Aesthetic principle and visual perception model of urban visual design

Deng Lujie[1,a,*], Li Jiang [1,b], Liang Lizhu[1,c]

[1]School of Digital Media and Design, Neusoft Institute Guangdong, Foshan, China
[a]912154956@qq.com, [b]315209741@qq.com, [c]285384802@qq.com
*Corresponding author

Abstract: *In urban visual design, aesthetic principles are particularly important to ensure the harmony between the design object and the natural environment, to create maximum visual comfort, and thus enhance the public's emotional belonging and value identification with the city. This paper outlines the three stages of the visual perception experience model, namely the cognitive stage, the comparison stage, and the dialogue stage, through theoretical research and case studies. The study of the visual perception model reveals the visual organization characteristics and semantic connotations of design objects as well as the mechanisms by which people generate emotional responses, providing a new theoretical path and design direction for urban visual design.*

Keywords: *urban visual design, aesthetic mechanism, visual perception, visual comfort*

1. Introduction

In the 21st century, design permeates almost all areas of human activity and has become one of the main elements of culture. Design activity aims to create harmonious and holistic living environments for human beings based on an awareness of the laws of art and design, a modern research approach to materials and technology, and an understanding of the laws of ergonomics, economics, sociology, and psychology. The design process requires the integration of engineering, natural sciences, and humanities (philosophy, psychology, sociology, art history, semiotics) to promote the visual comfort of the human environment and the development of design objects.

Cities are places where humans gather and live and contain elements of population, materiality, culture, relationships, and imagery. The French sociologist Yves Graf Meyer defines the city as the evolving product of modern set-up human society, referring both to the configuration of precincts, physical environments, and tangible objects and the relational union between inhabitants, collective living units, and social themes [1]. With the advent of time and technology and the era of map reading, the design of modern cities is faced with the aesthetic trend of pictoriality, i.e., the construction of urban imagery through a large number of visual images, through which urban residents perceive the city and establish a relationship with it. Relying on modern technology and communication media, the urban visual design transforms abstract readable textual information such as urban concepts and urban conceptual systems, urban planning and design, urban management ideas, urban rules and regulations, and urban laws and regulations into figurative visual elements with specific meanings such as graphics, logos, colors, and words, thus enhancing the public's aesthetic awareness and value recognition of the city.

This paper divides the content of urban visual design into two aspects: on the one hand, it refers to the formal design, the visual design of the urban image system, which includes the standard system of signs, words, graphics, colors, etc. Through the unique, standard, and overall system design, the visual recognition rate and dissemination rate of the urban image can be enhanced, and the public's visual perception and behavior can be guided; on the other hand, it refers to the environmental design, i.e., the visual design of urban space, which includes the specific design of urban on the other hand, environmental design refers to the visual design of urban space, including the design of urban architecture and urban landscape. From a macro perspective, the visual design of urban space includes the design specifications of the natural and human environments. The harmony between the natural and human environments is an important principle of urban space design, while the design of the human environment is what shapes the soul of a city. Overall, urban visual design is a collection of principles such as technicality and artistry, perception and cognition, and normative and aesthetic [2].

This paper defines the three levels of visual perceptual characteristics (physical, physiological and psychological) by describing the mechanisms of aesthetic demand and aesthetic emotion in urban visual design, i.e., through a visual organization, and emphasizes that the creation of a 'visually comfortable' environment is the main aesthetic principle of urban visual design. A model of visual perceptual experience is proposed based on the three levels of visual perception, i.e., a systematic visual perception is formed through the cognitive, comparative, and dialogical stages.

2. Aesthetic principles of urban visual design

The modern urban visual design has helped mankind to construct a 'second nature by increasing his detachment from the natural environment. Modern urban design was influenced by the modernist and internationalist design styles that were popular from the 1930s to the 1980s, with Mies van der Rohe as the representative of functionalism and the less is more design principle. The Internationalist design style is considered to be an accomplice to the elimination of aesthetics (de-aestheticization) and the destruction of the human ecology, which is the main reason for the decline of the Internationalist style [3]. Research has shown that the aggression and homogeneity displayed by modern cities under the influence of modernist and internationalist design styles have a negative impact on the psychological and physical state of the human being. Modern cities need to replace general visual communication with a more entertaining design approach [4] and the 'visual comfort' environment has become one of the main goals of modern urban design. Design should give priority to aesthetic principles, creating an urban environment that is conducive to public visual comfort and pleasure, satisfies aesthetic criteria, and is formally harmonious.

