Typology Research from Traditional Courtyard Housing to Old-type Lilong Housing in Tianjin, China

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Abstract: Lilong housing was the most representative dwelling house in modern Tianjin. It was generally thought that the Lilong housing was derived from the Chinese traditional courtyard housing. There are two kinds of lilong housing according to the extent of impact from traditional courtyard housing: the old-type Lilong and new-type Lilong. The former showed most characteristics similar to traditional housing, which the detailed interpretation about the evolution was neglected. Besides, the traditional courtyard housing and old-type Lilong housing in Tianjin have various forms that are ignored by previous research. Based on the method of Italian typology, this paper take the concept of level to build a uniformly classification system, bringing the two types of dwelling house into a same method. On this basis, this paper further analysis the typological process between the traditonal courtyard housing to old-type Lilong housing, also on the four levels. It is supplement to the history research on residence in Tianjin

1. Introduction

The traditional courtyard housing in Tianjin has been formed in 400 years since the castle of Tianjin was built in early 15th century (Figure 1a). Due to the easy accessibility to southern provinces by the Canal and Bohai, richness of resources, and the large number of immigrants in, the local architectural culture and construction technology have been promoted deeply. Tianjin courtyard housing was generally same as Beijing Siheyuan, which belong to the same dwelling system. A large amount of traditional courtyard housing constituted the urban texture of Tianjin. In 1860, Tianjin was opened to outside world, experiencing a great change in modernization and urbanization. The urban texture of Tianjin has undergone tremendous changes. As the most important component of the urban fabric, urban dwellings changed from traditional courtyard houses to modern Lilong housing, which is a new type of residence that is different from traditional courtyards.

Lilong housing developed from traditional courtyard houses, retaining the spatial layout of the central courtyard of it. Both are organized in a square courtyard, which is surrouned by a number of independent building entity, such as the main house, the wing room and the reversely-set house, forming a global dwelling house. The traditional courtyard architecture is deeply rooted. Scholars often called it the old-type Lilong housing. On the other hand, under the con-

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text of various social upheavals, some Lilong was impacted by western culture, showing the characteristic of row house as unit repetition. In a unit, the central courtyard disappeared, and the room layout is functionally oriented and connected compact to each other.

1.1. *Research on traditional courtyard housing and Lilong housing in Tianjin*

Compared with the Beijing Courtyard housing, the shape and space of Tianjin courtyard housing, also called "sihetao" (Teng, Jin, 2002), is more liberal due to the unique geographical and cultural. The most obvious feature of Tianjin traditional Courtyard is in the layout, in which the "jiandao" (arrow street) on the side to organize the traffic of different courtyards. There are both tandem and parallel transportation system at the same time in a dwelling house (Zhang, 2007). The courtyards also organize on width besides in depth (Teng, Jin, 2002). In addition, most streets including lane and hutong in the old city of Tianjin, are not straight, along which most courtyards arranged, the orientation and scale are limited, forming a special urban texture in Tianjin.

There are many studies on Tianjin Lilong hosuing, mainly focusing on the spatial form and its type, including external and internal space. The research on external space has accumulated more results, mainly focusing on the new-type Lilong. Wang, Shen and other scholars put forward different methods according to space texture (Jiang, 1993; Wu, 2013), architectural layout (Wang, Chen, 1987; Shen, 1993) and the lane structure (Wang, Chen, 1987; Sun, 2007; Li, Xu, Wu, 2000) . The study on internal space mainly refers to the the number of surrounding building entities in a courtyard in Old-type Lilong. In 1963, it was proposed that the old-type Lilong housing still follow the "house enclosing courtyard" and emphasize the traditional pattern of axis symmetry in "Tianjin Lilong Investigation Report". According to the number of building entities enclosing the courtyard, the Old-type Lilong was divided into four-side type, three-side type, two side type, one -side type and lock type, whose forms are also analyzed separately. Subsequent scholars followed the classification method (Wang, Chen, 1987; Li, Shu, 2010)

Above all, there are some shortage. On the one hand, the study on two residential types lacks uniform standards so that cannot be compared from a unified research perspective. On

Figure 1. *The classifications on overall layout (a.The traditional courtyard housing; b. the old-type Lilong housing).*

the other hand, there is a lack of specific interpretation on the evolution process from the traditional courtyard to Lilong housing, that is, the morphological evolution mechanism of the two residential types transformation process.

2. Typological method

Urban morphological research has a common hypothesis that there is a systematic organization in the texture, or organic attributes, in which the part and the whole, that is, the building type and texture are interdependent (A. Levy, 1999).

