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Analysis of Innovative Application of Digital Modeling Technology Based on Digital Modeling in Architectural Space Design

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Abstract With the continuous progress of science and technology, the digital reconstruction technology of architectural space has not only become a research hotspot, but its application demand also shows a significant growth trend. The traditional two-dimensional modeling technology has been difficult to meet the current demand for accurate architectural space modeling. In this paper, digital modeling technology is applied to set the shape parameters of the building space, and the solid shape of the building is designed through 3D modeling technology. Using OpenGL virtual reality technology, based on the acquired mathematical model of the target building space, the target building is extended and processed to design a more realistic three-dimensional virtual effect of the building space. Evaluating the results of the application of digital technology in the design of architectural space, among the eight house types, the K house type has the lowest K value of 0.7165.The house types with high average distance coefficients have a K value in an intermediate range, with an interval of 0.8465 to 0.9048.In the evaluation of the user experience, the average value of each score of the user experience of the architectural space is more than 90, which indicates that the architectural space is good for user experience.

Index Terms digital modeling technology, OpenGL, 3D virtual effect, architectural space design

I. Introduction

Contemporary public building space design is a comprehensive process that integrates a variety of concepts, technologies and methods. With the progress of society and the development of science and technology, the spatial design of public buildings no longer focuses only on the form and aesthetics of the building itself, but pays more attention to the functionality, comfort, sustainability and cultural connotation of the space [1], [2]. However, the traditional public building space design method is relatively single in design means, overly dependent on the experience and intuition of designers, resulting in a lack of scientific and precise design process, and difficult to cope with the increasingly complex and changeable design needs [3]-[5]. At the same time, the traditional design method is also easy to ignore the close connection between the internal and external space and functionality of the building, making it difficult for the public space to meet the growing demand for the use of people [6], [7].

The rapid development of digital technology has not only reshaped the concept of architectural design, but also provided designers with new innovative tools [8]. Among them, the use of digital modeling technology can enable users to intuitively and concretely experience the simulation design effect of architectural space, and directly feel the architectural space in the architectural space of various architectural forms, the surrounding environment, landscape, decoration styles, colors and other aspects of the architectural space environment [9]-[12]. This technology not only greatly improves the quality and efficiency of design, but also significantly shortens the construction cycle of the project and reduces the cost [13]. At the same time, it also enables users to further understand the use of digital modeling technology in architectural space design, drives the improvement of the level of science and technology of the entire construction industry, and promotes the development and innovation in the field of public building space design [14].

This paper uses Revit digital modeling software to provide the basic process of architectural space design for constructing the axis network system of architectural space. Digital technology is applied to the parameter setting of the building form, and with the help of mathematical formulas, the set relationship between the design variables is clarified to ensure the geometric continuity and coordination of the building space structure form. Through three-dimensional modeling technology, the mathematical model of architectural space is established, and on this basis, OpenGL virtual reality technology is adopted to extend the processing of the target building, which further enhances the three-dimensional virtual effect of architectural space. From the two perspectives of architectural space integration and conformity, the use efficiency of architectural space is jointly evaluated, and combined with fieldwork, the user's feelings about the use of architectural space designed by digital modeling technology are investigated.

II. Digital modeling of architectural spaces

II. A.Modeling process and method

Figure 1 shows the digital modeling process of the public building space, and the Revit digital modeling software is used to construct the axis network system of the building based on the needs of the project and building codes within the designed space site [15]. The spacing of the axis network is set to 8m to adapt to the demand for flexible layout of the building space. Subsequently, the wall structure of the building was constructed based on the axis network, and the external contour and internal space separation of the building were determined. After completing the basic framework of the public building space, the door and window elements are added to the corresponding positions of the wall to meet the functional requirements of the building. The main entrance of the building has a doorway width of 4m, a height of 2.5m, and a window size of 1.5m × 1.5m.

