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Analyzing the social efficiency of Contemporary and Islamic eras residential buildings in Cairo using Space Syntax

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Abstract:

Studying history of architecture is the chance for exploring design concepts in the past civilizations, how Architecture at those times revealed and reflected the harmony in human interaction with nature before (revolution of industry, machines, capitalism, megacities, and mass production), architects back then had only one goal in mind: the welfare and prosperity of people, which they achieved by designing spaces that improved their quality of life, regardless of their psychological, sociological, ethical and physical needs of users who occupy these spaces, and while tracking, we spotted the importance of domestic Architecture as the first interaction of an Architecture space in man's daily life, which has massive impact on individuals and families, and in turn builds their personalities and identity, comparing Islamic and contemporary houses based on sociological needs using space syntax tools (A GRAPH). (Safety, connectivity, privacy, identity and integration) which are the basics of human existence.

Keywords: Domestic Architecture – Social needs – Space syntax – Traditional and contemporary houses

Research Problem:

As Architectural Spaces affect the behavior of users, it was found that domestic households need to be more considerate about social behaviours in Architecture, due to lacking of affiliation and closeness behaviors between Family members.

Importance of the study:

It is believed that by returning to the Spatial configuration of the Traditional houses, more interaction and integration in spaces will lead to more close and interconnected family members.

Research Aims:

1- Highlighting the effect of Architecture spatial relations on the social status of the household.

2- Finding architectural designs that are more compatible with the social needs of users in residential buildings.

1- Introduction:

Through time, Architecture has reflected life aspects and social behaviors of people and their cultural traditions, as it is the tangible-built environment for man, that is the space which fulfils man's mental and physical needs, architects designed spaces that were derived from functions, while functions were derived from human needs, those spatial correlations have been conceptually applied during old nations through vernacular and social effective Architecture designs.

since the industrial revolution and the complete control of political, economic and commercial capitalist forces, cultural norms have changed rapidly and affected the capabilities of the built environment which didn't take into consideration the fulfillment of social needs in Architecture designs, the vision of the Architects remained to organize the built environment as just physical spatial units, the concept of dwellings, dimensions, distances and connections to streets and built areas, that would serve as a physical container suitable for people's activities became impossible to maintain human's stability and welfare, this was reflected on Architects goals, which were changed from the prosperity of people to the imitation of developed countries designs which followed the ideals of capitalism (Abdullah, 2013)

By time, life aspects have changed worldwide, capitalism and flourishing of industrial technologies affected humans needs; cultural ideas targeting financial gains above all, lead to population displacement from villages to cities, Colonization and Cultural opening to the west affected Egyptians lifestyle and mentality.

Domestic architecture, that represents a huge part of man's daily life, have always been designed according to occupants psychological and physical needs, but due to the changes previously stated, residential buildings in Egypt especially Cairo has increased by the increasing needs of the growing population, domestic architecture's goals recently became how to use as much space without paying attention to the real sociological needs, In many residential buildings, we see the narrowness of the spaces in terms of Human scale, and the difficulty of furnishing them in a manner that suits the nature of the activity. We also note the lack of interest in achieving the required degree of convergence between the activity of spaces and the preferred quality of communication between these spaces, each other according to the cultural mentality of the user, so it results in harming occupants mentally and physically on the long term.

In this research space syntax tools are used to analyze traditional Islamic houses and modern houses in Cairo by comparing the spatial configuration of some examples from each type and find which is more sociocultural efficient for inhabitants.

1-1- Research Methodology:

Specifically, the research examines space syntax techniques that are frequently used in analyzing the functional relationships between architecture and urban spaces. As a first

step in this research, the aim of these techniques is to demonstrate the link between space and accessibility, and then to analyze the social interaction among users of these spaces (the impact of space distribution and social efficiency).
Applying this method to two different styles of residential buildings in Cairo; Traditional Islamic Houses and Contemporary Modern Houses (especially modern villas for ensuring that the house only accommodates one or two families at most.)

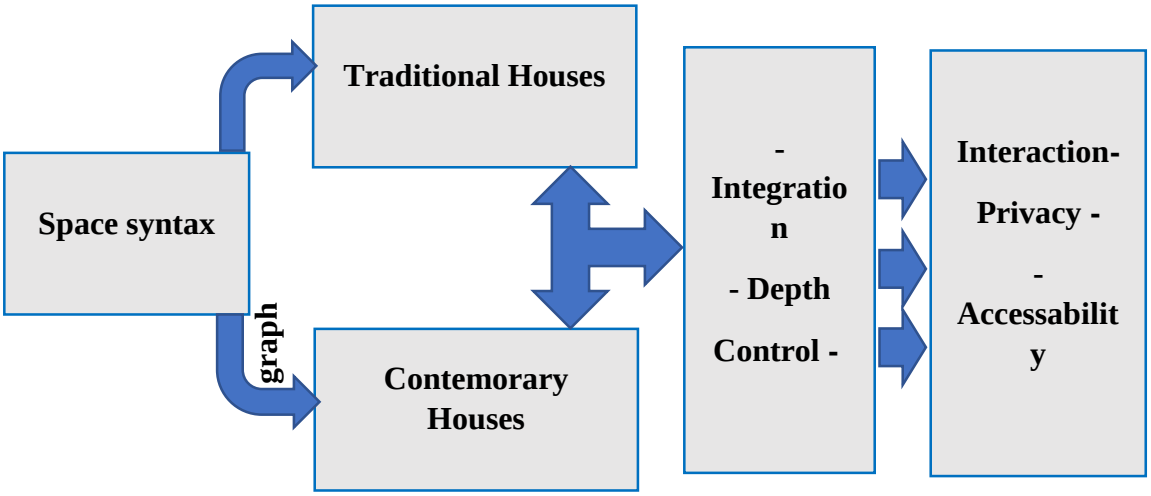

Figure 1 Research methodology

1- Design criteria for Islamic Eras residential buildings:

It was found that the design criteria of Houses through Islamic eras, were almost the same, based on the concept of inward direction and privacy which was also an essential element that affected the form of the floor plan of all traditional Muslim
houses, most of the house spaces surround one or more inner courtyard from which movement is distributed vertically and horizontally to the rest of the house.

Figure 2 Suheimy house

Figure 3 Keretleya House

Figure 2 yakan house

3-1- Majaz (Indirect Entrance)

In order to preserve the sanctity of the house, the refracting entrance was u+ sed, which, in addition to its role in preserving privacy, acts as a transitional stage from the street to the inner spaces and from the external climate to the internal climate, generally consisting of a vestibule, another door, and corridor in a combination that requires a visitor to turn at least once before entering the courtyard. This or "bent" entrance made it impossible to see into the house or courtyard from the street. It also blocked street noise and dust.

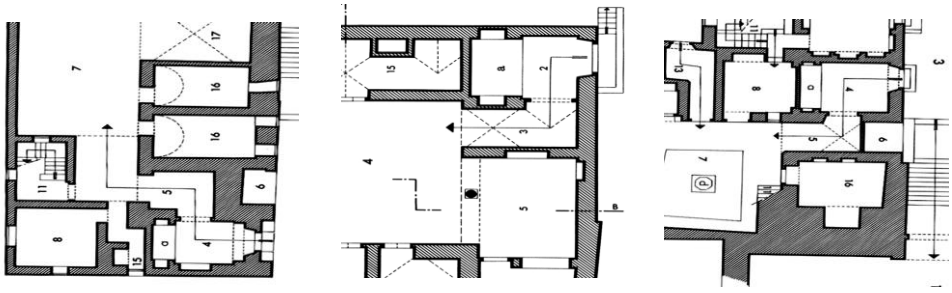

Figure 3 Entrance folowed by the Majaz (indirect entrances). Left, Bayt Shabshiri, middle, manzil Amna bint Salim; right, manzil al-Kiridliya (Abdeen, 2009)

3-2- The Courtyard

It was the most important space in Islamic Houses, as it was commonly used in other types of buildings like religious and commercial buildings, in the hot regions like Egypt, courtyard houses were adopted since ancient Egyptians civilization. (Husien, 2021)
The formation of the internal facades was based on the different formations of wood, cut with mashrabiyas, on colored glass. internal designs of the inner facades more than the external formation, it also provided a satisfactory idea for providing thermal comfort. The size of the courtyard varied, due to the design and the Area of the house. (Centre of Urban and Architecture Studies, 1990)

Figure 6 yard at al suheimy house (Abdeen, 2009)

Figure 7 yard at sinnari house https://www.bibalex.org/en/center/details/sinnarihouse

Figure 8 yard at kretleya house https://explorationvacation.net/gayer-anderson-museum-cairo

3-3- The Qa ‘ah (the Hall)

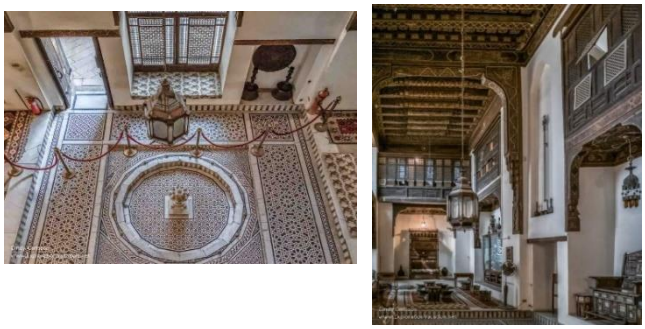

Figure 9 Qa'a and iwans in keretleya house https://explorationvacation.net/gayer-anderson-

It was a guest space, important visitors would indirectly enter from the courtyard to this large reception Hall, In the Islamic eras houses, the qa’a proves to be the eye-catcher of most of the floor plans, with emphasis on its size, internally divided into sub-spaces the durqa'ah which is located in the center with *High ceiling covered by the shukhsheikhah* and was always flanked by two slightly elevated spaces the two 'iwans (living areas) which were located on both north and south sides of the qa'ah at higher level
to accommodate diverse activities within the same large space. Always located by means of easy access from the entrance and close enough to the service zone. Tracing the examples of the early nineteenth century, the luxurious divided qa’a shrank into a prestigious hall for guests designated for living and dining activities.

