

Genetic Shape Plan of The Traditional Ottoman's Style House

- An Analytical study of selected models of the Traditional Ottoman's style house -

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Abstract

Buildings vary in shapes, types and locations, but are correlated in the original elements and relations to constitute the unified building Type or a certain architectural style from a certain place. These relations are linking points among different architectural styles; each style has a strategy in dealing with these elements and relations. The strategy of dealing with those variables are the genetic tape that contains several codes, each of which donates relation shape. The varieties of these relations lead to a variation in building types and architectural styles. This variation in the structure of the code (the relations) depends on several environmental, social and geographical factors...etc.

The building types that could be much affected by those factors is the traditional house. The traditional Ottoman's style house has been chosen in this study; as through previous studies conducted that there are some important points about the house and its shape . Most of the previous studies tackled only one specified term, other studies focused on the geometric principles to create traditional shape , and there is a co-genetic relations among the traditional houses. In order to achieve the objective of this paper, four samples of traditional house from four countries(16 samples): Iraq, Syria, Turkey and Egypt have been analyzed (four samples for each). An analysis houses outlines has been conducted and the major terms and determinants of the genetic code were found out. Then, the relations through which the basic shape was constituted have been found. Four elements of the genetic tape were identified as follows: Centrality, repetition, balance and scale. A matrix of the relations was made to find out the genetic tape of each house then of each region and eventually of the architectural style. The findings of the study show the existence of shape correlations which resulted in similarity among the genetic tapes of the traditional houses. Findings also show the shape's genes that identify the architectural identity of each area under discussion in addition to results of cluster analysis that show the three groups of selected sample within three clusters .

Key word :Traditional house, shape's structure , geometric element , co-genetic relation , shape's center , regularity. Genetic code .

شكل الخارطة الجينية لمخطط البيت التقليدي العثماني دراسة تحليلية لنماذج منتخبة من البيوت التقليدية من الطراز العثماني

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الملخص :

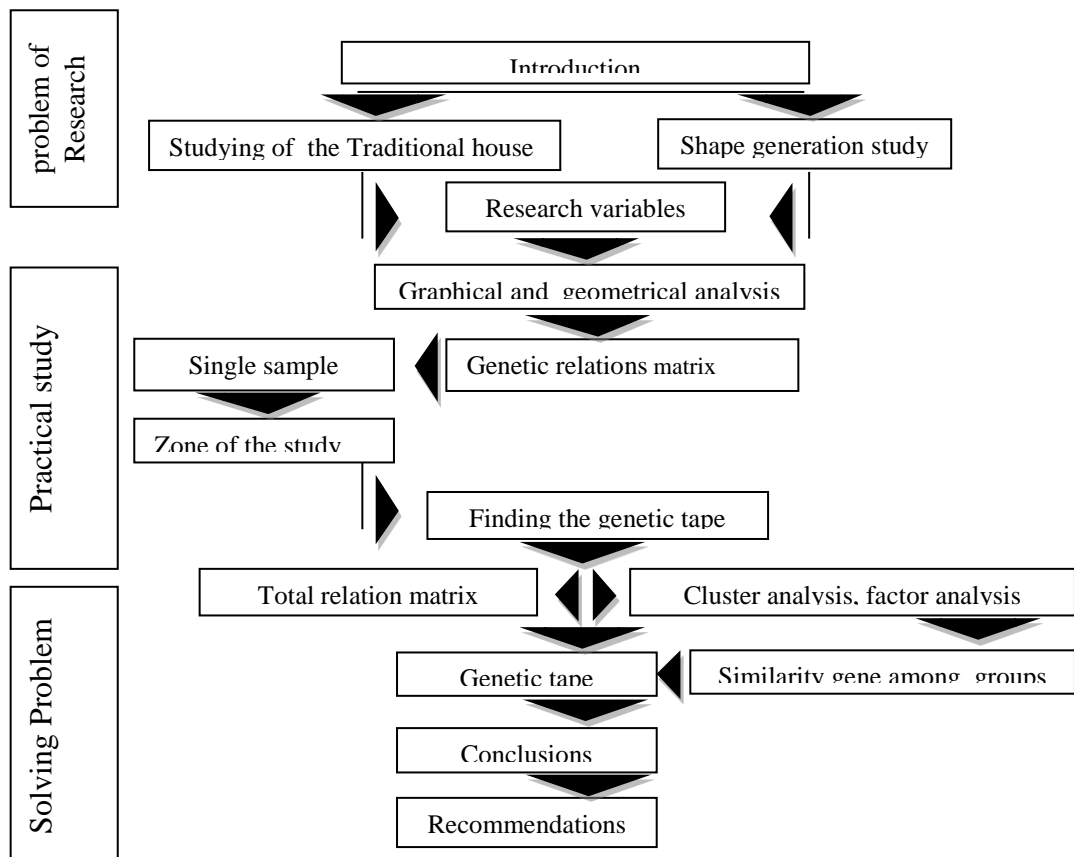
تتعدد المباني وأشكالها وأنماطها ومواقعها ولكنها ترتبط فيما بينها بعناصر وعلاقات أصيلة بين هذه العناصر لتشكيل نمط بنائي واحد أو طراز معماري معين من مكان ما ، هذه العلاقات هي نقطة الوصل بين الطرز المعمارية المختلفة ، فلكل طراز إستراتيجية في التعامل مع هذه العناصر والعلاقات ، إستراتيجية التعامل مع هذه المتغيرات هي الشريط الجيني ويحتوي عدة شفرات ، كل شفرة تدل على علاقة شكلية وباختلاف هذه العلاقات تختلف الأنماط البنائية والطرز المعمارية وهذا الاختلاف في تركيبة الشفرة (العلاقات) يعتمد على عدة عوامل بيئية واجتماعية وجغرافية . الخ ، ومن الأنماط البنائية التي تتأثر بهذه العوامل بشكل كبير هو البيت التقليدي ، حيث تم اختيار الطراز العثماني ليكون عينة للدراسة ، كما أوضحت الدراسات السابقة وجود علاقات مشتركة بين البيوت التقليدية إضافة إلى الدراسات التي ركزت على المبادئ التصميمية للبيت ذو الفناء ، لذا تم اختيار أربعة عينات من البيوت التقليدية العثمانية من أربعة مناطق (16 عينة) هي العراق وسوريا وتركيا ومصر (لكل منطقة أربعة عينات) ، حيث أجريت عملية تحليل لمخططات البيوت وتم إيجاد المفردات والمحددات الرئيسية للشفرة الجينية ، ثم تم إيجاد العلاقات الشكلية والتي بواسطتها تم تكوين الشكل الأساسي ، حيث تم تحديد أربعة عناصر للشريط الجيني وهي المركزية والتكرار والتوازن والمقياس وتم عمل مصفوفة من العلاقات لإيجاد الشريط الجيني لكل بيت ومن ثم كل منطقة وأخيرا للطراز المعماري ، حيث أبرزت نتائج الدراسة العملية وجود علاقات تراطيب شكلية هي التي أدت إلى التشابه بين الأشربة الجينية للبيوت التقليدية ، كما أظهرت النتائج الجينات الشكلية المحددة للهوية المعمارية لكل منطقة دراسية إضافة إلى تصنيف العينات المنتخبة إلى مجموعات عنقودية مكونة من ثلاثة مجاميع ضمن ثلاث ارتباطات عنقودية .

