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Research on the Application Path of Clustering Algorithm in New Media Art Creation under Big Data Environment

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ABSTRACT

In the context of information is mostly trivial, messy and disordered, under the context of information fragmentation, the creation path of new media art is also being affected by it. Based on the color sensual imagery, this paper adopts the gray correlation analysis method to research on the creation of new media art. Through the questionnaire survey, the cluster analysis algorithm is used to filter the color semantics, and the five most representative color imagery semantics are selected as the imagery scale in the quantitative space. Combined with the grey correlation analysis method to construct a new media art creation perceptual evaluation model, the new media art creation works as the object of color design practice, the constructed color design evaluation model well reached the product color scheme with the color screening, confirmation and evaluation of the preferred goals. The design practice based on the evaluation model of new media art creation. The results show that, combined with the gray correlation analysis, the color design evaluation model of new media art creation constructed under the intentional color system can effectively improve the color design efficiency of the work scheme, and give an intuitive and accurate reference standard for the selection of the color scheme of the work.

Keywords: new media art, color intention, cluster analysis, gray correlation analysis

1. Introduction

With the continuous development and progress of science and technology, new media art, as a new form of artistic expression, is increasingly receiving attention and research. New media art is an art form that makes full use of modern technology, especially electronic information technology, to create and express art [1-2]. It is a perfect fusion of various traditional art forms and modern technology, providing unlimited possibilities for artistic creation. New media art not only contains music, sculpture, painting and other traditional art forms, but also includes animation, movies, interactive art, virtual reality and other new artistic means of expression. In the creation process of new media art,

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the role of new technology is particularly important [3-4].

Compared with traditional art, new media art makes the art carrier from traditional paper to all kinds of digital, the content from text-based, image-supplemented to text, images, sound, animation and other forms of integration, in the means of creation, the form of expression, the existence of the way as well as the appreciation of the interpretation of the various aspects of the subversive changes have occurred [5-6]. As a result, the ability of traditional art theory to speak has been seriously challenged, and the philosophical, scientific, linguistic, and cultural methodologies on which it once relied are difficult to solve the problems faced by new media art relatively independently, and many of the propositions and concepts that were once prevalent in aesthetics have also been exposed in the context of the integration of contemporary culture, art and multimedia, and many important categories and concepts of traditional art theory need to be reconstructed and written urgently [7-8]. New media art uses computer technology, network technology, digital technology and other means to build a rich and colorful "virtual reality" world for people, which breaks the contradiction between virtual and real in traditional art. When the virtual world becomes an artistic "real" world, and the authenticity of the real world is eliminated in the virtual world, in the context of new media and under the influence of multiple factors, people need to rethink and explore the issue of artistic reality.

Literature [9] describes the future development of museums based on digital technologies aimed at facilitating better public engagement in art creation and art experiences, and proposes designs and implementations centered around the dimensions of individual/social, creation/consumption, and complementarity/ independence. Literature [10] analyzes the convergence of art creation, new technologies and art and design education, proposes the use of applications such as new media social media to foster and enhance artistic creative thinking, and analyzes art multimedia classroom practices to uncover strategies for artistic creativity development. Literature [11] systematically reviews the art creation empowered by AI technology, and the related research literature on art analysis and preservation, including topics such as computational aesthetics, multimodal representation, etc., to deepen the understanding and knowledge of the practice of AI technology in art creation and other fields. Literature [12] examines the process of art creation supported by AI technology to consider the gap between human and AI creativity, and proposes to promote the establishment of partnerships between human artists and AI in art creation to realize the complementary advantages of art creation. Literature [13] deeply analyzes and discusses art creation based on digital technology, revealing the impact of digital new media technology on human art creation, and broadening new dimensions for art creation, including printmaking, photography, film, and other carriers. Literature [14] combines aesthetics theory and computer art creation and other related journal articles to study the relevant issues related to machine creation of art, points out that the process standard and the result standard, subjective standard and objective standard of artistic creativity are unstable, and believes that the machine combined with human art creation has a wide range of space. Literature [15] proposes the use of the Internet of Things, cloud computing technology and platforms to collect the artistic preferences of the crowd as well as visual communication materials, in order to assist in the creation of rich and highly distinctive and expressive graffiti art. Literature [16] discusses the digital protection and inheritance of celadon art and culture, combining the characteristics of celadon cultural industry resources and market positioning for the scenic spot planning based on digital technology, and displaying celadon art in the form of virtual reality. Scholars from the perspective of technology-enabled art creation and the combination of art and technology to form a new carrier, centered on art creation, art presentation and art heritage protection and other perspectives to carry out a wide range of research.

The role of art for human beings is not only limited to the cultivation of aesthetic consciousness, but also has additional values such as religion, political propaganda and indoctrination. Literature [17] clarifies the role played by art in human society, not only limited to aesthetic education, and the aesthetic standard of art is also dynamic change, from the phenomenon like art is also a gradual

process of transformation, so the social education of art aesthetics is also a follow the laws of aesthetics and the development of the art of cultural relics in the field of art restoration is to adhere to the standards of the creation of art works of the past period. Literature [18] discusses that art not only has the function of artistic aesthetic education, but also has the role of conveying information and creating a ceremonial atmosphere, which is discussed in detail in the case of the art of religious frescoes in the era of the Tripilian culture and the reign of Kievan Rus.

The article adopts the questionnaire survey method and the cluster analysis method to screen out the representative color imagery semantics and evaluate the similarity relationship between color attributes and imagery. The representative color samples and discourse samples under the imagery color system are obtained, and the color semantic quantification experiment is set up to obtain the imagery evaluation values of colors on each discourse scale. Based on the obtained quantitative data and gray correlation analysis, a color design evaluation model for new media art creation is established in Lab uniform color space through color transposition.

2. The establishment of semantic space for perceptual evaluation of new media art creation

2.1. New Media Art Creates Sensual Imagery

The earliest philosophical monograph, Zhou Yi, talks about imagery and describes the relationship between the two, and the interpretation of imagery in Yijing conveys the philosophical and aesthetic point of view that "imagery" expresses "meaning". It can be seen that imagery coexists with the subject and is a product of the human brain intertwined with emotions after thinking, and is not independent. Psychology has a long history of research on imagery, and generally explains imagery from the perspective of cognitive psychology. In psychology, imagery usually refers to the perceptual image of a certain thing gradually evolved in the brain, which is the result of the integration of the external appearance of objective things and subjective cognition, and a series of complex cognitive responses. In short, imagery is a psychological synthesis produced by the collision of human subjective emotions, ideas and external things.

