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Following the codes of rationalist architecture through a syntactic analysis of early Turkish examples

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Abstract

Rationalist architecture is mainly based on a structurally and conceptually functionalist design approach using concrete, glass and steel in rectangular forms without any ornament. Focusing on functional constructs and simple forms, rationalist buildings largely carry international and timeless design qualities. They display strong similarities with each other even if they are built in different periods of time. They generally present a defined life style and hardly accommodate elements reflecting social structures, local cultures and personal taste. On the other hand, with the current research background, it is widely accepted that cultural and socio-economic factors have a profound effect in the shaping of the built environment and user's peculiar preferences and life styles are particularly reflected in the home environment.

Within that context, this paper seeks to develop an understanding of the interpretations of the internationally accepted design codes of rationalist architecture on housing practice in different cultures and locales away from where it originates. It focuses on the avant-garde examples of the early 1930s from Turkey and questions to what degree the spatial organization and the syntactic properties in these early modern Turkish examples display similarities with those of the houses which were designed by pioneering Western architects and largely acknowledged by the international academia as the keystone buildings of rationalist architecture.

Space syntax techniques are taken as appropriate means for a comparative analysis of the spatial characteristics of the early modern Turkish examples and the keystone rationalist buildings. In the analysis, UCL Depthmap, Spatial Network Analysis Software is facilitated. With the use of justified graphs and convex map analysis, the order of integration and mean depth values for each functional space are revealed. The findings from the keystone buildings are used as a basis in revealing the syntactic properties of the examples from Turkey which can be taken to reflect the idealized rationalism of the period.

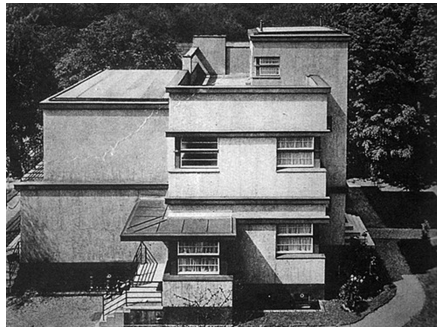
With the findings, it is pointed out that, in spite of a limited number of local traditions displaying a continued line, the syntactic properties of the examples of early modern houses from Turkey present spatial similarities with the keystone buildings of rationalist architecture with their newly developed functional and spatial structures. It is expected that these findings will contribute to the understanding of the interpretations of the internationally accepted design codes of rationalist architecture on housing practice in culturally and socially different environments.

Keywords

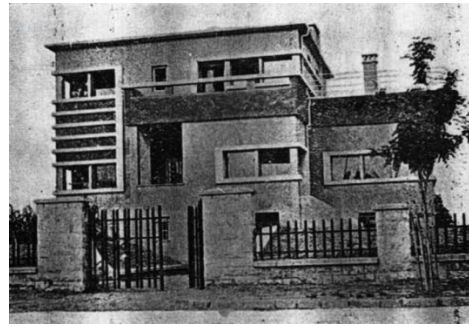
Rationalist architecture, early modern houses, Turkish architecture, space syntax.

1. Introduction

Modernist architects used concrete, glass and steel in simple rectangular forms in a state of perfection with the idea of a crisp, clinical, machine-like aesthetic with no decoration. Their rationalist designs which generally based on functional constructs, carry international and timeless architectural qualities (Glancey, 2002, p.124). These modern buildings hardly accommodate elements reflecting social structures, local cultures and personal taste, and display strong similarities with each other even if they are built in different locales and cultures [Figure 1]. They have a tendency to present a defined life style which largely contradicts with the current understanding which points out the profound effect of cultural and socio-economic factors as well as user's preferences in the shaping of the built environment, and in particular the home environment.



Abrahamsohn House, 1928, Berlin: Martin Punitzer



Sait Bey House, 1930, Adana: Semih Rüstem

Figure 1: Modern houses from Europe and Turkey in the late 1920s and early 1930s.

This paper seeks to develop an understanding of how the design codes of modern architecture are conceptualised and interpreted in different cultures away from where they originate. Focusing on the single-family houses, it takes Turkey as the case study area. As Germany was one of the leading countries in the development of this functional style (Fleming et al, 1991, p.182), the keystone works of the pioneering Austrian and German architects are taken to be compared with the syntactic properties of the early Turkish examples. With the use of space syntax techniques in this study, the potential of the techniques to contribute to architectural theory is also investigated.

2. Rationalist Architecture and Early Modern Houses in Turkey

The modernist ideology began to be reflected in architecture with a rationalist approach from the early years of the 20th century which later developed into an architectural style, namely the 'International Modern'. This approach, together with the developments in construction technology and materials, initiated new design ideas in Europe. In Austria, inspired by the American architects, Adolf Loos's writings on the reform of the applied arts and his standing out against ornament turned him "*into the unwitting father figure of the 1920s Modern Movement*" (Colquhoun, 2002, p.74). Loos's conception of Raumplan, plan of volumes, which can best be seen in his split-level houses had been largely influential on the succeeding generation of architects, and on Le Corbusier in particular, in developing the open plan approach (Frampton, 1992, p.92-95). Le Corbusier's designs and writings have a far more exceeding impact on the establishment of the language of the International Modern (Jordy, 1965, p.10). In Germany, the Deutscher Werkbund managed to integrate culture, arts and industry and opened way for the development of Bauhaus from 1919 to teach and promote the unity of art and technology, with Gropius in the lead. The design approach of De Stijl set the scene for the development of International Modern in Holland between 1917 and 1932 (Frampton, 1992, p.95, 126; Colquhoun, 2002, p.57, 58, 110). Italian Rationalism was led by the 'Gruppo 7' which was later expanded to form MIAR, with a seemingly modern programme influenced by the Futurist projects of Sant'Elia (Fleming et al, 1991, p.358).