1.Introduction:

The most important structural and cultural phenomenon of selected samples of people is to build their houses or places as an urban complexes ,which formed big cities and capitals having historical cultural characters such as Aleppo, Mosul, Diyar Baker, Bursa , Damascus, Cairo..etc. During all ages till the recent days. Traditional Arab houses drew old cities and are distinguished by architectural and graphical features such as the court, rooms ,... etc.(*Cerasi, 1998,p116*) These rooms and spaces were designed and organized to create the court, which was formed in various shapes commonly as a square or rectangle depending on relations among elements of the house. Thus; there are several shapes of traditional houses belong to the same style which is ascribed to the formation of the co-genes that are existed. Therefore, the co-genes among those houses have been found out in this research depending on structural relations of house shape.(*Wazeri ,2002, p16*)

The review of some studies on the traditional house and its shape shows the research problem that is unclear matrix of the shape and relations of the traditional Ottoman’s style house is found and there are no subjective study make a shape map , in spite of the similarity among those houses. However; there are deeper relations for this similarity. Such a matter has been hypothesized in the research. More precisely, the hypothesis of the research indicates that there is a co-genetic code between the traditional Ottoman’s style house and was thus established to attain the objective of the research which is (finding the genetic tape of the shape and relations of traditional Ottoman’s style house). In order to attain the objective of the research, the shape and mechanisms of how to deal with it as well as the origin shapes have been studied.

The research has been divided into two parts. The first is a review of previous studies that deal with shape in traditional architecture. Second part covers the shape and its constitutional mechanisms. Based on what has been achieved in the first part of the research, the research variables which are central-shaped, repetition, balance and scale have been chosen. These variables are of great importance in performing shape analysis process upon chosen models in the applied study. Four samples of each area have been chosen, finding out genetic codes of each house as well as the genetic tape of each area under discussion for fear of attaining the objective of the research followed by conclusions as shown in the research structure.

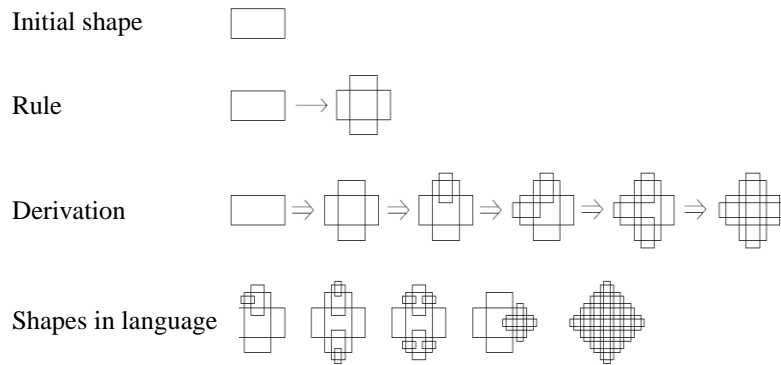


2. Previous studies

There are different studies concerned on the traditional house. Part of these studies deal with the spatial arrangement, the shape and traditional style of the house. Following are the most important studies that have approached the topic under discussion such as the study of **Zein Al'abdeen** (*Zeyin alabidin,1998*). The study has focused on reviewing the major factors that affected the shape of the Arab-Turkish traditional house, through depending on the environmental and the social factors in designing the traditional house in these regions as well as points of dissimilarity between plan of the traditional Turkish house and those of the traditional Arab house. The traditional Turkish house was occasionally characterized by its random shape particularly in the open area. Based on the study, we could conclude that there is a special shape of the traditional Turkish house; yet the genetic relations are the ones which connect the traditional Arab house with the Turkish one. As for the study of **Wazeri** (*Wazeri, 2002*); it has shown the spatial relation of the courtyard and why its places are different in the traditional house. The study was concerned about the geometrical dimensions of the courtyard and its location depending on the environmental factors only through making a comparison among three courtyards of traditional houses from different areas in Cairo and Toshka. The researcher has found a relation in the shape structure of houses depending on the location of court within the layout in addition to its area. The conclusion attained by the study leads to the importance of finding this shape relation not only at the courtyard level, but also at the whole house structure level.

The study of **Colakoglu** (*Colakoglu , 2003*) focused on the possibility of designing and developing traditional houses by depending on the rules of spaces connection among each others. The research has concentrated on finding the major relations by which the rooms of the traditional house are connected. Finding those relations, the researcher has made use of them in re-planning the same model and changing the mechanisms of dealing with the relations in order to draw a new outline having a structural correlation with the original traditional house. The research also focused on the relations of spaces among each others as well as the spatial arrangement of the traditional house, still, the whole shape of the house and relations shape of its structure have not been studied. Through this research, we could make use of the language and the co-relations existed among traditional houses to direct the research for finding out this language in a form of a genetic tape.

Among the studies that employed artificial intelligence, is the study of **John S. Gero and Vladimir Kazakov** (*Gero,2006*). In this study, artificial intelligence has been used to re-shape the outlines depending on codes being found in the original outline. The study has been concerned with the geometrical genes of the outline and how to employ them in drawing a new outline based on mathematics formulations. The research has considered that the geometric genes of every building depend on their geometrical dimensions and this gene could be used in the future to develop the same building. The research used mathematical formulations and equations to regenerate the outline or to develop it. The study of **Knight**, (*Knight ,1994*) shown a possibility to deal with the rule of shape and adopting them as a language of design. These rules can be employed to develop the shape besides the possibility of analyzing any given geometrical shape and bringing it back to its original shape passing through several stages of using shape rules as shown in figure No. (1).



