ANALYZING VISIBILITY STRUCTURES IN TURKISH DOMESTIC SPACES

Yasemin İnce Güney
Faculty of Engineering and Architecture, BAU

Abstract
Visibility refers to visual information provided to observers at any given location and is directly related to the geometry of space as much as to the movement of observer. In buildings in general and houses in particular, information control achieved through visual fields are part of privacy-territory building mechanisms that aim to regulate the amount and level of interpersonal interaction between inhabitants, and inhabitants and visitors. This paper presents the results of visibility analysis conducted on a sample of 108 Turkish apartment plans that had previously been examined in terms of permeability to understand the transformation of Turkish housing over the 20th century (Güney, 2005a). For visibility analysis, two software programs are used: Depthmap, developed by Alasdair Turner at UCL, and Syntax 2D program, developed by James Turner at the University of Michigan. The analysis has shown that spatially and visually the most integrated spaces coincide with each other for all three groups. The analysis also indicate that visibility characteristics of the houses enhance its special characteristics and thus the changes that are not apparent in permeability analysis might be clearly seen when examined in terms of visibility structures. This is because of the additional visibility measures that take into account variables that permeability analysis itself is not able to, such as the size of the opening between different functional spaces. These results corroborate the findings of earlier research and suggest that visibility structures work together and enhance the permeability structures to interface and distance different kinds of relationships.

Introduction
Architecture might be defined as the process of giving definitions to otherwise undefined space by providing boundaries. The boundaries used to define spaces may be dynamic, like swinging doors, or static, like walls. They may be transparent, like glass windows, or opaque, like brick walls. Whatever the nature of the boundaries, once defined, they provide a structure that distinguishes inside and outside. Depending on the nature of the boundaries, the accessibility, i.e. permeability, and visibility between inside and outside can be controlled. Both permeability - where you can go - and visibility - what you can see - directly affects how buildings in general and houses in

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Yasemin İnce Güney
MMF - BAU,
Bandırma Cad. 73/7 Merkez,
Balıkesir 10020, Turkey
yince@umich.edu
particular work spatially and how they are experienced by their occupants, inhabitants as well as visitors.

The concept of visibility is based on Benedikt’s method of describing space taking into account the perception of the moving observer, which is referred to as the ‘isovist.’ Benedikt defines the isovist as “the set of all points visible from a given vantage point in space and with respect to an environment” (Benedikt, 1979, p.47). Visibility analysis suggests that visual fields have their own form that result from the interaction of geometry and movement, and that the shape and size of the isovist is especially significant in relation to the information provided to the observer.

In urban environments and complex buildings, the amount of information provided by visual fields might help the moving subject to decide where to go next. In buildings in general and houses in particular, the role of visual fields is also directly related to the control of information provided to inhabitants and visitors. The control of permeability and visibility serves the need for privacy to regulate interpersonal interactions. Furthermore, privacy can be achieved by the establishment of territories, defined by means of physical or invisible boundaries. Physical boundaries can be marked by culturally coded semi-fixed symbolic objects, or by fixed barriers that limit movement, i.e. controlling permeability. The invisible boundaries can be marked by universal or culturally coded behavior mechanisms, such as avoiding eye contact, or by controlling the visual information provided by means of physical boundaries, i.e. controlling visual fields.

In houses, information control achieved through visual fields can be described as part of ‘privacy-territory’ building mechanism that aims to regulate the amount and level of interpersonal interaction between inhabitants, and inhabitants and visitors. Furthermore, even though the need for privacy is a universal characteristic of human beings, it is also moderated culturally. Therefore examining the visibility structures in houses can help in understanding the privacy level accepted by a culture, which might further indicate social aspects like what’s accepted as intrusion or distraction, as well as signs of status and authority. Donald Sanders’ (1990) study of the Bronze Age settlement of Myrtos, Crete is an earlier example that incorporated visibility to the analysis of domestic spaces, though not necessarily within a space syntax approach. Tahar and Brown’s (2003) study of traditional M’zambite houses is a more recent study that utilized space syntax methodology to analyze visibility as well as accessibility of domestic spaces.

It is important to examine visibility structures for the study of the social-cultural aspects of domestic spaces. This paper presents the results of visibility analysis conducted on a sample of 108 Turkish apartment plans that had previously been examined in terms of permeability to understand the transformation of Turkish housing over the 20th century (Guney, 2005a).

