Research on the Digital Transformation of Scientific Research Materials Based on Aesthetic Visualization Technology

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Abstract. The portrait of data is a very graphic metaphor that can effectively help people feel and understand the importance and significance of aesthetic visualization more intuitively. The popularization and development of digital technology provides a broad space and possibility for the development of aesthetic visualization. Through the application of digital technology, we can extract as much information and knowledge as possible from the data, and present them in a more vivid, graphic and intuitive way, so that people can more easily understand and accept the results of data analysis.

Key words: AI mapping; scientific research mapping; aesthetic visualization; digital transformation

1 Introduction

1. Aesthetic visualization is an art. The integration of data and art can make people understand data information better?

2. Can the interdisciplinary integration of aesthetic theory and computer vision technology deepen people's understanding and feelings of aesthetic objects with computer graphics, interaction and other technologies?

3. The existence of digital form is a new way of presentation and expression. If scientific research materials and achievements meet with ai painting, does this integration make scientific information more vivid? Does it also make scientific research more interesting and easier to understand?

2 Foreword

Aesthetic visualization is a way to present data through artistic means, which can improve people's ability to understand and identify data. As an art-based visualization form, it needs the characteristics of strong expression, high accuracy and rich information, which can have a direct and deep impression on the audience and make the data easier to understand and analyze.

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Aesthetic visualization technology is an interdisciplinary combination of aesthetic theory and computer vision technology. It is committed to the use of computer graphics, pattern recognition, human-computer interaction and other technologies, to measure, analyze, display and creation of aesthetic objects, so as to deepen people's understanding and feeling of aesthetic objects. In the digital and intelligent era, aesthetic visualization technology is faced with greater development space and challenges. With the development of technology, more and more aesthetic objects exist in digital forms, such as digital art, digital music, digital images, etc. These digital aesthetic objects need a new way of presentation and expression, which provides an opportunity for the digital transformation of aesthetic visualization technology[1] .

The intersection of digital transformation of scientific research materials and AI painting. The digital transformation of scientific research materials is no longer limited to traditional data charts, but through the integration of AI painting technology, scientific information is given a more vivid form of expression. This convergence not only enhances the artistic quality of scientific research, but also makes scientific research more interesting and understandable to the public.

In this context, we will focus on how to better utilize AI painting and aesthetic visualization to drive the digital transformation of scientific research materials, bring new visual experiences to science communication, and promote the positive impact of scientific research on a broader societal level[2]. This trend opens up new possibilities for the integration of science with art and technology, and also provides more diverse options for the communication and expression of scientific research in the future.

3 Research background and theory

With the development of artificial intelligence (AI), natural language processing (NLP) has become an important branch of the AI field. In this context, the emergence of OpenAI's GPT-4.0 (Generative Pretrained Transformer 4.0) has undoubtedly brought new vitality to this field. The GPT-4.0 API provides powerful capabilities that make it easier for developers to leverage this advanced model to develop various AI applications[3]. For example, Canva Design, the upcoming GPT store. OpenAI Research mainly covers natural language processing, machine learning, etc. OpenAI develops from natural language to the direction of computer interaction.

The development of digital technology makes the source and processing mode of data more convenient and efficient, which can quickly obtain a large amount of data, and conduct efficient data processing and analysis. Aesthetic visualization technology can make the data easier to understand and be accepted through visual and emotional expression. Digitization brings new display forms and means to aesthetic visualization technology, such as with the support of virtual reality (VR) and augmented reality (AR) technologies, which can provide users with a more immersive data experience. At the same time, digital technology can also provide more tools and methods for the data processing and presentation of aesthetic visualization technology. For example, artificial intelligence technology can help aesthetic visualization technology to better explore the trends and rules behind the data, and to provide them with better data analysis and prediction. On the research side, the combination of

aesthetic visualization technology with digitization can help us to better understand and explore complex data sets[4] , explore the laws and trends behind the data, and provide more accurate, interesting and visual results for scientific research and commercial applications.

The theoretical significance of this study is reflected in revealing and theorizing the necessity and possibility of digital transformation of scientific research materials and the influencing factors in the actual process. This study can help us understand the internal mechanism of the transformation of scientific research materials and various challenges, and provide theoretical basis and inspiration for future research. The practical significance of this study lies in the empirical research on the application of aesthetic visualization and AI painting in the transformation process of scientific research materials, and puts forward practical application suggestions. Through the empirical analysis of aesthetic visualization and AI painting, we can not only understand the specific performance of these two methods in beautifying scientific research materials, increasing their attractiveness, and improving the efficiency of scientific research information transmission, but also clarify the advantages and limitations of these two methods, so as to put forward specific ideas and operational guidelines for the transformation of scientific research materials.