(Figure 1) Stages of deriving the shape and origin shape. (Knight, 1994)

2-1 Conclusions of previous studies:

Previous studies focused on the traditional house beside the relations by which the spaces of the house are connected. Some of studies also showed that there is a possibility to find a language to design and develop the shape depending on the dimensional and geometrical relations. From the aforementioned, the problem of the research has become evident (no clear matrix of the shape relation for the traditional Ottoman's style house is found). The study has been divided into two parts, the first is concerned with the traditional house. As a result, we could conclude that shape, environmental and spatial relations for the house's shape could be found. There are also shape relations shared by the traditional house and are considered as being genes besides certain differences. From part two, we could conclude a method for the mechanism of deducing genetic codes to reach a solution for the problem of the research by finding out the relations matrix and the genetic tape of the traditional Ottoman's house.

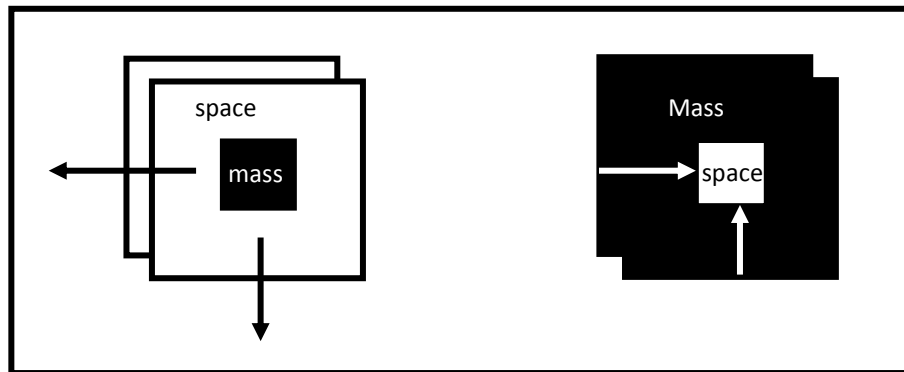
3- Traditional house and architectural style:

The social and historical circumstances have affected the traditional house by making it closed from outside and opened from inside, giving cities lanes a rocky elevation with high windows (Zeyin alabidin,1998,p32). These circumstances had granted a high privacy to a traditional Ottoman's house respect to its design and to its general shape (Cerasi,1998,p117) . Houses are different according to peoples social status, houses of rich and prominent persons are similar in structure, but is one of different boarder services and building sizes (Bianca ,2000,p73).

Traditional architecture is a representation of the architectural mass type harmony, which depends on its plans conformity and their type represents the harmony and recurrence of the plan and its shape, the shape of Islamic architecture has symbolic significances probably including many physical meaning, and these shapes have many architectural elements. The Arab and Islamic world in spite of that each one has a potential features but we can see vary in shape and concept (Zeyin alabidin,1998,p239).. Thus, we can analyze the house shape to get the original shape and identify any affected elements. To prove this relation, there should be a precise geometrical analysis to discover the code of the designing process, and how to deal with the shape codes, and its type related directly to the plan's structure.

3-1. Plan shape of Traditional house in Islamic cities:

Environment, for those living in the Islamic city, means pureness. Therefore, we can see, that the man had added the holiness of environmental elements to the design of his house by getting in an important element that is the courtyard. (Wazeri, 2002, p31), and making a square or rectangle shape of houses intervened by open centre and achieving the containment in this design, Walls are the essential elements to determine and separate this place internally and this distinguish the Islamic architecture of its sculpturing, The mass makes the space (Bianca, 2000, p83-84) (Figure 2).



(Figure 2) The inside to outside design and vice versa – space and mass (resource: researcher) (The figure is drawn by researcher)

The traditional house created by several elements and parts (Colakoglu, 2003, p144) which generate its shape by changing strategies to use this element and its position in the stage of design, this change will create the style of the house in different cities and places (Cerasi, 1998, p137).

3-2 Main elements to create the traditional shape :

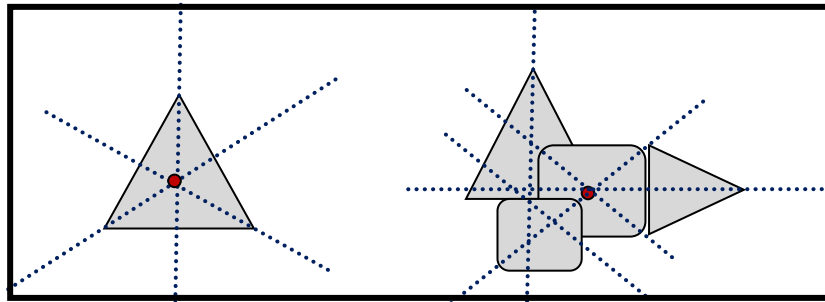
By studying plans and types of using spaces in the Arab traditional house, traditional ideas and beliefs reflected architectural features on the general house shape, as well as principles of creating space within the mass which was common in most of the Islamic architecture (Bianca, 2000, p28). That definitely means the balance between outside and inside in privacy, environment and shape. (Wazeri, 2002, p123).

These principles provided the possibility of impaction and neighboring among buildings and a great capability of utilizing the space areas inside the house. Also, using variable recurrence added a kind of diversity in the house shape. So, these indeed are characteristics of Islamic house in general, and it is supposed to find important elements to create the traditional house genetically, the concept of the traditional house is available but the plan design varies. Then analysis will be made to the traditional houses from four places (Iraq=Mosul, Egypt=Cairo + Tushka, Syria=Aleppo + Damascus, Turkey=Bursa + Diyar Baker + Ankara), to find, how to deal with shape feature. This analysis will be geometrically and graphically depending on features of one house, find the genetic code and the similarity among selected samples, and these code are depend on architectural principles and relations as shown in the next paragraph.