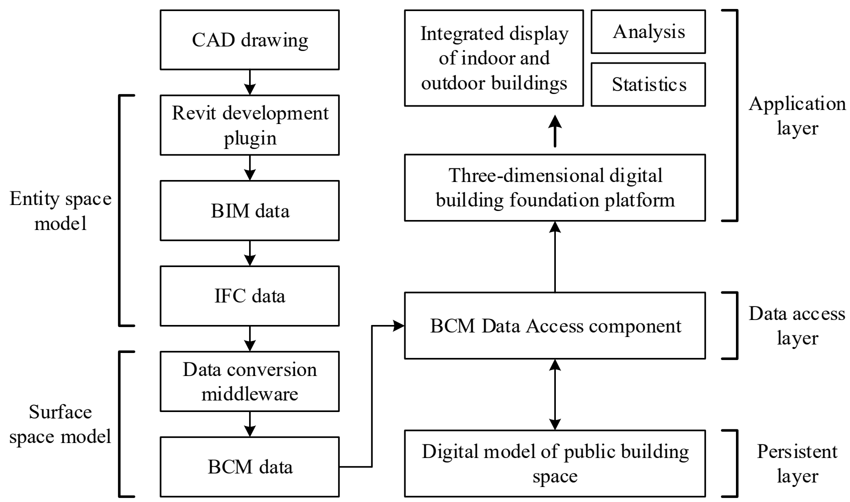

Figure 1: Digital Modeling process of public building space

II. B.Form parameterization

In carrying out the design of the spatial structural form, digital technology is used for the setting of the parameters of the form of this building, which involves the key design variables as described below:

(1) Height of the structure (H): the dimension of the structure in the vertical direction

(2) Width of the structure (W): the dimension of the structure in the horizontal direction.

(3) Span (L): the distance between two support points in the structure.

(4) Radius of curvature (R): the radius of the degree of curvature of the structural body

(5) Node spacing (S): the distance between nodes in a structural body.

With the help of mathematical formulas, the geometric relationship between the design variables is constructed to ensure the geometric continuity and coordination of the structural form of the public building space. The following is the formula for generating the surface of the public building space structure:

$$z = f(x, y) \tag{1}$$

where: z is the height on the surface of the construction space, x, y denote the coordinates on the surface respectively, and $f(x, y)$ describes the function of the shape of the surface.

The expression for the size relationship of the structure is shown below. By adjusting the values of the parameters n and S, the overall size of the structure and its detail construction can be precisely controlled:

$$L = n \times S \tag{2}$$

where: L is the span of the structural body, n denotes the number of constituent units of the structural body, and S is the node spacing of the structural body.

In order to guarantee the stability of the structural body in this building space, the minimum radius of curvature is set as a constraint, and its expression is shown below:

$$R \geq R_{\min} \tag{3}$$

where: $R_{\min}$ is the minimum value of radius of curvature allowed.

II. C. Digital design of architectural space skin

The digital design of architectural space skin is a multidimensional and comprehensive process. At the beginning stage, the core issues to be solved by the skin design, such as shading, ventilation, visual effect, etc., need to be clarified. By analyzing the skin design of analogous projects, relevant design elements and inspirations are proposed. Within the established public building space parameterization system, the main structure of the building space is constructed and the basic form of the skin is established. Subsequently, based on the basic morphology of the skin, the key parameters of the skin design are determined, covering material, texture, color and transparency. Using the plug-in of digital modeling software, a dynamic grid skin generation algorithm is developed based on the preset parameters in order to form a dynamic grid skin matching the morphology of the architectural space.

In this design process, a planar mesh is first created and initialized by setting the resolution of the mesh to $n \times n$ and the initial position of each node is defined as (i, j). During the mesh deformation process, for each node, its new position (x, y) is calculated as shown below:

$$x = i + a \times \sin(b \times i) \times \cos(c \times j) \tag{4}$$

$$y = j + a \times \cos(b \times i) \times \sin(c \times j) \tag{5}$$

where a is a parameter controlling the overall scale of the epidermis, b is a parameter controlling the variation of epidermal curvature, and c is a parameter controlling the variation of epidermal texture.

Next, a texture coordinate (u, v) is assigned to each node, as shown in the following expression:

$$u = i / (n-1) \tag{6}$$

$$v = j / (n-1) \tag{7}$$

After the deformation of the node positions is completed, the nodes are reconnected based on the connection relationship of the original mesh to form a dynamic mesh skin of the building space. Subsequently, the performance of the skin in terms of light, ventilation and thermal engineering is evaluated with the help of simulation software. Based on the simulation results, the parameters and morphology of the skin are carefully adjusted to optimize the performance. During the whole design process, by adjusting the parameter values, the designer can preview the effect of the skin in real time and visualize the dynamic changes of the skin shape, so as to accurately achieve the design goals. The digital design method not only improves the design efficiency, but also enhances the accuracy and innovation of the design, which fully demonstrates the important role of digital technology in the design of the skin of modern public buildings.

