Research Article

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Emotional information transmission of color in image oil painting

Abstract: To enhance the emotional communication of image oil painting art and better analyze the image oil painting art, this article puts forward the research on color emotional information communication in image oil painting art. First, starting from the artistic characteristics of color and its embodiment in various oil painting art forms, this article expounds the relationship and the significance between color language and emotional expression. Then, it summarizes the development of color in image oil painting from a macro perspective and analyzes the emotional expression of color in oil painting. Finally, it discusses the color law of the oil painting art and analyzes the emotional expression of the oil painting art from two aspects: image and artistic conception. The research shows that the design method can better convey emotion and make it easier for people to understand the connotation of image oil paintings.

Keywords: image oil painting, color emotion, information transmission

1 Introduction

With the gradual development of science and technology, people have gone through the era of black-and-white expression and embarked on a new color era. At the moment of digital media, colors naturally come to life. In the past, it was an abstract record display with black, white, and gray as the main tone, but now the color expression can faithfully record all kinds of colors in real life and strengthen it in modeling and expressing thoughts and feelings, which has become an important means of expression and way of expression. So simply the original record is far from enough. We need to use color to express feelings, express images, express the intention of oil paintings, and participate in emotional communication. In the image oil painting art, color is the most expressive means of modeling. Color emotion can cause people's emotional changes in an instant and stimulate people's inner emotions. Color metaphor has rich cultural connotation and unique aesthetic taste. Image oil painting is full of vitality under the influence of color emotion. Color is a special expression language of image oil painting; although it cannot express their own thoughts and feelings, people can feel some emotions from the oil painting color. This feeling comes from people's experience of life and from the accumulation of people's visual experience. Once people's experience has some resonance with the oil painting, they will fully appreciate the feelings of the audience and make each other excited, fear, and feel other emotions, thus producing emotional expression.

Thorstenson et al. [1] proposed the emotion–color association in the facial background. Emotional facial expressions contain important information, which observers can perceive and use to understand the emotional state of others. While there has been considerable research into facial muscle tissue and the perception of emotion, there has been little research into facial color and the perception of emotion. The current study examined the association between mood and color in the context of faces. Do and Kim [2]

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proposed to evaluate the esthetic value of protected wetlands based on photo content and metadata and analyzed the contents and metadata of photos taken in two popular wetlands in South Korea to evaluate their esthetic values. Time stamps and geotags are analyzed to determine when and where people like to visit. In addition, from the image content, deep learning is used for target detection, so as to achieve the quantitative analysis of the target. The results showed that many people were taking photos near the start of the wetland trail. The preferred time for visitors depends on the tourist attraction associated with a particular season and the part of the day. The photos revealed that most of the tourists had captured scenic shots, such as fog and sunsets. The results confirmed this, as they preferred to watch fog in the morning and sunset in the evening. Ironically, color–emotion association studies have shown that the common color of these images is a dark greyish-yellow, which often triggers negative emotions such as sadness, disappointment, fear, and contempt. Mohseni et al. [3] proposed a new emotion recognition system based on color histogram, which aims to clarify the impact of emotional valence of vocabulary on ERP when arousal is controlled and determine whether these effects will change with different task types. To achieve these purposes, an ERP experiment is designed to manipulate the valence of words and realize the awakening between different valences. Participants performed two types of tasks: One was that they had to read each word aloud and write it in black on a white background. In another case, they must say the color of the ink used for each word. The results show that the main effect of the valence state is independent of the task, and there is no interaction between the valence state and the task. The most significant valence effect is the reaction to negative words. The results show that when arousal is controlled, the cognitive information in negative words will trigger "negative bias," which is the only word that can trigger emotion-related ERP modulation. Although the aforementioned research has made some progress, it is not applicable to the image oil painting art. Therefore, it puts forward the color emotional information transmission in the image oil painting art. In the oil painting art, the psychological association of color and the use of color language summarize the connotation of color emotional expression. Liu et al. [4] propose color transmission of emotional images based on deep learning. Artists often use different color combinations to convey different emotions in their creations. The image network includes four main parts: low-level feature network, emotion classification network, fusion network, and coloring network. The underlying feature network extracts semantic information to prevent the occurrence of antinatural phenomena. The emotion classification network is used to constrain the color, so that the enhancement results can meet the user's emotion. The final deep learning framework combines the emotion classification network and the underlying feature network through the fusion network. Finally, the color network is used to obtain the enhanced image. Ranjgar et al. [5] takes Iranian Islamic painting as a case and puts forward a new method of painting emotion extraction based on Luscher's psychological color test. Painting evokes some emotions of the audience. Color, shape, texture, and many other factors will affect the feeling conveyed by painting. The main motivation for choosing the Luscher test is that this method is designed for personality and emotional analysis, which can better study abstract painting. A group of paintings from Islamic cultural heritage in Iran are selected as the data set, and an l-eep method based on the concept of cultural technology is proposed to extract emotion from paintings by using image processing technology and psychological knowledge. Then, according to the color coverage, the palette of extracted colors is sorted and entered into the search engine. Finally, the proposed method is further tested through the peer evaluation of a group of modern abstract paintings in the IAPS standard system. Dandolo et al. [6] proposed terahertz frequency modulated continuous wave imaging for advanced data processing of the art painting analysis. The reflected terahertz frequency modulated continuous wave scanner (300 GHz) has been skillfully optimized to image two easel paintings of different ages. By selecting appropriate terahertz image parameters, the information content of the obtained terahertz image is comprehensively checked. At the same time, a new data processing method is developed by Gaussian fitting of the reflected signal to improve the detail level of axially parameterized terahertz image. The reflected signal is carefully weighted as a function of the optical path, and the reflected amplitude is corrected for the positioning of the object surface relative to the beam focus. Artifacts affecting terahertz images recorded on nonuniform painting surfaces have been solved, and the obtained images are equivalent to the original painting.

