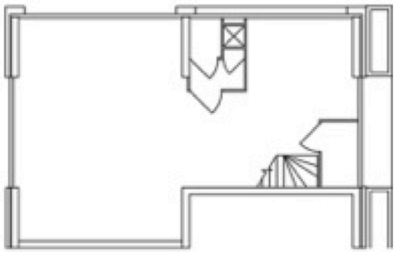
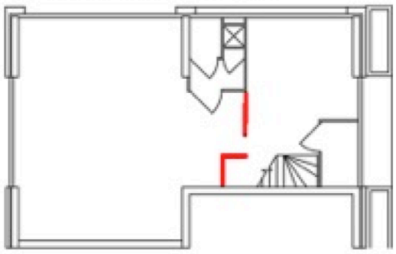


Fig; 14(1): Original design



Fig; 14(2): After change

Fig. 14: Family 220. (Source: by author.)

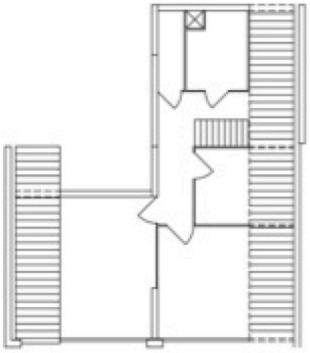


Fig. 15(1): Original Design

Fig. 15(2): After change

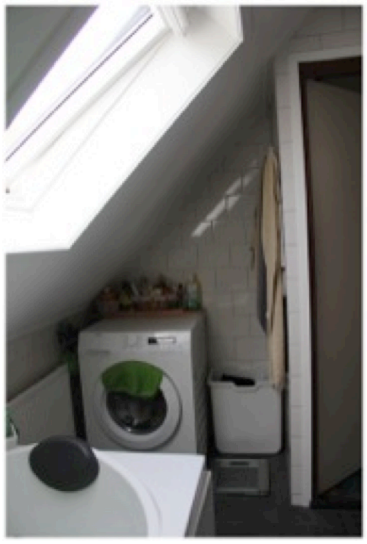


Fig. 15: Family 228. (Source: by author.)

Although there were some regrets in the participation process, the users were still generally satisfied with their house. Over the past years, they produced a special texture for their walls in the living room, changed some equipment in their kitchen, secured the internal staircase, but never made any noticeable change on the partition, since the layout was sensible for them.

It is admitted that although having participated in the design process, the unsatisfactory aspects of the housing was unavoidable. They could have arisen through some "mistakes" in the design process like Family 220 or by the new demand like Family 228. Both of the two families devoted themselves to change.

The biggest complaint of Family 220 was on their spacious living hall that was connected with the kitchen. The occupants regretted their original decision after living there for some time. Consequently, they separated the two spaces by building a

partition. Meanwhile, storage was created (Fig. 14)

> We had an open kitchen connecting with the living room at the very beginning. My wife and I decided it together with the architect. However, as time goes by, I felt the living room was much too big with the kitchen, and I did not like this form any more. Furthermore, in the winter all the heating in the living room went upstairs through the kitchen. So I added a partition with a door and a closet to make our living room isolated. My wife made all the models on the shelf. Now in the winter, we only need to close the door to keep the living room warm.[41]

The renovation in Family 228 is the most prominent design, as they changed a lot of equipment in the kitchen and bathroom. When the washing machine was installed, the bathroom in the upper floor became crowded. Due to this, users moved a portion of the partition to spare some space (Fig. 15).

In the second class, five temporary families were interviewed. These tenants spent less than ten years in the community; three of these families have been settled for only around one year. These families used their current suites as transitional housing. Three families had composed a specific schedule of moving out. Correspondingly, none had conducted much obvious change although they had been bothered by some problems. The typical cases could be seen in Family 67, 314b and 173.

Family 67 was unsatisfied with the relative location of the kitchen and the internal staircase. In addition, they felt the bathroom was too small. However, they have no plan to change this.