The Notion of Visibility in Space Syntax Research

Benedikt suggests that when an environment is defined by isovist fields, one is able to “assess some basic spatial qualities of environments whose conscious or unconscious apprehension may guide or underlie ‘higher’ cognitions and behaviors, and to create a basis for or a contribution to a fuller description of the environment” (Benedikt, 1979, p.52). Benedikt’s study inspired a number of researchers to examine the significance of isovists for spatial perception. Hillier and Hanson (1984) introduced visibility relationships into graph analysis of buildings and urban systems as part of the space syntax research agenda. They suggested constructing the
fewest and longest lines of sight and access in a system that traversed all the convex spaces constituting the system. They called these lines ‘axial lines’ and by subjecting them different quantifications, they were able to express the nature of circulation paths in terms of lines of sight. The drawback of this method was its dependence on convex spaces, which were not produced totally objectively. Peponis et al. (1997, 1998) suggested m-lines and e-lines as a more rigorous way to produce axial lines objectively. Movement lines, or m-lines, represent the minimum path that a moving observer needs to cover so that all surfaces have become visible from at least one point. The set of these lines produce what they called the ‘linear visibility map.’ End-point partition lines, e-lines, create discrete informationally stable units of space.

Other studies focused on examining architects’ way of exploring the relationship between visibility and permeability through spatial layering, transparency, the inter-penetration of volumes and the dissolving of boundaries, while some others tried to explicate the role of visibility in manifesting the social logic behind houses (Hanson, 1998). Some recent studies, on the other hand, examined the significance of visual fields in observers’ perception and decisions albeit in virtual environments (Conroy-Dalton, 2003).

To analyze the visibility structures a number of computer programs have been introduced. One of them is the Spatialist program developed by Peponis et al in Georgia Tech, in which e-lines have been automatically generated and convex spaces created by them, e-spaces, colored accordingly. The main problem with using e-space analysis is the quite high number of e-spaces, which makes it hard to makes sense of the data. Another program, which is developed at University College London by Alasdair Turner (2003), is called Depthmap. The program divides any given plan into a grid, whose size can be determined by the user, and enables to generate and examine the visibility graph representing visible connections between different point-locations at the center of each grid. Syntax 2D program, developed by James Turner at the University of Michigan (2005), is a more recent program that is still under development. It is significant to note that this program is a vector-based program that considers the geometry of the plans and can calculate various measures of the isovist field, such as its area at any given point on the fly.

Visibility Analysis

The sample consists of 108 apartment house plans that are all designed by Turkish architects and cover the period between the 1920s and the end of the 1990s. The number of houses per each decade is given in Figure 1. The Spatialist program has been utilized to conduct convex space, s-space and e-space analysis. Figure 2 demonstrates sample house plans colored according to convex space, s-space, and e-space integration values respectively.

![Figure 1: House counts per decade](image)
Based on permeability analysis, this longitudinal series of house plans are grouped into three genotypes: the houses of 1920s with no sector differentiation and one entrance; the houses of 1930s-1960s with different sectors with multiple entrances; and the houses of 1970s-1990s with different sectors and single entrance (Guney, 2005a).

Depthmap program has been utilized for the visibility analysis of the houses. The summary permeability and visibility integration and related visibility data for each decade is given in Table 1. The visibility integration (VI) values are highest for houses from the 30s and the 40s with 21.66 and 22.61 respectively. The houses of the 20s have the next higher VI value followed by the 90s and the 50s; 20.38, 19.59, and 19.16 respectively. The houses of the 60s have the lowest VI value with 18.18. It can also be seen that the houses of the 90s have higher permeability integration (PI) as well as higher VI value from the preceding decades. Three exemplary house plans per each decade colored according to visual integration as taken from the Depthmap are also given in Figure 3. It is important to note that, when the e-space integration is compared with visual integration, it could be seen that the e-space integration colors the plan in a very similar way as Depthmap does.

