

Test and Design of Colors and Visual Illusion Based on Changing Spatial Character

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Abstract: In order to change the dull and rigid atmosphere in some interior spaces, a kind of scheme of aesthetic optical illusion is designed combined the spatial principle, and colors and visual illusion design technology. Which is beneficial to change the spatial character. In this paper, VR technology is used to immerse the space of three times three times three cubic meters of red, orange, yellow, blue, green, purple, white and black, so as to collect the psychological effects of the experimenters, the results showed that 90% of them had the same color psychological induction. The conclusion of colors and visual illusion is verified through the successful application of the practical results in plane, indoor and medical treatment: changing the spatial character can reasonably use the colors and visual illusion design, can have unexpected humanistic interest and aesthetic enjoyment, and meet the aesthetic needs of space. Therefore, it is suggested to set up some colors and visual illusion works of art in the ordinary space to improve the comfort and aesthetic taste of the space.

1 Introduction

Color plays an important role in the interior space design, and it has exerted its role in the stage of design. However, with the competition and pressure brought about by the rapid development of society, the living space gradually shows its pressure and depression. People hope that the limited space can relieve the pressure, and hope that the space can be artistic, interesting and emotional. In fact, as long as we subtly use color illusion, people's wishes can be realized, which can make it produce special artistic effects, allowing the plain and unpredictable space interesting.

2 Vision and Visual illusion

2.1 Vision

People mainly rely on the human eyes to recognize indoor space, and the human eyes are the main way to recognize the objective world. The human eyes consists of two parts: the retina and the refractive system (including aqueous humor, corneal lens, and vitreous). The visible light refraction with a wavelength of 380-780 nm is imaged on the retina, and the optic nerve is transmitted to the visual center of the brain. The human eye can distinguish the color of the object and distinguish its brightness (as shown in Fig. 1, it is in the eye mask image). Thus, the human eyes can see the contours, shapes, sizes, colors, distances and surface details of the illuminated or reflective objects within the visual range. Simply speaking, the human eyes see an item and perceives its existence, this process is called vision.

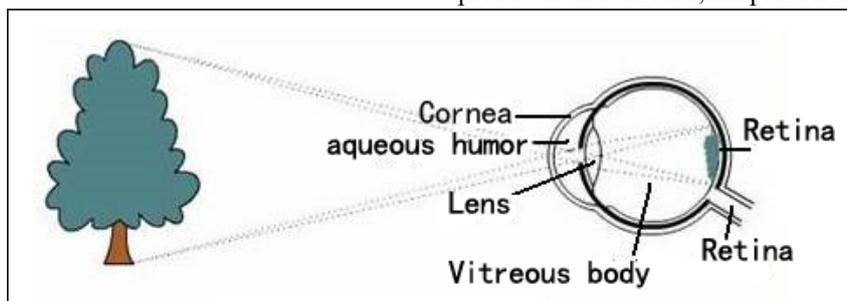


Figure 1. Image of an external object in the eye mask

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The process of visual formation is roughly as follows: the light reflected from the external object passes through the cornea, pupil, lens and vitreous body, it is refracted through the lens, and finally falls on the retina to form an object image. There are light-sensitive cells on the retina that transmit image information through the optic nerve to certain areas of the brain, and people possess vision.

2.2 Visual illusion

Hu Shi's "A Letter to Lan Zhixian " tells: "In fact, the 'pinyin text' has two sides, the pinyin is 'hearing', the text is 'visual'", and the reading text refers to the visual system at work. Through vision, people and animals perceive the size, brightness, color, movement and other objects of external objects, and obtain various information that is important to the human body. At least 80% of external information is obtained visually. Visual

is the most important thing for humans and animals. But it's worth noting that 20% of the visual information is "deceptive" and the eyes don't necessarily see it. The image is formed on the retina, and the vision is produced in the visual center of the cerebral cortex. The vision produced by the brain center is based on subjective experience and is not an objective observation. Let's take a look at our own "eyes" with the following images. As shown in Figure 2, when you see it, do you think the lines in the picture are curved? In fact, they are all parallel. As shown in Figure 3, do you think that one of the yellow lines in the figure is higher than the other one? In fact, they have the same height. As shown in Figure 4, do you think all the points are scrolling? In fact, they are still. As shown in Figure 5, do you think there are several black spots moving? In fact, they are all white, and they are still.