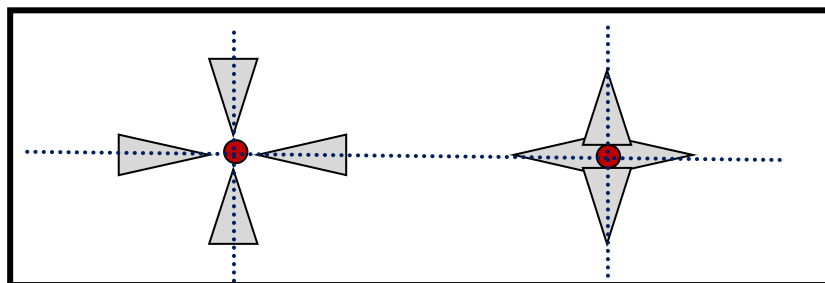
4. Centrality, repetition, scale and regularity

By reviewing the analytic and geometrical studies, we can reach the structural code of the traditional house, the primary study of the house design showed that it has many genes which identify its shape like Centrality, openness, neighboring relations, scale repetition, balance similarity, symmetry and proportionality. In this paper, focusing will be on centre of

shape, repetition, scale and balance attempting to make a genetic line of the traditional house depending on these genes (geometric features). Some studies have suggested that every architectural or organic shape has a centre (Danby,1963,p27). When shapes get together, one shape may lose its centrality which moves to other shapes according to the nature of this gathering (March 1971,p16) (Figure 3). Centre can be shaped by directing other shapes towards it or being connected to one point. Hence, another variable comes to appear which is recurrence and balance (Danby,1963,p46) (Figure 4).



(Figure 3) shape's center differs when shapes get together. (resource: researcher)



(Figure 4) Centrality differs according to the different relation of parts. (resource: researcher)

Centrality is considered a starting and crossing point of the shape's main axes. The other variable is the shape balance (Bonnie,1999,p138) and according to the scale, samples will be analyzed by adopting the scale within the shape forming stages, one of the secondary variables is the repetition of one element with different scales (Knight,1999,p482). These variables can be put in code matrix after coding each variable, the matrix will appear after making the applying study by analyzing samples and finding out the effective variables. The matrix illustrated in (table 2) is shown as columns which represent the affective variables arranged as numbers (1, 2, ..., 7) while the rows represent the main variables which are arranged by letters (a, b, c, d).

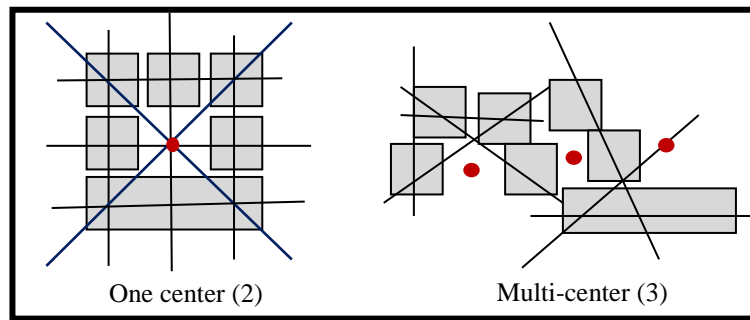
4.1 shape's centre:

This will be symbolized (row - a), but the secondary variables are centre type (column-1) (figure 5):

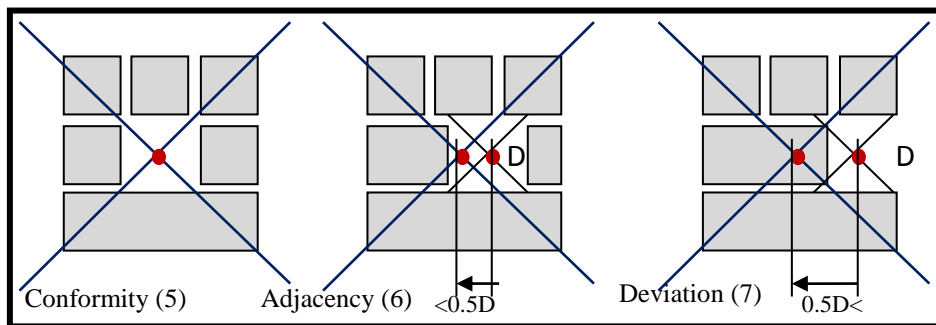
- one centre of the shape : its digital symbol is (column-2) that the shape has centre.
- multi- centres of the shape : its digital symbol is (column-3) which means there are many centers for shape (March,1971,p43-44).

And we can add other variables to know the conformity of a middle centre of courts within shape's centre for the traditional house and its symbol is (column-4), (figure 6)

- centre conformity : its digital symbol is (column-5).
- centre adjacency : its digital symbol is (column-6) when the distance between the two centers equals half length of the court.
- The deviation from the court centre : its digital symbol is (column-7) (Danby,1963,p27-29) (Bonnie,1999,p139.)



(Figure 5) the shape's centre and its types . (resource: researcher)



(Figure 6) the conformity of centers in the shape . (resource: researcher)

There could be several genetic codes for this variable included in row -a:

	1	2	3	4	5	6	7
a	0	0	0	0	0	0	0

After completing the practical study and finding the geometric element and relations , this row has several codes

	1	2	3	4	5	6	7
a	1	1	0	1	1	0	0

Or

	1	2	3	4	5	6	7
a	1	0	1	1	0	1	0

Or

	1	2	3	4	5	6	7
a	1	0	1	1	0	0	1

Or

	1	2	3	4	5	6	7
a	1	1	0	1	0	1	0

Or

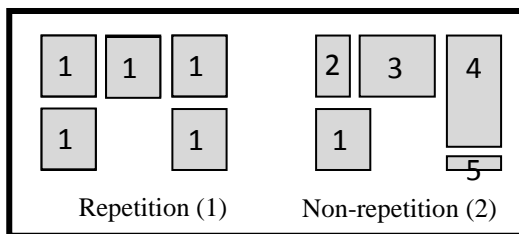
	1	2	3	4	5	6	7
a	1	1	0	1	0	0	1

And the same method will be adopted to all variables in the next stage . if the column (1) is zero the secondary variable (2 to 7) will marked as zero , so it mean that this variable is not found in this tape.

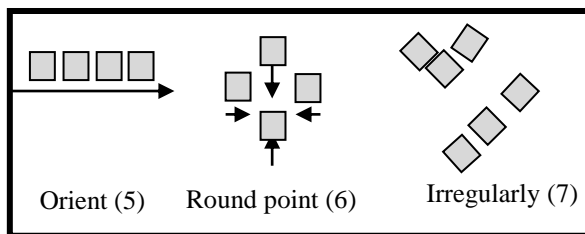
4.2 Shape repetition :

Its symbol is (row-b) and it has two main variables for referring to the level of the recurrence and its digital symbol (column-1) (figure 7),

- repetition in main shape : its symbol is (column-2) which means there is a repetition in main shape . (March 1971,p53)
- one shape for each part : many repetitions in the same main shape ,its digital symbol is (column-3), that shows that there is no repetition. But other variables in the style of repetition and its digital code is (column-4) which are : (figure 8)
- Orient repetition: its digital symbol is (column-5) ,
- repetition round point : its digital symbol is (column-6).
- Crossing repetition : its genetic symbol is (column-7) , in which the part in repeated irregularly within total shape. When this type of repetition is present, shape usually consists of many centers.



