A Computational Design Analysis and Generation of R.M. Schindler Houses

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by

James F. Snyder

Submitted to the Department of Architecture
in Partial Fulfillment of the Requirements
for the Degree of

Bachelor of Science in Art and Design

at the

Massachusetts Institute of Technology

June 2001

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ABSTRACT

A computational design study of a portion of R.M. Schindler's California houses was performed with the object of creating computational rules to generate designs in Schindler's style. Houses from 1928-1942 with a general L shape were studied to determine the essential qualities of his schematic layouts.

In general, the houses were found to have a direct relationship to the qualities of the site, such as the view, slope, and street. The resulting grammar rules generate schematic designs in Schindler's style. More rules can be developed in order to refine and include other important aspects common to Schindler's houses.

Thesis supervisor: Terry Knight
Title: Associate Professor of Design and Computation

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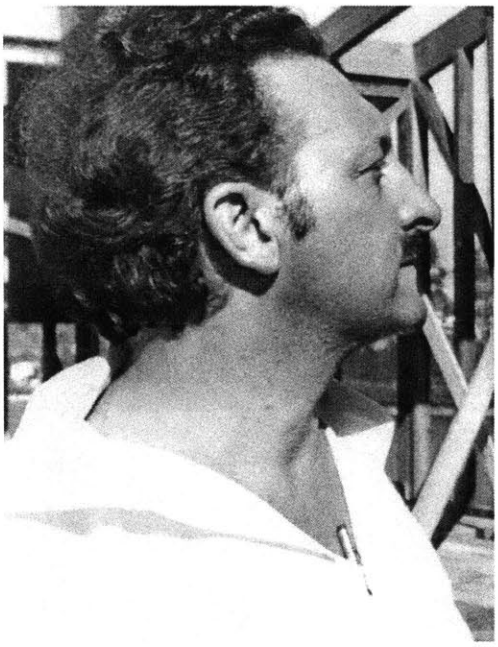


RM Schindler 1887-1953

Rudolf M. Schindler, born in Vienna in 1887, studied under both Otto Wagner and Adolf Loos while in Europe. Moving to Chicago in 1914, he eventually worked for Frank Lloyd Wright, and ran his studio for two years while FLW worked in Japan. While working for Wright, Schindler (now married to Pauline) moved to Los Angles in 1920, and started his own practice in 1922. In addition to Wagner's, Loos' and Wright's influences in spatial form, Irving Gill also influenced Schindler through the use of materials. In 1926 Richard Neutra, a contemporary, moved into Schindler's house and they started an architecture practice together, which failed in a short time. Being unjustly excluded from national exhibits of the "International Style", Schindler worked constantly on residential commissions, becoming known for his complex spatial forms and willingness to work with both site and material constraints. His key works include Lovell Beach House, How House, Kings Road House and the Falk Apartments. (Sheine 1998 pp. 7-27)

"The Architect has finally discovered the medium of his art: SPACE" (Sheine 1998 p. 19)

1887 Born in Vienna

1906 Studies Construction Engineering

1910 Studies Architecture under Otto Wagner

1913 Studies under Adolf Loos
(with Richard Neutra)

1914 Moves to Chicago (before WWI)

1917 Works for Frank Lloyd Wright

1919 Marries Sophie Pauline Gibling

1920 Moves to Los Angeles to oversee
Wright's Barnsdall House

1921 Kings Road House: Schindler/Chace

1922 Beach House for Philip M. Lovell
Starts his own practice

1925 House for James Eads How

1926 Richard Neutra moves into Kings
Road House for a short time

1928 Wolfe House
Rudolf & Pauline separate

1928 Period of Houses under study
1942

1940 Falk Apartments

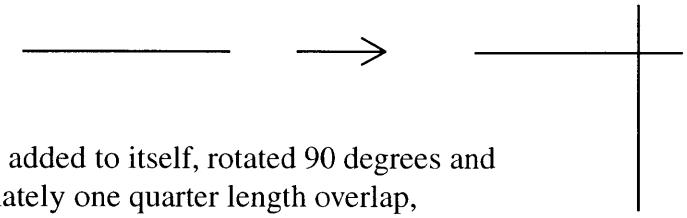
1942 Many other projects, mostly residential
1953

1953 Dies of Cancer

Computational Design

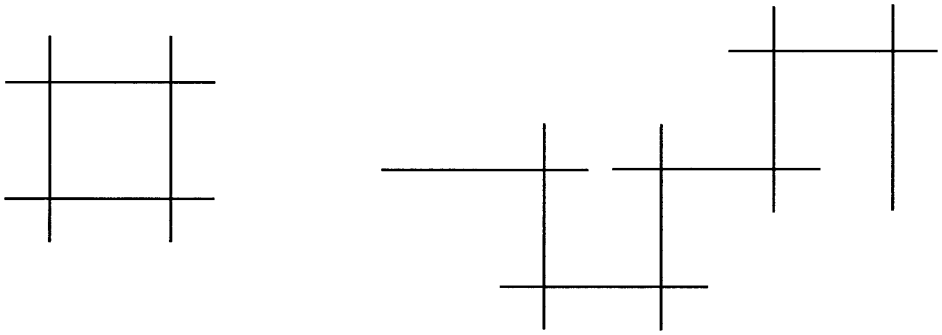
In computational design we define a set of spatial, geometric rules called shape grammars. Shape grammars generate languages of designs. The theory of shape grammars was pioneered by James Gips and George Stiny, and further refined by Terry Knight, among many others. Shape grammars can be simple or very complex, possibly involving many different types of rules.

For example:
This rule:



where a line is added to itself, rotated 90 degrees and with approximately one quarter length overlap,

could generate these designs and many others through repeated applications of the rule.



