

A View of Flexible Housing in China

Shanshan Li

Abstract—Beginning with the debate of concept, this essay explains the historical source and development of flexible housing in China. In the former part, the flexibility contained in traditional house is explored. While in the latter, the relevant practices in modern times are systematically analyzed as three phases—the *Embryonic Period* (1949 - 1980), the *Systematic Practice* (1981 - 2000), as well as the *Integrated Trend and Prosperity* (2001 - present). As a conclusion, the generalized flexibility is tentatively discussed.

Keywords—Flexibility, Long-term effectiveness, Variety, Social background.

I. THE DEBATE OF CONCEPT

TILL now, there is not any widely accepted definition of *Flexible Housing*, not only in China but abroad, however its essence can be traced in various descriptions.

It is universally acknowledged that Le Corbusier's design of Dom-Ino Frame marked the modern beginning of this concept especially in Europe. Although Corbusier and other modern architects all had original and fragmented practices of this subject, there was not any specific definition. It was flexible division of the interior for Corbusier, flowing space for Ludwig Mies van der Rohe, multiple-use rooms for Mart Stam and the various combination of standard components for Walter Gropius in the 1920s [1]. Subsequently, it was the "support building" for Prof. John N. Habraken, who firstly developed the systematic theory and method for this topic [2], [3]. Throughout the intricate appearance, the common cognition that **building and its surrounding was not uniform or static** had been clearly revealed. Although with various emphases in practical level, the above-mentioned concepts (together with the elaboration of adaptable housing, long-effective housing or potential housing in China) shared the common essence of synchronic diversity and diachronic effectiveness, or both of them [4]-[6].

However, for the driven factors, these concepts are with significant difference. The original practices were responses to the physical aspiration - housing shortage, while support building and its followers were directly called by the spiritual needs - the individual characteristics and democracy. This phenomenon is closely connected with social background. As a result, the most appropriate definition in China cannot be produced or selected before the social background is detailed addressed and the relevant practices against uniform or static are studied.

II. HISTORICAL SOURCE

Flexible housing is not a new thing in China. On the contrary,

the basic principle of it has been practiced by traditional building in the ancient years. Based on the all-purpose design method, the great majority of ancient buildings were built with similar forms and indeterminate spaces, which could be used flexibly in various ways.

Specific to housing, rooms were seldom designed according to detailed function or characteristic. It was found that there were many similar rooms in old houses. They were with similar size and structure, while the function and feature was given by the users according to their specific demands. Consequently, different from modern housing, rooms in traditional houses were never titled with function, but with location. Take the "back room" for example. It was defined as "the rooms at the end of the axis of the whole building group, which were used as living room, bedroom, storage room or others" [7]. The confusion of storage and living is unbelievable in modern housing. However, for the traditional Chinese houses, this phenomenon was very common.

What's more, the indetermination was also reflected in the confusion of different building types. Based on the research on the classification of Chinese buildings according to their purposes, Ito Chuta, the famous Japanese architectural historian, drew a conclusion that all the existing eight types, including housing, government, cemetery, Wu temple, Wen temple, Taoist temple, Buddhist temple and palace, were with similar architectural configurations [8], [9]. Whatever his classification was standard or not, his conclusion was enlightening. And it can be interpreted with the common phenomenon in ancient times that the wealth donated his house to the temple or school, since these three architectural types were built by the same universal system, they had not any essential difference in appearance or structure.

Meanwhile, however, the traditional housing was strictly regulated by the social ethic. It was an effective way by which the ruling class controlled the mass and it was contained in every aspect of living. Outside the family, the people were divided into various classes¹ and the correspondence between the social rank of the household and the form of his house was clear and compulsive. Any arrogation activity was sure to be severely punished. Throughout the situation in different dynasties, the specific regulations were continuously compiled and modified; however, the top priority to large scale was never changed.²

¹As recorded in *ZuoZhuan* (or *TsoChuan*), the people were divided into ten classes, from the emperor to the grass-root. *ZuoZhuan* was 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 was the record in the seventh year of Duke Zhao of Lu.

