

STUDY ON THE BASIC TONE OF THEMATIC MAP COLOR

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ABSTRACT:

Color is a vivid factor among map visual variables. Map color has information value and aesthetic value. Because of the complexity of color design, color using becomes one of the most interesting and challenging aspects of cartography. In thematic map designing, basic tone of color is firstly taken into account, which is the essence attribute of color. This study is mainly about the design of basic tone of color of thematic maps. With the analysis of different tonality attributes, this study puts forward principia and processes of the design of basic tone of thematic maps' color. What's more, the paper discusses in detailed the design of basic tone of color, including classificatory color, distinction color and riveness color. Classificatory color refers to the color of type maps. Generally maps of geology, relief and soil utilizing have their specifically standard color system, which reflects inherent features of these geographic phenomena and accords with physical identity. Distinction color refers to the color of distinction statistical map, whose color shows quantity guideline of geographical phenomena. Color selecting should obey the sequence of color change. Riveness color is mainly used in choropleth maps, which shows continuous variables as they occur within the boundaries of unit areas. And it is also used in statistical maps differentiated by area which could show the non-distinctive color of grounding.

1. INTRODUCTION

The color has the noticeable function in the map design, which is a very active factor in the map vision variables. Color itself is one kind of map signals, simultaneously plays the role of decorating the map. That is, map color have informational and esthetical value concurrently. But because there are many factors to influence color design, for instance, the color is multiply and the object which color displays is complex, as well as the different map readers feel different to the color and so on, color utilizing turns into a very complex problem.

In the thematic map design, it's necessary to grasp attributes of the color to utilize the color correctly. As the most basic attribute of the color, the tone of color is an important content during color emotion design. The map entire tone is the key color of color relations, which is the map designer firstly wants to give map readers. They maybe any type feeling, such as feeling full of the vitality energy or filled with deep grief, which all can shock the readers intensely. Therefore, it's the first in map design to determine the basic tone of color to express the map subjects (Wang tao, 2003).

2. ANALYSIS OF ATTRIBUTES OF THE TONE OF COLOR

2.1 the Formation of the Basic Tone of Color

In the thematic map, the geographical factors divide into thematic factors and basic geographical factors. Thematic factors are subjects of a map, which belong to the upper level plane of visual effects. The basic geographical factors show geographical environment where the subject occurs, which serves for thematic factor. The basic geographical factors

are in the lower level plane, which form two basic vision level of thematic map together (Huang Rentao, et al. 2003). Thematic factors which are above the basic geographical factors also possibly form two or two above visual levels, in which in the first floor are areal color spots. They are consist of classificatory color, distinction color and riveness color, which form the basic tone of color of thematic maps. Moreover certain spots and lines marks may also form the basic tone of color.

Maps are made up of graphics, colors and letters, but when map readers read a map, they often have deep impression of whole color at the first glance. The formation of the basic tone of color can construct harmonious visual effects and enhance visual levels. Thus a kind of harmonious color relations could be formed. The tone of color can show ideal condition and hobby of map designers, which is embodiment of artistic value of maps. Presented by different tone of color, thematic maps can show different characters and bring different emotional reactions to map readers.

2.2 Attributes of the Tone of Color

The tone of color of a map refers to the total color tendency, which is formed by the utilization of hue, brightness and saturation. They are marked off red tone, green tone and yellow tone and so on by hue. If by brightness they are made up of bright tone, gray tone and dark tone, and by saturation they can be vivid or light and so on, by character the tone may be warm or cold.

When carrying on the design of basic tone of color, characters of tone of color may be utilized to represent the feature of different geographical factors. The warm color is warm and active, which can give readers strong visual impulse and make

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persons excited. Whereas cold color is peaceful and profound which can calm persons, although cannot attack the vision intensely in the flash. In thematic map color, cold tone is available in expressing vegetation, water body of environment essential factors, for example, the blue tone is often utilized to display the precipitation frequently. When map designer wants to display warm and gentle feelings, the warm tone or bright tone may be used as basic tone of color, like sunshine map.

Also the tone of sprightly and lively feeling can be used to produce exquisite and joyful effects. For example the pure color and the bright color as well as the contrast -strong color can make one feel lively and happy. Designs of some environment maps based on this character can cause readers to accept the map information happily and enjoy the achievements of environmental protection and renewal.