Figure 10 Haramlek in keretleya house https://explorationvacation.net/gayer-anderson-museum-cairo

3-4- The Takhtabush

it is a kind of loggia, It is a semi-covered sitting space, encountered between two courtyards; one is open, large courtyard and the other is planted. There is a greater tendency for air to heat up in the large open courtyard than in the garden and this forms low air pressure area, so it pulls cool air from the garden through the *takhtabush.*

Figure 11 Takhtabush in Suheimi house (Abdeen, 2009)

3-5- Maka’ad

Oriented to the north to grasp the soft breeze, a square or rectangular covered loggia opens to the court on one side.

The maka’ad is commonly located in the first floor, directly accessible from the court through a staircase and a corridor, and usually connected to a reception space or a sleeping zone.

Even though it was not as large as the qa'a, the maka'ad compensated for its small size by its perfect location, which accommodated family life activities daily.

Figure 4 Maka'ad in keretleya house https://egymonuments.gov.eg/museums/gayer-anderson-museum/

2- Design criteria of the contemporary house:

Modern and Contemporary houses and villas revealed the ideals of capitalism; which are the fastest ways for enormous profits, and due to globalization, land prices Hiked up and Architects Imitated Modern western houses to compete with the demands for trendy houses designs.

Figure 5 Modern Villas in new cairo and Giza https://www.gateway.com.eg/en/property/8062/semifurnished-villa

4-1- The entrance

it is the entering space with a lobby that is connected visually with the reception area, it is common for primary entrances to face the street and to be oriented toward the corner of the building. To be visible to the public, primary entrances must be marked by paves or arches, or other elements.

In order to support visual privacy and safety, fences and walls are surrounding the house.

12qaThere is a clear shift from conservatism in Cairene society in the fifties and sixties, as evidenced by entrances opening directly into salons or reception areas.

Figure 6 entrance in new cairo villa https://www.behance.net/gallery/58008225/Private-Villa-in-New-Cairo

4-2- Reception Hall

This space always occupied the closest space to the entrance, separated from the rest of spaces. In some houses it had a separate secondary entrance. As social values of privacy changed over time, the entree moved from its original location towards the inside of the house. This feature can be observed in the examples of the thirties, In the middle of the century, it is observed that the reception space has merged in the lobby or foyer of the house with no clear physical boundaries. In the nineties of the 20th. century Residential

buildings exemplified the reintroduction of the guest's area in a large prestigious open space that is the reception. (Park, 2018)

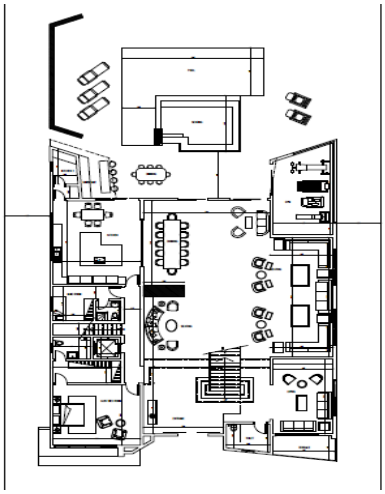

Figure 7 reception Hall villa in new cairo (Bluebird Architects 2021)

4-3- Living room

Houses were small in size in middle of the 20th century, when the social model at the time accepted that living as a setting was organized and included in the open space referred to as reception. The living space became the heart of the house once again by the end of the 20th century, situated in the most strategic position among other spaces in the house, and often serving as a semi-private/semi-public space.

Figure 8 balconies in modern houses https://uk.images.search.yahoo.com/search/images

4-4-Dining room:

A major focus of the floor plans was once again the qa'a, with its divisions of durqa'a and iwans. In the modern houses of the mid-twentieth century and afterward, one observes that the qa'a never existed again . As well, one can notice that the dining room has always been somewhat separated from the rest of the room and has been close to the kitchen and restroom. There is no doubt that this change took place for functional reasons, not only for cultural ones.

4-5- The balcony:

A balcony is a continuation of the inhabited and active living space; it is a fundamental part of any home; there does not need to be a direct link between it and the rest of the house, and it is exposed to the sun enough to provide light and air for the adjacent rooms.

3- Criteria of evaluation assessment:

The Architectural space is not simply the idle background of physical human existence, but rather it is an essential aspect of how societies and cultures are formed in the world where Spaces and their structures are more than a neutral framework for social and cultural forms. Human behavior appears in spatial forms (organization of functional spaces in buildings); Gathering, interacting, consolation, learning, and eating are not just activities

that occur in a space, but themselves forming spatial patterns. Houses as one of the types of buildings appear with different spatial patterns depending on the social and cultural environment that controls the users' reflexes.
(Morshidi, 2021) Social and cultural aspects of spatial preferences are related with life styles and culture-based necessities.

Space should be treated as a relational system, in which the spatial patterns not only accommodate patterns of behaviors and social relationships, but also generate them, the essential concept of the syntactic approach assumes that the interior and exterior forms of spaces are shaped according to certain cultural considerations and these forms also affect social relations in one way or another (†Unlu, 2003)

5-1- Theory of domestic space and Family members:

This theory assumes that space is the primary core of sociocultural events, The concept of privacy in Islam refers to the segregation between males and females. It involves the segregation of private and public spaces to provide security for family members.
As a result, achieving privacy in a house requires the interior space to be invisible to strangers and the spatial configuration to be appropriate to provide efficient communication within the house (Saeid Alitajern, 2016)
Human groups, by virtue of their varying beliefs and endorsements, vary in the amount of privacy that they require, and differ in the extent to which the achievement of that privacy is among the main tasks.
(Abdullah, 2013)
But in many cases, architects are interested in finding the maximum number of spaces that can be sold or leased, without considering their social efficiency nor those spaces that comprise them, in providing the physical requirements to perform activities such as motion and stillness, mental focus and relaxation, recreation, and accomplishment of tasks. (Abdullah, 2013)
Compactness of the plans increases **the real integration** values of the buildings rather than having extensions and the relatively small sizes of the spaces.
While the degree of social **interactivity and social control of the spaces increases as the integration values of the spaces increase.** (Bill Hillier, 1984)

4- Space syntax, concept and methodology:

Space syntax is theory of space and a set of analytical, quantitative and descriptive tools for analyzing the spatial formations in different forms: buildings, cities, interior spaces or landscapes, which is based on graph theory, is mainly used to analyze spatial configurations
The concept of spatial orientation in the built environment is the ease of identifying, distinguishing, perceiving, and then organizing the parts of the built environment, so that its spaces, sections and parts are clearly defined and easy to assemble into a holistic model, as the spatial orientation includes two basic elements, the first: identifying a space ; What is in the built environment, and the second ; how to reach the specified space, and if any of these two elements are lost, it will lead to confusion and loss of way in the built environment.

All of these common expressions give importance to the idea of space by linking it directly to human behavior. (Morshidi, 2021)

With a focus solely on spatial properties, Space Syntax was the catalyst for a paradigm shift in architectural analysis, rejecting the standard conventions which sought to understand architecture in terms of formal properties (shape), style (aesthetics) and geography (orientation and context). Instead, Conceptually, Space Syntax suggests that for understanding the ways people inhabit, cognitively process and behave in space, plans are more significant than elevations. (Mina Zolfagharkhani, 2021)
It does suggest, however, that the activities that happen over time, and which multiple people engage in, will tend to occur in the more spatially **integrated rooms** (more integration more social activities). Thus, Space Syntax models the statistical or mathematical properties of spaces, which have been shown to correlate to patterns in human behavior Once the graph for each plan is developed, then seven primary topological measures can be derived from it for each node (or room) comparisons can be undertaken between sets of
houses to reveal their planning structures and how they vary by region or over time.
Social structure is immediately apparent from the graph's shape, for example, a graph with a dense branching topological structure is known as a "bush-like" or "tree-like" graph. Users must pass through a few controlling spaces to access deeper parts of a plan in this

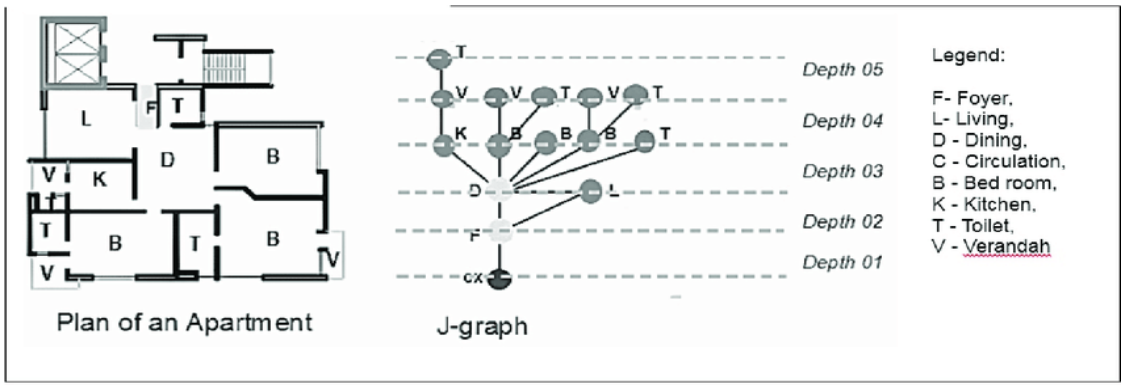

Figure 9 justified graph (Gomes, 2016)

configuration.