Adopting the modernist vision, the pioneering examples of these rationalist movements display some common architectural characteristics as given below:

- they offer design possibilities for the configuration of modernist space and respond to the modern way of living,
- they are largely shaped in asymmetrical forms and volumes in which the main body of the building is expressed freely,
- flow of spaces is an important characteristic of the plan layouts,
- largely based on functional constructs in which functional divisions separate day and night, service and activity, private and communal spaces from each other,

The design of Bauhaus School buildings with their smooth surfaces, glass-and-steel construction and true functionalism clearly reflects this attitude (Heynen, 1992, p.84).

Within the context of Turkey, as it was the case in most of the developing countries, the key concepts of modernity have largely been imported from the West. The modernisation process was initiated with the establishment of the secular nation state in 1923 and put into practice with the realisation of revolutions. As the rationalist approach of modern architecture suited the ideals of the young Republic, it came into effect in the architectural discourse of the country (Bozdoğan, 1996) and became increasingly popular among young Turkish architects.

In the early 1930s, traditional houses were the most common form of housing in Turkey, together with a number of early modern single-family houses which were generally designed for the rich and educated urban elite. These houses set within gardens were largely named as cubic houses and promoted as a symbol of social status and a self-conscious break with the past (Nalbantoğlu, 1993, p.68). With these houses, new conceptual and functional definitions were introduced. Spaces were allocated to specialized functions and the levels of privacy are clearly defined with an increasing emphasis on individuality (Ulus Uraz and Turgut, 1997). The developments in technology and industry also had a profound effect and with the adoption of new materials together with electricity and tap water systems (Bozdoğan, 1996), The functioning of service spaces such as kitchens and bathrooms got modernised, (Gürel, 2008). The garden, terraces and balconies are used as areas opening up to the outside world mimicking a western type of living (Sanlı et al, 2007).

3. The Study

The relationship between the modernist design paradigms set in Europe and their representations within distinct locales and cultures has long been a focus of research interest (Cavalcanti, 2003; Lang, 2002; Oshima, 2009).

To contribute to this line of research and to the understanding of the interpretations of internationally accepted design codes of rationalist architecture on housing practice, the present paper introduces the case of Turkey. It takes the keystone modernist houses designed by the pioneering Western architects as the originating point of study and by using classical space syntax methodological procedures, analyses them to establish a basis in revealing the syntactic properties of modern Turkish examples which were conceived accordingly.

3.1. The Method and the Use of Space Syntax Techniques

In this study, the spatial characteristics of the key examples of rationalist houses and the international interpretations of them are evaluated by using space syntax techniques which are proven to be appropriate tools for the representation, quantification and evaluation of spatial configurations (Brown, 1986; Hanson, 2001, p.06.13) although they disregard the shape and dimensions of spaces (Bafna, 1999, p.01.3). With the consideration that “*socially and culturally*

determined patterns are embedded in these configurations and social relations and processes express themselves in space through configurations" (Hillier et al, 1987, p.363), this paper takes mean depth and integration as basic measures "to express culturally significant typological differences among plans" (Hillier et al, 1987, p.365) and as important predictors in the syntactic description of design attitudes. In this way it questions the contribution of space syntax to architectural theory as well. An in-depth conceptualisation and formulation of the techniques can be found in Hillier and Hanson (1984), Hillier et al. (1987), Hanson (1998), Kubat (1999), Peponis and Wineman (2002) and Bafna (2003), among many others.

In the analysis, UCL Depthmap, Spatial Network Analysis Software is used with **justified graphs** (j-graphs) showing the two dimensional representations of the 'depth' of all spaces in a pattern from a particular point in it (Hillier, 1996, p.23) and **convex map analysis**, describing the generative types of spatial configurations and the sociologically relevant relationships embedded in spatial structures (Bafna, 2003, p.22-25). The differences in the spatial configurations of plan layouts are called as inequalities whereas the common and consistent spatial patterns can be detected as inequality genotypes (Hillier et al, 1987, p.363-4). The base difference factor (BDF) is also used in this study as an indicator of the strength of inequalities in the integration values of spaces under consideration. The lowest BDF value which is 0, indicates maximum difference whereas highest value 1 gives minimum difference with all values being equal and homogeneous (Hillier et al, 1987, p.365).

This study uses **justified graph structures** to turn the topological structure of the chosen houses into configurations (Bafna, 1999, p.01.2). The graphs are given together with the corresponding house plans. In the graphs the starting point of accessibility is taken as the root and it is represented by a crossed circle while bounded and/or defined interior spaces by circles and access relations amongst them with lines. As the evaluation of the plan layouts covers outside spaces of the houses as well, the front garden after the street entrance is considered as the first step and taken as the root. However in some cases, as there is no front garden, steps from the street to the main entrance are considered to be the root. In the resulting structures, depth of each space from the root is revealed. The graphs with a tree form including only one route from any space to any other, pointed out a high control of movement. While a shallow tree form revealed a symmetric and integrated pattern, an asymmetric space arrangement with a deep tree structure indicated segregation and higher levels of privacy, isolation or formality (Hillier and Hanson, 1984, p.149; Hillier et al, 1987, p.364). On the other hand, a structure including rings presented alternative routes for access and movement reducing the effect of depth. While some rings are local without any substantial effect on the whole system, some others have an overall effect (Hillier et al, 1987, p.365; Hillier, 1996, p.23; Amorim, 2001, p. 19.3; Bafna, 2003, p.21).

In the **convex map analysis** which is realised to underlie the concepts of **integration**, **mean depth** and real relative asymmetry, each functional space is considered as a node and an access graph is formed by drawing lines between spaces, starting from the root until all the spaces are reached. Walls, any kind of partitions and steps separating spaces from each other functionally and/or visually are taken as boundaries while doors and openings are considered as access points. The radius is chosen as n. As this study concerns itself with the design and the spatial arrangement of the houses as a whole, the evaluation of the plan layouts covers all spaces starting from the garden entrance to the basement and up to the roof top areas. However the basement and attic floors are largely evaluated as one whole service area. To prevent any kind of inconsistencies regarding the open plan organisations, the rooms, corridors or halls which are composed of a number of functionally and/or spatially defined sections without any kind of boundaries or separation, are taken as separate spaces. These spaces are given more than one functional label. Terraces and balconies are analysed syntactically as well. Stairs, staircase halls, landing of the stairs and steps are all considered as spaces to be analysed if they are connected to other functional areas.