Moreover, the bright and darkness also can produce the illusion of advancing and falling back. The purity also can produce the feeling of inflation and contraction, thus create advance and backlash effect. In thematic map, warm tone can express warm, dry, advancing and growth, cold tone cold shows cold, moist, backlash and reduction. Often using this characteristic to give prominence to the primary and emphasis main body. Also black, white or gray tone can be used to form a clear visual level. For example, when graduation statistical chart and district statistics diagram method are used as the same time, the graduation statistical chart often become background, using gray color. And the district statistics graph uses the bright secondary colors, which form two visual levels together.

3. RULES OF SELECTING AND PROCESS OF DESIGN

Based on knowledge of the tone of color, integrating different kinds of thematic factors, and utilizing characters of colors, the effect what designer wants to show can be expressed.

Rules of selecting include scientific rule, harmonious rule and aesthetic rule. Scientific rule means colors should consistent with map subjects. Harmonious rule refers that during map design, designer should focus on visual sensibility. For instance, too vivid color can make person fidgeted, and gray colors should be added to adjust them. Aesthetic rule means when many different kinds of color are used constructing a basic tone is very important. Designer should design from whole effect.

The color of thematic maps not only has something with characters of mapping objects, but the combining of different hue, brightness and saturation can show different. Readers can get different feeling. Process of the design of the basic tone of color is like this:

Step 1: To think over the visual sensibility which the map designer will show.

Step 2: Based on mapping objects, to analysis what kind of hue and color can represent geographical factors, then to select suitable tone of color as basic tone.

4. SELECTING AND DESIGN OF THE BASIC TONE OF COLOR (AREAL COLOR)

4.1 Classificatory Color

It is often used in classificatory map which is sorted by geographical classification, like land utilization map, ecology classification map of natural protection area, distribution map of rare and precious animals and vegetation resources, energy use and environmental protection map and so on. As one kind of visual information the color causes persons to understand the nature of things basically. Generally areal color in the classificatory map can demonstrate the quality characteristic of phenomena, so when carrying on design it's important to correctly reflect the inherent characteristic of different phenomena and quality difference between them (Zhu Guorui, 2004).

Generally in the thematic map mapping objects whose color has the explicit color characteristic can be expressed using its similar color, like the green as a basic tone in the forest and vegetation maps. Mapping objects who have no explicit color characteristic should express with the help of the symbolizing of the color. For example the warm tone is used in the high temperature area and the tropics, but the cold color used in the low temperature area and the frigid zone. The gray tone can perform environmental pollution. These tones correctly reflect intrinsic characteristic of various phenomena and conform to the natural characteristic with symbolizing. Like Figure 1 the green tone is used to show some place's hydrology condition, readers can think of clear rivers at a glance. In figure 2 the gray tone is used to show air pollution which covers in the industrial district, which makes the readers feel bad because of what the air pollution takes.

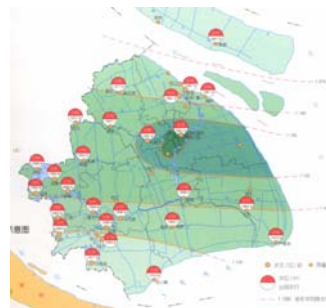


Figure 1. Some place's Hydrology Condition



Figure 2. Some place's air pollution

Moreover, the area of mapping factors also restricts its choice of color. According to unit area size of various types, it's necessary to make appropriate readjustment in the brightness

and the saturation in order to form different basic tone of color. For example bigger unit should enhance brightness and reduce its saturation. Below the construction of the vivid tone, the bright tone and the grey tone will be discussed:

4.1.1 the Vivid Tone

It refers to the cooperation of the secondary colors and the vivid color with gray slightly, which is one kind of method of color-matching by the purity.

The characteristic of color-matching of using the high-purity color is striking prominent and intense sprightly, but very difficult to conciliate, which often result in the vision effect of the color chaotic. So it is usually considered to match color using the same or similar color in the same or similar hue-scope, according to the spectrum order, which causes many kinds of hues to produce the natural harmonious change (e.g. Figure 3). When matching colors it is also taken to use colors which are separated with equal in hue ring, thus readers can achieve the same-intensity feeling and harmonious feeling can be displayed well. Sometimes the color contrast is too intense, it's useful to add the black or the white to regularize them(e.g. Figure 4 white roads to divide colors).