Maps with axial lines, constitute an axial map; they are the most efficient (in terms of number) and effective (in terms of coverage) set of lines. **It could also be described as the set of fewest and longest lines in an architectural plan, which give access to all spaces and allow a person to move everywhere and see everything in an environment. Once this set of connected lines is identified, then the lines are treated as nodes and their connections as edges, producing a graph which is then analyzed mathematically**.
The relationships are illustrated using justified graphs (j graphs), where the spaces appear as nodes and the relationships appear as lines connecting the nodes with links, and the street represents the root node It is from which the Depth of Configurations is calculated. Numbers can be used to express the relationships between configuration spaces, the root node takes the number 0 to express the start and the nodes directly related to it take the number 1 to express the first level and so on.

Spatial systems are characterized by two types of spatial properties, which can be measured after creating a Graph Access Justified diagram for those systems, which are:

6-1- **Total depth (TD)**: The total depth of all points in the building. The terms "shallow" and "deep" are used in relation to the depth of a system, a shallow system has a low value for **total depth**, while a deep system has a value for High **overall depth**. Color gradation starting with the warm colors of the higher values of integration to the cool colors of the lower values of integration. The **condensation of the lines of integration (the center of the highest number of intersections) represents the most integrated area**. (Morshidi, 2021)

6-2- **Mean Depth (MD)**

The depth represents the number of steps, shows the graphical user interface, and the depth of system spaces is represented by representing each space with a (node) and every connection relationship (direct permeability) between two adjacent spaces with a line (edge or path), each space is given a specific number, and the root node or root space is specified.(Hani Wada, 2018)

6-3- **Integration (I)**

Integration expresses the mobility of a space around it and inside it to build its parts, clarity refers to the extent to which it is possible to see the spaces connected in a physical way, and given that the physical connection of the spaces refers to integration, the possibility of seeing the space from another space is called the Connectivity property, The clear system is the system in which the spaces connected visually tend to be integrated spaces, the more it is possible to represent the relationship between integration and communication with a straight line, this means that the more visually connected the space is, the more integrated it is. (Morshidi, 2021)

6-4- **Relative Asymmetry (RA)**

The integration value (RA) describes how closely the space is accessible from all the spaces within the building.

Higher values indicate the isolation of the points compared to the lower values, that the points appear spatially extreme in the formation, where a high RA value of a space indicates its low integrity with the system, and a low value indicates high integrity. A value close to 0 translates to a shallow, and symmetrical formation, while values close to 1 have a sequential (deep formation) linear structure in the horizontal projection.

6-5- **Control Value (CV) (Mina Zolfagharkhani, 2021)**

A measure of the degree to which the space controls access to the spaces, values above 1 are considered a relatively high value and usually represent accessible spaces. Values less than 1 represent poor control of adjacent spaces, and therefore these spaces are located at the ends of the building (configuration). The high control values of the spaces connected physically indicate a strong linear attraction towards them in the control, the spaces located in Many of the shortest paths between other spaces have a control value higher than those that do not.

7- Case studies

7-1- **Criteria of choosing Traditional Houses:** This type of domestic buildings have its unique design of spaces and accessibility, the inward direction and the indirect entrance the private open yard which dominates most of the surrounding spaces, this concept in design along with other factors helped in boosting up interconnection and interaction of the household in the city, in this research the case studies were chosen in respect of:

1- Houses are still holding their formal design and form in perfect way (restored and conserved)
2- Though having the same criteria of spaces (inward direction-privacy) yet they possess variety of architecture designs.

Islamic Eras Traditional Domestic House

1- Al Suheimi House (Centre of Urban and Architecture Studies, 1990)

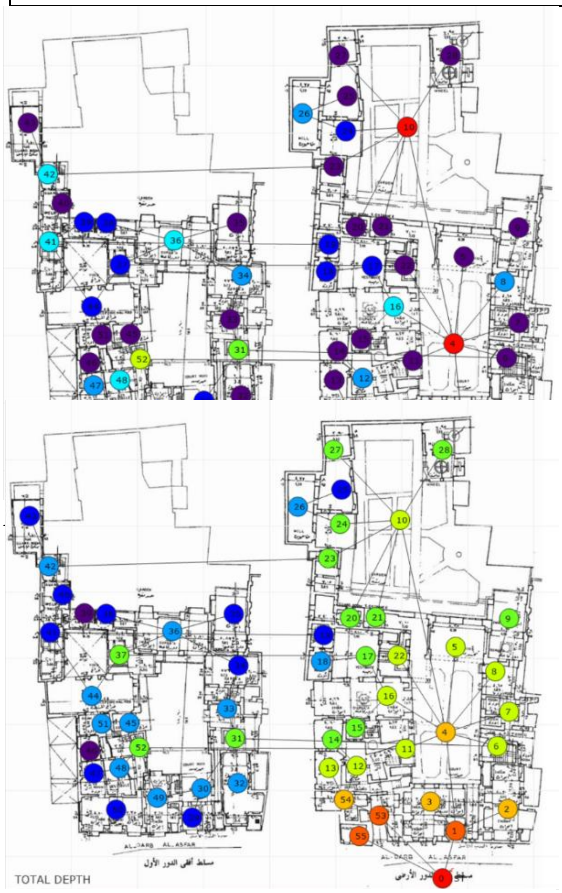

Figure 20 depth value suheimi house

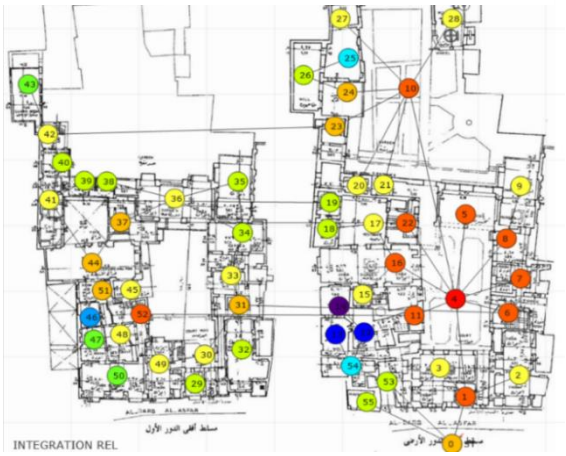

Figure 21 integration value suheimi house

3- Suheimy house has most distinct design as it possesses 2 courts**.**

	TDn	MDn	RA	I	CV
ST	233	4.31	0.12	8.3	1.
E	191	3.54	0.096	10.41	2.
2	245	4.53	0.133	7.51	0.
3	245	4.53	0.133	7.51	0.
4	155	2.87	0.070	14.2	4.
5	209	3.87	0.11	9	0.
6	195	3.61	0.099	10	0.
7	209	3.87	0.11	9.	0.
8	207	3.83	0.106	9.	1.
9	261	4.83	0.144	7.	0.
10	185	3.42	0.091	11	5.
11	187	3.46	0.092	11	0.
12	379	7	0.226	4.	1.
13	381	7.	0.226	4.	0.
14	433	8	0.264	3.	0.
15	253	4.68	0.138	7.	0.
16	199	3.68	0.101	10	1.
17	241	4.46	0.130	7.	0.
18	273	5.2	0.158	6.	1,00
19	282	5.2	0.158	6.	0.
20	239	4.42	0.129	8.	0.
21	239	4.42	0.129	8.	0.
22	190	3.51	0.094	11,00	0.
23	225	4.16	0.119	8.	0.
24	235	4.35	0.126	8.	0.
25	341	6.31	0.20	5.	0.
26	287	5.31	0.162	6.	1.
27	239	4.42	0.129	8.	0.
28	239	4.42	0.129	8.	0.
29	290	5.37	0.164	6.	0.
30	251	4.64	0.137	7.	1.
31	222	4.11	0.117	8.	2.
32	276	5.11	0.155	6.	0.
33	258	4.77	0.142	7.	0.
34	287	5.31	0.162	6.	1.
35	294	5.44	0.167	6.	0.
36	248	4.59	0.135	7.	1.
37	211	3.90	0.109	9.	1.
38	286	5.29	0.161	6.	0.
39	294	5.44	0.167	6.	0.
40	268	4.96	0.149	6.	0.
41	254	4.70	0.139	7.	1.
42	257	4.75	0.141	7.	2,00
43	311	5.75	0.179	5.	0.
44	228	4.22	0.121	8.	1.
45	259	4.79	0.143	7.	0.
46	359	6.64	0.21	4.	0.
47	305	5.72	0.178	5.	1.
48	253	4.68	0.138	7.	1.
49	245	4.54	0.133	7.	1.
50	307	5.68	0.176	5.	0.
51	232	4.29	0.124	8.	0.
52	205	3.77	0.104	9.	2.
53	279	5.16	0.156	6.	0.
54	327	6	0.188	5.	2,00
55	287	5.31	0.162	6.	0.
Min	15	2.	0.037	3.	0.
Mean	**25**	**4.**	**0.113**	**7.**	**1,00**
Max	43	7.	0.226	14	5.

