From individual to whole: the practical value of spatial phenomenon transparency in the building renewal

Guangyi Xie and Minjuan Wang
South China University of Technology B11-405, University Town, Panyu District, Guangzhou City, Guangdong Province, China

Email: 1227180334@qq.com

Abstract. With the development of modern life and production mode, the functions and facilities become more diverse in the process of architectural renewal, which leads to the contradiction between the diversified realistic demands and the overall order of architecture. Furniture is the main factor that affects the function and also the important element of facilities. The contradictions of formal logic between multiple furniture and architectural order include the expression of individual comfort and uniqueness. As a means of organizing form and space, phenomenal transparency transcend the limitation of historical style in visual mechanism, and provides methodological enlightenment for the contradiction resolution of individual differences and overall order through multiple interpretations of the combination of image and background. This paper attempts to apply the phenomenon transparency to the architectural renewal, refining three characteristics that contain front view, figureround transposition, and level progression. This paper puts forward a design method to solve the contradiction between the diversity of forms and the integrity of buildings after the new furniture and facilities are put in and finally evaluates the effectiveness and applicability of the method with practical cases.

1. Question: The Contradiction Between Diversity and Spatial Integrity
At the beginning of the 21st century, with the acceleration of urbanization process, the new production and lifestyle made the interior of the old buildings unfit for the first time which leads to diversification of indoor functions and facilities[1]. For instance, in order to realize the transformation and reuse of industrial buildings, the industrial space with single production function is transformed into a mixed form of business and office, leisure and entertainment and so on. In order to improve the living demand of accommodation, more modern requirements are put forward for new kitchen and bathroom facilities and other furniture. The rich and diverse functions and facilities are the real projection of modern life. Furniture is not only the leading factor of function, but also an important element of facilities. In the process of building renewal, new furniture and facilities are put in to meet the needs of modern life, but the diversity of which disturb the overall order of architecture. Taking the transformation of a gas station into an residence with American retro style as an example. In addition to retaining the original structural wall, cement floor, iron ladder and rest seat, modern kitchen facilities, comfortable sofa, tea table, lockers, decorative works of art and old posters collected by the owner are also put in the original building to meet the personalized needs of the owner (see Figure 1).
Therefore, how to form a unified whole in perception and use in the face of diversified realistic demands in architectural renewal?

![Figure 1](https://m.biud.com.cn/news-view-id-307104.html) These two figures have been placed side-by-side to save space. Justify the caption.

**Picture source:** https://m.biud.com.cn/news-view-id-307104.html

2. Analysis: the Causes of Diversity

2.1. Variety of Furniture Types and Organizational Forms

The function of architectural renewal changes from single to diverse. The original function of interior is mainly to meet people's survival needs of shelter from wind and rain. Later, the living environment is improved. The function of building interior is not only to meet people's survival needs, but also to meet people's physiological needs of rest adjustment. When the social material and cultural life has been greatly developed, the functions of building interior to meet people's material and spiritual needs have been increased[2]. For example, in the early 1950s, several families lived in the same old building. The kitchen and bathroom were shared. In terms of indoor function division, a room could play the role of bedroom, living room and dining room. After the reform and opening up, with the improvement of material and spiritual culture, more scientific and modern life style began to appear, which put forward diversified requirements for the internal functions of buildings. Based on the original single bedroom, living room, dining room and living room, a variety of functional interior spaces, such as special cloakroom, storage room, study, gym and entertainment room, have gradually emerged, which means the design of old buildings take more consider of the residents' personalized needs, and the diversity of functions has been fully reflected.