For a review of shape grammar theory and applications, see Terry Knight's paper "Shape Grammars in Education and Practice" (Knight 1999-2000)

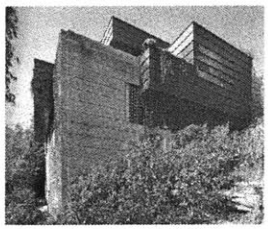
Goal of Computational Design Analysis

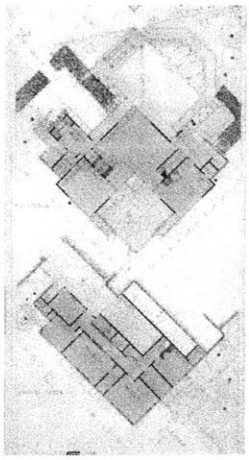
The goal of this study was to understand the architecture of Schindler by creating a shape grammar for a selected group of his houses. Through an ordered application of additive rules, schematic plans similar to those actually designed by Schindler may be produced. On the recommendation of Judith Sheine and Terry Knight, and after reviewing most all of his built works (Sheine 1998 pp 46-229) I limited myself to the residential designs created during his "plaster skin" period (1930s). This period contained many houses with a general L-shape form. By schematically breaking down each house, I found common design ideas among 15 houses more strictly L-shaped. These design ideas were then encapsulated in shape grammar rules. This analysis is unfortunately limited by the information available through pictures and plans found in books about Schindler, as I could not visit these houses in person.

Corpus

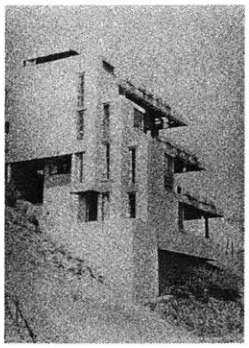
The 15 L-shaped residential resigns from 1925 to 1942 were analyzed for common features, some of which form the basis for the design rules on pages 14 and 15. All of the houses are formed as an "L" around a patio or terrace, bounding the terrace on two sides. Nearly all the sites are in wooded, sloping terrain, incorporating views of distant nature scenes: ocean, lake, valley or mountain. Only the Buck house is on a flat site without a view, having been built in the city. Sloped sites were generally cheaper to buy, as they were considered undesirable due to increased construction difficulty. However, the sloping terrain generally made the views possible. Schindler was a master at creating complex spatial designs on these challenging sites.