Artistic scientific research materials, with their unique language symbol system, formal structure, and beautiful expression and implication, have formed an important promotion for the digital transformation of modern scientific research materials with fast speed, large data and many changes. This transformation is complex and comprehensive, including but not limited to the digital transformation of scientific research materials themselves, the aesthetic presentation of scientific research materials in specific application contexts and environments, and the role and impact of emerging technologies (such as AI) in the transformation of scientific research materials[5].

4 Research design

The design of the experiment is to empirically compare two different forms of expression of scientific research materials - aesthetic visualization form and AI painting form. We collected 50 scientific research materials and transformed them into aesthetic visualization and AI painting respectively. All material is anonymized and transformed in a fair, random manner. We have collected and collated a large amount of data to evaluate the improvement in information delivery efficiency and artistry before and after the transformation of scientific materials.

We use the principles of aesthetic design to organize, summarize and display scientific research materials, so that they become more visual impact and appeal. AI painting converts scientific research materials into more artistic and imaginative images through the configuration of algorithms. We pay attention to the authenticity and validity of data, and make the process of data processing and statistical analysis open and transparent to ensure the credibility of empirical research. Through the analysis and comparison of aesthetic visualization research in different fields, we can see that our empirical research involves a variety of scientific research materials, from academic paper illustrations, to complex 3D models[6], to graphic information, etc. The rich types of materials provide sufficient practical basis for the application of aesthetic visualization and AI painting. Among them, the number

of medical materials is 20, usually for the aesthetic visual of human organ cells; Biochemical category 15 photos, mainly chemical element morphology, cell structure visible; 10 pieces of mechanical manufacturing, mainly for the 3D models of parts in academic papers; And other scientific material 5 photos.

The specific research contents are as follows:

1. Study the application of aesthetic principles in the process of digital transformation, and design aesthetic visual schemes suitable for the field of scientific research.

2. Explore the application of visualization technology in the digital transformation of scientific research materials, and study the integration of digital materials and visualization technology.

3. Based on deep learning algorithm, study the method of quickly processing and analyzing a large number of scientific research materials.

4. Case study, the digital transformation of scientific research materials based on aesthetic visualization technology is applied to scientific research practices in different fields, such as chemistry, medicine and other fields. The study aims to improve the efficiency of the presentation and use of scientific research materials through aesthetic visualization technology[7], reduce the difficulty of reading and understanding of researchers when facing massive data, and then promote the application of digital transformation in the field of scientific research, so as to provide better services for scientific research work.

Innovative approach with aesthetic data visualization as the axis.

a. Integration of cultural elements: Integrating the symbols and symbol systems of different cultural backgrounds into the visual design can make the visual graphics more emotional expression and cultural resonance, and improve the influence of the visualization.

b. Adopt multi-level data visualization: By designing a multi-level visualization layer, different data information and details can be displayed at the same time, making the whole visualization more colorful.

c. Interactive design: With the help of interactive design, audiences can change and explore the data through different operations, so as to improve their participation and experience.

d. Use of aesthetic elements: In the design of visual graphics, the aesthetic elements such as color, shape and line can be used to make the graphics more expressive and attractive, while enhancing the visual experience and emotional resonance of the audience.

e. Progressive disclosure of data: Through the gradual disclosure of data, the audience can be gradually guided to understand and explore the data. This method enables the audience to have a deeper understanding of the data and improves the influence and quality of the visualization[8]. Aesthetic data visualization is an innovative method of data visualization design, which can help us to convey data information and enhance the audience's experience and emotional resonance. By adopting different aesthetic elements and design techniques, we can create more expressive and tension visual figures, and realize the pursuit of beauty and artistry while realizing data communication.

The core of the transformation of aesthetic visualization technology to digital lies in the digital

presentation and analysis of aesthetic objects, such as art works, architecture, design and so on. Traditional aesthetic visualization technology measures and analyzes aesthetic objects through image processing, computer vision and other technologies to realize the visualization of aesthetic objects. The digital transformation pays more attention to the data, interactivity and innovation of aesthetic objects. First, digital transformation requires the transformation of aesthetic objects into digital data, such as using 3D scanning technology to transform artworks and cultural relics into digital models, or using computer vision technology to extract key information and features of aesthetic objects from images or videos.