When the sense organs are stimulated by something in the external environment, they will form a fuzzy impression and memory of the thing in the brain, but at this time, the memory will be retained in the brain purposelessly, and sometimes a series of sympathetic phenomena caused by the stimulus are associated with it to form a comprehensive imagery. When stimulated by the thing again, the brain will recall the previous memories or visualize the thing, and finally express the image of the thing in the form of language, words or images, which is the complete process of image formation and expression. In order to clearly illustrate this process, a conceptual diagram of image formation and expression has been constructed, as shown in Figure 1.

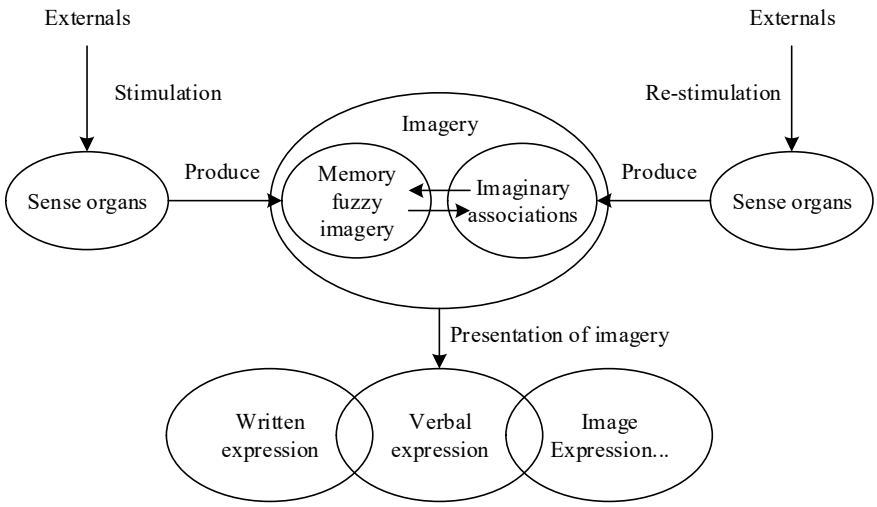


Fig. 1. Image formation and expression concept diagram

2.2. Research methods and tools

2.2.1. Perceptual research methods:

1) Brainstorming method: Brainstorming method, i.e., intellectual stimulation method, free thinking method, can stimulate new ideas through collective style, can creatively solve problems and get improvised ideas, and its process of generating and judging ideas are independent [19]. The judgment of whether to apply the brainstorming method is based on whether the generation and evaluation of ideas are simultaneous during the meeting, the essence of the method is to postpone the evaluation. The method is a very effective technical method for stimulating creativity and generating associations. In a certain situation, the activities of the group in the group to promote each other, members of the mutual stimulation of the imagination generated by each other, will provoke a wider range of associative response, thus generating a rich and diverse creative ideas.

2) Focus Group Method. Focus groups can yield some unexpected findings from free group discussions. The method can be used as a stand-alone data collection method, but in more cases it is generally used in conjunction with other complementary data collection methods. The method consists of the following steps: determining the sampling sample and soliciting participants, inviting focus group participants who are able to willingly provide us with the information we want, and at the same time, they must be representatives of the people who have an interest in this field; determining the number of groups and participants, usually 2-4 groups are possible; arranging the participants, informing the participants of the following information: the purpose of the focus group discussion, the location of the discussion The participants are informed about the purpose of the focus group discussion, where it will take place, who the other participants are and who the researcher is and the main points they represent; the location of the discussion and interviews are selected.

2.2.2. Statistical methods and tools:

1) Statistical methods. K-center clustering can achieve rapid clustering of samples, suitable for large sample data analysis, short computation time, can be set according to the need for the initial class center position, with the existing clustering results as the initial position factor analysis, you can make effective use of the results of the previous work. The limitation is that the user has to set the number of samples to be categorized, and can only complete the sample clustering. The basic idea is that n

numerical variables form an n-dimensional space to participate in rapid clustering, each sample is a point in the space, the number of classifications required for K; select K points as the initial class center cohesion point, and then according to the principle of the minimum Euclidean distance in the clustering of the rest of the samples represented by the point of condensation to the center of the class to get the initial classification scheme to calculate the initial classification of each initial classification mean value (center position); using the calculated classification means Reclustering until the cohesion points meet the convergence criteria.

When clustering analyzes the nature between samples or variables, the statistics used for distance and proximity are clustering statistics, and commonly used clustering statistics are distance and similarity coefficients. From the coordinates of each imagery vocabulary in the factor space, the cluster analysis distance model and similarity coefficient are established:

A. Distance: used for clustering of samples. Clustering has absolute distance, Euclidean distance, Ming's distance, Ma's distance drag, commonly used Thi Euclidean distance, which is described as follows.

For any two samples i and k can be defined as Euclidean distance as in equation (1):

$$\begin{aligned} D_{ik} &= \sqrt{\left(X_{i1}-X_{k1}\right)^2+\left(X_{i2}-X_{k2}\right)^2\ldots+\left(X_{im}-X_{km}\right)^2} \\ &= \left[\sum_{j=1}^{m}\left(X_{ij}-X_{kj}\right)^2\right]^{1/2} \end{aligned} \tag{1}$$

where X_{ij} represents the j rd variable of the i nd sample; X_{kj} represents the value of the j th variable of the k th sample; and D_{ik} represents the distance between the i th and k th perceptual terms in the factor space.

In order to eliminate the effect of differences in the scale of each indicator, it is often necessary to standardize the indicators before finding the distance between samples, i.e., to transform each observation into a standard value, as shown in equation (2):

$$X'_{ij} = \left(X_{ij}-\bar{X}_j\right)\Big/S_j \tag{2}$$

where $\overline{X_j}$ and S_j are the sample mean and sample standard deviation of the j rd variable respectively, the standardized indicator has a mean of 0 and a standard deviation of 1. Cluster analysis is performed using standardization.

B. Similarity coefficient: commonly used for clustering of variables. Similarity coefficients are tutor cosine and correlation coefficient. Continuous information commonly used Pearson correlation coefficient, such as equation (3); categorical information commonly used Pearson column linkage number, such as equation (4).