If the use function is regarded as the first attribute of architecture, the furniture and facilities are the specific content reflecting the use function. When the room without furniture and facilities can only provide abstract space intention, it is difficult to identify its real use. Neither the effectiveness of the function operation can be evaluated nor the specific functional experience can be provided[3]. Because the complexity and diversity of functions is to meet the needs of multiple functions, there are also a variety of types and organizational forms of furniture. For example, the seats in the living room can be used by one person or many people. In addition to sitting, lying, leaning and other positions are also needed to be considered. In terms of modeling, curved surfaces are mostly used, and soft materials such as leather, cloth and rattan are mostly used in materials. Furniture is arranged along the "U-shape" with relatively concentrated space in the middle. In the dining room, most of the seats are for single person, mainly considering the comfort of the combination of seats and tables. The organization form of furniture emphasizes that the center is arranged along the "one line"shape, and the surrounding space is reserved in the central part (see Figure 2). The functional logic and formal logic of various types of furniture are different. Furniture is placed according to their functional logic. The organizational form of furniture under different functions is also different. It needs to meet the personalized needs of the use function. Due to the development of modern life style, the function of the interior of architecture is gradually becoming complex and diverse, resulting in the interference of different furniture types and organizational forms on the overall order.
Figure 2. Different furniture organization forms in the living room

Picture source: https://www.emeiju.com/indinfo-38523.html

2.2. Diversity of Furniture Styles

Furniture, as the leading factor affecting the function, not only affects the quality of indoor function in the type and organizational form, but also plays a crucial role in the architectural form. The choice of furniture directly affects the overall shape of space[4]. With the improvement of human civilization, people put forward higher requirements for the art quality of interior space. Therefore, furniture form is not less important than use function. Furniture itself plays a role of decoration and satisfying visual pleasure. However, the evolution of furniture forms is diverse and complicated which reflects not only the factors of local culture and social background but also the diversity and complexity of daily life.

The evolution of design of furniture and architecture is almost synchronous. In ancient times, most of the furniture completely copied the shape of the architecture and became its epitome. The furniture and architecture in this period have always been unified in style[5]. For instance, in the Renaissance, local forms of architectural decoration such as cornice, buttress, pedestal and so on (see Figure 3) were transplanted to furniture decoration. At the same time, techniques such as painting, inlay, sculpture and gypsum relief were fully utilized to form the characteristics of the Renaissance (see Figure 4). By the end of the 18th century, the newly affluent middle class began to pay attention to the comfort and taste of the architecture interior. On the one hand, they pursued various historical styles of furniture, confidently mixing the Rococo style, Tudor Style, Gothic style and Renaissance style. On the other hand, they matched the sofa and chair with thick cushions, which were strange in appearance but comfortable to sit on. A collection of diverse and mixed styles were integrated inside and outside of the building in the whole 19th century.

Figure 3. Local form of architectural decoration

Figure 4. Renaissance furniture
In the period of Modernism, with the proposal of function determining form, combination of science and technology, and opposition to the traditional patterns and additional decoration, there appeared the ‘red and blue chair’ designed by littwell (see Figure 5), Barcelona chair designed by Mies (see Figure 6), and Vasili steel chair designed by Breuer with steel tubes(see Figure 7), etc. These furniture were widely criticized because they overemphasized pure perfection but ignored the regional, national and historical context of design, as well as the comfort and economy in use, which led to the identical "international style". However, the early classic furniture did not have too much influence on interior design. Until the outbreak of World War II, under the condition of material shortage, modern furniture in northern Europe accepted new materials and styles, and respected tradition and emphasized comfort and practicality. Alto began to pay attention to "human feelings" in design, material improvement and technological progress, with comfort as the first principle. Taking the ‘Paimio Lounge Chair’ (see Figure 8) designed in 1931 as an example. It is made of hot pressed plywood and bent wood. It is light, applicable and elegant without sacrificing its comfort, which makes the furniture warm and humanistic. The inheritance of the traditional style can be seen from the modern furniture in northern Europe. Since people's attachment to the historical style can not be completely compromised, the call for tolerance and diversity of traditional style is also rising. The style of furniture is gradually becoming diverse and individualized. And its use function, comfort, economy and style have entered the era of multiple values.

**Picture source:** KaiJun Tang. A Study on the Developing and Evolving Programme of Furniture style[D]. BeiJing:BeiJing Forestry University, 2003.

Since the demand of modern life style makes the function and furniture constantly pursue diversification and indviduation, if we force the standardization and unification of formal language to obtain the integrity between architecture and furniture, the natural logic of formal production will be obviously violated and people's free choice under the diversified life style will be limited. Then how to get the whole perception and use in the face of diversified realistic demands in build renewal? In the face of this realistic contradiction, the intention is to eliminate the differences between individuals and
the whole in the design method, and to achieve a balance between the diversity of form and the integrity of space.