(Figure 7) Repetition as element of genetic code



(Figure 8) Types of repetition

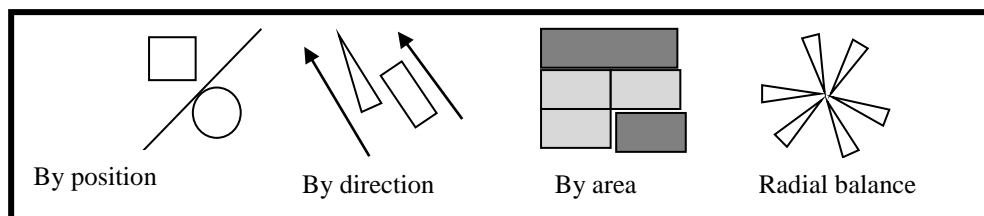
The genetic codes of this variable for this row are :

	1	2	3	4	5	6	7
b	0	0	0	0	0	0	0

4.3 shape's Balance :

Its digital symbol in the research is (row- c) and it has four secondary variables (Bonnie,1999,p149), as following : (Figure 9)

- Shape's balance : its symbol is (column-1) and it has two variable :
 - 1- By-position shape balance and its digital symbol is (column-2).
 - 2- By-direction shape balance and its digital symbol is (column-3).
- By- area balance and its symbol is (column-4).
- Radial balance and its symbol is (column-5).
- no balance (column-6).



(Figure 9) The genetic code of the balance and their types. (resource: researcher)

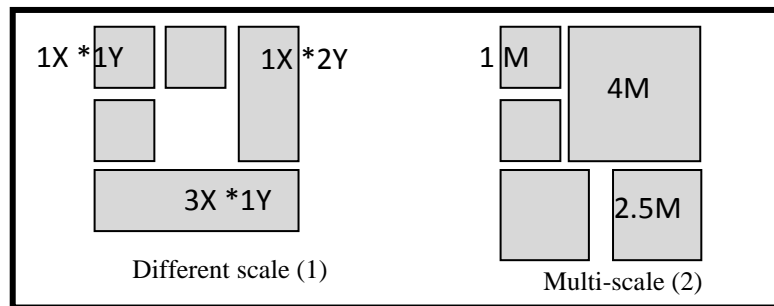
The genetic codes of this variable are :

	1	2	3	4	5	6	7
c	0	0	0	0	0	0	0

4.4 Scale:

It is placed in the genetic matrix as (row- d), the available smallest space area in each sample will be identified in the example as a standard of the scale, (Danby,1963,p91-93): (Figure 10)

- Different scale which is symbolic by , the change in x direction and y direction is different (column-1).
- Multi-scale which is symbolic by , the change in x and y direction is same (column-2).
- without scale principle used to generate the plan ,(column-3).



(Figure 10) The scale of traditional house plan in general . (resource: researcher)

The genetic codes of this variable are :

	1	2	3	4	5	6	7
d	0	0	0	0	0	0	0

5. Case study:

After identifying genetic codes determinants which are represented by some architectural characteristics the traditional house has, the correlate process will be finding the final matrix and genetic tape , we can make a genetic matrix for every traditional house. This process can be done by using geometrical analysis of the shape by using AutoCAD software in order to get the highest objectivity in analyzing the variables. At this stage, samples will be scaled by using measurement form after organizing the main and secondary variables to make easy to apply the study and to transfer the discovered information of the geometrical analysis for each sample. This paper form also contains the number of the sample and its information as well as the sample plan (diagram) drawn by AutoCAD as shown in table no. (1) . The next stage of the study is to move the geometrical analysis results to the genetic matrix containing variables as codes (table 2) and after the genetic line which represents the main features and codes of traditional houses as follows: (table 3).

(Table 1) paper form for measuring variable of the sample. (resource : researcher)⁽²⁾

sample	About the sample		Figure	
Centrality (a)	types (1)	One centre (2)	A12	
		Multi-centre(3)	A13	
	Conformity (4)	Conformity (5)	A45	
		Adjacency (6)	A46	
		Deviation (7)	A47	
Repetition (b)	Repetition level(1)	Shape itself (2)	B12	
		Individual (3)	B13	
	Repetition style (4)	Orient (5)	B45	
		Round point(6)	B46	
		Irregular (7)	B47	
balance (c)	In shape (1)	By position (2)	C12	
		By direction(3)	C13	
	Area balance (4)	C4		
	Redial balance (5)	C5		
	Non- balance (6)	C6		
scale (d)	Different scale (1)	D1		
	Multi-scale (2)	D2		
	Without scale (3)	D3		

(Table 2) Transform the results into a relation matrix for each sample

	1	2	3	4	5	6	7
a	0	0	0	0	0	0	0
b	0	0	0	0	0	0	0
c	0	0	0	0	0	0	0
d	0	0	0	0	0	0	0

(Table 3) Translate the results into a genetic line for each sample.

Sample No.:	Gen.1(a)	Gen.2(b)	Gen.3(c)	Gen.4(d)
Gen tape				

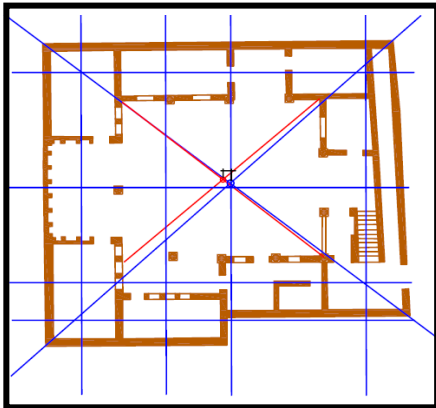
5.1 The selected samples:

From each study area, four samples of traditional houses plans are chosen (16 –models), many samples of traditional houses have been selected from the Ottoman's style. from Mosul (north of Iraq) are: ⁽³⁾ "Ziadah" "Al-Twaleb houses" and two houses from ottoman's style in old Mosul city. For Cairo (Egypt), "Zainab Khatoun", "Jamal Al-Din Al-Zahabi", "Ibraheem Al-Sinari" and "Al-Sahemi" in al Kardlea quarter. In Turkey, selected samples are "Taher Basha", "Bebek", "Mustafa Afandi" from (Bursa, diarbaker, Ankara,), and from Syria, Dahdah House, Agaqbash House, Bleet House and Basel House. All samples were

