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Research on Visualization and Creative Realization of Complex Forms of Packaging Design Based on Computer Graphics

Lu Xu[1,*]
[1] School of Art, Anhui Xinhua University, Hefei, Anhui, 230088, China
Corresponding authors: (e-mail: 3935910526@qq.com).

Abstract With the continuous development and popularization of information technology, the field of product packaging design is inseparable from the application of computer graphics design. In order to realize the visualization of complex forms of packaging design, this paper proposes a packaging design image processing algorithm based on the visual characteristics of the human eye to enhance the packaging design pattern. Combining the Transformer and Generative Adversarial Network (GAN) algorithms, the DPformer-GAN model is constructed to realize the layout innovation of the product packaging, and the loss function is designed. The packaging creative design method based on DPformer-GAN model proposed in this paper is applied to design the packaging of clothing products. The average value of the designed clothing product packaging is higher than 4 in each dimension of the evaluation of the effect of color elements, and in the evaluation of the effect of the logo elements of the packaging, the prominence of the packaging logo is the most prominent, and the average value of the psychological evaluation of the purchase intention and the degree of brand impression reaches a high rating of 4.18 and 4.09. The overall visual layout of the packaging elements is also more effective, which strengthens the unique characteristics and visual recognition of the packaging design. The overall visual layout of the package is also more effective, strengthening the unique characteristics and visual recognition of the package design.

Index Terms Image Processing, Transformer, Network Adversarial Network, Packaging Design

I. Introduction

Packaging design is a kind of industry developed in recent years, as an important part of people's lives, it can help products better integrate and adapt to the “collision” in people's lives, so as to promote the sales of products, and can promote the change of packaging design technology [1]-[4]. From the point of view of the development of the packaging design industry, packaging design technology, the number of enterprises, the number of employees and other aspects have been developed to a certain extent [5], [6]. At this stage, commodity packaging is not only wrapping the commodity, but also attracting consumers through exquisite surface creative packaging and visualization information, thus promoting the sales of commodities, which is a quite important sales promotion method [7]-[9]. However, the current commodity replacement rate is very fast, which puts forward more strict requirements for commodity packaging design [10]. Whether the commodity packaging design can have good quality and effect is directly related to whether the commodity can be sold out quickly, so the enterprise on the commodity packaging design to give high importance to the packaging design, through the packaging design to better publicize the commodity, the sale of goods is quite important [11]-[14].

In recent years, with the rapid development of computer technology in China, it promotes the leap and innovation of packaging design, and promotes the development of contemporary design. The contribution of computers to packaging design is indisputable, coupled with the development of computer graphics technology and its platform, which makes the application of computer graphics technology in packaging design possible [15], [16]. Computer graphics technology is a technology that allows the display of 2D and 3D graphics in rasterized graphic displays through a series of binary algorithms [17]. It is processed by computer graphics software through various data information describing the graphics, and finally realizes the different ideas of the user to be presented on the display [18], [19]. The current computer graphics technology shows diversified development trend, such as Photoshop, CAD, etc., which provides great support for packaging design [20], [21]. The effective use of computer graphics technology in packaging design can significantly improve the efficiency, quality, effect, etc. of packaging design, and well make up for the shortcomings of manual packaging design [22]-[24]. At this stage, the application of computer graphics technology in packaging design in China is in a stage of rapid development, which will surely provide strong support for packaging design work [25], [26].

In this paper, the visualization process of packaging graphic design is proposed from four aspects: searching for data, constructing hierarchy, transforming information and skillfully using visual forms. Aiming at the problem of visual imaging limitation of product packaging design images in the human eye, a packaging design image processing algorithm based on the visual characteristics of the human eye is proposed, which integrates the visual attention mechanism of the human eye into the process of constructing the image grayscale histogram, and forms the image information histogram to highlight the parts of the image that contain important information. The enhancement algorithm integrates the human eye's perceptual characteristics into the enhancement algorithm to reduce the amount of information in the main gray level of the histogram, so as to realize the visualization of the complex shape of the packaging design. The layout intelligent generation algorithm is innovatively introduced into the field of packaging design, and a packaging creative design method based on DPformer-GAN model is proposed. Combining the Transformer and GAN network, a content-aware module is designed with learning the content features of packaging design, and a design sequence module is proposed to serialize the packaging layout information. Fusing the content-aware and layout information, the model learns the content features and layout features of the image, and finally outputs the package design. Using the packaging creative design method based on DPformer-GAN model proposed in this paper, we carry out packaging design experiments for clothing products to explore the practical application effect and performance of the packaging design method in this paper.

