The Development of Flexible Housing in Modern Times

Writing a thorough history in regards to Chinese flexible housing is difficult, for both its definite beginning and scope are blurred. It is generally believed that formal research on this topic began in 1981, when Support Building was first introduced to China. Abundant result was achieved under the light of this imported concept. However, flexibility is never limited within the short period (from 1981 to present), nor in a single way (Support Building). Besides the enlightening practices in traditional housing, the germination in modern times can be traced back to the early 1950s in a completely different approach. The efforts of talented architects have yet to stop. Their research consists of an integral part in the record of history.

The research and practice on flexible housing, no matter at home or abroad, has never been an isolated issue. Firstly, it is closely associated with the overall context of its day - the developing level of architecture, the economic status, the policy of the authority, and so on. Secondly, in most cases, the practices are used to solve specific problems in society. This chapter has been organised under above-mentioned comprehensions. By using the period from 1949¹ to present day for research, branches are identified when specific problems emerged and architects decided to use flexibility as a solution. Three main drivers influenced the development of flexible housing. The first arose in the 1950s when

construction of area-restricted housing was under the direct control of the impecunious authority. Provided living standard could be dramatically improved in the near future, dwelling was advocated to be capable of changing. The necessity of this method was strengthened by the demand of flexible allocation as a compensation of the "Standard Design"². The second driver, starting in 1980s and continuing to present day, arose out of a belief that users' demands were various and alterable. As a response, housing was prompted to be diversified and changeable. Users were suggested be involved to in the decision-making process of their own dwellings. This trend accounted for the majority of Chinese practices. Thirdly, in the 1990s, the tremendous waste caused by short-lived residential building drew wide attention of both the government and scholars. To extend the service life of housing, the short-lived components were suggested to separate from the long-lived ones so that the former can be renewed without disturbing the latter.

BRANCH 1:

¹ The establishment of People's Republic of China.

² Zhang Jie & Wang Tao (2001). Edited by Lv Junhua, Peter G. Rowe and Zhang Jie. *Modern Urban Housing in China 1840-2000*. Munich: Prestel Verlag. pp. 125. "The following were the cardinal principles in the standard design of housing. A unit was to be designed with standard components conforming to a construction module. Various combinations of such standard units were to form different buildings, and when the different buildings were put together, they formed residential areas."

AREA ADJUSTMENT

Incentive | Following the continual wars³, China had an unprecedented demand for housing in the 1950s. In order to provide sufficient dwellings with minimal manpower and material resources, the "Standard Design" for housing with limited area was widely adapted. It was recognised that the area standard could be improved in terms of the development of living conditions. Correspondingly, the dwellings, which were ready for future change, were advocated by the authority.

In 1951, this idea was first excessively expressed as "combine short-term goal with long-term goals, but put emphasis on the latter"⁴. As a radical response, experimental projects with obviously exaggerated area standards were built. Those dwellings were proposed to be temporarily shared by more than one family, and years later they could be occupied by a single family so that the extension of the living area could be achieved. The mutual interference caused by this form came soon, which was the subject of complaint in memoirs.⁵

As an adjustment, the concept of "attaching importance to the short-term effectiveness

and giving appropriate consideration to the future" was proposed in the "Forum on Housing Standards and Architecture", which was held in Shanghai in 1958.⁶ This point of view was later echoed in the academic exchanges on housing problems in the "Third Conference of the Chinese Architectural Society" in 1961, as well as during its annual meeting in 1963.⁷ When the living area at present and in the future was rationally reflected upon, a complete with several rooms and suite an independent kitchen and bathroom was advocated. Both of them motivated the research on flexibility in the aspects of area extension and flexible allocation.

Extendible housing | The proposal for minimal housing with an outdoor veranda, dedicated by Prof. Peng Yigang (Tianjing University) in 1956, was the most prominent practice which focused on the area extension in the early years.

