Versatile Space: The Trend to Multi-functional Space And Design Strategy

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Abstract: This paper introduces the idea of versatile space to respond the rapid change of social and economical circumstances in high-density urban areas. The origins of versatile space are illuminated. And the measures to facilitate versatile space are reached by analyzing the factors involved in the function-space relation.

Keywords: versatile spaces, high-density area, design strategy

1. INTRODUCTION

With the rapid change of social and economical circumstances in high-density urban areas, the requirements of urban and building space are changed quickly. In their life spans, the urban and building structures must accommodate change and adjustment, and be prepared for conversion into different functions without rebuilding the structure because of the limited space resources and high cost. Thus versatile space has its role to make a solution.

2. VERSATILE SPACE

2.1. Space and Function

A space is the opposite of an entity. Outside of an entity, there is the space, which is invisible and untouchable. And space is also *something formed in the relationship between an entity and the one who feels it* (Ashihara Yoshinobu 1989). Laozi, the ancient Chinese philosopher, mentioned in his work *Dao De Jing* that *when making a vessel by clay, what we really need is the emptiness formed by the vessel. Having windows and doors on the wall to shape a room, what we really need is the emptiness in the room.* That is to say the value of a building lies in the emptiness enclosed by the walls, not the walls themselves. The emptiness inside the building is SPACE.

Various materials are used to enclose a space to accommodate some activities. FUNCTION is the activity accommodated by a space.

In a building, function represents content, while space represents form. There is a certain relationship between them: content decides form; form affects content.

2.2. Versatile Space

Versatile space, which is multi-functional, is the opposite of unitary space. Versatile space accommodates diverse functions, while unitary space is only suitable for a particular one.

3. ORIGINS

3.1. The Doubt of Modernism

Function zoning is one of the basis principles of Modernism. In the early days of Modernism, the method of function-zoning helped cities out of chaos. But it was doubted later due to its ignorance of the diversity of city life, increasing social cost and large energy consuming. In the smaller scale of urban fabric and buildings, too strict zoning disrupts the linkage between functions, prevents people from communication, and increases transportation and energy consumption.

Form follows function is another basis principle of Modernism. The principle was prevailing the whole world from 1930s to 1950s. However as the development of architecture, Modernism was facing challenges, as well as the principle of *form follows function*. Function may have some impact to form. But there is no one-to-one relationship between form and function. A given form could accommodate various functions, while a given function could be expressed as various forms.

3.2. Commercialization

The development of architecture is always affected by economic factors. As the fast change of the market, it becomes very difficult to predict the requirement of the potential user for a space. Buildings that designed as commodities have to respond to the change simultaneously. That's where versatile space is needed.

3.3. Digitization

In the digitized society, cities based on information technology are no longer constrained by forms, and cities might develop towards low rise and dispersed structure. Because of the fast and convenient information transportation, some functions used to require a large space are dispersed, which makes the space be able to accommodate various dispersed functions. Banks, used to occupy prominent buildings in the city, are changed into ATMs on the streets. The process of digitization eliminates space and time, and makes function more adaptable. Versatile space is becoming possible.

3.4. Sustainable Development

To tear down a building whose structure does not expire, or inadequate usage of a space is a waste of resources. One important character of a sustainable city and building is to be energy and resource saving. Versatile space could help to develop a sustainable city and building.

3.5. A Thought of Chaos

Through the development of civilization, there is always a trend to eliminate uncertainty by conquering and controlling the nature. This attempt is actually an illusion. The theory of chaos deems that we could never predict, dominate or control the chaotic systems. It is wiser to contain than to resist the uncertainty of life. Space should not be dominated by determinism. The functions a space needs to contain in the life span may change many times. Architects should design the space to maximize the possibilities of change, so that the space could be more adaptable to maintain valuable all through the life span.

4. SIGNIFICANCE

4.1. Adaptability

Adaptability is the potential of a system to harmonize with the environment. The adaptability of a space is the potential to change or adjust the elements constructing the space to respond the changing environment.