Starting from the artistic characteristics of color and its embodiment in various oil painting art forms, this article expounds the relationship and significance between color language and emotional expression. Compared with these studies, this article summarizes the development of color art from a macro perspective and analyzes the emotional expression of color in oil painting. This article discusses the color law of the oil painting art and analyzes the emotional expression of the oil painting art from two aspects: image and artistic conception. Starting from reality, this article discusses the significance of the emotional expression of color language and reveals the personalized function of color language. Image oil paintings bring people into the situation with the atmosphere created by a large area of color, which can dominate people's psychology, provide an atmosphere for each emotion, lure viewers into a higher level of artistic conception beauty, and better appreciate the connotation and depth of the works.

2 Image oil painting art color emotional information recognition

The role of color changes in the history of oil painting. Nowadays, artists pay more and more attention to the artistic expression of color, which is not only an important means of creation but also a carrier to express emotion and spirit. Color is an objective material phenomenon in nature, which not only reflects people's thoughts and feelings but also gives people emotional feelings. In the art of oil painting, once the color has a certain resonance with the external stimulation, it will produce emotional connection, guide people's emotions, and produce excitement, joy or calm, fear, and other emotions, thus producing the emotional expression of color. When you see the color, you will have different feelings and evaluate the color, which is the emotional function of the color. Color difference can stimulate people's senses and cause different feelings. Therefore, in the visual communication design, the use of color will be particularly important. For example, when the sun rises in the East, the golden red corresponds to the golden yellow, which creates an atmosphere of joy. When you see red and yellow, you think of the light and heat of the sun. Lying on the green lawn and seeing the yellow, red, and pink wildflowers, you will naturally have a happy and energetic mood. It can be seen from this that color emotion is formed by people's long-term experience and habit of cognition and use of color, which can be felt by anyone with normal vision and common sense. The color content of image oil painting is complex and changeable, which is the most effective way to express the emotional characteristics of image oil painting. In real life, color can be seen everywhere. The artistic color emotion of image oil painting can not only give people visual feeling but also affect people's psychology and cause emotional changes. Although the emotions caused by color are complex, due to the common human physiological structure and living environment, for most people, whether it is monochrome or multicolor mixing, there are similarities in color psychology. To better identify the emotional information of color in image oil painting, the relationship between emotion and color is studied, as shown in Table 1.

Studies have shown that people who wear red are more impulsive than those who wear blue. Because red is more reactive than blue. Red can speed up the pulse, raise blood pressure, and even cause psychological pain in special cases [7]. In addition, the visual effect of color also has specific performance in physical characteristics, such as cold, warm, close range, soft and hard, light and dark, humidity, and so on. Most of the time, red, orange, and yellow are warmer than blue and green. Red is better than blue, giving people the feeling of progress, looking shriveled, and so on [8]. Deep color makes people feel heavy,

Table 1: The relationship between emotion and color

Color	Emotion	Color	Emotion	Color	Emotion
Red	Enthusiasm, danger, revolution	Orange	Gentleness, jealousy, disgust	Yellow	Light, hope, activity
Green	Peaceful, safe and fresh	Blue	Long, calm, rational	Purple	Elegant, noble, uneasy
White	White, holy and unlucky	Grey	Ordinary, gloomy and terrible	Black	Serious, dead, vigorous

and light color makes people feel relaxed. People often associate the color in front of them with their past experiences. In most cases, when people see a certain color, they will associate it with related things.