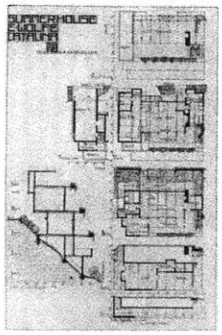
How 1925



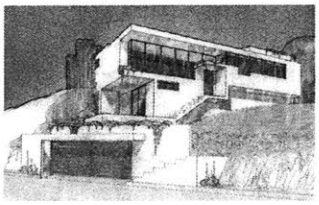


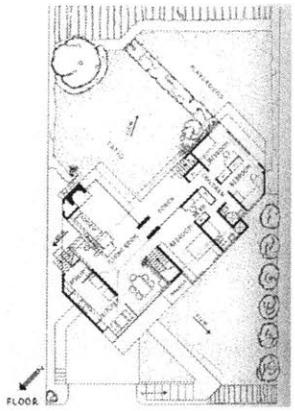
Wolfe 1928



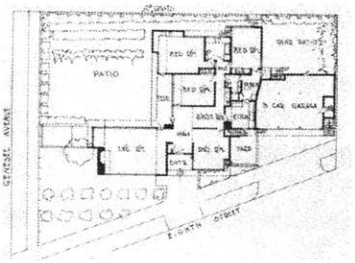


Oliver 1933

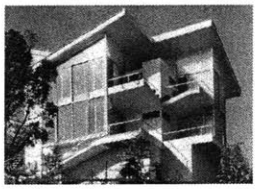


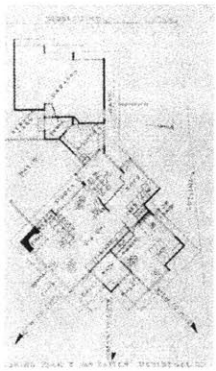


Buck 1934

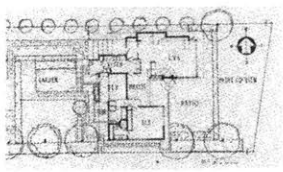


Van Patten 1934

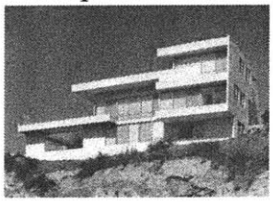


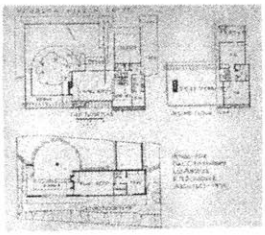


McAlmon 1935

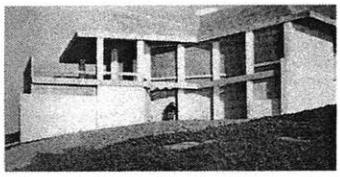


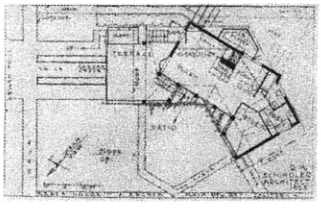
Fitzpatrick 1936



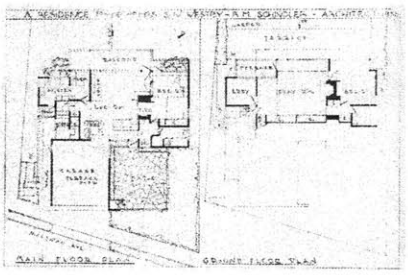


Zaczek 1936

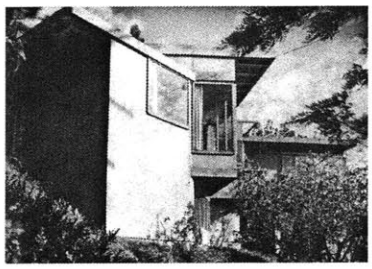


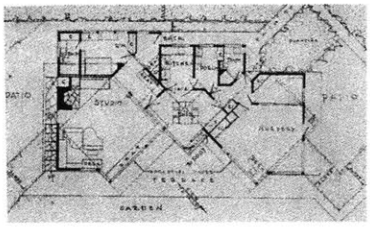


Westby
1938

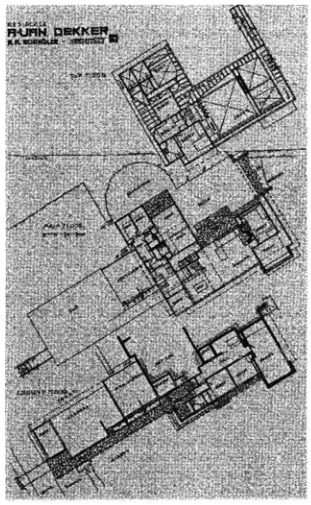


Southall
1938

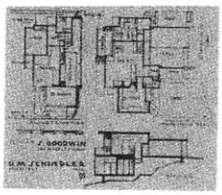




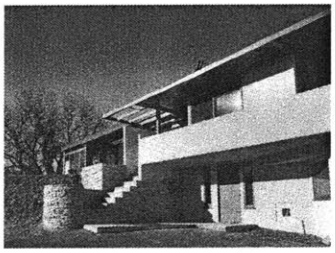
Van Dekker
1939

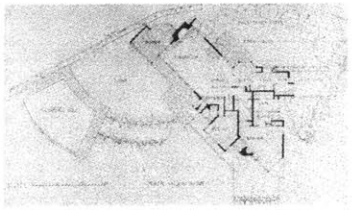


Goodwin
1940

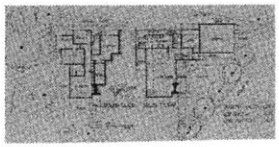


Gold
1940

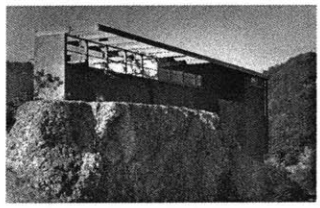


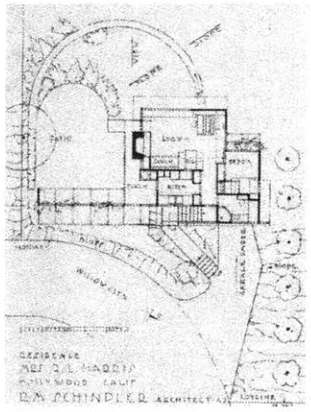


Druckman
1940



Harris
1942





Analysis of Corpus (Charts 1 & 2)

General Observations:
-L shape is always formed around a Patio or Terrace
-Living room and Master Bedroom have distant views
-Garage is always next to street
-Almost all sites are sloped

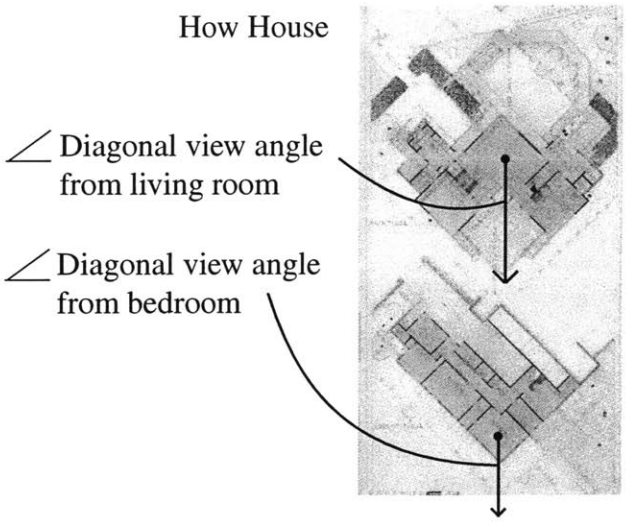
Views:
-Distant nature scenes and the patio form views from the living room and the bedroom.
-The views may be either perpendicular (⊥) or at an angle (∠) to the house.
-The patio view and distant view have three distinct relationships with respect to the living room.
  L-type: view to the patio forms an obtuse angle with the distant view
  Layered: view to the patio is coincident with the distant view
  Through: view to the patio is opposite to the distant view

Examples of houses to illustrate features in chart:

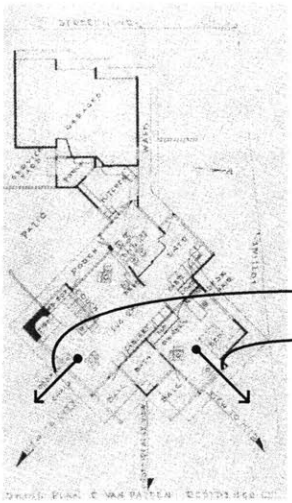
∠ indicates angled view from house:

The How house has only one distant view. The layout places the living and bedroom to take advantage of the view diagonally. The diagonal view is emphasized in the bedroom by the doorway placement at the opposite corner.

How House



⊥ indicates orthogonal view from house:



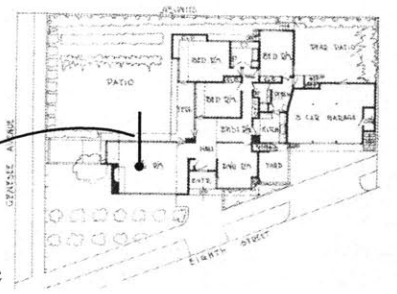
Van Patten

The Van Patten site has two distinct views, so the extensions of the L are oriented to take advantage of this. The resulting views are perpendicular to the living and bed rooms.

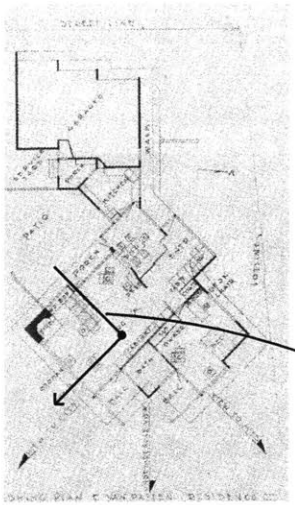
⊥ Orthogonal view angle from living room
⊥ Othogonal view angle from bedroom

Patio Only view:

Since the Buck house has no distant view available, the patio functions as the view of the outdoors.



