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Shape Grammar: Analysis & Generation of the Grammar of Glenn Murcutt's House style

Nujaba Binte Kabir¹

Abstract: An Australian architect Glenn Murcutt who is not only influenced by Mies van der Rohe's Barcelona Pavilion (1928-29) and the Fransworth house (1946-50) in the very early stage of his life but also try to incorporate the nature in to his design. As a result he constructed a series of singular projects from which repeated vocabulary and grammar come out and this grammar has been traced in the design of his single story houses. Traditional analysis may explain the characteristics of a style, the concept of an architect and much more. But this analysis has no methodology to analyze a design in details to understand a style and does not show how a form can be constructed. Shape grammar, which had been explored by Stiny & Gips (1972), is a rule based methodology for analyzing and generating designs of any style. The major aspects of this study are to explain a language of designs in a style in a generative explanation by studying a given corpus of that style. The aim of this paper has two parts. Firstly is to explain shape grammar methodology briefly and then generate an analytical grammar for Glenn Murcutt's single stories houses.

Keywords: Shape grammar, Language of designs, Non parametric grammar

1. Introduction

Shape grammar method is an alternative method to analyze any architectural style of an architect or of a period. Analytical shape grammar is a formal and generative methodology for analyzing and generating designs of an architectural style. A set of rules is developed by using distinct features of a style. The grammar deals with every detail of the style. Shape grammar, which is a rule based methodology, is appropriate to the design generation techniques (Ahmed & Chase, 2004).

Stiny and Gips (1972) introduced shape grammar to analyze a design style. Stiny and Mitchell have described (1978, P17) this approach in the following way:

“When several buildings each create a similar impression, they are said to exemplify a particular architectural *style*. Given a finite corpus of buildings that are perceived to be alike in some sense, the problem of style consists of characterizing the basis of this likeness. Ideally this characterization has three main purposes: 1) It should clarify the underlying commonality of structure and appearance manifest for the buildings in the corpus. 2) It should supply the conventions and criteria necessary to determine whether any other building not in the original corpus is an instance of the style; and 3) It should provide the compositional machinery needed to design new buildings that are instance of the style.”

It means that Stiny and Mitchell (1978) propose three criteria to evaluate the theory to understand a style. If I simplify those criteria they can be stated as follows:

- It should give a new example in the style.
- It should have the criteria to test whether a new example belongs to the original style or not.
- It should give the explanation of the basic compositional features of a style.

An analytical grammar can satisfy these criteria because a grammar is a generative method and can produce new designs in the language, the new design can be evaluated by using the grammar to generate and test it whether it is a member of the language or not and the grammar explains the common characteristics of the designs.

For generating languages of architectural designs (for house) with shape grammar have been studied in many research projects that include Frank Lloyd Wright's Prairie houses (Koning and Eizenberg 1981), the traditional Turkish houses (Cagdas 1996), Siza's houses (Duarte 2005), Queen Anne houses (Flemming 1987), Palladian villas (Stiny and Mitchell 1978), Bungalows of Buffalo (Downing and Flemming 1981), Taiwanese Vernacular houses (Chiou and Krishnamurtu 1995), Vernacular Hayat houses (Colakoglu 2005), Modern apartment houses of Seoul (Seo 2007), the Windows of Frank Lloyd Wright (Rollo 1994) and much more. The common aspects of these studies are to regenerate new examples in the style in a generative approach by studying a given corpus of that style.

An Australian architect Glenn Murcutt who is not only influenced by Mies van der Rohe's Barcelona Pavilion (1928-29) and the Fransworth house (1946-50) in the very early stage of his life but also try to incorporate the nature in to his design. As a result he constructed a series of singular projects from which repeated vocabulary and grammar come out. We can also call them a 'character'. And this influenced has been traced in the design of his single story houses. These houses are normally rectangular in plan, long and lean. Therefore the plans are one room wide to allow natural cross ventilation. He has always used a longitudinal passage from end to end to interconnect the internal areas. In some houses

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this passage way terminates either in an open space or in the bedroom. This open space actually a modified version of long ‘verandas’, which is the distinct character of traditional Australian houses. Murcutt has clearly divided the house in to three zones- public space, private space and service space. And these zones are interconnected by the long corridor. (Fromonot, 1995, pages 38-44).

But this analysis has no methodology to analyze a design in details and does not show how a form can be constructed. Koning and Eizenberg (1981, p295) had mentioned:

“Architectural historians have typically been more interested in tracing sources of influences and technological advances in building construction than in uncovering and elucidating the compositional structure of designs.”

On the other hand, in the application of shape grammar shapes can be transformed according to set of rules to generate new designs in a style. The aim of this paper has two parts. Firstly is to briefly explain shape grammar methodology and then generate an analytical grammar for Glenn Murcutt’s single storied houses. The composition of Murcutt’s houses is based on a relationship between the long corridor and the three zones. Then these three zones have been divided into different functions. These basic criteria provide the basis to develop the rules to define a language of Glenn Murcutt’s houses. To basis on the relationship of the corridor and the zones I have divided the rules in to two categories. First 10 rules which belong to category one, have developed to arrange the zones along with the long corridor. The rest of the rules segregate the zones into different functions to generate the new designs in the style. Few details of the house plans are over looked for facilitating the grammar.

