



Digital Graphic Design of Irregular Architectural Modeling Under Visual Communication

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Abstract. In the process of architectural modeling design, visual communication is an important part. However, in the traditional graphic design of irregular buildings, the artistic expression of visual communication is relatively less and single while the spatial structure, visual effect and color combination of the building will have a direct impact on the architectural modeling. Based on this, this paper first expounds the basic requirements of visual communication, then analyzes the specific process of digital graphic design of irregular architectural modeling, and shows its actual effect by constructing digital model and adjusting and optimizing the graphic design structure.

Keywords: Graphic Design · Digitization · Visual Communication · Irregular Architectural Modeling

1 Introduction

Under the background of the rapid development of information technology, with the help of which to design architectural modeling in the construction industry has become the key research contents and future development trend nowadays. In the reform and innovation of architectural modeling, people are no longer satisfied with the traditional regular modeling. In order to seek a visual breakthrough, irregular architectural modeling has gradually attracted extensive attention and widely used. However, the traditional graphic design of irregular architectural modeling is relatively monotone, which is difficult to give people a strong and deep impression visually. The graphic design of irregular architectural modeling based on visual communication can effectively optimize the data information structure of graphic design and carry out more modern design of lines, so as to improve the quality and effect of irregular architectural modeling design.

2 Basic Requirements of Visual Communication

2.1 Follow the Development of the Times

In the design process, through in-depth analysis of social information, designers can have a profound understanding of the development of the times and social needs. At the

same time, with the support of relevant architectural theoretical knowledge, designers can accurately judge the actual effect of visual communication. Visual communication is to effectively reflect the various forms and artistic beauty of architecture in the process of architectural design. Therefore, architects must do a good job in the integration, analysis and processing of social information, so as to ensure that they can design the plane pattern of architectural modeling and effectively express their ideas through artistic means.

2.2 Understand the Specific Needs of the Public

Graphic design based on visual communication will involve a variety of objects. Designers should pay attention to the public aesthetic characteristics on the basis of their own inspirations, formulate corresponding schemes for different projects, and constantly optimize the design. Therefore, designers need to conduct in-depth research and analysis on the project, and design according to the specific requirements of the area where the design project is located and the public, so as to ensure that the design can meet the psychological needs of consumers.

2.3 Expression of Visual Language

Visual communication design mainly expresses the design concept through elements such as light, color, three-dimensional geometry and text. In graphic design, it is necessary to systematically integrate relevant elements and form an ideal visual effect after reasonable optimization. At the same time, designers can also add more elements according to their professional ability, in order to enrich the visual communication effect. The effect of architectural graphic design is relatively poor under traditional mode, and there will be problems such as monotonous color. The digital graphic design using visual communication can effectively enrich the color to improve the effect of architectural design and make people feel the actual effect more intuitively [6].

2.4 Emphasize Color Design

Irregular architectural graphic design based on visual communication emphasizes the reasonable collocation of color elements. Scientific design of color elements and excellent lighting effect can effectively improve the light transmission ability of buildings, enhance the visual impact of irregular buildings, and promote consumers to more deeply understand the comprehensive performance of irregular buildings. Therefore, designers must attach importance to the application of color in the design, so as to highlight the graphic design effect of irregular buildings.

3 Overview of Graphic Design Under Visual Communication

In essence, graphic design under visual communication is a method to convey visual information, which requires designers to integrate text, image, color and other elements into the multi-dimensional design, so as to complete visual transmission and ideological expression. If designers want to realize visual communication, they need to elaborate on

the specific function in graphic design, effectively preserve the main content of visual information, screen texts and make reasonable arrangement and design. The purpose of visual communication design is to reflect the visual effect of art and effectively distinguish the pictures, paintings, texts and other information in visual communication, so as to make the design meet the actual standard requirements [4]. To demonstrate the sense of design and aesthetic of art through graphic design under visual communication, designers need to make use of their perfect skills in artistic design to deepen the visual impact and strong impression on people.