**Table 1:**
Data summary for visual analysis using Depthmap

<table>
<thead>
<tr>
<th>Decades</th>
<th>PI (HH)</th>
<th>VI</th>
<th>MD</th>
<th>GS</th>
<th>C.Coeff</th>
<th>V.Contr</th>
<th>Entropy</th>
<th>R.Entropy</th>
<th>M.I.</th>
<th>M.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20s</td>
<td>1.18</td>
<td>20.38</td>
<td>2.20</td>
<td>1689.80</td>
<td>0.77</td>
<td>0.31</td>
<td>1.45</td>
<td>2.23</td>
<td>4.49</td>
<td>89.14</td>
</tr>
<tr>
<td>30s</td>
<td>1.09</td>
<td>21.66</td>
<td>2.09</td>
<td>1313.65</td>
<td>0.74</td>
<td>0.34</td>
<td>1.45</td>
<td>2.18</td>
<td>4.91</td>
<td>84.82</td>
</tr>
<tr>
<td>40s</td>
<td>1.18</td>
<td>22.21</td>
<td>2.03</td>
<td>1163.13</td>
<td>0.74</td>
<td>0.34</td>
<td>1.41</td>
<td>2.17</td>
<td>3.79</td>
<td>81.85</td>
</tr>
<tr>
<td>50s</td>
<td>1.09</td>
<td>19.16</td>
<td>2.32</td>
<td>1829.57</td>
<td>0.76</td>
<td>0.34</td>
<td>1.56</td>
<td>2.22</td>
<td>4.57</td>
<td>89.16</td>
</tr>
<tr>
<td>60s</td>
<td>0.96</td>
<td>18.18</td>
<td>2.33</td>
<td>1650.63</td>
<td>0.77</td>
<td>0.33</td>
<td>1.90</td>
<td>2.22</td>
<td>4.81</td>
<td>91.21</td>
</tr>
<tr>
<td>70s</td>
<td>0.93</td>
<td>18.50</td>
<td>2.37</td>
<td>1773.60</td>
<td>0.78</td>
<td>0.36</td>
<td>1.64</td>
<td>2.22</td>
<td>5.63</td>
<td>84.65</td>
</tr>
<tr>
<td>80s</td>
<td>0.92</td>
<td>18.28</td>
<td>2.37</td>
<td>2224.91</td>
<td>0.78</td>
<td>0.37</td>
<td>1.66</td>
<td>2.21</td>
<td>3.03</td>
<td>96.69</td>
</tr>
<tr>
<td>90s</td>
<td>1.05</td>
<td>19.59</td>
<td>2.22</td>
<td>1548.07</td>
<td>0.77</td>
<td>0.36</td>
<td>1.96</td>
<td>2.18</td>
<td>3.08</td>
<td>79.93</td>
</tr>
</tbody>
</table>

As can be seen from the charts in Figure 4, when the houses are grouped into four, the PI values for the second and the third groups do not change considerably as compared to when the houses are grouped into three. However, the changes in VI values, when the houses are grouped into four, show a considerable difference between the groups as compared to when the houses are grouped into three. It is important to note here that, during the permeability analysis, there were other variables in addition to PI values that were...
considered to group the houses into three, such as the space types seen in the houses from each decade (Guney, 2005a; Guney, 2005b). The difference of VI values in grouping houses might be due to the double-, triple-, or four-door-sized openings that are very common to find in the houses from the 30s and the 40s. The permeability analysis was not able to account for the size of the openings as it only takes into account if there is or is not an access between spaces. It seems that the visibility analysis was able to pick on the size of the openings between spaces and objectify and demonstrate it via visibility integration values. Thus it can be suggested that when grouping the houses together, visual analysis offers additional measures that take into account variables that permeability analysis itself is not able to.

The visibility analysis conducted using Depthmap program also offers some specific measures that represent local and global visual characteristics of the houses. In Figure 5, sample apartment plans colored according to visual control (VC), isovist maximum radial (MR), relativized entropy (RE) and clustering coefficient (CC) values, as taken from the Depthmap program, is provided. The local measure visual control gives us locations that have the maximum visual control, i.e. spaces that might be called controlling (Turner, 2003). As demonstrated in Figure 5, the locations with high visual control values include central spaces, such as the main hall in Alatas house from the 20s or Kinaci house from the 30s, or spaces in corridors where there are doors or at the intersection of different corridors, such as Erguven house from the 70s or Lebelya house from the 90s. Isovist maximum radial measure indicates the distance to the furthest visible point from each node. As can be seen from the figure, in the house from the 20s, most locations within the house are colored red, while in the houses from the 40s and the 90s the red locations are rather limited. Entropy and Relativized Entropy (RE) are global measures that indicate how ordered a system is from a location, i.e. they provide global information available from that location. As can be seen from Figure 5, central spaces with higher areas have lower RE values (colored blue) which indicate that the system is rather ordered from these locations as there is more information; in other words the system is rather easy to traverse starting from these locations. The spaces that require higher number of turns to traverse the system have higher RE values (colored red) indicating that the global information from these locations is limited. The last row in the figure indicates Clustering Coefficient (CC) values. CC is a local measure that indicates how visual information is changing within the system; a measure that can detect the junction points in an environment. It is interesting to note that, as can be seen from the figure 4 and 5, CC colors the plan very similar to visual integration, only with reverse toning highlighting visually the most integrated locations with blue.