Due to the different cultural backgrounds such as time, society, and region, people's understanding of color is not the same. In addition, people's association from concrete things to abstract emotions makes color to have symbolic significance. Color has always had a wide range of symbolic significance, which brings people universal psychological hints and finally makes color produce social association [9]. This connection is related to the common consciousness experience of human groups. It is valuable historical precipitation and the crystallization of cultural development. Based on this, from the perspective of informatics and communication, this article discusses the transmission process of information and emotion in the oil painting display design. The steps of color emotion information recognition are standardized, as shown in Figure 1.
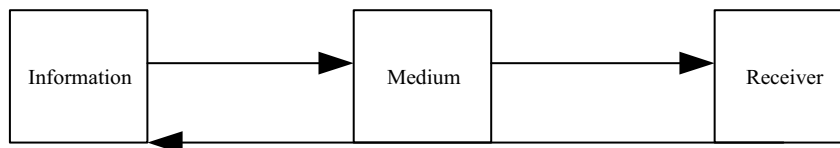

Figure 1: Color emotion information recognition steps.

Color is often the first natural expression of emotion. The mood in the painting is joy or sorrow, which can be seen with both eyes. With the method of comparison and illustration, this article expounds the emotional expression of color in oil painting and shows its unique charm from the perspective of ancient and modern Chinese and foreign, through the specific analysis of representative painters' works [10]. The in-depth study of color language is of great significance to carry forward the spirit of oil painting and develop contemporary oil painting. In the current transformation period, it is necessary to deepen the oil painting practice exploration and oil painting–related theoretical research.

3 Description of emotional information characteristics of oil painting color

Color emotion plays a very powerful role in conveying artist's emotion, which cannot be replaced by other language symbols. Color emotion, which has the expressive force and the sense of power, has symbolic significance and is called the soul of oil painting. Color as the medium has a rich cultural connotation. In a specific era, or a specific nation, or a specific region, or a specific school, painters in the use of color, often both common, and have their own characteristics. Individual color language is the symbol of artists' expression and performance in the new era, and it is also an important means for artists to form their own style [11]. The study of color language and its emotional expression is of great significance. Color emotion is an important tool for human beings to understand nature. Through the wavelength change and color difference to form a picture, color affects people's emotional experience. In addition, the color emotion of oil painting is transmitted to the brain through human visual sense organs, including the well-known color cold and hot law, as well as the accumulation of various visual experience. Color recognition and creation is a complex transformation process [12]. Basically, people's understanding of things has to go through three psychological experience stages: intuition, perception, and concept, which is an important part of color emotion expression. In the creation of oil painting, we should not only reselect and integrate the observed objective things but also use our own values and emotional experience to form a certain structure and order in the works. This process can be said to be long and difficult, not accidental, but a

gradual process [13]. It is the synthesis of all the experiences observed in human life. What's more, these brain memories are not in silence, and they are always interfering with each other. When the strength of the new experience mode is large, the original memory will be in a fuzzy or weak state, and the new experience mode will be kept slowly. To better convey the color emotional information of image oil painting, first, we need to describe its characteristics [14]. The specific description steps of color emotional information characteristics of oil painting are shown in Figure 2.
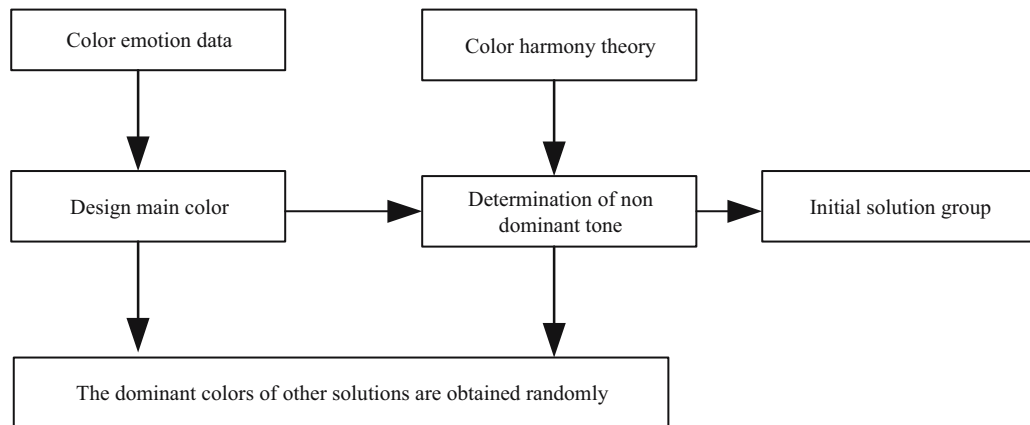

Figure 2: Description process of oil painting color emotional information characteristics.