Unitary space could not accommodate new functions by maintaining its own characters, and it could not provide the possibility to change or adjust some part of it. A unitary space loses its value when function changes.

Versatile space, which is more adaptable than unitary space, could accommodate new functions with or without changing.

4.2. Resources Saving

Various functions could take place in a versatile space simultaneously or successively. No extra spaces are required. This is a way to save resources.

4.3. Communication

Modernism emphasizes function zoning. The communication between functions is inconvenient as different functions occurred in different spaces. Versatile space contains different functions, the communication between which is promoted.

In the open office with low partitions, employees from different sections work in the same space, communication is more convenient than in conventional separated office rooms. The public space in a community or in a building would be more attractive when the space is designed as a versatile space, as various activities are facilitated.

4.4. Humanization

Rationalism, which promotes rationality while demotes contingency, is the rule western architects followed all the way through Classicalism, Revivalism, Functionalism to Modernism. But Rationalism regards human as machine and ignored the nature of humanbeings.

As versatile space could be occupied in various ways, the creation of human is largely encouraged and people could make the space the way he likes. Versatile space makes it possible for different functions occurring in the same space to encourage undesigned communication, therefore make the space more vivid and interesting, more humanized, and more organic.

5. STRATEGIES

To analyze the factors of a space reacting with function could provide strategies to facilitate the possibility of change. Function has certain relation with three factors of a space: size, shape and quality (Peng Yigang 1983). And for the function occurs in a series of spaces, linkage between them plays an important role.

5.1. Size

To contain certain function, a space requires a certain size. And to contain various functions, the size of a space should be proper for all of the functions.

Versatile space contains functions requiring similar size. A proper size and the guidance of versatile space design could be found out by listing the size each function requiring. Take an ordinary apartment for example, a room with the size of 15~20□ is not only proper to be a living-room but also a master bedroom. So, this room has the character of a versatile space. The size of a

space in a residential area facilitating activities of both old people for practicing Taiji and children for playing also makes the space versatile.

The spaces mentioned above don't require size change to contain different functions. Sometimes the size of a space might need to be changed to do so. Smaller office rooms could be shaped by adding some partitions to an open office. And in an apartment, two smaller bedrooms could be formed by adding a wall in the middle of a specially designed bigger one.

5.2. Shape

A space also needs to have some certain shape to contain certain function. Ancient Greek theatres are fan-shaped, ancient Roman arenas are elliptic, and the rooms for practicing musical instruments in a school are trapeziform.

Versatile space could satisfy functions requiring similar shapes without changing itself. A mezzo shape should be chosen to make a space versatile. The hall in a cinema or a theatre requires similar shape. But it's still different because of their visual an auditory characters: cinema hall is longer while theatre hall wider. If a hall in a community center is expected to be both a cinema and a theatre, a mezzo long-and-wide proportion should be chosen to make the space versatile.

Versatile space also could change its shape to contain different functions. The request for shape both before and after change should be considered in the design process. There is still an example in office building. The wall between two office rooms is movable. With the wall, the shapes of the two rooms are proper for official business. Without the wall, the shape of the united room is suitable for a long table to make a meeting room.

5.3. Quality

Quality is another important factor of space-function relation. The quality of a space concerns lighting, ventilation, sunshine, temperature and so on.

Versatile space contains functions requiring similar space qualities. For functions of office business, dwelling, dining and so on, if the quality of a space is proper for one of them, it's suitable for the others.

Versatile space could also change some of its qualities to content different functions. A bedroom and a living room may have different request for natural light. To make a room versatile, the outer wall could be designed to be able to adjust natural light.

5.4. Linkage

Some function occurs in a single space, while some needs a series of spaces. Different function may require different linkage of the spaces. Versatile space could accommodate different functions by changing the linkage of a series of spaces. There are different ways to partition a big building plan: partitioning the plan into closed rooms connecting by a corridor for office business, or partitioning the plan into a series of rooms connecting one by one for exhibition. As the linkage is different, the function is different. To provide the possibility of linkage change is the way to make a space versatile.