3. Reference: the Characteristics and Enlightenment of the Method of Phenomenon Transparency

Transparency is a concept drawn by urban theorists Colin Rowe and Robert Slutzky from the formal and structural features of Western Cubism painting, and then connected with modern architecture to extend the ‘transparency’ of painting to the ‘transparency’ of architecture, which contains two connotations. One is to show the transparency of material in the physical sense. The other is to show the phenomenon transparency of organizational characteristics[6]. The phenomenon transparency referred in this paper takes the whole space as the research object[7], and uses ‘parallel perspective, compressed depth of field, space contraction, oblique line grid’ to trigger figure-ground reference and multiple interpretations. Its significance is not only to clarify the category of transparency, but also to be an ‘ideal tool for rational treatment of form’. Therefore, it is extended by Colin Rowe and Ratsky in the sequel of Transparency to the discussion of historical architecture. Hoxley used a city development project plan in Venice, Italy, as an example. The old houses must be preserved in the site. In terms of geometry, it can be the two directions of the starting point of space organization. Transparent organization can create new space geometry system, which can make the existing urban network fragments, new buildings and all of the scattered special elements of are inclusive (see Figure 9).

![Figure 9. Urban development project plan in Venice, Italy](image)

**Picture source:** Colin Rowe, Robert Slutzky. Transparency[M]. Beijing: China Architecture & Building Press, 2008.

Colin Rowe and Slutzky found the production mechanism of phenomenon transparency that requires painters and architects to take the positive perspective as the dominant order of form organization[8]. And then Hoxley found a specific way to transform the transparency theory into the design method. First of all, he expressed a detached attitude towards the two opposite concepts existing in the architectural field, ‘form on function’ and ‘function on form’. Form was the means of design. Space could be seen as the public matrix of form and function. Form and function could be seen as two different sides of the same thing. In the process of design, they needed to be organically integrated and mutually adjusted to achieve a more harmonious state. Later, the topic of ‘function and form’ was turned to ‘space’. “This public matrix covers ‘space occupied by entities’ and ‘area limited by boundaries’. Although they are quite different in perception, they together constitute a complete spatial order. According to Hoxley, there is a direct corresponding relationship between the ‘function and form’ of architecture and the "real and virtual" of space. Once the compromise attitude of the former is transformed into the complementary figure-ground relationship between the entity and the
virtual space, it is unnecessary to emphasize the opposite nature of sense between them.” The multiple interpretations of the figure-ground combination relationship is the source of Corbusier's technique of transparent space. It is Hoxley who uses it to resolve the binary opposition of ‘function and form’ and open the way from formal analysis to design method: transparency can be clear and inclusive of ambiguity; it can produce order and provide free choices; each part has its certain position in the whole and bears several different meanings. Taking transparency as a means of formal organization can absorb contradictory or local specific content without compromising integrity and coherence. This has nothing to do with the content of style and patterns. As a means of form organization, the figure-ground combination can not only produce the overall order, but also absorb the local contradictions. And it can accommodate multiple and mixed styles and patterns, providing methodological enlightenment for solving form diversity and space integrity in building renewal[9].

4. Method: the Organization Mode from Individual Furniture to the Whole Architecture

From Hoxley's description of the method, we can realize that the precise control of the ‘figure and ground’ relationship is an important tool for spatial integrity and continuity. In the interior of architecture, we need to return to the topic of the relationship between furniture and space. In the words of Hoxley, furniture function and formal order are only two sides of the same thing and the demands on two aspects of space. We do not need to emphasize the contradiction between the style of furniture and the function of use, nor the sensory opposition between the entity and the void. Because ‘reality and emptiness’ and ‘function and form’ jointly participate in and constitute the coherence and integrity of space. Whether it's ‘figure’ or ‘ground’, it's just the texture presentation of the whole space. In other words, we should not only see the ‘figure’ but pay more attention to the ‘ground’, which is a decisive consciousness transformation for the intention of starting from individual furniture to the whole architecture.