In the creation of oil painting, the visual experience of color has a strong subjective implication of painter Bai ran. At the same time, the external objective things stimulate the brain, so that the original storage and accumulation of experience gradually form the subconscious state. Observing things makes Bai ran resonate with objective things consciously. During this period, emotional experience expresses the feeling of color through visual experience. The beauty of oil painting is mainly reflected in color [15]. With its unique appeal, color language deeply attracts people's thoughts. The audience can communicate with the picture and successfully express the ideological connotation of the work, which is undoubtedly an excellent work [16,17]. In the creation of oil painting, every work created by the painter is to express his thoughts and feelings, and its real purpose is to give oil painting life. The generation of emotion is that the
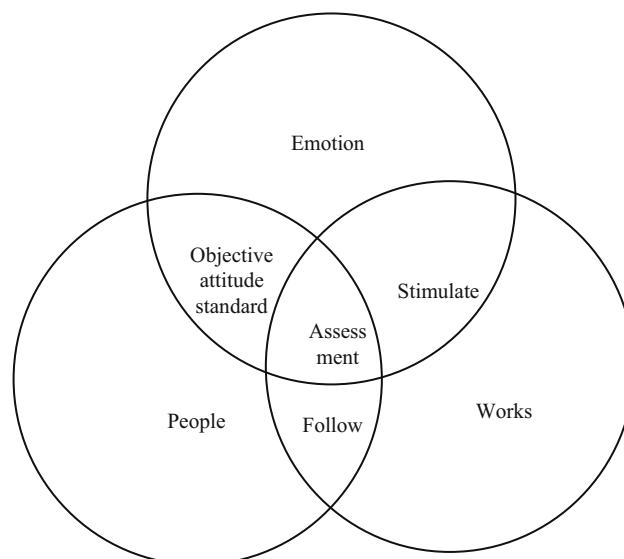

Figure 3: Correlation characteristics of influencing factors of color emotional information transmission.

creator consciously perceives many phenomena in reality [18]. The expression of emotion is mainly expressed by color. Based on this, the correlation characteristics of influencing factors of color emotional information transmission are analyzed, as shown in Figure 3.

Based on Figure 3, the reaction process and the result of oil painting (stimulation) combined with communication technology can be regarded as a kind of emotional and physiological response to the stimulation, and the result is the evaluation of the work (i.e., the result of cognitive evaluation) and then affects the emotion (emotional experience). However, from the aforementioned emotional process, we can see that evaluation (cognitive evaluation) is included in the perception of the stimulus, which occurs simultaneously with the physiological response caused by sensory stimulation, emotional experience, and emotion [19]. Only from the emotional impact of works on people, according to the emotional theory, the first is to stimulate (works) and stimulate (feeling) the emotional process, namely, physiological reaction, emotional experience stimulation.

4 Image oil painting color emotional information transmission algorithm

To depict the color structure of oil painting, it is necessary to segment the color oil painting to separate different color regions. During oil painting preprocessing, the color space consistent with vision is selected, the color difference judgment is introduced, and the color difference threshold is set [20]. Combining with the pixels of similar color with the vision, the combination meaning of 16 color semantic words, such as brightness, saturation, and hue, is obtained, i.e., $5 \times 5 \times 6 = 150$, which can realize the three-dimensional vector QN = $(Q1, Q2, Q3)$.

$$\mu_{Qa}(S) = \prod_{+1}^{3}\mu_{Q_j}(S). \tag{1}$$

To better describe the overall characteristics of oil painting, we define the average brightness of the whole image oil painting as S, average saturation as a, color contrast as b, and semantic description parameter as h.

$$\text{Color contrast } I = \mu_{Qa}(S)\left\{\frac{1}{n}\sum_{-1}^{K}I(a - a)^2 + (h - b)^2\right\}^2. \tag{2}$$