The British Conzen School defines the core of texture research as a town plan composed of different plan elements, and the whole of these elements is defined as a plan unit. In contrast, the Italian Cannigia School adopted an organic approach. The type of building and urban fabric is considered to be a typological process, a process that begins with the basic unit (Conzen M.R.G, 2009).

This paper uses the Italian typological process method represented by S. Muratori and G. Caniggia, introducing important concepts: type, level and typological process.

2.1. *Type*

The type of building is defined in Italian urban morphology, including two aspects: the inner essence and the external characteristics. Intrinsically, a type refers to a group of buildings that are dominated by the same architectural concept in the architectural culture in the same historical period and region. The architectural concept includes all the expectations in builder's mind before the existence of the house. While the architectural concept is determined by the specific architectural culture (Caniggia G., Maffei G.L., 2001).

In terms of extrinsic features, a building type refers to a group of buildings with certain or a series of common features. These common features include similar functions, similar structural distribution planes, and similar construction purposes. The extrinsic character is determined by the intrinsic nature of the type of building, ie the architectural concept (Caniggia G., Maffei G.L., 2001).

2.2. *Level*

Caniggia interprets the human environment as built object and divides it into four dimensions that are related to each other : buildings, building group, city, and region. Each built object is a complex entirety consisting of an element, elementary structure, structure system, and organism. Therefore, the built environment is an organism composed of all parts, and each component is also an organism (Moudon A.V., 1994). The organism is the research object, the element refers to the small-scale composition in the direction of the organism and related; the structure refers to the combination of elements not directly related to the organism; the system refers to the secondary organism which has a certain relationship with the organism. Caniggia uses the city as an organism, the block as a system, the block as a structure, and the building as an element; and interprets the interdependence and interaction between the four levels from the smallest-scale: building (Caniggia G., Maffei G.L., 2001).

2.3. *Typological process*

As a time-related factor, diachronic study the origin of building types. The type of building in the later period was based on the type of building in the earlier period. Both its intrinsic nature and its extrinsic characteristics are inherited from early types. By analyzing the early types, it is possible to derive architectural concepts such as the reasons for the type construction and the way of use (figure2).

The study of typological process is to compare the phenomenon of building type in the diachronic system from the synchronic prospective (Shen, 2010). The synchronic system refers to the classification of existing building types based on the current period. The type of building diachronism refers to the causal relationship between the same type of building and its past form. Therefore, the classification method using type processes must be guided by source and process.

3. Classification based on level

The traditional courtyard houses and old-type Lilong housing in Tianjin are centered on the courtyard space, with the surrounding buildings forming the whole residential group. The composition in a residential group is very complex and there are multiple levels (figure 3). First of all, multiple courtyards may be contained in a residential group. Secondly, in a courtyard there are many buildings. Further, a building entity contains multiple rooms.

The difference between the two types is that the traditional courtyard is built separately by a family, and the old-type Lilong housing is built uniformly on a scale, which is made up of repetitive units. In order to classify and analyze under the same standard. a residential group is regarded as an organism in the traditional courtyard housing and old-type Lilong housing. Thus, a courtyard is regarded as structure system. The relationship between different courtyards will be discussed in this level. The building entity is taken as the elementary structure, the relationship between building entities is included. The room is the element.