²Pedestal was taken as an important symbol of social status. According to the record of "礼记" (*Book of Rites*), the height of pedestal for emperor's house

While inside the family, the ethic was generated by the respect for seniority. For the families with multiple generations in the ancient China, it was of utmost importance to define a clear major and minor relationship, by which the rank distinction can be represented. This relationship was clearly and predominantly represented in location of one's room. According to traditional custom, the great majority of the building group was organized according to the north-south axis. The most important houses were located in the north side on this axis, which were built with highest standard for elder members of the family. East houses were in the second importance, while west ones were in the third. At last, south rooms were the least important, usually for the servants or guests.

When the social ethic was taken into consideration, the flexibility of traditional housing was restricted. The social order could be compared to the chessboard, while people were equal to the chess pieces. The location and movement of the chess or people was predesigned by the social order that penetrated into all aspects of life. Once the person was born, his social role was determined, and it was relatively stable. Correspondingly, the form of his house was partly defined; even his specific room was fixed.

In the period from 1840 when the Opium War enforced China to be the semi-colonial and semi-feudal society, to 1949 when the New China was established, China experienced dramatic changes especially in the social term. And the traditional house was substituted by modern housing that brought the other kind of flexibility.

III. DEVELOPMENT PROCESS

To begin with, the study period has to be restated - it is from 1949 when the New China was founded to present. According to the feature of practices in various phrases, this period can be divided into three stages: the *embryonic period* (1949 - 1980), the *systematic practice* (1981 - 2000), as well as the *industrialized and integrated trend* (2001 - present).

A. The Embryonic Period (1949 - 1980)

Shortly after the foundation of New China, the absolute centralized authority was established. It was the response to the lesson of three-years civil war, as well as the extreme poverty of the new state - she had to put the resources all over the country together.

In this period, all the building activities were under the direct control of the government and the whole atmosphere was oppressive. For the insufficiency of designers, funds and time, houses were designed by the standardization method which was learned from Soviet Union [10]. Even the distinction of south and north was neglected, let alone the characteristic for small groups or individual. This phenomenon did not change until

was nine feet, for the feudatory was seven feet, for the senior official was five feet, and for the scholar was three feet.

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》).

1959 when the diversity of different cities or provinces was taken into consideration. However, for the monotonous appearance and identical pre-designed lifestyle, this change was just the same as "the kettle calls the pot black".

Although the practice aimed at variety seems to be faltering, the sense of long-term effectiveness was starting to sprout. Being confident with the rapid growth of China, the authority also possessed a development perspective to the living standard, and various guidelines were released as consequence, such as "consider the recent and the future, give the long-term a priority"³ in 1952, "make near future a priority and give appropriate consideration to long-term"⁴ in 1958, and so forth.

In this atmosphere, some responsible scholars made some positive explorations, among which the project of minimal housing with outdoor veranda was the most creative one. With the aim of long-term effectiveness, it was a concept design proposed by Prof. Peng Yigang (Tianjing University) in 1956 [11]. There were four layouts in the current stage and four corresponding modifications in the long run elaborated in this proposal. Through the fine adjustment of partition or the splitting wall, the transformation can be made conveniently. For example, suite 1 was with two rooms and the independent kitchen and washroom for the family with three or four persons. The total living area was 15.8 m², 5.3 or 4.0 m² for each person. After years, it was possible to connect three adjacent suites for a family with 7 members - 6.8 m² for each. There were the independent living room and dining room, two large bedrooms and an extended kitchen. The living standard was obviously improved. And this kind of proposals had a positive influence on the development of flexibility (Fig. 1).