Houses analysed in this study are evaluated in two groups and five houses for each group, setting appropriate examples for a comparative syntactic analysis in terms of their size and style, are chosen. The **R group** houses are the distinct examples of German and Austrian rationalism designed between the years 1910-1928 and had a great influence on the development of modernist language internationally [Figure 2]. The **T group** houses, accommodate the early examples of rationalist single family houses from Turkey designed by a variety of noteworthy Turkish architects in the early 1930s [Figure 3].

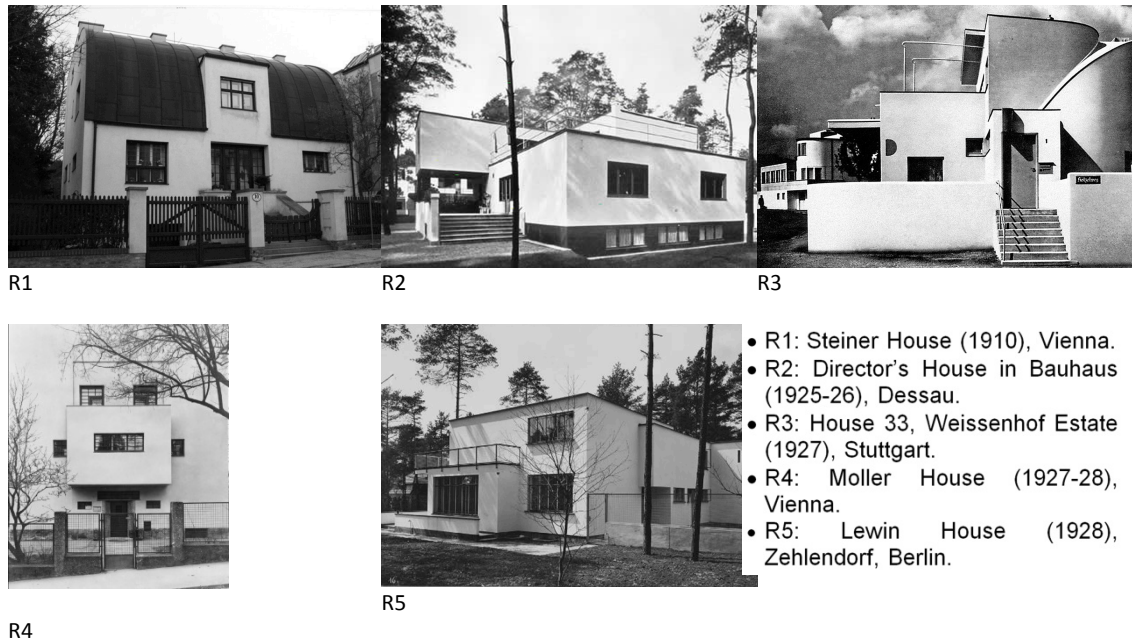


Figure 2: R group houses

In **R group** houses, **Steiner House (R1)** and **Moller House (R4)**, are designed by **Adolf Loos**. While his houses are cubes without ornament externally, the interiors accommodate a sensuous complexity with rooms each of which has a distinct character and connected to each other by the rotating movement of stairs (Heyden, 1992, p.88). In this way, the floor plans are transformed into volumes (Colquhoun, 2002, p.81). Steiner and Moller House reflect Loos's design attitude clearly.

Displaying a rationalist approach, **Walter Gropius** realised his idea of extending housing units in masters' residences of Bauhaus, and in **Director House (R2)** in particular (Frampton, 1992, p.127). His **Lewin House (R5)** is also an example of purely functionalist residential buildings that Gropius designed in Germany.

Scharoun's house, No. 33 in Weissenhof Estate (R3) carries the same rationalist qualities but with its curvilinear and functionally expressive forms, it has a different volumetric composition compared to the other houses of the Estate [Figure 2]. The plans of R group houses are put together using a variety of sources (Heynen, 1999, p.82; Davies, 2006, p.53; URL1-URL6).