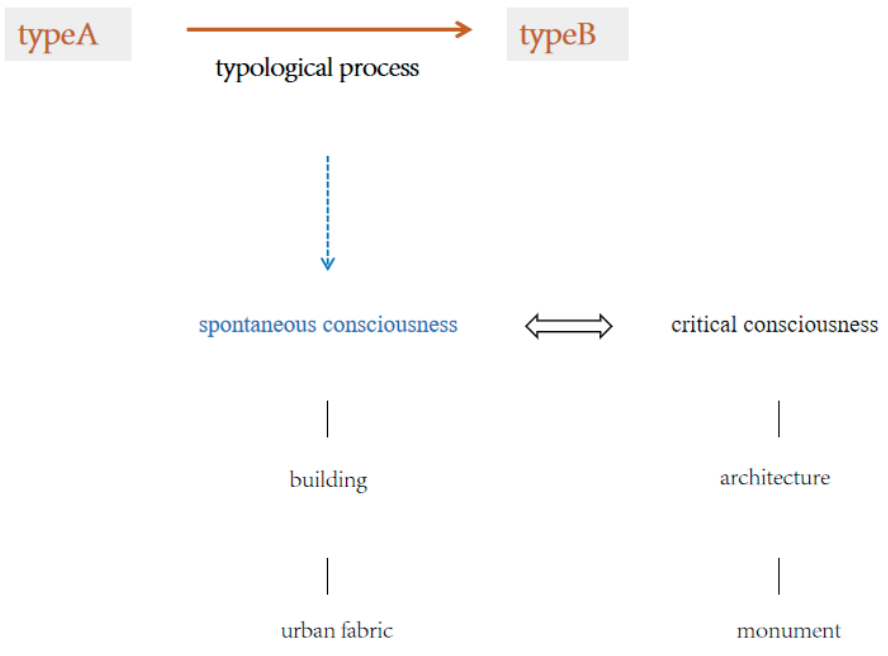

Figure 2. *The typological process.*

3.1. *Structural system: courtyard*

In a residential group, the relationship between different courtyards determines the most important spatial structure. According to the number of courtyards, the traditional courtyard can be divided into one-courtyard house, two-courtyard house and multiple-courtyard house, which includes three or more courtyards. The old-type Lilong housing is divided into one-courtyard housing and two-courtyard housing (figure 4). In Tianjin, the relationship between different courtyards is more complicated and diverse. In addition to the tandem traffic organization between different courtyards, that is, arriving at the backyard through the front yard, there is also parallel traffic, a unique form in Tianjin, which is to set up an arrow on the side of two courtyards. The privacy of the two courtyards is not affected by each other.

3.2. *Elementary structure: building entity*

In this level, the relationship between building entities will be discussed. The number of enclosed building entities is most important. Attention was only paid to the number of enclosed building entities in previous studies, according to which the traditional courtyard housing can be divided into four-side housing, three-side housing, two-side housing and one-side housing. The old-style houses are divided into four-side housing, three-side housing, two-side housing and one-side housing (figure 5). Also, the buildings in different locations are named according