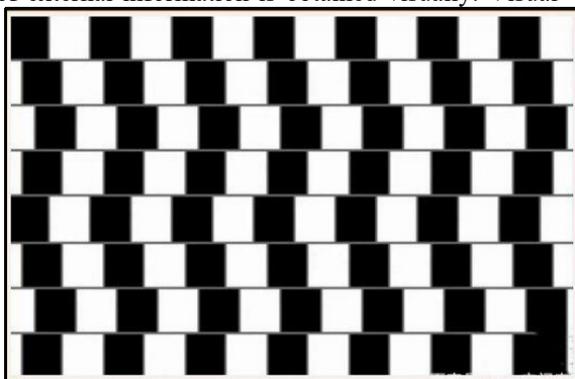


Figure 2. The parallel line illusion

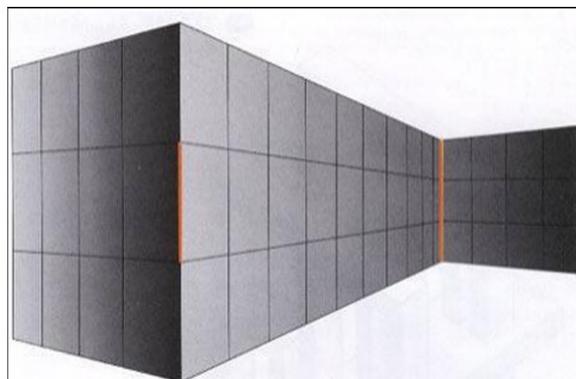


Figure 3. Contour illusion

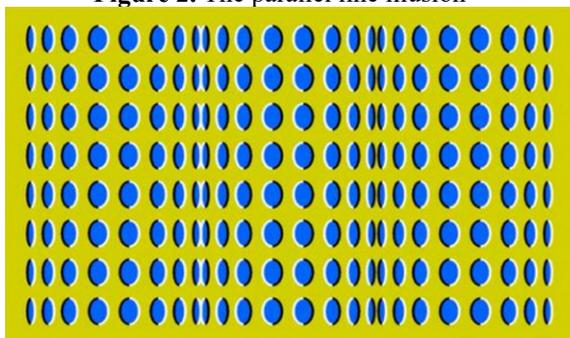


Figure 4. Point illusion

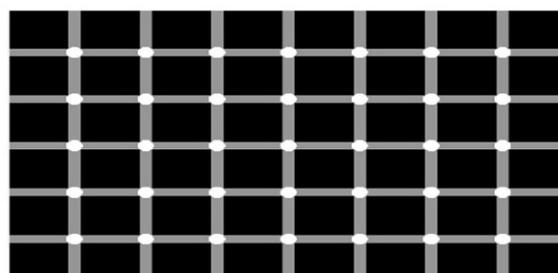


Figure 5. Cross line illusion

The similar phenomenon shown in these four pictures can be called "visual illusion". There are two reasons for this illusion, the first reason is that when you look at the picture, your eyeball has a slight disturbance; the second reason is that there is a certain difference between your gaze point and the surrounding area.

Visual illusion refers to the Visual illusion or distortion produced by the observer in the cerebral cortex center when the observer perceives the balance between his subjective grasp and the object. When the observer relies on past experience and invests in a visually suggestive mood, the reaction for the illusion is formed. Simply speaking, the Visual illusion refers that the object image seen under a certain visual suggestion is disturbed by past experience in the cerebral cortex to form a false

vision.

3 Practice on colors of psychological induction

3.1 basic knowledge about colors

Colors in nature include two parts: achromatic and color, achromatic refers to black, white, and gray with different depths, and all other colors are belong to color. Color has three attributes, including hue, purity and lightness. Hue is also called color, which is the basic feature of color; Purity refers to the purity of color, red, yellow and blue are the most pure colors, they are also called three

primary colors; Brightness is also called brightness, which means the brightness of color. If the color is closer to white, it has higher brightness, if the color is closer to black, it has lower brightness. Different colors with different hues, lightness and purity are put together in different ways to form color contrast, which will produce different feelings of colors, that is, psychological feelings of colors.

3.2 virtual experiment of technology

When people are in different color environments, in addition to their visual discrimination is affected and their vision changes, their psychological feelings are also changed. In order to verify the different color psychological feeling of different colors, the color virtual technology practice is carried out. Virtual Reality, or VR for short in English, is a technology to provide immersive feeling in the interactive three-dimensional environment generated on the computer by using the computer graphics system, and all kinds of facts and control interface devices. Then the simulation scene established in 3MAX software was imported into Oculus Rift software, which is an external head-display device. Meanwhile, the immersive experience of 30 subjects was collected to obtain the response under different scenes.

