

AN ANALYSIS OF THE FORMAL QUALITIES OF SPACE IN ARCHITECTURE

by

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Submitted to the Department of Architecture on October 23 1984 in partial fulfillment of the requirements for the degree of Master of Science in Architecture Studies

**ABSTRACT**

This thesis will provide an analysis of formal qualities of space from three perspectives; from the interior, from the boundary, and from the exterior of a space. The outline of this thesis will consist of an introduction, a case study analysis and some concluding remarks. The introduction will present three buildings which will be used as case studies for analysis. The first chapter will identify the formal qualities of the interior of a space by the elements contained in it. The second chapter will identify formal qualities of space from the configuration of its boundary. The last chapter will identify the formal qualities from the exterior of the space through the properties of position and proportion.

Thesis Supervisor: N. John Habraken  
Title: Professor of Architecture

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And finally, I thank my husband Nai for his kindness and moral support and Farnaz Beroukhim for her friendship during a difficult period.

## PREFACE

The intention of this thesis is to talk about the formal qualities of space in architecture. It is not an attempt to create an alternative language to functionalism, but an attempt to emphasize the continuing existence of formal qualities in contemporary architecture.

The reason for my interest in this subject is because of my belief that a good architecture has something more than just function. We may appreciate its spatial qualities, and these qualities may be explained in a rational way. At times it may be difficult to draw the line in determining between formal qualities and functional qualities of a space because it will usually have both qualities at the same time. Some architecture may express symbolic meanings which may be read in its formal qualities, but this thesis is directly related to formal qualities of architectural form, therefore symbolism will not be its subject.

The built environment is created from open spaces and built forms. Similarly, an environment inside a building also consists of open space and built forms, which are the spatial and physical elements of architectural form. The spacial elements of the built environment on the scale of a city, would include parks, highways, major and minor arteries. On a neighbourhood scale, the spatial elements would include streets, lanes, and alleys. On the scale of a building, the interior spatial elements would be rooms, while the exterior elements would include courtyards, front and back yards. The physical elements of the interior of a building would include interior and exterior partitions of rooms.

As a result from this observation, we may agree that spatial and physical elements may have formal or functional properties. Formal properties create formal images in our minds and give us a sense of place relative to its spatial organization. The purpose of their existence are mainly for descriptive purposes or to create identity. A functional property of a space or physical form, do not create formal images in our minds. They are elements which relate to a specific function, and entrance into a functional space will generally be associated with a particular goal or a concrete intention.

# CONTENTS

INTRODUCTION	1
Identifying Formal Qualities of Space	2 - 3
Description of the Buildings Used as Cases in this Study	4 - 11
<b>CHAPTER 1: THE INTERIOR</b>	<b>12</b>
1.1 INTERIOR PROPORTION	13 - 19
1.2 INTERIOR ELEMENT	20
1.2.1 Elements	20 - 24
1.2.2 Furniture	25 - 27
1.2.3 Interior Partition (Division of Interior Space)	28 - 34
<b>CHAPTER 2: THE BOUNDARY</b>	<b>35 - 36</b>
2.1 THE FORMAL QUALITY OF OPEN AND CLOSED	37 - 38
2.2 THE FORMAL QUALITY OF INTERIOR AND EXTERIOR	39
2.3 WALLS	40
2.3.1 The Buildings as Walls	40 - 41
2.3.2 Height	41
2.3.3 Molding	42
2.4 ELEMENTS OF THE WALL	43
2.4.1 Window	44 - 47
2.4.2 Gates and Doors	48 - 52
	53
2.5 ROOF	

CHAPTER 3: THE EXTERIOR	54 - 55
3.1 EXTERIOR PROPORTION	55 - 56
3.2 POSITION	57 - 59
3.3 ELEMENTS	60 - 62
CONCLUDING REMARKS	63 - 64
BIBLIOGRAPHY	65 - 66

## INTRODUCTION

The introduction will present three buildings which will be used as case studies for analysis in this thesis. The first three chapters analyse the cases from three perspectives: from the interior, the boundary and the exterior. We may identify the formal qualities from the interior of a space by the elements in the space and by its proportions due to formal intentions. The elements in the interior of a space may be selected for a functional purpose or in other cases, for a formal reason. We may determine the purpose from the position or proportion of the elements. Elements of the interior of a space may exist as furnitures or as interior partitions. Some elements may be neither furnitures nor interior partitions, for example, a fireplace or an inglenook.

The configuration of the boundary will show the formal qualities of a space from the perspective of the boundary. A boundary may exist as a wall or a roof. A wall may contain windows and doors where its position or proportion or other factors may create formal qualities.

From the perspective of the exterior, the exterior proportion and the position of a space may be observed to study the formal qualities of space. Similar to the interior proportion, the exterior proportion will show formal qualities if it were intended for formal reasons.

The concluding remarks will generalize some of the observations made from the analysis of the case studies. Hopefully, this thesis will clarify to some extent, the ambiguity between the functional and formal aspects of form and space and that the concept of formal quality may be thought of as a factor that is equally or more important to function.



## IDENTIFYING FORMAL QUALITIES OF SPACE

Some space have distinct formal qualities, while other space are less obvious. Take for example the comparison between a space representing a bay window and a space representing a bedroom. A bay window will create a distinct image in our minds through its form and shape. The formal qualities of the bedroom will be less obvious compared to the bay window because it will not create a formal image in our minds, its form or shape. We tend to identify a bedroom through what it should contain in order to represent a bedroom. Therefore we may identify a bedroom through the furnitures contained in the space. There are many alternative ways of identifying the formal qualities of that same bedroom. For example the formal qualities could be identified through its position relative to other rooms or through its formal relationship to other spaces. We can also identify the formal qualities of space by their formal characteristics, through the shape, color or proportions. From the shape, we may identify a room as a rectangle or a square room. From the color, we may identify a room as pink or white, and from the proportional characteristic, we may identify a room as a large or small room, or as a tall or short room. Instead of describing a bedroom as a place for sleeping, we may identify it as a large, pink square room.

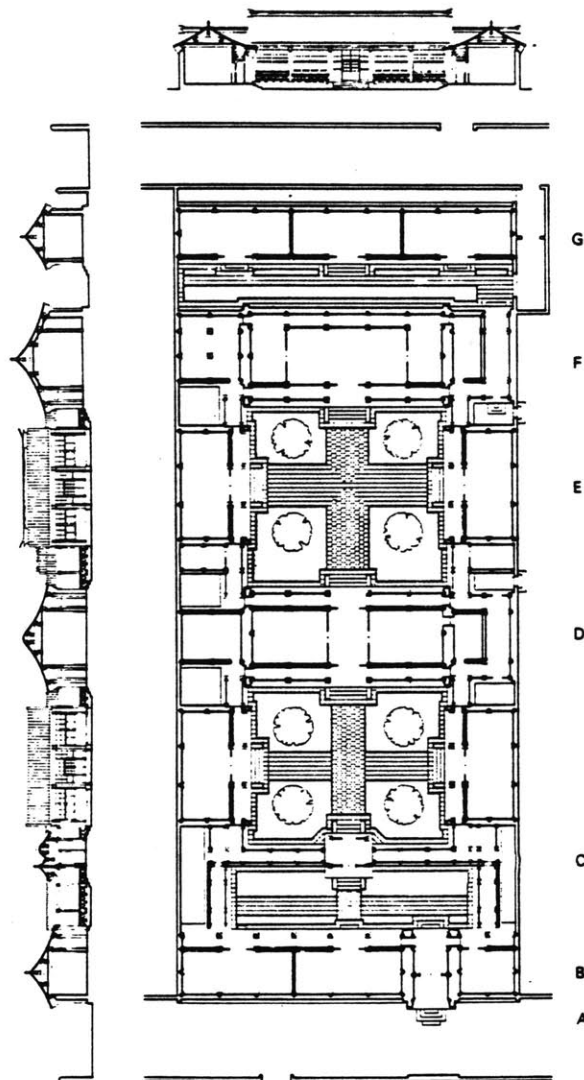
Names of rooms indicating their activity do not create an image in our minds, but names of spaces which relate to its formal aspects will create formal images. From this observation, we may say that formal qualities of space are closely related to the language or names given to a space. At the same time, we may also perhaps agree that language shows that people

think in formal terms. The name bedroom will represent a functional space, but the name bay window will represent a formal space.

Space can be found in all scales of the built environment. On the scale of a city, a formal space may be represented by a square. In the scale of a neighbourhood, and the scale of a building, formal qualities of space can also be found.

## DESCRIPTION OF THE BUILDINGS USED AS CASES IN THIS BUILDING

## CASE ONE : VERNACULAR CHINESE HOUSE



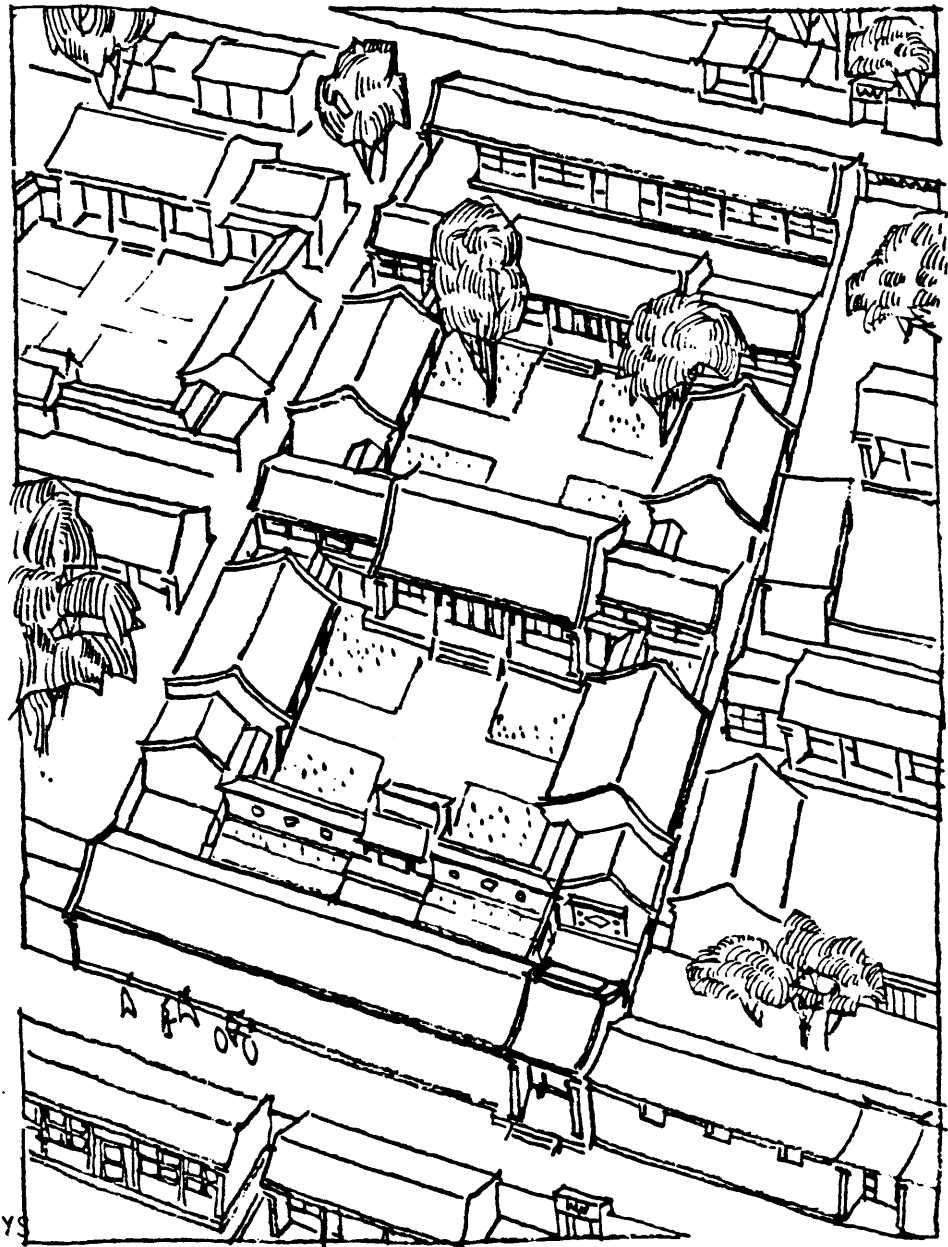
A TYPICAL LOW-BUILT ONE STOREY  
HOUSE OF THE CHING DYNASTY.  
(1644-1911)

- A Entrance gate
- B External guestrooms
- C Second gate
- D Inner guesthouse
- E Wing
- F Main building
- G Subordinate building

The art of building in China has always been subjected to certain rules promulgated by the state. The laws of the state ensure a frame for the social structure and the ordered system of the surrounding environment, and this is reflected in the uniformity of its architecture. Therefore, all the components of the building were dependent on rules which reflected the status of the owner either economically, socially, or aesthetically. The purpose of the rules was therefore to allow a large number of people to live together in harmony.

The platform and the roof represent the symbols of heaven and earth. The walls have a subordinate function; they protect the inhabitants against the wind and weather. A Chinese house distinguishes between a wall and a partition. The wall serves to form the enclosure and performs static functions. The internal partition divides up space but also has aesthetic and symbolic importance.

The courtyard of a Chinese house is created from an encircling wall with buildings facing inwards. The house is entered from the little frequented side street by way of an off-center main gate which gives access to a narrow outside court. This courtyard is used as a reception for guests. The inner courtyard is intended as accommodation for the women and girls of the family as well as the servants. The second inner courtyard is used as the living area for the master of the house and is oriented towards the south. The buildings on the east and west are used by the married sons of the household. In the front part, the outer courtyard, the kitchen and the service and store rooms are located with their backs to the street.