Islamic Eras Traditional Domestic House

2- Al Harrawy House (Centre of Urban and Architecture Studies, 1990)

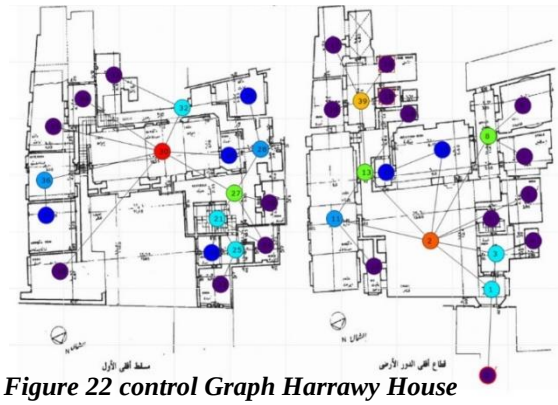

Figure 22 control Graph Harrawy House

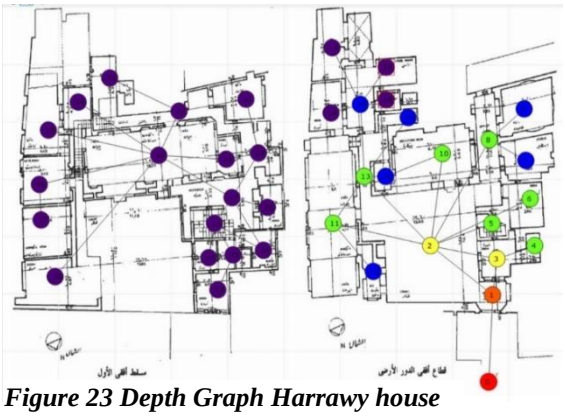

Figure 23 Depth Graph Harrawy house

Figure 24 integration Graph Harrawy house

23	224	5.89	0.31	4.	1.
24	193	5.07	0.26	4.	0.
25	189	4.97	0.26	4.	0.
26	193	5.07	0.26	4.	0.
27	171	4.5	0.28	5.	2.
28	208	5.47	0.28	4.	0.
29	208	5.47	0.28	4.	0.
30	192	5.05	0.26	4.	5.
31	264	6.94	0.35	3.	0.
32	227	5.97	0.31	3.	1.
33	229	6.02	0.31	3.	0.
34	264	6.94	0.36	3.	0.
35	227	5.97	0.31	3.	1.
36	229	6.02	0.31	3.	0.
37	229	6.02	0.31	3.	0.
38	229	6.02	0.31	3.	0.
39	205	5.39	0.28	4.	3.
Min	15	3.	0.15	0.	0,0
Mean	**24**	**6.**	**0.**31	**4.**	**0.**
Max	15	40,00	2.10	6.	5.

	TDn	MDn	RA	i	CV
ST	222	5.84	0.30	4.	0.
E	185	4.86	0.25	5.	1.
2	152	4.00	0.21	6.	3.
3	185	4.86	0.25	5.	1.
4	222	5.84	0.30	4.	0.
5	153	4.02	0.21	6.	0.
6	189	4.97	0.26	4.	0.
7	222	5.84	0.30	4.	0.
8	185	4.86	0.25	5.	2.
9	222	5.84	0.30	4.	0.
10	187	4.92	0.25	5.	1.
11	181	4.76	0.25	5.	1.
12	218	5.73	0.30	4.	0.
13	178	4.68	0.24	5.	1.
14	208	5.94	0.31	4.	0.
15	242	6.36	0.33	3.	0.
16	1560	41.00	2.15	0.	0.
17	242	6.36	0.33	3.	0.
18	242	6.36	0.33	3.	0.
19	215	5.65	0.29	4.	0.
20	224	5.89	0.31	4.	0.
21	156	4.10	0.21	6.	3.
22	261	6.86	0.36	3.	0.

Islamic Eras Traditional Domestic House

3- Aly Labib House (Centre of Urban and Architecture Studies, 1990)

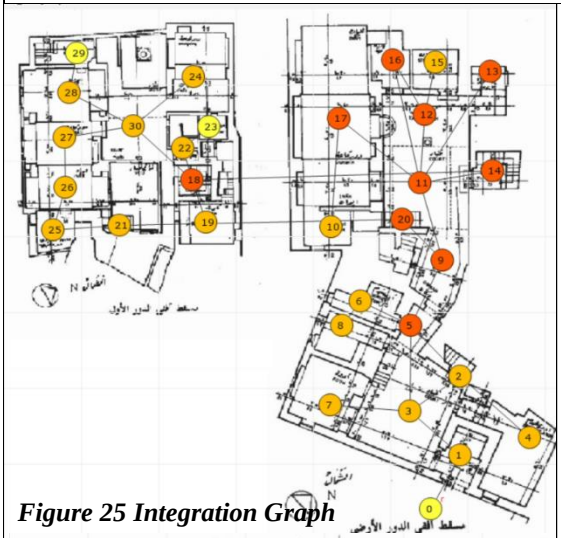

Figure 25 Integration Graph

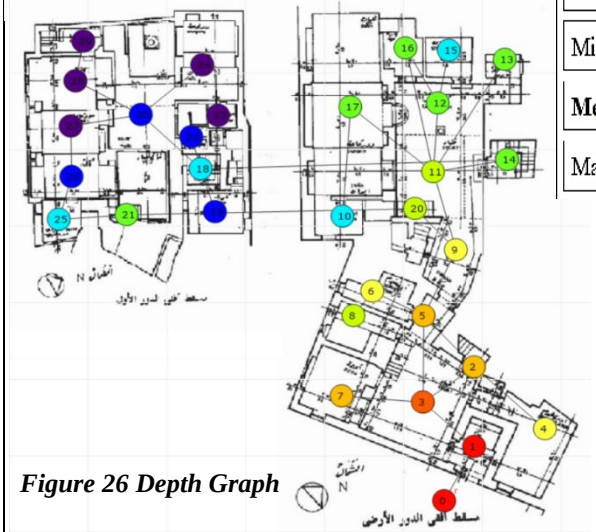

Figure 26 Depth Graph

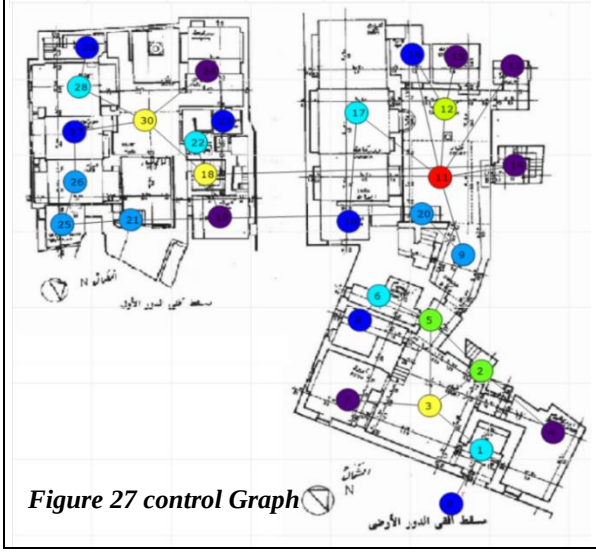

Figure 27 control Graph

22	133	4.58	0.31	4.	1.
23	162	5.58	0.38	3.	0.
24	150	5.17	0.35	3.	0.
25	136	4.68	0.32	4.	1,00
26	145	5.00	0.34	3.	1,00
27	142	4.89	0.33	3.	0.
28	148	5.10	0.35	3.	1.
29	177	6.10	0.42	2.	0.
30	121	4.17	0.28	4.	2.
Min	88,00	2.	0.13	2.	0.
Mean	**13**	**4.**	**0.27**	**4.**	**1,00**
Max	18	6.	0.41	7.	3.