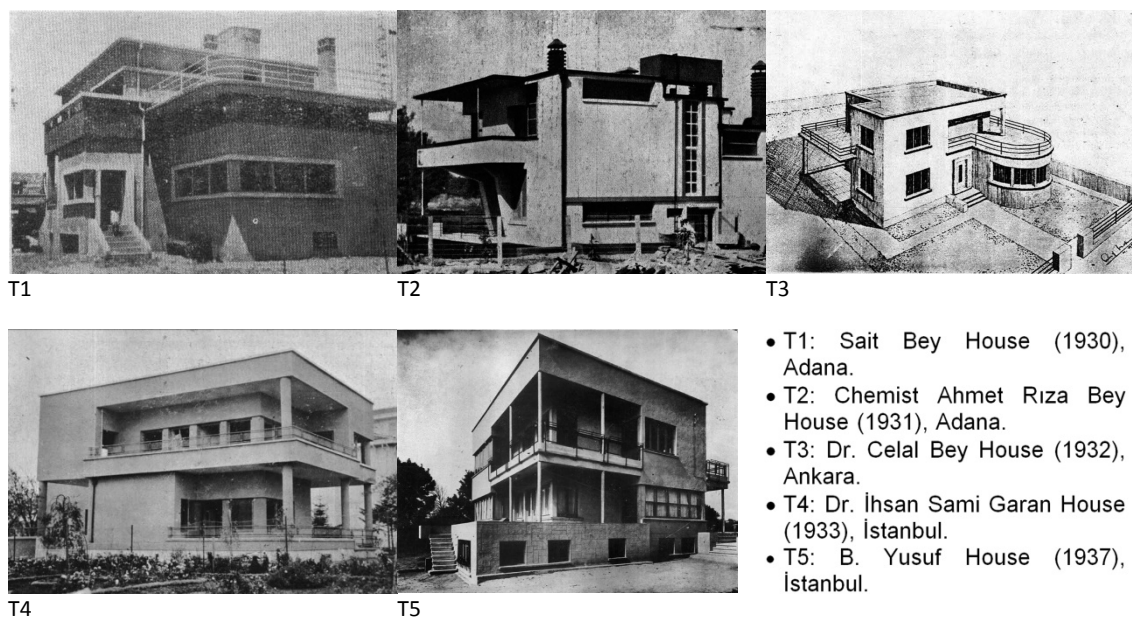


Figure 3: T group houses

In **T group** houses, **Dr. Celal Bey House (T3)** is a design of **İlyaszade Arif Hikmet** (Arif Hikmet Holtay) and it is in Ankara, the capital of the newly established Republic. Two of the houses, **Dr. İhsan Sami Garan House (T4)** which is designed by **Seyfettin Erkan** (Seyfi Arkan) and **B. Yusuf House (T5)** by **Rebii Gorbun** are in İstanbul, the former Ottoman capital. The other houses **Sait Bey House (T1)** which is a design of **Semih Rüstem** and **Chemist Ahmet Rıza Bey House (T2)** a design of **Aptullah Ziya** (Abdullah Ziya Kozanoğlu), are examples from Adana, a developing city from Southern Anatolia.

These houses are largely referred as the early examples presenting the modernist approach of the period as well as the architects' attitude (Aslanoğlu, 2001, p.310-312,316, Karaman and Erman, 2014, p.69). Plans of the houses are obtained from the architects' drawings published in the architectural magazine *Mimar* (later named as *Arkitekt*) (Semih Rüstem 1932; Aptullah Ziya, 1931; İlyaszade, 1932; Erkan, 1934; Gorbun, 1937) which was first established in 1931 and had been influential on modern architecture to become widespread and popular in Turkey (Batur, 1985, p. 135).

3.2. The Analysis

In **R group** houses, the keystone examples of modern style, the plan layouts are largely established in a free-flowing scheme with a functionalist design approach. Functionally related spaces are connected to each other visually and/or spatially through openings and the divisions are provided with the use of split-level organisations and partition elements. Day and night activities are established in different floors except in house R2, in which the main bedrooms are located on the ground floor together with living spaces. The service areas are distanced from the main spaces with the use of circulation and transition areas. They are grouped together and largely located in the basement or attic floors. Outdoor spaces like gardens, terraces and balconies are considered as a continuation of the interiors. There are at least three entrances to the houses with the main entry giving access to an entrance hall while secondary entrances lead to the service areas.

In all houses, main halls connect the entrance to the staircase leading to the upper floors. In house R4, the main hall is largely used as a living area opening up to the music room and the living room. Salons and dining rooms are established together or next to each other as in R3. The access to the kitchen, which was only a service area used for cooking is given via a service hall in R1, R3 and R5 and through a pantry in R2 and R4. On the first floor, bedroom and bathroom spaces are placed around a night hall. The bathrooms are located next to, and in house R1 in between, the bedrooms reflecting a modern way of living. The servants' rooms in house R1 are located in the basement and attic floors while in other houses they are established in different levels [Figure 4].