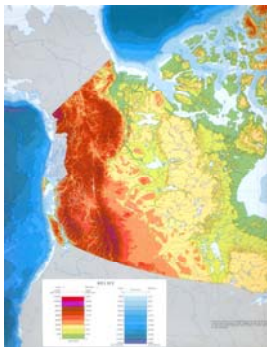


Figure 3. Some place's Chorography



Figure 4. Some City's Map

4.1.2 the BrightTone

The bright tone is the method of color-matching primarily by the brightness. After the white is mixed into the different color(under the CMYK pattern $k < 5$), the overall color can tend to brightly and form the bright melody to obtain the unified feeling.

4.1.3 the Grey Tone

It may weaken contrast relations among different hues when the pure colors are mixed into the grey(under the CMYK pattern $k > 15$). Simultaneously the saturation will drop and bring the steady feeling to readers. There are two kind of situations in the thematic map. one is that the base map mixed into gray may highlight the thematic factors, the other is,when the graduation statistical chart and the district statistics diagram method appear at the same time, it's suitable that the graduation statistical chart is as the background, using broken color with the grey, but the district statistics graph uses bright secondary colors. Thus the visual contrast is shown correctly(e.g. Figure 5).

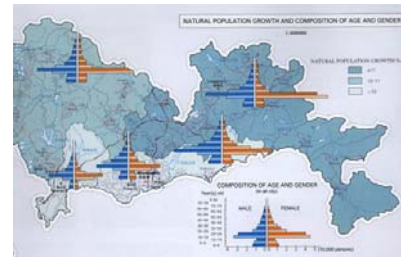


Figure 5. Some place's population Structure

4.2 Distinction Color

The areal color of the graduation statistical map can show quantitative index of environment phenomena. During selecting as the quantitative indexes enlarge, it's necessary to comply with certain depth change order and the logical relations, in order to express the quantitative relation correctly.

When the graduation rank is small, it is suitable to use one kind of hue to form the corresponding basic tone ,by adjusting the brightness and the saturation of the color to achieve equipoise. This method is unitary ,which can often form a certain of style. Like in Figure 1 the three-level color code is set up with the mixing of the green and white, in which the colors are arranged in order according to the brightness. The colors change from deep green ,green to light green and have certain rhythm and hiberarchy. Generally speaking, it's important to establish appropriate brightness contrast relations during the design. If a kind of hue is divided into 10 degrees from the deep color to the light one, the brightness differs 3-4 degree may be better. The brighter tone can expresses objects having small quantitative index, the gray tone expresses ones with big quantitative index.

When the graduation ranks are many, it's un-useful to differentiate various magnitude effectively with one kind of hue, it's necessary to select two kinds of even two kind of above hues. During the design, coordinating the hues change, it's right to transform from the cool-colored to the warm-colored direction or transform from the warm-colored to the cool-colored direction. This method of color-matching not only make the map spirited, also is changing without out of balance, like in Fig 6 the contrast of the cold and the warm tone bring different feeling. According to the advance and backlash characteristic of the tone, generally when value increases the color should change toward warmer tone, the contrast changes toward the colder tone.

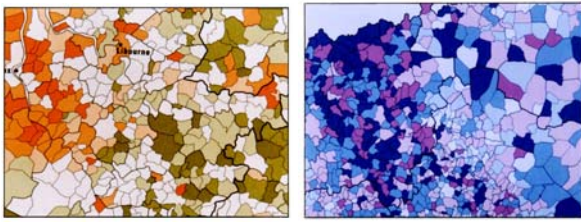


Figure 6. Contrast of warm and cold Tinality

Table 1 is an example of color-selecting based on agile and vivid visual susceptibility:

Agile and Vivid	
Basic sensibility	Agile and Vivid
Basic tone of color	Colors based on light, bright and vivid tone
Basic color-matching	Using the tone like that and integrating the same or similar hue

Table 1. Agile and Vivid Visual Susceptibility

4.3 Rifeness Color

Rifeness color is often used to display the areal plotting in the areal map and non-rank bottom color in district statistical maps. The Rifeness color can demonstrate the distribution scope of environment regions and their relations. Color quantity may be a color or a group of broken colors, and attention should be paid to having obvious difference among them. At the same time it's necessary to maintain the plan to be balanced.

