Coding and Anti-jamming Strategy for Color Recognition in Mind in Graphic Design

Huiling Li

ABSTRACT
This paper starts with the carrier of information in plane design, and defines the meaning of the symbol itself in the plane design. From the features and functions of visual symbols, we seek to design visual symbols that meet the needs of communication. The main media of visual symbols in plane design are analyzed, and the design and dissemination of visual symbols are carried out according to the characteristics of each media. And then it analyzes the valuable communication role played by symbols in the field of communication. Finally, the most effective communication method of symbolic language in plane design is discussed. At the same time, it analyses, collates and sums up some classic cases, and concludes the final core point of view.

Key Words: Anti-jamming, Mind, Positive emotion, Negative emotion, Graphic Design

DOI Number: 10.14704/nq.2018.16.5.1268

Introduction
Color endows objects with the image of beauty with its unique charm so that objects have a sense of beauty. Human beings’ desire for color is as natural and intense as the desire for breathing air (Abdullayeva and Kazim-Zada, 2008). Color is like the life of all things in the world which will be unmeaning without color. Art design is closely related with the history of color. Its long history can date back to prehistoric era. When our ancestors lived in caves, they left colorful original paintings on the rock wall. Color, as one of the basic elements of graphic design, plays an important role in graphic design. Modern design is inseparable from color. In the informationized modern society, color is applied to different fields, such as product packaging, advertisement design, poster design, logo design, film and television design, etc. Color not only carries information transmission, emotional transmission and function implying, but also arouses the desire of consumers to purchase and brings joy to consumers. In design and life, the most attracting one is amazing colors that are divided into primary color, binary color and broken color. Primary color can be divided into three primary colors of light, namely red, green and blue, as well as three primary colors of objects, namely red, yellow and blue. That two primary colors are blended is called binary color. That three primary colors are modulated according to different proportions, or binary color is modulated with binary color is called broken color, also known as tertiary color.

Hue contrast
When different colors are arranged, the hues affect each other so that the original colors have different feelings. Therefore, the color contrast formed by the difference of the hues is called hue contrast as shown in Figure 1. Hue contrast can be divided into same color contrast, adjacent color contrast, antagonistic color contrast and complementary color contrast.
Li H., Coding and Anti-jamming Strategy for Color Recognition in Mind in Graphic Design

Figure 1. Color saturation contrast

Lightness contrast
When two or more colors with different lightness levels are arranged together, the color contrast formed by the difference of lightness is called lightness contrast as shown in Figure 2. Yellow has the highest lightness, followed by orange, red, green, blue, and purple (Garcia-Villegas et al., 2015). The difference between the lightness of color determines the degree of lightness contrast. In the lightness color code, white is 10, black is 0. In the middle is evenly tactic 1~9 gray blended by black and white. Gray of 1~3 degrees is called low lightness color, 4~6 degrees is called medium lightness color, and 7~9 degrees is called high lightness color. Black of 0 degree is the lowest lightness color and white of 10 degrees is the highest lightness color. Lightness contrast is divided into same lightness contrast, similar lightness contrast, antagonistic lightness contrast and complementary color lightness contrast. Complementary color lightness contrast is the contrast between highest purity hue and none-color gray, both of which have a strong purity difference, so the contrast is called the strongest contrast of purity. This contrast is clearer, richer and high-definition. In graphic design, in order to highlight the graphic effects, lightness contrast and purity contrast can show a clear sense of graphs in addition to the hue contrast.

Figure 2. Color lightness contrasts in the nine palaces

Purity contrast
When two or more colors of different purity are arranged together, the color contrast formed by the difference of purity is called the purity contrast as shown in Figure 3. The difference in purity between colors determines the degree of purity contrast (Hossain et al., 2015). Contrast within the distance difference is called purity weak contrast and contrast of distance difference is known as purity medium contrast, while contrast beyond the distance difference is called purity strong contrast. And the contrast of purity difference between is the strongest contrast. Purity contrast is divided into same purity contrast, similar purity contrast, antagonistic purity contrast and complementary purity contrast. Complementary purity contrast is the contrast between highest purity hue and none-color gray, both of which have a strong purity difference, so the contrast is called the strongest contrast of purity. This contrast is clearer, richer and higher-definition than purity contrast but it is prone to produce stiff and exciting feeling. In graphic design, in order to highlight the graphic effects, lightness contrast and purity contrast can show a clear sense of graphs in addition to the hue contrast.

Figure 3. Color purity formation

Area contrast
Any color will cover an area and there is no color without area. When two or more color areas are arranged together, the color contrast is called area contrast as shown in Figure 4. The size of the color area affects people’s vision and psychology (Lee et al., 2008). The size of the color area is related to the hue. In the design, visual effect of color can be obtained by comparing the color area. For example, “a little red among the green” is the color area contrast. In the design of the layout, the position of “a little red” should be in the visual center. In the advertisement design, area contrast
of color is common, such as the use of plane color lump with pure hue. Combined with the shape of color lump and the interspersed color, the strong and weak visual effect of ups and downs is formed.