According to the size standard then, this proposal provided four basic suites, the area of which ranged from 15.8 m² for three to four persons to 39.1 m² for nine members maximum. The kitchen and bathroom were placed next to the public corridor, whilst the living space was half-divided into a main bedroom and a living room which could be used as children's room. Correspondingly, four lavouts for improvement of the living standard in the long run were designed. In suite B and D, it was achieved by reallocating them to small families. For example, suite D, which accommodated a family of nine, could be

³ Ibid. pp. 100. From 1937 to 1949, housing construction suspended for the continual wars. "In 1937, a war broke out between Japan and China. Soon large pieces of territory in China's north, east and south fell to the invading Japanese troops; cities were destroyed and construction activities stopped." "When the Japanese were defeated, a civil war ensued and the real estate business was not able to recover from depression."

⁴ Ibid. pp.126.

⁵ Yu Jiafeng (2009). Edited by Liu Yanhui. *Housing in China: Memoirs (1949-2009)*. Beijing: China Architecture & Building Press. pp. 19. See interview with Yu Jiafeng. "The greatest contradiction in shared apartment appeared in the kitchen and the bathroom. There was only one tap in the kitchen. Once it was in use by one family, the other families could do nothing but wait. Similar problem could be found in the bathroom especially in the morning. Furthermore, we had to be fully dressed even if we went to the toilet in the midnight."

⁶ Zhang Jie & Wang Tao (2001). Edited by Lv Junhua, Peter G. Rowe and Zhang Jie. *Modern Urban Housing in China 1840-2000*. Munich: Prestel Verlag. pp. 154. The concept of housing as a suite was emphasised in this conference. It was insisted that "each family should have its own apartment, complete with kitchen and bathroom". Not only shared suite by several families, but also "the sharing rooms by several families, but also "the sharing rooms by several family members" were criticised. It laid a foundation for the researches on flexible subdivision of internal space. ⁷ Ibid. pp.158.



Fig. 1: The proposal for minimal housing with an outdoor veranda. (Source: by author. According to Peng Yigang, Qu Haoran (1956). A Suggestion of the Minimal Housing with Outdoor Veranda (在住宅标准设计中对于采用外廊式小面积居室方案的一个建议). *Architectural Journal*. 1956 (06). pp. 39-48.)

reallocated to a six-person family. This change could be achieved easily by rearranging the furniture instead of changing any internal walls. This method meant a lot at that time when the living standard was judged by the living area per capita. More creatively, in suite A and C, the extension could be achieved by connecting the adjacent suites. Small changes on internal walls cannot be avoided when making the new layout practical and rational. For example, three suite A's could be connected by removing a bathroom and a non-bearing partition between kitchens. The new suite then had three rooms and the area was increased to 47.6 m² (Fig. 1).⁸

This design bore the characteristic of universal design. After fixing the basic elements, the overall layout of the whole building could be flexible by arranging the basic suites in different ways. Eight possible forms of overall layout were provided in this proposal and the orientation had been taken seriously. Under the "leftish" policy on the improvement of living standards, the design represented a rational thought in which the desire of providing a favourable living environment, both at present and in the near future, was expressed. Although never being realised, it provided a valuable reference for research in this field.

This concept was realised in Huolan Xincun (Shanghai) in the late 1970s. In this project, a staircase served six apartments, where four were two-bedroom apartments and two were single-bedroom suites. In the condition that one-room apartment was challenged, this project emphasised its

⁸ Peng Yigang, Qu Haoran (1956). A Suggestion of the Minimal Housing with Outdoor Veranda (在住 宅标准设计中对于采用外廊式小面积居室方案的 一个建议). *Architectural Journal*. 1956 (06). pp. 39-48.



Fig. 2: Extendible Apartments in Huolan Xincun. (Source: by author. According to Zhu Yaxin (1979). Step-type Apartment Building and Mobile Dwelling Units (台阶式住宅与灵活户型: 多层高密度规划建筑 设计的探讨). *Architectural Journal*. 1979 (03). pp. 43-48.)

advantage in relieving quantitative shortage. In addition, the inherited unsustainability was supposed to be healed by preserving the possibility of future extension. Provided that the family in a single-bedroom apartment lived a relatively simple life, the were matching facilities deliberately simplified. When necessary, the adjacent two apartments with different sizes could be connected. The extended suite could hold two bathrooms and one kitchen - the other kitchen might be used as storage. In the description of this project, the architect particularly emphasised the advantage of this form for families with two generations. The humanistic care expressed in this project had a positive influence on housing design at that time (Fig. 2).⁹

