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Emotional Translation in Data Visualization Design: A Case Study on the "AI Van Gogh" Project

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ABSTRACT
This paper takes the project "AI Van Gogh / AI Data Painting Immersive Experience" as the research object, exploring the emotional path of data visualization design driven by artificial intelligence. By analyzing the integration mechanism of AI technology and emotional design in the project, it reveals the transition logic of data visualization from "information transmission" to "emotional resonance", providing references for theoretical research and practical innovation in related fields.

KEYWORDS
AI; Data visualization; Emotional design; Immersive experience; Information transmission; Emotional resonance

1 Introduction

1.1 Research background and significance

In the technology-driven era, after decades of development (especially with advances in deep learning and hardware), artificial intelligence has expanded its applications—from speech and image recognition to natural language processing—reshaping people's lives and work, with the global AI market booming.Data visualization, evolving from simple charts to diverse forms, is crucial for understanding massive amounts of data in the big data age. It transforms data into intuitive visual forms (graphs, charts, maps) to reveal patterns, facilitating efficient decision-making in business (such as market analysis and sales forecasting) and scientific research.

The "AI Van Gogh / AI Data Painting Immersive Experience" project, as a typical case of the in-depth integration of artificial intelligence, art, and data visualization, has unique research value. The project uses AI technology to conduct in-depth analysis and learning of Van Gogh's paintings, and presents Van Gogh's unique painting style and emotional expression in an immersive form through the combination of data painting technology and color matching. When participating in the project, the audience feels as if they are in Van Gogh's artistic world, able to personally experience the strong emotions and unique charm contained in his paintings [1]. This project not only provides a new way for art display and communication but also offers an innovative practical example for AI-driven data visualization design. By studying this project, we can gain a deep understanding of how AI injects emotional elements into data visualization design, as well as the specific implementation paths and effects of emotional design in improving user experience, thereby providing new ideas and methods for the field of data visualization design and promoting the development of theories and practices in this field.

1.2 Research objectives and methods

This study aims to deeply reveal the emotional path of data visualization design driven by artificial intelligence. Specifically, through the study of relevant theories and practical cases, it analyzes the application status and development trends of AI technology in data visualization design, and explores the importance and implementation methods of emotional design in data visualization. On this basis, taking the "AI Van Gogh / AI Data Painting Immersive Experience" project as a specific case, it deeply analyzes its innovations and successful experiences in data processing, visualization presentation, and emotional transmission, and summarizes universal emotional design strategies and methods. Through the investigation and analysis of user experience, it evaluates the impact of emotional design on user participation, satisfaction, and emotional resonance, provides a basis for the optimization of data visualization design, and ultimately provides new theoretical perspectives and practical guidance for the field of data visualization design, promoting the innovative development of this field [2].

To meet the above research goals, this study employs multiple methods. First, case analysis delves into the "AI Van Gogh / AI Data Painting Immersive Experience" project—covering technical implementation, design concepts, and user experience—to summarize key elements and paths of AI-driven emotional data visualization design. It also collects related cases for comparative analysis to verify and refine conclusions. Second, literature research reviews studies on AI, data visualization, and emotional design to grasp existing results and status, laying a theoretical foundation. This explores interdisciplinary intersections and gaps, clarifying research directions. Additionally, user experience surveys via

questionnaires, interviews, and on-site observations gather feedback from participants in the AI Van Gogh project and similar ones. Quantitative and qualitative analyses of users' emotional reactions, cognitive evaluations, and behaviors deepen understanding of emotional design's impact on user experience, providing empirical support.

2 Theoretical basis and research review

2.1 Overview of artificial intelligence and data visualization technology

Artificial intelligence's history is marked by exploration and breakthroughs. The 1950 Dartmouth Conference coined "AI," launching the field with rule-based, logic-driven early efforts—limited by computing power and algorithms. Later, machine learning let computers learn from data; recent deep learning, via neural networks, excelled in image/speech recognition and natural language processing. AI has three main branches: symbolism (logic/symbol-based, used in expert systems), connectionism (neural network-simulating, key in image/speech tasks), and behaviorism (environment-interactive, aiding robotics and gaming). In data processing, AI's machine learning analyzes massive data to find patterns—enabling precise e-commerce recommendations and financial risk assessment.

Data visualization uses graphs, charts, and maps for intuitive data understanding, evolving from simple static charts (bar, line, pie) to interactive versions (via clicks, drags) that deepen data exploration. Now, with big data and AI, it's diversified and intelligent, featuring dynamic, 3D, and immersive technologies. Dynamic visualization aids real-time urban traffic flow monitoring; 3D visualization enhances terrain representation for urban planning and geological exploration [3].

