

A VIEW OF FLEXIBLE HOUSING IN CHINA

Thesis by
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CONTENTS

CHAPTER 1:

INTRODUCTION

Flexibility as the theme	1
The issues involved	5

CHAPTER 2:

REAPPRAISAL OF FLEXIBILITY IN TRADITIONAL HOUSING

Flexibility in use	10
Inflexible order	14
Advantage of modern housing: the liberation of users	17

CHAPTER 3:

THE DEVELOPMENT OF FLEXIBLE HOUSING IN MODERN TIMES

Branch 1: area adjustment	21
Branch 2: user participation	27
Branch 3: long-term effectiveness	39
Discussion: design for flexibility	47

CHAPTER 4:

POST-OCCUPANCY INVESTIGATION ON TYPICAL PROJECTS

Section 1: introduction	51
Section 2: Molenvliet Project	53
Section 3: Wuxi Project	73

CHAPTER 5:

DESIGN MANUAL AND FLEXIBILITY IN THE FUTURE

Section 1: a design manual	91
Section 2: flexible housing in the future	97

APPENDIX	102
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BIBLIOGRAPHY	103
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Chapter 1

Introduction

In the Dutch book *Open Ontwerpen*¹, the author outlines an interesting concept: to take photographs of a city everyday, and connect them into a movie chronicling the years. If the idea can be realised, changes to the city will be clearly revealed. Most prominently, the incremental development of dwellings will be observed, although their typology can be only slowly transformed², and even an ordinary house may last for hundred of years with proper maintenance. Compared with its static factors, the activity engendered by housing is much more dynamic. Suppose the camera lens can see into the enclosure, it will be clear that change is much more visible in housing than in other types of buildings. Take the period from 1949 to present in China for example. Lifestyle, the average living area and the supply pattern of housing have all obviously changed. If the focus is placed on the individual unit, the change will be more specific, such as the expansion or shrinkage of family size and subsequent shifts in lifestyle, the different physical demands seen throughout the year, the user's various activities during the workday and on weekends, or even within a single day. If individuality and personal preference are taken into consideration, the changes will be more frequent and complicated. It is the paradox between "the static character of a dwelling house" and "the dynamic character of its inhabitants

with their different and ever changing wishes and demands"³ that calls for flexibility.

China's native research on flexibility in modern housing was sporadically initiated in the 1950s, and was accompanied by plenty of experimental projects. This was later than international research, which was widely launched around the 1920s. How did this topic develop specifically in China? Are the outcomes of the experimental projects still as desirable as initially hoped? What is the direction of future development? These questions, which are far from being answered, are the concern of this study. By concentrating on the theoretical and practical aspects, I hope this dissertation will provide a disinterested record of the existing achievements of Chinese flexible housing.

FLEXIBILITY AS THE THEME

What is flexible housing? | The concept of "flexibility" has been employed in international research. The most influential definitions can be listed as follows.

"Flexibility is the aptest term for designating at abstract level the property of dwellings and residential buildings which can be adapted in

¹ Frans van der Werf (1993). *Open Ontwerpen*. Rotterdam: Uitgeverij 010. pp. 15.

² Aldo Rossi (1984). *The Architecture of the City*. Cambridge: The MIT Press. pp. 70-72.

³ Jos van Eldonk, Helga Fassbinder (1990). *Flexible Fixation: The Paradox of Dutch Housing Architecture*. Assen: Van Gorcum. pp. 9.

some way or other to the dynamic process of habitation”⁴. (Jos van Eldonk and Helga Fassbinder, 1990).

“Flexibility expresses freedom to choose among options or devise programs that fit individual needs and aspirations, whether for building, finance, ownership or management. Beyond that, and usually for architects, it describes the capacity designed into buildings, building programs, or building technologies to ensure an initial good fit and to enable them to respond to subsequent change. Such designed capacity has come to influence the size and spatial/configuration of built environments, services, and/or the technology of building components themselves”⁵. (Nabeel Hamdi, 1990)

“Flexible architecture consists of buildings that are designed to respond easily to change throughout their lifetime”. “Flexible buildings are intended to respond to the changing situations in their use, operation or location”⁶. (Robert Kronenburg, 2007).

“Our broad definition of flexible housing is housing that can adjust to changing needs and patterns, both social and technological. These changing needs may be personal (say an expanding family), practical (i.e. the onset of old age) or technological (i.e. the updating of old service). The changing patterns might be demographic (say the rise of the single

person household), economic (i.e. the need to update housing to respond to climate change)”. “It includes the potential to make changes prior to occupation as well as the ability to adjust one’s housing over time after occupation”⁷. (Tatjana Schneider and Jeremy Till, 2007)

These descriptions inevitably reflect the authors’ rhetorical preferences and their specific research focuses. However, a consensus on the essence of flexibility is clearly revealed, which can be defined as: the pre-arranged response to change. The change can be pre-occupancy (according to the users’ personal preferences) or post-occupancy (as response to the inevitable obsolescence after many years); it can be generated by physical factors (such as the degeneration of the facade and pipelines), or non-physical causes (i.e. the shifts in lifestyle); it may be a common transformation which happens in a wide range (for example the increased size of living space which was found all over the state), or an individual activity (i.e. the re-division of interior space for a new family member); it may occur with comparatively low frequency (for example, the universal change of interior layout in China takes about ten years⁸), or with high frequency (i.e. the shift of specific uses within a year, a week, or even a single day); it probably has to be achieved by constructional approaches (some partitions need to be removed), or non-constructional method (i.e. by the simple re-organisation of furniture).

⁴ Ibid.

⁵ Nabeel Hamdi (1990). *Housing without Houses: Participation, Flexibility, Enablement*. New York: Van Nostrand Reinhold. pp. 51.

⁶ Robert Kronenburg (2007). *Flexible: Architecture that Responds to Change*. London: Laurence King Publishing Ltd. pp. 11.

⁷ Tatjana Schneider and Jeremy Till (2007). *Flexible Housing*. Oxford: The Architectural Press. pp. 4.

⁸ It was analysed that the interior layout of housing had experienced at least five obvious and universal changes in the period from 1949 to present. Jia Yaocai (1997). *Design for New Home* (新住宅平面设计). Beijing: China Architecture & Building Press. pp. 28-29.

This study focuses on flexibility in permanent residential buildings especially in modern times (1949-present), with a particular interest in the congregated housing that can be found everywhere in the urban areas. All the tectonic strategies related to change can be explored in this research, in case corresponding clues can be found in China. This research also touches on some themes that are closely connected with the aim of change, although never titled with “flexibility”. These include adaptable housing, grow housing, long-term effective housing, Support Building, Open Building, etc. However, this research excludes some topics, for example moveable buildings that relocate from place to place, for their lack of popularity in China.