The design proposed by Chen Deng'ao in 1979 practised the area extension in a different way, for he took the housing unit instead of an individual suite as the basic element in his research. His idea was finally illustrated through two designs. In project A, a staircase served four two-room apartments. When the living standard was improved in the future, it could be converted into three apartments being served by one staircase. The average building area for each family rose from 46.8 m^2 to 62.5 m^2 . In project B, the unit with five families could be occupied with four apartments in the long run. The unavoidable changes included the movement of walls, bathrooms, and kitchens (Fig. 3).¹⁰

This method was confirmed by Wu Guoli in 1981. In his article, he insisted that area standard should be tightly controlled instead of blindly increased. He predicted that the future increase could be achieved changing the number of suites by surrounding a common staircase - for example, three flats being served by one staircase could be re-divided into two. Meanwhile he designed the working process in four steps: to design the living standard in the long run; to make latent design which was fixed according to current situation, whilst taking future

⁹ Zhu Yaxin (1979). Step-type Apartment Building and Mobile Dwelling Units (台阶式住宅与灵活户 型: 多层高密度规划建筑设计的探讨). *Architectural Journal*. 1979 (03). pp. 43-48.

¹⁰ Chen Deng'ao (1979). A Preliminary Discussion about the Problem of Archtiectural Design in the Industrialization of Housing Construction. (试论工 业化住宅的建筑创作问题 探索住宅建筑工业化 与多样化的设计途径). *Architectural Journal*. 1979 (02). pp. 6-11.



Fig. 3: Chen Deng'ao's Proposal. (Source: by author. According to Chen Deng'ao (1979). A Preliminary Discussion about the Problem of Archtiectural Design in the Industrialization of Housing Construction. (试论工业化住宅的建筑创作问题 探索住宅建筑工业化与多样化的设计途径). *Architectural Journal*. 1979 (02). pp. 6-11.)



Fig. 4: Wu Guoli's proposal. (Source: by author. According to Wu Guoli (1981). Housing Design towards Modernization (我国现代化住宅设计的探讨). Architectural Journal. 1981 (03). pp. 33-42.)

improvement as a reference; to make consideration on the equipment's and decoration in the future; and to complete the introduction for the future change (Fig. 4).¹¹

In the mid-1980s, with deepening reform in housing commercialization, the restriction on the standard of housing was relaxed. The increasing private dwellings raised the difficulty to the re-division of suites with different owners. Correspondingly, the necessity of extendible housing faded. However, the possibility of area extension was still reserved in some well-known projects as the secondary strategy of flexibility.

In the design for "Cuiwei Residential Quarter" in 1994, the concept was particularly expressed as the hole being reserved in the splitting wall. By closing or opening the hole, the adjacent two small apartments with independent entrances could be either separated or combined. Two possible layouts were provided to illustrate this idea. The significance of this design was far from area extension, but could be used to solve specific social problems. It was, for example, especially practical for families with two or three generations, since the third-generation was often looked

¹¹ Wu Guoli (1981). Housing Design towards Modernization (我国现代化住宅设计的探讨). *Architectural Journal*. 1981 (03). pp. 33-42.



Fig. 5: Area Extension in Cuiwei Residential Quarter. (Source: by author. According to Research Group of "Infill System in Adaptable Housing" (1995). *Drawings of Flexible Space in Well Housing*. Beijing: China Architectural & Building Press. pp. 12, 17.)



Fig. 6: Design for Flexible Allocation in Shandong. (Source: by author. According to material provided by the architect.)

after by the retired grandparents (Fig. 5). In 2008, a similar method was practised in "Little Universe" in Beijing.