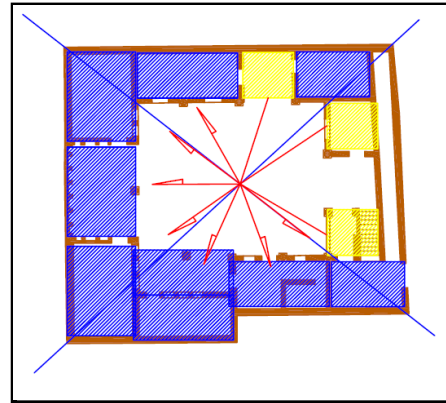
analyzed by depending on the plan of the ground floor .These samples were selected in this study because there is a full documentation study for its plans as following:(see the appendix)(Cerasi,1998)(wazeri,2002) (Mustafa,1983)(Arkawi,2003)(Hayderan,2002)(Zeyin elabidin,1998)(kamona,1989).

5.2 Sample analysis and finding out the genetic line :

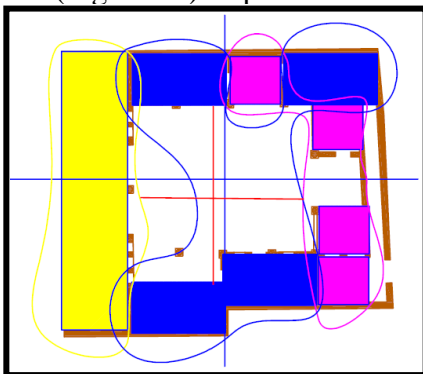
The architectural analysis of the first sample from old Mosul city were made on “Al Twaleb” house as show in (figure 11,12,13,14)



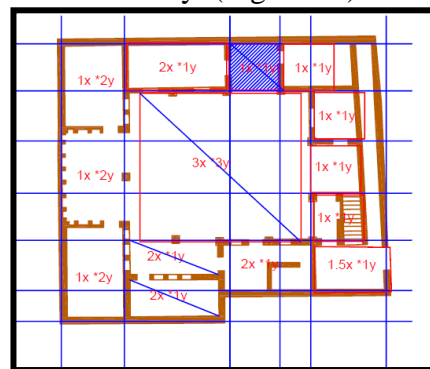
(Figure 12) Repetition



Centrality (Figure 11)



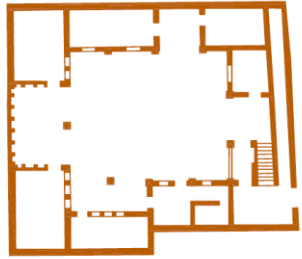
Balance (Figure 13)



(Figure 14) Scale

At this stage of research, the sample will be measured as follows table:

(Table 4) paper form for measuring the sample No. (1-1).

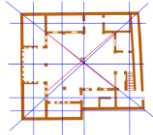
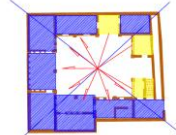
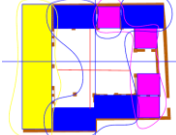

sample	About the sample		Figure	
1-1	Al-Twaleb house which is a traditional house located within old Mosul city boundary (Iraq)-Ottoman' style .			
Centrality (a)	types (1)	One centre (2)	*	A12
		Multi-centre (3)		
	Conformity (4)	Conformity (5)		A46
		Adjacency (6)	*	
Deviation (7)				
Repetition (b)	Repetition level (1)	Shape itself (2)	*	B12
		Individual (3)		
	Repetition style (4)	Orient (5)		B46
		Round point(6)	*	
Balance (c)	In shape (1)	By position(2)	*	C12
		By direction(3)		
		Area balance (4)	*	
	Redial balance (5)			
	Non- balance (6)			
Scale (d)	Different scale (1)		*	D1
	Multi-scale (2)			
	Without scale (3)			

After driving codes of each variable and model of study, these codes are translated and connected to form the genetic line for each sample as follows :

(Table 5) shows the translation of the results into a relating matrix .

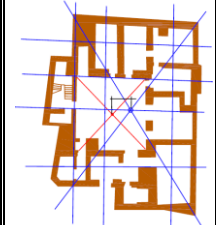
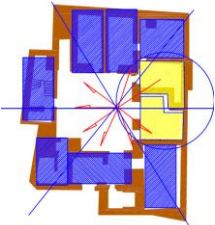
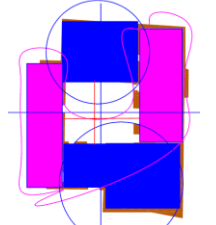
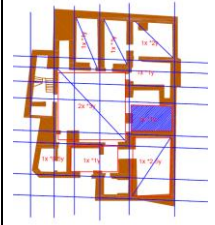
	1	2	3	4	5	6	7
a	1	1	0	1	0	1	0
b	1	1	0	1	0	1	0
c	1	1	0	1	0	0	0
d	1	0	0	0	0	0	0

(Table 6) the digital codes of the sample (1-1).

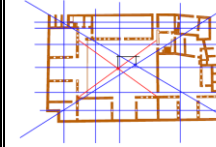
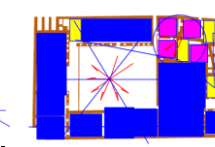
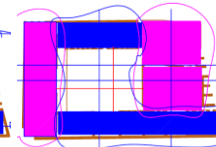
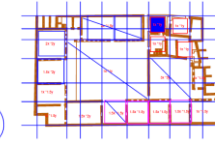
Sample No:	Gen.1(a)	Gen.2(b)	Gen.3(c)	Gen.4(d)
1-1				
	1101010	1101010	1101000	1000000
Gen tape	1101010110101011010001000000			

The tables above shows complete analysis of one of the selected samples , other figures and tables for other samples will be added at end of the research. “Zainab Khatoon” is another analysed result house in Cairo (Table 7), and “Basel house” from Aleppo (table

(Table 7) the digital code of the sample (2-1)

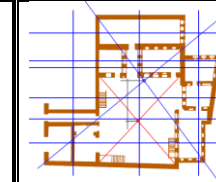
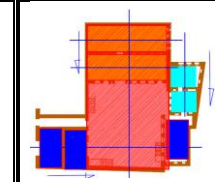
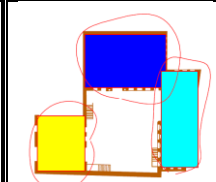
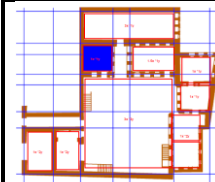
Sample No.:	Gen.1(a)	Gen.2(b)	Gen.3(c)	Gen.4(d)
2-1				
	11011001	1011010	1101000	1000000
Gen tape	1101100110110101011010001000000			

(Table 8) The genetic line of the sample (3-1):

Sample No.:	Gen.1(a)	Gen.2(b)	Gen.3(c)	Gen.4(d)
3-1				
	10111001	1011001	1101000	1000000
Gen tape	10111001101100111010001000000			

During analyzing traditional houses shapes in Turkey , there is a difference in some genes shown in (Table 9).