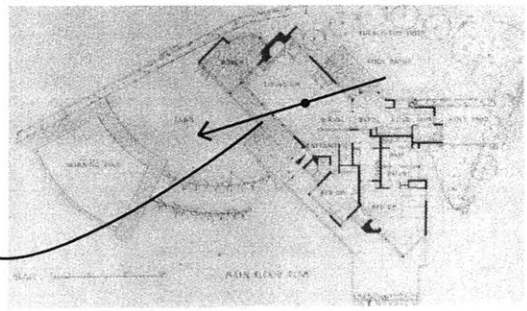
L-type view:



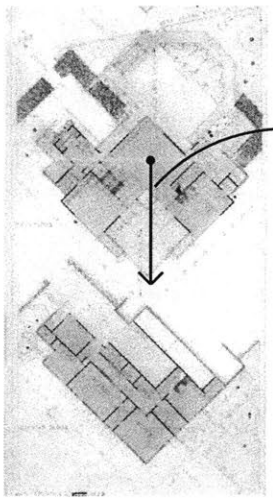
Here the patio forms a 90 degree L type view within the Living room with respect to the distant view.

Through view:

Within the Gold house the patio is 180 degrees from the distant view, creating a view through the living room from the patio.

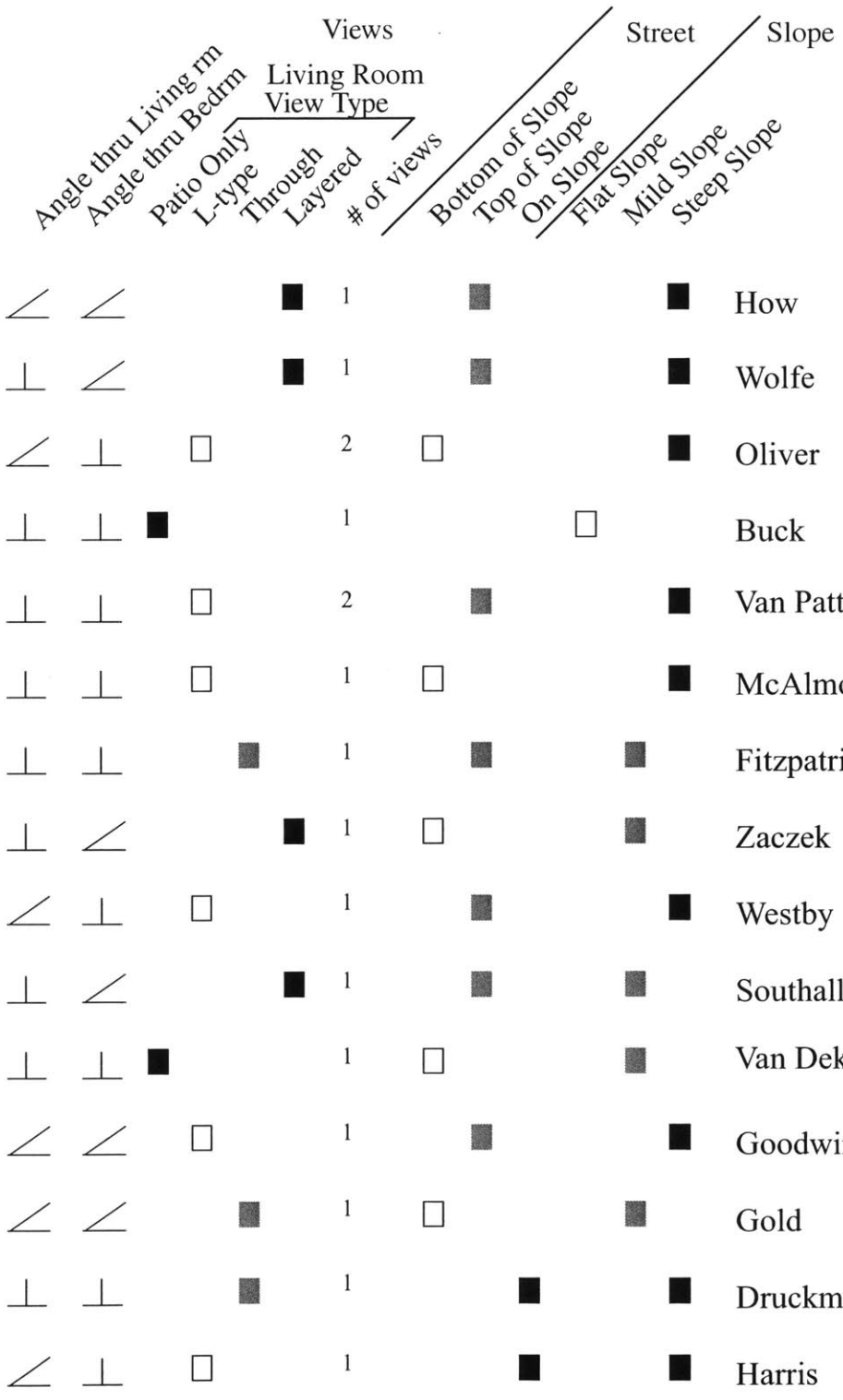


Layered view:

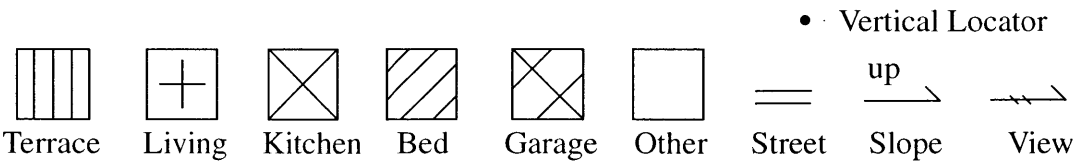


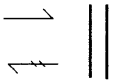
The patio forms a layer between the living room and the distant view. The view from the living room to the patio is coincident with the distant view.