Why flexibility? | Among the existing research, flexibility is widely recognised for its effectiveness in terms of economy, sociology and psychology.

Firstly, the economical advantage is represented in its response to obsolescence, and subsequent invalidation. In a statistical analysis of a building in Los Angeles, it is found that functional ageing occurs far

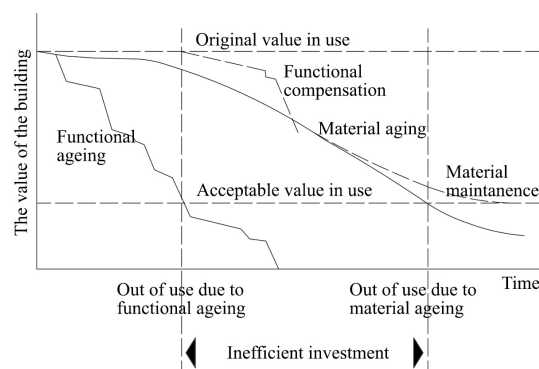


Fig. 1: A typical house in Los Angeles loses its value. It is revealed that functional ageing occurs far earlier than the material, and this phenomenon makes the amount of investment inefficient. (Source: by author. According to Zhao Guanqian (1991). *Housing in 2000 (2000 年的住宅)*. Beijing: China Architecture & Building Press. pp. 22.)

earlier than the material, and this phenomenon makes the amount of investment inefficient (Fig. 1)⁹. In order to decrease waste, both the material and functional ageing must be addressed, in which flexibility has a prominent performance. Secondly, Support Building, the most prominent branch of flexibility, emphasises the sociological importance. Housing is an important means for the users’ self-expression, and correspondingly, the users should possess their dwelling in the fullest sense of word¹⁰. Mass-produced construction separates housing from its future householders/tenants before it is completed. A certain degree of flexibility is beneficial for the users to realise their personal preferences and individuality with minimum effort. Thirdly, the physiological importance of this topic is emphasised by Robert Kronenburg’s discussion, which indicates that “setting ambitions and achieving them is a vital component in human nature”¹¹. Specific to housing, people wish to have a better living environment, and their ambition to make improvements can be appropriately satisfied in housing with flexibility.

Rough renovation, which is the most common approach to achieving change in inflexible housing, is worthy of discussion in order to explore the necessity of this topic within the Chinese context. Until now, there have been no official statistics or academic research about the general situation of renovation and frequency. In this case, the story of an ordinary family living in Nanjing was recorded as a case

⁹ Zhao Guanqian (1991). *Housing in 2000 (2000 年的住宅)*. Beijing: China Architecture & Building Press. pp. 22.

¹⁰ N. J. Habraken (1972). *Support: an Alternative to Mass Housing*. London: The Architectural Press. pp. 14.

¹¹ Robert Kronenburg (2007). *Flexible: Architecture that Response to Change*. London: Laurence King Publishing Ltd. pp. 14.

study. Throughout thirty years of living, the selected unit has undergone three obvious renovations - one in 1985, 1995 and 2012 (Fig. 2). The former two were conducted to enhance the individuality of the space and because of an increase in family size. The changes involved repainting the wall, laying the wooden floor, shutting off the balconies and removing an interior partition. The last renovation was a response to obsolescence, and was conceived at least five years before it was implemented. The work took four months, during which time the interior layout was entirely re-organised, accompanied with the removal of a load-bearing wall, and the destruction of the floor in order to change the pipelines. The householders, on the one hand, took pride in their brand new apartment, but also complained about the tremendous cost in terms of time, energy, and money due to the complicated working process. The neighbours had to endure terrible noise

pollution and construction waste, as they had already done or will do the same thing. What's worse, the renovation had a negative influence on the stability and durability of the structure. Mishaps, in which buildings were damaged by users' destructive renovations, can be found every year all over the state. The opposite of this is change through a comparatively convenient process that has zero-effect on the structure. It is a characteristic of flexible housing and has been proved in the post-occupancy investigation in this thesis and other counterparts. The sharp contrast necessitates the topic of flexibility.

For a long time, the limited service life of residential buildings seems to have restricted the necessity of flexibility in China. Before the strong need for change, the dwelling may be demolished and substituted by a new one. There are always plenty of real-estate businessmen willing to

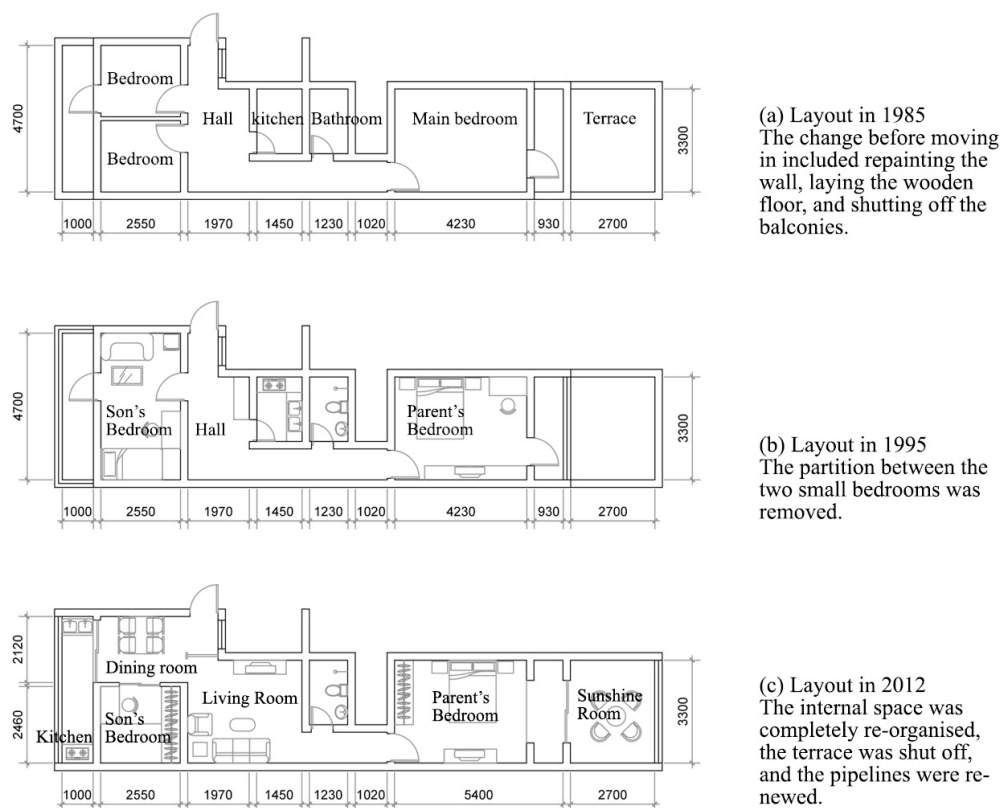


Fig. 2: The layout and renovation of an ordinary family living in Nanjing. (Source: by author.)

undertake regeneration work for economic interest. Although some amount of cost has to be paid to relocate old inhabitants, their profits can be guaranteed by the increase of overall building area. This may partly explain why high-rise buildings or even skyscrapers are increasingly found in the cities. However, the speed of building is sure to slow down when residential land is widely covered with high-rise buildings, and the potential benefit is too small to drive regeneration work. Correspondingly, the renewal of existing dwellings can no longer rely on demolition and reconstruction, but must depend on the housing's capacity for change. Flexibility will be beneficial for both the whole state and each individual householder.