Pearson correlation coefficient:

$$r_{ik} = \frac{\sum_{j=1}^{m}\left(X_{ij}-\overline{X_i}\right)\left(X_{kj}-\overline{X_k}\right)}{\sqrt{\sum_{j=1}^{m}\left(X_{ij}-\overline{X_i}\right)^2\sum_{j=1}^{m}\left(X_{kj}-\overline{X_k}\right)^2}} \tag{3}$$

Pearson column linkage numbers:

$$C_{xy} = \sqrt{\frac{x^2}{x^2+n}} \tag{4}$$

where x^2 is the x^2 value of the column table for $R\times C$ categorical information. n is the total number of samples for $R\times C$ categorical information.

2) SPSS statistical tools. Statistical analysis software includes: SPSS, SAS and Matlab, etc. SPSS statistical software from 1968 to the present, the number of revisions, its interactive performance is more and more high, can be automatic statistical mapping, in-depth data analysis, the global user of about 250,000 people, in communications, medical, design, scientific research and education and many other fields and industries.

This paper combines SPSS software, using cluster analysis and other statistical analysis methods to achieve the acquisition of perceptual color information in the creation of new media art.

2.2.3. Fuzzy semantics. The measurement of semantic information is a complex problem, which involves many factors such as the meaning of grammatical symbols, contextual relations, changes in the linguistic environment and the knowledge structure of the cognitive subject. Since the 1960s, people have begun quantitative research on the problem of semantic information and have made some progress, but it has not yet been well solved. Fuzzy semantics is an important fringe discipline that began to emerge in the 1960s and 1970s. It opens up a new way of semantic research in natural language and shows a broad development prospect, and its research object is the objective existence of a large number of fuzzy phenomena in semantics [20]. Fuzzy semantics, in contrast to the traditional tendency of just pursuing precision, puts forward practical non-traditional theories and effective and practical new methods for dealing with fuzzy semantic phenomena.

In order to describe semantic information, it is necessary to establish a characterization method of "meaning" first. We can use the method of logical truth to describe it. We set up a parameter "logical truth of meaning", which is denoted as t and $0 \le t \le 1$, and it is defined as follows:

$$t = \begin{cases} 1 & State\ \log ic\ is\ true \\ 0.5 & State\ \log ic\ in \det er \min ate \\ a(0,1) & State\ Logic\ Fuzzy \\ 0 & State\ \log ic\ is\ false \end{cases} \tag{5}$$

If the random event $X = \{x_1, x_2, x_3, \cdots x_n\}$, the probability of each state idea is $P = \{p_1, p_2, p_3, \cdots p_n\}$ and the logical truth of each state idea is $T = \{t_1, t_2, t_3, \cdots t_n\}$, then the semantic information structure of event X is:

$$S = \begin{Bmatrix} X \\ T \\ P \end{Bmatrix} = \begin{Bmatrix} x_1 & x_2 & x_3 & \cdots & x_n \\ t_1 & t_2 & t_3 & \cdots & t_n \\ p_1 & p_2 & p_3 & \cdots & p_n \end{Bmatrix} \tag{6}$$

The following semantic metric formula can be obtained:

$$\begin{aligned} H(X,T) &= K\sum_{i=1}^{n} tp(x_i)\frac{1}{\log p(x_i)} \\ &= -K\sum_{i=1}^{n} t_i p(x_i)\log p(x_i) \end{aligned} \tag{7}$$

Although semantic information has a deeper and wider meaning than grammatical information, when the subject acquires information, he or she is more concerned about "what it is good for", i.e., the utility of the information. Borrowing the terminology of linguistics, we call the information about "the utility of the state of things and the way of changing the state of things" as pragmatic information. Obviously, the measurement of pragmatic information is a more complicated problem, after the source sends out the information, its utility varies from person to person, from time to time, and from place to place, and the same information acts on different objects and in different environments, its utility is different, or even completely opposite.

In a similar way to the introduction of the logical truth of the formulas in the metric of semantic information, the concept of utility degree is used to deal with the problem of characterizing formulas' utility. Let the parameter of the idiographic utility degree be u, which satisfies:

$$u=\begin{cases}1 & \textit{State utility is } \max \textit{imised}\\ b(0,1) & \textit{State utility ambiguity}\\ 0 & \textit{Minimum state utility}\end{cases} \tag{8}$$

If the state idea of random event X is $X=\{x_1,x_2,x_3,\cdots x_n\}$, the probability of each state is $P=\{p_1,p_2,p_3,\cdots p_n\}$, and the utility of each state is $U=\{u_1,u_2,u_3,\cdots u_n\}$, then the semantic information structure of event x is:

$$S=\begin{Bmatrix}X\\U\\P\end{Bmatrix}=\begin{Bmatrix}x_1 & x_2 & x_3 & \cdots & x_n\\ u_1 & u_2 & u_3 & \cdots & u_n\\ p_1 & p_2 & p_3 & \cdots & p_n\end{Bmatrix} \tag{9}$$

The linguistic metric formula can be obtained as follows:

$$H(X,U)=K\sum_{i=1}^{n}u_i p(x_i)\frac{1}{\log p(x_i)}=-K\sum_{i=1}^{n}u_i p(x_i)\log p(x_i) \tag{10}$$

The discussion of fuzzy semantics not only adapts to the development of natural language, but also provides theories and methods for solving many difficult problems that formal linguistics and related disciplines are eager to solve. Fuzzy semantics combines linguistic research with natural science, and is a cross-discipline between the two, for example, computers using fuzzy language can increase its flexibility and practicality. Recent research results show that fuzzy semantics not only has theoretical value, but also has important significance for the research on natural language understanding in the fields of computer and artificial intelligence.

2.3. Determination of perceptual intention in the creation of new media art

The specific steps for screening the vocabulary of perceptual imagery are as follows:

1) Widely collect color imagery vocabulary from various fields, screen the vocabulary preliminarily and submit it to experts for review.

2) Conduct questionnaire surveys on design professionals and users to further reduce the amount of color imagery vocabulary.

3) According to the results of the questionnaire, the frequency of color imagery vocabulary is ranked, and the top 25% of imagery vocabulary is selected.