Chart 1

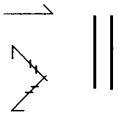

Views
Street
Slope
Angle thru Living rm
Angle thru Bedrm
Living Room View Type
Patio Only
L-type
Through
Layered
# of views
Bottom of Slope
Top of Slope
On Slope
Flat Slope
Mild Slope
Steep Slope
1
How
1
Wolfe
2
Oliver
1
Buck
2
Van Patten
1
McAlmon
1
Fitzpatrick
1
Zaczek
1
Westby
1
Southall
1
Van Dekker
1
Goodwin
1
Gold
1
Druckman
1
Harris

Schematic Analysis: illustration of symbols

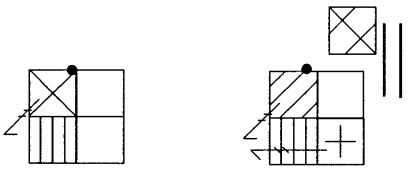
Legend: 



This particular site has the ground sloping up to the street, with a distant view away from the street.



The site illustrated here has the ground sloping up to the street, with two distant views at right angles to each other, away from the street.



In this schematic layout (How House) the kitchen is on the lower level, forms part of an L around a terrace, and has an angled distant view. On the upper level, above the kitchen, the bedroom also forms a part of an L, and has an angled distant view. The living room has a layered distant view across the terrace and completes the upper L shape. The garage is detached and next to the street. These schematic drawings are indicative of zoning placement, not of actual room sizes and design.

indicates that the overall layout is a simple L shape.

indicates that the overall layout is a complicated- or double- L shape.

indicates that the overall layout is an L shape combined with a rectangular form.

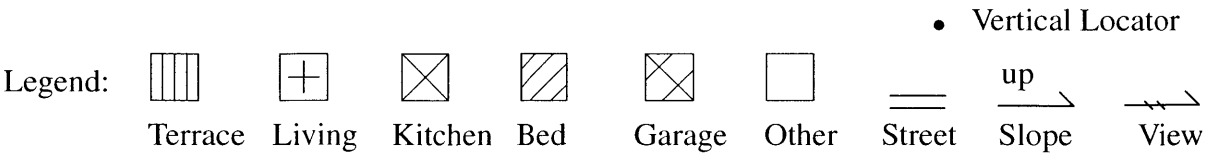
S indicates a small-sized house, typically only one bedroom

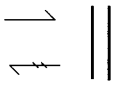
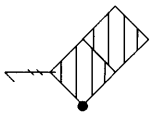
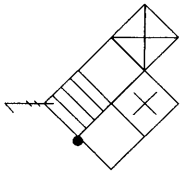
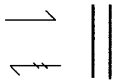
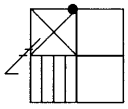
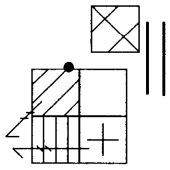
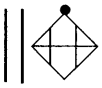
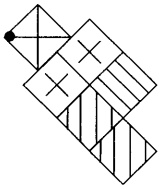
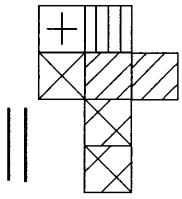
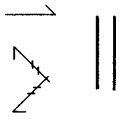
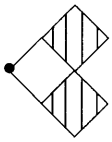
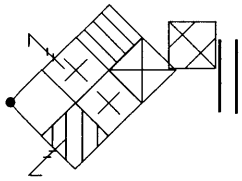
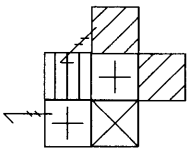
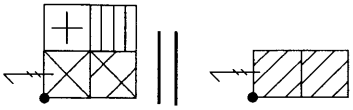
M indicates a medium-sized house, typically two bedrooms and a fairly generous living room

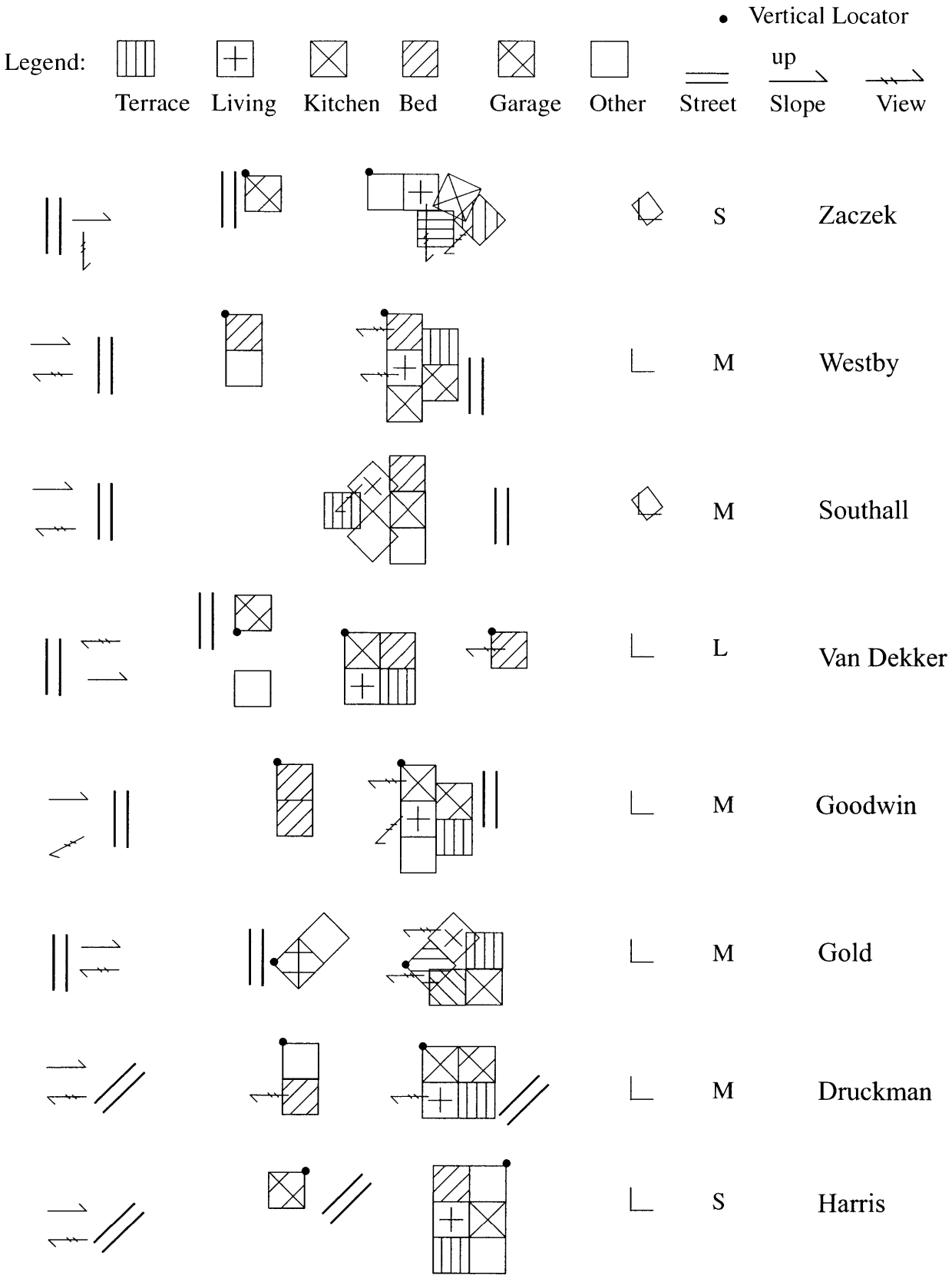
L indicates a large house; has two or more bedrooms, a large living room, and may be designed for more than one family.