Flexible allocation | For a long period, when housing construction and allocation was under the direct control of the state, how to balance the ratio of suites with different rooms was hotly discussed. The conservatives attempted to design in accordance to statistical data of family size, whilst some talented architects had proposed flexible rooms with reserved holes in competitions. By opening or closing the holes, the flexible room could be allocated alternatively to the adjacent suites. It is difficult to identify the first practice of method. According this to current knowledge, it was first conducted no later than in the 1970s in Gansu Province, not as an experimental project but as a universal design which was applied all over the district.¹² Similarly, it was also practised in Shandong province in the late 1970s and early 1980s. In this design, three two-room apartments were served by one staircase. After relocation, the three equal apartments were converted to one-room, two-room and three-room suites. According to the

¹² Gansu Standard Design Institute (1979). Research on Housing with Small Area and Multiple Rooms (关于小面积多居室住宅的探讨). *Architectural Journal*. 1979 (01). pp. 44-48.

architect of the latter practice, her design was selected from the competition for standard design in 1970s. She thought this to be an effective method to balance the ratio of apartments with different sizes. The method was in fact applied widely in Jinan city at the time (Fig. 6).¹³

The common problem in the two designs is that the creation of three-room apartments accompanied is inevitably with single-room one. The discussion on suites with only one room generated various opinions. As mentioned before, the early views emphasised its unsustainability. Additionally, in the process of reallocation, some one-room suites were abandoned and then, despite the inconvenience, shared by different families. This phenomenon was observed in the post-occupancy investigation having been conducted by Gansu Province. That was why the above-mentioned design was ceased in Gansu in 1976.¹⁴

BRANCH 2: USER PARTICIPATION

The attention on users | In 1979, dramatic changes began to take place in China's social and economic structure, which had profound influence on housing. With the process of commercialisation, the nature of housing was shifted from welfare to commodity, while the method of acquiring it was transformed from allocation to purchase. The user's preference was appreciated. increasingly And their requirements attracted wide attention of developers and architects. This trend was more obvious as people's living standards

rose and the function of housing became increasingly complicated.

The research on users was originally conducted on their family size and living pattern. In the practice, two corresponding issues were recognised. On the one hand, family size was not static but with inevitably changes. Accordingly, the family relationship could change as well. Both sociologists (Zhao Xianqiao, 1993¹⁵; Yang Shanhua, 2006¹⁶) and architects (Zhao Guanqian, 1999¹⁷) perceived this point of view. In addition, the difference of lifestyle became more obvious. Marked economic changes in the 1980s caused family consumption to grow considerably, and the rising life quality brought abundant family activities. Some early research tried to classify families according to the typical leisure activities and was designed for them.¹⁸ The types of SOHO and ageing at home, which are still practical now, share a similar concept with this tendency. It could be concluded as designing for the common characteristic of the specific group. The individual difference, which was deliberately ignored, was revealed through the various decoration activities.

¹³ Interview with Ms. Cheng Yuhua who was the chief designer of Shandong Standard Design Institute. April 26th, 2014.

¹⁴ Gansu Standard Design Institute (1979). Research on Housing with Small Area and Multiple Rooms (关于小面积多居室住宅的探讨). *Architectural Journal*. 1979 (01). pp. 44-48.

¹⁵ "Families were inclined to be divided into six categories: single person family, couple family, nuclear family, stem family, extended family and other family." Zhang Xianqiao, Hong Minwen (1993). *Residential Sociology (住宅社会学概述)*. Beijing: Social Science Academic Press. pp. 68.

 ¹⁶ Yang Shanhua (2006). Sociology of Family (家庭 社会学). Beijing: Higher Education Press. pp. 8.
¹⁷ Theo Cuencies (1991). Theorem (1991). Theorem (1991).

¹⁷ Zhao Guanqian (1991). *Housing in 2000*. (2000 年的住宅). Beijing: China Architecture & Building Press. pp. 37.

¹⁸ Zhu Changlian (1999). *Principles of Residential Building Design (住宅建筑设计原理)*. Beijing: China Architecture & Building Press. pp. 5. A typical result was recorded in this book, which is still used as the architectural learning material of national college. It classified modern families into five categories - social intercourse, domestic workshop, deskwork, housework, and recreation. And the correspondence between living activities and housing type was tentatively worked out.