**Figure 4.** Color area comparison

**Coding Error**

Coding is to convert information into communication symbols while decoding is to restore the communication symbols to information. Visual symbols become a bridge between designer's coding and receiver's decoding. Visual symbols become the carrier of load information. Both coding and decoding are engaged in a kind of subjective activities in the brain. When designers code information in the design process, it is also the time for them to create ideas, select materials and arrange picture structures, all of which have to be actively thought through the brain. Similarly, when a receiver is watching a graphic design work, he or she also needs to mobilize his or her mind to extract the information from the visual symbols and understand the meaning (Lightfoot et al., 2009).

Proportion is the correlation of the index. Both emphasize the ratio between the part and the whole, especially the practice subject—correlation of people. The Pythagorean school of ancient Greece holds that “All is number” and puts forward the so-called perfect ratio—“golden ratio”. The ancient Roman architecture was also inspired by human body's proportion, forming a classic Rome five column style (Lin and Noubir, 2010).

Figure 5 is a company's logo. We can find that the logo is an embossed fingerprint image with natural realistic texture mechanism, which is figurative. Combined with the anti-white effect of first letter of the company name S, the logo intends to express a kind of integrity and quality of the company. However, when the logo is gradually reduced according to a certain ratio, the original clear texture is stuck together. The overall visual effect is as muddled as a dirty stain. The original design concept can't be identified and it leaves the fuzzy and dirty impression, making the designer's intent greatly different from the audience’s decoding meaning. And from the perspective of logo design, the performance of so many details is also not conducive to the application of the logo in the future.

**Figure 5.** A company's logo, the fingerprints are too dense, and it becomes difficult to identify when they are narrowed.

**Decoding Error**

The decoding activity in the visual information exchange is very important. The meaning can't be generated and enter the circulation field if leaving from the audience's decoding. Then the design product bearing information is not used and loses the value. Besides, the audience's own characteristics will lead to the complexity of the factors affecting the decoding, which will lead to that misleading factors are divided into individual difference and common psychology (Ling and Li, 2009). Graphic design is the process of symbolizing information. The process of symbolization must be realized through graphical representation. Information is the connotation represented by symbols and symbols are the medium for carrying information. Symbols not only refer to graphic symbols and language symbols, but a variety of gestures symbols and emoticons. People have common languages and cultural awareness, which is formed after a long period of accumulation so that people live together and have a common understanding of symbols. These symbols include language, text, traditional graphic and auspicious patterns, which are very common in life.

**Individual differences**

Individual differences include: (1) individual experience; (2) cultural literacy and degree of education; (3) physique (color blindness); (4) emotion and attitude; (5) values and belief; (6) interest; (7) character; (8) gender and so on. Among them, individual experience, cultural
literacy, emotion and other factors are difficult to measure and quantify while individual physique such as color blindness is audience factor that can be completely predicted and considered.

**Figure 6.** The world in the eyes of Red-green color-blindness

In 2009, iPhone company announced the new product menu on its official website. The round red represents that the products are in stock and green represents the products are out of stock. The released information also attracted many people to line up in front of major Apple stores. This design is easy to read for normal people but is a big obstacle for red-green color blindness. Red-green color blindness is the most common color-weakness illness in congenital color disorders, accounting for about 8% of the global male population and about 0.5% of the female population. The main symptom is the inability to identify the red or green three-primary colors as shown in Figure 6. Therefore, the design of the iPhone’s webpage design for such people is the effect of the figure below: there is no difference between red and green circles. Red and green are widely used in life for the specific cultural accumulation. Even traffic lights have such problems. Obviously, these designs don’t consider the needs of special groups. In an era where more and more attention is paid to small crowd, is it worth for designers making corresponding changes for the 8% of the world’s population?

**Common psychology**

Threshold is the minimum amount of stimulus that causes the feeling of body. Aesthetic threshold can be seen as a range of standards that visual information can bring joviality when it stimulates the audience. Just like the middle scale of pH paper, acid-base properties are only separated by lines. Except for the special situation that the stimulation of visual information can't cause any correct reaction, it will only have two results: positive emotion and negative emotion. Then it is also important for a designer to how to grasp the threshold of design, which is related to whether the communication model is the result of positive feedback or negative feedback (Quan et al., 2015). Before the experiment, the subjects are trained to understand the experimental process, the experimental methods and experimental requirements. During the formal experiment, the subjects sit on a seat 600 mm away from the screen of the display and complete four experiments of different background colors. In order to eliminate the practice effect and continuation effect, the experiment order adopts Latin square design. Each experiment takes eight minutes and five minutes are left for rest between the two experiments. The computer automatically records the experiment data (the correct reaction rate and reaction time) as the evaluation index. Subjects complete the subjective questionnaire after completing the experiment. The correct reaction rate and reaction time of the subjects in identifying different color coding information are shown in Figure 7. It can be seen that the subjects have significant differences in the correct reaction rate and reaction time, indicating that the method to control the level of mental workload through the display speed of information is feasible.