2.2 Emotional design theory

Emotional design, proposed by Donald Norman in his book "Emotional Design", has rich connotations, covering three levels: visceral, behavioral, and reflective. It is a design concept and methodology system centered on users' emotional needs and psychological experiences. It breaks through the limitations of traditional design that overemphasizes functional realization, form shaping, or technical parameters, and shifts the focus of design to the emotional connection generated in the process of users' interaction with products, services, environments, or systems. Its core essence lies in, through systematic insight into users' emotional preferences, psychological demands, behavioral habits, cultural backgrounds, and other in-depth factors, using design languages (such as form, color, material, interaction logic, narrative methods, etc.) to trigger users' positive emotional reactions (such as pleasure, trust, sense of belonging, sense of achievement, etc.), while alleviating or avoiding negative emotions (such as confusion, anxiety, frustration, etc.), and ultimately achieving a lasting and in-depth emotional resonance between users and the design object, thereby enhancing users' acceptance, satisfaction, and loyalty to the design object.

2.3 Analysis of domestic and foreign research status

Foreign research on AI-driven emotional paths in data visualization design has achieved fruitful results. Technically, AI algorithms are used to optimize the visualization process, such as machine learning to automatically generate appropriate forms, and deep learning to analyze user behavior preferences to provide personalized experiences; in emotional design, the impact of visual elements on users' emotions is explored, principles and methods are summarized, and theories such as color psychology are combined, with attention also paid to application strategies in multiple fields.

Domestic related research has emerged in recent years, drawing on foreign results and combining local realities and cultural backgrounds. Technically, independent visualization tools are developed; in emotional design, attention is paid to exploring the application of traditional cultural elements, and at the same time, attention is paid to applications in social hot fields to enhance public participation. Existing research has shortcomings: technically, the interpretability of AI algorithms, the diversity and adaptability of visualization effects need to be improved; in emotional design, there is less research on the combination of data content and emotional design, and universal strategies for cross-field applications need to be explored.

3 Analysis of the "AI van gogh / AI data painting immersive experience" project

3.1 Project background and team introduction

In the era of deep tech-art integration, the "AI Van Gogh / AI Data Painting Immersive Experience" emerged. As AI advances, its art applications—from image recognition to creation assistance—offer new possibilities. Data visualization, linking data and audiences, explores AI integration for creative, emotional displays. Tech-art fusion grows, with digital tools like VR/AR transforming art exhibitions into immersive experiences. This project reinterprets Van Gogh's works via

AI, blending art and technology uniquely.

Created by Turkey's Ouchhh team—comprising scientists, artists, and engineers—the studio innovates in AI art, data coding, and multimedia. Leveraging interdisciplinary expertise, it integrates architecture, music, and nature into public life via multimedia, broadening tech-art reach. Their public projects use projection tech and AI to turn buildings into dynamic canvases, with real-time data and interactivity earning acclaim.

Figure 1 On-site display of Ouchhh team's works

3.2 Project technical principles and implementation methods

The "AI Van Gogh / AI Data Painting Immersive Experience" project integrates a number of cutting-edge AI technologies. Among them, the neural network, as the core technology, simulates the neural connection mode of the human brain. Through in-depth learning of Van Gogh's massive paintings, it accurately extracts his iconic style features - from warm color matching (such as preferring yellow and red when expressing passion, and using blue and green when depicting tranquility), to rough and powerful brushstroke forms and movement trajectories, as well as unique composition logic, all of which are efficiently captured by the system. The Generative Adversarial Network (GAN) shows strong creativity in this project: the generator devote oneself to studies the essence of Van Gogh's works and constantly tries to generate new paintings with the master's style; the discriminator identifies the authenticity of the works with strict standards, and the two evolve together in continuous games. After repeated training, the generator can finally create high-quality imitations that are almost indistinguishable from the real ones, bringing the audience an artistic impact that is both familiar and full of new ideas. The image-to-audio technology adds a sense of immersion. It relies on a deep learning framework to convert the visual elements of Van Gogh's paintings (such as color brightness, line tension, composition density, etc.) into matching musical languages - bright and lively paintings correspond to cheerful and jumping melodies, while deep and dignified brushstrokes match slow and low rhythms, achieving a seamless integration of audio-visual art [4].

In terms of emotional expression, the project makes efforts in multiple dimensions: emotional labels and background information of Van Gogh's works are integrated into the data processing stage, so that the neural network is closer to the master's emotional intentions when learning; visualization presentation invites the audience to participate through interactive design, and the audience's touch or body movements can affect the display effect of the works, deepening emotional resonance; and the audio that accurately matches the emotions of the picture enhances the atmosphere from the auditory dimension, allowing the audience to deeply understand the intense emotions and unique artistic conception contained in Van Gogh's art in the linkage of multiple senses.