II. Packaging design graphic design visualization process

Packaging graphic design mainly contains two major links, namely, the design process and design method. By organizing and processing the original graphic information, it can be effectively converted into visual information, making the abstract concept become more visual and concrete, graphic visualization design process shown in Figure 1.

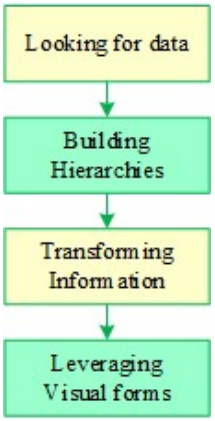


Figure 1: Graphic visual design process

II. A.Finding data

In order to further improve the level of packaging graphic visualization design, designers should comprehensively collect and search for the required data to ensure that the data investigation work in place, for the later packaging graphic clever design to provide an important basis and reference. In short, the scientific use of the collected information resources is an important link before the designers formally enter the packaging graphic visualization design, and the time spent in this link may far exceed the actual design time.

II. B.Hierarchy of construction

Packaging graphic design related information data mainly consists of many different types of data. The data is characterized by scattering and disorder, and the image visualization design has to screen and summarize the valuable data in addition to the precise description and translation of the information conveyed. Therefore, the designers pay attention to the analysis and excavation of important data, and reasonably determine the relationship between these important data, in order to lay a solid foundation for the later packaging graphic visualization design. During the construction of the information level, the designers should strictly follow the needs of the audience to build, the information construction level mainly contains the following two types.

1) Content level. Once a large amount of information appears in the same period of time, it will lead to the design process showing disorder and confusion. Therefore, the designers must group the information beforehand to

determine the important key information data; and according to the audience's personalized needs, the information data is classified in a scientific and reasonable way, so that the information analysis becomes more rational.

2) Spatial level. The spatial level provides designers with a clearer and more explicit design idea, setting valuable information in a more conspicuous position in the screen; then, by making full use of shapes, logos, text, images and other forms, to attract the attention of the audience.

II. C.Converting information

Packaging graphic information transformation mainly refers to the use of unit symbols, image, intuitively convey important information data, the image of abstract information into visual symbols, so as to highlight the image of the visual language, vivid and intuitive. For visual symbols, they mainly include the following visual elements: words, numbers and icons. Among them, icon as a common element of image visualization design, its presentation mainly includes abstract and concrete ways, when the icon is set, it can quickly determine the way of packaging graphic design expression.

II. D.Skillful use of visual forms

During the visualization design of packaging graphics, designers should focus on highlighting the beauty of packaging graphics and bring visual aesthetics to meet people's needs for the pursuit of situational aesthetics. By adopting the visual communication method, it can ensure that people can quickly understand the main intention of the designers in the first time. At the same time, it is also necessary to fully integrate the information structure and information unit to ensure that the design intention of the work is communicated comprehensively and intuitively. On this basis, the designers should use visual expression to provide people with a sense of visual pleasure, so as to realize the significant enhancement of the aesthetic value of the work. Skillful use of visual forms for packaging graphics visualization design of the final link, and the implementation of the effect of direct operation lights the whole design work of the degree of publicity and influence. Therefore, designers should pay attention to the skillful use of this visual form.

III. Image enhancement algorithms based on the visual perception characteristics of the human eye

In this chapter, a packaging design image processing algorithm based on the visual characteristics of the human eye will be proposed to achieve the enhancement of product packaging patterns, visualize the complex forms of packaging design, and provide a basis for the subsequent creative design of packaging.

III. A. Visual perception characteristics of the human eye

According to the Weber score (i.e., the slope of the curve), the curve can be divided into four regions [27]: the region with a slope of about 1/2 is called the DeVries region, which corresponds to the low illuminance region of the image; the middle section of the curve with a slope of 1 is called the Weber region, which is a region that can be clearly perceived to have a difference with a small intensity of the stimulus, and it corresponds to the medium illuminance region of the image; the high illuminance region of the image is defined as a saturation region, which is the region that is affected by the saturation of the stimulus, and it is the region that is affected by the saturation of the stimulus. The saturated region is the region affected by the stimulus, and the slope of this region is usually greater than 1; the remaining part of the region is the low-contrast region, in which it is difficult for the human eye to feel the light changes.