4.1. Observation View: from Perspective to Front

The perceptual experience of furniture and facilities is established in motion and time, and information is obtained from the three-dimensional perspective. The direct perceptual experience of space can not be directly restored to the overall order of space. "Transparency theory provides us with a way that contains complex and diverse forms of organization. But the visual mechanism of transparency and the interpretation of ‘figure-ground’ combination require architects to adopt a positive perspective and evaluate or organize spatial order with a rational attitude. This means that we need to go back to the plans and sections to see the relationship between entity and void from the perspective view."[3]

In the plans and sections, the representative features of all parts in the building are simplified to the greatest extent. The complex information about color, style and function is presented as a simple figure in the front perspective, while the blank part around it is the background of the figure. The contradiction between function and form is transformed into the study of the figure-ground relationship. Taking the transformation of a British tea house into a Chinese restaurant as an example. The designer hopes to integrate Oriental details into the original colonial architectural style and explore the integration of eastern and western architectural styles and materials. From the perspective view, we can see the integration of multiple styles of furniture such as wooden table top, glass lamp rack, rattan sofa seat, gold and chestnut printed fabric, brass lamp, white marble bar, etc. The shape, size, color and style of these furniture are not consistent. And there are single card seats in strips, and furniture organization forms in groups of two people and multiple people (see Figure 10). Their functional logic and formal logic are different. But they are all placed in the interior area of the building in a certain combination order. First of all, ignore the interference of all different forms of furniture and facilities, and turn the perspective view to the front view of the plans and sections. Only when several furniture implies the area of the certain shape, can they be interpreted as a figure-ground relationship (see Figure 11).
Figure-ground transformation is an extremely effective organization method for the spatial order inside a building. It represents the space background that is hard to perceive and juxtaposes it with the entity, making it an equally important object of concern. Take the transformation of an industrial warehouse into an temporary exhibition hall of sales office as an example. The 400 m² long strip space should accommodate all kinds of furniture and facilities related to the exhibition, sales, bar and children's play area. Individually, each facility has its own purpose and follows its own functional principles: the exhibition area needs to be displayed and eye-catching, the sales area needs to be conversational and comfortable, the bar needs to create an active and relaxing atmosphere, and the children's area needs to be safe and independent. These functional areas consist of the combination of black leather sofa, steel and glass tea table, pure white chair, line curtain, wooden lamps and other modern furniture and the old brick and wood. They are different in colors, materials and styles. But ignore the different forms of furniture and facilities entity itself, and transfer the focus to the graphics outside the entity (see Figure 12). From the plans, two meeting areas and one exhibition area clearly show four parallel horizontal expansion areas. Their corresponding length implies two longitudinal deep spaces at the same time. These void parts, which were originally used as background, show the outline of "figure" under the hint of sofa and desk chair (see Figure 13). From the sections, each single area is composed of line curtains, lamps and sofas or tables and chairs of different lengths. The position of the upper line curtain and lamp has obvious contraposition relationship with the position of the sofa on the plans, and the implicit spatial graphics outside the entity are clear (see Figure 14). It can be seen that the designer's focus is not on the furniture itself, but on the graphics formed after they are interrelated and the spatial penetration produced by the overlapping of graphics. So when the new furniture and facilities are put into the interior of a building, we should not only pay attention to furniture and facilities entities, but also to the part of the void beyond the furniture. In addition, transferring the focus to the space and from object to space graphics. Simply put, ‘figure-ground inversion: space is figure and element is ground’.
Figure 12. Case of Transformation of Industrial Relics into Temporary Exhibition Hall of Sales Office

*Picture source:* http://www.archdaily.cn/cn/772002/a-space-bo-lin-mi-te-qu-loftshou-lou-chu-plajer-and-franz-studio

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4.3. Progression: from Local Space to Overall Space