	TDn	MDn	RA	i	CV
ST	181	6.24	0.43	2.	0.
E	152	5.24	0.36	3.	1.
2	127	4.37	0.30	4.	1.
3	125	4.30	0.29	4.	2.
4	156	5.37	0.37	3.	0.
5	104	3.58	0.24	5.	1.
6	131	4.51	0.31	4.	1.
7	154	5.31	0.36	3.	0.
8	160	5.51	0.38	3.	0.
9	91	3.13	0.21	7.	0.
10	144	4.96	0.34	3.	0.
11	88	3.03	0.20	7.	3.
12	114	3.93	0.27	5.	1.
13	117	4.03	0.27	5,00	0.
14	97	3.34	0.23	6.	0.
15	143	4.93	0.34	3.	0.
16	115	3.96	0.27	5.	0.
17	115	3.96	0.27	5.	1.
18	106	3.65	0.25	5.	2.
19	135	4.65	0.32	4.	0.
20	112	3.86	0.26	5.	0.
21	127	4.37	0.30	4.	1,0 0

Islamic Eras Traditional Domestic House

4- Zaynab Khatoon House (Centre of Urban and Architecture Studies, 1990)

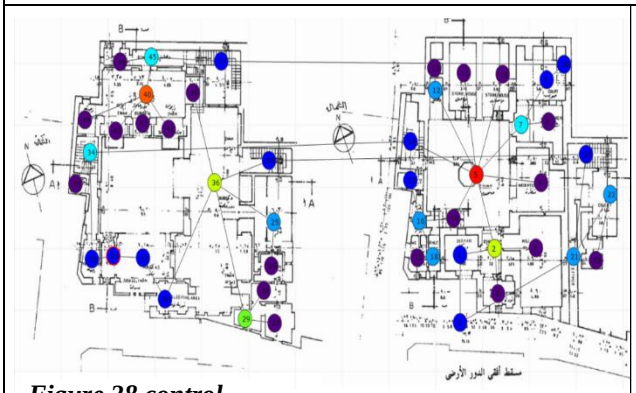

Figure 28 control Graph

Figure 29 Depth Graph

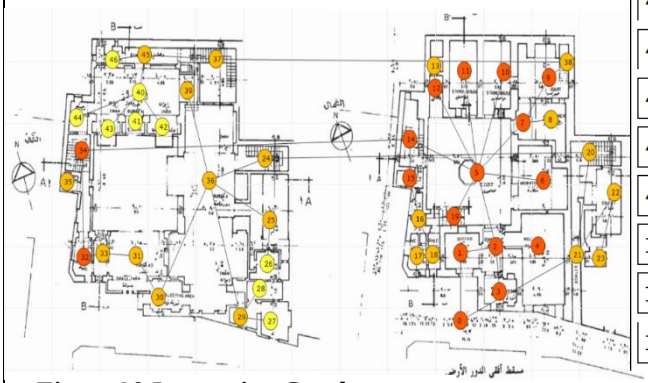

Figure 30 Integration Graph

22	300	6.66	0.29	4.	1.
23	345	7.66	0.34	3.	0.
24	297	6.60	0.29	4.	0.
25	354	7.86	0.34	3.	1.
26	399	8.86	0.39	2.	0.
27	397	8.82	0.39	2.	0.
28	397	8.82	0.39	2.	0.
29	352	7.82	0.34	3.	2.
30	298	6.62	0.29	4.	0.
31	281	6.24	0.27	4.	1,00
32	247	5.48	0.24	5.	0.
33	264	5.86	0.26	4.	1,00
34	226	5.02	0.22	5.	1.
35	271	6.02	0.26	4.	0.
36	311	6.91	0.30	3.	2.
37	303	6.73	0.29	4.	0.
38	272	6.04	0.26	4.	1,00
39	356	7.91	0.35	3.	0.
40	373	8.28	0.39	3.	4.
41	418	9.28	0.41	2.	0.
42	418	9.28	0.	2.	0.
43	418	9.28	0.41	2.	0.
44	418	9.28	0.41	2.	0.
45	336	7.46	0.33	3.	1.
46	381	8.46	0.37	3.	0.
Min	19	4.	0.17	2.	0.
Mean	**29**	**6.**	**0.26**	**4.**	**1,00**
Max	41	9.	0.4	7.	4.

	TDn	MDn	RA	i	CV
ST	240	5.33	0.23	5.	0.
E	223	4.95	0.22	5.	0.
2	206	4.57	0.20	6.	2.
3	251	5.57	0.24	5.	0.
4	251	5.57	0.24	5.	0.
5	193	4.28	0.19	7.	4.
6	238	5.28	0.23	5.	0.
7	216	4.80	0.21	6.	1.
8	261	5.80	0.25	4.	0.
9	243	5.40	0.24	5.	0.
10	238	5.28	0.23	5.	0.
11	238	5.28	0.23	5.	0.
12	236	5.24	0.23	5.	1.
13	281	6.24	0.27	4.	0.
14	207	4.60	0.20	6.	0.
15	245	5.44	0.24	5.	0.
16	256	5.68	0.25	4.	1.
17	344	7.64	0.33	3.	0.
18	299	6.64	0.27	4.	1.
19	231	5.13	0.22	5.	0.
20	278	6.17	0.27	4.	0.
21	257	5.71	0.25	4.	1.
22	300	6.66	0.29	4.	1.

Figure 19 control value suheimi house

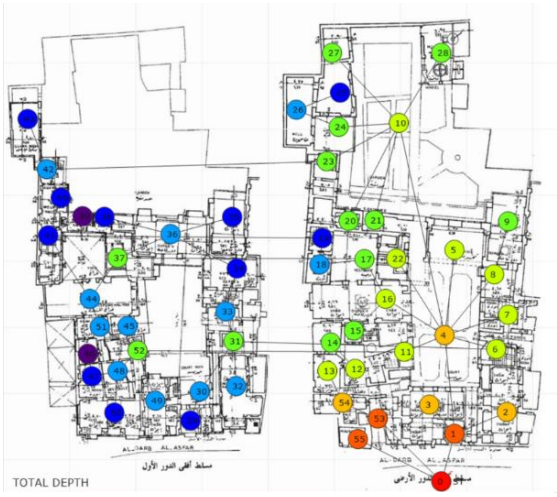

Figure 20 depth value suheimi house

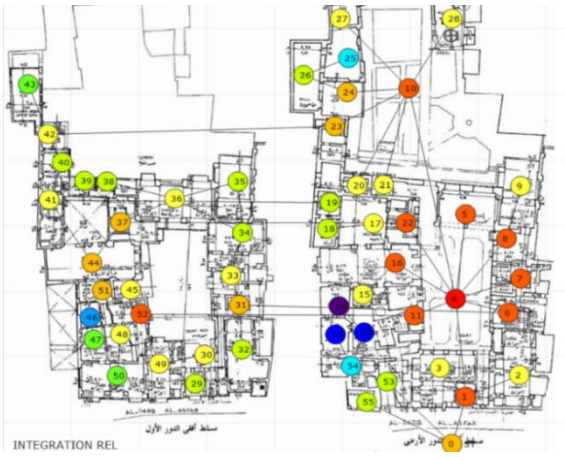

Figure 21 integration value suheimi house

	TDn	MDn	RA	I	CV
ST	233	4.31	0.12	8.3	1.
E	191	3.54	0.096	10.41	2.
2	245	4.53	0.133	7.51	0.
3	245	4.53	0.133	7.51	0.
4	155	2.87	0.070	14.2	4.
5	209	3.87	0.11	9	0.
6	195	3.61	0.099	10	0.
7	209	3.87	0.11	9.	0.
8	207	3.83	0.106	9.	1.
9	261	4.83	0.144	7.	0.
10	185	3.42	0.091	11	5.
11	187	3.46	0.092	11	0.
12	379	7	0.226	4.	1.
13	381	7.	0.226	4.	0.
14	433	8	0.264	3.	0.
15	253	4.68	0.138	7.	0.
16	199	3.68	0.101	10	1.
17	241	4.46	0.130	7.	0.
18	273	5.2	0.158	6.	1,00
19	282	5.2	0.158	6.	0.
20	239	4.42	0.129	8.	0.
21	239	4.42	0.129	8.	0.
22	190	3.51	0.094	11,00	0.
23	225	4.16	0.119	8.	0.
24	235	4.35	0.126	8.	0.
25	341	6.31	0.20	5.	0.
26	287	5.31	0.162	6.	1.
27	239	4.42	0.129	8.	0.
28	239	4.42	0.129	8.	0.
29	290	5.37	0.164	6.	0.
30	251	4.64	0.137	7.	1.
31	222	4.11	0.117	8.	2.
32	276	5.11	0.155	6.	0.
33	258	4.77	0.142	7.	0.
34	287	5.31	0.162	6.	1.
35	294	5.44	0.167	6.	0.
36	248	4.59	0.135	7.	1.
37	211	3.90	0.109	9.	1.
38	286	5.29	0.161	6.	0.
39	294	5.44	0.167	6.	0.
40	268	4.96	0.149	6.	0.
41	254	4.70	0.139	7.	1.
42	257	4.75	0.141	7.	2,00
43	311	5.75	0.179	5.	0.
44	228	4.22	0.121	8.	1.
45	259	4.79	0.143	7.	0.
46	359	6.64	0.21	4.	0.
47	305	5.72	0.178	5.	1.
48	253	4.68	0.138	7.	1.
49	245	4.54	0.133	7.	1.
50	307	5.68	0.176	5.	0.
51	232	4.29	0.124	8.	0.
52	205	3.77	0.104	9.	2.
53	279	5.16	0.156	6.	0.
54	327	6	0.188	5.	2,00
55	287	5.31	0.162	6.	0.
Min	15	2.	0.037	3.	0.
Mean	**25**	**4.**	**0.**113	**7.**	**1,00**
Max	43	7.	0.226	14	5.