According to this division, an image can be viewed as a combination of dark region, DeVries region, Weber region and saturation region. The De Vries region corresponds to the part of the image in which the human eye can recognize but not accurately obtain the image details because the brightness is too dark; the Weber region corresponds to the part of the image that can normally and intuitively reflect the image information, and the human eye can easily perceive the image details; the saturated region corresponds to the part of the image region that the human eye cannot accurately obtain the image details due to too much brightness; the dark region corresponds to the part of the image in which the human eye cannot accurately obtain the image details due to too much low brightness. The saturated region corresponds to the part of the image where the human eye cannot accurately acquire image details due to excessive brightness. It can be seen that the larger the area of Weber's region in an image, the clearer the detailed information in the image is displayed, and the better the visual effect of the image.

In practice, usually low contrast area and saturated area is combined into a region, the results will not have an impact on the processing.

III. B. Image Enhancement Methods for Combining Visual and Perceptual Properties of the Human Eye

III. B. 1) Histogram of image information

Image histogram is a commonly used tool in various processing algorithms for images. Although the image histogram cannot directly characterize the information of the image, it can react to the image features. However, the histogram does not take into account the relationship between the information weights of different spatial locations in the image. From the above, it can be seen that the human eye has a filtering function for all the information in an image, and will prioritize the information that the brain considers important. Thus, when performing image processing, the information processing of important parts should also be enhanced. In this paper, the histogram of image information based on the visual attention mechanism of the human eye is constructed, and the specific process is as follows:

1) Construct the saliency detection model based on the visual attention mechanism, and get the global saliency map of the image with this model.

2) Normalize the data of the global saliency map to obtain the weight coefficient $E(i,j)$ of each pixel.

3) Use the weighting coefficient $E(i,j)$ to weight the number of pixels that need to be enhanced with an image gray level of a with the following formula.

III. B. 2) Image enhancement methods

High-contrast product images usually enhance the visual effect of the product, which in turn is related to the gray level of the image. There are certain limitations in the ability of the human eye to perceive the gray-scale deviation of an image, and the human eye can recognize the change only when the gray-scale difference between the pixels of an image reaches a certain value. This value is known as the critical visible deviation, and when the pixel gray difference of an image is lower than the critical visible deviation, the change will not be perceived by the human, and thus the pixel can be compressed instead.

From the above analysis, it is clear that the human eye perceives changes in luminance differently in environments with different luminance levels. In high luminance background environments, the human eye perceives luminance deviation much better than in low luminance background environments.

After the original image is subjected to saliency enhancement, the gray levels of the important regions will occupy a larger data space, and these gray levels are called the main gray levels, and the rest of the gray levels are called the secondary gray levels. As the number of data in the main gray level is too large, which affects the running speed of the image enhancement algorithm later, it is necessary to limit the data in the main gray level. In this paper, the luminance threshold in the expression of the relationship between the luminance deviation inter-resolution value of the human eye and the background luminance is used as the lowest level of the main gray level for limiting. The flowchart of the image enhancement algorithm that integrates the attention mechanism and perceptual characteristics of the human eye is specifically shown in Fig. 2, and its specific steps are as follows:

1) According to the method of constructing the information histogram proposed above, find the information histogram of a certain image that needs to be enhanced for processing.

2) According to the information content of the information histogram, allocate dynamic ranges for each gray level in the information histogram.

3) If $D(k) > Q(k)$, then $D(k)$ is included in the set of primary gray levels with limiting; conversely, it is included in the secondary gray levels with the same dynamic range.

4) Count the amount of information removed due to limiting, and reallocate it to the sub-gray level information according to the size of the information weight.

5) Formulate a new information histogram based on the reallocated amount of information and fit the transform function to obtain the image enhancement algorithm.

III. C. Evaluation method of human eye visual perception image feature quality

There are different methods and criteria for judging the quality of an image, and features can represent the most important information in an image. Therefore, in this paper, we start from the gray scale histogram, combine VHIST with the visual characteristics of the human eye, and explore the evaluation method of image feature quality from the aspect of visual perception of the human eye.