II. D. Simulation design and realization of architectural space

Using the above set building parameter values, the following simulation design of the building space is carried out.

II. D. 1) Constructing mathematical model of building space

(1) Construction of spatial coordinate system and scale. Bricks with the same specifications are spread all over the exterior wall of the building, and the base unit selects the length and width of individual bricks, and while rendering the whole building, all the bricks are rendered as well, and the appropriate scale is obtained by this method.

(2) Representation of building components. The coordinates of the building components in the spatial Cartesian Coordinate System are the locations of the components, and the coordinate point with the smallest value is selected according to the priority order of z-axis, x-axis and y-axis, which is the location of the component. The building can be treated as a series of components for summation after construction. The mathematical model of the building space is:

$$library = \sum construction(pos, \arg s) \tag{8}$$

(3) Building space component modeling process. The main process of modeling building components is analyzed by giving an example of steps in front of a building. The mathematical modeling of the building steps is:

$$stairs\left(pos, len, wid, hei_i, num\right) \tag{9}$$

The height value of the parameter is in an equidistant series with the z value of the coordinates of each rectangular member in the step, which varies continuously, and the detailed formula is as follows:

Where: the positional coordinates of the step members are described by pos, the length, width and height of a section of the step are described by len, wid and hei, respectively, and the total number of steps in the step is described by num.

$$stairs = \sum_{i}^{num} Cubei(pos_i, len, wid, hei_i) \tag{10}$$

$$pos_i \cdot z = pos_1 \cdot z + (i-1) \cdot w \tag{11}$$

$$hei_i = hei + (i-1) \cdot hei \tag{12}$$

The shape of architectural entities is designed and completed by 3D modeling, but the modeled architectural objects, which have contour characteristics, but color, texture, texture and environment and other such visual effects are not yet available [16]. Therefore, the architectural object at this time does not yet have a sense of reality. In order to make the final effect more realistic, it is necessary to take a deeper layer of design on the basis of 3D modeling to produce a more realistic 3D virtual effect of architectural space.

II. D. 1) Extended processing using OpenGL virtual reality technology

The method in this paper adopts OpenGL virtual reality technology, based on the acquired spatial mathematical model of the target building, extends the processing of the target building, endows the target building with material and texture features, and arranges the light source, adjusts the point of view, and sets up the camera for the scene before that [17]. In order to obtain the ideal three-dimensional virtual view of the building space, the three-dimensional virtual building space model needs to be processed with special effects. In this paper, the effect is realized by using the extension techniques of OpenGL virtual reality technology, which are: the application of composite texture set depth texture, the establishment and use of off-screen rendering environments, the shadow body technique based on mask testing, and projection mapping based on visual mapping coordinates.

II. D. 1) 3D Rendering

In order to obtain the desired rendering effect, the relevant parameters need to be corrected before rendering to correct the environment in which the model is located, which can be summarized into the following steps:

(1) Determination of material. Determine the material, texture coordinate calculation, ambient light, diffuse reflection, transparency and other key parameters are set to add the material texture to the key entities, and later on, you can also use tools such as modifiers to implement corrections based on the material information of each entity.

(2) Establishment of light source. Electric light, cone light, parallel light, column light and surface light can be supplied by the system in this article, the need for different environments and choose the appropriate light source, the location of the light source to determine a good, to reach the establishment of the light source.

(3) The establishment of viewpoints and cameras. Planners to place the target camera to determine the observation angle, the point of view is placed in the optimal position, so that the rendering of the key target is obvious, to ensure that the environment is rendered well, the preparation of this composition for the later rendering into a map to make a good preparation.

(4) The establishment of the background. Scenery can be added in the production of rendering diagrams to make the three-dimensional virtual building more realistic, such as adding pedestrians, transportation, signs and other scenery. The images in the system scenery library need to be inserted into the rendering map to select the actual size. To render the overall 3D virtual building space, run the rendering engine after these steps are completed.