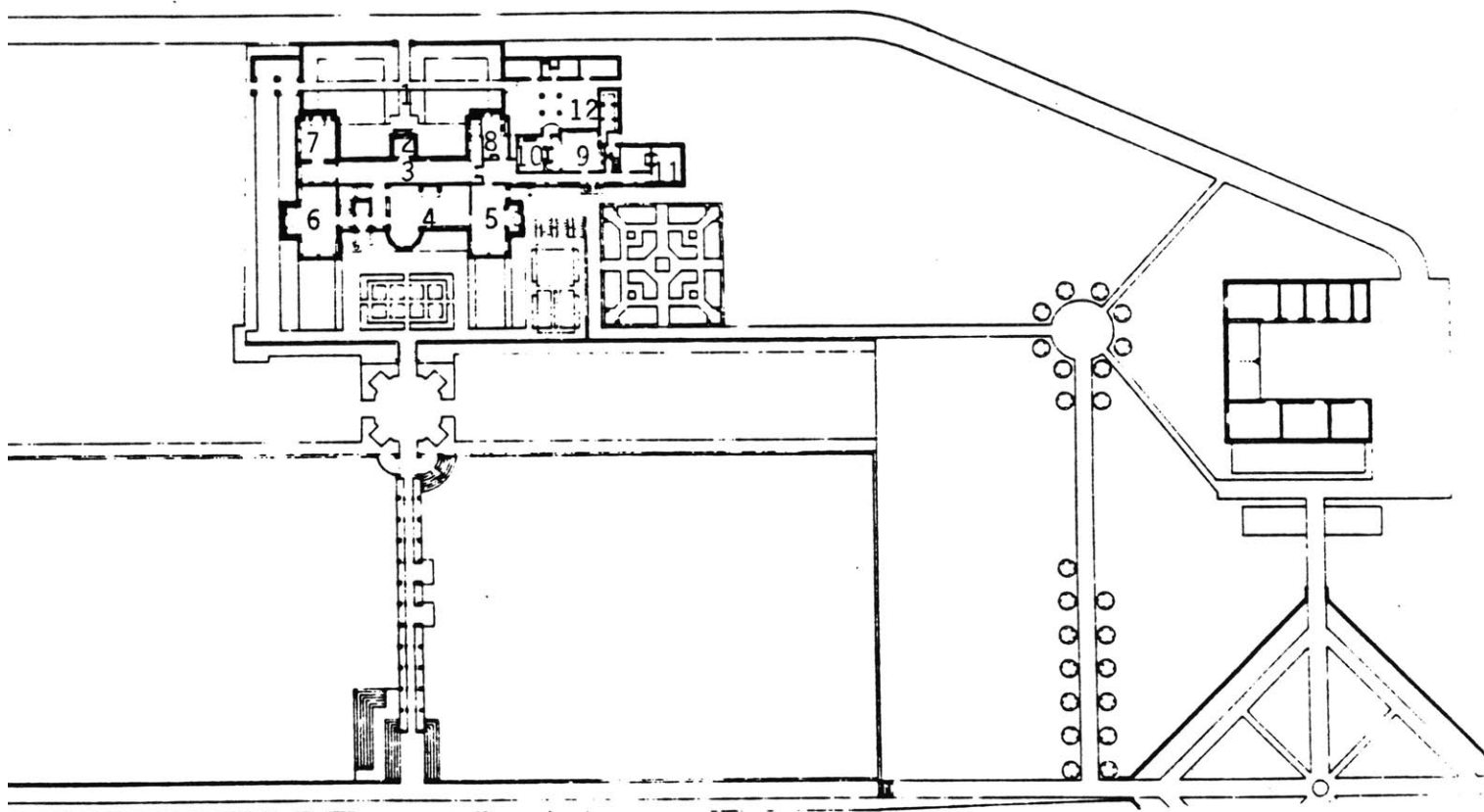


AXONOMETRIC DRAWING  
OF A CHING DYNASTY  
COURTYARD HOUSE AND  
THE ORGANIZATION OF  
THE STREETS AND ALLEYS

The streets located in the front of the houses represent a more public space, while the alleys located between houses and in the interior of houses represent a more neighbourhood space. The streets and alleys are used for different purposes. For example, the streets are shared by all the houses of the neighbourhood, while the alleys located between the houses are shared by the owners of the two houses and by the neighbours on their way to visit them.

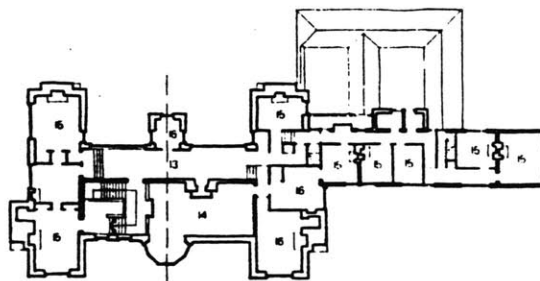
The alleys located in the interior of the house may be used by their direct neighbours and other neighbours who are on good terms with the owner of the house.

## CASE TWO: LITTLE THAKEHAM, EDWIN LUTYENS



GROUND FLOOR PLAN OF LITTLE THAKEHAM, SUSSEX 1902

1. Entrance courtyard
2. Porch
3. Corridor
4. Hall
5. Dining room
6. Drawing room
7. Library
8. Pantry
9. Kitchen
10. Scullery
11. Servants' hall
12. Courtyard
13. Corridor
14. Void
15. Bedrooms
16. Bathroom



SECOND FLOOR OF LITTLE THAKEHAM

The hall of Little Thakeham is emphasised by its increased height as the climax of a group of three reception rooms, the drawing room, the dining room and the hall. The hall is disengaged from the exterior, and only indirectly connected to the terrace via a screened passage. The reception rooms are bounded by fireplaces on the cross axis. The movement by axis is blocked in the vestibule by the wall of the hall so that it has to be entered off-axis in order to increase the apparent size of the building by introducing complicated circular patterns.

In some of his houses, Lutyens attempts to increase the apparent size of the building through many methods at the same time. The methods stated below are quoted from an article written by Peter Inskip in Architectural Monographs 6, Edwin Lutyens.

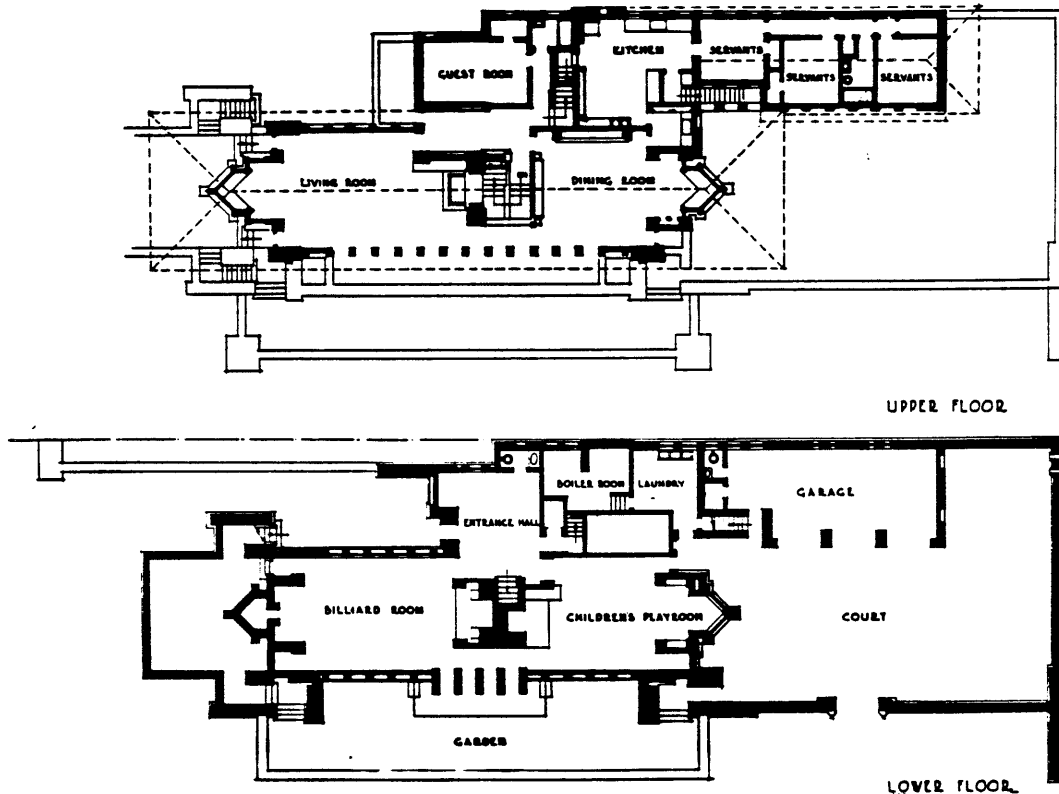
He encouraged movement backwards and forwards within the building so that the architectural experience would be more extensive than the house would otherwise allow.

Through axial planning, he reinforced the importance of certain rooms, but direct axis was denied by the interruption of movement of axis.

The external appearance of the house is also increased by the relationship of the house to the garden, which was considered as an extension of the house

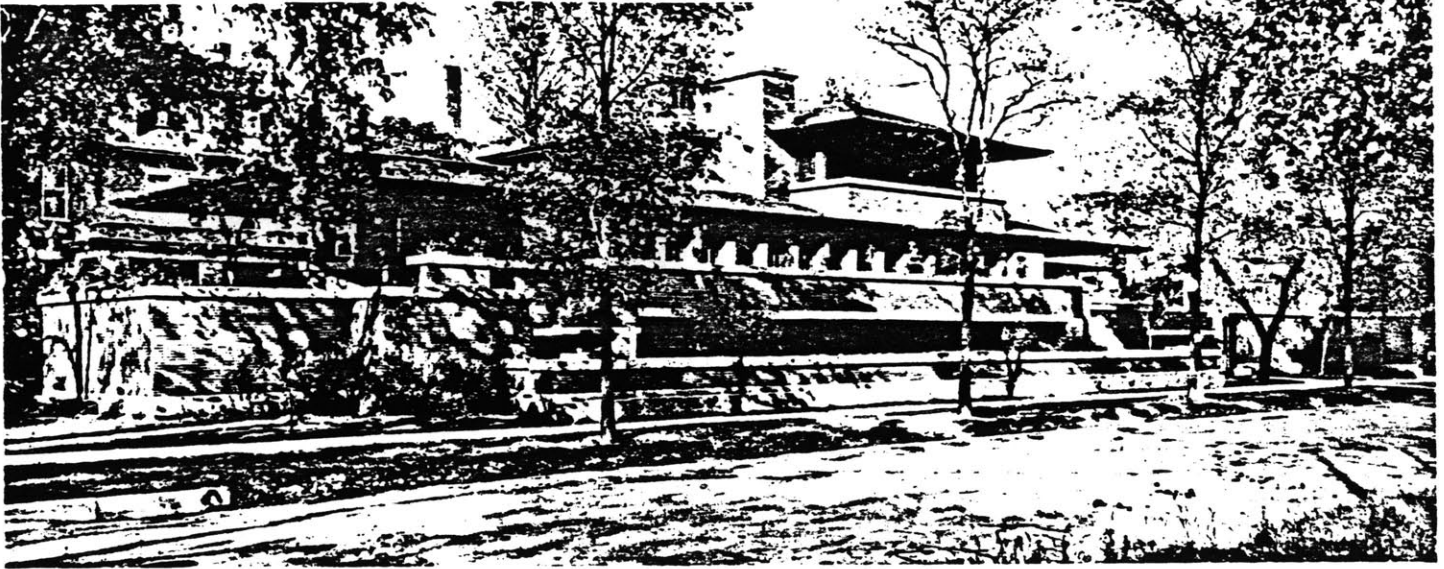


## CASE THREE: ROBIE HOUSE, FRANK LLOYD WRIGHT



FREDERICK C. ROBIE HOUSE, CHICAGO, ILLINOIS 1909

To Sullivan and Wright, architecture in the United States reflected a colonial heritage and had nothing to do with the American culture. They wanted to break away from the snobbish "upper class" architecture being imported from Europe and create a genuinely American "democratic" expression which will not be built upon formal pretense. To Sullivan, "beautiful form could only be created after functional expression had been satisfied". Even if Wright had been influenced by Sullivan, he did not express form as a direct result from functional considerations. He used formal devices derived from principles based on a "democratic architecture" and an "organic architecture".



ELEVATION OF ROBIE HOUSE (FRONT)

The "new democratic architecture" represented a break away from the traditions of European or classical architecture. The formal representation of the facade should no longer express a strict classical order, but instead the exterior should express the spatial organization of the interior. It must be an honest architecture which expresses its contents and intents on the face and in all details of its building.

# CHAPTER ONE

# CHAPTER ONE: THE INTERIOR

## 1.1 INTERIOR PROPORTION

When we observe the dimensions of a room, we may distinguish it to either have a functional or a formal quality. A room which has a functional quality may obtain its minimum and maximum dimensions from the arrangements of furniture and the rules of human engineering. A functional room accomodating a larger activity, will require more furniture, and therefore a larger capacity of space. But when a room does not have an obvious function, we can no longer determine its dimensions from a functional basis. To find the appropriate formal dimensions, we cannot approach the solution from the most efficient size. If we are not able to determine the the minimum and maximum space capacity, how do we determine dimensions? Are we able to explain the basis of formal dimensions as clearly as the basis of functional capacity?

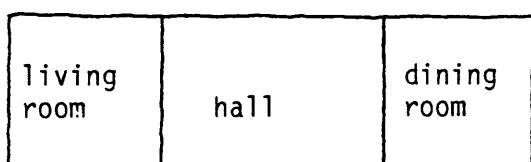


fig. 1  $1\frac{1}{2}$  times larger?

A method of determining the formal dimensions of a room would be to find the relative proportions of the rooms with a functional dimension. Take for example a hall. A hall does not have an obvious function, but we

know that it should be larger than other rooms because it is the most public space in a house. Furthermore, we do not know what furnitures it should accomodate.

The dimensions of a living room and a dining room may be found in the building code of minimum standards, but it does not specify the dimensions of a hall. But if we know the dimensions of the

living and dining room, the proportion of the hall may be generalized from the size of the existing rooms. From the bay width of the living and dining room, we will be able to find an appropriate dimension for the hall by multiplying the width of the bay to a suitable relative proportion. For example, (fig. 1) we may decide that a hall should be one and a half times larger than a room. The dimensions of a hall can also be calculated from the relative proportions of existing rooms. For example, a hall should not be smaller than the area of the largest room in the house, it should be proportionally larger than the larger rooms in the house.

There are several alternative methods of determining dimensions from a formal approach, and it may become clearer to us as we analyse the buildings of the case studies.

#### Case 1: Vernacular Chinese House

When we look at the spatial elements of a vernacular Chinese house, we see that it consists of bays, and buildings.