4) Invite relevant professionals to fill in the similarity detection questionnaire to detect the similarity of imagery words.

5) The test results are counted, the data are clustered and analyzed, and the imagery words that match the products are selected and grouped.

2.3.1. Vocabulary Collection of Color Imagery for New Media Art Creation. Since the vocabulary is a preliminary collection of color imagery vocabulary for art creation works, there are still more problems, such as the similarity of the vocabulary and whether it is in line with people's perception of the imagery, etc. Therefore, three graduate students majoring in art creation-related fields were invited to form a focus group to further screen the 70 vocabulary words obtained as mentioned above, and to eliminate the words that are not commonly used, with repetitive meanings and ambiguous word meanings, and eventually 30 color-sensitive semantic words were obtained, as shown in Table 1.

Table 1. Image vocabulary after screening

Numbering	Vocabulary	Numbering	Vocabulary	Numbering	Vocabulary	Numbering	Vocabulary	Numbering	Vocabulary
1	Technological	7	Lively	13	Interesting	19	Individualistic	25	Abundant
2	Clean	8	Flamboyant	14	Soft	20	Mature	26	Sweet
3	Pleasurable	9	Plump	15	Sven	21	Sharp	27	Bold
4	Modern	10	Perceptual	16	Contracted	22	Heartwave	28	Simple
5	Locomotor	11	Varying	17	Official	23	Ornate	29	Enthusiastic
6	Commercial	12	Conservative	18	Plain	24	Mashup	30	Fluent

2.3.2. Color Imagery Lexical Similarity Detection. The 30 adjectives will be further screened, in order to avoid the influence of the existing sample color on the artistic imagery, as accurately as possible to understand the perceptual imagery of the color of the new media art creations, through the PS software will be black and white processing of the color samples, through the association of the selection of suitable perceptual semantic words, the production of questionnaires and distribution, a total of 42 copies of the recovery are valid, in accordance with the recovery of the questionnaires selected vocabulary for the word frequency ranking, the first 15 adjectives were taken. The first 15 adjectives were taken, and the results of vocabulary sorting are shown in Table 2.

Table 2. The image vocabulary of the second screen

Numbering	Vocabulary	Numbering	Vocabulary
1	Clean	9	Flamboyant
2	Interesting	10	Atmospheric
3	Sharp	11	Ornate
4	Technological	12	Heartwave
5	Modern	13	Individualistic
6	Perceptual	14	Abundant
7	Official	15	Fluent
8	Soft		

Among the above 15 words, there are still words that are similar in meaning, such as "gorgeous" and "atmospheric", "modern" and "technological", etc. Therefore, the method of similarity detection is introduced, nine subjects majoring in art creation are invited to fill in the similarity questionnaire, and any two vocabularies are compared one by one, scored according to the similarity evaluation scale shown in Table 3, and the corresponding values are filled into the similarity matrix, and the vocabulary similarity is shown in Table 4. Through this method, the degree of similarity between perceptual vocabularies can be judged, and the core vocabulary describing the color imagery of art creation works can be extracted.

Table 3. Similarity test scale

Similarity	Unsimilarity	It's kind of like	Similar	Very similar	Self
Scoring	0	1	2	3	4

Table 4. Similarity detection

Numbering	Vocabulary 1	Vocabulary 2	Vocabulary 3	...	Vocabulary 15
Vocabulary 1	4				
Vocabulary 2		4			
Vocabulary 3			4		
...				4	
Vocabulary 15					4

2.3.3. Imagery Lexicon Cluster Analysis. SPSS statistical software was used to systematically cluster the data, and the sum of squares of dispersion method was used in the clustering method, according to the tree diagram, as shown in Figure 2. The clustering number of perceptual words was defined into four categories, and four representative perceptual words were screened out, namely "individual", "technological", "interesting" and "rich", and the specific systematic clustering is shown in Table 5.

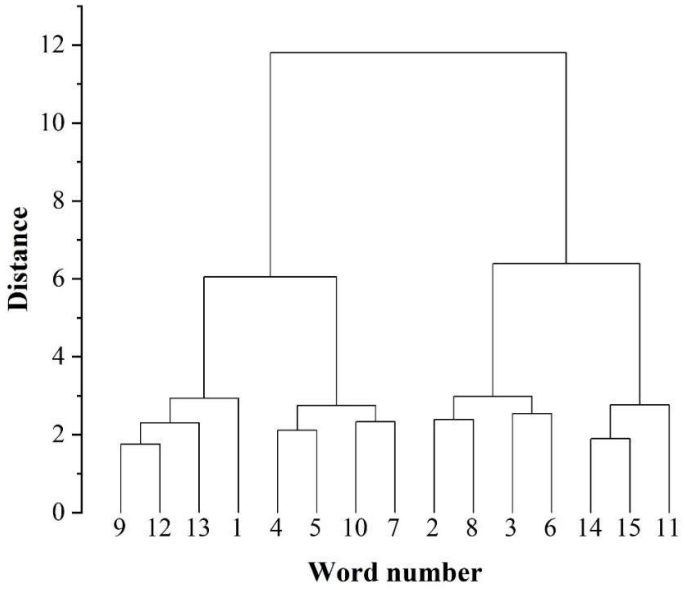


Fig. 2. System cluster diagram

Table 5. System cluster vocabulary grouping

Group	Representative vocabulary	Group vocabulary
Group 1	Individualistic	A public, spiritual, and clean
Group 2	Technological	Modern, atmospheric, formal
Group 3	Interesting	Soft, vivid, and emotional
Group 4	Abundant	Sleek, ornate

The data were clustered by K-means, and according to the group of systematic clustering, four clusters were used, and the words closest to the cluster center were selected, that is, the distance close to 0, and five adjectives were comprehensively screened out: "atmospheric", "clean", "modern", "sensual" and "technological", as shown in Table 6. As can be seen from the table, the lowest similarity of soft is 1.695, and the highest similarity of technology is 3.091.