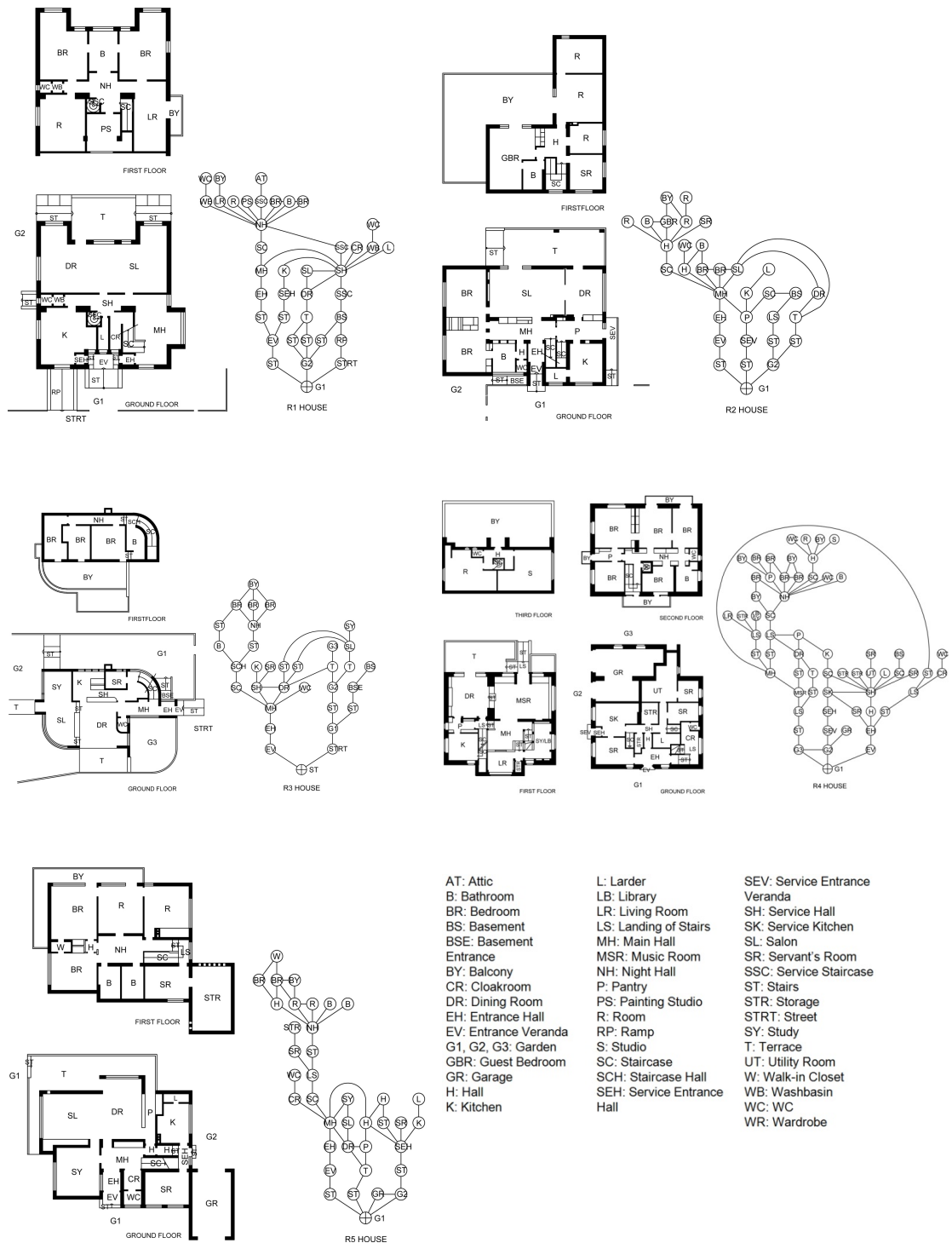


Figure 4: Floor plans and the justified graphs of the R group houses

J-graphs of these houses are largely similar structures and the total number of levels ranges from eight to twelve and nodes from 33 to 62 (Figure 4). The linkages from the root space display relatively linear structures with rings until reaching out to the main circulation areas and the number of levels to reach these central spaces changes between three and five. After that they turn out to be shallow tree ones. The deepest spaces are revealed as balconies, toilets, bathrooms and bedrooms, followed by the halls and servants' rooms. There are routes creating rings within the house. Based on Hillier's (1999) classification of topological types of spaces, while most of the rings

between functional spaces are d-type, very limited of them are c-type. The d-type rings set up linkages between the; communal spaces such as the main hall, salon, dining room and terraces, private spaces like the night hall, bedrooms and bathroom, service areas and outdoor spaces and they can be taken as a reflection of a free-flowing scheme. For this group, the order of integration and mean depth values of spaces are given below [Table 1].

Table 1: Order of mean depth and integration values of spaces of the R group houses

<i>Order of Integration Values of spaces</i>		
R1 HOUSE	SH>SSC>MH>NH>SSC>DR>SC>K>SL>WB>L=CR>EH>BS>T PS=R>ST>ST>ST>ST>EV=RP>ST=WC>G2>STRT=ST>BY=WC=AT>G1	<1,00 mean Intg. >SEH>LR=WB=B=SSC>BR=BR>
R2 HOUSE	MH>P>SC>SL>EH=BR>H>BR>DR>SEV>T>H=SC>K> B=G2>R=SR>L>BSE>ST>BY>R	<0,96 mean Intg. EV>ST=ST>BS>B>ST>WC>R>GBR>G1=
R3 HOUSE	MH>DR>SC=SH>T>EH>G2>ST=ST>SCH>WC>EV>SL>ST>K=SR SY>NH>ST>ST>BR>BR=BR>BSE>BY>BS	<0,707 mean Intg. >G3>ST=ST>T>B>STRT>G1>
R4 HOUSE	LS>P>ST>DR>SC>MH>K>ST>SC>ST>MSR>NH>SH>LS>T>H>ST>ST>ST>BY>SK>LS>EH> SC>ST>P>SR=BR>BR>BR> SC=UT>B=WC>L=SR=STR=STR>G3=CR>SEH>EV>LS>G1>G2> SEV>H> BR>BR=BY>BY>BS=SR>WC>LR=SY/LB=STR>GR>WC=S=R=BY	<0,72 mean Intg.
R5 HOUSE	MH>SC>H>LS>DR>EH>SY=CR>ST>P=H>T>EV>SR=NH>ST>SL=ST> G2=STR=B=B>ST>GR>K>SR>BR>BY>BR>L>W	<0,68 mean Intg. ST>G1>WC>SEH>R=H>R>
<i>Order of Mean Depth Values of spaces</i>		
R1 HOUSE	SH<SSC<MH<NH<SSC<DR<SC<K<SL>WB<L=CR>EH<BS<T PS=R<ST<ST<ST=ST<EV=RP<ST=WC>G2<STRT=ST>BY=WC=AT<G1	<4,0 avr. MD <SEH<LR=WB=B=SSC<BR=BR<
R2 HOUSE	MH<P<SC<SL>EH=BR<H<BR<DR<SEV<T<H=SC<K<EV B=G2<R=SR<L<BSE<ST<BY<R	<3,9 avr. MD <ST=ST<BS<B<ST>WC>R>GBR>G1=
R3 HOUSE	MH<DR<SC=SH<T<EH>G2<ST=ST>SCH<WC>EV>SL<ST>K=SR<G3<ST=ST>T SY<NH<ST<ST BR=BR>BSE<BY>BS	<5,0 avr. MD <B<STRT<G1<
R4 HOUSE	LS<P<ST<DR<SC<MH<K<ST<SC<ST>MSR<NH>SH<LS<T<H>ST<ST<ST<BY>SK<LS<EH< SC<ST<P< SR= BR<BR SC=UT>B=WC>L=SR=STR=STR>G3=CR>SEH>EV<LS>G1<G2< SEV<H BR=BY>BY>BS=SR>WC>LR=SY/LB=STR>GR>WC=S=R=BY	<6,01 avr. MD
R5 HOUSE	MH<SC<H<LS<DR>EH>SY=CR>ST>P=H<T<EV>SR=NH<ST<SL=ST> R<G2=STR=B=B<ST>GR<K<SR BY L<W	<5,3 avr. MD <ST>G1<WC>SEH<R=H<

In R group houses, by being the central circulation core, main halls are the most integrated spaces followed by the staircase and dining rooms. Service halls and entrance halls together with the salon, kitchen, pantry and terraces, which at the same time operate as transition areas to a limited extent, are also well integrated spaces. Integration values of spaces which are located on the main floor are above the value of mean integration and this can be taken as a reflection of an open plan character.

Although the segregation levels of spaces display an inconsistent pattern, the most segregated ones are the balconies, bedrooms, sanitary areas, servants' rooms and service areas, particularly the ones in the attic and basement floors, which are quite isolated with their high levels of mean depth and low levels of integration values [Table 1]. This structure reflects the need for privacy for the bedrooms and sanitary spaces and the preference to distance out the service areas and the servants' rooms from the main living quarters.