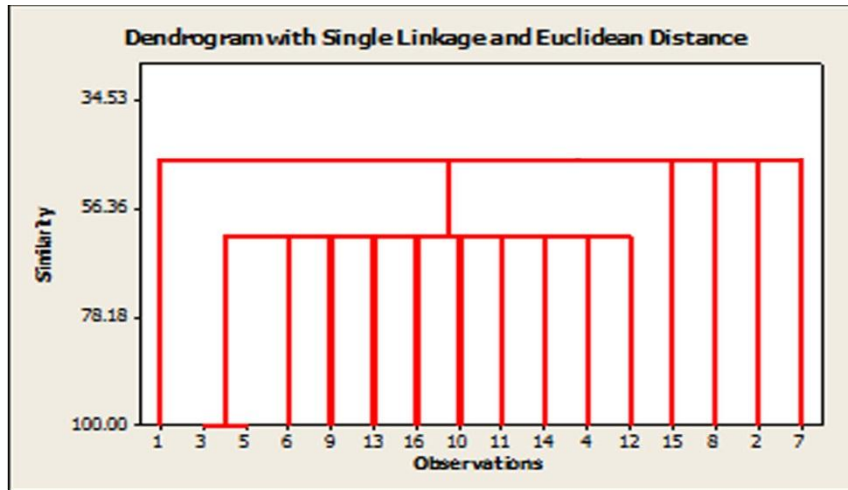
(Table 9) Translate results into a genetic line for sample (4-3).

Sample No.:	Gen.1(a)	Gen.2(b)	Gen.3(c)	Gen.4(d)
4-3				
	1101001	1011100	1011000	1000000
Gen tape	1101001101110010110001000000			

5-3. Results

After applying the practical study by using measurement form, and measured traditional houses samples from Ottoman's style in Egypt , Syria , Iraq and Turkey, and transformed results to relations matrix. Using a cluster analysis, results showed that there are strong relations and linking in mechanisms of designing the house shape, by the mutual approximation in the genetic line of each sample .This similarity is considerable among selected samples. But there are genetic mutations in the house structure which made them convergent formally and structurally giving sense of a similarity in using the house samples, that each area had its own digital line which means that there is different identity. Results showed that there is a conformity among Ottoman houses in Egypt , Iraq , Syria and Turkey with (62%), and there are relations shape among selected houses in Mosul with Ottoman's style in general. Turkish traditional houses have different structure somehow from Iraq, Egypt and Syria's and that is possibly due to the environmental and social conditions: According to the shape center, the traditional house in Iraq and Egypt has a clear shape centre providing a greater stability and a clarity regarding the functional distribution. The Egyptian

and Iraqi houses are simple not complicated, while the Turkish and Syrian's have more than one centre, keeping the main shape center, which made the house more complicated regarding to the functional distribution. Also due to the centre deviation from the court centre in the Syrian, Turkish and Egyptian traditional houses, while the shape centers in Mosul traditional houses are adjacent to the court centre. For recurrence, the traditional house in Mosul has more regular and harmonious recurrence than the others, which provided the house with bigger balance as well as approximation between the traditional house in Iraq and Syria.



(figure 15) cluster analysis show 3 groups from 16 samples in 18 variables.

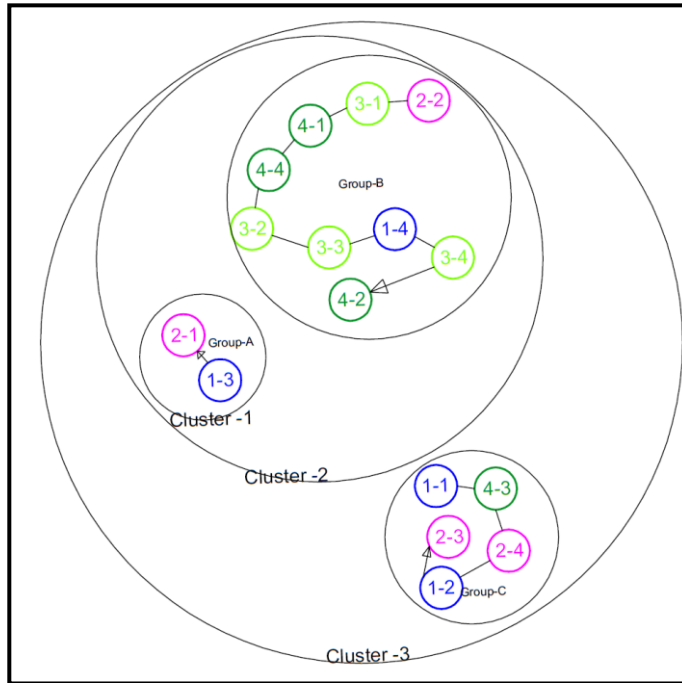
results of cluster analysis (figure 15) are in 3 groups , group A consist 2 samples (3-5) related with group B (samples -6 -9-13-16-10-11-14-4-12), these two groups linked with group C (sample-1 -15-8-2 -7) .