> When the door of kitchen is open, it will knock our staircase, and you cannot go anywhere. So we removed this door. That is the only thing we changed. (……) The bathroom is not good as well. It is too small, and difficult to be extended except moving the adjacent wall. I know this change is possible, however, we do not have this plan. It is too complicated for us, to move the wall and re-arrange the related pipelines. The house is not mine. It is better if the owner could change that.[42]

Family 314b has a special unit, whereby the entrance and main bedroom are located on the ground floor whilst the living room and secondary bedroom are on the upper floor. The parents feel this floor plan is inconvenient to look after their little son who lived upstairs.

> As my son is still young, it is not convenience for us to take care of him. (……) I know it is possible for us to re-divide the internal space to solve this problem, but it is too complicated. We plan to leave here for only one year. It is not so necessary for us.[43]

Family 173 is a new couple with a probable plan of renovation. The couple discovers the small room upstairs is not suitable for their future baby as the water heater is found inside. As a result, they may re-divide their bedroom when the first child was born. However, they also said finding a new apartment in this community might be an easier solution.

Between the above-mentioned two groups, there are many tenants who are not the original residents but have spent a significant amount of time in this community; they were termed the ***third class***. In the long period, these tenants possess deep affection to their housing and

[41] Interview with Family 220. Sept. 20th, 2014.

[42] Interview with Family 67. Sept. 20th, 2014.

[43] Interview with Family 314b. Sept. 25th, 2014.