The main objective of design is therefore to create design objects with a high artistic and aesthetic value and a unified form and function. The need for aesthetics is one of the fundamental factors that reflect the psychological well-being of human beings, which is often overlooked by researchers and designers. In general, the creation of harmonious and emotionally comfortable urban design objects is a basic aesthetic need for modern urban design, and urban design for a 'visually comfortable' environment, i.e., urban visual design, can fully evoke a positive emotional response and thus escape the negative emotions brought about by the monotony and aggressiveness of the environment.

The main purpose of urban visual design is to harmonize the various elements of formal and environmental design, to enhance and beautify our living conditions, to improve the aesthetics and taste of the public, and to cultivate the spirit and soul of aesthetics through the consideration of aesthetics. The visual organization of design objects can help the public to establish a good mood, stimulate happiness, awaken memories and conquer the mind, and people can achieve the aesthetic realm of 'seeing things like feelings and turning feelings into things' through viewing or experiencing them. Therefore, the visual aesthetics of a design object can elicit a corresponding emotional response, which is expressed in the visual organization that defines people's visual perception characteristics.

From a cognitive psychological point of view, the use of simple geometric shapes as a base shape in the urban visual organization can draw attention to itself. The visual organization of the city is created using simple lines, flat shapes, and three-dimensional figures, however, despite their simplicity, they can also elicit certain emotional responses from the public. The public's perception of the visual organization of a design object is not limited to simple geometric shapes but can mobilize emotion and feeling. The visual perception of geometric shapes is characterized by three main layers.

Level 1: The physical layer - refers to the principle of mechanical imaging of the human retina, where visual information is communicated through the optic nerve to the visual central nerve in the cerebral cortex, ultimately forming vision. This principle is similar to that of the camera, in that the human eye quantifies precise measurements, identifies and describes geometric shapes, ovals, polygons, spheres, etc. and translates them into visual images of specific scales, angles, or volumes, and the process of viewing is like that of a camera taking pictures, where one sees the objective object itself.

Layer 2: Physiological layer - refers to the visual physiological process of assessing visual perceptual parameters based on the principles of visual physiological imaging, i.e. the processing of visual information from the retina to the cerebral cortex. Simple visual information such as shape, color, size, and texture of the viewed object is used for initial perception, and the information of interest is quickly targeted so that it is prioritized for visual perception and memory. Visual physiological imaging is the physiological underlying factor of visual perception. People form visual information processing, processing, and operational mechanisms [5] through visual attention, visual selection, and visual memory,

which help people to quickly access visual information and store it into experience and memory as later visual perceptual experience.

The third layer: the psychological layer - refers to the viewer's visual perceptual experience of things, this experience is based on the subject's sense and perception of the information processing process, the design of object lines and geometric shapes, planes and volumes, and many other elements can be coordinated with each other and produce a "holistic effect "[6]. Gestalt psychology theory believes that this "overall effect" is the overall impression formed by the linkage between vision and brain during the viewing process and that human visual perceptual behavior is holistic [7]. In the urban guidance system signage elements, the overall structure of Chinese characters, English characters, and Arabic characters play a key role in visual perception, and the clear and definite frame structure of the font will directly affect the degree of recognizability of the font, which is determined by the totality of visual perception.

Impressions and memories of objective objects subconsciously influence one's ideology, emotions and value system. Thus, simple geometric shapes also influence our moods and emotions, resulting indescribable, systematic impressions and memories. The various formal elements of a design object (point, line, surface, volume) in themselves and the interrelationship of these elements can bring about different emotional experiences such as pleasure or pain to the viewer. From a market perspective, the different emotional experiences created by the visual perception of form can influence people's needs and purchasing preferences, so mobilizing people's emotions by creating harmonious visual forms is not only an aesthetic requirement but also a market need.