Schematic Analysis: corpus

Chart 2

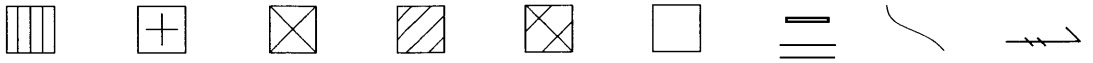


Site	Floors: Lower	Floors: Upper	Type	Size	Name
				M	How
				M	Wolfe
				S	Oliver
				L	Buck
				M	Van Patten
				M	McAlmon
				L	Fitzpatrick


• Vertical Locator
Legend:
Terrace
Living
Kitchen
Bed
Garage
Other
Street
up
Slope
View
S
Zaczek
M
Westby
M
Southall
L
Van Dekker
M
Goodwin
M
Gold
M
Druckman
S
Harris

Design rules: Schindler Shape Grammar

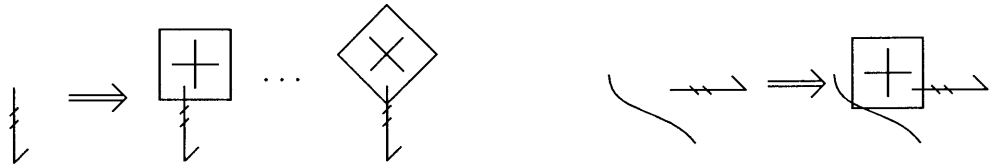
Legend:



Plan **Section**

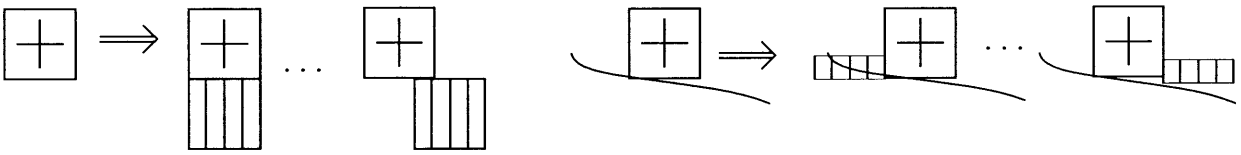
Rule 1: Distant View --> + Living Room

In this rule, start with a distant view, and place the living room to take advantage of it.



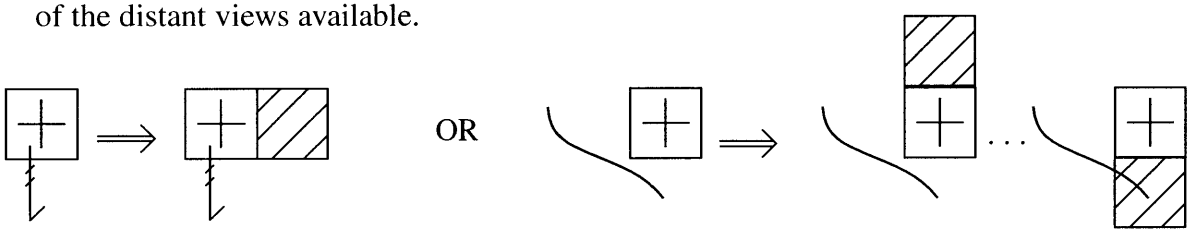
Rule 2: Living Room --> + Patio/Terrace

In this rule, start with a living room, and place the terrace adjacent to it.



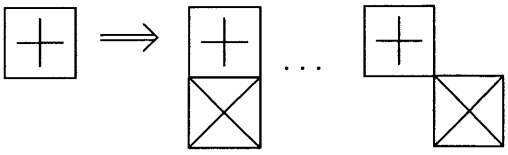
Rule 3: Living Room --> + Bedroom

In this rule, start with a living room, and place the bedroom adjacent to take advantage of the distant views available.



Rule 4: Living Room --> + Kitchen

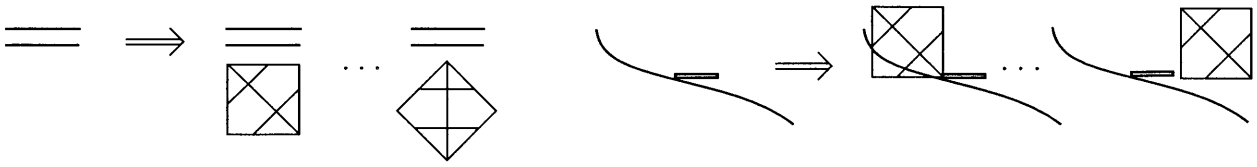
In this rule, start with a living room, and place the kitchen adjacent.