In thematic map areal color is often light. When broken color is used, it's important to add the gray into the different color, thus the individuality is desalinated and the general character is enhanced, which make the plan seem to be coordinated. Figure 7 In the background the grey is added into the yellow, but the upper thematic factors' tinting is bright, so the subject is prominent, and the overall color appears gently, it's slow to the visual stimulation and suits the long-time reading. Figure 8 is the Hamburg port development and planning map, in which the old harbor area uses the purple added into the gray, which make persons feel agelong; The new harbor area uses the purity purple to reflect current situation. The whole has formed the time series which looks harmonious.

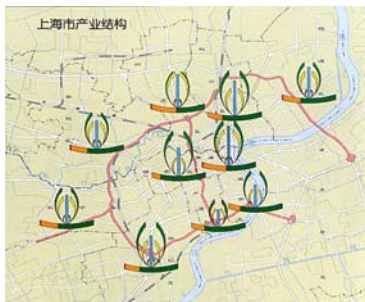


Figure 7. Industry Structure of Shanghai

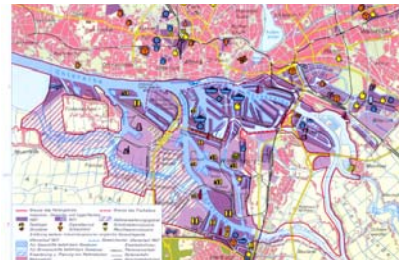


Figure 8. Development and Planning of Hamburg

When the colors contrast intensely, it is often taken to reduce the saturation of several colors or certain color to achieve a harmonious effect. The size and the place of the color block can effect the design. Generally, the low saturation and the weak contrast color is commonly used in the big area, the contrary color is suitable for the small area.

In the practical design work, it's necessary to use the tone of color according to different expression method and actual map usage.

5. DESIGN OF THE BASIC TONE CONSTRUCTED BY POINT AND LINEAR SYMBOLS

5.1 Point Symbols

Here point symbol refers to the small mark whose color area is relative smaller, for example, in the environmental pollution map, the position of sampling point of environment essential factors is often expressed using the fixed-point mark law, the point law, the localization diagram method and so on. The pollutant density value or the pollution index in the sampling point, the source of pollution (for example factory fuel consumption, the three wastes quantity and nature and so on), the pollution radius, the pollution degree and the pollution outlet position and so on all belong to this kind of color symbol. Because the area of the point symbol is small, when designing, according to the impulse which the color give to the vision, it's necessary to use the hue contrast to obtain an clear plan level, with that primary color and the secondary colors are put into use.

5.2 Linear Symbols

The rivers water quality map uses the striation mark law to indicate the linear water body pollution distributed condition, in which the width expresses current capacity and the color expresses pollution degree. When designing attention should be paid to the logic, ordered according to the color gradation rules or visual impulse. The locomotive linear method may express the movement tendency and the change characteristic of environment factors or phenomena, like the line, direction, speed of pollutant movement, pollution change tendency as well. Linear mark uses vivid color, which is the main body of map, but anchor symbols on behalf of the pollutant should use lighter colors than those of linear symbols. The environment factors or the phenomena, which continuously distribute and change gradually, are often expressed in the thematic maps using the isoline method. For example, the isopleth can be used to show the proliferation of the pollutant of atmosphere and the surface water, and the iso-noise can express the proliferation of the traffic noise and so on. The designer should express feeling with the different tones, based on the

average condition and coordinated with the color of the equivalent line, thus can express dynamic changes of the pollutant well.

6. CONCLUSIONS

The customary color of maps is decided by two aspects: First is the attribute characteristic and the color characteristic which reflect thematic geographical factor itself; Second is the readers' color vision sensibility to the map. The tendentiousness of map colors is the synthesis of both. The design of the basic tone of color of the environment map should utilize the esthetic characteristic and the visual psychology of reader community effectively, from the general goals of the environment map, and carry on the comprehensive analysis on the basis of environment mapping factors. Color matching not only embodies esthetics demands, but also is a identification signal which may strengthen. Therefore, after the basic tone of color is determined, it should be maintained certain stability to play the role of assisting recognition and strengthening map information.

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