2. Shape grammar:

Shape grammar was introduced by Stiny to explain visual shape composition. A grammar consists of a set of rules (R) that specifies how one shape or part of a shape can be replaced by another. This simple process is used to explain a design style. A shape grammar is a method which helps to define a design style in the form of algorithm to organize the designs elements. Several design styles have been analyzed with a set of rules and explain how the rules can be used to generate new designs in there styles (Knight, 2000).

There are two types of shape grammar: non-parametric and parametric shape grammars (Stiny, 1985). Both types contain a set of rules. In the rule (A→B) application, shape on the left side (A) of an arrow which is a sub shape of an initial shape(C) determines which part of the shape will be replaced. The shape on the right side (B) of the arrow specifies the sub shape (C') after the transformation (T) by $C' = [C - T(A)] + T(B)$. Then the grammar defines a set of shapes called a language which contains all the shapes generated by the grammar. Each of the shapes is developed from the initial shape by applying the rules and the new shapes are sub shapes of the shapes in the set S (which is a finite set of shapes and is used as a vocabulary for the configuration of other shapes) (Stiny,1980).

Figure 1 shows a generation of a shape using a non-parametric shape grammar. The grammar which consists of an initial shape and two set of rules is represented in figure 1a. Figure 1b shows how the rules apply repeatedly to generate a complex pattern. The shapes generated by the grammar are shown in figure 1c.

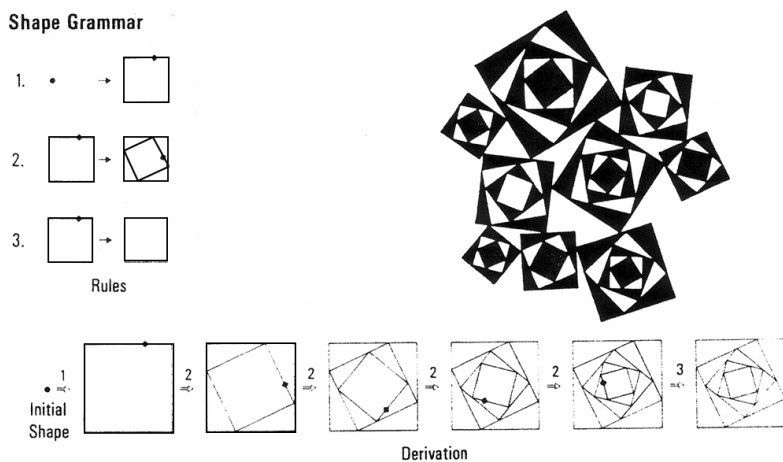


Figure 1- (a) Rules for a Standard Shape Grammar (b) A derivation of the rules (c) A result generated by applying the rules repeatedly. (Stiny, 1985)

Like a non parametric shape grammar, a parametric shape grammar also has a set of rules that indicate how shapes replace sub shapes of a composition. It uses parameters for shape organization. Shapes have proportional parameters and the values of the parameters can be changed. The parametric shape grammar creates shapes with more variation than the non parametric shape grammar. Figure 2 shows a parametric grammar.

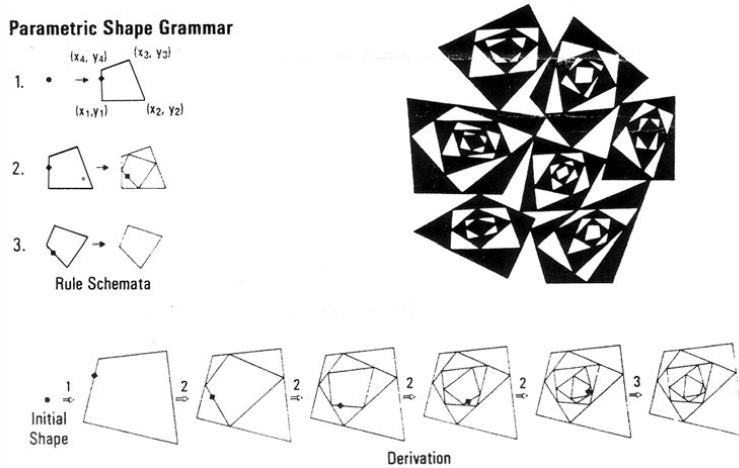


Figure 2- (a) Rules for a Parametric Shape Grammar (b) A derivation of the rules (c) A result shapes generated by applying the rules. (Stiny, 1985).

A user arranges shapes either by translation, rotation, or scaling using labeled rules. The label is a symbol that indicates how to apply the rule to the initial shape in a derivation. The label in the shape is also used to control the generation process. Each rule generates different derivation results with the labels at different position (Fig 3).

The above mentioned rules can also be applied to 3 dimensions. Similar to the previous 2D rules, the 3D rules also have labels. These rules are used for generating the derivations (Fig 4). For design style analysis both non parametric and parametric shape grammar can be used.