### Table 2:
Summary data for groups of 3 and 4 respectively

<table>
<thead>
<tr>
<th>Groups</th>
<th>PI (HH)</th>
<th>GS</th>
<th>VMD</th>
<th>VI Int</th>
<th>CCof</th>
<th>VContr</th>
<th>Entropy</th>
<th>RE Entropy</th>
<th>MI</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Group</td>
<td>1.18</td>
<td>1689.80</td>
<td>2.20</td>
<td>20.38</td>
<td>0.77</td>
<td>0.31</td>
<td>1.45</td>
<td>2.23</td>
<td>4.49</td>
<td>89.14</td>
</tr>
<tr>
<td>2.Group</td>
<td>1.09</td>
<td>1539.25</td>
<td>2.20</td>
<td>20.30</td>
<td>0.75</td>
<td>0.34</td>
<td>1.51</td>
<td>2.20</td>
<td>4.52</td>
<td>86.76</td>
</tr>
<tr>
<td>3.Group</td>
<td>0.97</td>
<td>1848.86</td>
<td>2.32</td>
<td>18.79</td>
<td>0.75</td>
<td>0.38</td>
<td>1.75</td>
<td>2.20</td>
<td>4.18</td>
<td>87.09</td>
</tr>
<tr>
<td>1.Group</td>
<td>1.18</td>
<td>1689.80</td>
<td>2.20</td>
<td>20.38</td>
<td>0.77</td>
<td>0.31</td>
<td>1.45</td>
<td>2.23</td>
<td>4.49</td>
<td>89.14</td>
</tr>
<tr>
<td>2.Group</td>
<td>1.14</td>
<td>1236.40</td>
<td>2.06</td>
<td>21.94</td>
<td>0.74</td>
<td>0.34</td>
<td>1.43</td>
<td>2.18</td>
<td>4.35</td>
<td>83.34</td>
</tr>
<tr>
<td>3.Group</td>
<td>1.04</td>
<td>1840.10</td>
<td>2.33</td>
<td>18.67</td>
<td>0.77</td>
<td>0.34</td>
<td>1.58</td>
<td>2.22</td>
<td>4.69</td>
<td>90.19</td>
</tr>
<tr>
<td>4.Group</td>
<td>1.05</td>
<td>1848.90</td>
<td>2.32</td>
<td>18.79</td>
<td>0.75</td>
<td>0.38</td>
<td>1.75</td>
<td>2.20</td>
<td>4.18</td>
<td>87.09</td>
</tr>
</tbody>
</table>


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To further examine the interplay between permeability and visibility, three exemplary houses are selected from each decade for a detailed analysis of functional spaces within the houses. The selected houses are shown in Figure 3, in which they are colored according to their visibility integration values. The charts given in Figure 6 indicate the mean values of permeability integration, visibility integration, visibility relative entropy and visual controllability for cooking, living, receiving, master bedroom and entry hall. The isovists generated at the center of functional spaces using Syntax 2D program are given in Figure 7.

The first line in Figure 6 refers to cooking spaces. As observed from the charts, in the houses of the 20s the cooking spaces have the highest PI values and lowest VI values. The charts indicate that even though permeability integration for cooking spaces has an increasing tendency, the visibility integration has a decreasing one. Even in the houses with the highest integration values, the houses of the 30s and the 40s, cooking spaces have rather limited visibility as can be observed in Figure 7. It is also observed that, within time, living spaces become less integrated in terms of both permeability as well as visibility. Living spaces and master bedroom show rather similar changes of PI and VI values over time, except the 90s when the master bedroom becomes more integrated in terms of permeability.