Islamic Eras Traditional Domestic House

1- Al Harrawy House (Centre of Urban and Architecture Studies, 1990)

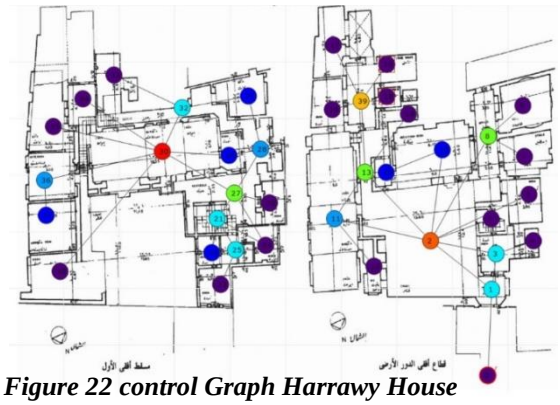

Figure 22 control Graph Harrawy House

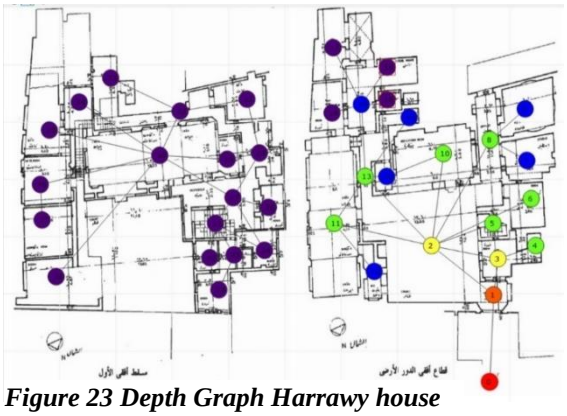

Figure 23 Depth Graph Harrawy house

Figure 24 integration Graph Harrawy house

23	224	5.89	0.31	4.	1.
24	193	5.07	0.26	4.	0.
25	189	4.97	0.26	4.	0.
26	193	5.07	0.26	4.	0.
27	171	4.5	0.28	5.	2.
28	208	5.47	0.28	4.	0.
29	208	5.47	0.28	4.	0.
30	192	5.05	0.26	4.	5.
31	264	6.94	0.35	3.	0.
32	227	5.97	0.31	3.	1.
33	229	6.02	0.31	3.	0.
34	264	6.94	0.36	3.	0.
35	227	5.97	0.31	3.	1.
36	229	6.02	0.31	3.	0.
37	229	6.02	0.31	3.	0.
38	229	6.02	0.31	3.	0.
39	205	5.39	0.28	4.	3.
Min	15	3.	0.15	0.	0,0
Mean	**24**	**6.**	**0.**31	**4.**	**0.**
Max	15	40,00	2.10	6.	5.

	TDn	MDn	RA	i	CV
ST	222	5.84	0.30	4.	0.
E	185	4.86	0.25	5.	1.
2	152	4.00	0.21	6.	3.
3	185	4.86	0.25	5.	1.
4	222	5.84	0.30	4.	0.
5	153	4.02	0.21	6.	0.
6	189	4.97	0.26	4.	0.
7	222	5.84	0.30	4.	0.
8	185	4.86	0.25	5.	2.
9	222	5.84	0.30	4.	0.
10	187	4.92	0.25	5.	1.
11	181	4.76	0.25	5.	1.
12	218	5.73	0.30	4.	0.
13	178	4.68	0.24	5.	1.
14	208	5.94	0.31	4.	0.
15	242	6.36	0.33	3.	0.
16	1560	41.00	2.15	0.	0.
17	242	6.36	0.33	3.	0.
18	242	6.36	0.33	3.	0.
19	215	5.65	0.29	4.	0.
20	224	5.89	0.31	4.	0.
21	156	4.10	0.21	6.	3.
22	261	6.86	0.36	3.	0.

Islamic Eras Traditional Domestic House

2- Aly Labib House (Centre of Urban and Architecture Studies, 1990)

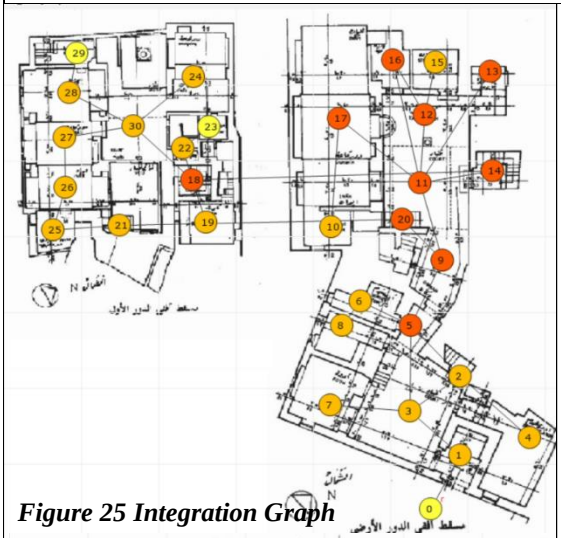

Figure 25 Integration Graph

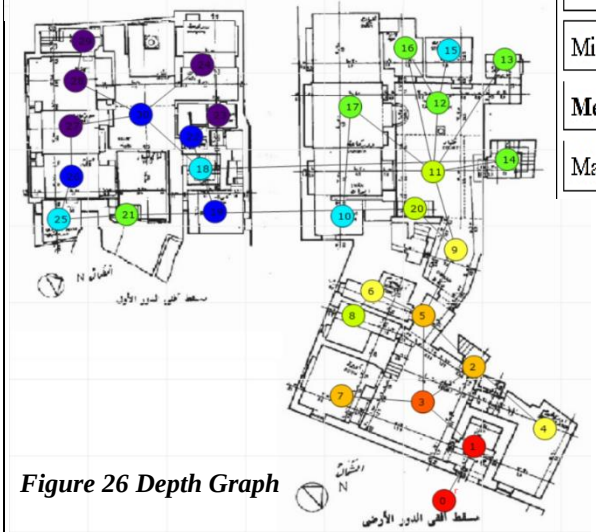

Figure 26 Depth Graph

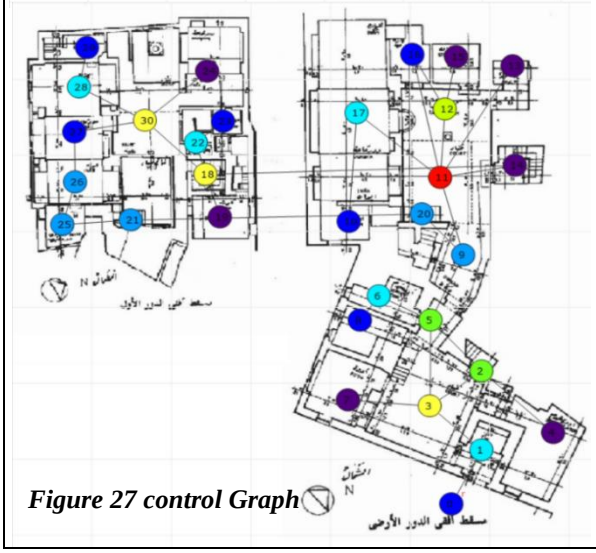

Figure 27 control Graph

22	133	4.58	0.31	4.	1.
23	162	5.58	0.38	3.	0.
24	150	5.17	0.35	3.	0.
25	136	4.68	0.32	4.	1,00
26	145	5.00	0.34	3.	1,00
27	142	4.89	0.33	3.	0.
28	148	5.10	0.35	3.	1.
29	177	6.10	0.42	2.	0.
30	121	4.17	0.28	4.	2.
Min	88,00	2.	0.13	2.	0.
Mean	**13**	**4.**	**0.27**	**4.**	**1,00**
Max	18	6.	0.41	7.	3.

	TDn	MDn	RA	i	CV
ST	181	6.24	0.43	2.	0.
E	152	5.24	0.36	3.	1.
2	127	4.37	0.30	4.	1.
3	125	4.30	0.29	4.	2.
4	156	5.37	0.37	3.	0.
5	104	3.58	0.24	5.	1.
6	131	4.51	0.31	4.	1.
7	154	5.31	0.36	3.	0.
8	160	5.51	0.38	3.	0.
9	91	3.13	0.21	7.	0.
10	144	4.96	0.34	3.	0.
11	88	3.03	0.20	7.	3.
12	114	3.93	0.27	5.	1.
13	117	4.03	0.27	5,00	0.
14	97	3.34	0.23	6.	0.
15	143	4.93	0.34	3.	0.
16	115	3.96	0.27	5.	0.
17	115	3.96	0.27	5.	1.
18	106	3.65	0.25	5.	2.
19	135	4.65	0.32	4.	0.
20	112	3.86	0.26	5.	0.
21	127	4.37	0.30	4.	1,00

Islamic Eras Traditional Domestic House

3- Zaynab Khatoon House (Centre of Urban and Architecture Studies, 1990)