III. Analysis of the effects of the application of digital technology and the results of architectural space design

III. A. Efficiency of building space utilization

III. A. 1) Comparison of Integration

The status quo of residential architectural space use belongs to the category of residential sociology, which reflects the real lifestyle and behavior of users in the spatial environment of the suite. We analyze the relationship between users' lifestyles and the space within the residential suite through household surveys, interviews with residents, photographs, and actual mapping. This is a way for architects and related researchers to really consider the actual needs of the users, listen to different design improvement opinions, and make the design of residential units more objective, rational and scientific. The current situation research can avoid the tedious data statistics and clarify the actual needs as well as the potential needs of the users through the qualitative description.

The object of this survey is the representative residential units of 50-100m² in the neighborhoods of Xiangyuan City in Baohu District, Guoyao Petal Lane in Jingkai District, Gezhouba Nine Long Mansions in Jingkai District, and Huichang Court in Binhu New District of HF City.

According to the organization of household types, eight different categories of household types can be found:

(1) Two rooms, two halls, two baths, D+K+L type, two openings and three deep house types;

(2) Two-bedroom, two-bathroom, one-bathroom, type K+DL+B, three-room, two-depth house type;

(3) Two-bedroom, two-bathroom, aisle type, two openings and three deep house type;

(4) Three-bedroom, two-bathroom, one-bath, D+K+L type, two-room, three-depth house type;

(5) Three-bedroom, two-bath, walk-through, three-room, two-depth floor plan;

(6) Three-bedroom, two-bathroom, one-bathroom, type K+DL+B, two-room, three-depth house type;

(7) Three-bedroom, two-bathroom, two-bathroom, D+K+L type, two-room, three-depth house type;

(8) Three-bedroom, two-bathroom, two-bathroom, type K+DL+B, two-room, three-depth house type.

In order to facilitate the next study, A, D, F, H, J, K, O, and R house types corresponding to each of the eight categories were selected as representative house types for analysis.

Compare the degree of integration of functional spaces such as living room, master bedroom, guest bedroom, study, dining room, kitchen, public bathroom, living balcony, and domestic balcony in different types of households. A higher degree of spatial integration means that after exhausting all possibilities, it takes fewer steps to get from the center space to the other spaces. Simply put, a high spatial integration value of a functional space means that it is less costly to travel from that functional space to each functional space in the suite, while the opposite is true: it is more costly to travel from that functional space to each functional space in the suite. Comparison of functional space integration for the eight house types is shown in Table 1.

Subsequently, the maximum integration value, minimum integration value, and average integration value of the eight household types are organized and calculated, and a comparison of the calculation results is shown in Figure 2.

The average integration values in descending order are D household type with a value of 1.1528, H household type with a value of 1.0916, J household type with a value of 1.0815, A household type with a value of 0.9434, R household type with a value of 0.8659, K household type with a value of 0.8242, O household type with a value of 0.7532, and F household type with a value of 0.7129. It can be seen that house type D has the highest space use efficiency at the level of spatial grouping relationships, while house type F has the lowest space use efficiency. Subsequently, comparing the average integration values of the eight house types from the perspectives of the number of halls and rooms and spatial organization characteristics, it can be concluded that:

(1) The comparison of the two-room household types reveals that the average integration value of house type D with K+DL+B as the spatial organization feature is higher than that of house type A with D+K+L, in contrast to the lowest average integration value of the aisle-type F house type.

(2) Comparison of three-room household types reveals that the average integration value of household type J with aisle type as the spatial organization feature is higher than that of household types K and R with type K+DL+B.

(3) The comparison of two-room and three-room household types reveals that the average integration value of two-room household types A, D, and F is high compared to three-room household types H, J, K, O, and R.