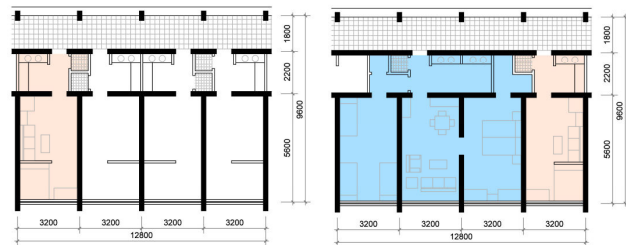


Fig. 1 Current and future arrangement of suite 1

B. The Systematic Practice (1981–2000)

The reforming and opening in 1979 means a new era in China. Crucially, the absolute centralization was disintegrated. For housing, multiple construction bodies, including local institution or even users were involved, which diversified the building results at great extent. What's more, the private ownership increased the residents' enthusiasm of improving their living environment.

Meanwhile, accompanied with the alleviation of the quantitative shortage especially from 1990, the quality of housing was taken as a priority by the users as well as the

³It was proposed in order to close the gap between the high per capita living area in Soviet and the situation in China. As a result, plenty of large houses were built, which had to be shared by two or three families.

⁴It was proposed in the conference of "Housing standard and art" in 1958 to correct the problem caused by the former guideline.

government. The incoordination of the universal design and individuality, as well as the contradiction of stable housing and continuous change was emerging, which drew great attention.

Continual attention was paid on the flexibility. In the 1980s, this concept was advocated as “enough to live and possible to change”⁵ by the government as the response to the limited space caused by the increase of household appliance. In 1987, it was firstly recorded in the “*Design Code for Residential Building*”. And various practices bloomed in this period.

Yueyahu community in Nanjing was one of the most noticeable projects, among which the future adjustment was elaborated in suite C [12]. It was based on the deep research on the spatial scale in housing in order to achieve the reasonable and comfortable result. And the final results were four or five-storey buildings with the sloping roofs, while the flexibility was fully realized by four ways. Firstly, the depth of south-facing balcony was extended to 1.8m, so that it can be used as a multi-functional space; secondly, the partition wall between the kitchen and dining room was unfinished. As the user's personal demand, the kitchen can be open or closed; thirdly, the living room was deliberately designed as a large space for the sociable family. For the family with more members, it was also possible to be divided as a relatively small living and a bedroom (Fig. 2); at last, the attic and the underground space were possible to be used. Family in the top level may involved the attic space while the family in the ground floor may use part of the basement as a gym, acoustic room or bedroom (Fig. 3).

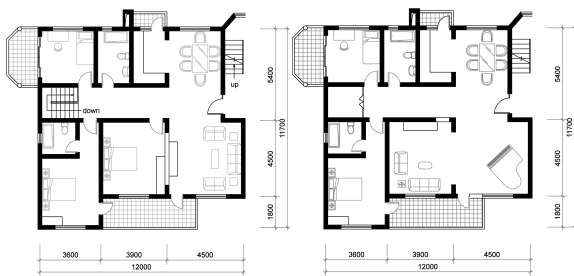


Fig. 2 Layouts of sociable family and family with more members



Fig. 3 Layouts of basement and the attic space

There was not any high technology adapted in this project, nor the sliding components. However, it was one of the most

⁵ It was a further adjustment of the relevant principles proposed in 1952 and 1958 respectively.

successful examples in China. In 1999, the layout of suite C was awarded the golden prize in “Bailong National Design Competition”. And all suites were quickly snapped up shortly after the completion.

In 1980s, relevant practices in the west, especially Prof. N.J. Habraken and his support building⁶ attracted attention of the professionals. In 1981, the theory and design method was firstly introduced to China by Prof. Zhang Shouyi (Tsinghua University, Peking, China). In 1985, under the guidance of Prof. BaoJiasheng (Southeast University, Nanjing, China), the first support housing was completed in the countryside of Wuxi [6]. The support part was invested by the villages' committee and designed by the professional. The future users could buy it by installment or onetime payment, and then bought or rent the infill part to divide the internal space. In this project, the specific method proposed by Prof. Habraken was completely practiced, and the intertexture of the state's support and the private initiative in the transformation period of the country was cleared reflected.

