88	10.5	6.5
5	19	›stanbul	1.90	13.5	8.5
6	19	›stanbul	2.42	13.08	8.58
7		Bolu	2.0	11.33	7.33
8		Vranga ?	1.90	13.5	7.5
9	18	›stanbul	2.17	14.5	10.0
10	19	›stanbul	2.18	12.5	8.5
11	18	Filibe	2.11	10.67	8.67
12		Bolu	2.25	8.91	5.91
13	18	Kerriye ?	1.86	9.0	6.0
14	19	Ankara	2.18	14.0	9.0
15	19	Filibe	2.0	9.33	7.33
16	19	Bulgaristan	1.88	12.5	8.5
17		Bursa	2.0	12.83	7.83
18	19	›stanbul	2.09	14.67	8.67
19	19	›stanbul	1.88	7.5	6.5
20	18	›stanbul	2.44	19.33	15.33
21	19	›stanbul	2.5	17.34	12.34
n=21		MEAN	2.07	12.70	8.51

Table 7
Central Sofa Type Houses

If we evaluate the mean scores of depth value, integration and compactness values presented in Table 8, all mean scores are higher in centrally located sofa typologies compared to linear located ones. This also shows that the linear based aggregates are converted to central type aggregates in developed types. The integration between cells in an aggregate becomes higher as a result of the centralization of the origin space, in other words, the main circulation area. This also emphasizes that especially in developed examples the aggregate tends to be a centralized and compact formation rather than in a linear formation (Table 8).

Table 8

Typology	*Depth Value*	*Integration Value*	*Compactness Value*
Outer Sofa (2-RoomType)n=16	1.8	3.72	3.09
Outer Sofa (Multi RoomType) n=18	1.81	5.65	4.1
Outer Sofa (LywanType)n=17	1.89	4.38	3.60
Outer Sofa (KioskType)n=13	1.93	8.19	5.53
Outer Sofa (Lywan/KioskType)n=13	1.90	9.20	6.56
Inner Sofa n=22	2.13	10.14	6.79
Central Sofa n=21	2.07	12.70	8.51
Σn=133			

Table 8. Comparison of Traditional Turkish Houses based on Depth, Integration and Compactness Values, Mean Scores

41.11

5 Conclusion

This paper explores the relationship between spaces and the main circulation area. In this research, the depth level, the integration level and the orientation level of permeability between spaces are important parameters in the conversion of linear based types to central based ones. This syntactic assumption has been implemented in traditional Turkish houses between 17th and 19th centuries, and values like integration, depth and compactness are found to be comparatively higher in inner and central sofa houses. The analysis presented in this paper is not casual, but it is the result of cellular relations of an aggregate. The depth level and manner which determine the quality of cellular relations and how these relations cause to changes in the formation of an aggregate are considered as main reasons for typological changes.

6 References

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41.12