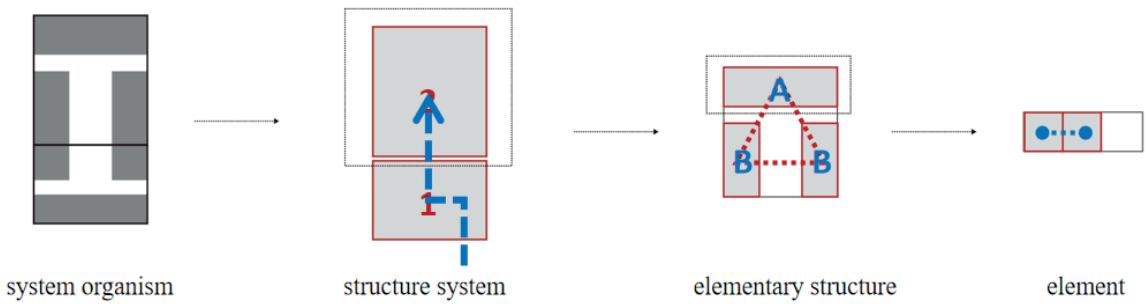

Figure 3. *The level in the courtyard house.*

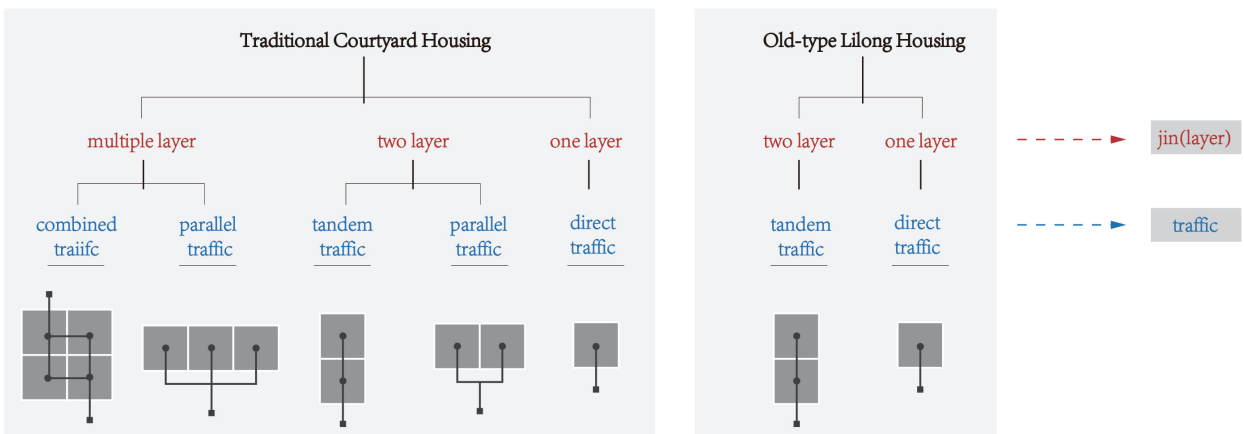

Figure 4. *The classification on structural system: courtyard.*

to the hierarchical relationship between the buildings. The main-room building, in the most central position of the courtyard usually facing south, used for the parents of the big family, is named A, which means the highest grade,. The wing-room building is located on the side of the courtyard for the children to live in, followed by B. The downside building is located at the entrance and faces north for guests to live or perform other functions. The lowest level is C. According to the method above, in traditional courtyard, the four-side housing includes one type: A+B+B+C; the three-side housing includes three types: A+B+B, B+B+C, A+B+C. The two-side housing includes three types: A+B, B+B, B+C. The one-side housing includes B type. In old-type Lilong housing, the four-side house includes A+B+B+C, the three-side housing includes two types: A+B+B, B+B+C. The two-side housing includes B+B and A+B, the one-side housing B type.

3.3. *Element: Room*

The room is taken as element. In the traditional courtyard in Xigu, there are four basic types of room arrangement in a single building entity. The room is named according to the different characteristics. The living room and bedroom directly connected to the courtyard are "M", and the living room and bedroom accessed through other rooms are "m". The living room and bedroom are the main functions. The ear room directly connected to the courtyard is "S", and the ear room that enters through other rooms is "s". Since the traditional courtyards are mostly made of wood, the rooms are arranged in three or five room on width. Therefore, the traditional courtyard includes the five room type named "three bright rooms with two dark rooms" (s-m-M-m-s, S-m-M-m-S) and three room type named "one bright room and two dark rooms" (m-M-m). That is to say, there is an entrance in the central room, the dark rooms on two sides enters through the central room. The bright room in center is used as receiving guests and the living room. The dark room is used as a more intimate function such as study room and bedroom. In addition, there is a special type of room, which is attached to both sides of the main house, known as ear room. The most obvious difference between "three bright rooms with two dark rooms" and "one bright room and two dark rooms" is the ear room. Therefore, in a single building, different rooms also assume different functions and have different connections to the external space.

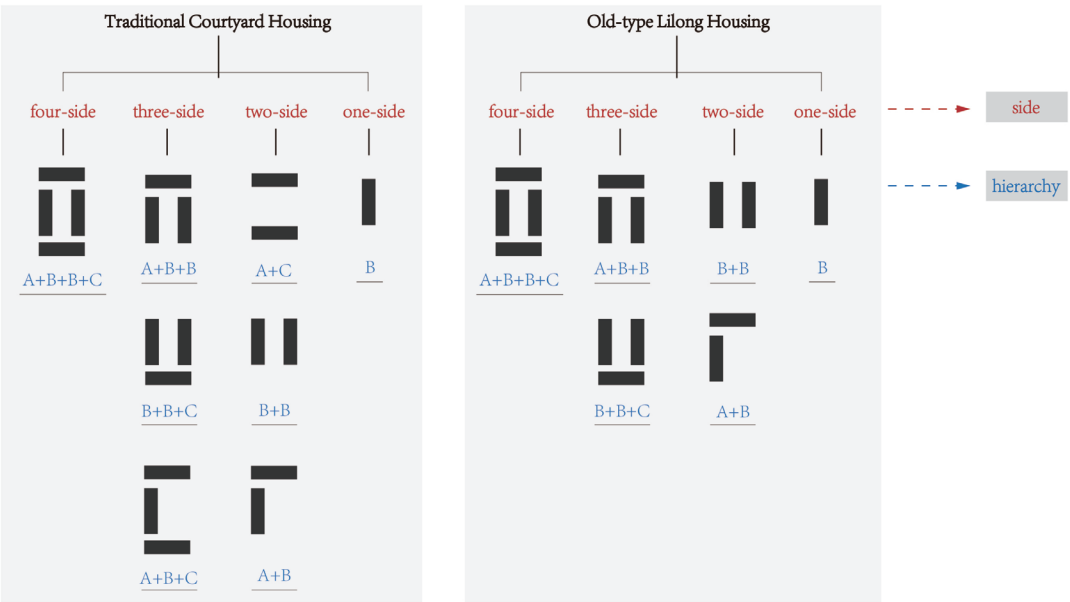

Figure 5. *The classification on Elementary structure: building entity.*

In the old-type Lilong housing are included three types: "three bright rooms with two dark rooms" (M-m-M-m-M) and "one bright room with two dark rooms" (m-M-m), double-room suite (M-m) and one-room-for-one-family type (M) (figure 6). The "three bright rooms with two dark rooms" (M-m-M-m-M) has the difference between the traditional courtyard housing and old-type Lilong housing. The later is more liberal. The width of the ear room is similar to that of the main room and the bed room. Besides, it can be accessed directly from the courtyard. It can also be used as main function such as a living room and a bedroom. In addition, in the type of the two-room suite, there are two directions the room connected in the old-type Lilong housing, both on width and in depth. While the one-room-for-one-family type (M) is the most common form in the old-type housing, which various functions in a family like living room, bedroom, storage are combined in one room.