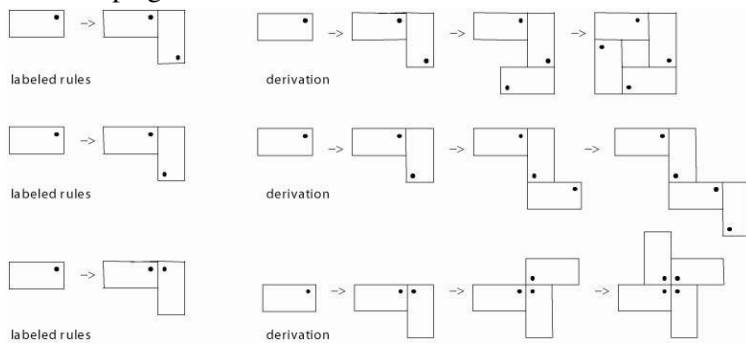


Figure 3- Various 2D labeled rules for standard shape grammar and their derivations. (Knight, 1994).

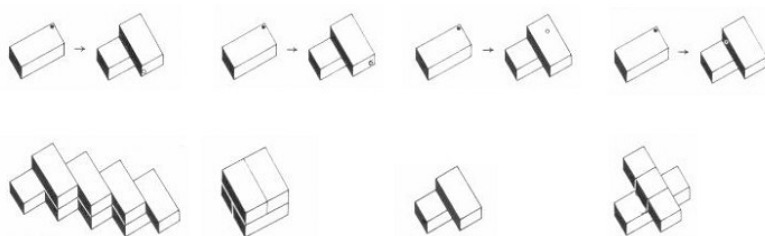


Figure 4- Various 3D labeled rules for standard shape grammar and their derivations. (Knight, 1994).

3. Analysis and generation of Glenn Murcutt's house style with shape grammar:

Stiny and Mitchell (1978) developed the grammar for 16th century Palladian's villas. This Palladian's villas grammar describes architectural plans which include walls, spaces, windows, and entrances. The grammar consists of 72 rules which generate all the existing villas plans and also new plans in the style. This grammar starts from a single point which indicates the location of the plan on a site and the generation of the plan starts with the definition of a tartan grid and that defines possible locations of internal and external walls at a later stage (Fig 5).



Figure 5- Possible Palladian villa plans after the Palladian villas grammar. (Stiny and Mitchell, 1978)

To develop a grammar for Glenn Murcutt's single story houses I followed the framework described by Stiny and Mitchell (1978) – examine the corpus, write the grammar, generate the designs and test the designs whether these belong to the style or not. The test might depend either on the writer of the grammar or on the experts of the style to judge the newly generated designs. Usually for analytical grammars authors of the grammar judge the results.

4. The corpus of Glenn Murcutt's single story houses:

The grammar for Murcutt's single story houses is based on a corpus of nine houses in figure 1. The corpus contains:

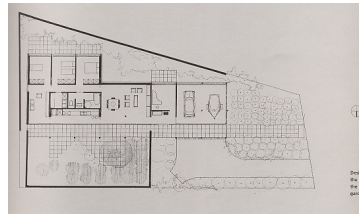
01. Glenn Murcutt House, Sydney 1968-69
02. Douglas Murcutt House, Sydney 1969-72
03. Laurie Short house, Sydney 1972-73
04. Nicholas House, New South Wales, 1977-80
05. Ball Eastaway House, Sydney, 1980-83
06. Magney House, New South Wales, 1982-84
07. Meagher House, New South Wales, 1988-92
08. Simpson Lee House, New South Wales 1989-94
09. Fredericks House, New South Wales 1981-82

Designs in this corpus are representing the all categories of all single story houses. In each design the plan has been divided into three function zones- public, service and private zones. Public zone contains living room, dining room sitting/family room, and open space which is the main component of his house. He used this feature as the representation of traditional Australian verandas. (Fromonot, 1995, pages 38-44). The service area included kitchen, storeroom, staircase and toilet. But sometime toilet and kitchen group together as a central core to serve both the living and bedroom areas. The private zone is designed by the bedrooms and sometime with toilet. After studying all the plans I have found that in his plan he places these zones along with a long passage way. In most of his designs he places the public zone at the left side of the corridor or in the middle of the corridor and the service zone in the middle but at Douglas Murcutt house and Magney house service area is placed differently. The private zone has placed at the right side of the corridor. So we can say that private zone always placed either at the opposite of the public area or at the side of the public area.

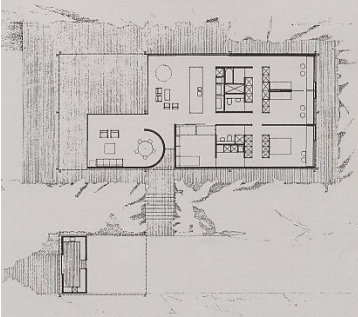
The grammar for Murcutt's single story houses is based on the layouts of the plans of these houses.