Table 1: The comparison of eight household function space integration

Household number	Master sleeper	Living room	Dining room	Public health	Guest bedroom	Study	Balcony	Kitchen
H	0.6485	1.1254	2.7569	0.6485	0.6482	1.3456	0.6145	0.9453
J	1.2145	1.4866	1.4875	0.6632	1.0215	1.0148	0.7485	1.0152
K	0.6822	1.2489	1.2065	0.6278	0.6185	0.8165	0.6485	0.7445
F	0.6896	0.7698	1.0485	0.5596	0.6648	-	-	0.5453
A	0.8856	1.2698	1.4985	0.5755	0.8563	-	-	0.5749
D	0.8612	2.0188	2.0486	0.7926	0.7186	-	0.6145	1.0154
O	0.5846	0.7639	1.2485	0.5636	0.8168	0.8545	0.5356	0.6584
R	0.6369	1.4685	1.4988	0.7448	0.6074	0.7984	0.5048	0.6675

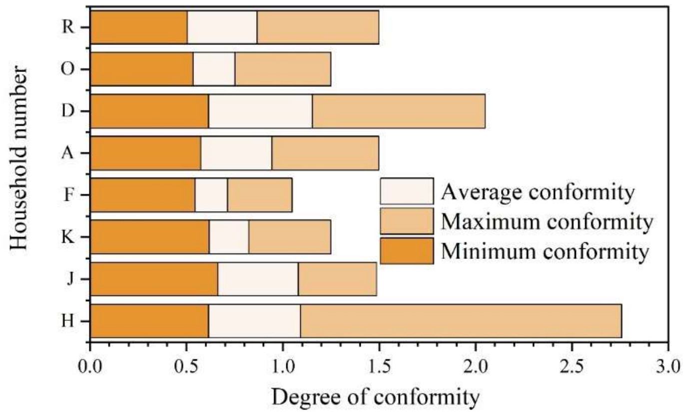

Figure 2: Unit space integration degree value arrangement

III. A. 1) Spatial complexity

The data indicators of the eight household types are now organized as shown in Table 2. Since the average distance coefficient can most intuitively reflect the efficiency of the use of residents' living space, a comparative analysis of the average distance coefficient with the other four sets of data indicators reveals that:

(1) Households with low average distance coefficient tend to have high K-value, i.e., the shape of the household is more square, but there are still special household types that do not have such a proportional relationship, such as household type K, with a K-value of 0.7165. Households with a high average distance coefficient have a K-value that is in the middle of the range, which is reflected in the table in the interval of 0.8465 to 0.9048.

(2) There is no obvious proportionality between the average distance coefficient of household types and the average integration value. Since the average integration value reflects the grouping relationship between spaces, there is no correlation with dimensions such as distance.

(3) Household types with low average distance coefficients tend to have low visual integration coefficients, i.e., the visibility of living rooms is better, but there are still special household types that do not have such a proportional relationship, such as Household Type J. Household types with high average distance coefficient tend to have high line-of-sight coefficient of aggregation, i.e., the visibility of the living room is poor, but there are still house types with special characteristics that do not have this proportional relationship, such as House Type O.

(4) There is no obvious proportional relationship between the average distance coefficient of the house type and the percentage of transportation area.

(5) Compared with the three-room H, J, K, O and R house types, the average distance coefficient of two-room A, D and F house types tends to be high along with the coefficient of line-of-sight aggregation as well as the ratio of traffic area, i.e., in the 90-100m² house design, the number of halls and rooms is controlled in the three-room house type with a higher efficiency of space use than the two-room house type.

(6) The K value of H house type is the highest, and at the same time, its average distance coefficient is low, the average integration degree value is high, the coefficient of line of sight aggregation and the proportion of transportation area are low, and from a comprehensive point of view, the space use efficiency of H house type is higher compared with other house types. This indicates that comprehensive consideration of each index in space design tends to improve the overall space utilization efficiency of the house type.

(7) In general, there is no absolutely uniform pattern and connection between the indicators.

Table 2: The values of eight house type indexes are summarized

Household number	Mean distance coefficient	Average conformity value	Vision aggregate coefficient	Traffic area ratio	K Value
A	1.0486	0.9434	0.8315	8.9165	**0.9048**
D	0.8966	1.1528	0.9345	10.1626	0.8654
F	0.9426	0.7129	0.8435	8.9645	0.8536
H	0.7048	1.0916	0.7952	8.1845	0.9815
J	0.7766	1.0815	0.8756	9.7856	0.9536
K	0.6345	0.8242	0.8263	8.9485	0.7165
O	0.8248	00.7532	0.8168	7.9895	**0.8465**
R	0.6548	0.8659	0.7956	7.7854	0.9436

III. B. Analysis of users' experience

III. B. 1) User experience scores

Figure 3 shows the user experience scores, the experiment in a district in HF city randomly selected 100 citizens, divided into 10 groups, on the use of digital modeling technology designed by the architectural space for the evaluation of user experience, architectural space user experience of the average value of the scores are more than 90 points, of which, the sense of realism, interactivity, hierarchy and the design of rationality of the mean value of 93.9347, 94.0178, respectively, 94.0801, 93.9759, the architectural space designed by the technology used in this paper has a better sense of user experience.