4. Typological process analysis based on four levels

The typological process analysis from the traditional courtyard to the old-type Lilong housing is based on the classification study above. In this paper, one example will be taken to explain the process.

The four-side courtyard housing is a typical form of the traditional courtyard in Tianjin (Figure 7a). On one hand, it has the general characteristics of the northern courtyard dwelling housing system in China. With two courtyards, the front yard is narrow and the back yard is more spacious, which assumes the main function in a family. This kind courtyard has enough lot to build up, which can reflect the builder's personal will. The room arrangement is "one bright room with two dark rooms", which is the traditional form. On the other hand, it also has the unique feature. The arrow street is set up to organize the traffic of two courtyards, which is the most obvious difference in Tianjin to Beijing.

The two-side Lilong housing is the most important and typical form of the old-type Lilong housing (Figure 7b). Two building entities are contained in each courtyard. Compared with the traditional courtyard, it still encloses a courtyard by wall and buildings, retaining the courtyard space. In a building entity, the room arrangement takes the one-room-for-one-family type, which is the most effective way that can contain more families.

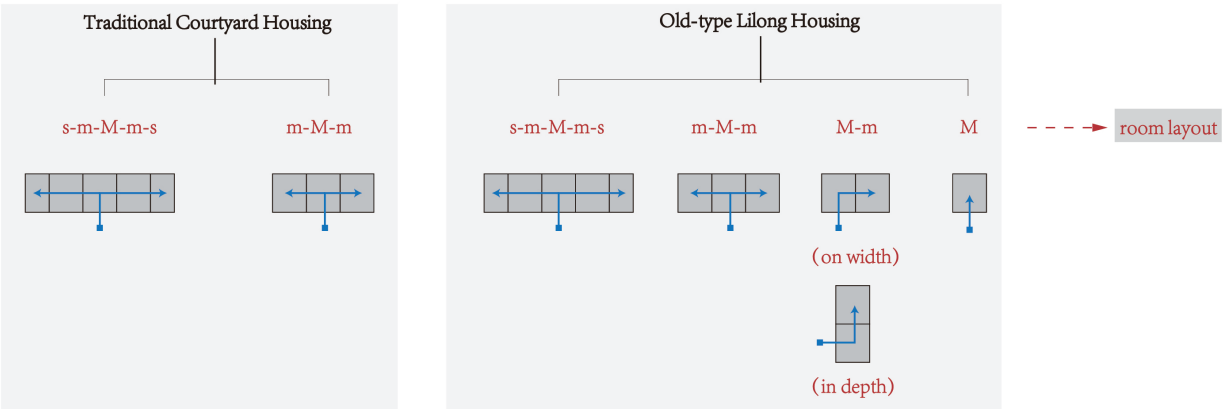

Figure 6. *The classification on Element: Room.*

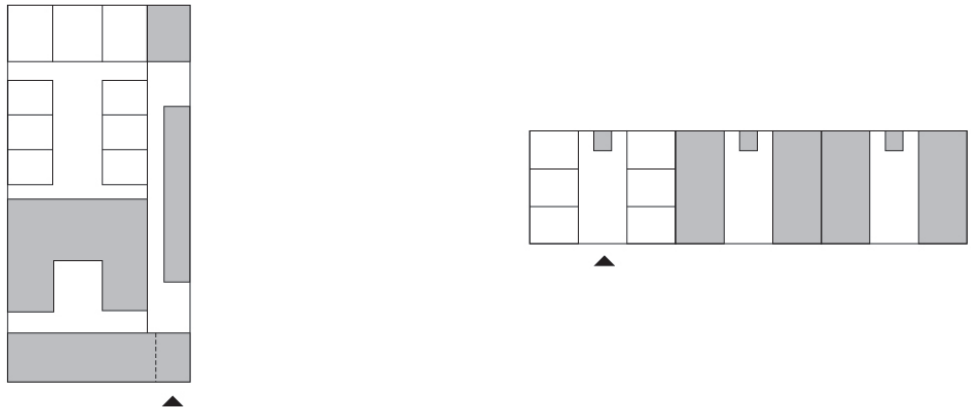

Figure 7. *a.The four-side courtyard housing b.The two-side Lilong housing.*

4.1. *Organism: Residential group*

The whole residential group is enclosed by walls and buildings. In this level, only the relationship between courtyards is discussed. Due to the increasing need for cost savings and decreasing privacy requirements, some old-type Lilong housing do not have a courtyard door or continuously enclosed wall, but the building entities retain the traditional form. In this way, however, courtyard is the important space to organize the space and assume daily life. Thus, the space characteristics and function of courtyard have not changed.