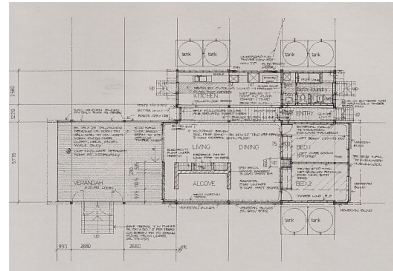
Glenn Murcutt House



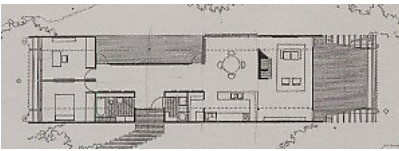
Douglas Murcutt House



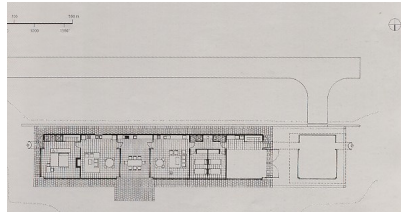
Laurie Short house



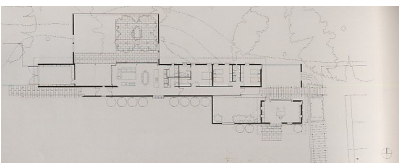
Nicholas House



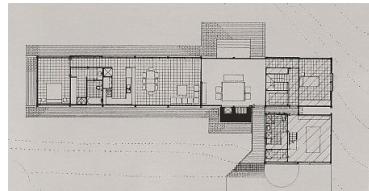
Ball Eastaway House



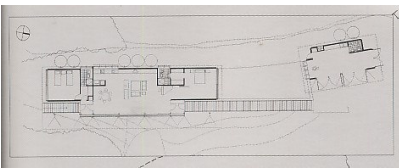
Magney House



Meagher House



Fredericks House



Simpson Lee House

Figure 6- The corpus: nine single story Glenn Murcutt's houses.

5. Distinct features of the plan:

The main features of the plans are: the shape of the plans, the corridor or the long passageway and the three zone areas.

5.1. Shape of the plans:

All the buildings of Murcutt's houses have long and lean plans which are rectangle in shape. These shapes are actually the outcome of the influence of Mies. His elongated buildings help to allow natural cross ventilation. After observing the corpus I found that in most of the designs the width of the building is normally 1/6th of the length. When Murcutt works with a large scale requirement or wants to distinguish between living and bedroom areas then two or three elongated

rectangular forms are placed in parallel and they open to each other. Actually this rectangular form becomes the basic unit of his architecture. (Figure 6).

5.2. The corridor:

Glenn Murcutt mentions in his own words that:

“Linearity produces a dynamic quality which increases the tension. It is a special linearity which does not disturb the serenity, or doesn’t reduce serenity. It is dynamic but not tense..... You can find it in the Munro house and Ball Eastaway house; it’s connecting the site to the other end. I do it largely using access ways, by the space moving over the walls, but it is really connecting the two ends of the house. It’s telling you how long the house is and it’s telling you where the building sits in the landscape, particularly in the Ball and Eastaway and Munro houses. You’ll find that more recent buildings now connect the sites from one end to the other so you can look through them, through the access system, from one end to the other and through the ends into the landscape to the intermediate distance.” (Drew, 1999, page 99).

From the above passage we can see that how he clearly mentions about the passageway. What ever might be the site and the climate Murcutt always use a linear long passageway from end to end to interconnect the internal areas. (Figure 6, Magney house) or to connect the different parallel pavilions. (Figure 6, Glenn Murcutt House, Douglas Murcutt House, Nicholas House, Laurie Short house, and Meagher House). In some examples it also merges with the internal function. (Figure 6 Ball Eastaway House, Simpson Lee House, Fredericks House). Walking through the passage always has a break in an intermediate area between outside and inside, and form of which varies from one building to another. If the one side of the passage way terminate into the living areas, or in a three side open space or a terrace or a platform attached to the house then the other side terminate into the bedroom areas. As all the functions are around this passage way I take this long corridor as the starting feature (Initial shape) of the grammar.

5.3. The three zones:

In his designs the sequence starts from most public to most private. Murcutt has clearly divided his house into three zones – public, private and service zones, which he organizes in a variety of ways. But the most common feature is if I divide the long rectangle into 3 zones and give the name as left (L), middle (M) and right (R) of these subdivided part we can see he usually places the public zones in to left cell, service zone in the middle cell and the private zone in the right cell.

For service area in his first designs which are influenced by the Mies’s philosophy, kitchens and bathrooms are grouped together and placed them in the middle cell. (Figure 6. Glenn Murcutt House, Douglas Murcutt House, Laurie Short house). In exceptional cases he places this service area in the left cell. (Figure 6. Ball Eastaway House, Fredericks House). In one case he places the service area on the right side of the building. (Figure 6. Nicholas House). In his later works he introduced these service areas as interconnected pavilions. (Figure 6. Nicholas House, Meagher House, Magney house).

Public areas include the living room, dining room sitting room and the most important feature open space. In most of the designs he uses open space on the left cell and place the living and dining area beside this open space sharing a light and removal screen. (Figure 6. Glenn Murcutt House, Nicholas House, Meagher House). Some times these functions are interconnected in two pavilions. (Figure 6. Douglas Murcutt House). In special case he also placed the open space and living room on the right side of the building. (Figure 6. Ball Eastaway House, Meagher House, Magney house).