In **T group** houses, ground floor is raised from the garden level. The number of entrances is more than one with the main entry giving access to an entrance hall while secondary entrances open up to service areas. Within the house, there is a clear distinction between the floors while ground floor

accommodates communal and daytime activities such as the salon, dining room, living room and the kitchen, on the first floor bedroom, bathroom and the storage spaces take place around a night hall.

There is not much division with steps or partition elements. Spaces are organised around sequential halls. Except houses T3 and T4, main halls are used as living and transition areas opening up to the salon, dining room and the service hall, as well as connecting the entrance to the staircase leading to the upper floors. Apart from house T1, salons and dining rooms are connected to each other and placed close to the entrance. In the rooms and halls, double or triple-sized doors are used to bring flexibility to the spatial organisation of spaces. The access to the kitchen is given via a service hall or a pantry. On the first floor, the bathroom and the toilet are located next to each other and are largely reached via a small hall. There is a servants' room which is located on the ground floor in house T1, on the gallery level in house T2 and on the first floor in house T3. In these houses which are surrounded by gardens, there are also terraces on the ground floor together with balconies on the first floor [Figure 5].

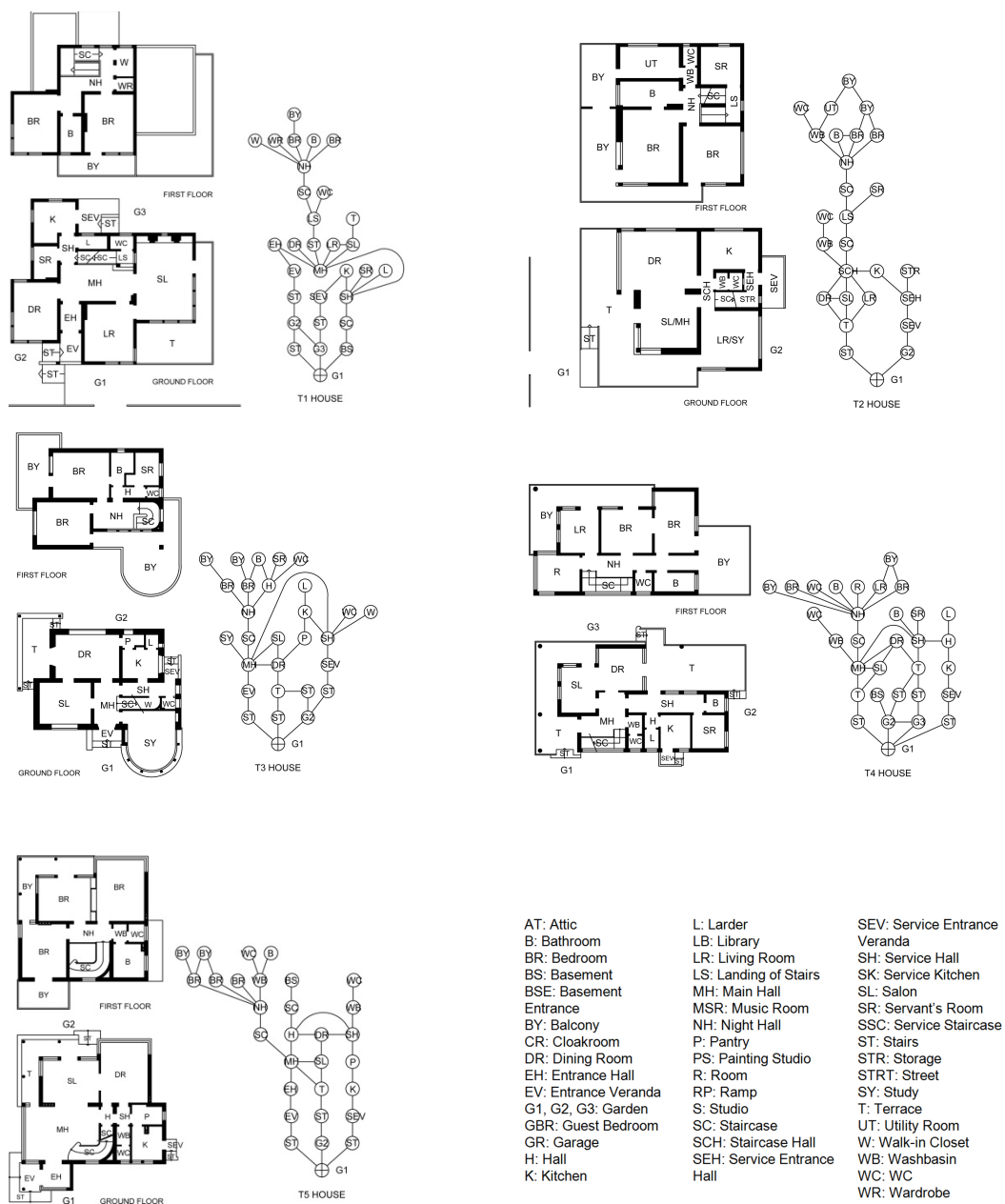


Figure 5: Floor plans and the justified graphs of the T group houses

J-graphs of T group display a more consistent structure than the other group. In the graphs the total number of levels ranges from seven to eleven with the number of nodes changing between 27 and 32. The houses in this group are mainly shallow tree structures with rings but houses T1 and T2 present a relatively deep structure with their linear tree-like form. The number of levels to reach the central spaces changes between three and four. The linkages from the root spaces generally display a linear structure until reaching out to the night halls. The deepest spaces are revealed as the balconies, toilets, bathrooms and bedrooms, followed by the service areas such as servants' room, utility and wardrobes. Spaces such as the main hall, living room, dining room and terraces which are connected to each other with different routes created rings. Bedroom spaces that open up to a number of spaces with doors also established rings. Most of the rings are d-type in living, dining, service and circulation spaces. They are c-type in bedroom spaces except houses T1 which has no rings and T2 which has d-type rings [Figure 5]. For this group, the order of integration and mean depth values of spaces are given below [Table 2].