From our-side courtyard housing to two-side old-type Lilong housing, the repetition of courtyard occurred (figure 8). The layout of courtyard is also diverse when repeating. . In one piece of Lilong, the courtyard units are arranged side-by-side type, head-to-tail type, back-to-back type, face-to-face type, same way type, and quadrilateral type.

In general, the courtyard is generally replicated in the width direction. In one piece of Lilong, the courtyard units are arranged side by side, head-to-tail, back-to-back, face-to-face, in-situ, and quadrilateral (figure 9). When the social environment in Tianjin changes and the population increases, the living needs rise sharply, courtyard repetition is the easiest way to accommodate more families without no special design.

4.2. *Structural system: courtyard*

In this study, the four-side courtyard housing contains two courtyards wih a arrow street, and two-side old-type Lilong housing contains only one courtyard. From the former to the latter, the most important change that has occurred is to remove the arrow (figure 10). The arrow is a unique form in the traditional courtyard of Tianjin. On the one hand, the arrow street occupies lot width, which is the most important factor determining the land price. More importantly, the existence of the arrow is due to the hierarchy between the courtyards and privacy requirements. In the old-type Lilong, the homogenized living mode makes the hierarchy disappear. Therefore, the arrow disappeared.

Besides, from the traditional courtyard housing to old-type Lilong housing, it can be seen that the partition wall between the two courtyards disappears and the courtyard space merged(-figure 11). This also means the homogenization of the living space. In the traditional courtyard