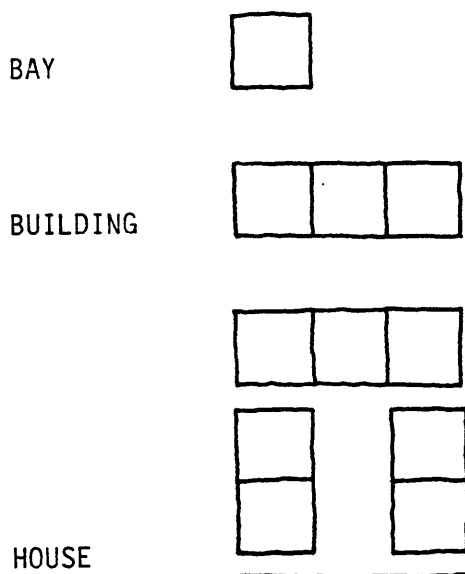


fig. 2

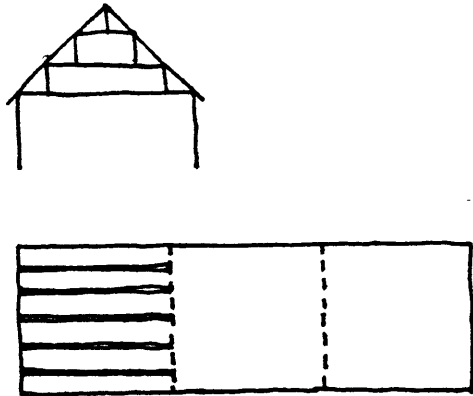


fig. 3 BAY

PROPORTION- The number of rafters in a bay.

DIMENSION- The width of a bay and the distance between each rafter.

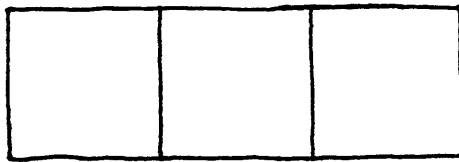


fig 4 BUILDING

DIMENSION- The size of the bays.

PROPORTION- The number of bays.

### Bay size

The depth of a bay depends on the number of rafters. The number of rafters will depend on the status of the owner in the social hierarchy. For example, for officials of the third grade, the depth of a bay should not have more than five rafters. No rule regulates the width of a bay, or the distance between each rafter. The dimensions, unlike the proportions of a bay, may vary according to the size of each family, but generally, the bay should be square.

### Building size

The proportion of a building will depend on the number of bays. The number of bays in a building will be regulated by the rules promulgated by the dynasties which aimed at preserving the social hierarchy. These rules control the proportion of the buildings which in turn will control the proportion of the other buildings from the strict growth of the house.



ONE BAY

Minimum size of a gate  
Minimum size of a hall



THREE BAYS

Minimum size of a building

fig. 5 MINIMUM DIMENSIONS  
OF A GATE, HALL, AND BUILDING

" Below officials of the third grade, the main hall shall not have more than five bays and five rafters."

This rule advocated by the society controls the minimum and maximum proportion of a hall.

The number of bays of a building is also controlled by the rules of society. The highest ranked position may consist of up to eleven bays, while the common citizens may have a maximum of three bays for each building.

An ancestors hall is always wider than the width of the main gate. The main gate is always at least the width of a bay. A hall should always be located at the center position, so therefore, we may agree that the minimum size of a building containing a hall would be three bays.

The rules advocated by the dynasties made no implication on the importance of dimensions. The uniformity of the proportions were the important factors in preserving the order of society. The dimensional size of a bay may depend on each individual family.

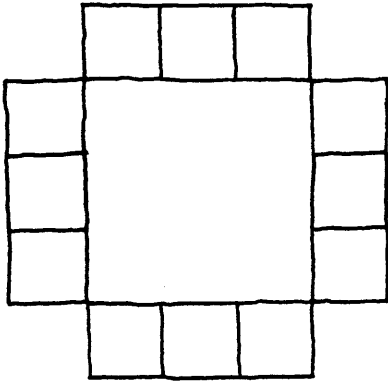


fig. 6 GROWTH OF BUILDINGS

The proportion of a building will control the proportion of the other buildings. If the a building consists of three bays, the other buildings will also follow suit. The uniformity of the proportion of each building is regulated by the rules of growth.

### Case 2: Little Thakeham, Lutyens

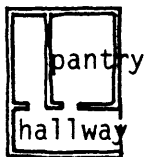
In Little Thakeham, Lutyens takes a different approach to create uniform proportions in its space. The grid initially kept the size of the rooms uniform, but Lutyens used the method of subdivision to create small and large rooms.



This grid contains a large sized room, the dining room.



This grid contains a medium sized room, a library, and the hallway.



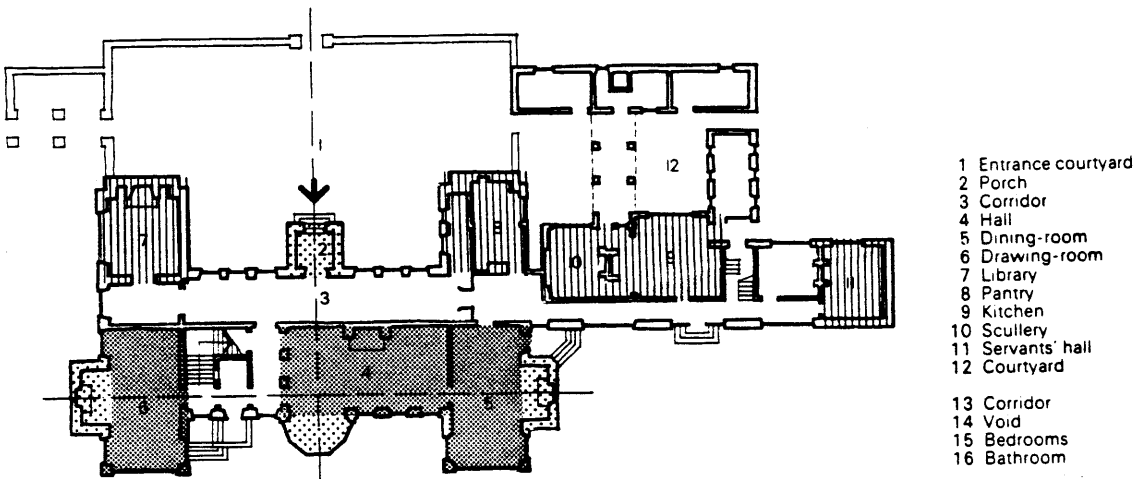
This grid contains two small rooms and a hallway.

fig. 7

Part of the order of Little Thakeham is its dimensional order. Its space consist of mainly two dimensional sizes, but within this constraint Lutyens was able to create large, medium and small size rooms. Take for example, the diagrams at the left. The various sized rooms were created from the same grid, through the method of subdivision. Therefore each grid may contain a mixture of small and medium rooms.



From this dimensional order, we may be able to perceive that each spatial element (1) in Little Thakeham belongs to a dimensional order.



FLOOR PLAN OF LITTLE THAKEHAM

Large size element



1. Hall
2. Drawing room
3. Dining room

Medium size element



1. Library
2. Kitchen
3. Pantry
4. Scullery
5. Servants' hall

Small size element



1. Bay window
2. Porch
3. Inglenook

footnote: "spatial element" (1). An interior space defined by a boundary. It may exist as a room or as a space attached onto larger spaces, for example, the bay window, or the inglenook.

### Case 3: Robie House, Wright

As Vincent Sculley has already mentioned in his book, American Architecture and Urbanism; "Wright forced all plans into puristic geometries, and the spatial areas expand and contract according to their functional requirement rather than to a preconceived abstract order."

Similar to the Chinese house and Little Thakeham, Wright believed that dimensions were not as important an issue as proportion. The size of his rectangular plan may expand or contract depending on the function, but the important factor to keep in mind is to preserve the shape or the proportion of the rectangular plan. He believed that proportion represents a formal meaning and therefore he forced his plans into rectangular geometries to create low horizontal profiles. The diagram below shows the subdivision of rectangular forms due to functional requirements.

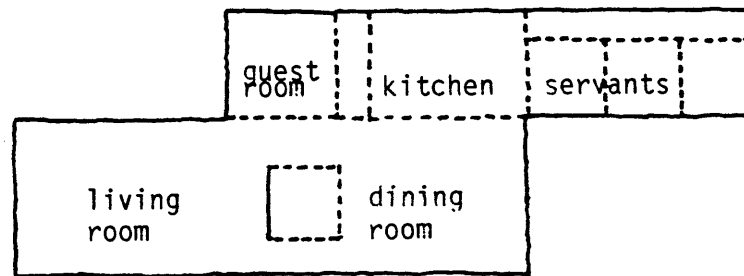


fig. 8 DIAGRAMATIC REPRESENTATION OF ROBIE HOUSE

## 1.2 INTERIOR ELEMENTS

So far in the previous section, we have looked at interior spaces for the proportions of their overall dimensions.

We may also find formal qualities in those spaces aside from the issue of proportions. The alternative method is to observe the interior elements of a space, or a room. All spaces contain elements. These elements may exist as furnitures, walls, or other forms such as a fireplace. The same room containing a different configuration of elements will portray a different character or quality. To further clarify how we may distinguish the difference between formal and functional quality from the interior elements of a space, we may explain that a different set of furniture will represent a different function and therefore depict a different functional quality, but it may not necessarily change its formal quality. It is more important to question for what purpose the element is put there, and why it is put in that specific location. Therefore it may be the position and the rationalization of why the element is there that will describe the formal quality. Nevertheless, it is always arguable as to whether elements may exist for a functional or a formal reason. Some elements may exist purely for a formal reason, while some may exist for a functional purpose but at the same time have a formal intention. Take for example a fireplace. This element exists for a specific use and therefore, is a functional element. But if this element is placed at the center of the room or on the line of axis, we may say that the fireplace is a formal element. This will be further clarified by the analysis of the case studies.

### 1.2.1 Elements

In this context, elements represent physical forms in a space other than furnitures, or boundaries.

#### Case 1: Vernacular Chinese House

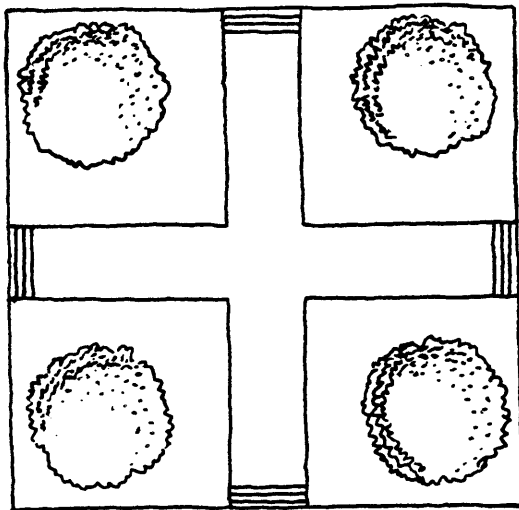


fig. 9 COURTYARD

#### Elements of a Chinese courtyard

1. trees
2. steps
3. pathway

The courtyard has been chosen as an example to show that the space contains formal elements. Take for example the element called tree. The trees planted in this courtyard may be observed as formal elements because the position in which they stand are symmetrical and in axis. This arrangement is a fairly typical example of a Chinese courtyard.

The other elements contained in the courtyard are the pathway and the steps. The steps and trees may have a functional purpose initially to connect the courtyard to the building and the trees to provide shade, but the trees and the steps are formal elements through their position.

Case 2: Little Thakeham, Lutyens

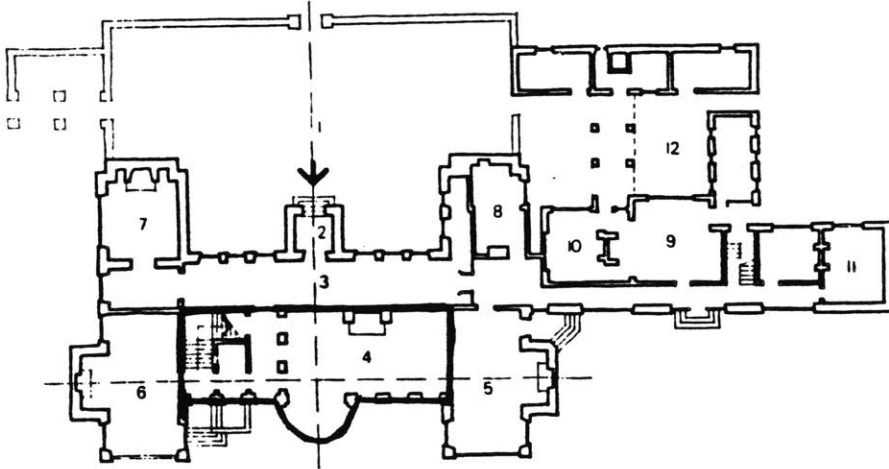


fig. 10 FLOOR PLAN OF LITTLE THAKEHAM

From the floor plan of Little Thakeham, we are able to see that the hall extends from the drawing room to the dining room. The space includes the stairway, the passage-way and the main hall. The passage-way is created from the boundary separating the main hall from the smaller hall. The photograph in fig. 11 shows the interior of the main hall and the boundary as the subdivision of the main hall and the smaller hall.

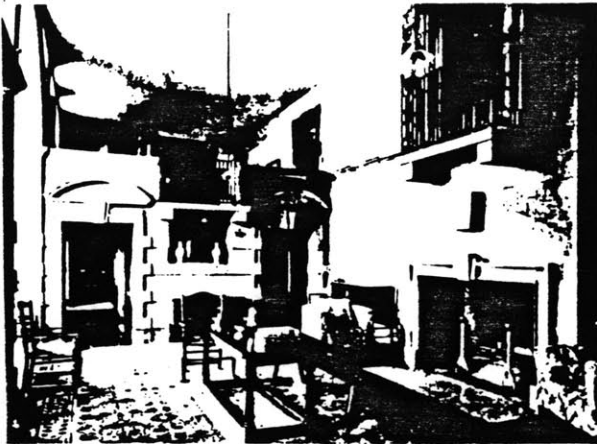


fig. 11 MAIN HALL OF LITTLE THAKEHAM

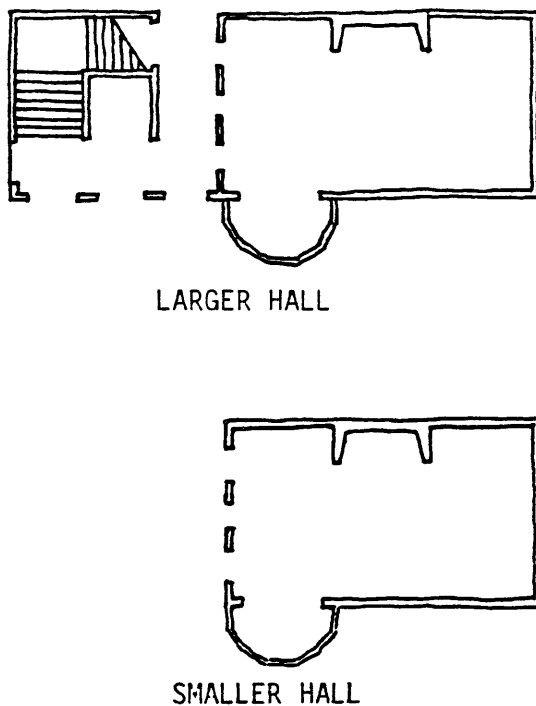


fig. 12 HALL

The elements contained in the hall are the fireplace, the chandelier, and the balcony above the fireplace.