Table 6. K mean clustering

Image word	Class	Distance	Image word	Class	Distance	Image word	Class	Distance
Sharp	1	2.752	Interesting	2	2.432	Technological	1	3.091
Modern	2	1.721	Individualistic	3	1.687	Atmospheric	3	1.865
Flamboyant	4	2.674	Ornate	3	1.759	Perceptual	2	3.357
Heartwave	3	2.915	Clean	1	3.411	Official	1	2.855
Abundant	1	2.241	Soft	4	1.695	Fluent	4	2.216

In summary, it is found that the clustering results are not consistent, but the in-depth analysis shows that the lexical meanings of the two clustering methods are similar. According to the results of systematic clustering and K-means clustering, five adjectives of "atmospheric", "clean", "modern", "sensual" and "technological" were determined, and four image adjectives of "flamboyant", "clean", "soft", "smart" and "gorgeous" were selected and used with antonyms as the semantic basis for color image measurement, as shown in Table 7. A total of four representative groups of color image adjectives for new media art creation were identified as the evaluation scale of imagery.

Table 7. Final vocabulary

Numbering	Vocabulary	Numbering	Vocabulary
1	Flamboyant - Official	4	Heartwave-Perceptual
2	Clean - abundant		
3	Soft - sharp		

3. Perceptual evaluation of new media art creation

3.1. Perceptual evaluation model construction based on gray correlation analysis

3.1.1. Objective measurement modeling of perceptual evaluation indicators. The construction method of the objective measurement model of perceptual evaluation indexes in this paper is shown in Fig. 3: firstly, the semantic difference scale of perceptual evaluation of work appearance is used to evaluate the appearance of the work and obtain the perceptual evaluation data: then, the eye movement data of the subjects when browsing the appearance of the work is collected and recorded by applying the eye movement equipment and the software such as BeGaze: secondly, the correlation analysis between the alternative eye movement indexes and the various dimensions of the perceptual evaluation is conducted Second, the correlation analysis of the alternative eye movement indicators with each dimension is conducted, and the eye movement indicators with significant correlation with each dimension are selected to construct the measurement model; finally, the partial least squares method is used to regressively model the perceptual evaluation indicators with the significant eye movement indicators, and an objective measurement model is constructed, which can measure the value of the user's perceptual evaluation indicators of the appearance of the work through the objective eye movement data.

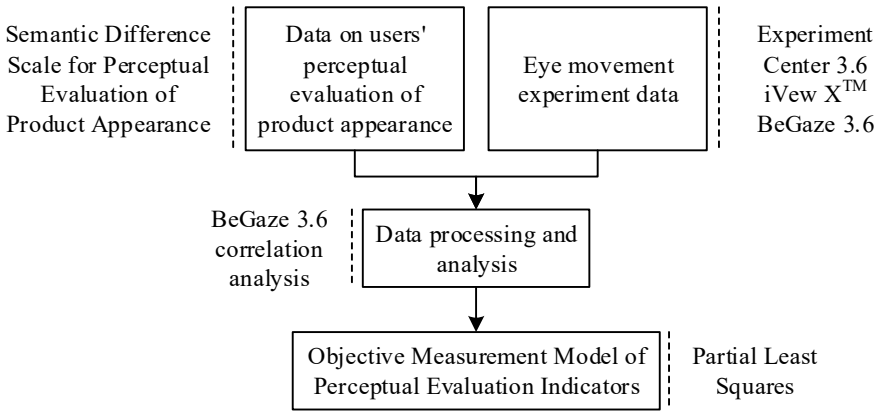


Fig. 3. The method of objective measurement model constructed

In this paper, the constructed objective measurement model of perceptual evaluation indicators is denoted as:

$$E_{ik}(j) = \alpha_j + A_j^{\mathrm{T}} Y_p \tag{11}$$

Among them, $E_{ik}(j)$ represents the evaluation value of the k nd participant on the j th perceptual evaluation index of the i rd product, $i = 1, 2, \cdots m$ represents the number of products, $j = 1, 2, \cdots, n$ represents the number of perceptual evaluation indexes, $k = 1, 2, \cdots, h$ represents the number of subjects participating in the experiment, α_j represents the constant, A_j matrix is composed of all the significant eye movement index coefficients on the j th perceptual evaluation index, and Y_p matrix is composed of the experimental data of the p significant eye movement indicators of the k th participant on the i th product on the j th perceptual evaluation index.

3.1.2. New media art perceptual evaluation model construction. The construction method of the work appearance perceptual evaluation model in this paper is shown in Figure 4: first, the semantic difference scale of perceptual demand is utilized to obtain the user's expectation of the multidimensional perceptual demand of the work appearance: second, the objective measurement model of the perceptual evaluation indexes is used to measure the multidimensional perceptual evaluation value of the work appearance through the user's eye-movement data when browsing the appearance of the work; Finally, gray correlation analysis is used to calculate the degree of closeness (gray correlation) of the connection between the measured value of the user's multidimensional perceptual evaluation of the work's appearance (which constitutes the comparison sequence) and the user's expectation of the multidimensional perceptual demand for the work's appearance (which constitutes the reference sequence), and the larger the gray correlation is, the greater the degree of closeness of the measured value to the expectation, and the better the appearance of the work satisfies the user's multidimensional perceptual demand.

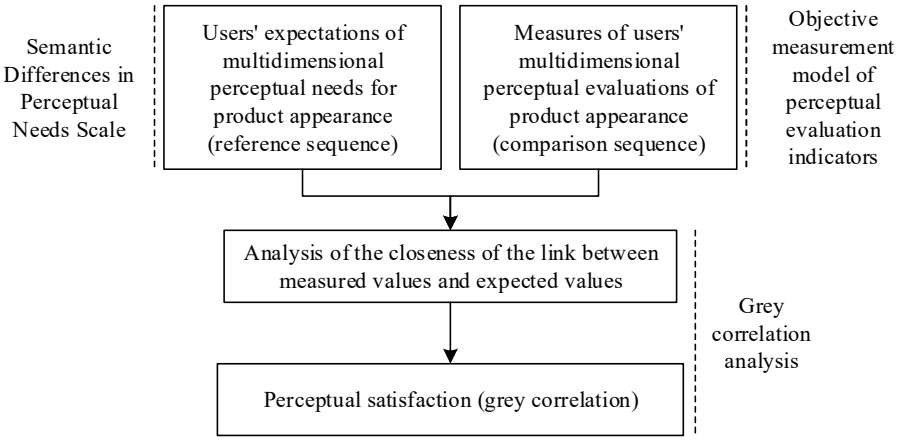


Fig. 4. The method of product appcarance evaluation model constructed

Satisfaction is a psychological state that produces a sense of pleasure after the user's needs have been met, and it is the relative relationship between the user's actual feelings after viewing the work and the expected feelings before viewing, and the degree of this psychological state is usually measured by user satisfaction. Considering that the gray correlation in this paper indicates the degree of connection between the measured value of multidimensional perceptual evaluation of work appearance and the user's expectation of multidimensional perceptual needs of the work appearance, which is very similar to the satisfaction, the perceptual satisfaction is defined as a measure of the degree to which the work appearance meets the user's perceptual needs in this paper and is expressed in gray correlation, so as to achieve the purpose of the synthesis of the multi-dimensional perceptual evaluation dimensions for the The purpose of perceptual evaluation of work appearance is realized by considering multiple perceptual evaluation dimensions.