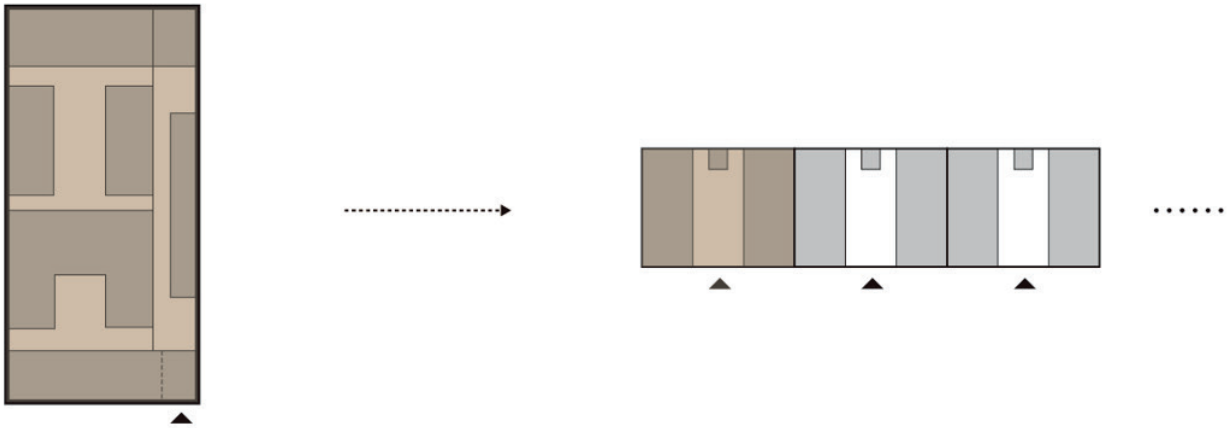

Figure 8. *The repetition on organism residential group.*

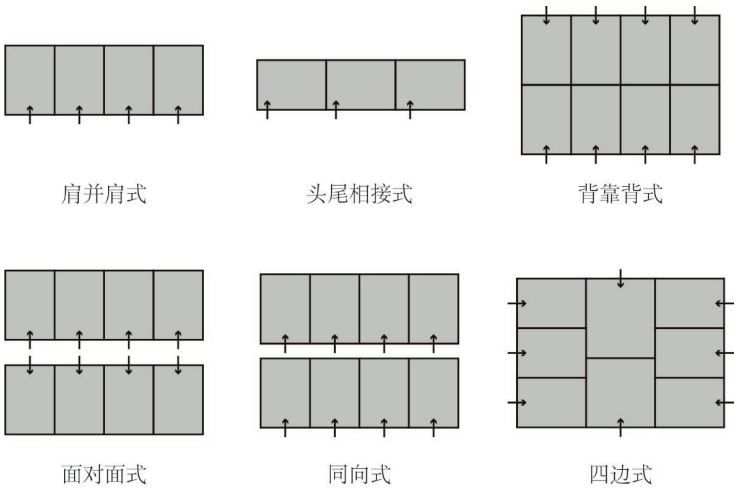

Figure 9. *The form repetition*

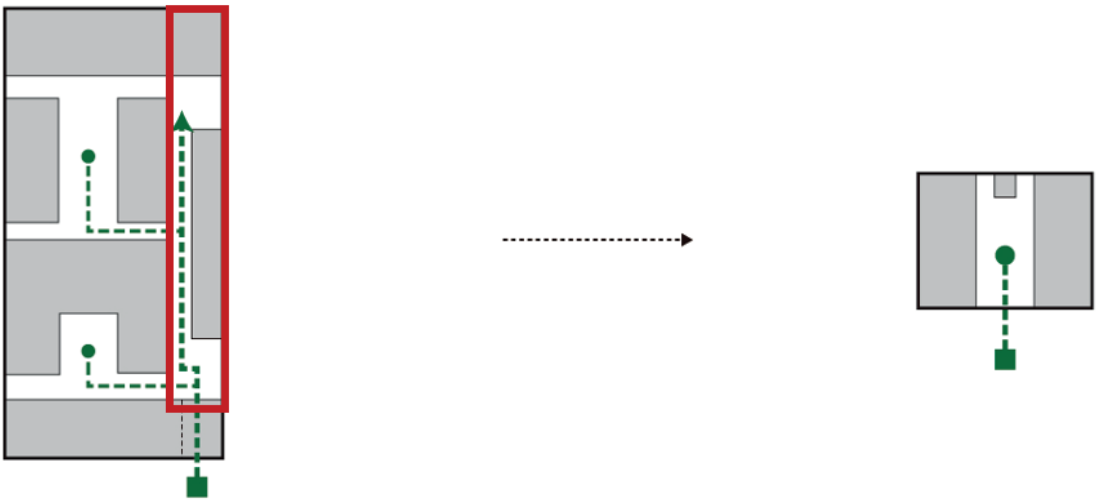

Figure 10. *Arrow street removed on structural system courtyard.*

housing, the courtyard space is graded. The backyard is ranked higher than the front yard. The front yard is a narrow rectangular shape, and the backyard is close to a square, assuming the main life function. In the two-side old-type Lilong housing, the hierarchy disappears. All residents can share a same courtyard space.

4.3. *Elementary structure: building entity*

In this level, the building entities in one courtyard are discussed. From the four-side courtyard housing to two-side old-type Lilong housing, the proportion of has remained basically unchanged in one courtyard. However, the building entity is removed inside the courtyard(figure 12). In this case, the main room building entity has been removed in a courtyard, breaking the hierarchy and forming a more homogeneous living mode. In the traditional courtyard housing, the existence of the main room makes the space allocation more complicated. The main room is higher than the two wing room buildings on the both side, while the two are the same. In the old-type Lilong housing, the main room building entity is completely removed. The courtyard space has also changed from the original T shape to rectangle shape, a more simple, homogeneous space. From the perspective of the proportion of buildings in the entire courtyard, the two types are basically similar. But the later is a new mode of living that is more homogeneous.