Private areas include bedroom and toilet areas. These areas are normally placed on the right side of those buildings which have public areas on the left side of the building. Reversely in two cases private areas are placed on the left side of the building as the public areas are on the right side of the building. (Figure 6. Ball Eastaway House, Meagher House, Magney house). Case like Simpson Lee house and Fredericks house the private area is placed on both side of the building to terminate corridor where the public area takes place on the middle.

5.4. Plan types:

The plans of Murcutt’s single story houses are grouped according to the locations of their zones (left, middle and right). I have divided them into 5 categories:

- i. One row house
- ii. Two offset row house
- iii. Two row house

- iv. Three row house
- v. One row house with two right cells.

These classifications also include subtypes of each type. Here I use the term ‘row’ for the long rectangle shape. So one row house means the house has a long rectangular form with one corridor. In this way all the name has actually been given. And I have divided each rectangle into three equal cells no matter how long the rectangle is. So one row house also means a house with three cells: left, middle and right. (Figure7).

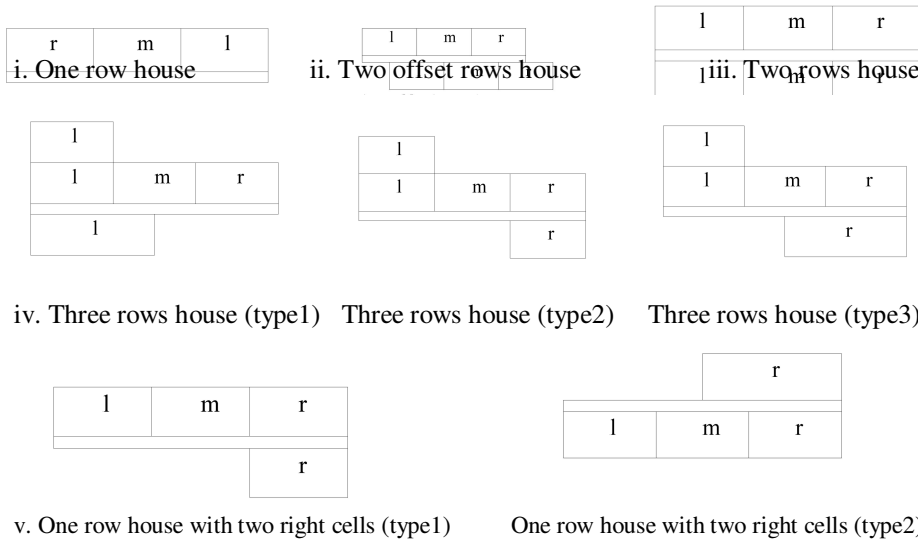


Figure 7- The Plan Types.

i. One row house:

As I mentioned above that one row house means a house which is rectangular in shape with three equal cells and a corridor. In these type the corridor normally used either in the middle of the house or in the side of the house or at the 1/3 position of the house. In this type the left and right cells have the private area and the middle cells, the public and service area together. In one case the right cell has the public area. (Figure 7, example 1).

ii. Two offset rows house:

In this type the house has two equal rectangles in an offset direction in relation with the corridor. Each rectangle has been divided into three cells. The left cells of this house have the public areas, the middle cell, service area and the right cell, private areas. But in this type we can also see the exceptional case where the middle cell has become the public area and the right cell has become public area. The main features of this type are that if the three cells of one row are used as the public areas then the other row will be the private area. Or if the public and service areas are placed in the left and middle cells then the private areas will be on the right side of the both rows. And the corridor will terminate in the open space at one side and in the bedroom at the other side (Figure 7, example2).

iii. Two rows house:

In these house types the house has two equal rectangles on the both side of the corridor. In this house type the left cells are always containing public areas, middle cells, the service areas and the right cell, the private areas. The corridor has terminated to the open space on one side and the other, side to the private space. (Figure 7, example 3).

iv. Three rows house:

These types of houses have one row of rectangle and one cell on the top left of the row. These types also have another one and half cells at the bottom of the row connected by the corridor. This one and half cell either has been placed on the left side or in the right side of the building. For this type the left cells have mainly the open areas and among them one left cell has private areas and the other, the service areas. Middle cells are treated as public areas and the right cells, mainly private

areas. One right cell has special function like musical room and garage. The one and half cells contain function like open space and open space with room. (Figure 7, example 4).

v. One row house with two right cells:

These types of house have two subtypes. One type has one row of rectangle and one right cell at the bottom of the corridor. And the other type has one row of rectangle with one and half right cell. This one and half right cell has been divided as service areas. (Figure 7, example 5).

6. The grammar:

I have tried to develop an analytical grammar to generate the plans of Murcutt’s single story houses. Mitchell (Mitchell et al, 1991, page 19) stated that:

“The shapes that appear in rules may be actual construction elements and spaces, or they may be abstract shapes and volumes that serve as construction lines, grids, axes, placeholders for later substitution of something else, and other devices that guide the development of a design.”

A shape grammar contains a vocabulary, a set of shape rules, and an initial shape which generate the shapes in the vocabulary. By applying the shape rules recursively to the initial shape, we can generate a formal composition of design. (Stiny and Gips,1972, p 1461-1462).