Props of experiment: 3D simulation spaces of three times three times three cubic meters of red, orange, yellow, blue, green, purple, white and black are made respectively, and external head-display device named Oculus Rift is also made.

Subjects of experiment: 30 adults, 15 women and 15 men are included.

Purpose of experiment: collect the information of psychological effect of the experimenter by immersing himself in different color space with VR head-display

device.

Design of experiment: 30 experimenters wear VR head-display device, they virtually stay in the red, orange, yellow, blue, green, purple, white, black space, three minutes of immersion experience in each space, and then talk about their own experience, and the staff record the experience data.

Analysis of experiment: Colors affect people's psychological feelings and comprehensively physiological feelings, which affects people's memory, perception, association and emotion, and stimulates vision. When 30 experimenters saw red, orange, yellow and other warm color systems, these 30 people immediately associated with the sun, hot blood, flame and other images, producing warm, warm, excited and other color feelings, accounting for 100% of the participants; When they looked at the warm colors such as red, orange, yellow, which in the black and dark background, 27 people felt that the color porcelain had a sense of advancement and expansion, these accounted for 90% of the participants. When they see the blue, blue purple, blue green and other cold colors, 30 people associated with the sea, sky, ice and snow, which makes people feel cold, rational and calm, quiet, even a little melancholy, and when they are stacked with red, yellow and orange blocks, 27 people felt that those colors have the feeling of receding and shrinking.

Results of experiment: collect 30 experimenters' information about red, orange, yellow, blue, green, purple, white and black respectively, which concludes that people will have different psychological changes when they are in different environments of colors under the same environment. Different colors produce different psychological feelings of colors, which is shown in Table 1 Different colors represent different psychological feelings.

Table 1. Different colors represent different psychological feelings

Color	Association that causes psychological effects and feelings														
	Excitement	Melancholy	Enron	Passion	Refreshing	Easy	Heavy	Distant	Closeness	Warmth	Coldness	Quiet	Anger	Power	Softness
Red	■			■			■		■	■			■		
Orange	■									■				■	
Orange yellow	■			■					■						
Yellow	■			■					■	■					
Kelly							■			■		■			
Green			■		■			■			■	■			■
Green blue								■			■	■			
Sky blue								■			■	■			
Light blue			■		■	■		■							
Blue		■			■		■	■			■				■
Purple		■			■		■	■			■				
Fuchsia	■									■					

White					■	■								
Light gray						■								
Dark gray		■					■							
Black		■					■						■	

Note: “■” indicates that there is such a psychological effect or feeling association.

3.3 Practical Conclusions

The use of visual illusion is to enable the observer to change the subjective idea on the original thing with some visual experience and psychological cues, and to realize the changing spatial sensation in the process of viewing.

Extended space Visual experience provides us the ability to perceive deep space. The audience can change the visual perception depth through visual illusion, thus causing virtual changes in spatial distance and the space is expanded. In addition, scale illusions and color illusions can also cause changes in the visual range. When the audience observes things in the environment, according to the principle of perspective, people will produce the illusion. The color is reflected to the retina, it has different wavelength, and people will generate different distance sense. In the extended space, these illusions are often used to adjust the object scale and distance.

Adding fun Rationally using the principle of Visual illusion will increase the interest of the indoor space environment. The visual illusion leads to a contradiction between the visual image and the objective real object, which causes the visual sensory system to generate stimuli. The visual tension caused by this special stimuli will arouse people's interest. The audience are willing to respond to the designer's suggestion and appreciate the transformation that occurred in front of them. It is the visual illusion that allows them to experience the special perceptual effects of design and production activities, which can extend the interest of the viewers.

Creating a situation Contemporary interior design pays more attention to create atmosphere to meet people's material and spiritual needs. It involves people's visual,

auditory, and olfactory in the indoor space environment, extending to the layout for indoor spaces and the matching effect of sound, light, color and shape indoor. The rational use of Visual illusion can create an atmosphere with a certain artistic effect and a unique atmosphere.

4 Application of Color Optical Illusion

The use of color optical illusions enables the observer to change the subjective idea of the original thing to design based on some visual experience and psychological cues, and enable the observer to realize the change of the feeling of color in the process of watching. Proper use will produce unexpected value-added effects.