Plan **Section**

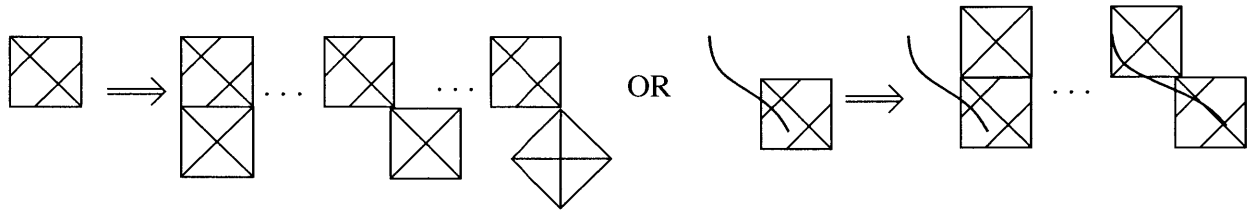
Rule 5: Street --> + Garage

In this rule, start with the street and add the garage.



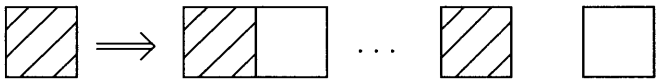
Rule 6: Garage --> + Kitchen

In this rule, start with the garage and add the kitchen either adjacent or above the garage.



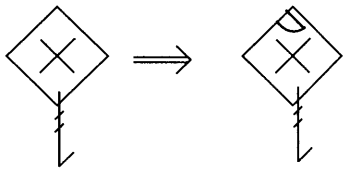
Rule 7: Bed --> + Other

In this rule, start with the bedroom and add "other", either adjacent or separated by another zone.



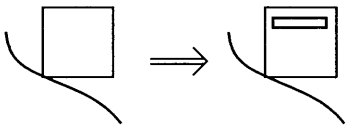
Additional common design features:

Diagonal Entry



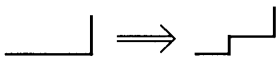
In many of the plans, the entry to a room is in a corner, opposite windows with a view, creating a long diagonal view through the room to the outside.

Clerestory Windows



Every house has rooms with clerestory windows. These were used to allow light in from either the outside or the inside where there was no view. This also made rooms feel spacious.

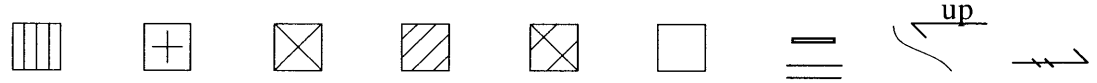
Notching



Notching allowed for more spatial variety, as well as letting in more light from different angles. This also generates emergent L shapes.

Generated designs: Schindler Shape Grammar • Vertical Locator

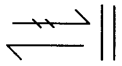
Legend:

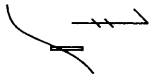


Terrace Living Kitchen Bed Garage Other Street Slope View

In order to test the design rules, three hypothetical sites were formed. The first two sites are the same, while the third is different. Applying the rules, three different hypothetical designs were created.

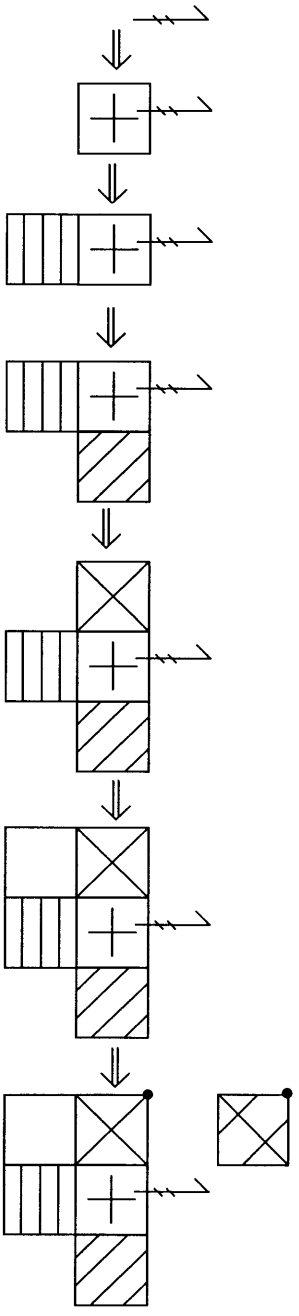
Site 1:





In this hypothetical site, the land slopes up from the street, with a view across the street.

Plan **Section**



Start with View

Add Living Room (rule 1)
take advantage of view

Add Patio (rule 2)
adjacent to living room

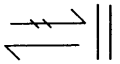
Add Bedroom (rule 3)
adjacent to living room