For generating a grammar two types of approaches can be used by the application of the set of rules. In the first approach a rectangular shape or grid is generated at the initial stage and then improved in order to generate a plan composition in further stage. This approach can be found in the Palladian grammar, Bungalow grammar and the grammar of Japanese tea rooms. In the second approach, in order to generate the grammar it starts by locating a space and the other spaces to the plan composition are added in the further stage. Queen Anne grammar is the example of this type of approach. (Cagdas, 1996, p 443-464).

For this grammar the first approach has been chosen to generate the plan of Murcutt’s house. A long linear rectangular shape which represents the corridor is used as the initial shape. The generation process begins by locating the three equal cells in relation with the corridor with the labels ‘l’, ‘m’, ‘r’ where ‘l’ stands for ‘left’, ‘m’ stands for ‘middle’ and ‘r’ stands for ‘right’.

I divide the generation process into two parts. In the foremost part the first 10 rules are applied to allocate the three cells of three zones in relation with the corridor and in the second part the rest of the rules are used to divide the cells into functions. I grouped them according to their cell name. From rule 11 to rule 21 has been used for the left cell and from rule 22 to rule 31 for middle cell and rule33 to rule 48 for right cell.

Table1. Symbols used to identify spaces.

Symbol	Meaning	Symbol	Meaning
b	Bedroom	mu	Music room
d	Dining room	o	Open space
g	Garage	s	Store
k	Kitchen	st	Sitting room
li	Living room	t	toilet

6.1. The first part of the grammar: allocation of three cells with the corridor:

The first 10 set of rules are used to generate the each plan type. These set of rules show the complete the relation between the corridor and the three zones (Figure 8: first ten rules).

The left hand side of the rule 01 is the initial shape, a long linear rectangular shape which represents the corridor. The right hand side of the rule consists of three cells with three labels (l, m, r) in the middle of the cell. The first rules cannot be applied again as the labels are placed at this stage.

Rule 02 helps to generate the two rows of cells in an offset direction at the both side of the corridor. This rule generates the plan type 2.

Rule 03 helps to generate the plan type 3 by placing the two rows of cells at the both side of the corridor.

By the application of rule 04 one and half cell is added at the bottom of the corridor and the other side of the one row of cells.

Rule 05 helps to place a left cell on the top of the one row of cells. Actually rule 06 and 07 can be applicable after this stage. Rule 06 only can be applicable after the application of either rule 04 or rule 05. But rule 07 only can be applied after the rule 05 has been applied. And these rules generate the plan types 4 and its subtype.

Rule 08 and rule 09 generate the plan type 5. These rules add one right cell and one and half right cell at the bottom of the corridor. These rules only can be applicable after the application of rule 01. Rule 10 helps to generate plan type 1.

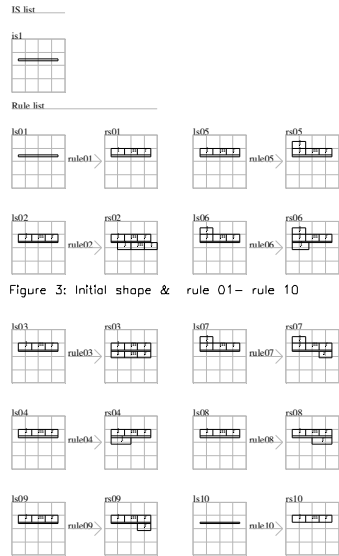


Figure 3: Initial shape & rule 01- rule 10

Figure8- The initial shape & rule 01- rule 10

6.2. The second part of the grammar: conversion of the zones into functions:

When the plan types are determined after the application of rule sets 10 then the rest of the rules can be applicable. Here the choice can be made how these plan types would be changed into functions. Each plan type can be chosen first then rules for left cell will help to change the cell in to public areas like open space, living room, dining room and sitting room. In some special case from rule15 to rule 20 contain private and service areas. From rule 11 to rule 21 are used for left cell (Figure9). The label ‘l’ has been changed according to the function’s symbol: li, d, st, o, mu, g. (Table 1).

After the left cell rule 22 to rule 32 will be used to change the middle cell. Normally the middle cell has accommodated the service area but there are some special rules which have public area also. Rule 22, rule 31 and from rule 24 to rule 27 has the function like living room, dining room and sitting room beside the service area. Only rule 30 has a private function like bed with toilet. So after application of left cell the rule for middle cell has to be applied carefully as some rules for middle cell are containing the same function as of left cell (Figure 9). The label ‘m’ has been changed to k, t, st. (Table 1).

Lastly the rules for right cell have applied to complete the plan. Mostly these rules have the functions of private space like the bedroom and the toilet area. Rule 32, rule 33, rule 42, rule 45, rule 46 and rule 48 are the special rules as they contain the functions like open space, living room (Figure 10). Here the label ‘r’ has been changed to b and t. (Table 1).