3.3 Project achievements and influence

The "AI Van Gogh / AI Data Painting Immersive Experience" project has achieved fruitful results and exerted extensive and far-reaching influence in the art field, technology field, and on public cognition and aesthetic influence. In terms of achievements, the project has produced a series of wonderful data visualization works and multimedia artworks. Based

on data visualization, "DATAMONOLITH_AI" and "POETIC AI" explore the relationship between humans and machines, as well as the impact of data on our cognition and perception of the world by converting a large amount of data into dynamic images and sounds. These works, with unique perspectives and innovative expressions, have triggered people's thinking about the relationship between technology and humans. Ouchhh used Generative Adversarial Networks (GAN) and AI algorithms to learn the data of Göbekli Tepe (Göbekli Tepe, 9600-7000 BC), an archaeological site in southeastern Anatolia, Turkey, collected static images on-site, and converted them into graphical visual data, thereby illuminating the originally dark "Boulder". The work is a poetic interpretation of AI. The text and images transcoded by AI are projected with 3 billion pixels, creating an immersive visual experience for the audience. At the same time, the effects of light and movement are also automatically generated through a preset algorithm. These works have brought new ideas and methods to art creation and expanded the boundaries of art.

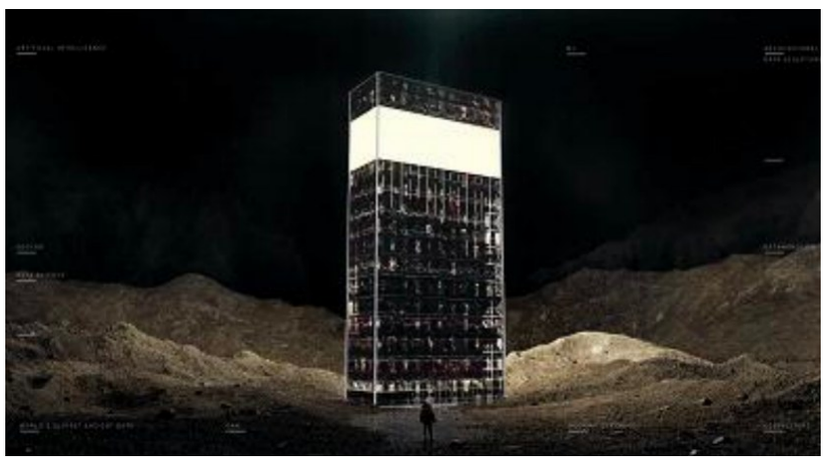

Figure 2 Works of Datamonolith_AI

The project also held a striking parallel universe exhibition. The Ouchhh team collected, scanned, analyzed, and learned more than 9, 000 oil paintings and 1, 100 sketches by Van Gogh, and reconstructed them using various AI algorithms, especially GAN algorithms. In the offline exhibition, multimedia technology was comprehensively used to present a 30-minute video with 12 billion particles moving rapidly, making visitors completely immersed in Van Gogh's world. Through stunning visual effects and immersive experience, the exhibition made the audience feel as if they had traveled through time and space, had a dialogue with Van Gogh across the century, and deeply felt the unique charm and emotional power of Van Gogh's artworks.

The project has brought new ideas and methods to art creation and display. It has broken the boundaries of traditional art creation, combined AI technology with art, and provided artists with new creative tools and sources of inspiration. Artists can use these technologies to explore new art forms and expression techniques, and create more creative and personalized works. The project has also provided an example for the innovation of the form and content of art exhibitions, promoting the transformation of art display from traditional static display to dynamic, immersive, and interactive display, bringing the audience a richer and more diverse artistic experience, and stimulating the audience's interest and love for art.

4 Analysis of the emotional path of data visualization design driven by artificial intelligence

4.1 Data processing and extraction of emotional elements

In the "AI Van Gogh" project, processing Van Gogh's work data underpins emotional expression. The Ouchhh team fed over 9, 000 oil paintings and 1, 100 sketches into neural networks, which extracted emotional elements like colors, brushstrokes, and compositions from the images.

Deep learning analyzed Van Gogh's color use: "The Starry Night," for example, contrasts deep blues and bright yellows to evoke mystery and vibrancy. Across works, warm tones (red, orange) convey warmth; cool hues (blue, green) depict calm—these inform visualization color schemes. Neural networks also learned brushstroke traits (shape, direction, strength), digitizing them to support simulation and generation.