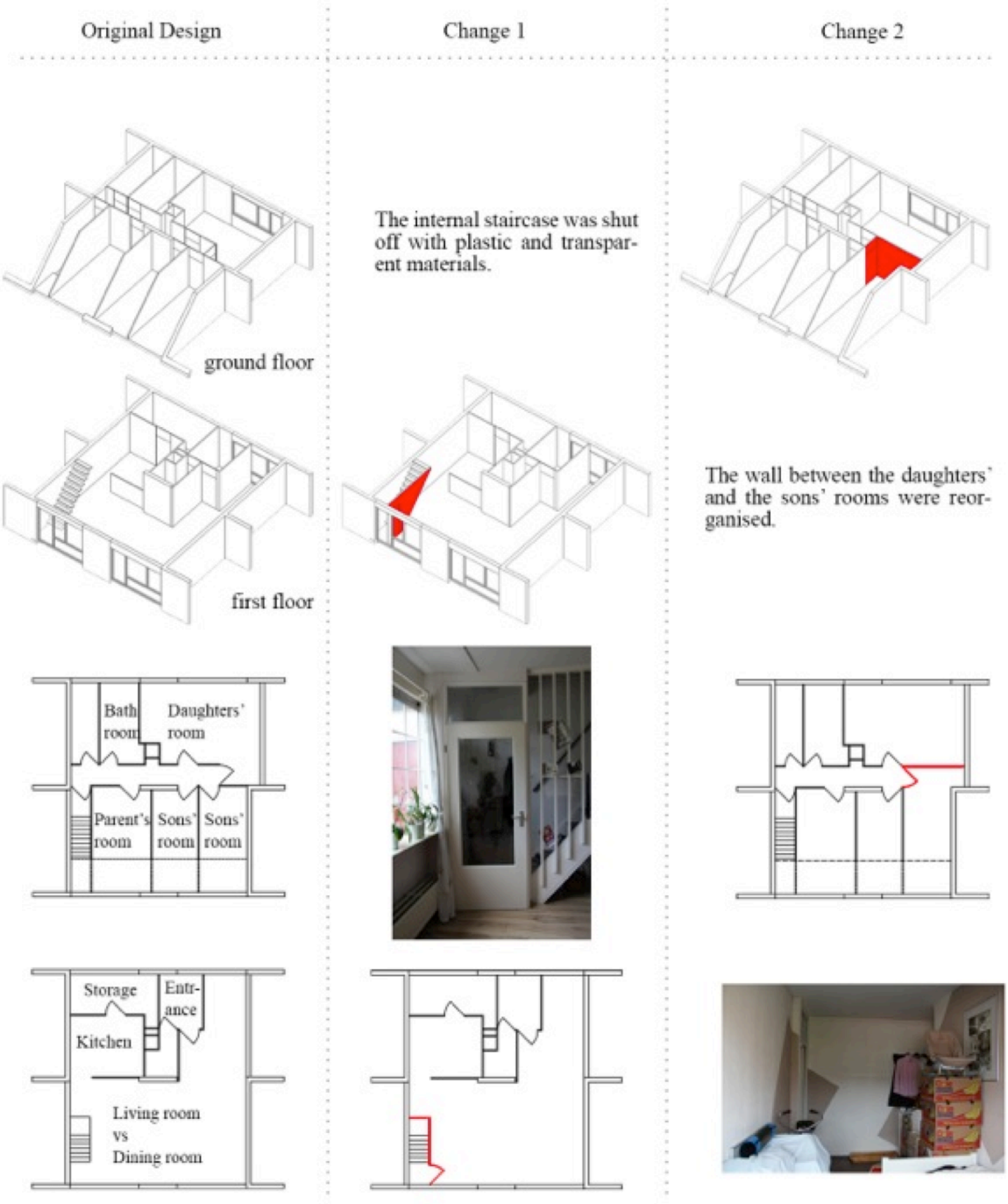


Fig. 16: Family 246. (Source: by author.)

living environment, whilst understanding their units clearly. Some interviewees have made enlightening renovations, in which Family 246 is a representative example for its sensitive attitude towards change.

Family 246 is a duplex apartment, whereby the lower floor is designed for family gatherings, whilst the upper accommodates four bedrooms. After the original tenants had moved out, a middle-aged couple rented it with their eight children on July 1st, 1986. Within twenty-eight years' living, alternations were conducted to "correct the disadvantages" in the original design (Fig. 16).

The first "shortage", which was found shortly after moving in, was the inefficient heating of the lower floor. It was found that the rooms upstairs were always warm while the living room on the ground floor was much colder. To respond to this problem, they shut off the internal staircase using plastic and transparent materials to avoid the heated air going upstairs. The door to the staircase was initially transparent, but was changed to a wooden one to prevent the young children from knocking into it.

After some years' of living, the grown children noticed the unreasonable arrangement of the upper floor. The daughters found it was unnecessary to have two doors for their room, while the sons in the adjacent room found the corridor occupied too much space and their bedroom was over-crowded. Correspondingly, the children launched a renovation by themselves, in which the sons' room included a part of the corridor.

Almost in the same time, the four daughters, who shared the spacious bedroom, wanted to divide their bedroom into two. However, this idea was not carried out. After some years, this requirement seemed to be become decreasingly important as the daughters left their parent's house one by one. Over the last year, the youngest daughter got married and also left the home.

> My four daughters lived in one bedroom, two were in this side with bunkbeds and two were on that side. We wanted to add a wall here to separate the room into two for a little privacy. And we were allowed to do it. But we gave this idea up because it was too expensive. We had to pay an extra to divide the big window into two small ones. In addition, it was better to have a big room, provided their friends would come and live here. At last we decided we could not change this room.[44]

Currently, a new renovation was conceiving in order to welcome the man's ninety-year-old mother who would be accommodated into the daughters' old bedroom. In order to provide and ensure an easy life, a mini kitchen would be planned upstairs, and an internal elevator was proposed to overcome the inconvenience caused by duplex form.

The user's dynamic response to the "mistakes" of house was also found in Family 290 and Family 177. The former composed of a half-closed kitchen resulting in indirect daylight. Once the second tenant moved in, two partitions around the kitchen were lowered. However, in some cases, the "mistake" was to some extent subjective, and referred to the point that went against the next tenant's individual preference. Take Family 177 for example. Having spent sixteen years in the unit, the strong individuality of middle-aged tenant was first represented through the overall green colour of her house. Furthermore, she removed the original railing of the internal staircase, since she "felt it likened a jail". She also constructed a partition to separate the storage room from the living room because she "felt uncomfortable if she saw the storage as soon as she entered house".

SECTION 3:
WUXI PROJECT

1. Basic Information

At the northern foot of Hui Mountain (Wuxi, China) is a site with a group of residences with typical Chinese characteristics. The stepped shape, pitched roof, and grey tile make these buildings stand out from the ordinary. Roaming around the community, the picturesque surroundings and peaceful atmosphere

[44] Interview with Family 246. Sept. 26th, 2014.

bring people to an untouched paradise on earth. Realized at the end of 1985, this is the first Support Building project in China, which is taken as the earliest mature practice of flexible housing in modern China.