4 Digital Graphic Design Process of Irregular Architectural Modeling

In the process of digital graphic design of irregular architectural modeling, designers need to comprehensively and systematically collect, integrate, select, process and output relevant information. Especially, the graphic design of irregular buildings integrating building, landscape, interior and soft outfit needs to build a scientific and perfect information model. Then on the basis of the model, a professional information database is built to standardize the irregular architectural modeling design. As shown in Fig. 1, the process mainly includes the establishment of irregular building data model, the construction of database, the formulation of professional specifications and standards, the

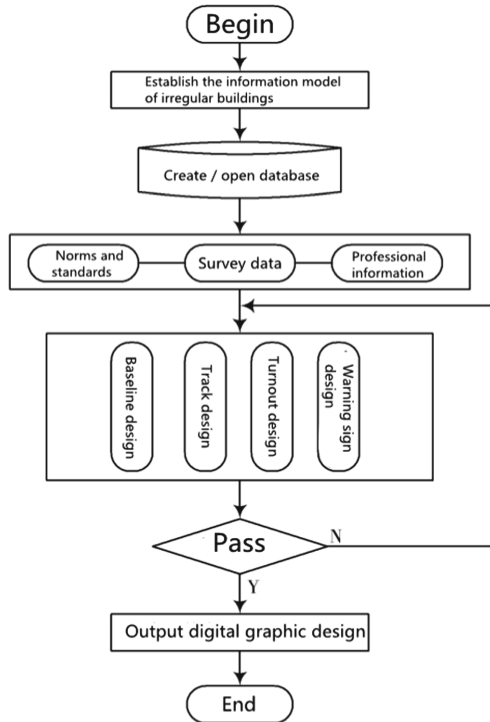


Fig. 1. Digital Information Model for Irregular Buildings.

integration and survey of relevant data, the setting and planning of warning signs, the design of switch structure, baseline design, review and analysis, and the formation of digital plane design drawing.

The digital graphic design scheme of irregular architectural modeling based on the visual communication mainly starts with the reasonable and scientific information model, and optimizes and adjusts the relevant structures in the digital graphic design according to the information model of various equipment applications, and formulates the graphic design route. On this basis, the structural association method in the digital graphic design of irregular architectural modeling is further studied and analyzed, so as to improve the quality and efficiency of the graphic design of irregular architectural modeling [5].

5 Constructing Digital Information Model for Irregular Buildings

5.1 Building the Information Model

Constructing the information model of irregular building is the basis for digital graphic design of irregular buildings. Designers need to comprehensively integrate and analyze the relevant data involved in graphic design, and create building information model that can meet the actual needs according to the types of irregular buildings. Then the model can be used to design various functions in irregular buildings and effectively analyze the plane data in modeling design. After systematically analyzing the plane data, the information model of irregular architectural modeling is formulated as shown in the Fig. 2.

In the model, the data related to geographical environment are divided into digital environment and digital geology and topography, which integrate two forms of information expression: natural ecological environment and social humanistic environment. Digital geological and topographic information in geographical environment is very important, which can directly affect the whole graphic design scheme and modeling design. The preconditions for the connections between different information include the interconnection of coordinates, the continuity of curvature, and the same state of different tangent angles and orientations. There is a certain correlation between the constraints

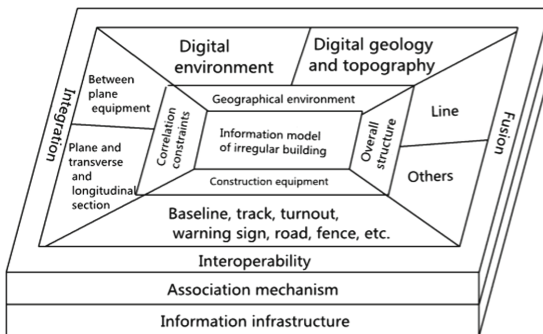


Fig. 2. Illustration of the general architecture of the Irregular Building Information Model.

and the parameters at both ends of the data, and the numerical equation can be used to optimize the calculation process [7].

The vector of the previous message is:

$$P_0 = [n, a, b, k, \varphi, m, x, y,]^T$$

The latter information parameter is:

$$P_1 = [n_1, a_1, b_1, k_1, \varphi_1, m_1, x_1, y_1]^T$$

The user specifies the first four parameters, this is equivalent to finding the last four parameters by knowing the first four. According to the nature of the previous information, the calculated model solved after the parameters is shown below:

(1) When $n = 1$, the following equation is obtained:

$$\begin{bmatrix} \varphi_1 \\ m_1 \\ x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} \varphi \\ m + a \\ x + a\cos\varphi \\ y + a\cos\varphi \end{bmatrix}$$

The φ in this equation denotes the tangent azimuth; a, m, x and y are all numbers in the vector.