Table 2: Order of mean depth and integration values of spaces of the T group houses

<i>Order of Integration Values of spaces</i>		
T1 HOUSE	MH>ST>SH>EH>LS>SL>LR>SC>DR>K>SC>EV>SR=L>BR>ST=W=WR=B=BR>BY	<0,742 mean Intg. BS>SEV>WC>ST>NH>T>G1>ST>G2>G3>
T2 HOUSE	SCH>SC>LS>SC>K>SL/MH=DR>LR/SY>NH>WB>SR>STR>BY>UT>WC>G1>G2>BY	<0,713 mean Intg. EV=SEH> WB>BR>BR>B>WC>ST>SEV>
T3 HOUSE	MH>SC>SH>DR>EV=NH>SL>SY>T>SEV>P=K>ST>SR=WC>BY>BY	<0,909 mean Intg. WC=W>H>BR>BR=ST>ST=ST>G1>G2>L>B>
T4 HOUSE	MH>SH>SC>T>DR>SL=T>H=NH>WB>ST>SR=B>WC=B>WC=ST>SEV>BY=BS	<0,942 mean Intg. ST>ST>G1>K>G2>G3>BR=BR>LR>BY>L=R=
T5 HOUSE	MH>H>SC>SL>T>EH>SH=NH>DR>ST>SC>EV>SEV> ST=BY>WC=B=BY>WC	<0,806 mean Intg. P>BR=WB>WB=BR>G2>BR>ST>K>G1>BS>
<i>Order of Mean Depth Values of spaces</i>		
T1 HOUSE	MH<ST=SH<EH<LS<SL<LR<SC<DR<K<SC<EV<SR=L<BS<SEV<G3<BR<ST=W=WR=B=BR>BY	<4,7 avr. MD WC<ST<NH<T<G1<ST<G2<
T2 HOUSE	SCH<SC<LS<SC<K<SL/MH=DR>LR/SY<NH<WB<SR<EV=SEH<STR<BY<UT<WC<G1<G2<BY	<4,7 avr. MD WB<BR<BR<B<WC<ST<SEV<
T3 HOUSE	MH<SC<SH<DR>EV=NH<SL<SY<T<SEV<P=K<ST<WC=W<SR=WC<BY>BY	<3,9 avr. MD H<BR<BR=ST<ST=ST<G1<G2<L<B<
T4 HOUSE	MH<SH<SC<T<DR>SL=T<H=NH<WB<ST<SR=B<ST<ST<G1<WC=B<WC=ST<SEV<BY=BS	<3,9 avr. MD K<G2<G3<BR=BR<LR<BY<L=R=
T5 HOUSE	MH<H<SC<SL<T<EH<SH=NH<DR<ST<SC<EV<P<ST=BY<WC=B=BY>WC	<4,3 avr. MD BR=WB<WB=BR>G2<BR<ST<K<G1<BS<SEV<

In these modernist houses, main halls are the most integrated spaces together with the staircases and salons. Service halls, dining rooms and night halls are the other integrated spaces. In this group, the service spaces in the basement floor and the gardens are generally segregated, but the most segregated spaces are the sanitary spaces and balconies. They are quite isolated as a result of the privacy needs. The mean integration value of cells is relatively low in T1 and T2, while the mean depth values present high values as a result of their linear formations. On the other hand as T3 and T4 have compact forms, the mean integration value of the cells is higher in these houses [Table 2].

4. Findings and Discussion

With the analysis realised, it is revealed that there are similarities between R and T group houses both in terms of their plan formations and syntactic descriptions. Rationalist design approach of the keystone examples is also adapted in the establishment of modernist housing environments in T group. Particularly in houses T1 and T2, the volumetric compositions and the rectangular forms of rationalism are clearly reflected. In T group houses, to establish cubic forms in an asymmetrical composition, different levels are connected to each other with staircases, steps and terraces, in a similar way with R group. In addition to that, separation and differentiation of functional areas are also succeeded through the use of steps in T group houses, but in a less intricate way than R group houses.

As a result of the functionalist approach adopted, the systematic functional grouping of spaces which is succeeded in R houses, is also aimed at in T houses. This, at the same time, provided the needed privacy. Together with the main living quarters SL and DR, spaces such as P, K, SH, SR are also included in the plan layouts in both group of houses as a reflection of a modern way of living. Although located in the service area, kitchens become more integrated to the daily life in both R and T groups. In both groups, the use of a variety of entrances to the houses established a stronger relation with the outdoor areas as well as setting an easier access to different functional areas.

Table 3: Basic syntactic data for both groups of houses

	Min. Mean Depth Value	Max. Mean Depth Value	Avr. Mean Depth Value	Min. Integration Value	Max. Integration Value	Mean Integration Value	BDF Value
R1 HOUSE	2,605263	5,157895	4,0	0,690703	1,789033	1,003023	0,81
R2 HOUSE	2,5	5,3125	3,9	0,615671	1,770054	0,960803	0,77
R3 HOUSE	3,375	7,96875	5,0	0,380998	1,117929	0,707092	0,79
R4 HOUSE	4,1967211	7,704918	6,0	0,520128	1,090935	0,720907	0,89
R5 HOUSE	3,567568	7,459459	5,3	0,43935	1,105313	0,688006	0,83
T1 HOUSE	3,0666666	6,666667	4,7	0,454367	1,245845	0,742662	0,80
T2 HOUSE	3,3076923	6,307693	4,7	0,451967	1,062032	0,71327	0,86
T3 HOUSE	0,720109	5,071429	3,9	0,611472	1,659709	0,909657	0,79
T4 HOUSE	2,612903	5,225806	3,9	0,618931	1,6216	0,942555	0,81
T5 HOUSE	2,8275862	5,448276	4,3	0,569389	1,38587	0,806815	0,83

The character of rings, number of nodes and the step levels generated differences in the average mean depth and mean integration values of the houses. Structures with rings in R group connecting main halls to other living areas as well as presenting alternative routes in between the service spaces, can also be seen in T group houses.