The particle swarm optimization (PSO) algorithm for the color vision information transmission optimization problem is optimized, and each particle is regarded as a point in the solvable space. If the size of a cluster is k, the position of I in the cluster can be represented by pBest, v_i is the best position in the cluster, and G is the best location in the cluster. Therefore, because particles will be calculated faster and better according to the following formula:

$$c = w \star v + c_1 \star \text{rand}() \times (\text{pBest}[i] - x_i) + c_2 \star \text{Rand0} \star (\text{pBest}[g] - x_i), \tag{3}$$

$$V_i = \text{Color contrast } I(x_i + v_i). \tag{4}$$

Among these variables, c_1 and c_2 are constants, called learning factors; rand() is random number [0,1]; and W is inertia weight. On this basis, PSO is applied to color recognition, and a new color recognition scheme is proposed. To evaluate the beauty of color harmony, the communication information processing algorithm is further introduced:

$$m = v_i + o/c. \tag{5}$$

Here, M is the harmony degree of color matching, o is the order factor, and the calculation method of o is as follows:

$$o = \left\{ \begin{array}{l} \sum mg \\ \sum Oh + \sum Ov + \sum Oc \end{array} \right\}. \tag{6}$$

Among them, g is the order factor of colorless gray combination, and oh, OV, and OC are the order factors determined by color difference, lightness difference, and chromaticity difference when color participates in color matching, and its value depends on the coordination relationship between attributes:

$$\Delta C = Cm + Cn + Cv + Cc, \tag{7}$$

where Cm represents the total color difference of all colors in the color matching process, Cn represents the total color difference of all color combinations, Cv represents the total color difference of all color combinations, and Cc represents the total color difference of all color combinations [21]. The larger the number m, the better the color match. To improve the compatibility and scalability of the system server to multiple systems, JSON format is used to restrict the color emotion transfer data, and IP address and port are restricted. Users can access it on any mobile platform [22]. The service provides IP address and data in the JSON format as the interface. Based on this, the temporal structure of information transmission is optimized, as shown in Figure 4.
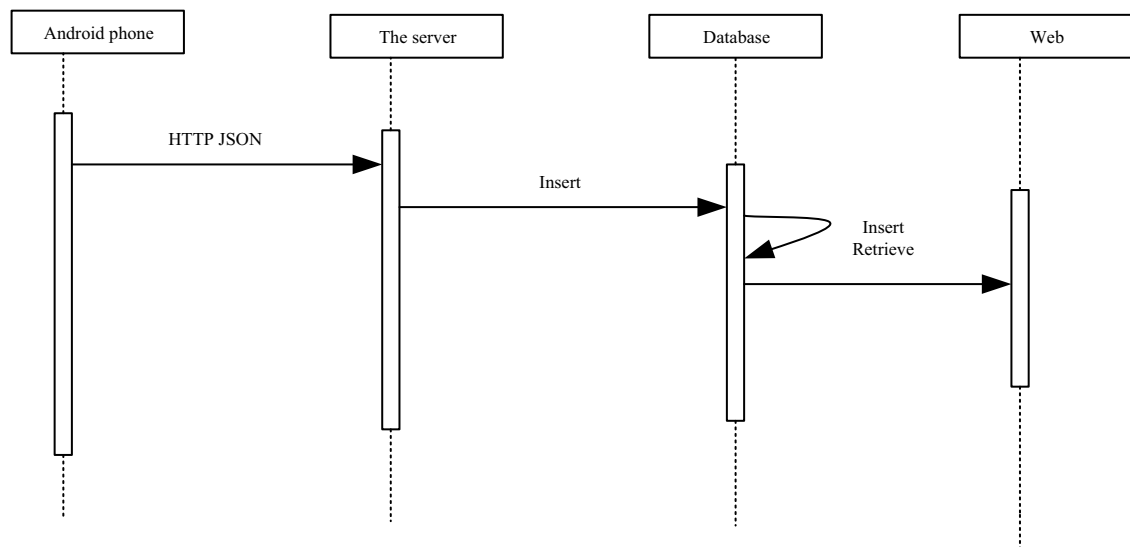

Figure 4: Sequence diagram of information transmission.

There are differences between the emotional expression information of color and the physical information of oil painting. Oil painting color emotional expression information cannot exist alone, but must rely on material existence, and the relationship between oil painting color emotional expressions is explained in Figure 5.