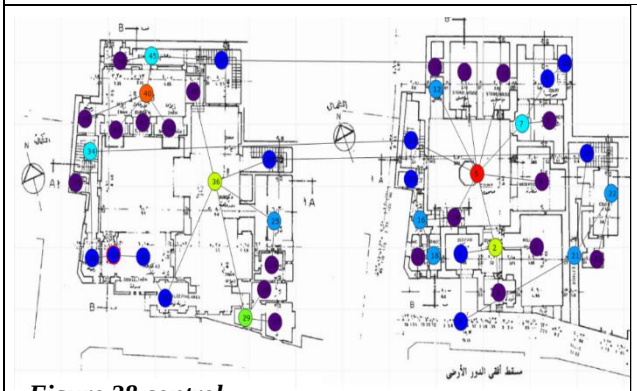

Figure 28 control Graph

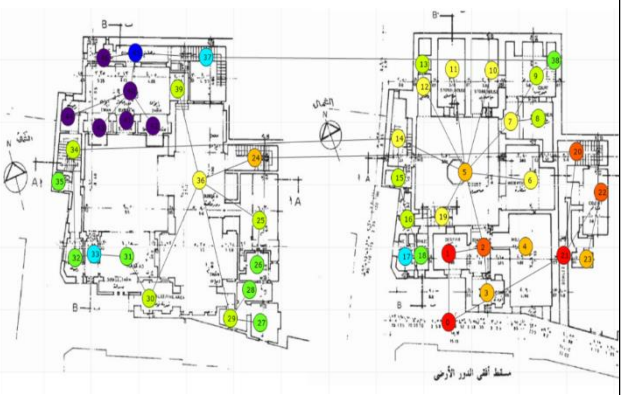

Figure 29 Depth Graph

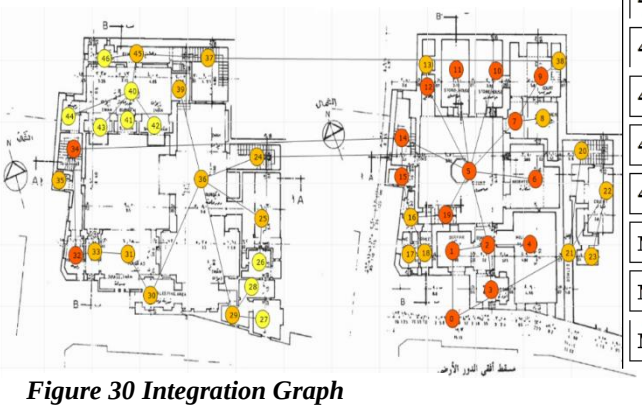

Figure 30 Integration Graph

22	300	6.66	0.29	4.	1.
23	345	7.66	0.34	3.	0.
24	297	6.60	0.29	4.	0.
25	354	7.86	0.34	3.	1.
26	399	8.86	0.39	2.	0.
27	397	8.82	0.39	2.	0.
28	397	8.82	0.39	2.	0.
29	352	7.82	0.34	3.	2.
30	298	6.62	0.29	4.	0.
31	281	6.24	0.27	4.	1,00
32	247	5.48	0.24	5.	0.
33	264	5.86	0.26	4.	1,00
34	226	5.02	0.22	5.	1.
35	271	6.02	0.26	4.	0.
36	311	6.91	0.30	3.	2.
37	303	6.73	0.29	4.	0.
38	272	6.04	0.26	4.	1,00
39	356	7.91	0.35	3.	0.
40	373	8.28	0.39	3.	4.
41	418	9.28	0.41	2.	0.
42	418	9.28	0.	2.	0.
43	418	9.28	0.41	2.	0.
44	418	9.28	0.41	2.	0.
45	336	7.46	0.33	3.	1.
46	381	8.46	0.37	3.	0.
Min	19	4.	0.17	2.	0.
Mean	**29**	**6.**	**0.26**	**4.**	**1,00**
Max	41	9.	0.4	7.	4.

	TDn	MDn	RA	i	CV
ST	240	5.33	0.23	5.	0.
E	223	4.95	0.22	5.	0.
2	206	4.57	0.20	6.	2.
3	251	5.57	0.24	5.	0.
4	251	5.57	0.24	5.	0.
5	193	4.28	0.19	7.	4.
6	238	5.28	0.23	5.	0.
7	216	4.80	0.21	6.	1.
8	261	5.80	0.25	4.	0.
9	243	5.40	0.24	5.	0.
10	238	5.28	0.23	5.	0.
11	238	5.28	0.23	5.	0.
12	236	5.24	0.23	5.	1.
13	281	6.24	0.27	4.	0.
14	207	4.60	0.20	6.	0.
15	245	5.44	0.24	5.	0.
16	256	5.68	0.25	4.	1.
17	344	7.64	0.33	3.	0.
18	299	6.64	0.27	4.	1.
19	231	5.13	0.22	5.	0.
20	278	6.17	0.27	4.	0.
21	257	5.71	0.25	4.	1.
22	300	6.66	0.29	4.	1.

Contemporary Domestic House

1- Villa in Sodic New Cairo ***https://www.pinterest.com/pin/830984568719261282/***

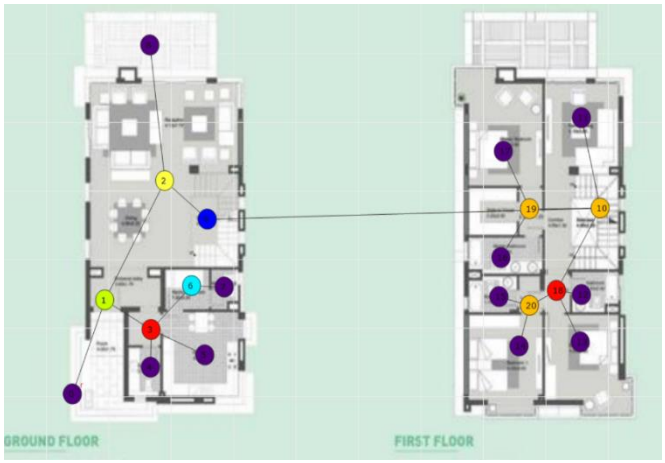

Figure 31 control Graph

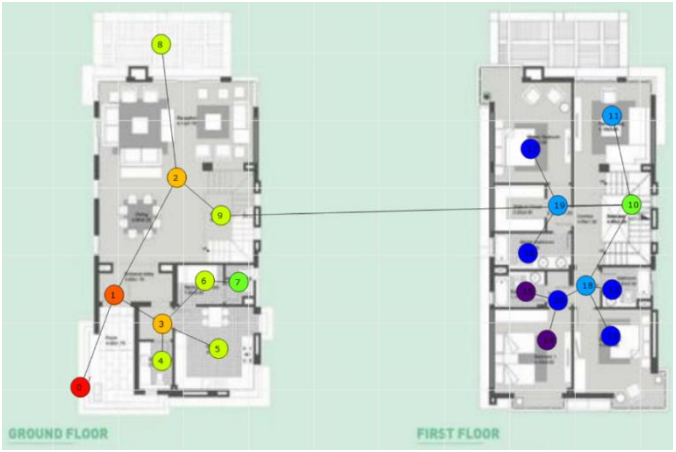

Figure 32 Depth Graph

Figure33 integration Graph

	TDn	MDn	RA	i	CV
ST	87	4.57	0.48	2.	0.
E	68	3.57	0.37	3.	1.
2	61	3.21	0.33	4.	1.
3	79	4.15	0.43	3.	2.
4	98	5.15	0.54	2.	0.
5	98	5.15	0.54	2.	0.
6	96	5.05	0.53	2.	1.
7	115	6.05	0.63	2,00	0.
8	80	4.21	0.44	3.	0.
9	58	3.05	0.32	5,00	0.
10	57	3.00	0.31	5.	2.
11	76	4.00	0.42	3.	0.
12	85	4.47	0.47	2.	0.
13	85	4.47	0.47	2.	0.
14	100	5.26	0.55	2.	0.
15	100	5.26	0.55	2.	0.
16	91	4.78	0.50	2.	0.
17	91	4.78	0.50	2.	0.
18	66	3.47	0.36	4.	2.
19	72	3.78	0.39	3.	2.
20	81	4.26	0.44	3.	2.
Min	57,00	2.	0.21	2,00	0.
Mean	**83**	**4.**	**0.**42	**3.**	**1,00**
Max	11	5.	0.6	5.	2.

Contemporary Domestic House

2- One Floor Stand Alone Villa ***https://www.pinterest.com/pin/24910604168398595/***

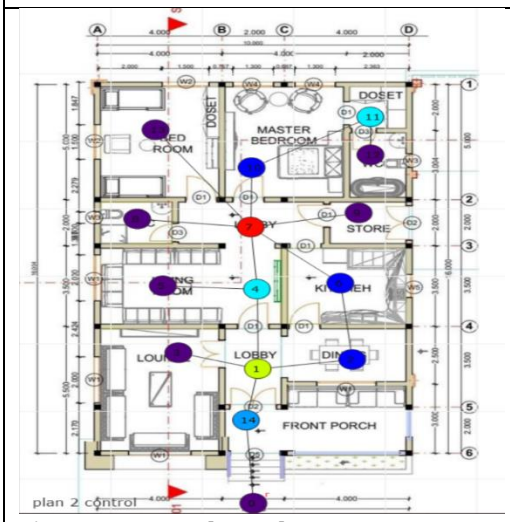

Figure 34 Control Graph

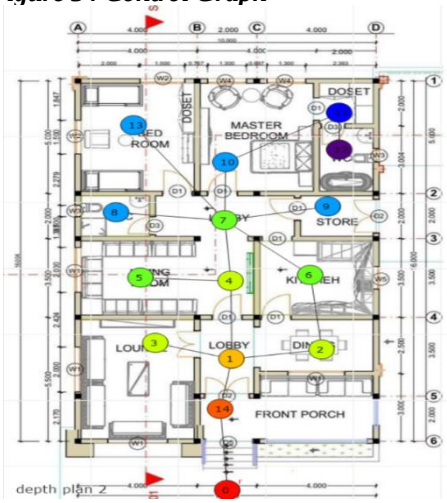

Figure 35 Depth Graph

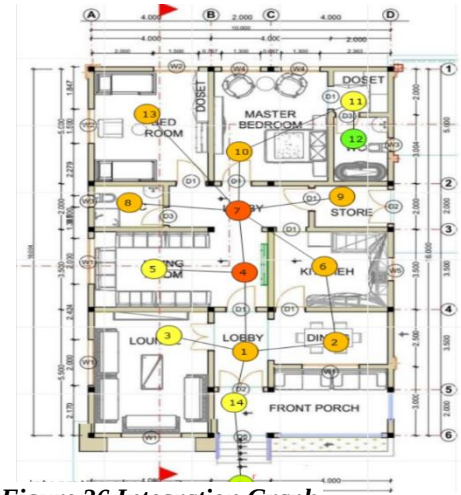

Figure 36 Integration Graph

	TDn	MDn	RA	I	CV
ST	57	4.07	0.31	2.	0.
1	33	2.35	0.35	4.	2.
2	37	2.64	0.40	3.	0.
3	46	3.28	0.50	2.	0.
4	29	2.07	0.31	6.	1.
5	42	3.00	0.46	3.	0.
6	34	2.42	0.37	4.	0.
7	27	1.92	0.29	7,00	4.
8	40	2.85	0.43	3.	0.
9	40	2.85	0.43	3.	0.
10	36	2.57	0.39	4.	0.
11	47	3.35	0.51	2.	1.
12	60	4.28	0.65	1.	0.
13	40	2.85	0.43	3.	0.
E	44	3.14	0.48	3.	1.
Min	27,00	1.	0.15	1.	0.
Mean	**40**	**2.**	**0.**30	**3.**	**1,00**
Max	60,00	4.	0.61	7,00	4.