Although the fireplace is designed for a functional purpose, Lutyens uses it as a formal element by placing it in a position at the center of the hall. Similarly the chandelier is also placed at the center of the larger hall.

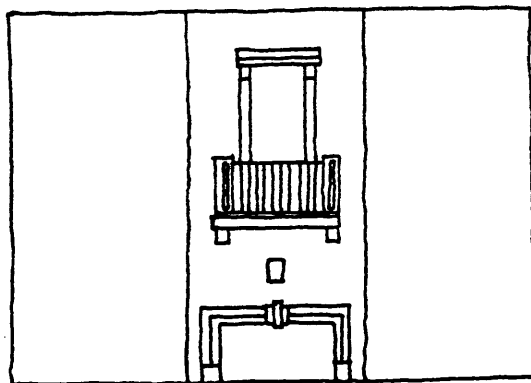


fig. 13 BALCONY

Directly above the fireplace adjoining the corridor on the second level, is a balcony which overlooks the hall. Because of its unconventional position, one would expect a solid wall to accommodate the fireplace and chimney. By its unconventional position, the balcony reinforces the central axis of the main hall.

The pipes for the chimney are hidden at the side of the balcony. Further-

more, the width of the balcony is the same as the width of the fireplace. By making the two elements have a similar dimension, Lutyens has brought to our consciousness the formal qualities of the two elements.

Case 3: Robie House, Wright

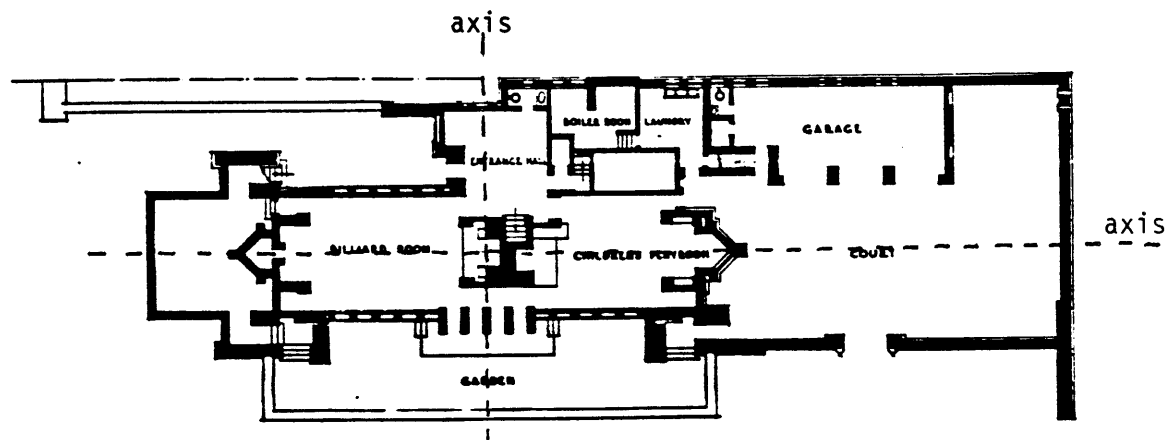


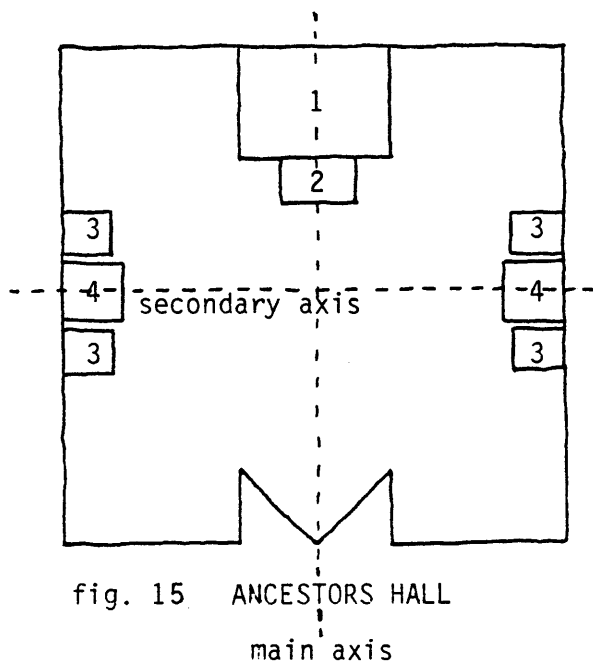
fig. 14 LOWER LEVEL OF ROBIE HOUSE

To Wright, the primitive elements of nature are water, fire, and earth. These elements of nature are consistently expressed as the theme of his buildings. To Wright, the hearth represents the forces of order of nature on this earth. In the Robie House and in most of his other buildings, the hearth is placed at the center of the house, symbolizing birth and a mystical life giving element in the heart of the houses from which all spaces grow. Because Wright designed the fireplace with a formal intent, the fireplace becomes a formal element through its position in the center of the house.

### 1.2.2 Furniture

An element which can be found in the interior of a space is furniture. Some furniture elements are arranged according to a functional rule, but other furniture in a room may be arranged according to its proportional or positional rule. By observing the furniture from the two approaches, we will be able to distinguish the element to have a formal or functional quality.

#### Case 1: Vernacular Chinese House



The furniture included are:

1. family altar table
2. eight person table
3. formal sitting chair
4. tea-poy table

The furniture in the ancestors hall follow a rule of position. The furniture elements of major importance will take the position in the center of the hall facing the door. The furniture elements of minor importance will take the position on the east-west axis.

Looking at the furniture arrangement from a larger scale, the more important parts will be placed on the line of axis of the house, while the furniture of less importance will be placed on the secondary line of axis.

footnote: (2) The translated version of the furnitures of the ancestors hall, is taken from the thesis, Traditional Patterns and Walk-up Apartments in Taiwan Area, June 1984, by Jon-Hui Hu.



Case 2: Little Thakeham, Lutyens

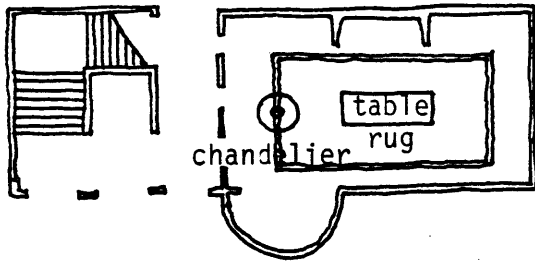


fig. 16 FURNITURE ELEMENTS OF  
THE HALL OF LITTLE THAKEHAM

Although the furnitures  
hall of Little Thakeham is not  
as strictly arranged according  
to its formal position compared  
to the furnitures of the ances-  
tors hall, some elements do  
follow a positional rule.

The furniture in the hall consists of chairs, a table, and a persian rug. From the diagram of the hall in fig. 14, we are able to see that the chairs are randomly placed in the hall. But if we observe the position of the table and the rug, we can see that the elements follow a positional rule. The table will always be placed at the center of the rug, and directly in front of the fireplace at the center of the room.

Because the elements, table and rug, follow a formal rule of position, they can be identified as formal elements. Because the hall contains formal elements in the interior of the space, we may say that the hall has formal qualities. Furthermore, we may justify the formal aspects of the hall from the description of its formal qualities.

Case 3: Robie House, Wright

The formal quality of the furniture in the dining room of the Robie House is also due to the position and to the design of the furniture. Similar to the furniture of Little Thakeham and the Chinese house, the dining furniture of Robie House is also placed according to the axis of the house. The design of the long horizontal table and the vertical upright chairs repeat the horizontal and vertical planes of his building. Wright created horizontal planes in his buildings through his long rectangular plans and low roofs with overhanging eaves, and vertical planes were created from tall central cores.

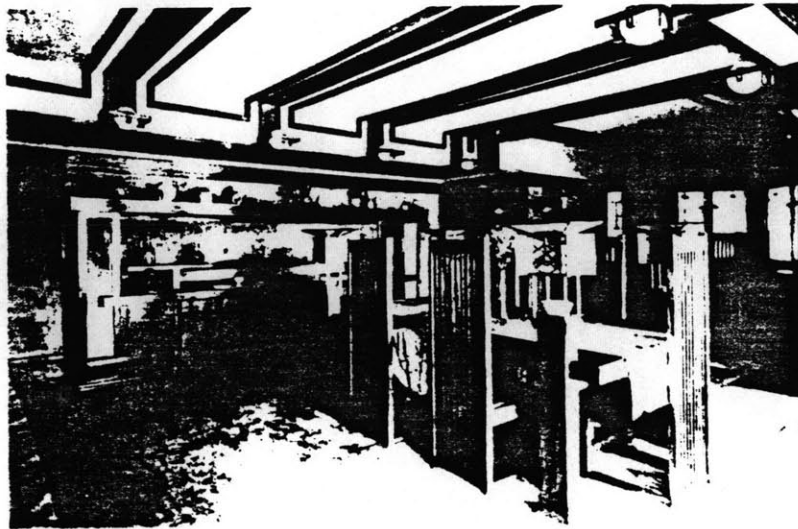


fig. 17 ORIGINAL FURNITURE BY WRIGHT IN DINING ROOM OF ROBIE HOUSE

### 1.2.3 Interior Partition (Division of Interior Space)

The interior of a room may also contain another element other than the furniture and fireplace. Interior partitions which divide an interior space, may sometimes exist for a formal reason.

#### Case 1: Vernacular Chinese House

The interior partition of the ancestors hall of a Chinese house may consist of a chao or a screen. The interior partitions may be located between the main hall and the service space at the rear of the hall, or at the east and west side of the hall, separating the main hall from the guest rooms.

The interior partitions are made of wood to identify them from the solid masonry wall of the room to room boundary. Unlike the room to room boundary, the chao and screen are traditionally used to subdivide a room with homogenous characters or functions.

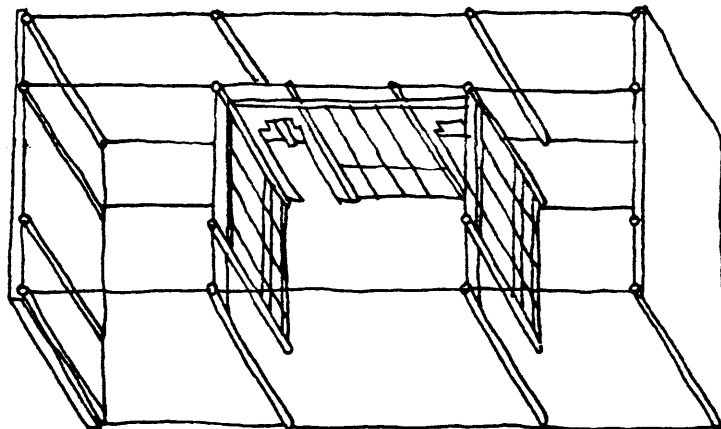


fig. 18 AXONOMETRIC OF THE ANCESTORS  
HALL SHOWING THE INTERIOR PARTITION

## Screens

The function of the screens is to provide a higher accessibility and visual linkage to the adjacent spaces. The screens are attached to the floor with rails, and these partitions may be opened by sliding the partition into a slit in between the wall.

The screens express formal qualities because they represent a transition between two spaces. This is made possible by the visual linkage of the screen and the accessibility between the spaces.