2. Architect's Concept

Prof. Bao Jiasheng | As a background, the academic experience of the architect will be provided. Born in 1937, Prof. Bao Jiasheng became involved with architecture at the age of eighteen when he was admitted to the Department of Architecture in Nanjing Institute of Technology (which was renamed Southeast University in 1988). After five years of systematic education that paid particular emphasis on design practice and drawing techniques, he stayed on to teach after graduation while also beginning his career as an architect. His interest in Support Building was provoked in 1982 when he was sent to Massachusetts Institute of Technology (MIT) as a one-year international visiting scholar. Just two years after his return, Wuxi case was realized. Both Prof. Bao Jiasheng's national educational background and his overseas experience have had a profound influence on this project, which will be discussed hereinafter.

Basic principles | Wuxi Project was conducted under two major principles, in which the architect's strong architectural views and personal preference were clearly revealed.

This project was aimed at diversification to compete with the monotony of modern city. The problem of standardization and diversification was one of the hottest topics in the 1980s. Different from his counterparts, Prof. Bao Jiasheng confirmed the advantage of industrialization and standardization. Influenced by Prof. N. John Habraken's idea, he attributed the lack of diversification to the absence of users in the design process. As a result, he was convinced that favorable conditions should be provided for users' further activity. This concept, together with modular systems for industrial production, was reflected deeply in his management of basic dimensions.

Furthermore, being tired of strip-shared buildings, Prof. Bao Jiasheng decided to create a modern, residential building with notably local characteristics. As a result, traditional housing had a great influence on this project. This choice was by no means accidental. It was deeply rooted in his drawing practice of historical buildings and strong interest in the field of Chinese Architectural History during his undergraduate years. However, it is most clearly reflected in his MIT years, when he made an intensive comparison between traditional Chinese housing and Support Building in his second paper on flexibility.[45] His personal preference of traditional residences, especially vernacular housing in the southeast of China, was embodied especially in the arrangement of layout as well as the organization of exterior space. This preference provided the special flexibility for this project.

Design for individual building | As the site was unknown, the harmony of the building and its surrounding was not considered at the beginning of the project. Instead, the architect paid his main attention to the layout of an individual building.

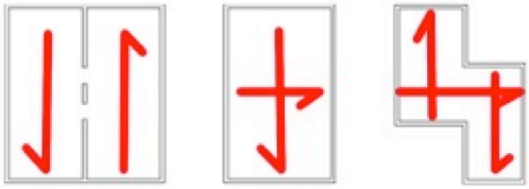
The design took "a family" as its basic research subject. It was "selecting a seed" for the architect.[46] This idea was not something new, but had already been used in the universal design that was widely adapted in Tianjing in the 1980s[47]. What is

[45] Bao Jiasheng (1984). SAR in China. *Open Building International*. 1984 (09).

[46] "I wish to cultivate a fine seed, and then it would germinate and hybridize, so the new forms would be gained." In Prof. Bao Jiasheng's interview. April. 25th. 2014.

[47] Dong Lemin, Zhang Feifei (1982). Standardization and Diversification in Housing

special in the Wuxi project was the flexibility embedded in the basic element. The form was developed on the base of a critical analysis of the Keyenburg Case in the Netherlands, and large-span practice that was discussed widely in China. For the former, the flexibility was limited in the depth direction, while for the latter the cost was dramatically increased for the large-span structure, although it provided flexibility in both width and depth direction. Based on the analysis of the advantages and disadvantages of them, Prof. Bao Jiasheng finally took two staggered rooms as his basic element. This was prominent characteristic in his research (Fig. 17).



(a) (b) (c)

a. Keyenburg case
b. Large-span practice
c. Wuxi case

Fig 17: The Comparison of flexibility in Keyenburg Case, large-span practice and Wuxi Case. (Source: by author. According to Bao Jiasheng (1988). *Support Housing (支撑体住宅)*. Nanjing: Jiangsu Science & Technology Press. pp. 61.)

The specific dimensions of the "seed" were, first of all, restricted by regulation of the state governing the area of urban housing.[48] Meanwhile, the pursuit of flexibility specified as multi-purpose rooms, had a decisive effect on the detailed sizes.