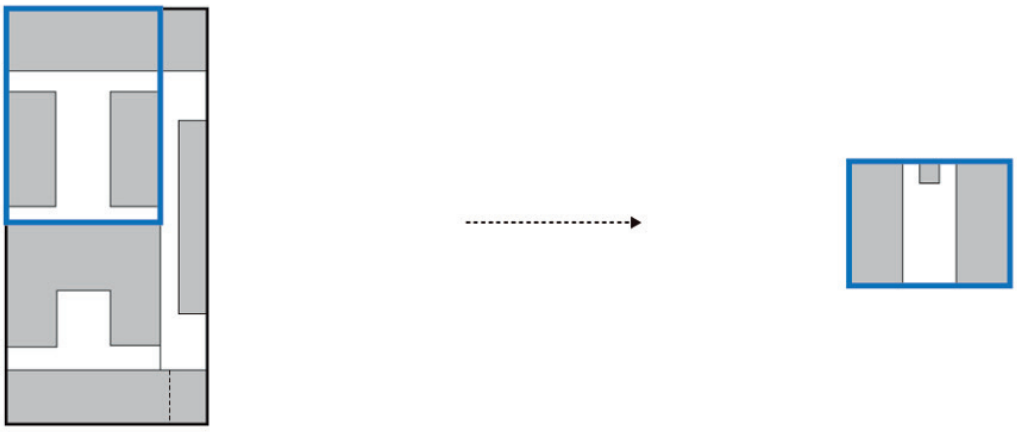

Figure 11. *Space merging on structural system courtyard.*

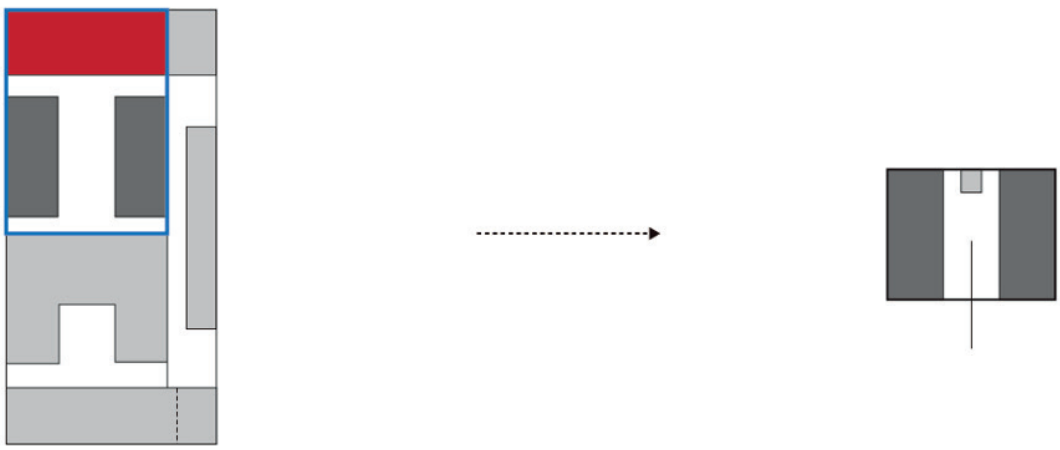

Figure 12. *Building removed on Elementary structure: building entity.*

4.4. *Element: Room*

In this case, the room changed from "one bright room with two dark rooms" (m-M-m) to one-room-for-one-family type (M). The change between two types of room arrangement is to remove the rooms on both sides(figure 13). The former type accommodates one family unit and the living room connects two bedrooms. It can separate the living space of parents and children. The function is very detailed. As the number of households in a building entity increases, the space occupied by each family unit decreases. The emergence of the M type is for larger living needs. In this form, the functions of living room and bedroom are combined in one room.

5. Discussion

This paper supplements the research of urban texture with architecture as the entry point. The morphological study and classification of the traditional courtyard housing and the old-type Lilong housing are supplemented in detail. By interpreting the evolution from traditional residences to modern residences, it fills the gap in the history of Tianjin's residential development.

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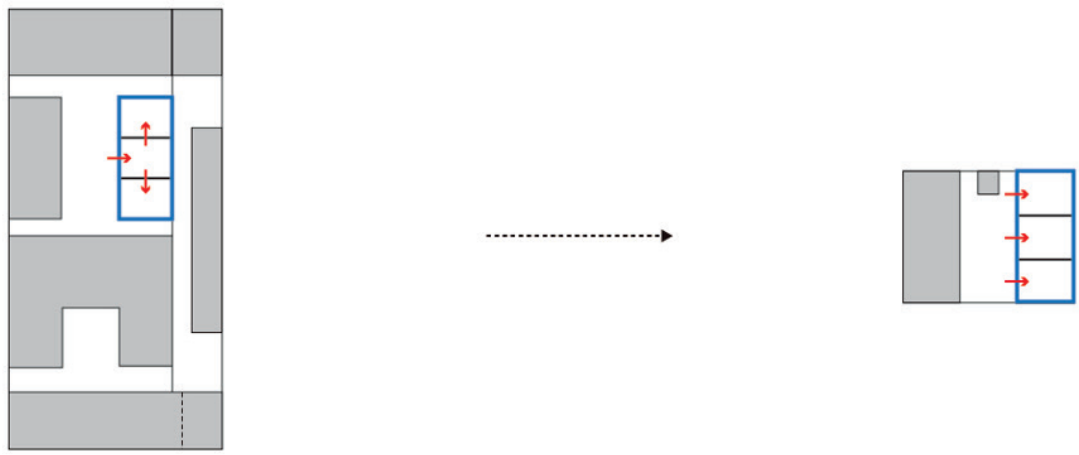

Figure 13. *Room change on Element room.*

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