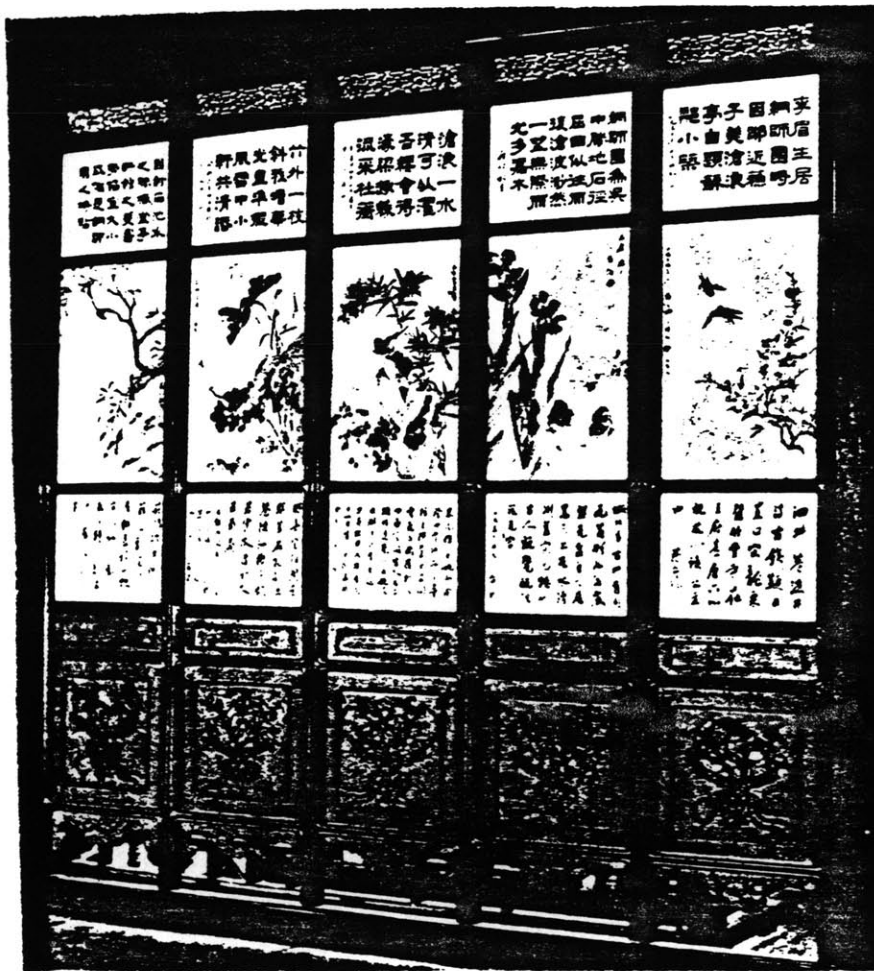


fig. 19 THE SCREENS USED AS SUBDIVISION OF A SPACE

### Chao

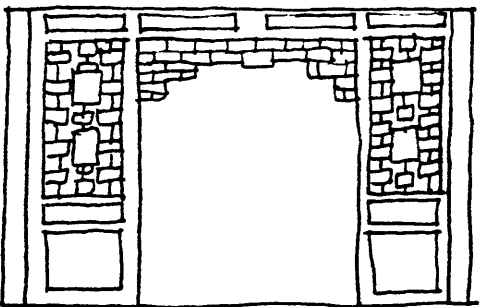
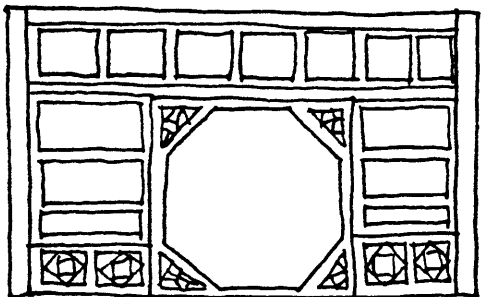
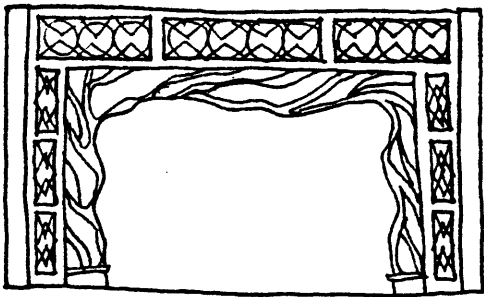
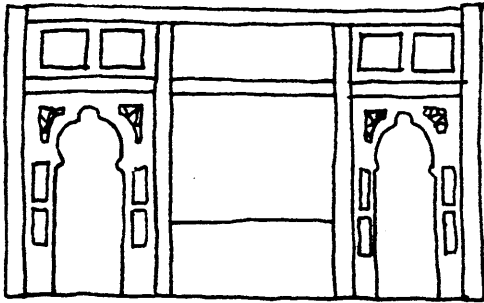
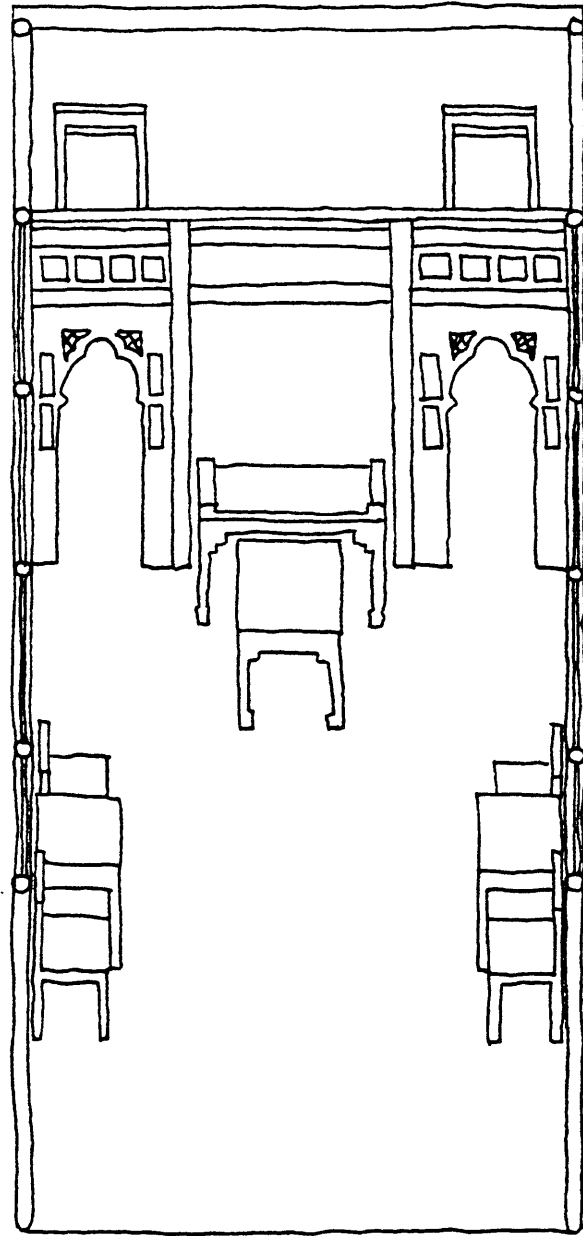


fig. 20 FOUR BASIC VARIATIONS  
OF THE CHAO

There are four basic variations of the chao. The chao symbolically divides a room into separate spaces. The formal quality of the chao is based on the symmetry of its designs. The chao is divided into two sections, an upper and lower section to make a room appear lower. A chao is always symmetrical, for example, a chao with one opening will be located at its center, while a chao with two openings will be located on both sides.

A chao with two openings may be placed at the rear of the hall with the altar table at its center. The chao with a single opening may be placed on the east and west side of the altar table.

We may observe the formal qualities of the chao from the symmetry of its design and from its position which emphasises the symmetry and axially of the room.



The formal quality of the chao is its symmetrical design which accentuates the symmetry of the ancestors hall.

fig. 21 VIEW OF THE ANCESTORS HALL FROM THE ENTRANCE SHOWING THE CHAO

Case 2: Little Thakeham, Lutyens

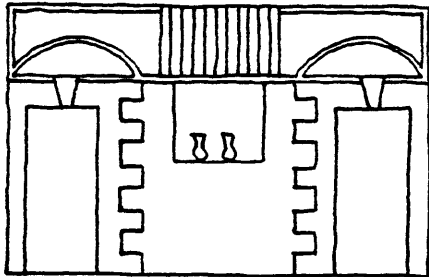


fig. 22 REDUNDANT WALL IN  
THE HALL OF LITTLE  
THAKEHAM

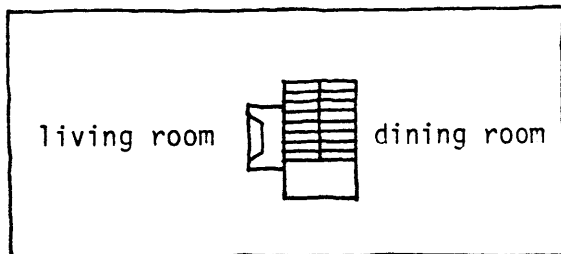
The interior boundary found in the hall of Little Thakeham, separates the stairs from the main hall. The stairs is disguised by the wall and we are fooled into thinking that there is a room beyond the other side of the wall. Because this wall is not used in the traditional way, as the boundary of

a room, and because the stairs do not functionally need a wall as its boundary, we can say that this wall does not exist for a functional reason, but purely for a formal reason. The symmetry of the wall and the landing of the stairs which appear more like a balcony, further intensifies the formal quality of the wall. The symmetry of the wall creates a similar formal quality to the solid partition with in-between doors in the ancestors hall of the Chinese house.

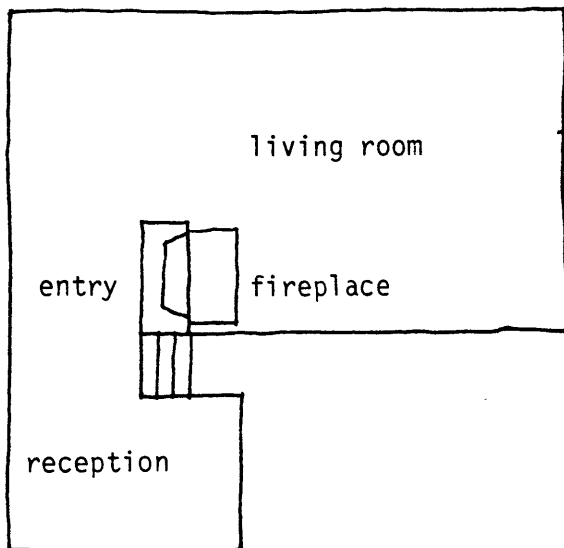
Case 3: Robie House, Wright

Wright eliminated the concept of isolated rooms defined by boxed-like solid walls in favor to a selection of certain elements used to define different spaces.

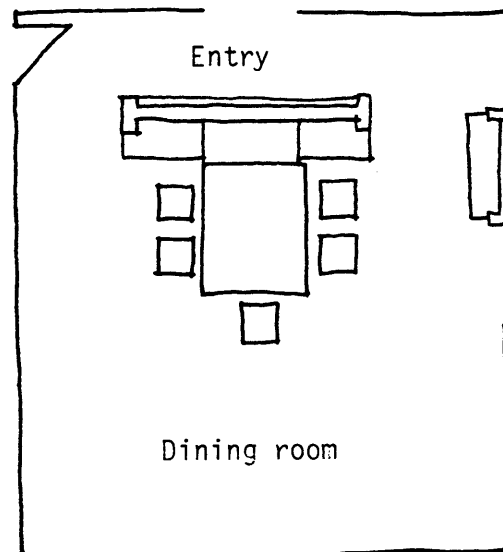
Wright selected certain elements like the fireplace, stairs, utilities and storage closets, and built in furniture consisting of storage walls and built in tables. Wright used this method consistently in all of his residential buildings. The examples in fig. 23 are taken from different buildings to show the consistency of Wright's approach.



(a) THE STAIRS. (upper floor)  
Robie House, Chicago, 1909



(b) THE FIREPLACE. Mrs. Thomas H.  
Gale House, Oak Park, 1909



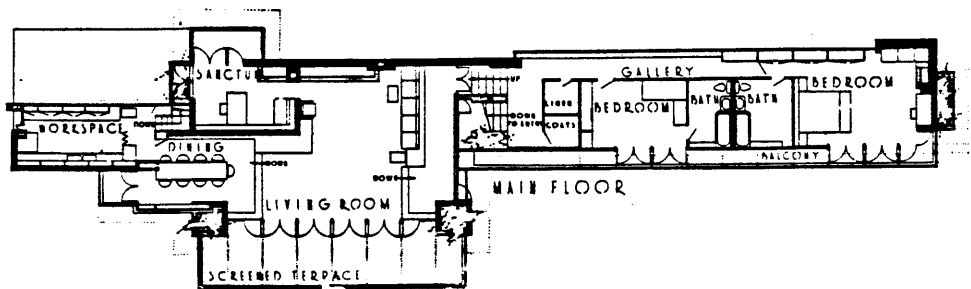
(c) THE FURNITURE. American  
Ready Cut Bungalow, 1915

fig. 23 ELEMENTS OF THE INTERIOR PARTITION



In fig. 23 (a), Wright utilized the stairs as an interior partition to separate the living room from the dining room. In fig. (b), the fireplace defines the entry from the living room. In fig. (c), the built-in dining furniture defines the dining room and the entry.

Other than using a selection of elements as boundaries of a space, Wright eliminated the interior boundary to break away from the conventional method of defining interior space and introduced change-in-levels to define a space.



THE BUILT-IN FURNITURE AND THE STEPS. Lloyd Lewis House, Ill, 1904.

The steps and built-in furniture act as a psychological boundary.

fig. 24 CHANGE IN LEVEL BOUNDARY

## CHAPTER TWO

## CHAPTER TWO: THE BOUNDARY

The most explicit formal quality of a space is the boundary. We may recognize the formal qualities of a space by looking at its boundaries. In this chapter, I will attempt to identify the formal qualities of the boundaries of a space.

The physical boundaries of a space, consist of the roof or ceiling, and the wall. The formal quality of a space, may depend on the type of configuration of a wall. Similarly, the configuration of the roof will also affect the formal quality of a space. For example, a space with a roof will have an interior quality, while a space without a roof will have an exterior quality. Similarly, a space with a wall will have a closed quality, while a space without a wall will have an open quality.

When we look at a space from the point of view of the interior, the boundary, and the exterior, we will see that the boundary is the only element which defines both interior and exterior space. Therefore, when we look at an interior space or an exterior space, we are looking at a space with reference to its boundaries. The properties of a space, for example, the position, or the interior dimension of a space, will depend on where the boundary begins and ends. Therefore, when we talk of the formal qualities of a space, we are speaking of it in the context of the boundary.

## 2.1 THE FORMAL QUALITY OF OPEN AND CLOSED

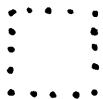
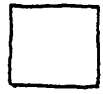






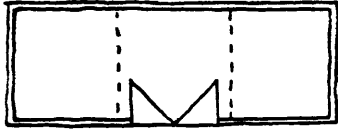
fig. 25

CONFIGURATION OF WALLS

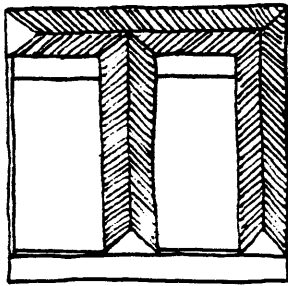
From the configuration of walls in fig. 25, we are able to see that a space can be totally closed or totally open, or partially open or closed. A boundary may consist of walls or columns, or a mixture of both. We may call a boundary a configuration of walls. Although the analysis of form do not deal with material, only the walls and columns are classified as the physical boundaries, while the windows and doors are classified as open.

However, we will not be able to succeed to classify all configurations of walls into categories of open and closed, and this is the reason why the analysis of form is interesting. We may say that this configuration  has a closed quality, and this configuration  has an open quality. But the configurations  and  can be either open or closed. If we are not able to decide whether a space is open or closed, then the issue of open and closed may depend on more than one factor. Hopefully we may be able to prove this from the analysis of the case studies.

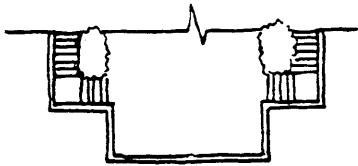
Examples taken from the Cases



building of the ancestors  
hall. (closed)



courtyard (closed)



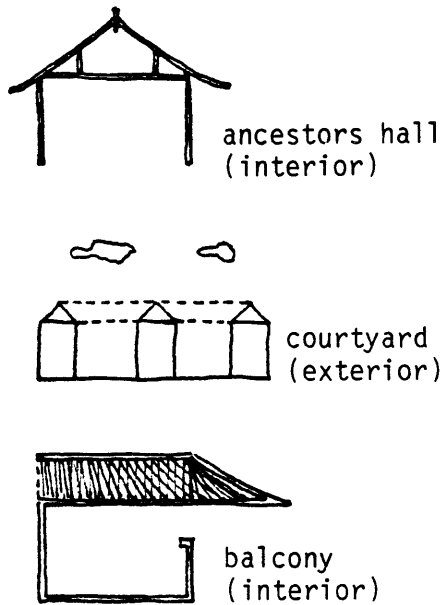
balcony (open)

fig. 26 EXAMPLES OF  
OPEN AND CLOSED QUALITY

The examples in fig. 26 have been chosen from the three case studies. Take for example the courtyard of Little Thakeham. Although it does not have a roof, it is enclosed by solid walls and therefore has a closed quality. Take another example, the living and dining room of Robie House. Although it has a ceiling, it still has an open quality. This shows that an open and closed quality depends only on the configuration of walls and not on the configuration of a roof.