Entry hall PI values change quite a bit at different decades but still it can be seen that there is a tendency to increase. Their VI values on the other hand show a general decline. In the houses from the 20s, the entrance door directly opens to the hall in the center of the house giving immediate and unmediated access to the rest of the house and intruding privacy of the household. When isovists at the center of entrance halls are examined it is seen that in the earlier houses these

<table>
<thead>
<tr>
<th>Visual Control</th>
<th>20s_Alatas</th>
<th>30s_Kinaci</th>
<th>50s_hayat</th>
<th>60s_ece</th>
<th>70s_korunen</th>
<th>90s_lebelya</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isovist Maximum Radial</td>
<td>20s_Alatas</td>
<td>40s_anaf80</td>
<td>50s_hayat</td>
<td>60s_ece</td>
<td>80s_korunen</td>
<td>90s_lebelya</td>
</tr>
<tr>
<td>Relativized Entropy</td>
<td>20s_Alatas</td>
<td>30s_Kinaci</td>
<td>50s_petek</td>
<td>60s_ece</td>
<td>80s_sehin</td>
<td>90s_lebelya</td>
</tr>
<tr>
<td>Clustering Coefficient</td>
<td>20s_Alatas</td>
<td>30s_Kinaci</td>
<td>50s_israel</td>
<td>60s_ece</td>
<td>80s_korunen</td>
<td>90s_lebelya</td>
</tr>
</tbody>
</table>

**Figure 5:** Exemplary houses colored according to visual control, isovist maximum radial, relativized entropy and clustering coefficient values as taken from Depthmap.
isovists could see most of the house areas while in time not only that the area of the isovists gets decreased, they can only see the public sector of the houses.

Receiving spaces have the highest PI and VI values in the houses of the 30s and the 40s. This increase, however, in integration values is most probably a result of the change in the overall spatial organization of houses; the houses of the 30s and the 40s have the highest integration values. The isovists at the center of receiving spaces in (Figure 7) also demonstrates the effect of the overall spatial organization for individual functional spaces. It can also be seen from the changes in the visibility relative entropy (VRE) values (Figure 6) that it becomes easier to traverse the houses from the cooking and receiving spaces over the course of time. Living spaces and master bedrooms, on the other hand, become spaces that provide lesser visual information and thus get more difficult to traverse the houses from.

The last column in Figure 6 refers to visual controllability values for each functional space. Controllability measure picks out the areas that may be easily visually dominated. It is different from the control measure that picks out visually controlling spaces that can see more. The controlling spaces are locations that are strategic from the point of view that they are difficult to be controlled. As mentioned earlier, when the colored-house plans are examined in Figure 5, it is recognized that the amount of space that are controlling gets reduced to locations with a much smaller area, usually next to doors in corridors. Controllable spaces, on the other hand, are locations that can be easily seen from other locations but themselves cannot see much. Turner (2001) gives the example of panopticon where the cells are controllable spaces while the center is the controlling one. When each functional space examined individually, cooking in the houses of the 30s and the 40s are the least controllable as compared to cooking spaces in other decades. Moreover, living spaces becomes less controllable in the second half of the nineteenth century, while receiving spaces become more controllable as does the master bedrooms.

The charts for measures related to the geometry of the isovists generated at the center of functional spaces using Syntax2D program.
The measure of occlusivity refers to the proportion of the perimeter lying on the solid boundary of the environment. It is seen from the chart that for all five functional spaces, the occlusivity is the lowest for the houses from the 20s, while it is highest either in the houses from the 30s or the 40s. As can be expected since the houses from the 30s and 40s are the most integrated ones, and there are quite a number of double-, or triple-, or –four-sized-doors in these houses. The third column has the charts for the mean values of the skewness measure. This measure indicates the spikiness of the isovists. Cooking, living and receiving functions have the highest skewness values as can be seen in the figure 7. The last measure, Maximum Radial, refers to isovists longest line of sight possible in the plan.

It is important to recognize that the sample for the analysis of the functional spaces is very limited to three per decade. The rest of the sample also needs to be analyzed in a similar way to examine the visibility structures for each functional space in the houses.
Discussion and Conclusion

In buildings in general and houses in particular, the role of visual fields is related to the control of information provided to observers, including inhabitants as well as visitors. Earlier studies suggested that the visibility structure is often used as a means to ‘fine-tune’ the permeability structure “into a more effective device for interfacing and distancing different kinds of relationship” (Hanson, 1998, p.106) These results of this research corroborate the findings of the earlier research and suggest that visibility structures work together with and enhance permeability structures.