If the transformation of figure-ground relationship solves the problem of visual unity of individual and background in local area, it means that it can further expand the field of vision, deal with higher-level and more complex spatial relations, and organize each local area into a broader coherent whole. This is another key link for the intention of integrating furniture into the whole building. Take the transformation of industrial relics into temporary exhibition hall of the sales office as an example again. First, the single area for talks and exhibitions at the entrance is composed of a display desk, two groups of sofas and a tea table. The part surrounded by a dotted line at the bottom has overlapping parts in the crisscross, which makes the whole area for talks and exhibitions coherent. This is the most microcosmic regional level (see Figure 15) In the next level, the hall in the center of the whole building is divided into four small areas, including exhibition area, meeting area, sales area and leisure bar, which are staggered with the horizontal sequence of the corridors on both sides, and the various areas of the whole temporary sales hall become coherent. It can be seen from the plans that there is a clear contrapuntal relationship between each single area and the corridors on both sides which thus forms a space belt in different directions. When you stand at the intersection of regions, due to the fuzzy boundary, some positions appear ambiguous in vision. You can feel the existence of two parts of space at the same time. Maybe this position belongs to both the exhibition area and the meeting area. So the space can be understood in many ways. This kind of relationship is coherent, pluralistic and fuzzy. Through this method, the single areas of exhibition, meeting, sales and leisure bar become a whole, which is no longer an independent space, but a continuous texture among many single areas.
(see Figure 16). And in the next level, the furniture of the whole open space forms a continuous texture, while this part of the room forms another closed texture. The two sets of spaces are quite different - one is very open and the other is very dense, which originally belongs to two different textures, but it forms a fusion through vertical interlacing (see Figure 17). In the whole region, the homogenous texture of graph-ground inversion is continuous, and the space is orderly and abundant. It can be seen that the furniture and facilities in the whole area are different in form style and means of organization. They respectively undertake the basic functions of the renewed buildings, reflecting their own purposes and the unique expression of the exhibition. It is necessary to form the highest-level transparent space by means off figure-ground transformation, so as to fully demonstrate the principle of the integrity and diversity of the architectural space.

In general, there are various interpretation possibilities of the combination of figure and ground. Furniture and facilities play a major role in the progressive relationship between figure and ground. The visual mechanism of phenomenon transparency requires our observation to return to the front perspective. The figure-ground transformation is still an effective form organization tool that makes the richness of vision and the overall order of space unified again.

5. Conclusion

When the new furniture and facilities are put into the building, they are faced with the contradiction of form diversity and space integrity. First of all, return to the front perspective of the plan and section, the virtual and realistic differences between furniture and space background are transformed into the observation of the figure-ground relationship. Then adjust the recognition degree of the background figure to show the ‘ground’ shape to make the ‘figure’ fade into the background, get rid of the concern of single furniture entity and turn to the concern of space figure between entities. The local spatial
organization is progressive to form a higher-level relationship between the figure and ground, further strengthening the coherence and integrity of the space, and finally transforming the contradiction of styles into the overlapping of continuous texture. The figure-ground transformation opens up the design path from individual furniture to the whole, and solves the contradiction between the form diversity and the space integrity in the building renewal.

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References
[1] WenYang Ni. Policies Research of Historical Buildings Reuse in the Old City of Colin Rowe, Robert Slutsky. Transparency[M]. BeiJing: China Architecture & Building Press, 2008.
[2] RenPing Tang. The Study on the Relationship between Life Style and Interior Design[D]. ChangSha: Central South University of Forestry and Technology, 2009.
[3] GuangYi Xie, Qi Li, MinJuan Wang. The Space Significance of Furniture: Enclosed and Continuous[J]. Huazhong Architecture, 2019(07).
[4] ChunZhu. Elementary design of interior[M]. ShangHai: Shanghai People's Fine Arts Publishing House, 2006.
[5] KaiJun Tang. A Study on the Developing and Evolving Programme of Furniture style[D]. BeiJing: Beijing Forestry University, 2003.
[6] Yu Cheng, Zhi Tao. Transparency of Contemporary Interior Design Interpretation: Yabu+Pushelberg Works as an Example[J]. Art & Design, 2015(06).
[7] Guangzhou[D]. GuangZhou: South China University of Technology, 2009.
[8] Ying Zeng. Cubism, Mannerism and Modern Architecture: The Legacy of Colin Rowe(III)[J]. The Architect, 2016(1).
[9] GuangYi Xie. Research on the Methodologies of Interior Design Based on Spatial Integrity[D]. GuangZhou: South China University of Technology, 2019.