When $n = 3$ or 4 , an information mitigation curve can be obtained whose length can be expressed: $l_0 = a^2/b$, then the following equation can be obtained:

$$\begin{bmatrix} \varphi_1 \\ m_1 \\ x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} \varphi + \beta k \\ m + l_0 \\ x + x_z \cos\varphi + y_z \left(\cos\varphi + \frac{k\pi}{2} \right) \\ y + y_z \sin\varphi + y_z \left(\sin\varphi + \frac{k\pi}{2} \right) \end{bmatrix}$$

5.2 Optimizing the Graphic Design Structure

After the information model of irregular building is built, the data structure involved in digital graphic design needed to be further clarified and optimized. It is not only necessary to describe the basic attributes and conditions such as data type, longitude and latitude and scale, but also to ensure that it meets the preconditions for creating behavior model and data model of irregular buildings. Therefore, professionals should systematically and scientifically optimize and adjust the data structure about irregular buildings [1]. In the process of optimizing the data structure, designers can rename the plane design scheme of irregular buildings, convert its file format into “. mbb”, and uniformly set different structural information to the same file format. At the same time, the relevant fields in the information table should have a reasonable corresponding relationship with the variables in the data structure, which is convenient for designers to save and import the relevant graphic design information in the data structure.

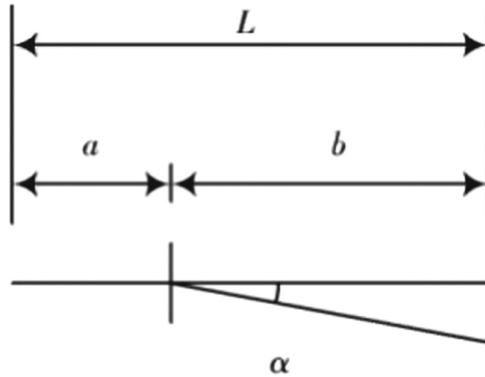


Fig. 3. Schematic diagram of the geometry of the turnout.

5.3 Route Planning of Irregular Buildings' Digital Graphic Design

In the process of digital graphic design of irregular architectural modeling, architects turn the main line of single turnout into straight line and the side line into right opening or left opening. That is, the side line is formed by the main line to the right or left. In the actual design, in order to meet the digital graphic design requirements of irregular architectural modeling, the turnout can be represented by the center line at the turnout and intersection. This method will greatly facilitate the designers to draw the scheme. The geometry of the turnout itself is shown in Fig. 3.

a indicates the distance between the line start section to the turnout center; b for the turnout center to the line after the withdrawal of the fork track seam distance; L for the full length of the turnout, that is, the distance start from the turnout basic line to the line after the withdrawal of the fork track seam; α for the turnout withdrawal angle. Combined with the content shown in Fig. 3, a one-dimensional array $XYArray$ can describe the line property in the design, specific numbers and meaning are shown in Table 1.

The main contents of route design are route saving, route movement and route construction. At the same time, each route is not independent, and there will be a certain management relationship with other facilities and equipment in the plane. It can also accurately calculate the geographical location of signal facilities according to the associated turnout information. Therefore, the connection design of line is the most important in line design. There are two common design schemes.

The first is to associate the line facilities with the line turnouts. The turnouts in the middle of the line can lead out the line smoothly. At the same time, two variables, $ACHAR\ INTRACKNO$ and $ACHAR\ OUTTRACKNO$, are used for comprehensive recording, so as to facilitate the designers to quickly obtain the associated line equipment [2].

The second is the association between line facilities and signal equipment. Through scientific and effective association processing operation, the relationship between line equipment and signal settings is detected. Through the correlation between the line equipment and the turnout, $SwitchBH$ can number and record the turnout associated with the annunciator and the alarm signal and the turnout. Afterwards, the experimental

Table 1. Meanings of line element arrays and their specific numbers.

Code	Meaning	Numbers
XYArray[0]	Line property	1. Single open; 2. Double open; 3. Triple open; 4. Crossed divisions; 5. Diamond cross
XYArray[1]	Withdrawal of fork angles	α
XYArray[2]	Left and right turn	0. No left or right; 1. Right turn; -1. Left turn
XYArray[3]	Start tangential azimuth	$0-2\pi$
XYArray[4]	The length of turnout centre	Projected miles to the line baseline
XYArray[5]	N coordinate of the centre of the turnout	--
XYArray[6]	E coordinate of the centre of the turnout	--

design can be used to explore the effects and requirements of digital graphic design for specific irregular buildings, to maintain aesthetic appeal visually and to verify the effectiveness of digital graphic design for some irregular architectural shapes under visual communication [3].

6 Conclusions

Architectural modeling is not only an important aesthetic expression, but also the soul of buildings. The digital graphic design of irregular architectural modeling based on visual communication is the comprehensive design of buildings using architectural aesthetics. When the visual communication effect is highly unified with the graphic design effect, the building will show a unique architectural beauty, which can effectively convey the thoughts, emotions and style that the designer wants to express. When carrying out graphic design of irregular architectural modeling under visual communication, designers must focus on the basic needs of the public, and follow advanced technology and modern ideas, so as to ensure that the architectural beauty can be fully reflected.

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