Both groups present relatively high mean integration values and lower average mean depth values. The mean integration value of T1, T2, R3, R4 and particularly R5 are low with their linear forms. On the other hand, in R1 and R2 which have compact forms, the mean integration values are high. Mean

depth values are 3,9 in houses R2, T3 and T4 being the lowest with their compact forms and 6,0 in house R4 to be the highest as a result of its linear formation.

In terms of BDF values, R2, R3 and T3 have the lowest values with their relatively compact layout, while R4 has the highest value with 0,89, pointing a weaker BDF and less differentiation in the integration values of spaces [Table 3].

To achieve a final concentrated comparison of the mean depth and mean integration values, a grouping is realised in which similar type of functional spaces are put together, under one of the twelve labels [Table 4].

Table 4: Order of mean integration values regarding the functional groupings

<i>Order of mean integration values regarding the functional groupings</i>		
R1	circulation>service>circulation>storage>cooking>living>sleeping>activity>sanitary>service>transition>outdoor>exterior	
R2	circulation>living>cooking>service>circulation>sleeping>transition>outdoor>sanitary>service>activity	
R3	service>circulation>living>circulation>sanitary>cooking>outdoor>exterior>transition>activity>service>sleeping	
R4	cooking>circulation>service>circulation>living>transition>storage>sleeping>outdoor>service>sanitary>activity	
R5	circulation>living>service>circulation>transition>activity>outdoor>storage>service>sanitary>cooking>sleeping	
T1	living>circulation>cooking>service>circulation>service>transition>sanitary>outdoor>sleeping>storage>activity>exterior	
T2	circulation>cooking>living>activity>service>circulation>sleeping>sanitary>service>transition>storage>outdoor	
T3	service>circulation>living>circulation>transition>storage>cooking>sleeping>sanitary>outdoor>service	
T4	circulation>service>circulation>living>outdoor>transition>sanitary>cooking>service>sleeping>activity	
T5	circulation>living>service>circulation>sleeping>cooking>transition>outdoor>sanitary>service	
activity: S, PS, SY, LB, R	circulation: MH, H, ST, LS, SC, SCH, EH, NH	cooking: K, L, P
exterior: STRT	outdoor: T, G1, G2, G3, BY	living: DR, LR, SL
sanitary: WB, WC, B	service: SR, UT, GR, BS, AT	service circulation: SH, SEH, SSC
sleeping: BR, GBR	storage: STR, W, WR, CR	transition: EV, SEV, BSE, RP, ST (outer)

The order of mean integration values of the spatial groupings display similar structures in both R and T houses with the circulation group being the most integrated of all. This can be related to the houses to be more circulation dominated with their linear branching tree structures and the main hall to be the central core of the houses. Living, sleeping, service and sanitary spaces present similar ordering in their average mean integration values.

Although in R group, there are no group of spaces with equal values, houses T3, T4 and T5 have functional groups with the same integration values. These houses are shallow structures with lower mean depth values with the central core of the houses, which is the main hall, being closer to the root and to the core of the night activity. Additionally the high number of spaces connected to these core spaces in the form of bushes and rings, point out an inadequate functional specialization. This can be taken as an indication of the functionalist designs of T houses, except T1 and T2, being not at the level of the keystone houses architecturally.

5. Conclusion

In the early 1930s, the living environment in Turkey began to be transformed into modernist frames of space. In their designs, young architects of the period clearly reflected the ideologies of the newly established Republic together with the changing cultural, economic and social structures of the Era.

They have set the scene to accommodate modern conceptions in house form and culture and certainly offered a new synthesis for a contemporary domestic space. The configurational characteristics of the modern houses of the period present newly developed functional and spatial structures together with a limited number of local traditions displaying a continued line. As a result, while accommodating modern lifestyles, these rationalist houses also embodied some traditional elements in their spatial compositions.

Within this framework, by using space syntax techniques which proved to be relevant in achieving the goals of the study, a substantial amount of spatial similarities are observed between the early modern houses from Turkey and the keystone examples of rationalist architecture. The findings of the study revealed that there are internationally accepted design codes of rationalist architecture and these codes are adapted to a great extent in housing practice in the 1930s, even in culturally and socially different environments. However as it was the case in Turkey, they were taken in a simplified and less intricate manner. Modern architecture is largely mimicked with its volumetric compositions but occasionally considered as an architectural way of thinking to investigate what new materials and construction techniques could offer.

It is expected that these findings will contribute to the understanding of the interpretations of the internationally accepted design codes of rationalist architecture on housing practice.

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- URL 4:http://www.greatbuildings.com/buildings/Steiner_House.html
- URL5: <http://casa33-scharoun.blogspot.com.tr/>
- URL6: <http://www.capitalieuropee.altervista.org/1/133.html>

Figure References:

Figure 1.

Abrahamsohn House: <http://germanpostwarmodern.tumblr.com/post/101493404920/abrahamson-residence-1928-in-berlin-germany-by>

<http://www.juedische-architekten.de/architek/punitz3e.htm#ansicht>

Sait Bey House: <http://dergi.mo.org.tr/dergiler/2/84/859.pdf>

Figure 2.

R1: https://classconnection.s3.amazonaws.com/83/flashcards/897083/jpg/steiner_house1349966906915.jpg

R2: http://www.meisterhaeuser.de/en/house_walter_gropius.html

R3: http://www.mai-nrw.de/uploads/pics/weissenhof02_01.jpg

R4: <http://rubens.anu.edu.au/htdocs/laserdisk/0352/35223.JPG>

R5: <http://www.ncmodernist.org/gropius-lewin-6.jpg>

Figure 3.

T1. <http://dergi.mo.org.tr/dergiler/2/84/859.pdf>

T2. <http://dergi.mo.org.tr/dergiler/2/277/3867.pdf>

T3. <http://dergi.mo.org.tr/dergiler/2/86/893.pdf>

T4. <http://dergi.mo.org.tr/dergiler/2/38/322.pdf>

T5. <http://dergi.mo.org.tr/dergiler/2/28/198.pdf>