THE ISSUES INVOLVED

A brief summary of native research | It is necessary to outline a brief summary of the existing study conducted by Chinese scholars before the focus of this research is explained.

China's research on flexibility began with sporadic design proposals in the 1950s, while the intense work was accelerated during the years around the 1980s. In recent years, it was shown that the native research focused on the description of practices at home and abroad, and discussion of design methods. These studies were primarily represented as abundant journal articles, among which Prof. Peng Yigang's research on extendible housing (1955) and Prof. Zhang Shouyi's introduction of Support Building (1981) are prominently influential. Accompanied by the further exploration, some prominent projects generate a small amount of monographs.

Prof. Bao Jiasheng's writings in 1988 constitute the first academic book on flexibility in China. The book used a small

section to introduce the design concept and method of Support Building, but concentrated on the author's actual practice in Wuxi. It is, to some extent, a comprehensive design introduction touching on terms of design concept, overall layout, and interior design. Similarly, the introduction of "Little Universe Project" in Beijing generated two instructional publications (2012) on its architectural design and constructional details respectively.

Plenty of researches have concentrated on the discussion of design methods, the great majority of which emphasised on the individual buildings or units. The most influential books are by Prof. Jia Beisi, whose research is characterised by a broad knowledge of relevant research and practices at home and abroad. His research, with the title of "Housing with Long-term Effectiveness" (1993) concentrated on both physical (exploring flexibility and adaptability) and nonphysical aspects (referring to user participation). His further research (1998), together with Wang Weiqiong, on adaptable housing continued to concentrate on physical terms, including discussion on structure, apartment relationship, space between the interior and exterior, and internal space. In the period from 1992 to 1994, state-dominated research was conducted on the application of the Open Housing concept in China, and the results led to a descriptive publication (1995), which is essentially a form of design guidance. Besides the detailed introduction of experimental projects, this book includes a completed set of drawings in terms of architectural layout, pipeline placement, electricity arrangement, the possible division of interior space and the selection of partition, etc. In addition, a discussion of design methods can also be found in the book's chapters as a way to improve building quality - among which Jia Yaocai's research on flexibility (1997) and

Prof. Zhou Yanmin's discussion on changeable units with limited area (2008) are most informative.

Discussion about achievements and design methods is also found in some academic dissertations, with an emphasis on Open Building. These researches normally began with a discussion of existing research at home or abroad, and after deep analysis or comparison, plenty of suggestions were tentatively proposed to improve the current design. The most convincing results could be found in Prof. Wu Jinxiu's discussion on the improvement of the building process (2000), Cheng Yong's discussion of Open Building method (2008), Chen Weiwei's study (2009) of user participation, Li Nanri's exploration of high-rise Support Housing (2010), Xu Peicai's architectural and technological discussion of CSI¹² housing (2012).

An interesting trend has emerged in recent years, which explores the possible application of flexibility to deal with specific social problems. The national concern is for extendible housing for multi-generational families. This was precisely explained in the master's thesis of Zhao Yue (2012). However, the relevant research abroad provided a beneficial reference and inspiration, which was specified as co-housing activity, attention paid to neighbourhood relationships (Herman Hertzberger, 1991) and the extendible housing for the family growth (Avi Friedman, 2001).

Other than the mainstream research mentioned above, other research explores the development history and post-occupancy investigation. The current research on development history is insufficient, which is the topic Hao Fei's master thesis (2009). His research is

dedicated to a chronological organisation of the development of Open Building. The exploration of the root of this topic focused on flexibility embodied in traditional housing, while his study of modern housing (1949-2009) emphasised the social background in different periods and the subsequent expression of this topic. Restricted by length and research scope, the study does not provide a complete picture of flexibility, while its simplified discussion of typical cases is another disadvantage. Compared with international counterparts, such as Prof. Stephen Kendall and Jonathan Teicher's precise summary of the development of residential Open Building (2000), Koos Bosma, Dorina van Hoogstraten and Martijn Vos's archeological study of SAR¹³ (2001), Tatjana Schneider and Jeremy Till's historical organisation of flexible housing (2007), its imperfection is obvious.

Few researchers have concentrated on post-occupancy investigation, which is an effective way to explore the actual situation of selected projects. There are just four bodies of research on this topic. The earliest is Ma Yunyu's investigation (1993) into a large-span building in Changzhou, in which the interior layout was not predesigned. The study, which was conducted shortly after the realisation, focused on the user's design according to their demands. Prof. Wu Jinxiu's study (1999) on "Wuxi Experimental Project" and "Cuiwei Residential Quarter" emphasised emotional description. Miao Qing's investigation (2010) of "Little Universe" in Beijing is noteworthy for its systematically analytical approach, and sufficient samples. It concentrates on the records of actual living situations and the users' assessments. As the investigation

¹² CSI is short for "China Skeleton Infill".

¹³ SAR (Stichting Architecten Research or Foundation for Architects' Research) was a nonprofit organisation, which was concentrated on the research related to Support Building.

was conducted only three years after completion, the capacity for change was not clearly revealed. These studies provided a unique perspective on the effectiveness of flexibility.

The content and methodology | My research into the existing achievements, especially the shortage, has lent this thesis three main tasks, which can be specified as the systematic organisation of existing results, the post-occupancy investigation on typical cases, and the perspective of its future application responding the social requirements. Besides the introduction, which declared the scope and necessity of this study, the rest of the dissertation is organised in four chapters.

In chapter two and three, the native development of flexibility is presented. Flexible housing has a long history in China. The unintended practice of flexibility can be traced back to the traditional timber houses built in ancient times, which were characterised by both their flexibility in tectonic aspects and inflexibility in sociological aspects. In the existing research, the former aspect has been widely recognised, while the latter is deliberately ignored. Their striking contrast is the focus of chapter two.

Chapter three continues with the discussion of typological history, but in modern times. During the period from 1949 to the present day, flexibility has been represented by three branches: area adjustment, user participation and long-term effective housing. The existing research on the development of urban housing in China (Lue Junhua, Peter G. Rowe, Zhang Jie, 2001) provides crucial support to the explanation of social background. Most of the actual projects are sourced from many journal articles and relevant didactic books. In addition, some projects, especially architectural drawings have been acquired

from the archives or provided by the architects who have devoted themselves to this topic.