Everything in emotional communication does not exist in isolation, but in cooperation and integration. Media that can effectively convey emotions should be well organized. What it conveys is a unified thought and strong emotion, which is the soul of the artistic conception of oil painting. Just like a good prose, it emphasizes "the form is scattered, and the spirit is not scattered." No matter how good a language is, it serves the central idea. In the case of the central spirit unchanged, these paragraphs enrich the connotation of oil painting. The details are shown in Figure 6.

We should fully realize the objective law of the audience's acceptance and cognition of information, make full use of the characteristics of the audience's choice of receiving information, and serve the emotional communication through emotional experience, cognitive experience, and the relationship between
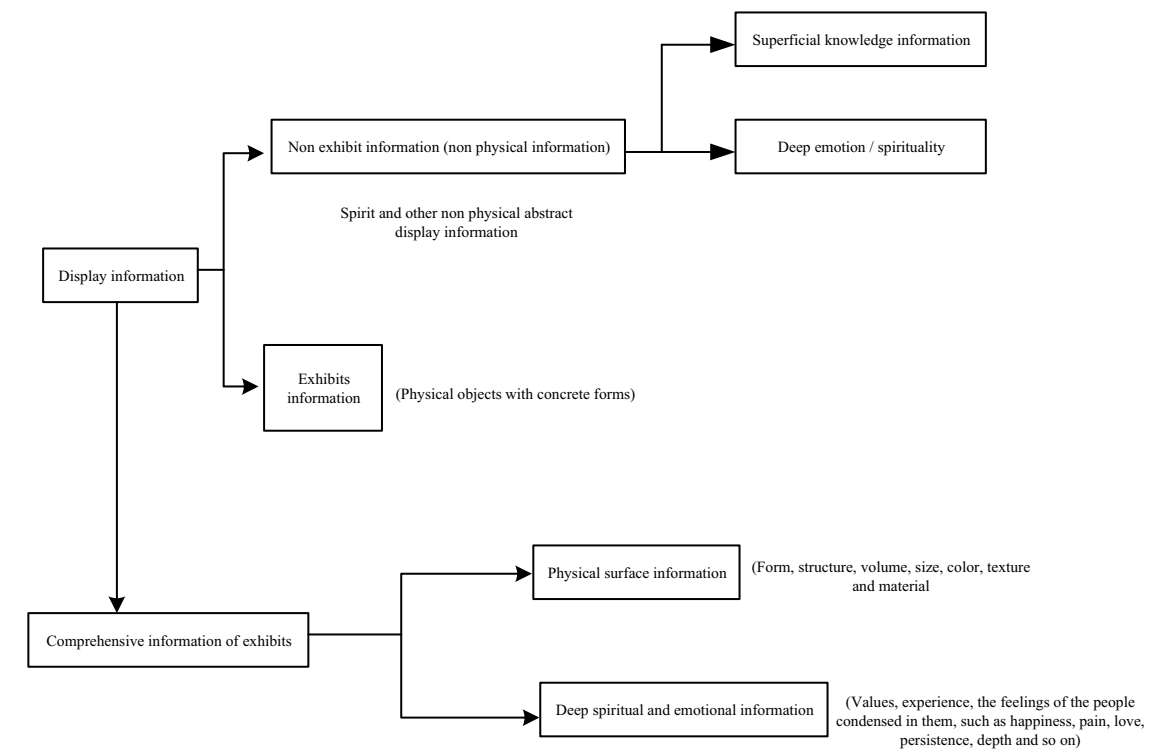
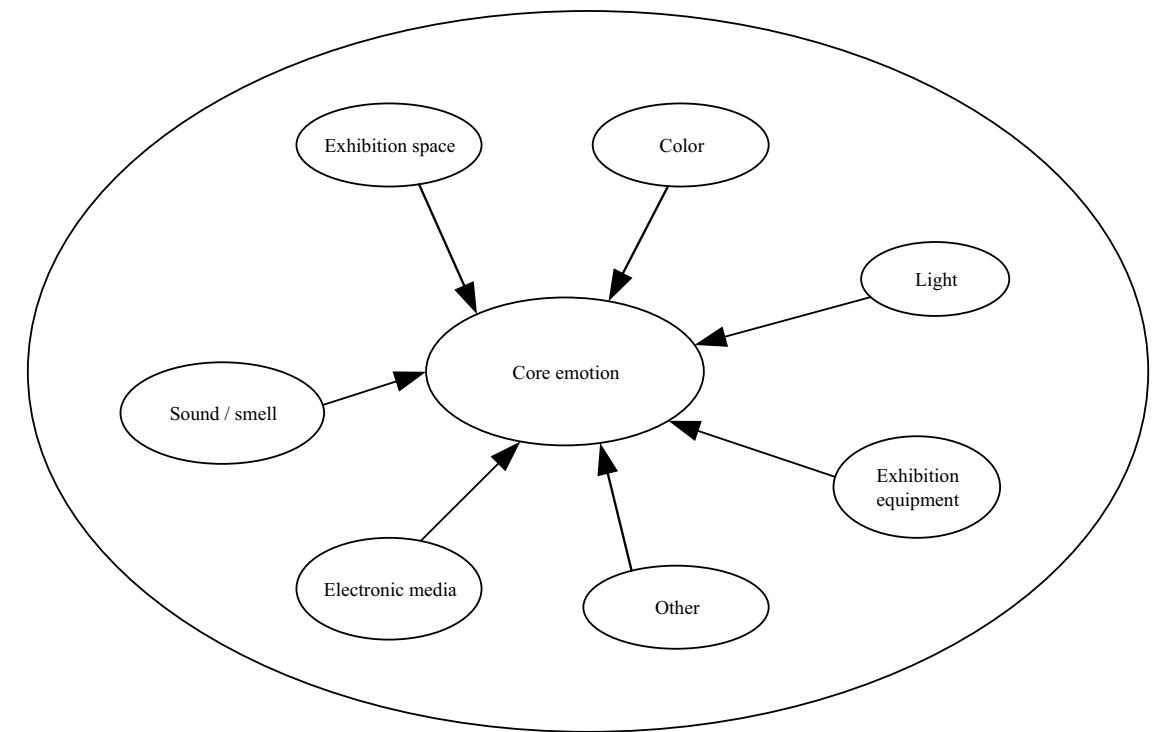**Figure 5:** Color emotion expression relationship of oil painting.