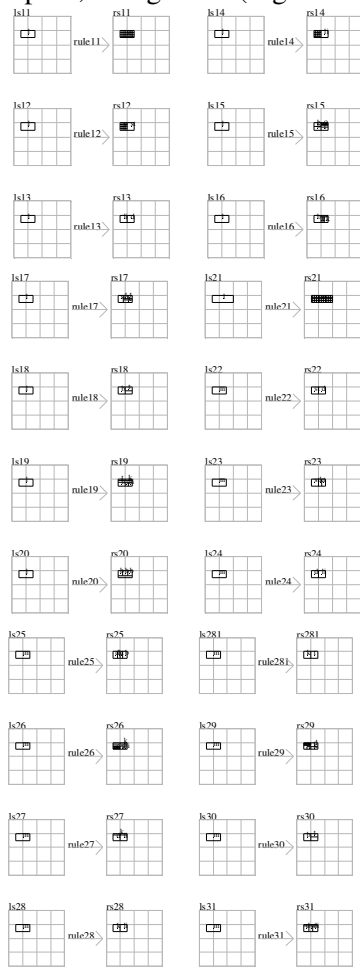


Figure9- The rule 11- rule 31

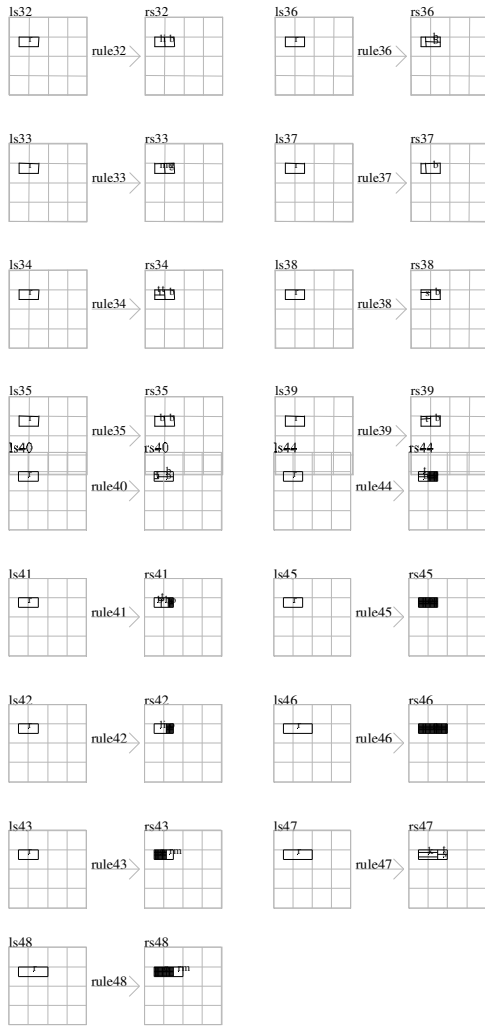


Figure10- The rule 32- rule 48

7. Generation process:

For generating the grammar for Murcutt's houses the starting point is the choice of the plan type. The set of rules which are specified above has been applied to allocate the functions in each cell after choosing the plan type. And this stage will determine the complete plan. By the application of the different combinations of the set of rules various plan types can be generated. These set of rules generate the language of 31 designs which include all the 9 designs in the corpus. The rest of the designs are new in the language. (Figure10-17). When the grammar produces the designs then the grammar needs to be assessed by the three criteria proposed by Stiny and Mitchell (1978) to evaluate the theory to understand a style. The criteria are stated as follow:

- 1. It should give a new example in the style.
- 2. It should have the criteria to test whether a new example is belongs to the original style or not.
- 3. It should give the explanation of the basic compositional features to design a new example of a style.

According to the first criteria the grammar should able to generate a new design which is not in the corpus. A new design has been generated by Murcutt's house grammar which does not belong to the nine designs of the corpus. The new design belongs to the type 2; two offset row house. (Figure 10, design15).



Figure11- The derivations of 1 (one) row house

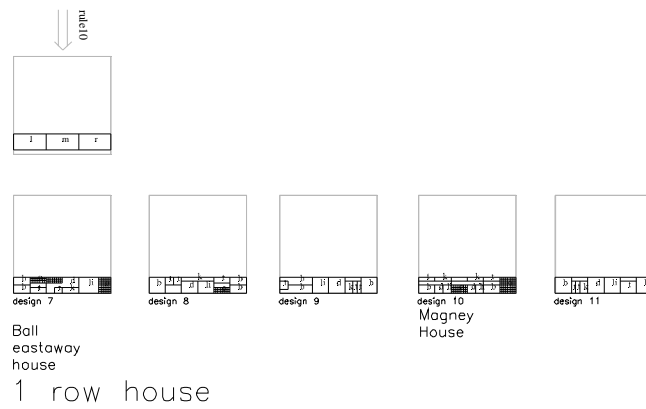
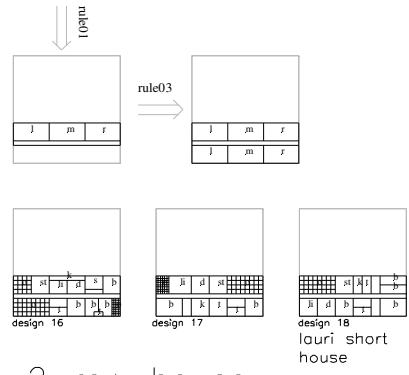