> The width of 3.6 m is wonderful for a bedroom. When the adaptability is taken into consideration, 3.6 m is not sufficient. As mentioned above, for a bathroom and a kitchen 3.3 m is acceptable. If an entrance is added, however, we may need more than 4 m. And another phenomenon - for a family with two children of opposite sex, two independent bedrooms are necessary when one of them reaches fourteen years old. Consequently, it will be better if the large bedroom is possible to be divided into two small rooms. (.....) The (clear) width of each small bedroom cannot be less than 1.8 m. And I also take the size of living room into consideration. (.....) Finally, I fixed 4.2 m as the width of the large room, for the maximum span of hollow slab was 4.2 m. (.....) The cell was fixed in this stage.[49]

Meanwhile, the "Infill," which was expressed as the partition of living space, was separated from the "Support," which was specified as the entrance, bathroom, and kitchen.

The architect's preference for a traditional, civil residence was well displayed in his creation of a courtyard, which was the other prominent feature of this project. The form of a courtyard was warmly welcomed when the whole courtyard was occupied by a single family; however when the courtyard had to be shared by several families, it was seen as a sign of a low living standard and criticized harshly. The negative effect on users' privacy was the most serious deficiency. Prof. Bao Jiasheng recognized the interference caused by a shared courtyard, but he personally treated it as an opportunity in communication as well as a

Design for Tianjing *(天津市住宅设计的标准化和多样化)*. *Architectural Journal*. 1982(06). pp. 9-16.

[48] "Housing Grade 1 allowed forty-two to forty-five square meters for employees of factory and mines. Housing Grade 2 allowed forty-five to fifty square meters for ordinary cadres. Housing Grade 3 allowed sixty to seventy square meters for intellectuals with intermediate academic titles and for principal heads and deputy heads at a county level, and Housing Grade 4 allowed eighty to ninety square meters for high-ranking intellectuals and bureaulevel cadres." Reference to "Regulations on the Design Standards of Workers' Housing" and "Supplementary Regulation", 1981.

[49] Interview with Prof. Bao Jiasheng. April. 25th. 2014.

breakthrough against the indifferent neighborhood. In the interview, his concept of this problem was particularly discussed.

> (The form of the) traditional residence has been abandoned in modern times. It is reasonable. The courtyard was enjoyed by only one family in the old times. In the summer, the family members might enjoy the cool or take it as a private garden. However, it turns into a warren when it is shared by various families, and therefore the great majority of users do not like it. It is not an absolute problem for me; on the contrary, I took a dialectical attitude on it. The warren has its own advantage: users are able to meet each other easily, and then get familiar with each other - a harmonious neighborhood relationship would be achieved. It would be quite different from modern residences where people live in the same community, or even the same building, but never know their neighbors. Of course, the disadvantages have to be recognized, such as privacy, which would be weakened since "face-to-face" doors and windows are inevitable.[50]

To make up for the main drawback, independent entrances outside the courtyard were designed for some families on the ground floor, which were more inclined to be influenced by the courtyard. These entrances brought new flexibility to the community in the meantime, since the related apartments were possible to be used as stores or workshops. This was probably an unintended result, since it was never mentioned in the architect's publications on this project or in his interview with me. However, the possibility had been pointed out in Prof. John Habraken's report after revisiting this project.[51]

Besides the shared courtyard for the whole building, Prof. Bao Jiasheng also provided private courtyards for the majority of families. This concept originated from his dream of providing access to "the sky and ground." His insistence on uncovered space had a profound influence on the shape of these buildings.

> We often joked about the multi-story residence, which was far from the sky and ground especially for the users living in the middle layers. (.....) I decided to change this situation and to provide a small outdoor garden for each family.[52]

From drawing to building | Different from ordinary projects that were started by "Party A," this project was greatly promoted by the architect. Shortly after the design for the individual building was finished, Prof. Bao Jiasheng attempted to make it a reality. Since the construction land was still in the strict control of government, he had to repeat his presentation of concept and design to various government officials until he received the full support of the Department of Construction of Jiangsu Province that assigned a small plot in Wuxi for his practice.

> (.....) After working out the design, I made a model, a solid model - an architectural model for a single building and began lobbying. (.....) I firstly visited the deputy major of Nanjing City, who was responsible for urban construction. We had met each other before, so he fixed an appointment immediately in which I

[50] Ibid.