The analysis has shown that spatially and visually the most integrated spaces coincide with each other for all three groups. In the first and second group of houses, spatially and visually the most integrated spaces are central halls called ‘sofa’ where daily activities took place. The main difference between two periods is the location of this central hall. In the first group, the entrance door directly opens to this central hall giving immediate and unmediated access to the rest of the house and intruding privacy of the household. In the second group, this central hall is distanced via introduction of an entrance hall. Later in the third group, the entrance hall becomes one of the spatially and visually the most integrated space. The guest receiving spaces and bedrooms are similar in terms of spatial and visual integration in the first group. In later groups, guest receiving spaces becomes more integrated while the bedrooms become more and more segregated. The kitchen that is segregated both spatially and visually in the first and second group houses becomes more integrated in the third.

In terms of visibility, for the houses from the 30s and the 40s the boundaries of spaces need to be controlled with opening or closing of doors because of the centrality of the plan with a central hall that provides direct access to most of the house that surround it. In later houses of this group, one can see the effort to use visibility to provide some spatial differentiation within the central hall. Although in terms of physical boundaries there is still no difference between the earlier and later examples, the visibility from the entrance door is limited in the later examples.
Furthermore, in the houses from the 30s and the 40s, although there is more division of the space with halls, there are also lots of double- or triple-sized doors between spaces that bring flexibility to the organization that enable to create a big reception space by combining the two rooms and the central hall. The public and semi-public areas of the house can act as one space during special occasions, such as receptions and religious festivals when the doors in between are opened.

The houses from the 30s and the 40s are more symmetrical and have the highest integration within the entire sample. They are supposed to be representing short models according to space syntax terminology, which means they have a tendency to integrate different social categories. However, in these houses the social model is not always a short one, as it depends and changes from occasion to occasion. When the doors are opened to have a bigger reception hall, then the interior becomes a continuum of spaces that are knit together and thus act more integrated. In the daily routine, on the other hand, there are rules governing the behavior, which are different according to categories of people involved. These rules control which doors to open and when, and who is supposed to be in one room and not the other.

The guests, for example, are supposed to go right into the formal guest receiving area without being able to either see or enter the other parts of the house. Therefore, even though receiving spaces have higher VI values, the doors that connect this space to the rest of the house are closed most of the time. The dining is usually located next to the formal area and separated by doors as big as 4 doors wide. It is quite possible that the dinner is made ready and only then the doors between the receiving and dining are opened to enable guests to come and eat, and when dinner is finished the guests could go back to the formal area again and close the doors while the tables are being cleaned. In other words, even though visibility is considered as immediate and unmediated by rules, the door sizes and their uses in the houses from the 30s and the 40s, indicate that a different scenario is also possible, which needs further examination.

The results also indicate that visibility characteristics of the houses enhance their special characteristic and thus the changes that are not apparent in permeability analysis might be clearly seen when examined in terms of visibility structures. One of the main examples for this is the size of the opening between different functional spaces. In terms of PI values, the size of the opening does not have much affect in the calculations. However, they do affect the calculations of visibility structures both in Depthmap analysis of discrete points as well as vector-based Syntax 2D program. In the current research, we were able to pinpoint the differences between the houses from the 30s and the 40s and the houses from the 50s and the 60s. As a result, the grouping of the houses into three, based on PI as well as other values such as space types, could be changed as four groups of houses.

To conclude, the research analyzed visibility structures of nineteenth century Turkish domestic spaces using a number of tools available. The findings of the research indicate that visibility analyses is more sensitive then the permeability analyses as it is able to account for variables that permeability analysis is not able to do so, such as the size of the openings between spaces. The research findings also suggest that there is a difference between houses with high integration values, which have double- or triple-sized doors that can be opened or closed to control the spatial organization, versus other building types such as offices where the integration values may be high, also because of the openness of the plans. In public spaces,
even if there are doors that control accessibility, often they remain open during the regular hours. In houses, on the other hand, one needs to examine the existence of rules governing the behavior of the occupants that might dictate the space use more than the spatial organization.

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