The evaluation of the image can be judged from the brightness level, edge contour is clear, these indicators are called the contrast characteristics of the image, and the contrast characteristics of the image pixels and the gray scale difference between the pixels is related to the gray scale difference between the two pixels. 2 pixel gray scale difference can be obtained through the gradient calculation, when the value of the gradient is larger, the larger the difference between the gray scales is also larger, the corresponding contrast is also larger.

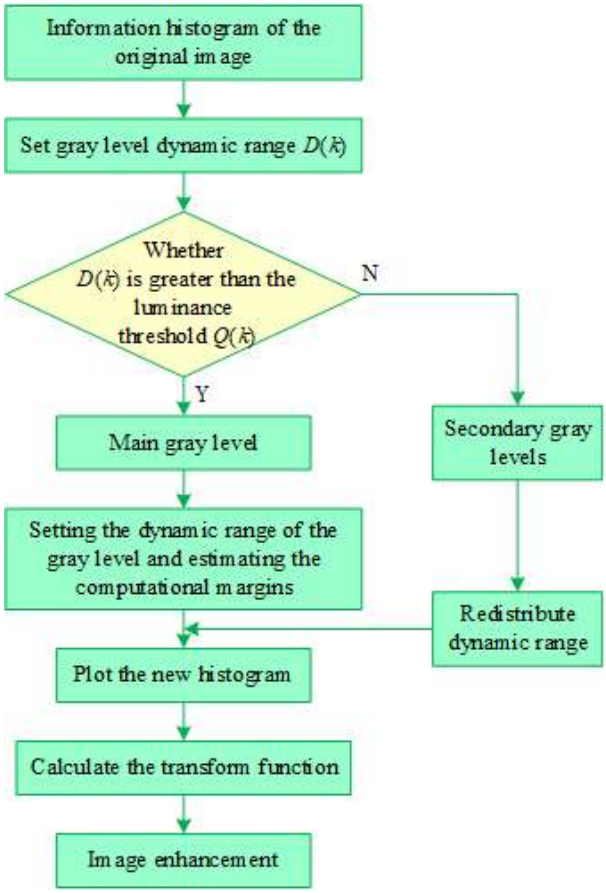


Figure 2: Process of image enhancement algorithm

III. D. Simulation Experiments and Tests

In order to verify the effectiveness of the image enhancement method based on the visual perception characteristics of the human eye proposed in this paper, a commercially available K brand ice cream product is selected for experimental testing. The packaging design of K brand ice cream product has a low image contrast. Using the algorithm of this paper and the traditional algorithm to evaluate the image indexes of K brand ice cream products, the results include the comparison of image contrast, information entropy, brightness relationship factor, as shown in Figure 3. The traditional algorithm shows significantly higher contrast than that of the original image, which can reach 39.42, the brightness relationship factor is slightly higher than that of the original image, which is 0.77%, and the information entropy is 7.54 bit. In contrast, the data values of the image enhancement algorithm in this paper are higher, and the contrast, brightness relationship factor, and information entropy can reach 45.12, 0.82%, and 7.96 bit, respectively. This shows that Although both the traditional algorithm and this algorithm can realize the improvement of the quality of the original image, this paper's image enhancement algorithm based on the visual perception characteristics of the human eye is more superior, and can significantly enhance or improve the quality of the image of product packaging design.

The evaluation results of this paper's algorithm and the traditional algorithm in the database are specifically shown in Fig. 4. Figures (a) and (b) correspond to the evaluation results of the traditional algorithm and this paper's algorithm, respectively. It can be seen that the evaluation results of the traditional algorithm scatter plot, scatter distribution is uneven, more dispersed, and not uniformly distributed in the curve fitting neighborhood. In contrast, the scatter distribution of the algorithm in this paper is more centralized and evenly distributed around the curve fitting. This shows that compared with the traditional algorithm, the VHIST algorithm can show its better prediction linearity and higher prediction accuracy in the database of product packaging design.