Three years later, the publication “*Support Housing*” was released, in which the basic principle and detailed method of SAR theory, as well as the possibility of its realization in China were elaborated [6]. Although the specific design process was too complicated to be completely practiced by all the projects, its primary concept and design logic had a significant influence on the development of this concept in China. From then, the aspiration of individual was directly taken into consideration, and the user's participation was practiced in housing. In these years and later, various “support” projects were built, for example “Jiangnan New Village” in Guangzhou (1985), Building 23 in Huawei Community in Beijing (1991), Youyi Building in Tianjing (1995), and so on.

In this process, the inevitably technological troubles brought by support building facilitated further researches, including the large-bay structure, integrated pipeline and so forth. The results were clearly reflected in the experimental building in Cuiwei Road (Beijing) in 1994. With large bay, this building tried to avoid interior load-bearing walls at the highest level. The basic bay was with 5.4m of its width and 10.8m of its depth. The splitting walls were load-bearing, while the light-weight partitions were used for dividing the space. The site of kitchen and bathroom was fixed, and the left space with about 42.4m² was open for further division. The technological advancement could be specified as three aspects. To begin with, the modular of support and infill was highly unified; and then, assemble partition and furniture were widely adapted; at last, all the vertical pipes were placed in the pipeline well - there was not any vertical pipe in the kitchen or bathroom [13].

The practices in this stage were reconciled with the whole atmosphere of housing. The great majority of them adapted multiple-story and masonry-concrete structure, while they

⁶ N. J. Habraken (born Oct. 29th, 1928) is a Dutch architect and theorist. The concept of support housing is proposed in his seminal book “*Support: an Alternative to Mass Housing*” in 1962 (English edition 1972). In this book, Habraken proposes the separation of “support” from “infill”, the former is designed by the architect, and the latter is determined by the user. His research provides an effective way for the users' participation in housing activity.

concentrated on the freedom of subdivision or re-division of internal space. The basic methods adapted were to provide universal space by large-bay structure, and by flexible partition, the internal layout can be arranged and changed according to diversification of living contents.

C. The Integrated Trend and Prosperity (2001 - Present)

In the new century, the living standards had been further improved, and the requirement of housing quality was getting higher and higher. In this period, the high price and the structural shortage of housing were the prominent problems.

From 2005, a series of regulations were released by the government in order to stabilize housing price and balance housing supply. The "National Six-Point" in 2006 proposed that medium and small suites (below 90 m²) should be advocated; the "State Council: certain opinions about solving the housing difficult problems for urban low-income" gave priority to the low-income families.

Meanwhile, in this stage, the great majority of houses were invested by the real-estate business. The phenomenon of an excess of demand over supply - which was the dominant expression of structure shortage - prompted the economic oriented businessman into the attention on the user's demand. The feedbacks of the future users were high valued, which brought flexibility to a higher degree.

As a direct response, the "Minimal Housing" was proposed by Vanke Company⁷ in 2012. The proposed suite with the area of only 15 m² was planned for the university students or couples who were too poor to afford a big house. By the superposition of different functions and folding furniture, the main space of the suite was supposed to be multiple used - it was a living room in the daytime while at night it was substituted into a bedroom. (Fig. 4)



Fig. 4 Arrangement of day and night use

Maya building in Chongqing (2007) was the other typical example, in which the logic of flexibility was creatively used in order to balance the supply and increase sales. The project covered the area of about 7,000m² and its total construction area was consisted with two residential towers and some skirt buildings with approximately 50,000m². The primary design was only focus on the basic information since the future users were indeterminate. It adapted the column grid with 6.9m * 6.9m, and used half a grid (3.45m * 6.9) as a basic element. There were totally 15 basic suites, from one to four basic

elements. The drainage and smoke exhaust systems were placed in the facade and corridors, while the appearance of facade was also primary designed. As soon as the construction of skirt buildings began, the suites were open for booking. Based on the situation of the initial pre-sale, the architects adjusted the proportion of various suites. And the tower parts were then constructed according to the modified design. When the 22nd floor was in construction, the design was adjusted for the second time as the marketing situation. And the buildings from 23rd to 25th were built according to the new design [14].