It was gradually realised that the ordinary and static design methods were insufficient to solve changing problems mentioned above. Instead of assuming the user's life, some longsighted ones tried tentatively to reserve a degree of decision-making power to the occupants. The native practices could be found firstly in national design competition in the late 1970s. Afterwards, this trend was compensated by the enlightening theories and practices in Europe - the original concept was extended and the method was polished. Fruitful results were generated, which left an indelible mark on Chinese flexible housing.

Sporadic and informal practices | In the early 1980s, the user's individual choice has been conceived in a conservative way. The sporadic proposals left only one or two places uncompleted for the future user's decision.

"Stepped Garden Housing" proposed by Tsinghua University in the National Design Competition in 1985 was a typical representative. It used the grid of 3.3m*3.3m as the basic element. A suite could occupy three to seven elements. The separation of the hall from a multiple function room was half finished with a folding partition. When the partition was open, a spacious hall was created for family gatherings or entertaining friends, whilst an independent bedroom could be acquired



Fig. 7a: Picture of Stepped Garden Housing. (Source: Lv Junhua & Shao Lei (2001). Edited by Lv Junhua, Peter G. Rowe and Zhang Jie. *Modern Urban Housing in China 1840-2000*. Munich: Prestel Verlag. pp. 216.)



Fig. 7b: Layout of Stepped Garden Housing. (Source: Lv Junhua & Shao Lei (2001). Edited by Lv Junhua, Peter G. Rowe and Zhang Jie. *Modern Urban Housing in China 1840-2000*. Munich: Prestel Verlag. pp. 217.)

when the partition was unfolded. This change could be made conveniently anytime even within a day. When the living standard was comparatively tense, this method was particular effective. What's more, this form was also determined by the day-lighting requirement. In order to save land, some suites were with small width and large depth, and rooms without natural lighting could not be avoided. A flexible partition was an effective remedy to this disadvantage. This design was later realised in Beijing, Tianjing, and Yantai, and earned widespread acclaim. However, it had a limited performance in raising the building density, and as a result, it was not realised widely in China.¹⁹ (Fig. 7)



Fig. 8a: Photo of interior space. The partition between kitchen and living room was uncompleted. (Source: by author.)



Fig. 8b: Photo of Yueyahu Community. (Source: by author.)



Flexibility was reserved in four points. (1) The partition between kitchen and dining room was unfinished; (2) The partition between living room and a bedroom was uncompleted; (3) The storage could be changed to an interior staircase for area extension; (4) The width of a balcony was extended, so that it could be used as an additional room.



Layout of the top floor.



Layout of the ground floor.

Fig. 8c: Typical layout in Yueyahu Community. (Source: by author. According to Bao Jiasheng & Zhang Zheng (2000). Proper, Open, Efficient and Advanced – Award-winning Suite Design and Residence Suite Design of Nanjing Crescent Residence Community (南京月牙湖小区获奖套 型设计兼谈住宅套型设计). Architectural Journal. 2000 (08). pp. 5.)

¹⁹ Lv Junhua & Shao Lei (2001). Edited by Lv Junhua, Peter G. Rowe and Zhang Jie. *Modern Urban Housing in China 1840-2000*. Munich: Prestel Verlag. pp. 215.

The "Yueyahu Community" in Nanjing is another practice with an uncompleted spot. In his articles on this project, the architect highlighted particularly the user's irreplaceable role in housing design. And he asserted that architects should provide a helping hand for users to create their own dwelling. The final results were four-to-five storey residential buildings, the interior spatial scale of which was precisely researched. Similar to the above-mentioned design, it left the partition between the hall and bedroom uncompleted. It could be a spacious living room for the sociable family. Alternatively, by adding a partition, a bedroom was separated from the hall for families with more members. Similarly, the partition wall between the kitchen and dining room was unfinished too, so that users could determine if they preferred an open kitchen or closed one. Additionally, the depth of the south-facing balcony was extended to 1.8 m, which could be used as an additional room with multi-function. Area extension could be achieved by including the attic and underground space. There was not any advanced technology adapted in this project, nor the sliding components. The possibility for future change was merely reserved by design approaches. This suite was highly praised in the last 1990s and was awarded the golden prize at the "Bailong National Design Competition" (Fig. 8).²⁰