Figure12- The derivations of 1 (one) row house

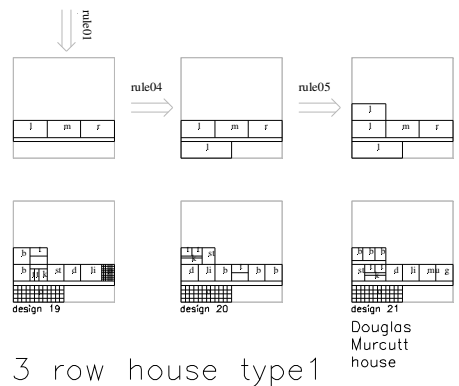


Figure13- The derivations 2 row house



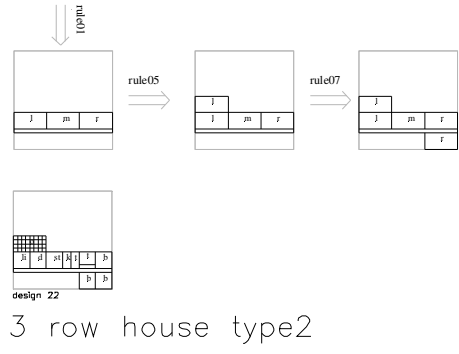
2 row house

Figure14- The derivations of 2 row house

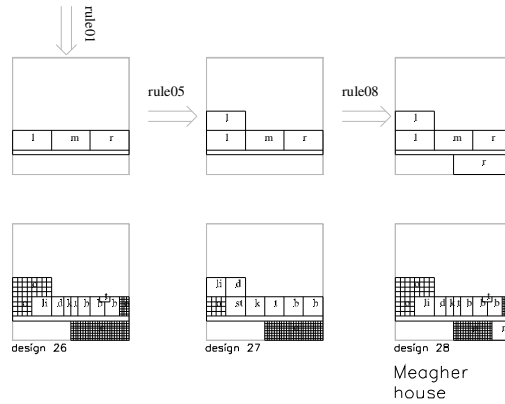


3 row house type1

Figure15- The derivations of 3 row house

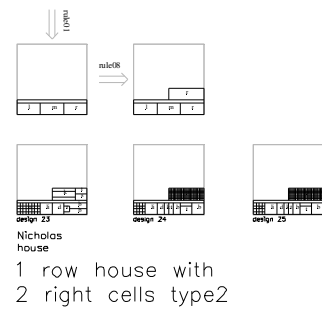


3 row house type2



3 row house type3

Figure16- The derivations of 3 row house



1 row house with 2 right cells type2



1 row house with 2 right cells type1

Figure17- The derivations of 1 row house with 2 right cells

The new design that has been produced by the grammar actually belongs to the original style. When I had chosen the examples for the corpus I kept hidden the tenth design which is Marie Short house (1974). And the plan type of this house belongs to type 2; two offset row house.

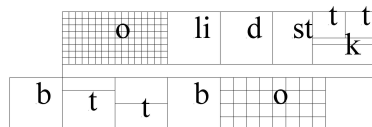
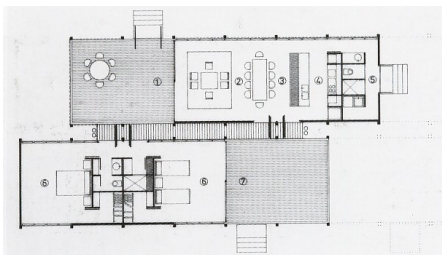


Figure 18- The new design.

If we consider the characteristics of the two offset row house type then we could see that the plan which is generated by the grammar has the resemblance with the original plan of Marie Short house (Figure 18). At the left side of first row of

the new plan is open space and the right side is the service and the middle is the public area. That means one row has been treated as the public and service areas. So according to the characteristics the opposite row has to be the private area which we can clearly be seen on the other row of the design. The long corridor has been placed from end to end to connect the two pavilions and terminated by the open space. The corridor and the open space both are the distinct features of Murcutt's house. So we can say that the grammar satisfy the second criteria as the new design belongs in the style.

According to the third criteria the new designs which are generated by the grammar belong to the style (Figure 10). Because during the generation process I divided the cells in such a way so the cell can match with the side cell. That means the functions should not appear in a repetitive form. So that during the generation process I skip those kind of designs which are sharing common function in both cells. The new designs satisfy the characteristics of Murcutt's single story houses. The main characteristics are:

01. There are normally 5 types of plan which this grammar can produce.
02. Every house should have a long passage way to interconnect the internal areas or the two rows.
03. Every house should have an open space and this open space is infact a modified version of traditional Australian verandahs.
04. Every house should have three zones; public, private and service zones.

These are the main features of the style. Beside that every house type has its own characteristics which I mentioned above.

8. Conclusion:

The grammar presented here explains the composition of the functions in relation with the corridor with the help of the set of rules to generate the floor plans. All details of the plan are skipped during the generation process. The grammar can only be produced single line plans. Although the grammar has satisfied the three criteria of Stiny and Mitchell (1978) but I think the grammar needs to be revised. Because the language of design is infinite and the subdivision of the cells need to be controlled by the users. In that case there should be control on the cell rules so that when the left cell has been changed in to function then the middle cell would be changed with the appropriate rule. In that way it is possible to generate a finite numbers of designs.

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