Chapter four is concerned with the actual situation of typical examples. “Wuxi Experimental Project”, which is the first mature practice in China, has been selected as the research subject, along with the “Molenvliet Project”, which is widely accepted as the most prominent work of flexibility. I have deliberately avoided a mechanical and superficial description of these two case studies. Both began with a face-to-face interview with the architects, and moved to the interviews with selected users. Their description, praising or critical, is organised in this thesis. In a sense, the study provides an organisation of the typical personal statements. Besides a few original images, the great majority of the illustrations used have been redrawn by myself, on the base of the material provided by the architects, or sourced in the architectural archives.

In the final chapter, the design method for flexibility is defined in a conceptual way, and its applicability as a response to current social issues is discussed. Since a detailed explanation of the former has led to abundant achievements in existing research, this study deliberately simplified the theoretical description, and concentrated on forming a structure in the various scopes, from the community, the individual building, the single unit, to a specific room. Following this, hot topics, such as the high price of housing, multi-generational families, and the indifferent neighbourhood relationships are discussed, and the specific methods summarised in the first half are suggested as a response.

Chapter 2

Reappraisal of Flexibility in Traditional Housing

The Chinese have always paid lots of attention to their history. According to ancient records written on turtle shells and animal bones, there were various “historical accounts” in the Shang Dynasty (17th century BC - 11th century BC). During the Qin Dynasty (221 BC - 207 BC) when the centralised system was set up, the historiographer and institution for the administration of historical materials became an essential part of the central authority. China has plenty of historical books and materials covering all fields, the largest in the world. History is taken as an important reference point for development. This concept is specifically discussed in the book “*尊史*” (*Respect History*), in which the knowledge of history is the key requirement for truth searching.

For architects, knowledge of traditions and history is of equal importance. Modern architecture and its theory originated in the west, and the bracket or wood structure, which is a characteristic of traditional housing, seems to be helpful only for historians. However, the cultural connotations embodied in ancient Chinese buildings were given some attention and the re-expression of which has evoked some outstanding works, such as Ieoh Ming Pei’s designs for the Fragrant Hill Hotel (1982) and Suzhou Museum (2002)¹, etc.

That partially explains why the traditional house is primarily studied when flexibility is practised in China. The “Wuxi Experimental Project” is widely accepted as the first mature practice of flexibility in modern China, in which the facade and architectural style, even the overall layout are the successors and development of the traditional house. In the research especially those on the development process of this concept in China, the professionals are inclined to start with a high evaluation of traditional timber housing since it was a representative example of flexibility in the terms of tectonics. It provided similar rooms of an indeterminate function, adopted assembled wood structures, and was prepared for several future generations. Compared with modern housing, which is built only to satisfy the user’s current life, the fading of tradition should be regretted before its strict ethical order is taken into consideration. This order was an effective tool, by which the authorities controlled the thought and behaviour of the masses. Specific to housing, it was presented as a set of regulations throughout the whole life of all of the houses, and it compromised their flexibility.

Consequently, a traditional building is characterised by flexibility in its use and

¹ Philip Jodidio & Janet Adams Strong (2008). I. M.

Pei Complete Works. New York: Rizzoli. pp. 182-189, 312-327.

inflexibility in its order. Both concepts are closely related to the social background. By reappraising traditional houses from this perspective, the concept of flexibility will be further clarified.

FLEXIBILITY IN USE

Phenomena: indetermination in design |

The primary and well-accepted evidence regarding the flexibility of ancient housing is represented as its indetermination. The traditional house was seldom designed according to specific functions or characteristics. It was found that there were many similar rooms in traditional houses. They possessed similar size and structure, while their functions and features were determined by the users according to demand. Consequently, unlike modern housing, rooms in Chinese houses were never titled with their functions, but with the locations. Take the “back room” for example. It could be defined as “the rooms at the end of the axis of the whole building group, which were used as living rooms,

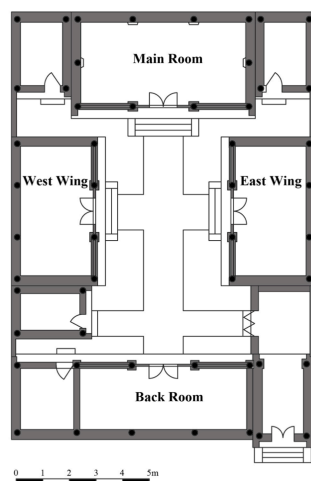


Fig. 1: Typical layout of traditional dwelling. Rooms in Chinese house were never titled with their functions, but with the locations. (Source: by author.)

bedrooms, storage rooms or others.”² The confusion of the purpose of storage and living is unbelievable in modern housing. However, in traditional Chinese houses, this phenomenon is very common (Fig. 1).

What’s more, indetermination was reflected in the confusion of different building types. Based on the research into the classification of Chinese buildings according to their purposes, Ito Chuta, the famous Japanese architectural historian, concluded that there were eight types of buildings: housing, government, cemetery, Wu temple, Wen temple, Taoist temple, Buddhist temple and palace, with similar architectural configurations.³ Whether his classification is standard or not, his conclusion is enlightening. It can be interpreted with the common phenomenon in ancient times of the wealth donating his house to a temple or school, since these three architectural types were built by the same universal system and do have not any essential differences in appearance or structure (Fig. 2).

Did the traditional house or room have its own features? The answer is definitely yes. The majority of buildings had to be redefined according to their practical purposes. However, this task was normally undertaken by the arrangement of furniture. The characteristics of the rooms can be expressed through the adaption of different furniture, while various functions can be alternated by the re-arrangement of furniture. In addition, the words on the plaque or couplet were an effective way to express the personality of the household as well.

² Ye Zurun (2009). *Traditional housing in Peking* (北京民居). Beijing: China Architecture & Building Press. pp. 65.

³ Li Yunhe (2005). *Cathay’s Idea – Design Theory of Chinese Classical Architecture* (华夏意匠——中国古典建筑设计原理分析). Tianjing: Tianjing University Press. pp. 78.

Housing	Government	Cemetery	Wu temple	Wen temple	Taoist temple	Buddhist temple	Palace

Fig. 2: Layouts of different building types. Based on the comparison of these typical layouts, Ito Chuta believed that all the existing eight types were with similar architectural configurations. (Source: by author. According to Li Yunhe (2005). *Cathay's Idea – Design Theory of Chinese Classibal Architecture* (华夏意匠——中国古典建筑设计原理分析). Tianjing: Tianjing University Press. pp. 78.)