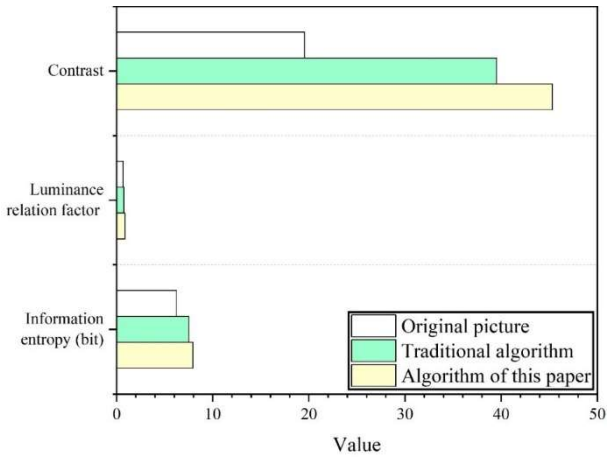
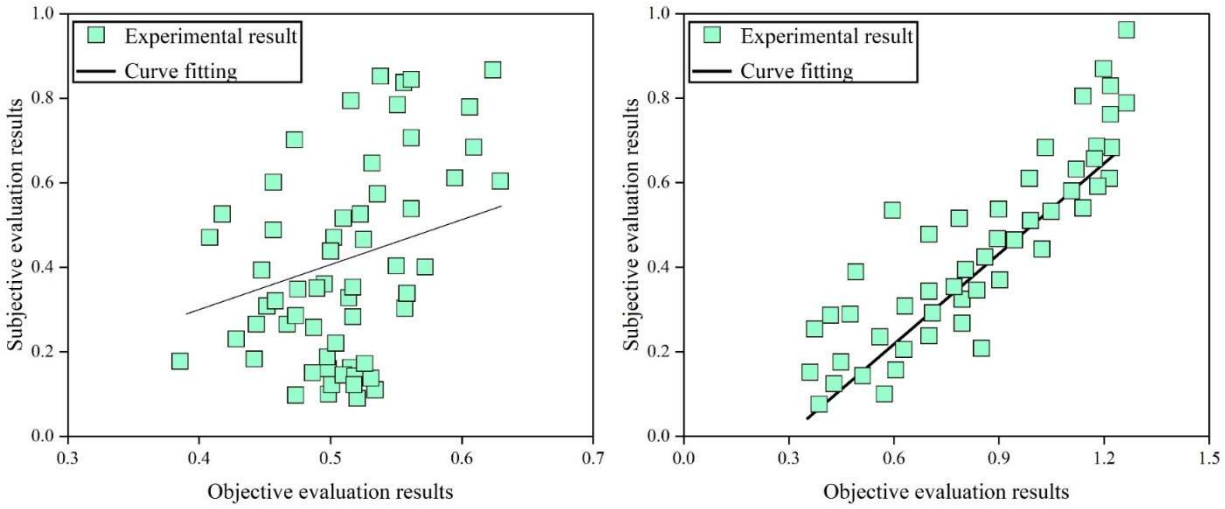


Figure 3: Comparison of image quality evaluation



(a)Traditional algorithms (b)Algorithms in this article

Figure 4: Evaluation results based on database

IV. Packaging creative design method based on the DPformer-GAN model

Based on the enhancement of product packaging patterns, this study proposes a packaging innovation design method based on the DPformer-GAN model, aiming to solve the problems of relying on generic packaging and lack of product characteristics that are often faced in the current stage of packaging design process.

IV. A. Packaging layout design

IV. A. 1) Definition of Packaging Layout

Layout design is the effective combination of visual elements such as text, images, and colors in a certain flat space, constituting a multi-dimensional layout with multiple viewpoints and three-dimensional spatial levels, which brings a strong stimulus to people's vision. Based on this, the intelligent layout design of packaging layout mentioned in this study refers to the use of deep learning, reinforcement learning and other intelligent algorithms to reasonably arrange the images, text and other elements required for packaging layout design, and automatically generate a layout that conforms to the constraints of aesthetics rules, user preferences and other constraints.

Therefore, the package design process needs to consider the picture position, space white space, text font size and the positional relationship between the elements, etc., are the scope of packaging layout. As an important part of packaging design work, the realization of automatic generation of layout, that is, intelligent layout of packaging layout, will largely save the designer's design time, shorten the creation cycle and promote the sale of goods. Compared with the industrial parts intelligent layout needs to carry out cutting and other tasks, packaging layout intelligent layout is more focused on aesthetics, and the constraints to be considered are more content.

IV. A. 2) Deep Learning Based Packaging Layout Design Approach

Traditional automatic layout methods mainly include constraint solving based on rule descriptions and generation based on templates, but this method is almost unintelligent and can only generate layout according to established rules or fixed templates, with poor layout diversity. Deep learning-based intelligent layout method for packaging layout generates new packaging layout by learning the experience of historical packaging layout design. For packaging, from the perspective of deep learning, 4 steps are needed to complete its layout intelligent layout.