Add Kitchen (rule 4)
adjacent to living room

Add Other (rule 7)
apart from bedroom
completes L shape
around the patio

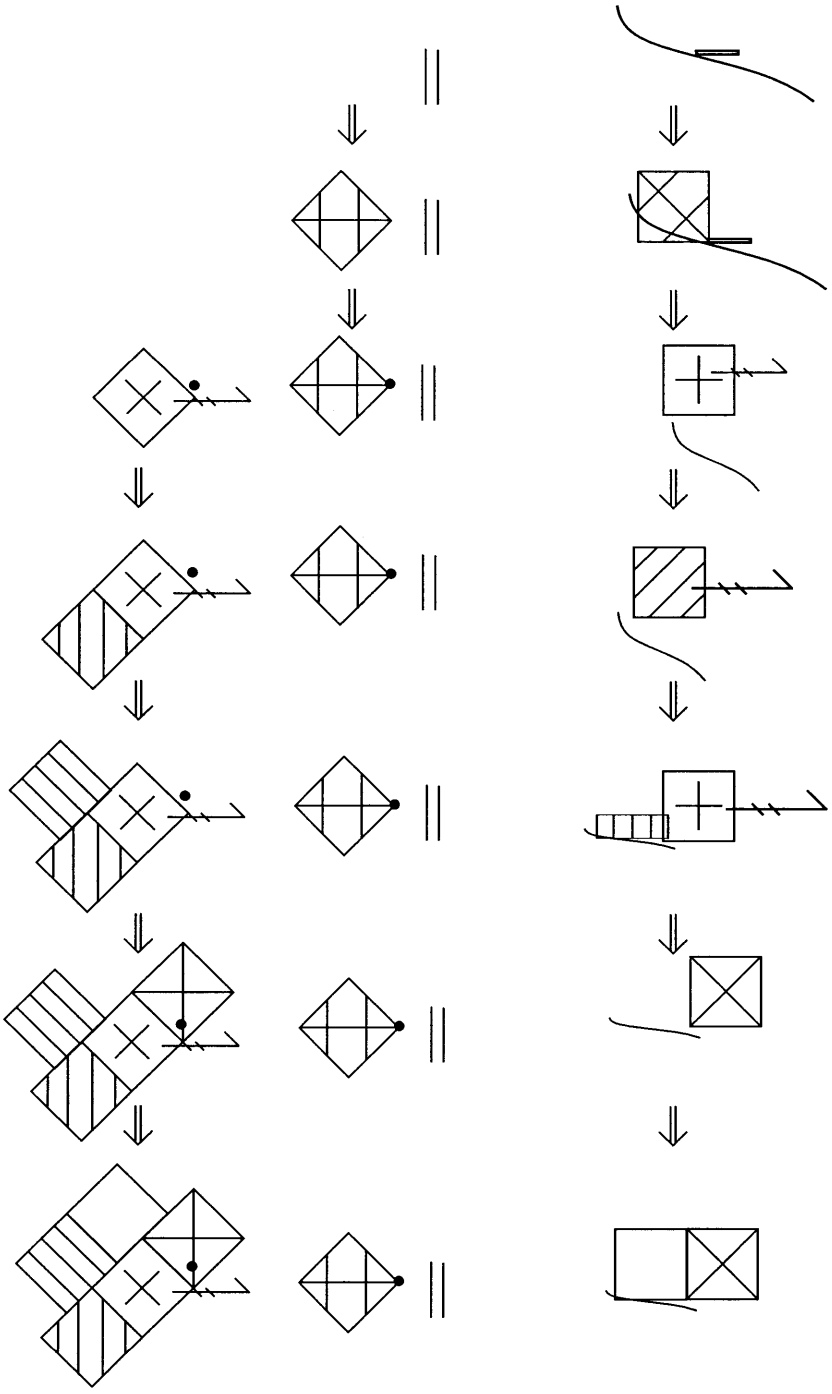
Add Garage (rule 6)
below kitchen
next to street

Completed design

Site 2: 

To demonstrate the variety of design solutions possible, this site has the same conditions as the first site with a different generated design.

Plan **Section**



Start with Street

Add Garage (rule 6)
next to street

Add Living Room (rule 1)
takes advantage of view
above garage level

Add Bedroom (rule 3)
adjacent to living room
also has a distant view

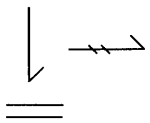
Add Patio (rule 2)
adjacent to living room
forms "through" view

Add Kitchen (rule 5)
adjacent to living room
forms bend of L shape

Add Other (rule 7)
completes L shape
around the patio

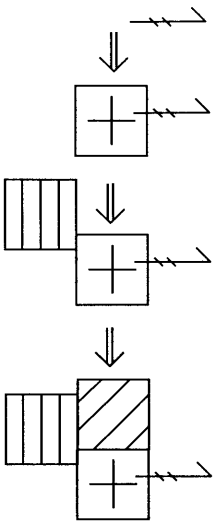
Completed design

Site 3:



The site slopes down to the street and the view is parallel to the street, which is unusual.

Plan **Section**



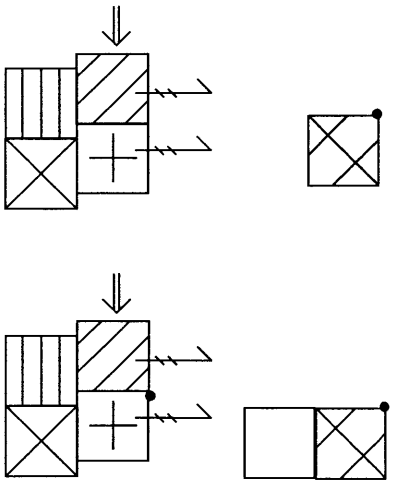
Start with View

Add Living Room (rule 1)
takes advantage of view

Add Patio (rule 2)
next to living room
forms an angled "through" view

Add Bedroom (rule 3)
next to living room
takes advantage of view

Add Kitchen (rule 4)
next to living room
completes L shape around the patio



Add Garage (rule 6)
below kitchen
next to street

Add Other (rule 7)
completes support for upper level

Completed design

Evaluations:

Site 1 design appears to be closest to Oliver House both in form and in layout. The only two major differences stem from the orientation to the street and the "other" behind the kitchen. Site 2 reflects the overall orientation of Oliver House with respect to the street. With the exception of the garage (dependent on the street location), the overall layout mirrors the Westby/Goodwin configuration. Site 3, more unusual in that the view runs parallel to the street, combines elements from Zaczek (view orientation) and Fitzpatrick (general layout).

Conclusions:

The seven spatial relations outlined on pages 14 & 15 do an admirable job creating new designs that embody the schematic qualities found in Schindler's L-shaped houses. These rules accurately convey the importance of the site in designing a residence. The process of analyzing the basic qualities of a range of houses and encoding them into shape grammar rules works quite well. This can be verified if the set of rules creates the designs that were taken into consideration. By using shape grammars to create design rules, new designs can be made in the same style of the buildings studied, just by following the rules. In this way, designs not conceived through typical means can be explored.

The shape grammar rules do not directly or automatically create L shape arrangements. L shapes are created indirectly by applying rules in special ways. Since the rules formed do not specifically generate L shaped plans, it may be possible to investigate whether these rules generate other non L shaped Schindler plans.

The rules are limited to schematic explorations of Schindler-type designs. By refining and adding more rules, specifically ones that alter form and spatial relations on a smaller scale, the generated designs would become more powerful and result in houses that appear to be created directly by Schindler. Some of the refining rules were outlined at the bottom of page 15: diagonal entry, notching, and clerestory windows. Additionally, other types of computational grammars, such as color, parametric, and emergent, can be used to address different design issues. A Schindler cube (March and Sheine, 1995 p 58) , with dimensions and ratios marked out, has been developed and could be incorporated into a 3D Schindler grammar.

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Sheine, Judith. *r.m. schindler: works and projects.* Barcelona: Gustavo Gili, 1998

Steele, James. *R.M. Schindler.* Hohenzollernring: Taschen, 1999