6. MEASURES

6.1. Neutralization

Neutralization means a space is designed for some different functions not a particular one. Neutralised space could contain any one of the considered functions without any change. The size, shape, quality and linkage of space all could be designed neutralised. By analyzing the considered functions, a table could be formed to choose proper parameters to be the design guidance. Take a space in an office building for instance, the functions considered include formal meeting for 10

persons, offering the employees lunch and coffee space, resting and communication. A table is formed according to these functions. (Table 1)

Table 1 Function Analyses for Neutralization

Factors	Formal Meeting for 10	Lunch and Coffee Space	Resting and Communication
Size	Area:15 sq. m., net height:3m	Area:10[illegible], net height:2.4m	Area:10[illegible], net height:2.7m
Shape	Rectangle	No particular request	No particular request
Quality	Natural or artificial lighting	Natural lighting and ventilation	Natural lighting and ventilation Nice outside view
Linkage	Connecting to the public space	Connecting to the public space and the service room	Connecting to the public space and the outdoor space

A design guidance for the space could be reached by analyzing the table: area15 sq. m., net height 3m, rectangle, natural ventilation and lighting, connecting to the public space and service room, with a nice view and access to the outdoor space.

6.2. Homogenization

Homogenization means in some particular range, the space has the same or similar characters, facilitating the exchange of functions.

The spaces of traditional Chinese architecture are typical homogenized spaces. A room supported by wood frame is the fundamental unit of traditional Chinese architecture. These fundamental units make up buildings of similar size and shape, and courtyards of various sizes connect these buildings together to make the urban fabric. Each *room* is a similar rectangle space facing the courtyard. Only the locality is different. Thus the room in traditional Chinese building is not named after function but locality.

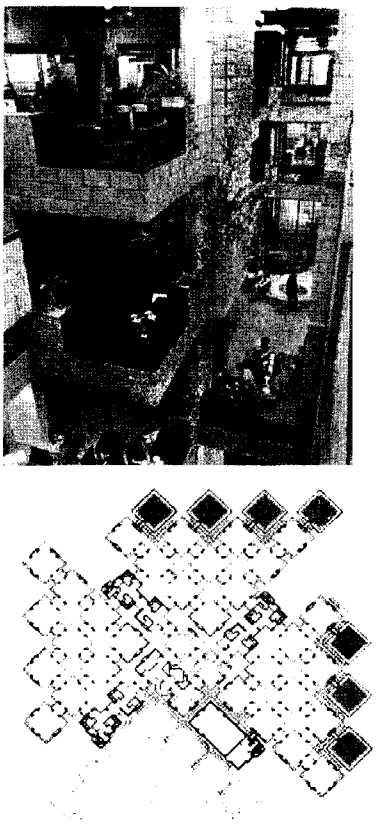

Figure 2 Plan of Central Beheer

The domino system promoted by Le Corbusier might be the beginning of modern homogenized space. The spaces, formed by regular column matrix, have the similar or same quality. It is possible to partition the space in various ways.

If the domino system plan is big enough, the quality of spaces inside would be different: the spaces near the outer wall may have good quality of natural lighting and ventilation, while the rest don't have that quality. The concept of *void* would be useful to maintain a large plan homogenized. To create void is to make some *holes* in a large plan. Central Beheer designed by Herman Hertzberger is a good example for void. The structure of the building is formed by the main frame of 9mX9m and secondary frame of stripes 3m by width. Courtyards are created within the structure to make every point in the plan fell the nature. So there are unnumbered possibilities to arrange functions.

Void also could be introduced to high-rise buildings. T.R. Hamzah & Yeang make some aerial gardens in ecological high-rise building to facilitate the access to nature in higher parts as the ground floor. The spaces in high-rise building are also homogenized.