1) Establish a deep learning model applicable to packaging layout intelligent layout through relevant investigation and research. Conduct a detailed survey on the current packaging design, especially the layout module, to understand the packaging layout method and its improvement direction, and establish a suitable model algorithm based on the survey.

2) Construct the packaging layout dataset. According to the content and format of the dataset needed for model construction, it mainly includes the collection of raw data, preprocessing of raw data, feature extraction, and the construction of data loading module and other necessary work, and then based on the constructed data loading module, the final dataset is synthesized.

3) Based on the deep learning algorithm to complete the intelligent layout of packaging layout. After constructing the model and dataset, it enters the real intelligent generation part of the intelligent layout of packaging layout, including the training of the model and the generation of the layout in two parts.

4) Evaluate the model and generated layout and think about the direction of future improvement.

In short, the core of the method is the construction of the deep learning model, and the subsequent work is also centered on the model construction, and the final quantitative results are calculated based on the evaluation indexes of the model and the generated layout.

IV. B. DPformer-GAN model construction

Generative design has been developing in recent years, and many scholars have found that the combination of Transformer and GAN has better results in the field of image generation [28], [29]. On this basis, this study designs a DPformer-GAN model that considers both image content and layout information for layout generation, unlike natural language and images which usually have a natural order, layout information usually does not have a certain sequence during the annotation process, so a design sequence module is designed in this model to sequence the layout data before inputting it into the model. The model structure is the same as traditional GAN, which is divided into two parts: generator and discriminator.

The design sequence module is used to extract layout features, and its input is a randomly initialized layout, the layout generation module is used to generate layout information, and the outputs of the content-aware module and the design sequence module are jointly used as inputs to the layout generation module for layout generation. The core of the layout generation module is a CNN-Transformer-BiLSTM network (CTB), the output of the design sequence module goes through the CNN and the Transformer module into the BiLSTM, while the output of the content-aware module goes directly into the BiLSTM network.

The discriminator consists of the content-aware module, the design sequence module and the layout judgment module. The input and role of the content-aware module are the same as that of the generator, and ResNet-18 is used as the backbone network of the module; the input of the design sequence module is the layout generated by the generator; the layout judgment module is used to judge the authenticity of the generated layout information.

IV. C. Simulation Experiments and Tests

In this section, the DPformer-GAN model proposed in this paper is trained, the training environment is built on GoogleColab platform, and the code is run by renting a GPU-accelerated server on Google Cloud. The virtual machine connected in the experimental run is Python 3 GoogleCompute Engine backend (GPU) version, RAM (virtual machine running memory) is 12.68GB, and disk is 78.19GB.

In order to enable the model to fully learn the data features so as to get a better effect of image generation, the DPformer-GAN model training In order to enable the model to fully learn the data features so as to obtain better image generation results, the epochs of DPformer-GAN model training were increased to 60, and the accuracy, clarity and style diversity of the generated images were observed, and it was found that the generated images did not show a large effect improvement in the above indexes. The loss values of the generator, discriminator and DPformer-GAN model during the iteration process are recorded and plotted as a line graph, as shown in Figure 5. The orange solid line represents the trend of the generator loss value, the gray solid line represents the change of the loss value of the discriminator, and the green solid line represents the total loss of the whole CGAN model.After the training of the DPformer-GAN model is finished, the loss value of the generator and the discriminator model tends to be the same, which is about 0.682, indicating that after the model has been run for 60 epochs, the ability of the generator to generate the fake packing After 60 epochs of model running, the generator's ability to generate

the fake package image and the discriminator's ability to discriminate the image as real are not similar, thus realizing the model to reach the Nash equilibrium in the antagonistic game, and the loss value of the CGAN model is slightly larger than that of the generator and the discriminator, which is about 0.845.