Support Building | In the late 1970s, universal space was advocated by some architects, which could be subdivided by non-bearing partition or furniture and changed by occupants. This proposition was explicitly expressed in design competitions as proposals with large width or depth, as well as with a fixed bathroom and kitchen. The architects mentioned nothing about user participation, nor did they pay attention to the subdivision or changing process. However, the awareness on the occupant's control of the living environment emerged.²¹

Support Building, which was proposed by Prof. N. John Habraken in the 1960s, provided a helping hand not only in deepening the concept but also in achieving a rational design method. The prominent advantage of this concept was the clear understanding of the user's decision-making power. In 1981, it was first introduced to China by Prof. Zhang Shouyi (Tsinghua University, Peking. China). In her article "SAR²² Theory and Method", she made a general map of its achievements, including the design method for individual housing (SAR 65), the cooperation with computer (SAR 70), and the design for urban environment (SAR 73). In conclusion, she used British and West Germany as examples to discuss its application abroad. This discussion also implied the possibility of its practice in China.²³ Afterward, scholars in both the

²⁰ Bao Jiasheng & Zhang Zheng (2000). Proper, Open, Efficient and Advanced – Award-winning Suite Design and Residence Suite Design of Nanjing Crescent Residence Community (合理、开放、高效、 超前——南京月牙湖小区获奖套型设计兼谈住宅 套型设计). Architectural Journal. 2000 (08). pp. 4-6.

²¹ Shui Qingxun, Zhao Guanqian, Feng Lifang, Xu Lizhen, Ban Zhuo (1980). The National Design Competition (全国城市住宅设计方案竞赛评述). *Architectural Journal*. 1980 (02). pp.1-7.

SAR (Foundation for Architects' Research) was a nonprofit organisation, which was established on September 23, 1964. "Vital to the image of the SAR was the development of methods that were to clarify the design process and facilitate decision-making for all parties involved in the building process." This research office was known as two lines of studied. "The first line touched the generalities in contemporary housing construction: the various 'means of communication and coordination' at the level of the autonomous building, also known as the SAR 65 method". The second line "involved fitting supports into a city's urban-design scheme" and "resulted in the 'tissue method' expounded in SAR 73". Koos Bosma, Dorine van Hoogstraten, Martijn Vos (2000). Housing for the Millions: John Habraken and the SAR (1960-2000). Rotterdam: NAI Publishers. pp. 142-285.

²³ Zhang Shouyi (1981). The Theory and Method of SAR (SAR 的理论和方法). *Architectural Journal*. 1981 (06). pp. 1-10.



Fig. 9a: Layout of typical unit. (Source: by author. According to Bao Jiasheng (1988). Support Housing (支 撑体住宅). Nanjing: Jiangsu Science & Technology Press. pp. 70.)

architectonic field (Zhou Shi'e, 1982)²⁴ and at the sociological level (Zhang Qinzhe, Zhu Chunhua, 1984) sporadically explored this possibility.

The first Support Building project ("Wuxi Experimental Project") was realised in November 1985, with eleven buildings of two to six storeys. This design mainly depends upon the concept and methodology in SAR 65. At the Support²⁵ level, the architect, Prof. Bao Jiasheng, designed a facade with typical Chinese characteristic. The scope of each suite was determined according to the compulsive area standard in the 1980s, while the future combination of adjacent suites was also conceived. In addition, the location of bathroom and kitchen was fixed. Besides the decoration and equipment, the user's decision was restricted mainly to partitions, which was in the rank of Infill. It should be emphasised that the separation of Infill from Support indicated different investors at the same time - the former was paid by occupants



Fig. 9b: Photo of the solid model. (Source: by the architect, Prof. Bao Jiasheng.)



Fig. 9c: Photo of Wuxi Experimental Project. (Source: by the architect, Prof. Bao Jiasheng.)

²⁴ Zhou Shi'e (1982). The Application of SAR in Brick-concrete Housing (在砖混体系住宅中应用 SAR 方法的探讨). *Architectural Journal*. 1982 (10). pp. 45-47.

²⁵ According to Prof. John Habraken, the Support is determined by the architect and can be mass-produced, while the Infill is decided by the users and expresses their individuality.