Therefore, the specific steps for constructing the work appearance sensibility evaluation model in this paper are as follows:

Step1: Determine the comparison sequence. For the problem of perceptual evaluation of work appearance, the average of all perceptual evaluation indicators for each work appearance constitutes a comparison sequence $E_i(j)$:

$$E_i(j)=\left\{E_i(1),E_i(2),\cdots,E_i(n)\right\} \tag{12}$$

where, $E_i(j)=\dfrac{\sum_{k=1}^{h}E_{ik}(j)}{h}$, $i=1,2,\cdots,m$ denotes the number of works; $j=1,2,\cdots,n$ denotes the number of perceptual evaluation indexes, $k=1,2,\cdots,h$ denotes the number of subjects participating in the experiment, and $E_{ik}(j)$ denotes the value of the kth subject's evaluation of the appearance of the ith work on the jth perceptual evaluation index.

Step2: Determine the reference sequence. When evaluating the perceptual evaluation of each work appearance, the first step is to determine the evaluation standard (optimal value), and in this paper, the expected average value of the user's perceptual demand for the appearance of the work is set as the reference sequence $E_0(j)$:

$$E_0(j)=\left\{E_0(1),E_0(2),\cdots,E_0(n)\right\} \tag{13}$$

where, $E_0(j)=\dfrac{\sum_{k=1}^{h}E_{0k}(j)}{h}$, $E_{0k}(j)$ then denotes the k rd subject's expectation of the work's

appearance on the j th perceptual evaluation index, obtained from the semantic difference scale of perceptual needs.

Step3: Mean value processing. Because the order of magnitude and the scale of each perceptual evaluation index value are usually different, in order to carry out the comparison and weighting operation, and to reduce the interference of random factors on the results, it is necessary to carry out the homogenization processing as follows:

$$X_i(j)=\frac{E_i(j)}{\overline{E}_i(j)} \tag{14}$$

where $\overline{E}_i(j)=\frac{1}{m+1}\sum_{i=0}^{m}E_i(j)$

Step4: Calculate the association coefficient. Define the correlation coefficient between the comparison sequence $E_i(j)$ and the reference sequence $E_0(j)$ on each perceptual evaluation index as $\xi_i(j)$:

$$\xi_i(j)=\frac{\min_i\min_j\left|x_0(j)-x_i(j)\right|+\rho\max_i\max_j\left|x_0(j)-x_i(j)\right|}{\left|x_0(k)-x_i(j)\right|+\rho\max_i\max_j\left|x_0(j)-x_i(j)\right|} \tag{15}$$

where ρ is the discrimination coefficient, the value range 0-1, usually take $\rho=0.5$.

Step5: Determine the weights of perceptual evaluation indexes.The correlation coefficients of each index calculated in Step4 are dispersed, and it is not possible to carry out the comparative analysis between the appearance of works, so in order to carry out the comparative analysis as a whole, it is necessary to centralize each correlation coefficient into a single value, i.e., weight the correlation coefficients to find the average value, and the weights are determined according to the importance of each perceptual demand dimension, and are noted as:

$$W_J=\left[w_1,w_2,\cdots,w_n\right] \tag{16}$$

where w_j is the weight of the j nd perceptual evaluation index.

Step6: Calculate the correlation degree of perceptual evaluation of work appearance. Use the correlation coefficient of the appearance of the work on each perceptual evaluation index to weight the average value to express the degree of correlation, notated as:

$$\gamma_i=\sum_{j=1}^{n}w_j\times\xi_i(j) \tag{17}$$

This results in a matrix of users' perceptual satisfaction with the appearance of the work KS:

$$KS=(\gamma_i) \tag{18}$$

Step7: Perceptual evaluation of the appearance of the work based on the user's perceptual satisfaction matrix KS of the appearance of the work.

3.2. Example Validation and Analysis

3.2.1. Experimental program setup. The color design is carried out with the new media art creation works as the object to verify the effectiveness of the color design method based on perceptual intention color system and gray correlation analysis. Invite the creators to assign colors to the works, a total of five groups of color schemes are obtained, and the primary and secondary color values of each color scheme are transposed to Lab color mode, and their specific values are shown in Table 8.

Table 8. 5 group color scheme lab value

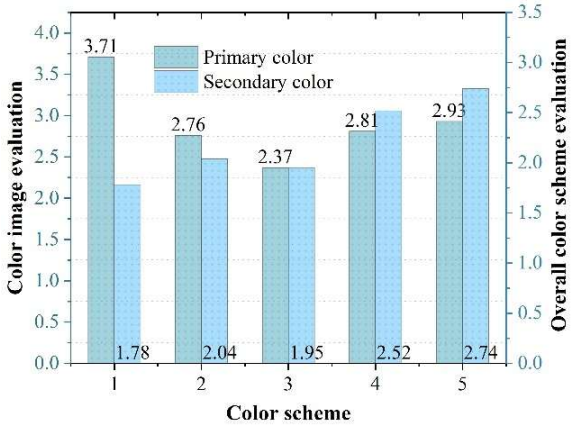
Color scheme	Main color A (L,a,b)	Paracolar B (L,a,b)
1	(54,66.9,31.4)	(43,–21.6,–6.5)
2	(53.1,–27.1,–11)	(74.3,–24.3,8)
3	(79.1,–24.1,19.1)	(65.5,–14.4,–12)
4	(94,–7.3,4.9)	(79.7,–34.8,–9)
5	(62.5,–37.1,6.7)	(69.8,–20.3,43)

3.2.2. Color Scheme Gray Correlation Imagery Evaluation. Through the color design, any color in the scheme can be identified in the 25 basic color samples as the corresponding neighboring color and its color value in the Lab color model. Let the main color A of the work by the gray correlation analysis of the color imagery evaluation value of $e_A(n)$, the secondary color B color imagery evaluation value of $e_B(n)$, then the overall color imagery of the work is shown in equation (7).