3. A model of visual perceptual experience for urban visual design

Everything designed for human beings should take into account the specificities of their visual perception. The creation of a 'visually comfortable' environment is one of the main objectives of modern urban visual design, and its solutions involve psychological and physiological research, as the mechanisms of visual perception are extremely complex and can be expressed as an active perceptual process aimed at converting visual signals into visual images. The process of visual perception is a "visual reading process" from the outside in and is the process by which people recognize and understand visual images and preserve the visual perceptual experience. Based on the three levels of visual perception characteristics mentioned above, the visual perception model of a design object is divided into the following three stages.

3.1 Cognitive stage

The cognitive stage is the subject's direct perception of objective things and is the primary stage of visual perception. The process of visual perception can be understood as the process of acquiring retinal image information, and the information acquired at this stage is considered to be plain, uninterpreted, and meaningless sensory information [8]. In this stage, visual physiological processes and visual mental processes work together to process what is seen by the eye through the brain's neural coding system and to enable clear recognition of memory. This is an instinctive, non-culturally, geographically, age- and gender-independent visual perception ability, a non-acquired intuitive mental phenomenon. In the case of urban visual design, when confronted with an urban landscape of tall buildings, people see nothing more than an interweaving of geometric lines and a collection of geometric bodies of different sizes.

3.2 Comparison stage

The comparison stage is the process of mental comparison and cognition of incoming information by the visual cortex of the brain and is a processing activity of information. The cognitive stage underpins this phase, unlike the sensory or intuitive role of the previous phase, in which perception plays a major role. According to Arnheim, the visual image is never a mechanical reproduction of perceptual material, but rather a creative grasp of reality, which contains imaginative, creative beauty [9]. In the process of 'creative grasping', people's existing knowledge and experience play an important role in establishing links and relationships with previously known objects through comparison, comparing the viewed object with known images, finding differences, capturing variations and unexpected relationships and features. This stage is considered to be a process of sifting, revising, schematizing, and interpreting the previous stage, where past experiences and knowledge are involved in determining what the viewer sees, how they understand, and how they see it [10]. In this process, perception compares and processes visual

representations of objective things without involving the deeper level of imagery (connotation level). Through active perceptual selectivity, people select the elements they are familiar with or interested in for perceptual analysis and construction among the complex visual information, thus forming an overall visual perception and visual experience of objective things.

In urban visual design, the comparison stage can help people to recognize details systematically and completely and to be able to distinguish between different design objects. Each city has its visual symbols of urban culture: the "Eiffel Tower" in Paris, the "Statue of Liberty" in New York, the "Oriental Pearl Radio and Television Tower" in Shanghai, and the "Little Barbarian Waist"in Guangzhou. Through comparison, people can distinguish between the visual symbols of different cities and construct a visual perception of difference and uniqueness, which in turn aids urban visual design.

3.3 Dialogue Stage

Dialogue is an interaction of the mind, an imaginative dimension of visual image perception. In this stage, thought intervenes in the process of viewing, guiding, and reconstructing our visual experience through imagination, judgment, and reasoning. The image we see is not an image in itself, but a thoughtful "imagery", the semantic connotation of the visual image. The imagery reflects the shaping and construction of the subject's mind through the communication between the object itself and through the visual perception of the object, which resonates mentally and thus gives new. The thinking interaction in the dialogue stage can break through the boundary and existing norms between perception and thinking, creatively connect the image world with abstract thinking [11], is the in-depth perception of objective things after the comparison stage, to construct the image connotation of visual images. These connotations are formed by the joint action of intuitive perception and rational analysis of the visual form of objective things.

4. Conclusion

The visual perception of a design object evokes a corresponding aesthetic and emotional response. This aesthetic mechanism is expressed in the form of visual organization, which defines the visual perception characteristics of the physical, physiological, and psychological layers of the design object through the visual reading process from the outside to the inside. In urban visual design, this is reflected in the creation of "visual comfort" environments that influence people's moods and emotions. In addition, the visual perceptual experience model predicts the impact of the design object on the emotional and affective state of the individual, and it is necessary to consider how emotional colors and imagery are generated in visual images when undertaking design projects. Urban visual design should be responsible for the overall construction of the city, combining the commercial aspects of the city with the spiritual and cultural aspects of the city, creating a harmonious and comfortable environment full of humanistic feelings, satisfying people's aesthetic needs and emotions, enhancing people's sense of belonging and happiness, and enabling people living in the city to realize what Hölderlin called "The poetic habitat"[12].

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