A wall may consist of a solid wall, or it may consist of columns. A wall with columns may be visually transparent, and will therefore have an open quality. A solid wall will not be visually transparent and therefore, it will have a closed quality.

## 2.2 THE FORMAL QUALITY OF INTERIOR AND EXTERIOR

fig. 27 EXAMPLES OF INTERIOR  
EXTERIOR QUALITY

We already decided that a space with a roof will have an interior quality, and a space with no roof will have an exterior quality. But some interior space can have an open quality, and some exterior space can have a closed quality. If we do not think in formal terms, the issue of interior, exterior, open and closed, may become confusing.

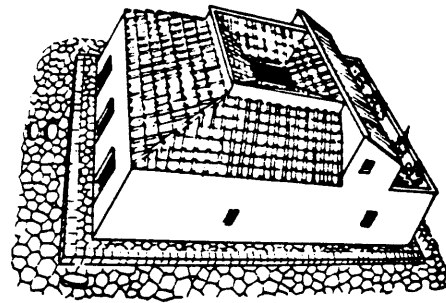
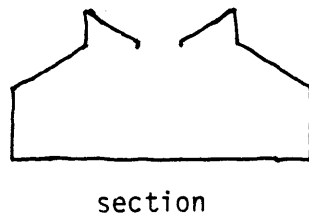


fig. 28 A TYPICAL ROMAN HOUSE IN THE 3RD &amp; 4TH CENTURY B.C.

Similar to the configuration of walls, some roofs do not represent a space that is entirely interior or exterior. Take for example the atrium of a Roman house in fig. 28. The atrium has a roof with an opening at its center. We can say that the atrium is an interior space because it has a roof, but showing the qualities of an exterior space.

## 2.3 WALLS

Boundaries may exist in the interior and exterior of a space. In chapter one, we have already talked about the interior boundary, or the interior partition of a room as a form of boundary. This chapter will concentrate mainly on the exterior boundary of a room and building.

In section 2.1 and 2.2, we have already discovered two ways to determine formal qualities of boundaries. Apart from looking at the configuration of walls and roofs, to observe the formal qualities of open, closed, interior and exterior, we may look at boundaries from other points of view. In this section we will look at other methods to analyse the formal qualities of walls. The examples in this section will be taken from the case studies.

### 2.3.1 The Buildings as Walls

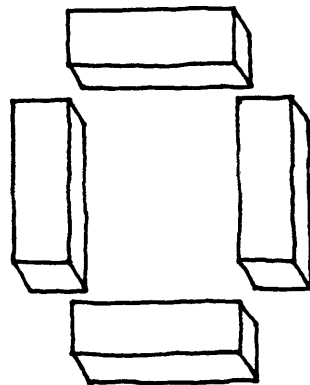


fig. 29 THE WALLS

In case study 1, the walls or the exterior boundary of the vernacular Chinese house will consist of the buildings themselves. The buildings are grouped in a way so that it forms an exterior boundary of the house. In Western architecture, the boundary of a building will usually consist of walls, but in Chinese architecture, the boundary will consist of the buildings

themselves. One sees buildings as the boundary when standing in the courtyard because one can see the volume of the building from the courtyard. Furthermore, the buildings are organized in a way that it creates an interior courtyard, unlike the entrance courtyard of Little Thakeham where the courtyard is surrounded by a solid wall.

### 2.3.2 Height

Other than manipulating the configuration of walls to create a penetration of interior and exterior, Wright played with the height of walls by designing high and low walls of porches and balconies. The examples in fig. 28 are taken from the Robie House.

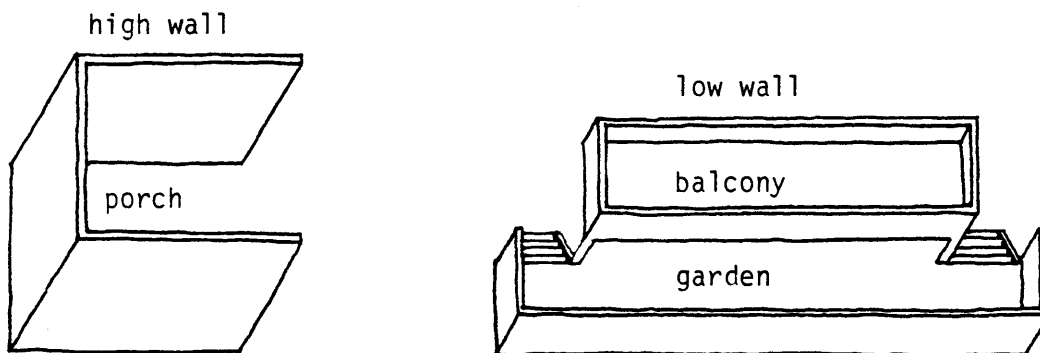


fig. 30 THE WALL OF THE PORCH, BALCONY AND GARDEN OF ROBIE HOUSE



### 2.3.3 Molding

To Wright, an honest architecture meant that the ornamentation should be expressive of the material and designed for machine production and therefore should be expressed in straight lines. The ornamentation of the Robie House consists of exterior moldings of the balconies, patio, and garden wall. Although the moldings originated from a functional purpose, Wright used it so consistently to emphasise the long horizontal lines of the house which symbolizes the flowing terrains of the American frontier.

Similarly the moldings of the balcony and the garden wall will minimize the height of the house by defining each storey with a horizontal line and by using the horizontal lines to break the height of the house into sections.

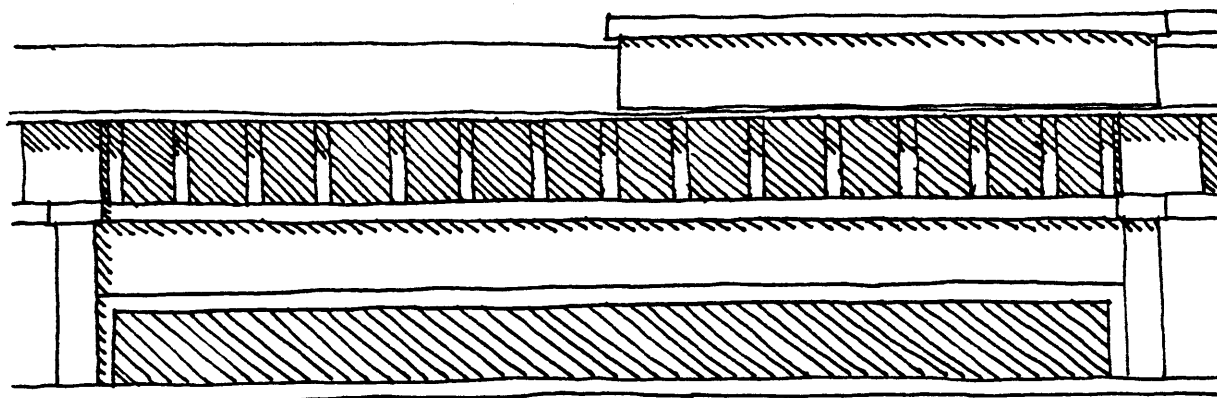


fig. 31 FRONT ELEVATION OF THE ROBIE HOUSE SHOWING THE BALCONY AND GARDEN WALL.

## 2.4 ELEMENTS OF THE WALL

A wall may consist of windows and doors. In Western architecture, the connection of interior to exterior can become a very important aspect and sometimes the success of a building may depend on how accessible the building is to the exterior view. In order to encourage higher accessibility, the wall may contain a variety of elements. In Chinese architecture, the concept of accessibility and the connection between the interior and exterior is totally discouraged. The buildings are highly accessible from the interior courtyard, but have no relation to the exterior. Therefore, the exterior wall of a Chinese house will usually contain a few elements, small windows and a gate.

Windows and doors are functional elements. Windows provide natural light and ventilation, and doors provide accessibility from room to room and from interior to exterior. But not all windows and doors are functional elements. When a window or a door has a certain shape or form, or located in a certain position, we may describe the element as formal. This subject will be further developed in sections 2.4.1 and 2.4.2, in Windows, and Doors.



fig. 32 ELEMENTS OF A WALL

### 2.4.1 Window

#### Position

Unlike the Chinese house, The exterior wall of a Western architecture will contain many interesting elements. One of the most popular elements is the bay window. The function of a bay window is to encourage maximum visual connection from the interior to the exterior.

It may be debatable as to say that the formal qualities of a bay window may be identified from its shape or form, because a bay window may exist in various shapes and forms. But looking at the picture below, we may agree that in Little Thakeham, we may identify the formal quality of a bay window from its position. Lutyens expresses the bay window as a formal element by placing it at the central axis to emphasise the symmetry of the building.



fig. 33 REAR ELEVATION OF LITTLE THAKEHAM

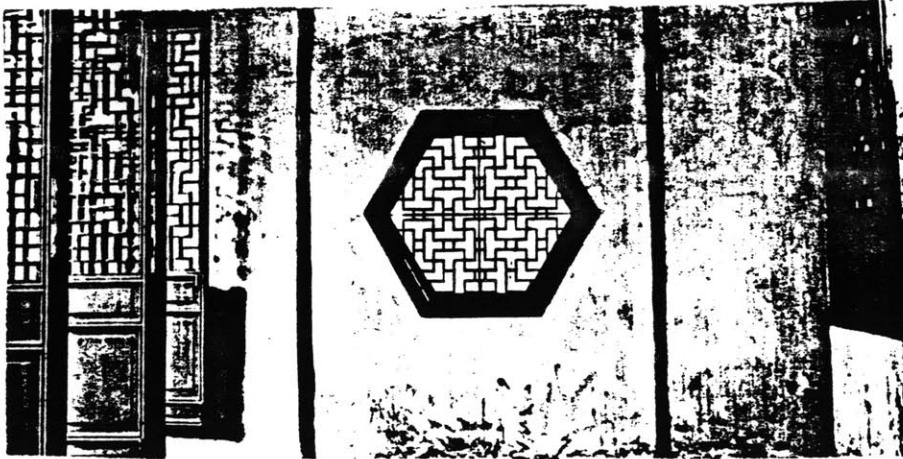
Shape

fig. 34 COMPOSITION OF A PICTURE WINDOW

Unlike the exterior boundary, the interior boundary of a Chinese house, overlooking the courtyard will contain formal elements. Take for example the window in fig. 34. Although there are no shutters on this window, we may still recognize it to be a window from its dimension and position on the wall.

The formal aspect of the window is the shape. The shape creates a picture frame of the view. Therefore the window not only provides a function but also a formal perspective of the view. We may then say that the shape of the window has a formal quality because of the representation of the window frame as a picture frame.

There are many variations of a picture window. The basic variations are shown in the diagram below. Although the shape of each window is different, they all have geometric shapes implying a similar formal meaning and are therefore formal elements.

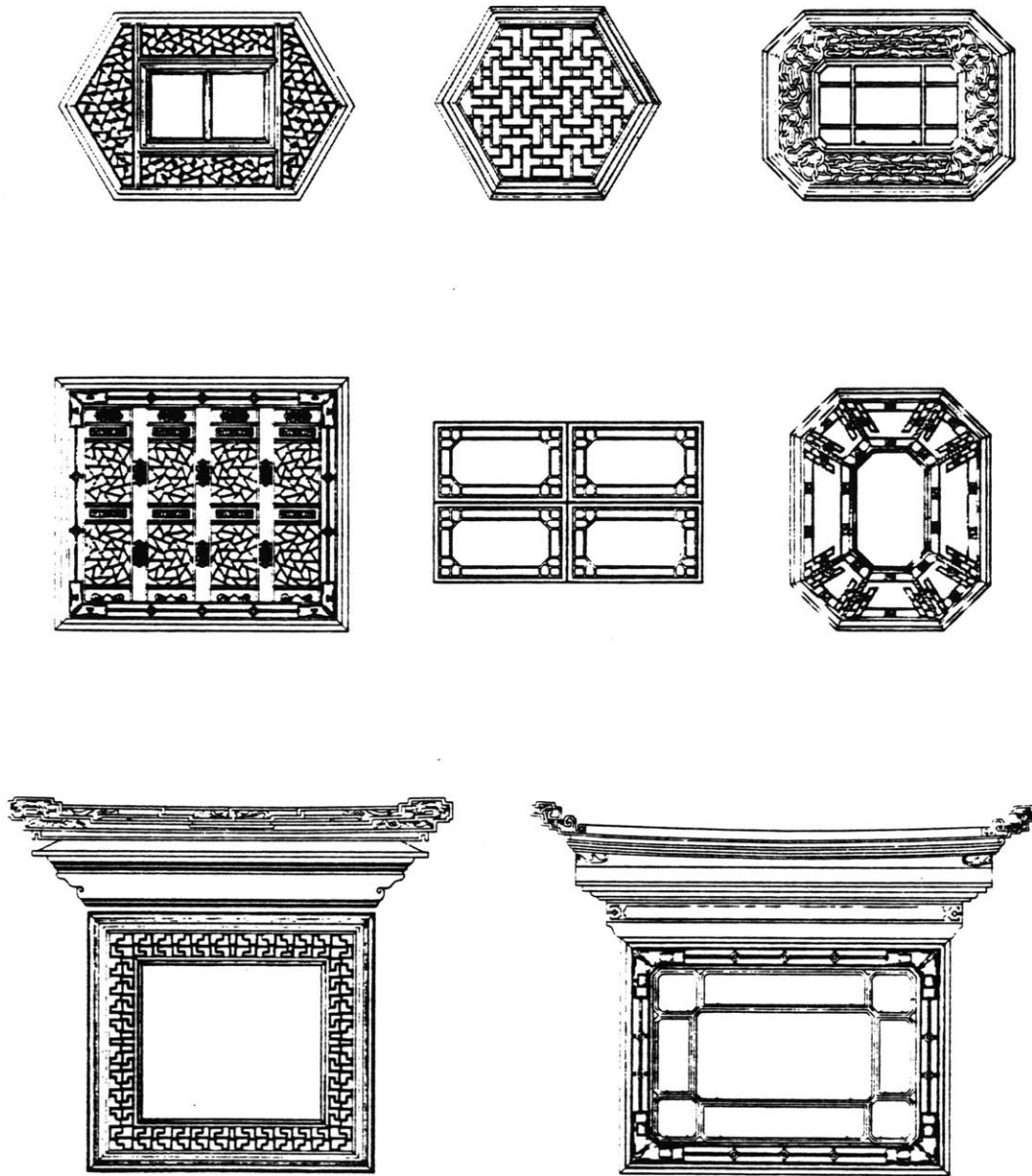


fig. 35 VARIATIONS OF PICTURE WINDOWS



fig. 36 PICTURE WINDOW OF AN ANCESTORS HALL



fig. 37 PICTURE WINDOW OF A ROOM IN THE GARDEN

### 2.4.2 Gates and Doors

As mentioned before, gates and doors may have formal qualities due to its shape, form, position or proportion. The examples related to these issues will be analysed from case study 1.