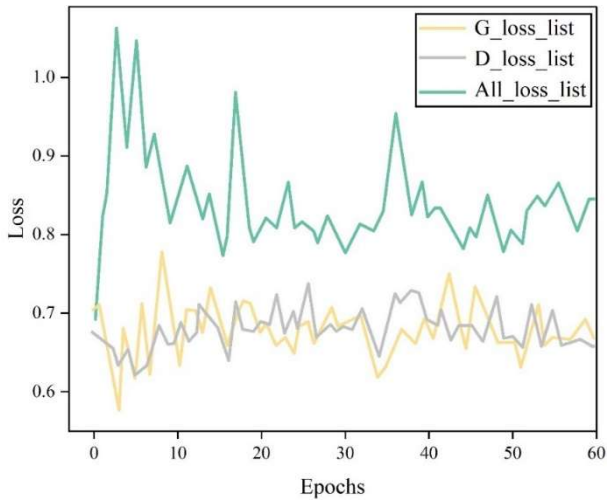


Figure 5: Loss function diagram

V. Packaging design experiment for apparel products

This chapter will use the packaging creative design method based on DPformer-GAN model proposed in this paper to carry out packaging innovation design experiments for apparel products, and evaluate the apparel product packaging design solutions generated by using the method in this paper.

For the subjective evaluation of the packaging design of apparel products generated by the packaging design method of this paper, and to obtain the visual intuitive feeling of the human body, this chapter adopts the expert scoring method, starting from the three aspects of color, brand logo and layout effect, and launches a questionnaire survey for the groups with education level of graduate students and above, and a total of 60 copies of the “Packaging Design Evaluation Questionnaires” were issued to the respondents, and the valid replies were received as 58 copies. For each measure. There are 5 levels of "strongly agree", "agree", "not necessarily", "disagree" and "strongly disagree", which are recorded as 5, 4, 3, 2, and 1 respectively.

V. A. Evaluation of the Effectiveness of Color Elements

The evaluation results of the effect of color elements are shown in Table 1. It can be seen that the clothing product packaging designed using the packaging creative design method based on the DPformer-GAN model proposed in this paper, the overall score in the evaluation of the effect of color elements is relatively excellent, the mean value of each item is greater than 4, indicating that the respondents involved in the evaluation of the effect of the color elements of the packaging is more consistent degree of acceptance, showing a higher sense of identity.

Table 1: Color element effect evaluation

Dimensions	Mean	Std.	Skewness	Kurtosis
Rationality of color application	4.08	0.752	-0.161	-0.661
Rationality of color matching	4.45	0.686	-0.157	-0.435
Color appeal	4.04	0.788	-0.718	0.962

V. B. Evaluation of the Effectiveness of Brand Logo Elements

The evaluation of the design effect of the brand logo elements is specifically shown in Table 2. The evaluation of the package design is divided into two main categories: psychological effect and brand effect. The logo elements of the package design received scores of 4.02, 4.05 and 4.07 in terms of the overall layout matching, the appropriateness of the size and proportion of the brand logo, and the prominence of the brand logo, respectively. This indicates that the saliency of the brand logo performs most prominently in the overall design, while its size and proportion appropriateness and overall layout rationality do not differ much in the evaluation. In terms of the four psychological impact evaluations, the clothing packaging designed in this paper received a high rating in “purchase intention”, with a mean value of 4.18. Meanwhile, the rating of “brand impression” was also relatively high, with a

mean value of 4.09, which indicates that consumers are more interested in the application of the creative design method of this paper than the brand logo. Consumers have a high degree of awareness of the packaging of clothing products designed by applying the packaging creative design method of this paper, and have a good understanding of the brand's related information.

Table 2: Effect evaluation of brand logo elements

-	Dimensions	Mean	Std.	Skewness	Kurtosis
Brand effect	Overall layout matching	4.02	0.624	-0.164	0.155
	Suitability of the size and proportion of the brand logo	4.05	0.715	-0.068	-0.314
	Significance of brand logo	4.07	0.733	-0.372	-0.307
Psychological effect	Visual attention level	3.86	0.778	-0.425	0.426
	Ability to transmit information	3.88	0.742	-0.404	-0.387
	Brand impression degree	4.09	0.715	-0.244	-0.084
	Purchase intention	4.18	0.706	-0.123	-1.017