Contemporary Domestic House

3- Palm Hills Villa ***https://www.palmhillsdevelopments.com/en-us/residential/details/417908d6-44c9-40d0-a6d8-4d4b3188c9c0/Palm%20Hills%20New%20Cairo***

Figure 37 Control Graph

Figure 38 Depth Graph

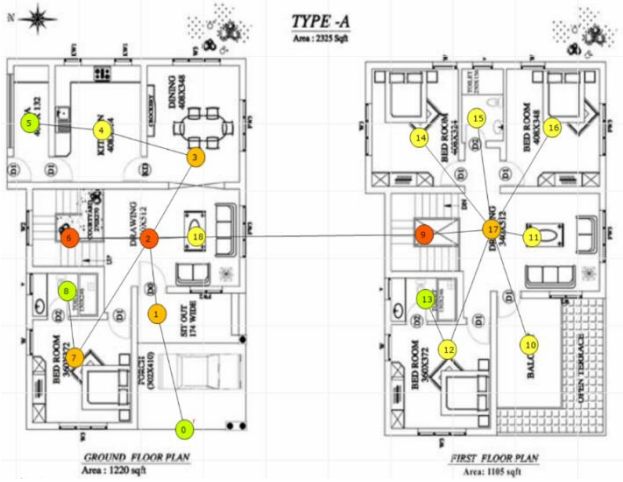

Figure 39 Integration Graph

	TDn	MDn	RA	i	CV
ST	80	4.44	0.52	2.	0.
E	63	3.50	0.41	3.	1.
2	48	2.66	0.31	5.	3,00
3	61	3.38	0.39	3.	0.
4	76	4.22	0.49	2.	1.
5	93	5.16	0.60	2.	0.
6	47	2.61	0.30	5.	0.
7	63	3.50	0.41	3.	1.
8	80	4.44	0.52	2.	0.
9	48	2.66	0.31	5.	0.
10	68	3.77	0.44	3.	0.
11	68	3.77	0.44	3.	0.
12	66	3.66	0.45	3.	1.
13	83	4.61	0.54	2.	0.
14	68	3.77	0.44	3.	0.
15	68	3.77	0.44	3.	0.
16	68	3.77	0.44	3.	0.
17	51	2.83	0.33	4.	6,00
18	65	3.61	0.45	3.	0.
Min	47,00	2.	0.23	2.	0.
Mean	**66**	**3.**	**0.**35	**3.**	**1,00**
Max	93,00	5.	0.6	5.	6,00

Contemporary Domestic House

1- Villa in Allegria ***https://homefindereg.blogspot.com/2012/03/new-villas-for-sale-inside-compound.html***

Figure 40 Control Graph

Figure 41 Depth Graph

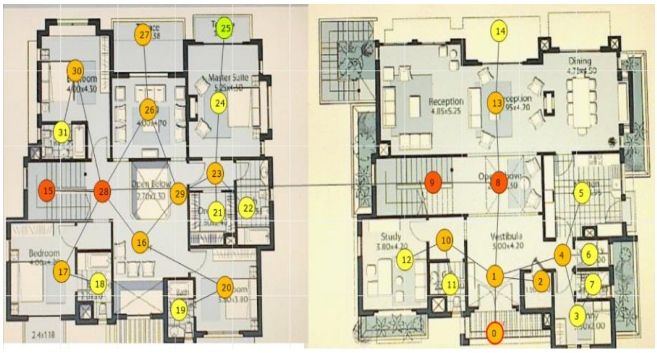

Figure 42 Integration Graph

29	143	4.61	0.29	4.	0.
30	141	4.54	0.29	4.	1.
31	171	5.51	0.35	3.	0.
Min	11	3.	0.19	2.	0.
Mean	**16**	**5.**	**0.**32	**3.**	**1,00**
Max	22	7.	0.45	5.	2.

	TDn	MDn	RA	i	CV
ST	159	5.12	0.33	3.	0.
E	129	4.16	0.26	4.	2.
2	159	5.12	0.33	3.	0.
3	179	5.77	0.37	3.	1.
4	151	4.87	0.31	3.	2.
5	181	5.83	0.37	3.	0.
6	181	5.83	0.37	3.	0.
7	209	6.74	0.43	2.	0.
8	119	3.83	0.24	5.	1.
9	115	3.70	0.23	5.	0.
10	155	5.00	0.32	3.	2.
11	185	5.96	0.38	3.	0.
12	185	5.96	0.38	3.	0.
13	147	4.74	0.30	4.	1.
14	177	5.70	0.36	3.	0.
15	113	3.64	0.23	5.	0.
16	127	4.09	0.26	4.	1.
17	141	4.54	0.29	4.	1.
18	171	5.51	0.35	3.	0.
19	185	5.96	0.38	3.	0.
20	155	5.00	0.32	3.	1.
21	195	6.29	0.40	2.	0.
22	195	6.29	0.40	2.	0.
23	165	5.32	0.34	3.	2.
24	193	6.22	0.40	2.	1.
25	223	7.19	0.46	2.	0.
26	129	4.16	0.26	4.	1.
27	159	5.12	0.33	3.	0.
28	113	3.64	0.23	5.	2.

Analyzing Results

Traditional Houses	Mean V.				Contemporary Houses	Mean V.			
	Tdn	**Mdn**	**I**	**Cv**		**Tdn**	**Mdn**	**I**	**Cv**
1- Al Suheimy house	**83**	**3**	**6**	**1**	1- Villa in Sodic New Cairo	**83**	**4**	**3**	**1**
2- Al Harrawy House	**24**	**6**	**4**	**0**	2- One Floor Stand Alone Villa	**40**	**2**	**3**	**1**
3- Aly Labib House	**13**	**4**	**4**	**1**	3- Palm Hills Villa	**66**	**3**	**3**	**1**
4- Zaynab Khatoon House	**29**	**6**	**4**	**1**	5- Villa in Alegria	**16**	**5**	**3**	**1**

Table 1 comparing the results of the chosen samples

Findings:

The Criteria of Architecture Design of The Islamic house revealed an understanding of the laws of composition, which created a conscious arrangement of elements of a building in a functionally and visually satisfying whole. Hierarchies were an essential factor in the
design process of the Islamic house, which highlighted the importance of the interior and exterior of a building. Scale, proportion, contrast and balance were also tools, which enhanced the character of buildings.
However, there is a huge difference between Islamic and contemporary houses is about the integration and connectivity of spaces in a house, as the hierarchy of connectivity and accessibility to spaces are limited in modern houses
They relate to social and cultural changes and the resulting spatial transformations; these can be in the form of relationships between other underlying concepts such as individuality and communality; and public and private. However, such dialectics need supporting tools that go beyond the typological analysis.
In this context, the pattern language can be regarded as a process of looking at the house elements as words, that form a vocabulary of a language that has a cohesive grammar. Thus, the study of patterns can provide a basis for comparing the houses built at different times thereby the reason for the existence of certain patterns and the meanings possibly associated with them can be revealed. The behavioral setting concept can be utilized as a research paradigm conceived as a process of systematic observation of what people actually do in a particular pattern in a particular time with emphasis placed on the way in which people behavior in space influences and is influenced by its physical characteristics.

- The most important Spaces in the Islamic Houses are the court and the Hall (Q'aa – Durq'aa- Iwan)

Results

The results of the analysis using (A- Graph) of Case studies revealed the features of the differences between the Samples and their spatial organization, as analyzed referring to the (root) node
despite of the differences in spatial configuration and total depth rate, and mean depth values and the similarities in control values, integration value in traditional houses is Higher than that of contemporary houses which indicates a higher efficiency for social

interactions and integrated activities. As the interaction and activities between the family is directly proportional to the value of integration and control, as mentioned previously in the research.

Recommendations:

1- **There is a persistent need for considering Human Behaviors that are affected by Architecture Design.**
2- **Families need social interaction, connectivity and a level of Privacy to feel safe inside the house.**
3- **Humans need various levels of privacy.**
4- **Seeking profit in Architecture Design of residential buildings contradicts with the prosperity of families and builds an apart and selfish household.**
5- **Space syntax is an effective app for analyzing Spatial configuration.**
6- **Courtyard houses Design is most reliable for achieving connectivity, control, privacy and integration which lead to healthier household.**

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