Furthermore, the research on support building and its combination with specific situation in China was never finished and tended to mature and industrialized gradually. In 2006, under the guidance of SI building in Europe and KSI housing in Japan, the CSI (China-skeleton-infill) housing was developed successfully in Jinan. It was one of the most mature and representative systems of the combination of SI theory and the situation in China. Based on industrialized construction, it focused on increasing the durable life, internal change and user participation. It was firstly exhibited in Nov. 2010 as the sample room "House of Tomorrow II". The moveable partitions made the room outstanding. Additionally, it adapted double floor, between which the pipes were placed. As a result, the location of infill, including partition, kitchen and bathroom was of utmost flexibility, and the pipes can be maintained conveniently. According to the user's demand, the infill can be bought or rented and layout can be changed at any time.

In the same year, "The Technical Guideline for Construction of China-Skeleton-Infill Housing" was released, in while the technological details in design and building process was formulated. From then, this concept was firstly advocated and popularized by the state, and it was taken as a milestone of flexibility. Under the guidance of it, "Little Universe" (2011) was built in Peking.

Located in the north end of Yongding Road, this project occupied an area of 22,000m², and with total building area of 77,800m². It was consisted with two public buildings and six residential buildings from six to nine storeys for 486 families. As a response to the demand of small suite, the project provided the area of 34,7000 m² for the suites below 90m², 78.95 percent of the total building area of residential building. This project focused on the relationship between current life and the future, and concentrated on the innovation of both technology and design method. In the technological aspect, it adapted the most developed technology of integrated housing in Asia, including the separation of pipelines and wall, centralized pipeline well, drainage system of the same level, and so on. The bathroom, kitchen, vestibule were also integrated. Once selected by the use, they can be transported and installed immediately [15].

IV. DISCUSSION AND CONCLUSION

What is *Flexible Housing*? Every background has a different response. It can be interpreted as the pursuit for variety and long-term effectiveness in the west. While in China, it means primarily the freedom. This is the inevitable requirement after the long-time concentration and the remaining problems. The revolutions and reforms released the mass from the rigid ethics

⁷Vanke is the largest residential real estate developer in China.

and strict order in traditional housing, and the decentralization of control in opening and reforming in 1978 set user free from the passive position. These activity are not directly connected with housing, however, the flexibility can never be achieved without them.

The variety and long-term effectiveness as the responses to various and continuously modified individual demands are the subsequent requirements for *Flexible Housing* in China. Through the former, the user's individuality is respected; while through the latter, the inevitable change is acceptable. It can be found that, the users' participation and creativity are increasingly advocated and evaluated in the development process.

Till now, the major attention of the professionals is still paid on the indoor space and during the maintenance stage. However, the research on the realization of users' demand can never be restricted within the interior after their move in. Whereas, it should be open to the entire living environment and any stage in the whole process from finance, ownership, building, to management.

The generalization of flexibility is of significant importance at the moment when the structural shortage of housing has been taken as the severe problem in China from 1990s. This problem is partly caused by the high price of commercial housing which occupies the great majority of all the houses. According to the comparison of housing price and household income, it is clearly revealed that commercial apartments are too expensive for the low-and-medium income families to afford. As a result, the affordable housing, not-for-profit housing and low-rent housing for the low incomes are supported by the government, but with limited numbers. There are still numbers of people who can neither afford a commercial housing, nor achieve the standard to get the welfare houses. That is why the "shortage" of housing is still severe, although according to statistics, the number of housing suits is 1.02 times of the households. Under this environment, the various finance or construction body seems to be the effective remedial measure, in which the active role of user is highly appreciated.

Take co-housing activity as example. It is initiated by users for the unsatisfactory of the high price of commercial housing at the beginning of 21st. After nearly 10 years of hard trying, the first practice "Dream Community" was realized in Wenzhou. There were more than 200 participants devoting themselves in this activity. They joined together spontaneously, collaborated on the investment money and supervised the whole design and building process. In 2012, the construction was completed, which consisted of 256 apartments with the area from 60 to 110m². The price per square meter was 7000 yuan, 40 percent lower than the commercial housing nearby.

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