V. C. Evaluation of the effect of visual layout elements

The evaluation of the effect of visual layout elements mainly centers on three aspects of visual layout, psychological evaluation and brand evaluation, and the specific evaluation results are shown in Figure 6. A1~A3 in the figure are the dimensions of visual layout collocation rationality, visual layout content richness, and visual layout innovation, B1~B5 are the dimensions of visual attention, interest, information transmission, packaging brand impression, and purchase willingness in psychological evaluation, and C1 and C2 are the dimensions of brand feature highlighting and brand image shaping in brand evaluation. It can be observed that the visual layout scores 3.88, 3.92 and 4.08 in the three aspects of visual layout collocation rationality, visual layout content richness and visual layout innovativeness respectively, with similar scores in each dimension, and the overall presentation effect of the package is better. At the psychological evaluation level, the scores of the dimensions of visual attention, interest, information transmission, packaging brand impression, and purchase intention are all greater than 4. At the brand evaluation level, the mean values of the two dimensions of outstanding brand characteristics and brand image shaping are also 4.13 and 4.02 respectively, and it is obvious that the packaging of apparel products, which was designed by applying this paper's packaging design method based on the DPformer-GAN model, performs well in terms of the effects of visual layout elements. That excels in the effect of visual layout elements, highlights and strengthens the unique features of the package and the visual recognition of the brand.

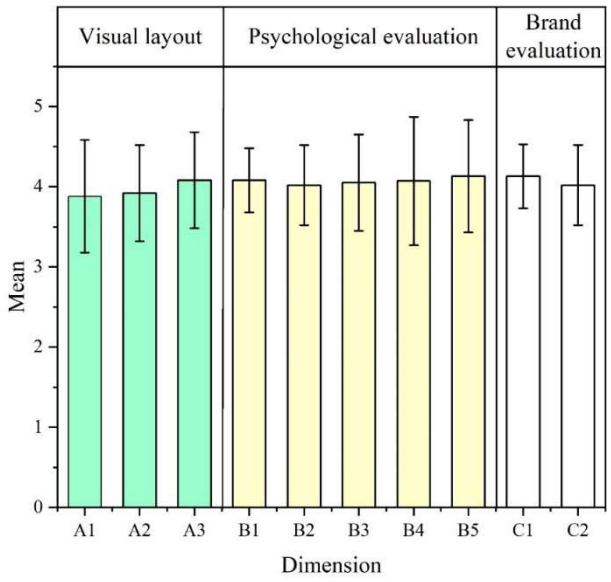


Figure 6: Evaluation of the effect of visual layout elements

VI. Conclusion

This paper proposes an image enhancement algorithm based on the visual perception characteristics of the human eye by integrating them into the image enhancement method to realize the visualization of the complex forms of

packaging design. K brand ice cream products are selected to test the effectiveness of the image enhancement algorithm proposed in this paper. The data values of this paper's image enhancement algorithm are higher than those of the traditional algorithm, and the contrast, brightness relationship factor, and information entropy reach 45.12, 0.82%, and 7.96 bit, respectively. In the evaluation results of the database, the scatter distribution of this paper's algorithm is more concentrated and uniformly distributed around the curve fitting, which is superior to the traditional algorithm whose scatter distribution is uneven and scattered, and it has a more superior image enhancement effect. It can effectively improve the quality of product packaging design images.

Combined with Transformer and Generative Adversarial Network, the packaging creative design method based on DPformer-GAN model is proposed, and the packaging design of apparel products is selected as the experimental content, and packaging design experiments are carried out to explore the practical application effect of the packaging creative design method in this paper. In the evaluation of the effect of color elements, the average value of the dimensions of the rationality of color application, rationality of color matching, and color infectiousness are all greater than 4, and the overall score is excellent. Further evaluation of the effect of brand logo elements on the designed packaging of apparel products, the overall layout of the brand effect of matching, the size and proportion of the brand logo suitability and the significance of the brand logo obtained a mean value of 4.02, 4.05 and 4.07, respectively, and in the evaluation of the psychological impact of the willingness to buy, the degree of brand impression of the dimensions of the mean value of the higher 4.18, 4.09, respectively. Rating. Facing the effect of visual layout elements, the packaging of clothing products designed in this paper scored 3.88, 3.92 and 4.08 in the three dimensions of visual layout: rationality of visual layout, richness of visual layout, and innovativeness of visual layout, and the mean value of the dimensions of psychological evaluation was higher than 4. The mean values of the dimensions of brand characterization and brand image shaping of brand evaluation were 4.13 and 4.07, and the mean values of the dimensions of psychological influence evaluation were 4.18 and 4.09, respectively. Overall, the clothing product packaging designed by applying this paper's packaging creative design method based on the DPformer-GAN model has excellent performance in the three aspects of color elements, brand logo elements and visual elements, and has great potential for application in the field of product packaging design.

About the Author

Lu Xu, teacher and associate professor at the School of Art, Anhui Xinhua University, specializing in art and design.

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