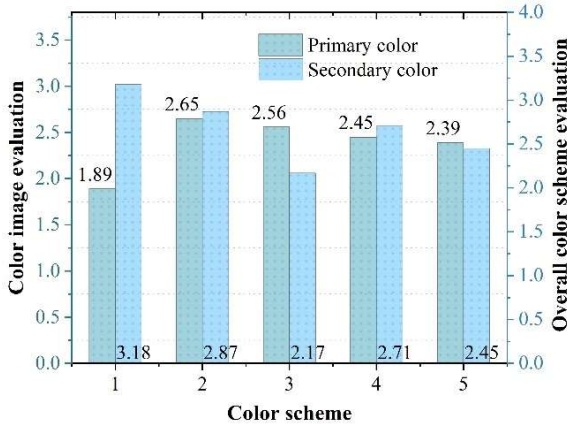
$$E(n) = e_A(n)P_A + e_B(n)P_B, (n = 1, 2, ..., 5) \tag{19}$$

In color scheme 1, for example, the adjacent color samples of A_1 (55.6, 46.9, –2.5) and A_6 (82.8, 12.1, 38.5) of primary color A (54, 66.9, 31.4) and the adjacent color samples of secondary color B (43, –21.6, –6.5) are B_{17} (48.2, –18.4, –21.6) and B_{25} (59.1, –22.4, –7), respectively. The gray correlation degree between the main color A and A_1 and A_6 is γ(A, A_1)=0.76, γ(A, A_6)=0.4, the gray correlation degree between the secondary color B and B_{17} and B_{25} is γ(B, B_{17})=0.67, and the γ(B, B_{25})=0.87 is substituted into the formula, and the image evaluation weight coefficients of the adjacent color samples A_1 and A_6 of the main color A are 0.58 and 0.37, respectively, and the adjacent color samples of the secondary color B are B_{17} The weight coefficients of image evaluation in B_{25} were 0.41 and 0.55, respectively. Combined with the color image evaluation of the primary and secondary color adjacent color samples at the scale of freshness, hope and vivid vocabulary, the color image evaluation was 3.55, 3.81 and 1.75 and 1.78, respectively, and the image evaluation value of the main color A and the image evaluation of the secondary color B was 1.76, and the evaluation of the main and secondary color images was substituted into the formula, and the overall color image evaluation of color scheme 1 under the scale of freshness, hope and vivid vocabulary was obtained by combining the area proportions P_A and P_B to obtain the overall color image evaluation of color scheme 1 at the scale of fresh, hope and vivid vocabulary was 2.89. In the same way, the evaluation of the main and secondary color images of the remaining four groups of color schemes and the overall color image evaluation of the scheme were obtained under the vocabulary scale, which were 2.75, 1.91 and 2.43 for color scheme 2, 2.23, 1.85 and 2.07 for color scheme 3, 2.71, 2.40 and 2.67 for color scheme 4, and 2.87, 2.76 and 2.84 for color scheme 5. The data sample was plotted with this as the data sample, and the five groups of color schemes under the remaining four vocabulary scales were plotted in the same way, and the final result is shown in Figure 5.

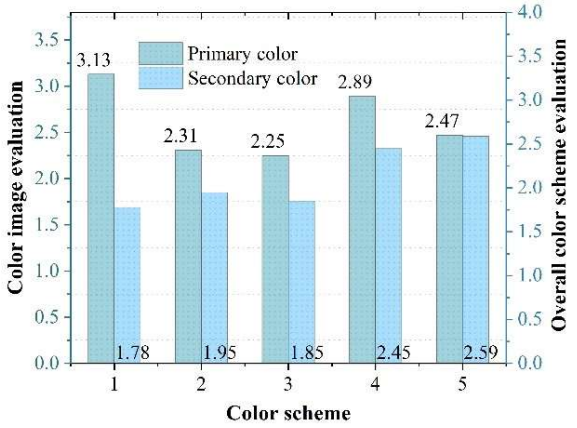
Comparative analysis of the imagery ratings of the five groups of color schemes at different discourse scales is used to optimize the color schemes. Taking clean, soft, and sharp as an example, the overall imagery ratings of the five color schemes are 2.65, 2.26, 2.12, 2.82, and 2.53, respectively, so that color scheme 4 is the most suitable for the imagery needs and is highly desirable in the color design of new media art works using this scale as the imagery.



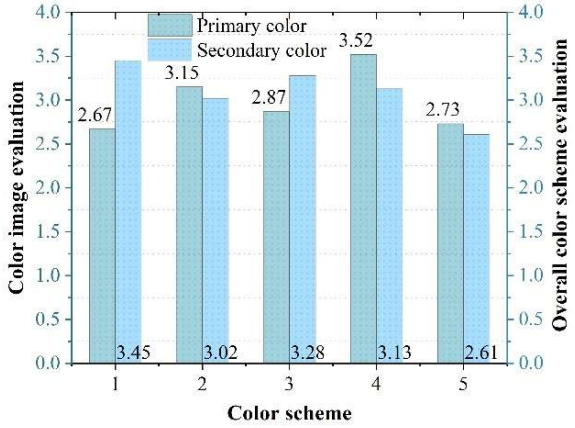
(a) Modern, Technological, Ornate



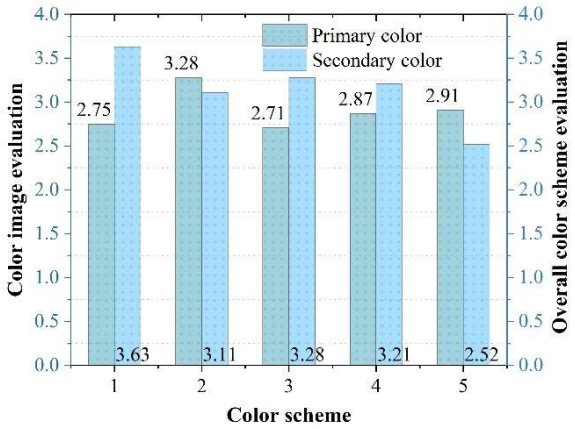
(b) Spirit, Richness, Atmosphere



(c) Clean, Soft, Bright



(d) Emotional, Fluid, Interesting



(e) Formal, Public, Personal

Fig. 5. The image evaluation of the main vice color and the overall plan

In order to verify the validity and reasonableness of the method, 12 creators with rich experience in color design were invited to subjectively evaluate 5 groups of color schemes with the same discourse scale, and the evaluation was based on a five-point system, with the degree of imagery fit increasing with the increase of the score value, and the control relationship between the evaluation results of the designers and the calculated scheme imagery evaluation value was shown in Fig. 6, and the subjective evaluation results of the creators of the 5 color schemes were highly similar to the calculated scheme