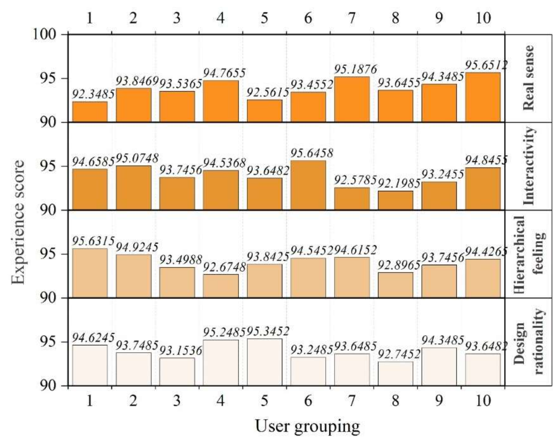

Figure 3: User experience score

III. B. 1) Architectural space field research results

This paper evaluates the satisfaction with the architectural space design of a neighborhood from six perspectives: travel convenience, commercial facilities, medical facilities, public parking lots, parking lot security, and roof gardens, and divides these six indicators into A-F, with the labels 01-05 representing satisfied, quite satisfied, fair, less satisfied, and dissatisfied, respectively. Figure 4 shows the building space satisfaction survey, 79% of the 100 residents thought that the bus interchange in a neighborhood of HF was convenient for people to travel. In the space design of commercial facilities, 45% and 30% of the respondents were satisfied and more satisfied, respectively. 40% and 41% of respondents rated the satisfaction level of medical facilities as satisfactory and more satisfactory. Parking lots were rated as satisfactory and more than satisfactory by 75% and 64%, respectively, for satisfaction and safety. Overall, respondents were more satisfied with the design of building spaces based on digital modeling techniques.

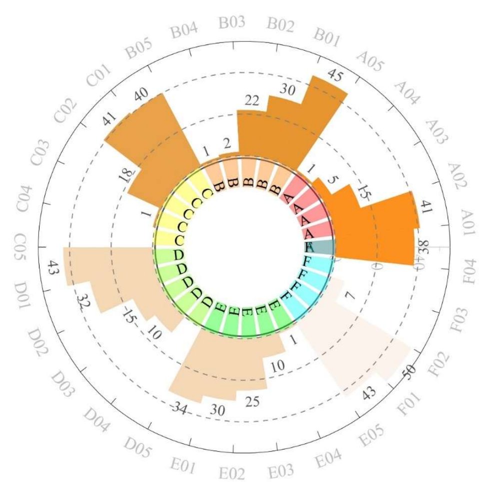

Figure 4: Survey of architectural space satisfaction

IV. Building space optimization design strategies

IV. A. Space design principles

IV. A. 1) Compact combination of morphological elements

The energy consumption and carbon emissions during the construction of the load-bearing structure and envelope of traditional collective housing have given rise to the urgent need for improvement in the high-quality connotative development of cities. Under the policy guidance and technical support of the “dual-carbon target”, the structural selection and scale control of future miniature living space should give full play to its independence, durability, greenness and other advantages, and realize the long-term goals of land saving, material-saving construction and energy-saving use.

The current incremental miniature living space is characterized by the efficient design of uniform unit patterns, set plan rules, and the efficient construction of prefabrication and assembly, but the research on the compact design of specific morphological elements is still insufficient. In order to further realize the construction goals of energy saving, carbon reduction and compactness of form, the horizontal layout should be controlled under the reasonable range of human use size, and the floor height should be raised appropriately in order to fully expand the vertical design of the living space. For example, weakening the plane occupation of independent storage rooms, using vertical space to increase storage functions, or changing the location of the bed plane, the original footprint as a centralized combination of storage areas or study and dining areas. By exploiting all available vertical space, a compact combination of morphological elements is realized.