4.1 Application in Graphic Design

Using color psychological effects to design patterns can produce interesting Visual illusions and even illusions. Figure6 is the French flag, but many people think that the three color blocks are the same in size. The original French flag was made in the same width as blue, white and red. Later, the designer found that the white color in the middle is brighter than the two sides, the human eyes have an illusion that they think that the red bands on both sides are not as wide as the blue one. Later, in order to overcome this visual illusion, the designer narrowed the blue band and widened the red band. Then it looks natural and well-balanced, thus forming a color as blue, white and red from left to right, which accounted for 30%, 33%, and 37%. The "Color Art - Color Subjective Experience and Objective Principles" by Johannes Eaton, Germany, mentions that contrast is a viable starting point for studying color aesthetics.

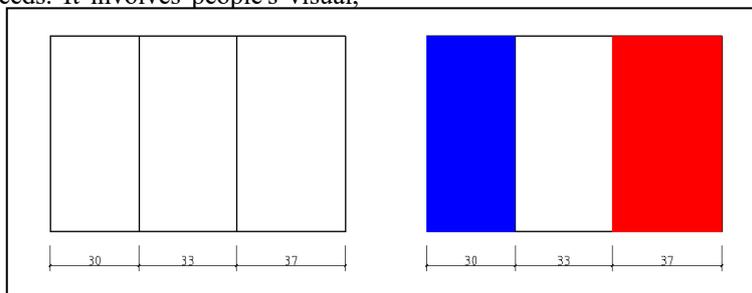


Figure 6. French flag

4.2 Application in Interior Design

Applying the color visual illusion to the interior space design will improve the space, add value to the space, and change the space sense through contrasts in color.

Figure7 is a TV background wall without a blue background, Figure8 is a blue and white background wall, in the blue-centered color combination, it has a visually reduced and retracted effect, which can allow the small space to be wider, lighter and cleaner.



Figure 7. White



Figure 8. Blue and white

Stairway corridor space is a relatively small or narrow space, people will feel bored when crossing this space. Using color illusions to improve such spaces makes the space interesting and impressive. In the McDonald's in Tianhe District, Guangzhou, the dining area leading to the basement is a relatively narrow spiral staircase. The designer uses pure yellow to brush the wall and use light-assisted lighting to make the whole staircase relaxed and comfortable. Because yellow can make people feel bright, cheerful, and spacious, which is

in line with the psychological expectations of young people in the left of Figure 9. In the space full of light and color, the improvement for the small space has a unique idea.

The light is applied to the object to produce a projection, thereby forming a light and shadow space. As the position of the illumination source changes, the shape of the shadow is also changed. The role of light and shadow enriches the shape of the corridor space, creating a dynamic and



Figure 9. Corridor light effect



Figure 10 . Corridor checkerboard illusion

mysterious atmosphere. As shown in the corridor light effect in the right of Figure 9, for the light and shadow effect of the blue and white stripes, with the change of the intensity of the light, it can not only clearly express the shape of the space, but also allows the space atmosphere active and vivid. Some corridors are too long, allowing people feel it is boring. Design an illusion of color in the aisle of the corridor to enhance the interesting atmosphere is a great idea. As shown in the illusion of the checkerboard in Figure 10, it seems that several blues are hanging, when you observe it in another position, you will find a square. In fact, the painting range is large and long.

their mental state. It was found that 71% of the forest ramblers felt that less depressed, and 90% of the forest ramblers felt that their self-confidence increased. Only 22% of people walking in indoor shopping malls felt less stressed, 50% of people walking in indoor shopping malls felt more stressed, and 44% feel less confident. The study shows that green can allow people to be calm, gentle, relaxed, calm, comfortable and comfortable. For mental patients, green is a cheap and affordable “environmental therapy” that is feasible and has no side effects.

4.3 Applications in Medicine

“Environmental Therapy” uses the psychological effects of color to treat patients. Scholars at the University of Essex in East England are responsible for studying “environmental therapy”. In the study, they conducted a study on 20 volunteers with mental health problems, they were required to walk for 30 minutes in the green trees and indoor shopping malls respectively, and then tested

5 Conclusion

The design of color visual illusion can be used to open the door of visual aura, and enjoy the aesthetic value added by color optical illusion which is the purpose of this study. This purpose seems to call on the observer to accept the phenomenon of color visual illusion psychologically and to be willingly of being deceived, but this is actually a blessing in design.

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