Figure 6: Connotation of emotional information transmission of oil painting color.

human and environment. According to the principle of information dissemination, information should be complementary and expressed according to the characteristics of communication. The media should always aim at the accurate and efficient information dissemination of "everything for communication effect." Media organizations should have clear emotional clues and deepen cognition through "touching." All kinds of media need to find emotional language with similar meaning and establish a coordinated information field. Gestalt psychologists believe that media combination should establish the concept of integrity, pay attention to adjust the reasonable relationship between media, and arrange the organization according to the principle that the whole is greater than the sum of parts, so as to promote the recognition and transmission of color emotion.

5 The effect of oil painting color emotional information transmission

Emotion is the subjective reflection of the objective environment in practice. Just as people's subjective emotions have different manifestations. The creation of oil painting is to express emotions by mastering rich colors. Obviously, color is the language that artists express their emotions. It is based on the inner emotional needs of painters and serves their emotions. In oil paintings, the artistic emotional expression of color can be reflected from two aspects. The creator reveals the true feelings in his oil paintings and expresses his feelings with colors. The use of rendering method in oil painting can make the oil paintings show more strong realistic emotion and make the works more realistic. Because of the stimulation of external color and people's accumulated knowledge and experience, people have an association and some psychological emotion. Color association is both concrete and abstract. The specific association of color refers to the oil painting symbols of color, which can make people associate with the specific things in nature: red can associate with sunlight, flame, and blood; yellow can associate with golden wheat field and desert; green can associate with grassland, forest, and vegetable. Abstract association of the color is based on specific color association. Color makes people feel and feel something visible. For example, red can make people have daydreams such as brilliance, passion, vitality, and danger, while yellow can make people daydreams such as brightness, happiness, infinity, and pride, while green can make people have daydreams such as freshness, health, bitterness, and astringency. As mentioned earlier, indirect color association mainly refers to the symbolic meaning of color. Color symbols are based on association, and the meaning of association is beyond the oil painting itself. Oil painting color emotion is extracted from people's actual contact. Oil painting color emotion is the expression of the ideological world and is the emotional expression outside the image. Based on this, this article classifies and analyzes the emotional transmission intention of oil painting color, as presented in Table 2.