6.3. Multi-linkage

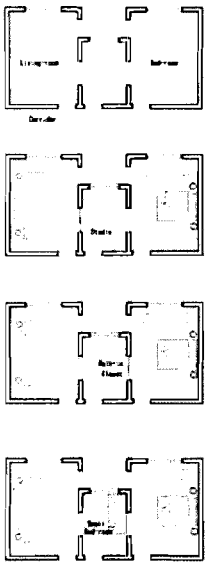

Figure 3 Multi-linkage of a room

Multi-linkage refers that there are different ways to link the spaces involved. Multi-linkage makes versatile space in two situations: the linkage between spaces is changed to facilitate new functions, or the space has convenient linkage to other spaces to make easy access to encourage various activities.

To change the linkage, some physical change should be made, but the change could be restricted in a small extend. Take a room in an apartment for example. The small room between two bigger ones could open doors on three of the walls. Open the door to the bedroom, the small room turns into a walk-in closet; open to the living room, a studio; and open to the corridor, a small bedroom. The linkage to three spaces makes the small room a versatile space.

Conventional linkage to the other spaces makes a public space versatile. Because of the conventional linkage to the other parts of the building and the treads in it, the hall of Apollo School in Amsterdam is very attractive for the children. The most important one in the linkages is the access to nature. Sunshine and fresh air encourage children's activities.

Figure 4 The Hall in Apollo School, Amsterdam

6.4. Hierarchical levels

Versatile space facilitates new functions with or without physical changes. In most cases, to facilitate new functions doesn't require the change of the whole structure. But to alter or replace building parts is difficult, because the change or adjustment would affect other parts, and require the other parts to be removed or taken away and rebuilt. These building parts might be under control of different parties, and these parties also need to correspond. There are friction and conflict in the process of change or adjustment, which Stephen Kendall called "building entanglement".

Hierarchical levels could be employed to avoid the entanglement when the building or structure is too complex to be under the responsibility of only one party, or when many different parties each desire to have control of some part of the whole. Thus levels such as the following emerge Stephen Kendall 2002:

Urban Structure (the larger scale ordering of land uses and transportation arteries)

Urban Fabric (Neighborhood)

Base Building (the shared parts of multi-tenant buildings)

Fit-out (partitions, some mechanical equipment)

Furniture and Equipment

Each level concerns not only physical parts of a building or structure but also social force, equipment and construction skill etc. Each level is restricted by the next higher level above, while sets conditions for the next lower level. The levels work in a hierarchical way. The adjustment and change in each level doesn't affect the higher one. Thus parts of the building or structure could be altered to facilitate new functions. The higher level provides various possibilities of change for the lower level, while minimizes the impact to the other parts.

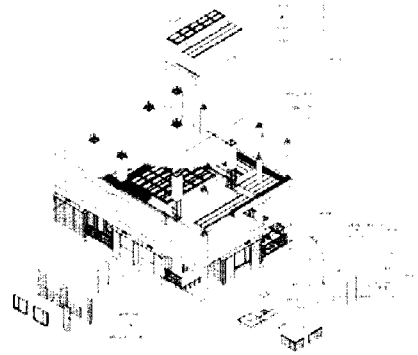

Figure 5 Hierarchical levels of Next 21, 6-16 Shimizudani, Tennoji-ku, Osaka City, Japan

Figure 6 Next 21, 6-16 Shimizudani, Tennoji-ku, Osaka City, Japan

7. CONCLUSION

The implications of versatile space are significant. Versatile space makes a solution to design building and structure adaptable to respond the rapid change of social and economical circumstances in high-density areas.

The theory of versatile space is originated from the doubt of some principles of modernism, such as function-zoning and *form follows function.* And it is also originated from commercialization and digitization. Commercialization requires timely changing of the spaces according to the market, and digitization makes function more adaptable to the space.

Size, shape, quality and *linkage* are the basic factors involved in space-function relation. Based on the analyses of the factors, measures to facilitate a versatile space emerge:

Neutralization, (A space is designed for some different functions not a particular one.)

Homogenization, (In some particular range, the space has the same or similar characters.)

Multi-linkage, (There are different ways to link the spaces involved.)

Hierarchical levels, (The levels of a structure is designed to work in a hierarchical way.)

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