[51] "I was surprised to hear that the courtyards met with criticism and still believe the principle is sound. Finally the public spaces have also house entrances directly, which I believe is important: these will become shops and workplaces and add to the life and uses of the street." *Some comments after visiting the Wuxi city experimental project*. Provided by Prof. John Habraken.

[52] Interview with Prof. Bao Jiasheng. April. 25th. 2014.

Fig. 18: Overall view of Wuxi Experimental Project. (Source: by author.)

> explained my design. (.....) The deputy major thought this idea was very good. When I said, "Let's find a site for an experimental house," he did not reply.
>
> I then went to the Department of Construction of Jiangsu Province. There were three vice directors. Just as with the deputy major, two of them thought highly of my design, but never intended to address any real issues. However, I did not give up easily. So I explained my design to the last director, who was much younger and quite familiar with architecture. He liked my design very much and asked the housing office to find a piece of land for my practice immediately. (.....) At last, the director of the housing office found some land, a vegetable plot, for my practice - that is our site today.[53]

After obtaining the land with an area of 8,400 m², Prof. Bao Jiasheng made an overall plan with eleven buildings for two groups. Meanwhile, he designed the other

Fig. 19: Solid model of Wuxi case. (Source: provided by the architect.)

five building types which shared a similar layout and appearance with his original design. However, he did not pay much attention to the public space, but instead left that to the users. This master plan was accepted and realized immediately (Fig. 18-19).

The construction of "Infill" part needs to be further explained here. During the construction, six buildings were allocated to the relocated families. Using relevant regulations, the "Infill" parts in these buildings were designed by the architect and constructed before allocation. The remainder was bought by a factory. Although the factory manager intended

[53] Ibid.

initially to make all the buildings completely, he was finally persuaded by the architect.

3. User's Feedback

The design process of this project showed a reasonable and logical thought. What is more, it kept the possibility of change for future users. This original intention gave special necessity for a study of the users' feedback. In order to gain a general impression, two group discussions with users were organised before individual interviews.

Initial impression | Most of the initial assessments were given by users who moved in shortly after the project was completed. Those residents were generally satisfied with these buildings when they moved in. They especially emphasized the uniqueness of this project.

> These buildings are unique. You may not find any other similar buildings in Wuxi. It is an example. These buildings are designed according to the concept from the Netherlands.
>
> They are stepped, likes Siheyuan (traditional house) in Beijing. I think this shape is with better for earthquake-resistance performance. When it was built, even foreigners came to visit our house - many foreigners. Not only foreigners, but many people visited this project. The project was really outstanding then.[54]

Complaints after thirty years of use | The users' evaluations were almost the opposite when it came to their living environment at present. Their complaints were mainly about leaking roofs, inadequate natural lighting, and limited space.

Fig. 20: The destroyed celling caused by the heavy rain. (Source: by author.)

Fig. 21: The celling. One year after decoration, the celling has mould for rain leakage. (Source: by author.)

Rain leakage was the most serious problem which was shared by all families on the top floor, including apartments under the spacious terrace. This problem had been mentioned in Prof. Wu Jinxiu's investigation in 1999[55]. In other words, these families were bothered with the seeping of water for at least fifteen years. That was why they were in such an emotional state when talking about it.

> I have two apartments in Building 106 - one is on the second floor, the other is on the top floor. I really want to show you the latter. It was inherited from my father-in-law. (.....) After his passing away, we decorated his house

[54] Group discussion with users. April 26th, 2014.

[55] Wu Jinxiu, Qin Xingang (2001). Post-occupancy Evaluation of Two Residential Open Building Projects in China. *Open House International*. 19-22.

> and rented it out. You know what? Just after one month the renter moved out because the roof leaked whenever it rained. We had repaired it by ourselves, but it did not work. The apartment has been kept empty ever since. We tried to rent it out with only 500 yuan per month, but nobody wanted to come. It is also difficult to get it off our hands. We cannot put it on sale: it is my father-in-law's inheritance. Last year, a part of the ceiling fell off because of the heavy rain. Now heavy rainfall is coming. I do not know how our house may survive (Fig. 20).[56]
>
> My house? It leaks, of course. I had my apartment decorated at the end of last year. Now the ceiling has mould. Every family suffers from the leakage problem. Just look out of the window. You can see these roofs look like old clothes with many patches. It is a common problem (Fig. 21).[57]

Users were much more tolerant when they talked about other quality problems - exterior walls peeled off, some grey tiles fell down, and so on.