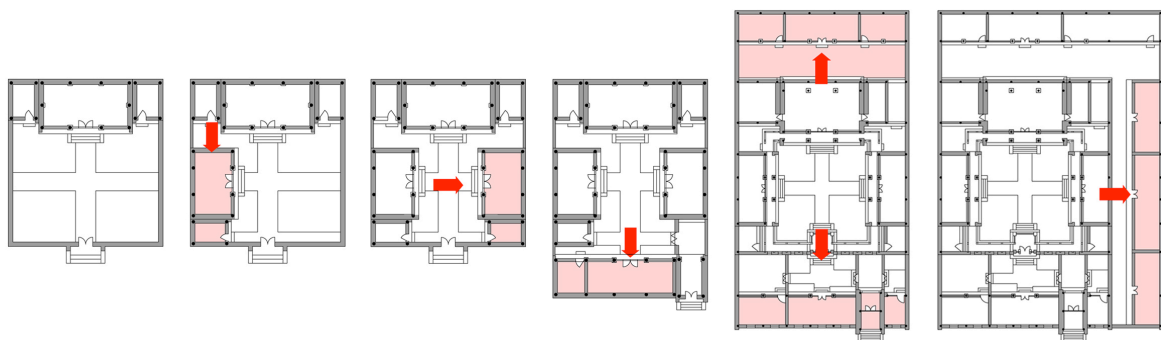


Fig. 3: Siheyuan with different sizes and organisations. (Source: by author.)

The flexibility is expressed in the organisation of the building groups. Siheyuan in Beijing is a typical example. According to the financial resources and family size, the organisation of Siheyuan can be quite different. The relatively poor and small families can be located around a single courtyard, with three main rooms, two wing rooms and two back rooms. It was also possible to abandon the back rooms, or remove both back rooms and one wing room. What's more, the poorest families built nothing but the three main rooms. However, the rich and big families' houses normally consisted of several

courtyards in the longitudinal direction, or more than one axis in the horizontal direction. In other words, the whole family resided in several connecting or isolated building groups. It was common for an integrated or growing family to add an adjacent group, and a disintegrated family divided its building group into several parts for the new and small families. Even if the construction was completed, its use could be adapted for various conditions (Fig. 3).⁴

⁴ Sun Dazhang (1987). *History of Chinese Architecture* (中国古代建筑史话). Beijing: China Architecture & Building Press. pp. 169.

Attribution in the architectural field |

Hereinabove, the well-accepted phenomena of flexibility are elaborated upon. However, the traditional house is insufficient to be taken as flexible design based on this evidence, since they are the inevitable result of the design method adapted at that stage.

The all-purpose design method is the main inducement for the above-mentioned phenomena. Based on it, the majority of traditional buildings adopted a similar timber structure and square layout. Their function was indeterminate and intangible in the design and building process, since, no matter what its function, the building was built according to universal and basic principles. Why was this method, instead of others, adapted by the Chinese? The old way of living and production was an important precondition. Since the family was the basic element for living and working, the function of housing was inevitably diversified, and, consequently, became flexible. In fact, it was difficult to distinguish housing from other buildings in ancient China - the palace was the home of the emperor's family, the local government was the home of the official's family, shops were the home of the owner's family, while mausoleums were houses for the dead. This comprehension retained its dominant position until the Tang Dynasty and had a profound influence on the building development afterwards.

In addition, the timber structure also had a positive influence on flexibility. The reason why wood, not stone, was used as the principle material in ancient buildings is still open to discussion. Some scholars attribute it to the abundance of wood and the deficiency of stone, especially in the birthplace of Chinese culture (Liu Zhiping, 1957), and others explain it with the shortage of slaves (Li Yuese, 1971) or the low productivity (Xu Jingzhi, 1964). These

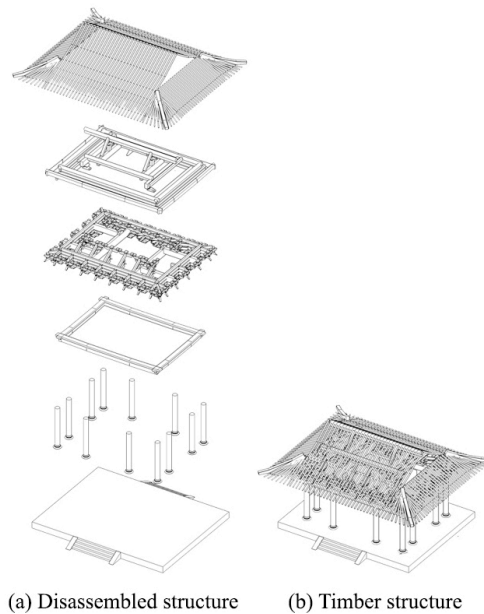


Fig. 4: The timber structure of an ancient house. (Source: by author.)

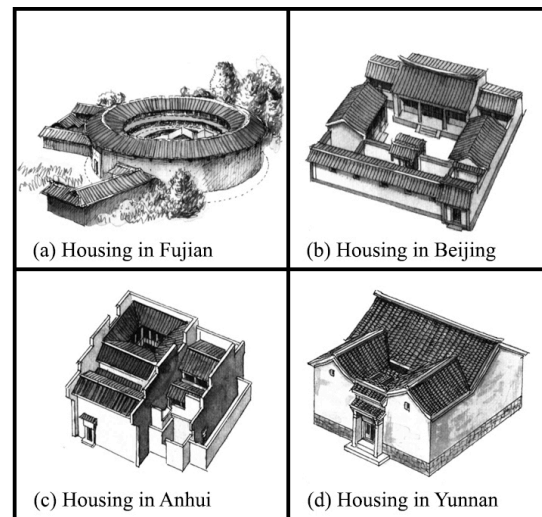


Fig. 5: Local housing in Fujian, Beijing, Anhui and Yunnan. Although formed with the same construction logic, their appearances are quite different. (Source: Wang Qijun (2005). *Chinese Construction* (华夏营造). Beijing: China Architecture & Building Press. pp. 151-171.)

viewpoints are, to some extent, reasonable and their biases are obvious (Li Yunhe, 2005)⁵.

⁵ Hou Youbin (2009). *Aesthetics of Ancient Chinese Architecture* (中国建筑美学). Beijing: China Architecture & Building Press. pp. 5-10.

However, regardless of the reasons, the timber structure used in traditional houses was a perfect match with the all-purpose design, and it provided flexibility to some degree. It was similar with Domino System, proposed by Le Corbusier in the 1910s, although the materials used were quite different (Fig. 4). This structure can be described as: using a rammed earth base; placed stone basement; set timber columns; placed beams on the columns, and connected them with horizontal or longitudinal components. All of the load was borne by the structure while the internal walls were only used for space division. Consequently, the enclosure was of great flexibility. Macroscopically, the walls could be thick or thin with earth, brick, stone or any other local materials, and the house could be adapted for different climatic zones as was demonstrated by the variety of traditional houses all over the state. Although the buildings were formed with the same construction logic, the appearances were quite different from place to place (Fig. 5). While microscopically, different functions could be realised within the same structure since the window or door, from location to area, was flexible. It could be completely open for a bower, partially closed for a dining room, or completely closed for a storehouse.