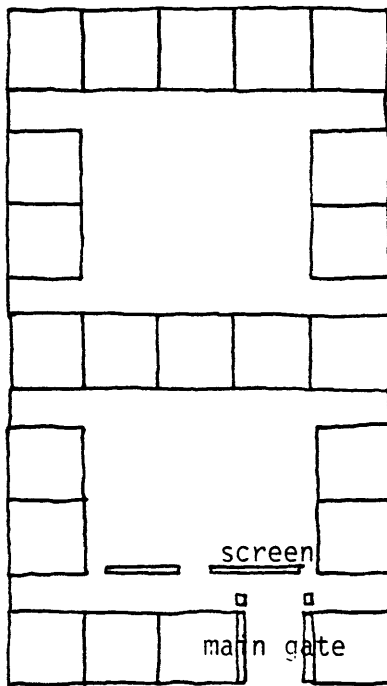


fig. 38 POSITION OF GATE OF CASE STUDY 1.

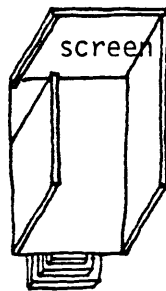
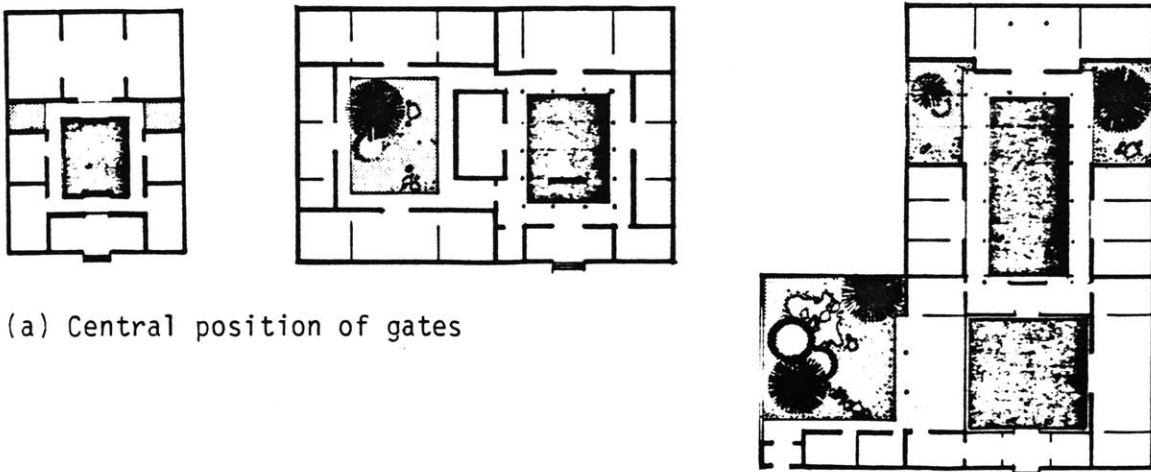


fig. 39 SIDE GATE

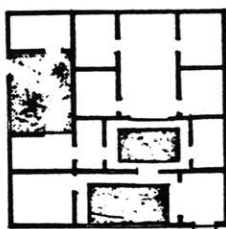
#### Position

Because the laws of preserving the social hierarchy do not allow the position of the main gate to be at the center axis unless the owner is a high ranked official, we may argue that the main gate of the Chinese house is formal due to its position. From another point of view, the position of the main gate may imply a functional reason. The asymmetrical position diverts the evil spirits from entering the house. But on the other hand, a solid masonry wall facing the entrance of the gate, functions as the barrier to evil spirits, and thereby, we may say that the asymmetrical position of the gate is due to the formal representation of the social hierarchy.

At the same time, the position of the main gate can also appear at the center of the boundary. The position of the gate will represent the owner as a high ranked official. We already know that a gate must satisfy the function of diverting the evil spirits from the house. But if the position of a gate may change according to the social hierarchy, then we will agree that the position of the gate is not a result of hindering the spirits. From the position of the screen, we may agree that its position is based on a functional reason rather than a formal reason, judging from the consistent position of the screens located on the pathway of the gate to stop the evil spirits from entering into the house.



(a) Central position of gates



(b) Assymetrical position of gates

fig. 40 POSITION OF GATES



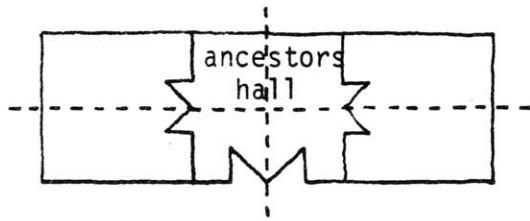


fig. 41 POSITION OF DOORS  
OF THE ANCESTORS HALL

In the vernacular Chinese house, the position of the doors of some rooms may imply a formal quality. From this example we will discover that formal qualities are closely related to the lines of axis.

### Form



fig. 42 THE MAIN GATE OF A CHINESE HOUSE

When we observe the main gate of a Chinese house, we will see that the form of the gate will imply a formal quality. The gate and the wall has a roof to show that it is the exterior boundary of the wall or the boundary of a sub-group of buildings. The roof of the gate becomes taller and larger which identifies the gate from the boundary wall. From another point of view, we may say that the larger roof on the gate functions to provide shelter from the rain and sun.



fig. 43 DOOR IN A GARDEN

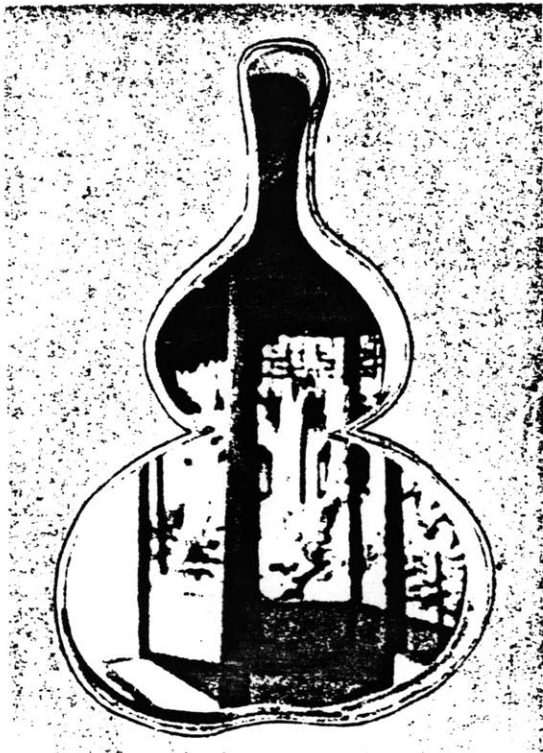


fig. 44 WINDOW IN A GARDEN

### Shape

The diagram in fig. 43 represents a door through its form but not through its function. A functional door, or a "real" door can be open or closed, or locked. Irregular shaped doors of the Chinese gardens express a romantic social implication of good fortune. The formal purpose of the door is to create a transition between the interior and exterior space of the garden.

Similarly, the formal aspect of the window is its large opening. The window provides such an extensive view of the exterior space that a visual transition of spatial qualities is created. 1

### Proportion

Some doors of a room have similar proportions compared to screens (interior partition). The standard proportion of these doors are either 1:3 or 1:4. The interior proportions of these doors are always 1:2. When proportion of doors become standardized, the dimensions will no longer be decided from its functional requirement. Therefore the formal implication of the proportion of doors is the repetitive proportion.

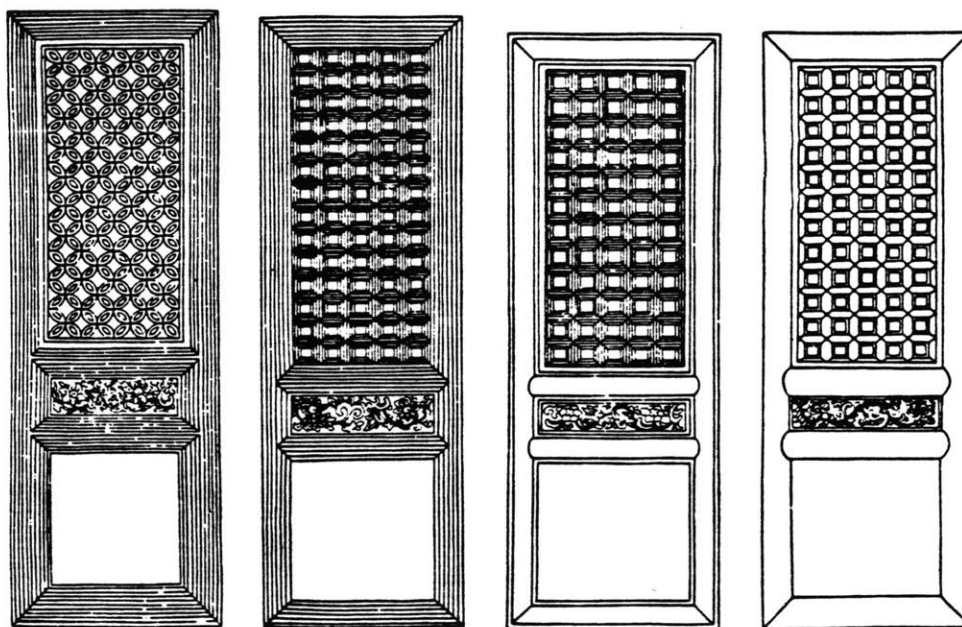
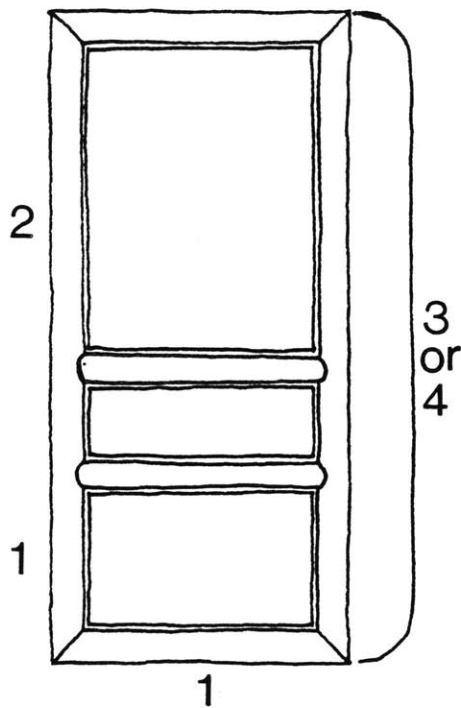
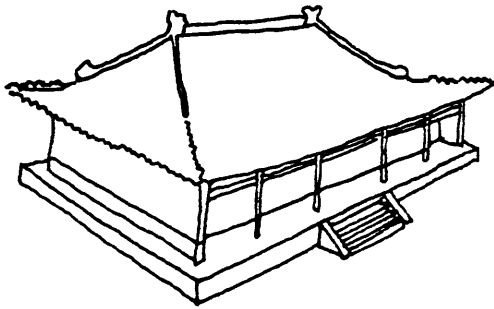
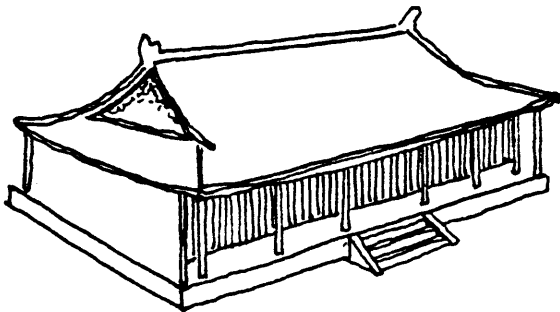
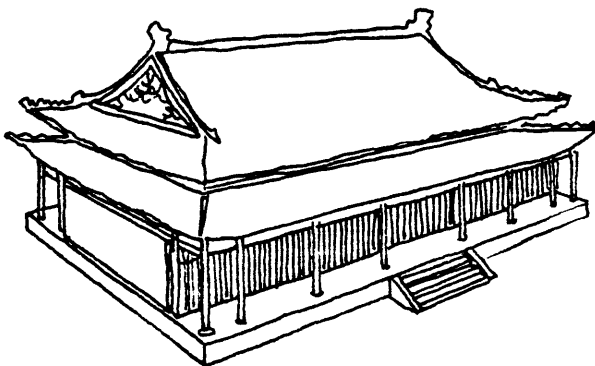


fig. 45 STANDARD PROPORTION OF DOORS

## 2.5 ROOF



(a) HIPPED ROOF (highest position)

(b) HALF HIPPED AND GABLE ROOF  
(second highest position)(c) DOUBLE TIER HALF HIPPED AND  
GABLE ROOF

The form of some of the roofs of the Chinese house are created to express the class hierarchy of the Chinese society. The hipped roof symbolises the highest position in society, and the half hipped roof represents the second highest position. Other than its formal symbolism, the form of the roof originated from the purpose of hindering evil spirits from entering the house. The lower deck of the roof curves upwards at a slight angle, to lead the spirits away from the house instead of downwards into the house. The actual function of the roof is to provide the maximum amount of sunlight into the house hindered by the overhanging eaves.

fig. 46 ROOF TYPES

## CHAPTER THREE

## CHAPTER THREE: THE EXTERIOR

In the previous sections, we have already analysed spaces from its boundary and interior, but in this section we will study the formal qualities of spaces from the exterior of a space. We will study similar properties of a space for example, its proportion, position and elements, but from the perspective of the exterior.

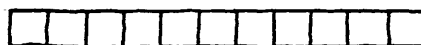
### 3.1 EXTERIOR PROPORTION

In chapter one, we have analysed the formal quality of the interior proportion of a space. In this section, we will observe the proportions of a space from its exterior. The exterior proportion is obtained by the comparison of proportions of spaces. The difference between interior proportions and exterior proportions is that interior proportions is a measurement of proportions of the interior of a room or space, while the exterior proportion is relative proportions of rooms and spaces.

Sometimes the proportion of a space may be governed by a social constraint. For example, the proportion of the buildings of a Chinese house is predetermined by the social position of the owner of the house rather than by the size of the family. The proportions are determined by the number of bays. The highest ranked position may consist of up to eleven bays, while the common citizens may have a maximum of three bays for each building.