(Table 10) matrix of variables and selected samples

	A12	A13	A45	A46	A47	B12	B13	B45	B46	B47	C12	C13	C4	C5	C6	D1	D2	D3
(1-1)-1	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	1	0	0
(1-2)-2	1	0	1	0	0	1	0	1	0	0	1	0	1	0	0	1	0	0
(1-3)-3	1	0	0	0	1	0	1	0	1	0	1	0	1	0	0	1	0	0
(1-4)-4	1	0	0	0	1	0	1	0	1	0	1	0	0	1	0	1	0	0
(2-1)-5	1	0	0	0	1	0	1	0	1	0	1	0	1	0	0	1	0	0
(2-2)-6	0	1	0	0	1	0	1	0	1	0	1	0	1	0	0	1	0	0
(2-3)-7	0	1	0	1	0	0	1	0	0	1	0	1	0	1	0	0	0	1
(2-4)-8	0	1	0	0	1	0	1	0	0	1	0	1	0	0	1	0	1	0
(3-1)-9	0	1	0	0	1	0	1	0	0	1	1	0	1	0	0	1	0	0
(3-2)-10	1	0	0	1	0	0	1	0	0	1	1	0	1	0	0	0	1	0
(3-3)-11	1	0	0	1	0	0	1	0	0	1	1	0	1	0	0	1	0	0
(3-4)-12	1	0	0	1	0	0	1	0	1	0	1	0	0	1	0	1	0	0
(4-1)-13	0	1	0	0	1	0	1	0	0	1	0	1	1	0	0	1	0	0
(4-2)-14	1	0	0	0	1	0	1	0	0	1	1	0	1	0	0	1	0	0
(4-3)-15	1	0	0	0	1	0	1	1	0	0	0	1	1	0	0	1	0	0
(4-4)-16	0	1	0	0	1	0	1	0	1	0	0	1	1	0	0	1	0	0
total	10	6	1	5	10	2	14	2	7	7	11	5	12	3	1	13	2	1
Ratio	62.5%	37.5%	5%	31.5%	62.5%	12.5%	87.5%	12.5%	43.75%	43.75%	67.5%	31.5%	75%	20%	5%	86.5%	12.5%	5%

(table 11) final matrix for ottoman's style of selected traditional houses

	A12	A13	A45	A46	A47	B12	B13	B45	B46	B47	C12	C13	C4	C5	C6	D1	D2	D3
	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	1	0	0



(Figure 16) results as 3groups in 3 Clusters related to results in table no.10 .

6. Conclusions:

Every functional style has its own genetic line and shape design. The traditional house is one of the significant samples which impacts directly on forming the city because it is regarded as the main element of the city structure. Houses are similar in the functional way that they do the same purpose in every zone ,there are other effects which make the similarity between two or three zone . These effects are determinates to design the shape of traditional house , these effects vary from zone to another and from country to another depending on the social and environmental nature of the architectural style in these zones . Therefore, the conclusion from studying the traditional house for the Ottoman's style, the traditional Ottoman's style house has different types and shapes as the results have showed , but this percentage is measured through every variable of the shape design in the house. This difference could be great in spite that the percentage is considered approximate, that changing one gene in the house's genetic matrix may lead to a mutation in the house structure, which make the middle court to be outside the house as a garden for example. The traditional house which have been studied can show us that they are simply of one style by their genetic line in spite of the differences among genes' location within one line but ultimately they have Ottoman styles with different shapes . There are affected variables more than others like conformity of shape's center with court's center, the results show that genetic lines is deferent form place to place depending on zone and culture features in addition to change the element of the house concept related with the environment .

7. Recommendations

- special mechanism should be used to design buildings in old cities ,the new design should be depending on the genetic line for the same type of building in old cities ,
- The geometrical features (shape centre , balance , repetition style and the scale)should be adopted when the designer plans to design and restore traditional house of ottoman's style.
- Traditional houses which had not been documented before should be documented , and make a digital genetic line for every house as a “code” to be easy used for researchers and reformers.
- Graphical analysis should be made before designing and restoration any type of building inside traditional cities .

8. References

- Arkawi,Dr. Abir ,(*Preservation of traditional houses in the old city Damascus*), The 4th International Conference - Science& Technology in Archaeology & Conservation, , Organized by the Department of Antiquities of Jordan AND Queen Rania Institute of Tourism and Heritage /The Hashemite University , Amman , 2003
- Bianca, Stefano,(*Urban form in the Arab world , past and present*) Thames & Hudson Ltd. , London , 2000.
- Bonnie, Skaalid , (*Design Theory : Classic Graphic Design Theory Principles of Design: (Balance)* Environment and Planning journal B: Planning and Design, 1999.
- Cerasi, Maurice. (*The Formation of Ottoman House Types: A Comparative Study in Interaction with Neighboring Cultures*). Muqarnas XV: An Annual on the Visual Culture of the Islamic World. Gülru Necipoglu (ed.) Leiden: E.J. Brill, 116-156, 1998.
- Colakoglu, Dr. Birgul,(*Design by grammar: an interpretation and generation of vernacular hayat houses in contemporary context*), Environment and Planning B: Planning and Design, volume 32. ,2005.
- Danby , M.,(*Grammar of Architecture Design*), Oxford university press , London , 1963 .
- Engineering construction Office, residential buildings in Mosul city, a form of documentation-General, Ministry of Culture and Information, Archaeological office in Nineveh, the heritage union , Vol.1 ,1983.
- Gero ,John S.and Vladimir Kazakov, (*Machine Learning in Design Using Genetic Engineering-Based Genetic Algorithms*) , Key Centre of Design Computing and Cognition Department of Architectural and Design Science The University of Sydney NSW, Sydney , 2006 .
- Hayderan ,Rabee k.,(*The effect of spatial configuration on current functional of traditional house in the old city of Mosul*), Thesis ,architectural department ,engineering college , university of Mosul, Mosul ,2002 .
- Kamona , Dr. Haydar,(*Privacy heritage for designing Arab house*), Civilization and Identity , scientific magazine, the union of restoration of social own for Arabic Country, Vol.6-7, Baghdad 1989.
- Knight ,T.W.O, (*Shape Grammars ; Five Question , Environment and Planning*) , Kluwer Academic Publisher , B261 ,P15-36, 1999.
- Knight, T.W.O, “Transformations in Design: a Formal Approach to Stylistic Change and Innovation in the Visual Arts”, Cambridge University Press, Cambridge, UK, 1994.
- March, L.& Steadman., (*The Geometry of Environment, An introduction to spatial organization in design*), RIBA Publications limited, London, , 1971.

Alchalabi: Genetic shape plan of the Traditional Ottoman's style house

- Mustafa,Dr. Salih.L,(*Architectural Islamic Personality to design the house with court*) the world of , 5th year No. 49 , Al-Riyadh , 1983 .
- Wazeri, Yahya ,(*Environment Architecture Application*), Madboli library for publishing ., Cairo ,ISPN:977-208-309-4 ,2002.
- Zeyin elabidin , Mahmud , (*History Overview “ Architecture of Turkish and Arabian house*) Aleppo , Syria ,1998 .

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