IV. A. 1) Flexible use of flex space

In the traditional miniature living space, there are extreme ways of "under-dividing" or "excessive" in the division of functional areas, forming a "unobstructed" display scene or a "rigid and rigid" fixed pattern. In the face of the scale of new citizen units mainly living alone or nuclear families, it emphasizes the comprehensive treatment of open and unified space and functional dynamic and static partitions, that is, to achieve the fuzzy integration of spatial boundaries and the flexible separation of flexible components, so as to realize the flexible use of time and space by residents.

In addition, in the case of limited area to safeguard residential micro living space mostly ignored the functional design of the balcony, in fact, the balcony plays the role of residential living space flexibility adjustment. Not only realize the health needs of lighting and ventilation, drying and ventilation, but also help to alleviate the long time suffocated in the indoor space of the depression, especially in the epidemic closed control period, the balcony as the indoor and outdoor transition space, realize the psychological needs of the home to stay in observation of the personnel of the external exchanges and contact with the environment. In some micro living space design with balcony, there is integration of housework line to realize the integration of washing, drying and receiving behavior, and there is also the combination of living function to form the expansion of flexible functions such as entertainment and dining, communication and rest. Therefore, the flexible role of balcony in micro living space should be given more attention.

IV. B. Optimization Strategies Based on the Study of the Correlation between Morphological Composition and Usage Efficiency

IV. B. 1) Relative adjustment of bound and guided segregation

Dividing elements play a role in restraining and guiding living behavior, and their morphological elements are not limited to traditional enclosing walls or opening and closing doors and windows, but also include furniture cabinets, and the behavioral limitations brought about by spatial height differences. In terms of the efficiency of behavioral application, the efficient and positive restraining effect can reduce the degree of behavioral interference, such as high quality of sleep behavior, learning behavior, concentration, kitchen behavior, blocking the fumes from dispersing. Efficient and rapid guidance can facilitate smooth behavioral changes, such as folding partitions to form an instant switch between living and resting behaviors, and kitchen islands to seamlessly connect operation and dining behaviors. The internal partition system of micro living space should reduce the constraints of partition components to realize the smooth guidance of different spaces under the premise of ensuring the normal occurrence of basic physiological behaviors.

IV. B. 1) Flexible adaptation of spatial height and behavioral scale

The three-dimensional space is a composite use of the upper part of the miniature living space for sitting and lying, storage and storage needs, and the lower part for sitting and lying and access needs, which can be realized with the help of the combination of ladders and steps under the general net height (2.8-3.0m). It has the advantages of meeting various scale behaviors, accommodating more objects and improving space utilization efficiency, but it also causes local space depression and poor lighting and ventilation. Therefore, the following points should be noted in the design of three-dimensional space:

(1) In-depth study of static facility scale and dynamic behavioral activities, such as sitting and lying down to study and rest, briefly sitting up to pass and other spatial scale requirements are not high in the region can be formed three-dimensional space composite, while living, dining, kitchen and other areas of high demand for light and ventilation is not suitable for three-dimensional space composite design.

(2) To ensure the safety and convenience of vertical access to storage items, it is appropriate to add a solid staircase handrail, or set up a slide ladder on the storage wall to facilitate the flexible access to items at different heights.

V. Conclusion

In this paper, Revit digital modeling software is used to construct the basic structure of architectural space, and digital technology is used to set the shape parameters of the building. Through OpenGL virtual reality technology, the mathematical model of building space is processed to realize the digital design of building space.

(1) The design results of this paper are evaluated through the index of building space utilization rate, and the average integration degree of the eight house types is ordered as D>H>J>A>R>K>O>F,with the values of 1.1528, 1.0916, 1.0815, 0.9434, 0.8659, 0.8242, 0.7532, and 0.7129.

(2) The mean values of users' evaluation of the realism, interactivity, hierarchy, and design rationality of the architectural space designed using digital modeling technology are 93.9347, 94.0178, 94.0801, and 93.9759, respectively, and the sense of user experience is good.

(3) From six indicators, including the degree of travel convenience, the user satisfaction is analyzed. 79% of the people think that the bus transfer station in a neighborhood of HF brings convenience to the people's travel, and the satisfaction of the rest of the indicators is over 60%, which indicates that the users are more satisfied with the architectural space design of the digital modeling technology.

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