4, such as the similarity of scheme 4 was more than 4.5, proving that the method has certain application value in the actual color design process. The subjective evaluation results of the creators of the five groups of color schemes and the calculated imagery evaluation value have a high degree of similarity, such as scheme 4 similarity of 4.5 or more, the final program selection results are also consistent, proving that the method has a certain value of application in the process of actual works of color design.

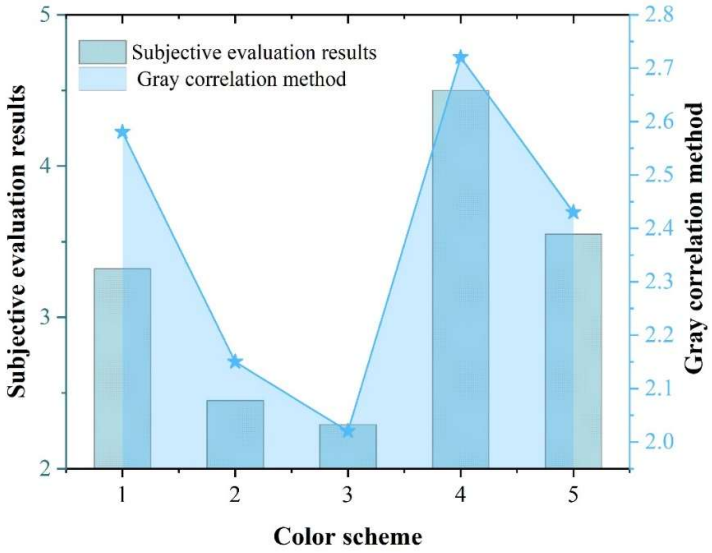


Fig. 6. The subjective evaluation is controlled by the result of the calculation

In addition, combined with the scheme effect diagram to further analyze the results of the imagery evaluation of the color scheme under the clean, soft and sharp vocabulary scale, it can be found that the four colors used in the two schemes of Color Scheme 1 and Color Scheme 5 belong to different color families, with obvious differences in hue, and there is a large span in the evaluation of monochromatic color imagery, and the difference in the evaluation of color imagery between the primary color and the secondary color of Color Scheme 1 is especially huge, but the overall color imagery evaluation of the two schemes is extremely similar. The difference between the color imagery of the primary and secondary colors in color scheme 1 is particularly large, but the overall color imagery ratings of the two schemes are extremely similar. Comparing Color Scheme 1 and Color Scheme 4, the color imagery ratings of the primary colors are similar, while the color imagery ratings of the secondary colors differ greatly, and the overall color imagery rating of Color Scheme 4 is higher than that of Color Scheme 1.

The color design method based on the perceptual intention color system and grey correlation analysis can not only be used for the selection of the final color scheme of the work, but also help the creators to filter the colors in the color library according to the design needs in a certain situation, and produce a variety of color pre-selected schemes for the work.

3.3. Creative Practice and Analysis

Practical method: In order to save the time of creation and design, 4 representative color schemes are selected from the above 5 schemes to facilitate the testers' design of the creative works of new media art.

Evaluation method: Based on the questionnaire survey of semantic difference method, the tester subjectively evaluated 4 design schemes, based on the three pairs of image semantics of "public-formal", "soft-distinct" and "clean-rich", with a subjective evaluation of 1 to 5 points, the closer to the left image word, select "1", and the closer to the right image word, choose "5".

SUBJECT GROUP: 41 subjects with different industry backgrounds, of which 21 were related to the art creation industry.

Experimental results: the results are shown in Table 9. The critical value of the imagery evaluation results is “3”, the mean result is less than 3, which means that the more the design scheme favors the left side imagery, and the mean result is more than 3, which means that the more the design scheme favors the right side imagery. And the more the result is inclined to “1”, the stronger the left side imagery of the design scheme is.

Result analysis: According to the evaluation results, except for scheme design 1, the image of "public-formal" is greater than "2", and the scores of other design schemes in "soft-distinct", "clean-rich" and "gorgeous-technological" images are all less than "2", but the overall image evaluation results are less than the critical value of "3". Illustrate the four design schemes, all of which are in line with the expected "flamboyant", "distinctive" and "rich" style orientation. However, the reason why the "gorgeous" image of scheme design 2 is higher than that of "2" may be caused by too low color saturation, and the color saturation can be increased in the later stage to strengthen its "gorgeous" image. However, the overall design evaluation has met expectations.

Experimental conclusion: art creation color imagery evaluation model, can be realized, given the color imagery, deduce the color design elements in line with the characteristics of the imagery, i.e., reverse verification of the reliability and feasibility of the evaluation model of color imagery of art creation works.

Table 9. The results of the evaluation of color image of artistic creation

Scheme design 1	1.41	1.52	1.92
Scheme design 2	1.85	1.63	2.13
Scheme design 3	1.89	1.94	1.82
Scheme design 4	1.63	1.55	1.99

4. Conclusion

1) Color representative semantics and sample acquisition, constructing new media art creation color perceptual imagery space. The collected perceptual color adjectives were preliminarily screened in the form of questionnaires, and the similarity matrix was established through the similarity questionnaire, and the clustering analysis work was completed in the SPSS statistical analysis software to determine five groups of representative color imagery adjectives of new media art creation as the imagery evaluation scale.

2) The positive correlation between the overall artwork imagery evaluation value and the independent color imagery evaluation value based on the color design method of perceptual intention color system and gray correlation analysis.

3) The art creation color imagery evaluation model can realize the given color imagery, which verifies the reliability and feasibility of the art creation work color imagery evaluation model.

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