Table 2: Image conveyed by emotional information of oil painting color

Image types	Concrete image
Evaluative image	Beautiful-elegant-vulgar, favorite-disgusting, natural-pinched, intimate-alienated, balanced-messy, clean-dirty, valuable-worthless
Active imagery	Warm-cool, eye-catching-turbid, gorgeous-simple, lively-silent, male-female, stable-restless, trendy-classical, lively-steady, leisure-formal, sweet-bitter, fresh-stale
Power image	Fresh-gloomy, tough-soft, young-old, light-heavy, bright-dark, strong-weak, tense-relaxed, sharp-dull, romantic-rational, natural-artificial

Through the qualitative analysis of various influencing factors of human emotion, it is concluded that the perception of color is composed of color, brightness and color, and color is three dimensional. Table 3

Table 3: Example of image semantic description

Regional semantic description	Area size (%)	Global semantic description
Darker green	24	Medium bright, light, medium contrast colors
Medium bright medium strong yellow	20	
Medium grey	13	
Very bright, light blue	11	
Darker blue	11	
Medium bright strong orange	1	
White	40	Brighter, thicker, high contrast colors
It's dark and dark red	13	
It's dark. It's very red	12	
Black	7	
It's very bright. It's very yellow	6	
Darker and darker green	5	
Very pale yellow	2	

shows some important conclusions from the oil painting Research Association, which can be applied to visual communication design.

Table 3 shows that the color emotional semantic description of oil painting includes two parts: the regional color semantic description and the global color semantic description. On this basis, the color semantic description of the middle layer of oil painting is realized. Similarly, the visual experience of any oil painting does not lie in the main function of its modeling, but lies in the forerunner of its color, giving the viewer a visual impact and forming an overall impression. For example, when appreciating the impressions of sunrise by money, the representative French painter, the audience will first immerse themselves in the rendering atmosphere of light blue, orange, purple gray, and light yellow and then further understand the content of the picture. Based on this, this article analyzes the emotional characteristics of color in the impression of sunrise, as shown in Figure 7.

The whole painting is mainly composed of light and elegant gray tone, with complicated strokes, presenting a scene of mist interwoven. At sunrise, the sea was foggy, and the sea reflected the color of
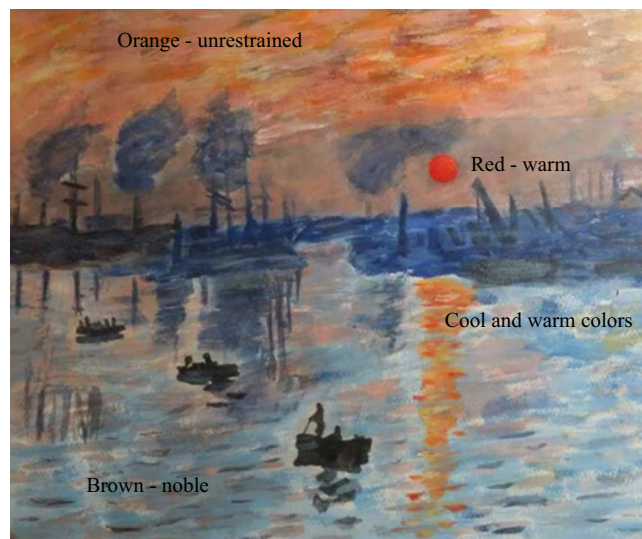
Figure 7: Color emotional characteristics of the impression of sunrise.

the sky. The scenery on the shore is hazy, giving people a sense of instant. After careful observation, we will find that the painter uses a short fine pen to arrange various colors on the canvas, forming a charming scene of undulating light and shadow. In the early morning, the sea, sky, boat, mast, buildings are looming, and the picture is filled with a light lyric atmosphere, endless scenery, gorgeous, and colorful.

6 Analysis and discussion

In the visual communication design, the expression form of the color image and its perceptual knowledge, cold and warm, strong and weak, and likes and dislikes are colorization of the color image. The oil painting is composed of pixels and is described by natural language according to people's feelings and description habits. To a certain extent, it makes up for the semantic gap in oil painting and provides a basis for semantic-based oil painting retrieval and query. As the unique visual language of oil painting, color plays an irreplaceable role in line, stroke, texture, and other aspects.

7 Conclusion

Color is the important language of image oil painting art, but it is also the main means of expression of image oil painting art. It has the obvious subjective tendency, decoration, and symbolic significance. Winners are good at using color to express emotion, create atmosphere, and create artistic conception. Color is the basic element of image oil painting. To promote the further development and progress of Chinese oil painting art, we must study from both theory and practice and feel the importance of using color emotion in image oil painting creation. It is an important medium to reproduce the artist's spiritual world, and it lays a good artistic spirit for the creation of better image oil painting works and greatly expands the creative thinking mode of image oil painting color expression. We should also pay attention to the emotion of image oil painting color creation and the context of expression. The study of image oil painting color also laid a solid theoretical foundation for the later creation, which can be further discussed in the future.

Conflict of interest: The authors state no conflict of interest.

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