Philosophic reason | The design logic mentioned above is much more easily explained by philosophical tools because the Chinese philosophy has an extensive (indifferent) attitude towards things and an intensive attitude towards humans.

For the ancient people, especially the respectable and wise, character cultivation is of great importance. They perceived the noble and lofty spirit as the base of national stability. This perspective was clearly interpreted in “大学” (*Great Learning*)⁶,

⁶ The *Great Learning* is one of the prominent

the classic masterpiece of ancient Chinese Confucianism, in which the social harmony was supposed to be achieved by the masses through cultivating themselves, regulating their families and governing the country. It was modified to “in obscurity, scholars would maintain their own integrity, while if advanced to dignity, they made the whole empire virtuous as well” in “孟子” (*Mencius*)⁷, another classic book on Confucianism. How to cultivate oneself? What is the representation of the cultured? The indifferent attitude towards things was an important standard. In “论语” (*Analects*)⁸, Confucius, the saint, praised his student Yanhui as a wise man, for the latter remained optimistic despite living in slum. The opposition of material comforts and noble spirit was widely accepted.

Even the attitude towards life was deliberately simple, let alone the house. This simple perspective on life could be found throughout the development of traditional architecture. There were not purely decorative components until the Qing Dynasty. The decorative productions were originally generated in response to the structure: Dougong was developed to support the deep eave, while the colour painting was necessary to prevent corrosion. Being driven by the simple architectural

masterpieces in Confucianism. It is consisted with a short main text attributed to the teachings of Confucius, and then ten commentary chapters accredited to one of Confucius’ disciples, Zengzi. The ideals of the book are supposedly Confucius’s, while the text is written after his death.

⁷ The *Mencius* is a collection of anecdotes and conversations of the Confucian thinker and philosopher Mencius. It dates from the second half of the 4th century BC. And it is ranked as a Confucian classic from Song Dynasty.

⁸ The *Analects* (also known as *the Analects of Confucius*) is the collection of sayings and ideas of the Chinese philosopher Confucius and his contemporaries. The final version of it was completed in the mid-Han dynasty (206 BC - 220 AD). And in the last 2,000 years, it has been one of the most widely read and studied book in China.

and living concepts, the requirement for objects was deliberately neglected, and it was certainly out of necessity to cost extra manpower or resources. Consequently, houses were supposed to be constructed using the easiest approach. That can also answer the question why the universal design method and timber structure was so widely accepted in ancient buildings.

To remedy the disadvantages caused by the extensive thought and all-purpose design, the concept of self-improvement was deeply ingrained. It was interpreted as a “happy medium” which was achieved by self-guidance, self-education, and self-improvement. Specific to architecture, the gap between the universal building and the user’s specific demand was acceptable or even welcomed since it can be remedied by self-improvement. To the question of whether the pursuit of flexibility - individuality or long-time effectiveness - existed in Chinese philosophy, there are no definitive answers, since different schools have opposing opinions and they never reached a definite conclusion. However, the pursuit of self-improvement indirectly elaborated on this question.

INFLEXIBLE ORDER

In the previous section, I attempted to analyse the flexibility embedded in the all-purpose design and timber structure. It was widely accepted that the indetermination was the representation of flexibility, since it implied the freedom of building and use. However, the freedom was often incomplete, because it was strictly regulated by social ethics. It was an effective way by which the ruling class controlled the masses and which was contained in every aspect of living. Specific to housing, the ethics can be generally interpreted as the hierarchy in the field of unrelated relationships, and family order

based on the blood or marriage relations. The seemingly simple and rustic house was endowed with the element of ethical order. This was another characteristic of Chinese buildings.

Social hierarchy | Social stratification was long-standing in Chinese history. In the famous historical book “左传” (*Zuo Zhuan*), people were divided into ten classes, from the emperor to the grass-roots, and the relationship of domination and obedience was subsequently elaborated upon⁹. Although the specific division method varied from time to time, the basic principles were relatively stable and represented in many aspects. Consequently, there was a clear correspondence between the social rank of the household and the form of their house. The corresponding regulations permeated all construction activities and every building type especially housing. Its wide scope and precise regulation was striking. From the overall planning of the city to the arrangement of building groups, from the design of individual buildings to the decoration of each detail, everything was controlled by a strict order. Throughout the situation in different dynasties, the specific regulations were continuously compiled and modified, however the top priority of large scale was never changed.

Pedestals were an important symbol of social status. According to the “礼记” (*Book of Rites*), the height of a

⁹ *Zuo Zhuan* (or *Tso Chuan*) is among the earliest Chinese works of narrative history, covering the period from 722 to 468 BC. It is one of the most important sources for understanding the history of the Spring and Autumn Period. The discussion of hierarchy is the record in the seventh year of Duke Zhao of Lu. The document in simplified Chinese is “天有十日，人有十等，下所以事上，上所以共神也。故王臣公，公臣大夫，大夫臣士，士臣皂，皂臣舆，舆臣隶，隶臣僚，僚臣仆，仆臣台，马有圉，牛有牧，以待百事”.

pedestal for the emperor's house was nine feet, for the feudatory it was seven feet, for the senior official it was five feet, and for the scholar it was three feet¹⁰. The relative regulation was modified in the Qing dynasty. According to the official position of the user, the pedestal was divided into three levels, with a height of above 2 feet, 2 feet, and 1 foot. Even in the same building group, pedestals for different buildings were obviously different to indicate the different degrees of importance.