**Figure 7.** Correct response rates to the different color coding for tested groups

The interaction effects between the background color and the target color of the two groups of subjects are significant, so it is meaningless to further test the main effect of the background color and the target color. Only the LSD method is used to conduct multiple comparisons of the simple main effect of the background color and the target color. The simple main effect of the target color after multiple comparisons is shown in Table 1. Then comfort subjective evaluation of
different background color and target color is conducted.

Table 1. Post hoc tests for simple main effect of the target colors

<table>
<thead>
<tr>
<th>Background color (I)</th>
<th>Background color (II)</th>
<th>Correct response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Red</td>
<td>Blue</td>
</tr>
<tr>
<td>Black</td>
<td>Dark</td>
<td>0.297</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>0.182</td>
</tr>
<tr>
<td>Dark</td>
<td>Brown</td>
<td>0.250</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>Brown</td>
<td>0.843</td>
</tr>
<tr>
<td></td>
<td>Brown</td>
<td>0.026</td>
</tr>
</tbody>
</table>

Anti-jamming Strategy

Information expression

The expression of visual information mainly refers to how designers use graphs, images, symbols, text and the relationship between them to clearly and correctly express the corresponding semantic information. The scale and proportion of visual information are the keys to expressing information correctly (Zhu and Jiang, 2014). Take the logo of “mind your head” for example, the author has found a relatively mature example as shown in Figure 8. It is a foreign design and the logo part of the graph is more accurate and easy to read. It shows the scene of a person standing on an elevator with an important “props”— hanging advertising board, foreshadowing the possibility of bumping the head. Divergent graphic standing for attention also uses a red warning color. The overall shape of the signboard is an inverted triangle. The hypotenuse is parallel to the handrail of the elevator so that the signboard and the elevator have similar morphological analogy. The whole sign interacts with the actual scene.

Figure 8. The contrast between the two types representation of “MIND YOUR HEAD”. The logo on the right is more accurate than the left side of the problem to express the meaning of a careful encounter.

Information distinction

When there is a lot of information to express, how to present the information in visual information and then differentiate it becomes an important issue for designers. It is feasible to use colors, graphs and arrange the organization. Colors and graphs are effective means of differentiating information.

Figure 9. Toronto distribution map, the use of representative colors and graphics to carry out a one-to-one correspondence, effective discrimination of various information.

In Figure 9, it is the improved design by the author based on the above factors. It can be seen from the figure that the number of colors is limited to nine or less and these colors are basically pure primary colors with high cognition degree in people’s experience. And their difference in hue is large, which is easy to distinguish and judge for the audience. Beside, a variety of shapes and graphs, such as circles, triangles, stars, horizontal lines, slash lines, intersecting lines, are used so that the visual information is added with the dimension of color to become more colorful so as to pass more information. In the layout, the color graphs are consciously divided into three groups according to the location of the map, that is, the three color graphs at the lower left and several at the axis are divided into two groups, and graphs at the right form a third group, making the visual information has a sense of logic and hierarchy. The last key point is to remove the graphs at the right to the left side of the name without changing the color, shape, and proportion so that the name information and graphic information establish a more intuitive one-to-one correspondence (just like toys for toddlers make use basic human recognition), which makes people to find the information more accurately and quickly.

Information guidance

A lot of visual information needs to provide audiences with information guidance, such as
orientation, direction and function so as to help people understand and use the design correctly. Plane graphs and typeface are simply given as decorative skin on the packaging surface while ignoring the particular structure of the package itself. The opening part shall be covered by color graphs to guide the correct use and adhesive sticker is also completely transparent. Adhesive place where should be closed shall be left and transparent. How to modify the design of this package?

Figure 10. The improved design of the bottle cap. A scroll picture printed on the top of the cap, and it is not only ornamental but also ingeniously hinting at the opening direction.

How can the packaging designers improve this cap design to provide the maximum amount of information to people? As shown in Figure 10, the author once wanted to change the vertical stripes non-slip lines on the side of such beverage caps to the directional arrows, which are like the lines on the bottom of the tire so as to give a hint in the right direction. However, this method is suspected to be too vague (subtle changes in the side may be difficult to detect) and it is also related to the three-dimensional contouring and mechanical problems of bottles.

At the bottom of the figure is a scheme following the current practice of printing logo on the top of many caps. It adds a ripple graph with direction attributes to the bottle cap while keeping the sign, which imparts decorative interest and provides the audience with direction information. It is simple and will not cost too much production costs. This also reflects several advantages of graphic visual information from the side: significant, simple, and low-cost.

**Conclusions**

By studying the characteristics, functions and generation methods of visual symbols in plane design were analyzed. We have a more comprehensive understanding of the characteristics of visual symbols in graphic design, so that we can master visual symbols from selection to design in the process of graphic design. The communication theory is applied to the plane design, and the process links of communication are analyzed from the elements of the graphic design of visual symbols. According to the main features of the graphic design, the design of visual symbols is carried out to achieve the purpose of effective communication. Finally, the practice of effective strategy guidance for visual symbol propagation in plane design is summarized and summarized.

**References**