> These buildings are old now. After all, they have been used for nearly thirty years. The quality problem is unavoidable.
>
> Last week, a piece of grey tile dropped off suddenly. Fortunately, nobody was hurt. You know, sometimes, it happens in old buildings. So many years without maintenance.[58]

The second problem, which was widely echoed in the group discussions, was about natural lighting. The discussion on this topic received a mixed response. On one hand, it was a prominent advantage valued by residents living in the southern part. Most of their positive assessments were attributed to the good natural lighting.

> Several years ago, I moved here to look after my mother who was not good in health. And I have live here since then. (.....) My mother has passed away, but I still live here with my wife. Why? Because of the good natural lighting. (.....). As you see, I added a sunshine room so that I may enjoy the sun in my spare time (Fig. 22).[59]
>
> I started practicing calligraphy when I was very young... five years old, I think. Although I am working as a journalist now, I never stop practicing. The south-facing living room is also used as my study room. It is in very good lighting condition. And we have a corridor outside. In summer, the light cannot come in the room: it stops in the corridor because of the large angle of incidence. Whilst in winter, half of the room may be invaded by the sun. Just look at the wooden floor. It does not fade at all. It is amazing. I like basking in my room, especially on winter afternoons.[60]

On the other hand, it was an unbearable drawback for the families living on the northern side. Unexpectedly, the complaint on this problem was initiated by a man whose family was never bothered with this problem, and then complemented by other sufferers. They may have discussed this problem many times in the past years.

> (.....) Although my apartment has an excellent lighting, I must admit that the bad natural lighting is the main failure of this project. (.....) People living in the northern apartments cannot enjoy sunshine for the whole year: the southern part blocks their

[56] Interview with Family D1. April 28th, 2014.
[57] Interview with Family D2. April 28th, 2014..
[58] Group discussion with users. April 26th, 2014.
[59] Interview with Family C7. April 30th, 2014.
[60] Interview with Family D3. April 30th, 2014.

sun.[61]

> My house is dark everyday throughout the year. The situation may improve a little in the afternoon for a little while. You know, my husband and I are old now. Being far from sun exposure is not good for our health and brings us plenty of trouble. For example, we have to hang laundry in the open space. And I have to move my flowers out for their sunbath everyday (Fig. 23).[62]

The last problem that was mentioned frequently was the limited space.

> Our apartment is very small, even smaller than our upstairs neighbors. It is about 41 m². It is utterly impractical. No renovation can solve this problem, so I never decorate my house.[63]

> It will be excellent for a family with only two people (a couple). You just need to knock down only one or two walls to make the house comfortable - with a large bedroom and a spacious living room. But it is much too small for a three-person family.[64]

Besides the whole suite, the limited area also referred to some specific rooms, for example the kitchen and dining room. Users were trying to solve this problem with renovation.

> In the 1980s, the house was acceptable except for the small dining room. We had four family members then, so I knocked the wall between the dining room and the kitchen. I had to knock it down. Otherwise, how could we have dinner together?[65]

Fig. 22: Sunshine room. To enjoy a sunbath, a sunshine room was built by the old couple in 2013. (Source: by author.)

Fig. 23: Flowers in sunbath. For the bad natural lighting, the user has to move her flowers out for their sunbath everyday. (Source: by author.)

> The kitchen was so small. It was simply unbearable. As soon as I moved in (in 2004), I removed the wall of the kitchen. I did not want an open kitchen, but I had no choice.[66]

User's Initiative | The community was full of users' creative work that was specified as renovation activity. There were sixteen families with obvious renovations being undertaken at the time of investigation.

Their initiative could be attributed to four main factors that were particularly expressed in the following four stories (Figure 24; Table 2).

61 Group discussion with users. April 26th, 2014.
62 Interview with Family D2. April 28th, 2014.
63 Group discussion with users. April 26th, 2014.
64 Interview with Family D2. May 1st, 2014.
65 Interview with Family A1. April 28th, 2014.
66 Group discussion with users. April 26th, 2014.