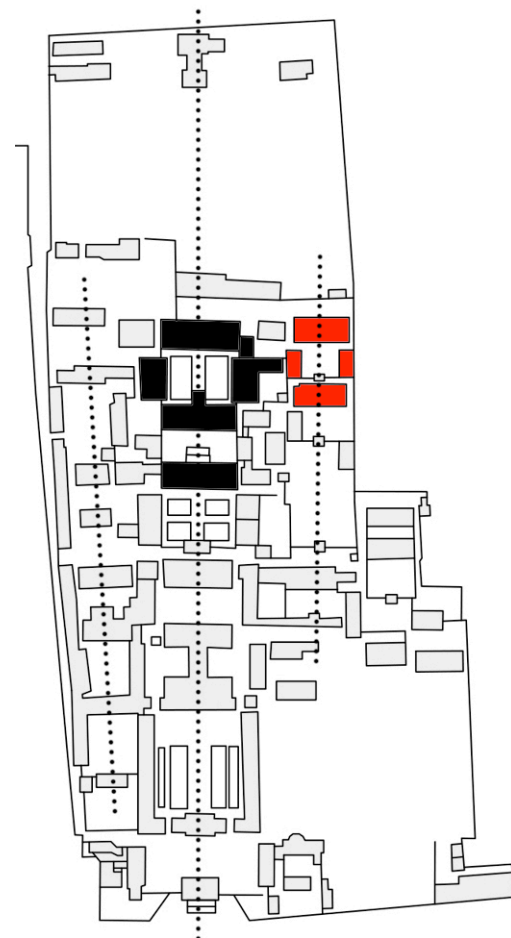
More importantly, this regulation was not only an ethical rule, it was also an imposed law. All people had to guarantee that their houses were within the allowed range, for any arrogation activity was sure to be severely punished. The emphasis on social order was clearly revealed in death of Niohuru Heshen¹¹. In the Qing dynasty, the most powerful minister, Heshen was sentenced to death by the emperor. One of his serious crimes was that his house went beyond the prescribed standard. After that, his house was re-allocated to a prince, who was compelled to modify the house according to relevant standards. Based on the criticism of the arrogation behaviour, the emperor re-emphasised the importance of compulsory regulations.

Family order | Social order within the

¹⁰ The *Book of Rites* is a collection of texts describing the social forms, administration, and ceremonial rites of the Zhou dynasty as they were understood in the Warring States and the early Han periods. The quotation comes from Chapter 10 named "Liqi" ("Utensils of rites" or 《礼记·礼器》). The document in simplified Chinese was: "有以高为贵者：天子之堂九尺，诸侯七尺，大夫五尺，士三尺".

¹¹ Niohuru Heshen (1746 - February 22, 1799) was one of the most corrupt officials in Chinese history. In 1799, he was condemned to slow slicing for 20 crimes, of which "defiance of imperial supremacy" and "power transcendence" accounted for half.

family was generated by the respect for seniority and the separation of men and women. Essentially, the two orders were in accordance with the order of society.



- The residence of the most senior descendant of Confucius
- The residence of the younger descendant of Confucius

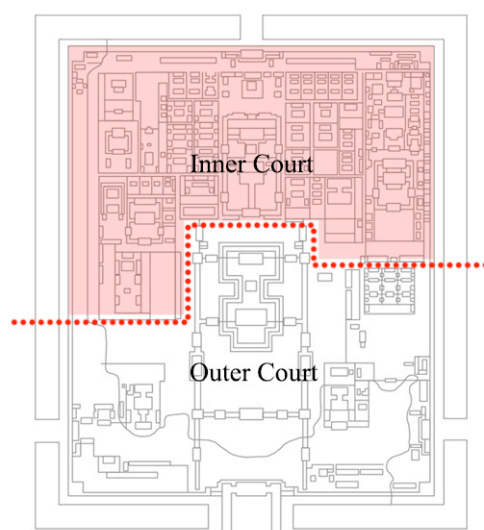
Fig. 6: Overall layout of Kong Family Mansion (Qufu, China). This overall arrangement consisted of three axes. The most senior descendant of Confucius took up residence in the central axis, while his younger brother occupied the Yi Guan hall to the east. (Source: by author. According to Hou Youbin & Li Wanzhen (2002). *Illustrated Treatment of History of Ancient Chinese Architecture* (中国古代建筑历史图说). Beijing: China Architecture & Building Press. pp. 154.)

The location of one's room was the predominant expression of the position in the family. In the ancient China, the large population was the embodiment of its prosperity.

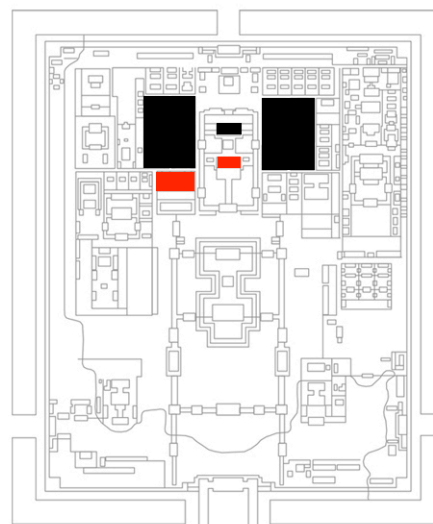
Consequently, multi-generational living was the main residential model. What's more, the size of family was intangible - the prominent families normally consisted of immediate and distant relations, as well as many servants, while the size of declining families was quickly decreased. Jia's family in the famous novel “红楼梦” (*Dream of the Red Chamber*)¹² is a typical example of the change of family size. It became extremely large when the granddaughter, Yuanchun was elected as the wife of the emperor. At that time both the lineal and distant relatives lived Jia's house. However, when their prosperity became a thing of the past, a bleak scene was represented by the fragmented family as members died or moved away.

For a family with multiple and complicated relationships, it was of utmost importance to define a clear major and minor relationship, by which the rank distinction could be represented. This relationship was clearly represented in the building. According to traditional customs, the majority of the building group was organized according to the north-south axis. The most important houses were located on the north side of this axis, and built to the highest standard and for the eldest members of the family. The east houses were of secondary importance, while the west were third. The south rooms were the least important, and usually for the servants or guests. This sequence was clearly and especially illustrated in Siheyuan.

¹² *Dream of the Red Chamber* is one of China's Four Great Classical Novels and is widely acknowledged to be the pinnacle of Chinese fiction. It was written in the middle of the 18th century during the Qing Dynasty.



(a) The separation of Inner Court from Outer Court



■ Emperor's residence
■ Residence for the Empress and the concubines

(b) Residence of the Emperor and his wives.

Fig. 7: Overall layout of Forbidden City (Beijing, China). The Forbidden City is divided into two parts. The Outer Court includes the southern sections, and was used for ceremonial purpose. The Inner Court includes the northern sections, and was the residence of the Emperor and his family. The Emperor's palace was placed to the south of the residences for the concubines. (Source: by author. According to Hou Youbin & Li Wanzhen (2002). *Illustrated Treatment of History of Ancient Chinese Architecture* (中国古代建筑历史图说). Beijing: China Architecture & Building Press. pp. 130.)

For the extended family, the buildings can be organised along several axes, among which the central was given priority. This principle was specifically reflected in the Kong Family Mansion¹³ (Fig. 6).

The isolation of women was the other feature of the traditional house, which was represented by the strict separation of the interior and exterior. The general status of women was very low in the feudal times. The women had no freedom nor equality, since she was denied an independent life - before marriage, she had to be obedient to her father and after marriage, her husband was her master, finally, she had to rely on her son. Consequently, a woman had to be isolated from any resistance consciousness since obedience was a basic requirement. Specific to housing, this principle was represented as the strict separation of the women from both the men and the outside world. It was stated by Mo Tzu, who was a famous ideologist in Warring State Period (475 BC – 221 BC), as “use the high wall to separate woman from man.”¹⁴ This exposition was of significant importance to the overall layout of traditional housing. In an ordinary house, it was represented by the rooms for men being in the front and the rooms for women in the back. In the Royal Palace, the official buildings were in the front, while the bedrooms were in the back. A similar layout was clearly revealed in almost all of the building groups (Fig. 7).