Secondly, after digitization, it is necessary to use data mining and machine learning technologies to carry out more in-depth analysis and experiment of aesthetic objects, so as to reveal the aesthetic characteristics in various dimensions more fully and in detail than the traditional visualization technology. Finally, an important purpose of digital transformation is to promote the interactive and innovative development of aesthetics, such as the creation of digital artworks and virtual exhibitions, which can integrate the application of more cutting-edge technologies and give full play to the application potential of aesthetic visualization technology. The transformation of aesthetic visualization technology to digital can improve the access and understanding experience of aesthetic objects, while also providing a new path for the interaction[9], research and innovative exploration of aesthetic data.

After the aesthetic visualization and AI painting transformation of the collected materials, we randomly selected 20 scientific research materials from the maternal sample for in-depth comparative analysis. After taking many factors into consideration, we used Ai painting to generate visual information such as pictures and tables, mainly using scientific research materials in medical, biochemistry, mechanical manufacturing, nanoscience, new energy science, and information science.

After the transformation of scientific research materials through aesthetic visualization and AI painting, both in terms of artistry and information transmission efficiency have been significantly improved[10]. Using aesthetic visualization method for scientific research materials, the overall visual sensory experience is enhanced, and the image expression is more clear and vivid. AI painting shows unique artistic value, makes scientific research more artistic, and improves the artistic degree of scientific research. In addition, we also found from user evaluations that these transformed scientific research materials have improved readers' understanding and absorption of scientific research content.

However, we also note that aesthetic visualization and AI painting also have some limitations in the transformation process. One of the most obvious aspects is that because aesthetic visualization and AI painting are still in the development stage, their technical maturity and standardization need to be improved. On the other hand, these two methods emphasize their artistry and innovation at the beginning of design, but in use, the results may not meet the expectations or lack of accuracy, so that the first contact may face difficulties in understanding. Due to the limitation of technology and equipment, it may be difficult to transform some complex scientific research materials, which needs to be further discussed in future research.

5 Research and analysis

Information visualization is to visua large amount of data, so that people can easily understand and understand the relationships and characteristics. It involves the design and development of data charts, graphics statistics, dynamic display[11], virtualization and so on. From the aesthetic point of view, information visualization needs to consider the design of color, shape, layout and other aspects, in order to achieve the unity of visual effect and aesthetic feeling.

Time-varying data visualization is the visual processing of dynamic data. It can show the process of data change and help people to better understand the past and future trends and patterns. From an aesthetic point of view, time-varying data visualization needs to consider the design of dynamic effect, color gradient, display effect and other aspects, so that users can better feel the process of data changes.

Spatiotemporal information visualization is the visual presentation of geographic information and temporal information in order to better understand the relationship between geographic spatial and temporal changes. It can integrate information on maps, population, weather and other aspects, enabling people to better grasp and understand the changing trends of these information, and thus discover the relationship between them. From an aesthetic point of view, the visualization of spatiotemporal information needs to consider the color and layout of the map, the design of the time axis, and the dynamic effect of the globe or plane map.

Based on the above analysis and consideration of empirical research, we propose the design principles that should be considered in the digital transformation of scientific research materials. Data production should consider the principle of "user center, aesthetic design and technical realization"; In the presentation of information, it is necessary to emphasize the characteristics of "concise and clear, taking into account artistic and information transmission efficiency"[12].

We emphasize that the proposed design principles are aimed at improving the artistry of scientific research materials, improving the efficiency of information transmission and improving the user's reading comprehension experience, and serving to further optimize and improve the digital transformation of scientific research materials. We believe that transformational design following these principles can not only enhance the artistry of scientific research materials, but also effectively improve the efficiency of information transmission.

Looking ahead, we believe that the development of aesthetic visualization and the use of AI painting have great potential in the digital transformation of scientific research materials. On the one hand, the continuous iteration and update of technology provides more possibilities for the transformation of scientific research materials. On the other hand, based on the consideration of user experience, scientific research materials will pay more attention to aesthetic design and artistic expression.

At the same time, we also recognize that there are limitations that require further research and resolution. Future researchers can conduct in-depth research on the application of aesthetic visualization and AI painting in scientific research materials from multiple angles and layers, and propose more operational, adaptive and innovative digital transformation schemes for scientific research materials. We hope that in the future, in the process of digital

transformation of scientific research materials, more diversified display methods can be formed to promote the effectiveness and influence of scientific research communication.