3 bay building



11 bay building

THE PROPORTIONS OF THE BUILDINGS ARE DETERMINED BY SOCIAL CONSTRAINTS

### Relative Proportions of Space

The rooms in Little Thakeham, the dining room, the drawing room, the library, and the pantry, all have the same exterior proportions. From this observation, we may agree that Lutyens may have created the proportions of the rooms from a formal reason rather than a functional reason. From a formal perspective, we may conclude that Lutyens was trying to design a building that is symmetrical in form, made possible through the identical proportion of rooms. Therefore the formal aspect of the "exterior proportion" of rooms of Little Thakeham is that the proportions were not created from a functional requirement; if they were, the proportion of the rooms would not have been identical. Rooms with different functions will certainly require different proportional dimensions. Furthermore, the formal aspect of the identical proportion of rooms is the reason, to make the building symmetrical.

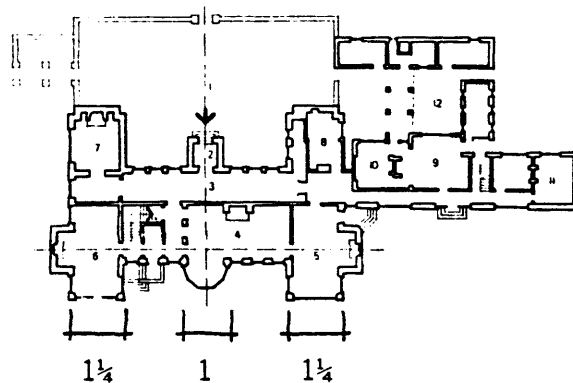


fig. 47 EXTERIOR PROPORTION OF THE  
ROOMS OF LITTLE THAKEHAM

### 3.2 POSITION

In chapters one and two, we know that the formal aspects of the "interior elements" and the "elements of the boundary", may be determined from its formal position or proportion. Sometimes the elements may be described as formal because the elements may exist purely for a formal reason.

In this chapter, the issue of proportion has been selected as an important factor in the formal analysis of "exterior elements"(3). Although the issue of proportion also influences the determination of the formal quality of the element, we already know from chapters one and two that these formal proportions are always created from axially and symmetry. On the other hand, the issue of formal positions may be based on various reasons other than centrality or axially.

#### Position Determined by the Laws of Feng shui

Unlike the Western concept of building houses accordingly to the site, the Chinese house follows the rules of geomancy (feng shui), by bearing in mind the north-south axis to find order and harmony in the uni-

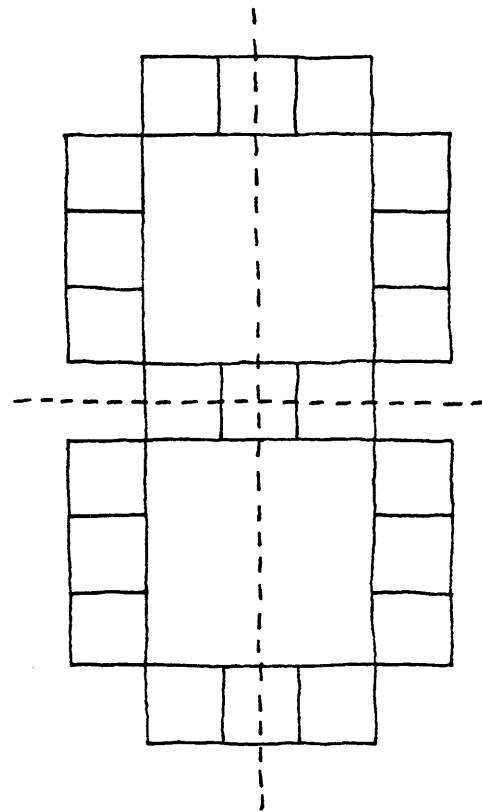
footnote: "exterior elements" (3). Unlike the interior elements, the exterior elements may be observed from a larger context; for example, the building relative to the site, whereas the interior elements could be furniture or partitions relative to the room.



verse. The north represents the rigours of winter and the threat of barbarian invasion. The south represents sunlight and prosperity, and therefore the dwellings were built facing the south.

It is arguable that the direction of the north-south axis may have more of a functional implication because, by turning its back against the north, they are protecting themselves against the cold winds and the barbarians.

On the other hand, the laws of feng shui are always based on a social understanding, and can only be applied under a specific cultural context. The laws follow strict formal rules, and it would be logical to conclude that if the position of an element is based on the laws of feng shui, then the element can be described as formal.



north-south axis

fig. 48 POSITION OF A CHINESE HOUSE DETERMINED BY THE N-S AXIS

Furthermore, the north-south axis of the building will represent the most important position in the building. Therefore, rooms or spaces placed on the north-south axis, for example, the main courtyard, or the ancestors hall, or sometimes the main gate, will take on a formal position.

Formal Position Determined by the Axis of the Garden

The position and orientation of Little Thakeham is not determined by the north-south axis, nor the angle of sunlight, but is based on the axis of the garden. The entrance vestibule of Little Thakeham follows the axis of the entrance courtyard. Furthermore, the forecourt, entrance vestibule, hall and garden are planned symmetrically along the north-south axis of Little Thakeham. Therefore the axis of the garden will formally determine the position and orientation of the building.

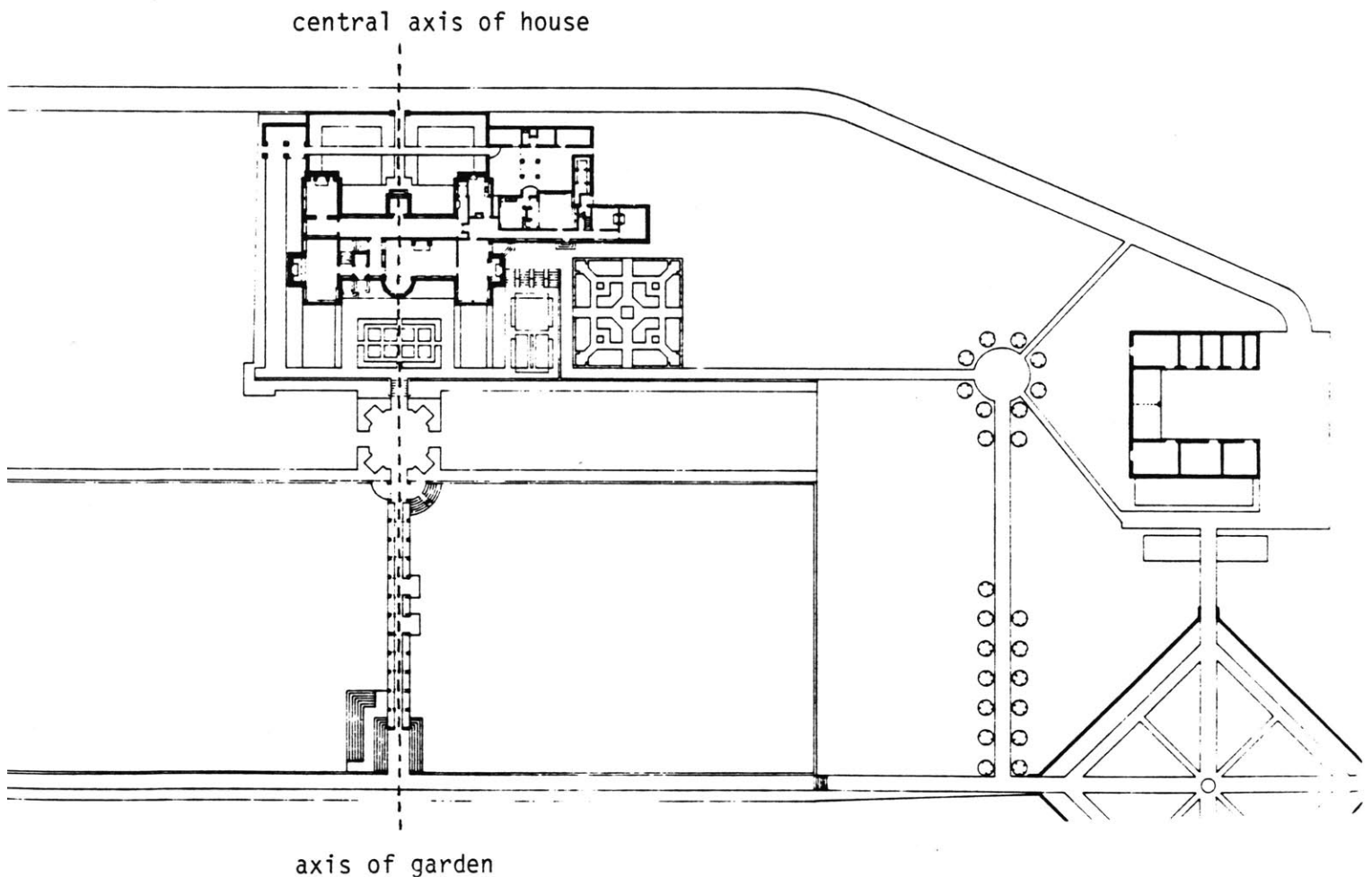


fig. 49 THE POSITION OF LITTLE THAKEHAM DETERMINED BY THE AXIS OF THE GARDEN

### 3.3 ELEMENTS

In chapter one, we have discussed interior elements. We know that they only exist in the interior of a space. We have also agreed that some elements may be described as formal because they exist purely for a formal reason. Other elements may be formal because they have formal proportions, or because they are placed in a formal position. The following descriptions of elements have been selected from the cases as examples of formal elements.

#### Driveway

The large circular node, seen from the entrance of the driveway, will express a formal quality.

The trees planted among the driveway are also formal, because they emphasise the formal shape and size of the driveway. This example is taken from the driveway of Little Thakeham, designed by Lutyens.

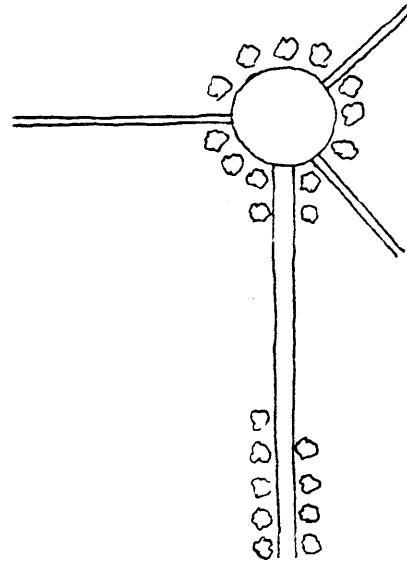


fig. 50 DRIVEWAY OF LITTLE THAKEHAM

### Elements of Symmetry

The porch and the bay window emphasize the central axis of the building. The inglenooks attached to both ends of the building emphasize the symmetrical quality of the building and create a formal ending. This example is taken from the elements of Little Thakeham.

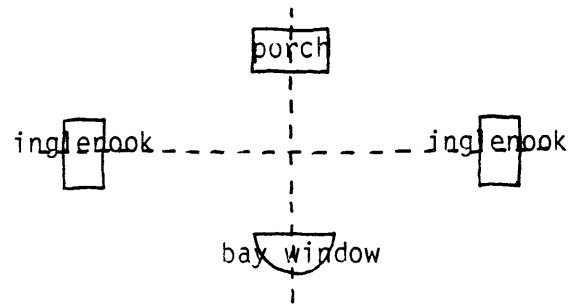
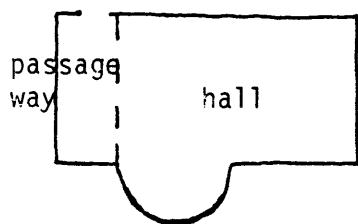


fig. 51 THE ELEMENTS OF SYMMETRY

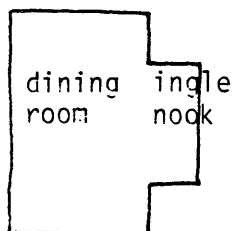
The bay window and porch act as elements which create a north-south axis. The similar proportion and the symmetrical position of the dining room and the drawing room with the inglenook attached on either end, create an east-west axis. The north-south axis and the east-west axis, therefore created a formally symmetrical building. But Lutyens breaks the symmetry of the building by adding an additional wing to the house. Therefore from the exterior, the house creates a sense of symmetry, but at the same time, it is also asymmetrical.

Although part of the building which is symmetrical consists of the entrance at its center, the movement in the building do not also follow a symmetrical pathway. Lutyens consistently designs in this way by creating a symmetrical form and an asymmetrical function to emphasize the distinction between form and function.

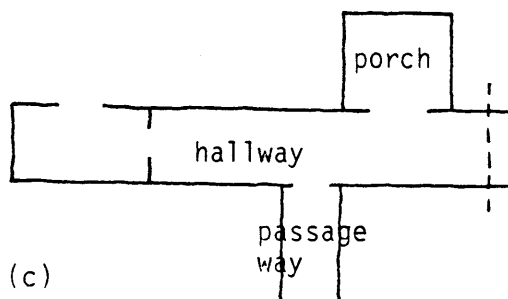
Connection of Large and Small Elements



(a)



(b)



(c)

Lutyens treated the organization of the rooms and spaces of Little Thakeham as connections of large and small elements. In fig. a, the hall (large space) connects to the bay window (small space), and the passageway (small space). In fig. b, the drawing room and dining room (large spaces) connect to an angle-nook (small space). In fig. c, the hallway (large space) connects to the small spaces like the porch, and the passageway.

The connection of large and small elements make the large element seem larger, and the small element seem smaller.

fig. 52 CONNECTIONS OF LARGE AND SMALL SPACES

## CONCLUDING REMARKS

From the analysis of the cases, we may agree that all the architects of the buildings we had analysed, adapted a certain kind of geometry which used to obtain formal proportions and dimensional order. The geometry does not indicate function nor dimensional measurements, but are generated from the addition or subdivision of a "unit space". For example, the geometry of the Chinese house is the addition of bay units in a horizontal or a vertical direction. The geometry of Little Thakeham is the subdivision of two unit sizes to create a classification of large and small spaces. The geometry of Robie House is the subdivision of rectangular planes to create a variety of room sizes determined from their functional requirements.

We may generalize that sometimes the emphasis is on interior formal qualities, and sometimes it is on exterior aspects. For example, the Chinese house emphasises a formal interior by placing the room and furniture of the ancestors hall according to the axis of symmetry of the building. Little Thakeham presents a formal exterior because the elements of the building are placed in a way which create a symmetrical building. The Robie house emphasises a formal interior because the furniture of the dining room are placed according to the axis of the building.

The intention of this thesis is to observe buildings from a new dimension, other than function, language, symbolism, or motivation of the architect. It is not intended to provide a set of criteria rules to be used in a design, but to provide a few observations which may lead the audience to think and analyse for themselves.

Due to the limitation of time, this thesis could not make a more thorough analysis, but the intention is not to provide a thorough analysis but to generate new ideas and thoughts which may stimulate new studies and interests.

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