The role of people in traditional house |
As previously explained, ancient housing is

¹³ The Kong Family Mansion was the historical residence of the direct descendants of Confucius of the City of Qufu, the hometown of Confucius in Shandong Province, China.

¹⁴ Mo Tzu was a Chinese philosopher during the Hundred School of Thought period. His thought was developed as an independent school named Mohist, in which the social order was one of the most important factors for the stability of a state. The quotation in simplified Chinese was: “宫墙之高，足以别男女之礼”.

the representation of etiquette and social order. All of the people were closely connected and in the control of the relative order. More precisely, the social order can be compared to a chessboard, where the people were equal to the chess pieces, and their location and movement was predesigned by the social order. Once a man was born, his social role was determined, and it was relatively stable. Correspondingly, the form of his house was partially defined, even his specific room was fixed. The workaround was unavoidable in practice. For example, the main house for ordinary people could not be more than three bays. However, in practice, many families built a jointed room on both sides, so that they essentially had five rooms. However, the options were few. From this perspective, the flexibility caused by the indetermination of design was not worth mentioning. Even the soul and behaviour of the users were imprisoned, how could a flexible life be realised. In other words, when the freedom of the people was restricted, the real flexibility was impossible to discuss.

ADVANTAGES OF MODERN HOUSING: THE LIBERATION OF USERS

The revolution of society | After the Opium War in 1840, the rapid development of industry and the adjustment of the social structure had a significant influence on housing. Western architecture was gradually introduced to China. Over the subsequent 100 years, the traditional residential model and construction system was dramatically changed, and modern housing was born which was completely different from traditional housing. This alternation was represented by the weaker emphasis on social stratum and stronger attention on function.

As an important precondition, society's innovation should be briefly described. Due to their failure in the Opium War, the Chinese people were affected by dual oppression from imperialism and feudalism, and their lives were extremely bleak and difficult. In such circumstances, the enterprising talents devoted themselves to finding salvation. In 1911, accompanied by the fall of feudalism, the previous social order, which can be summarised as three cardinal guides – the emperor guided his subjects (people), the father guided his son, and the husband guided his wife, was replaced by a new order, which was characterised by democracy and freedom. Furthermore, the exploitation of social culture was begun from the May 4th movement in 1919, and had a significant influence on society. It has to be admitted that until now social hierarchy still exists and is accepted by the sociologists, however, its division is not based on the descendent status, but the combination of power, wealth and fame¹⁵. Consequently, it is not represented as political oppression as in the original hierarchy, but as autonomous respect and advocated friendship. Its reflection in housing is ambiguous and its meaning is completely different.

The liberation of users | Compared with traditional housing, modern houses are characterised by their deterministic purpose. Based on a predesigned lifestyle, the features for each room are clear. The characteristics of the bathroom and kitchen are too obvious to be ignored; a big and open room is for family gatherings; a relatively closed but usually south-facing room with an independent bathroom is normally for the parents; and a smaller room is used as a study or bedroom for the children. Even if there are not any specific

instructions, people will not confuse them. The importance of a specific room is reflected in its orientation, area or consummation degree. However, there are no definite connections between the room and its user. Liu's and Sun's families are good examples of this opinion. Both families are living in two-bedroom apartments in Building 4th in the Hongyuan community (Jinan, China). They are living in the same layout, in which the main bedroom is south-facing with an area of 22 m² together with an independent bathroom, while the second bedroom is north-facing with the area of 9.6 m² (Fig. 8).

Liu's family moved into the apartment in 2005, when the son was a 20 year-old bachelor. At that time, Liu's couple occupied the main bedroom while their son lived in the smaller one. Five years later, Liu's son got married, however, the new couple was too poor to afford an independent apartment. To save money for their new house, the new couple lived in the son's previous bedroom until the third generation was born in 2011 and the room was too small for three people. Consequently, Liu and his wife switched rooms with their son, and moved into the second bedroom.

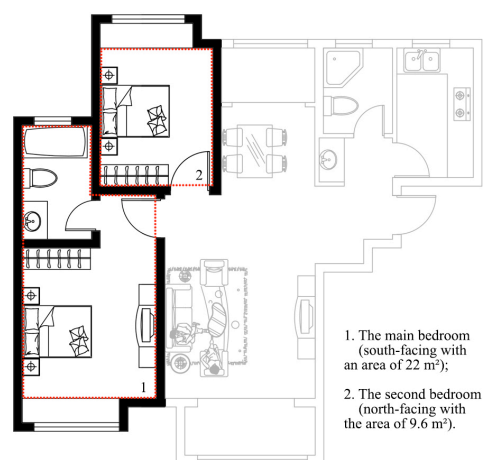


Fig. 8: The layout of Liu's and Sun's apartments. (Source: by author)

¹⁵ Yang Jisheng (2006). *Analysis on the Social Stratification of Contemporary China* (中国当代社会各阶层分析). Lanzhou: Gansu People's Press. pp. 10.

Similar phenomenon was found in Sun's family, which was primarily consisted of Sun and his wife. While moving in the two-bedroom apartment, Sun's couple lived in the main bedroom and used the smaller one as working room. Around 2008, Sun's father passed away, his widowed mother decided to live with them and moved into the previous working room.

It is clearly revealed in these two cases that the connection between the user and a specific room or position is diminished. The old ethical regulations, which prescribe that the elder must be in the more important position, have been abolished. It is the inevitable result of social transformation and the subsequent alternation of architecture. This phenomena can be found everywhere in modern China.

The comparison between traditional and modern housing is enlightening when flexibility in terms of sociology is studied. All-purpose design methods and a timber structure provide favourable conditions for the realization of the user's personality. However, compared with the respect for the rites and social order, individuality was suppressed, which was represented as "self-restraint and returning to rites" in "论语" (*Analects*). The wide aspects of buildings were strictly regulated, the pursuit for individuality was hidden and innovation activity was forbidden¹⁶. Accompanied by the development of society, modern buildings have made great progress since the people were freed from the strict hierarchy. Although the concrete structure excludes the changeability of timber components, and the definite space, which is connected to a specific function, ignores the possibility of change, the liberation of the people should be

celebrated. From this perspective, modern housing itself is the realisation of flexibility since its principle part, the user, is set free.

¹⁶ It is recorded in "*the Book of Rites*" that "special sound, cloth, technique or appliance is the way of arousing suspicion and should be sentenced to death".