By leveraging digital technology, we can extract a wealth of information and knowledge from data, presenting them in a visually captivating, intuitive manner. This facilitates enhanced comprehension and acceptance of data analysis results. The burgeoning presence of aesthetic objects in digital form, such as digital art, music, images, etc., underscores the significant potential for further development in aesthetic visualization technology[13]. Consequently, there is an opportunity to advance this field through its integration with computer vision technology. Through amalgamating aesthetic theory with computer graphics, pattern recognition, human-computer interaction, and other technologies; our approach aims to measure, analyze display and create aesthetically pleasing objects that deepen individuals' understanding and emotional connection with them. The outcome is presented using artistic means while conveying the underlying data through aesthetic visualization techniques. Incorporating aesthetic visualization technology into scientific research materials presentation enhances their usability efficiency by mitigating reading difficulties researchers encounter when faced with vast amounts of data; thereby promoting the application of digital transformation in scientific research.

This study designed a questionnaire filled in by chemical and pharmaceutical students and a small number of researchers in a school. The questionnaire consists of three modules:

A. Basic personal information;

B. The demand for scientific research results in the conduct of scientific research;

C. The impact of the research material platform on the implementation of customized services for scientific research results by university researchers. The questionnaire was in the form of electronic questionnaire (questionnaire star). A total of 189 questionnaires were sent out, and 189 valid questionnaires were collected.

According to Figure 1 of the survey results, among the vocational fields/professional directions of the students and researchers who participated in the survey, medicine accounted for 23.28%, chemical industry accounted for 29.1%, art accounted for 47.62%, of which undergraduates accounted for 92.59%, and a small number of graduate students, doctoral students, teachers and graduates.

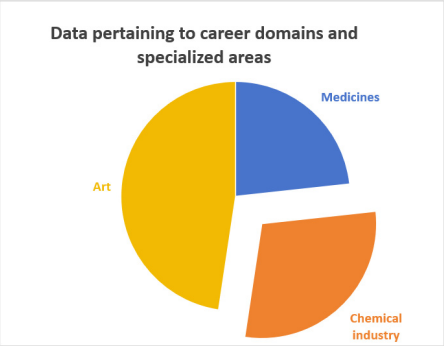

Figure 1 Professional directions

In the process of scientific research, as shown in Figure 2, people's demands for visualization of scientific research results are sorted as follows: image format conversion (60.32%) > resolution (40.21%) > physical size (28.04%) > color requirements (24.87%). As the visual display method can display scientific research results more intuitively, 95.77% of the personnel choose to display scientific research results in the process of scientific research, only 4.23% of the personnel have not used this display method.

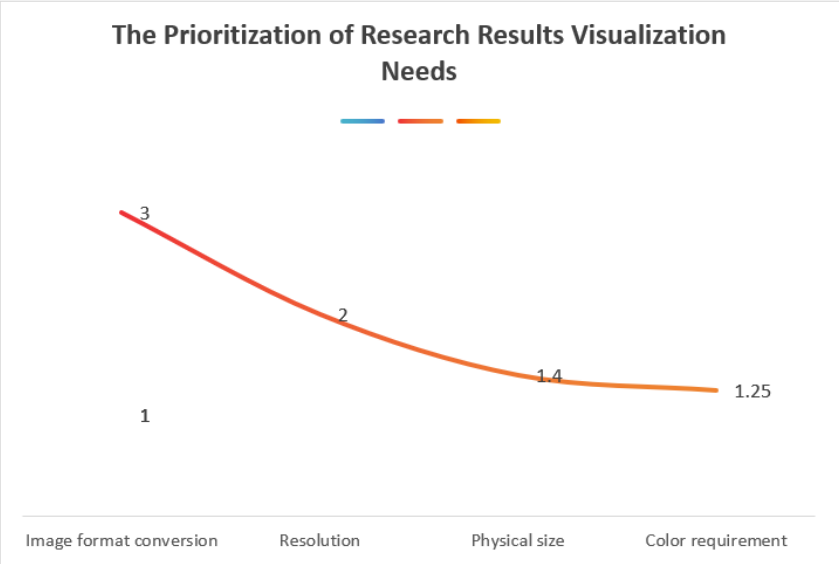

Figure 2 Visualization Needs

As for the types of visualization of scientific research results, Figure 3 shows that the overall needs are diverse and widely distributed. 48.68% of the respondents (schematic diagram, as shown below, item 1) chose to use schematic diagram for visualization of scientific research results; 35.45% of the respondents (flowchart, as shown below, item 2) chose to use flowchart for visualization of scientific research results; 31.22% of the respondents (data processing diagram, as shown below, item 3) chose to use data processing and mapping methods to visualize scientific research results; 26.98% of respondents chose to use illustration to visualize scientific research results; 16.4% of the respondents (illustration, animation principle display, as shown below, item 4) chose the method of animation to display the principle of scientific research results for visualization of scientific research results.

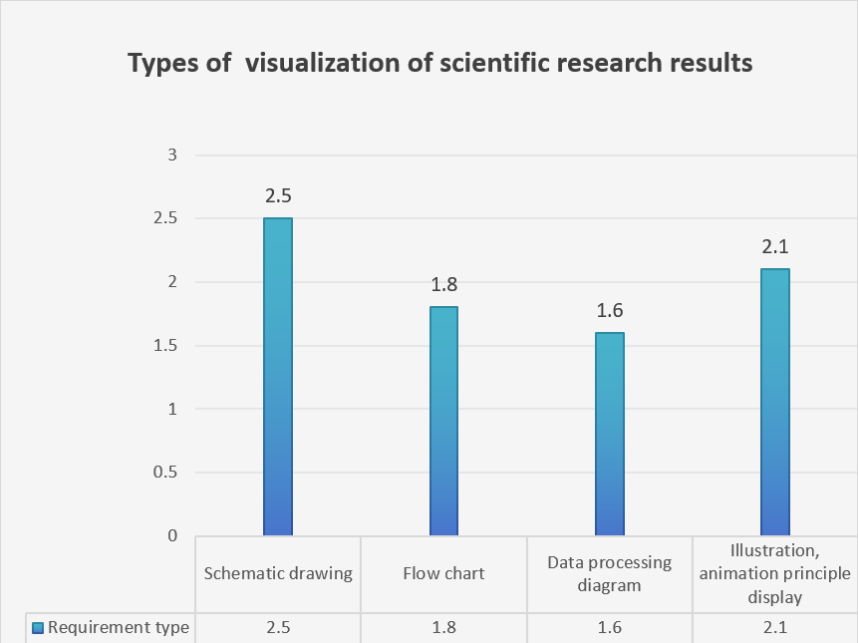

Figure 3 Visualization type

(From the traditional table, the data clearly displays the data information with a chart, which allows us to grasp the clear and important information, as shown in the figure above. So if we think backwards, will it be more vivid and easier to understand if we use ai painting, video and other methods?)

In conclusion, employing data portraiture as a metaphor can effectively enhance individuals' perception and comprehension of the significance and importance of aesthetic visualization in a more intuitive manner[14]. The widespread adoption and advancement of digital technology offer vast opportunities and limitless potential for the progress of aesthetic visualization technology. This study aims to enhance the presentation and utilization efficiency of scientific research materials through the application of aesthetic visualization technology, alleviate researchers' challenges in comprehending extensive data, thereby promoting digital transformation in scientific research domains while providing superior services for scientific investigations.

6 Peroration

We believe that the development of aesthetic visualization and the use of AI painting have great potential in the digital transformation of scientific research materials. On the one hand, the continuous iteration and update of technology provides more possibilities for the transformation of scientific research materials. On the other hand, based on the consideration of user experience, scientific research materials will pay more attention to aesthetic design and artistic expression.

At the same time, we also recognize that there are limitations that require further research and resolution. Future researchers can conduct in-depth research on the application of aesthetic visualization and AI painting in scientific research materials from multiple angles and layers, and propose more operational, adaptive and innovative digital transformation schemes for scientific research materials. We hope that in the future, in the process of digital transformation of scientific research materials, more diversified display methods can be formed to promote the effectiveness and influence of scientific research communication.

The digital economy focuses on benefiting enterprises and benefiting the people, and scientific visualization service companies based on scientific research should clarify the purpose of digital transformation, and cannot imitate others and digitize for digitalization. In addition to providing the traditional material library platform and customized services, it should also be fully combined with the network resources of the new media era[15], scientific research information of academic new media and other scientific research content, so as to link and provide available scientific research resources for college students, effectively improve the scientific research ability of students, and lay the foundation for training high-level scientific and technological talents in the fields of national chemical industry and medicine.

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