4.2 Visualization design and emotional mapping

In the "AI Van Gogh / AI Data Painting Immersive Experience" project, the extracted emotional elements are presented through elaborate visualization design, realizing effective mapping between data and emotions. In terms of dynamic

image design, the project makes full use of color, brushstroke, and composition elements in Van Gogh's works to create dynamic effects with strong visual impact. By simulating the unique movement trajectory of Van Gogh's brushstrokes, the lines and colors in the picture seem to flow naturally, creating a dynamic sense full of vitality and life. When displaying Van Gogh's "The Starry Night", the rotating nebulae and twinkling stars in the dynamic image are presented with smooth animation effects, as if bringing the audience into a dreamlike cosmic world, enabling the audience to personally feel the passion and imagination when Van Gogh created it. The dynamic change of colors is also cleverly used. According to the emotional expression characteristics of colors in Van Gogh's works, the saturation, lightness, and hue of colors are dynamically adjusted in different scenes and emotional atmospheres. In scenes expressing warm emotions, the saturation of red and orange is gradually increased to make the picture more vivid and eye-catching, stimulating the audience's sense of excitement; when depicting quiet night scenes, the lightness of colors is reduced to make the picture present a soft and quiet atmosphere, allowing the audience to feel inner peace.

4.3 User interaction and enhancement of emotional experience

Free exploration in virtual space is also an important interaction method of the project. Users can enter Van Gogh's artistic world immersively through virtual reality (VR) or augmented reality (AR) technology. In the virtual Van Gogh exhibition, users can move freely through various exhibition halls, appreciate Van Gogh's works at close range, and even touch and zoom in on the works to observe the details in the works. In the virtual scene displaying "The Starry Night", users can walk around the painting, appreciate the colors and brushstrokes of the painting from different angles, and feel the vastness and mystery of the starry sky depicted by Van Gogh [5]. This free exploration interaction method allows users to interact with the works in a more active way, enhances users' sense of immersion and participation, enables users to have a strong emotional resonance in the exploration process, as if having a dialogue with Van Gogh across time and space. By continuously collecting user feedback and optimizing, the project can continuously improve users' emotional experience, make emotional design more in line with users' needs and expectations, and realize a positive interaction between data visualization design and users' emotions.

5 Analysis of advantages and challenges of emotional path based on cases

5.1 Advantage analysis

The emotional path adopted in the "AI Van Gogh / AI Data Painting Immersive Experience" project shows significant advantages in improving user experience in many aspects. In terms of emotional resonance, the project successfully touches the user's inner world through in-depth excavation and accurate presentation of emotional elements in Van Gogh's works. When visualizing Van Gogh's "Sunflowers", the project uses AI technology to accurately restore the bright and warm colors and unique brushstrokes in the painting. These elements are closely connected with Van Gogh's love for life and yearning for a better life. When appreciating, the audience seems to feel the passion when Van Gogh created, thus generating a strong emotional resonance. In terms of user participation, the rich interactive links of the project have greatly stimulated users' enthusiasm for participation. Users can freely explore Van Gogh's artistic world in virtual space and participate in artistic creation. This interactive experience transforms users from passive information receivers into active participants. In the virtual exhibition hall, users can freely choose the visiting route, zoom in or out of the paintings, view the details of the works, and interact with the works through gestures, voices, etc. This way of independent exploration satisfies users' curiosity and desire for knowledge and improves user participation. The link where users participate in artistic creation has also been widely praised. Many users said that in the creation process, they not only gained an in-depth understanding of Van Gogh's painting skills and artistic style but also exerted their own creativity and obtained a unique experience.

5.2 Challenge analysis

While the "AI Van Gogh" project has made notable progress in AI-driven emotional data visualization, it faces challenges in technical implementation, data security, and balancing art and technology.Technically, complex algorithms (e.g., neural networks, GANs) demand massive computing resources and time for training—insufficient capacity can slow or disrupt operations, harming user experience. These "black-box" algorithms lack interpretability, hindering optimization and user trust.

Overemphasizing AI display over Van Gogh ' s artistic essence risks unbalancing art and technology: flashy VR effects may fail to convey his emotions, leaving audiences fixated on tech novelty rather than art. Innovating with technology while respecting artistic essence—achieving their organic integration—remains a key challenge for the project and data visualization as a whole [6].

5.3 Coping strategies and suggestions

To address these challenges, adopt strategies for sustainable AI-driven emotional data visualization.

Technologically, boost AI algorithm research: optimize structures to enhance efficiency and interpretability, develop new architectures to reduce computing resource use, enabling wider device compatibility. Research algorithm interpretability, create visualization tools to intuitively show decision processes—helping users understand how algorithms learn Van Gogh's features—thus increasing trust and transparency.

For data security, improve laws to clarify data collection, use, and protection norms. Require explicit user consent and clear purpose/scope disclosures. Establish strict encryption and access controls: encrypt Van Gogh's work data and user info during transmission/storage, limit access to authorized personnel via multi-level permissions. Strengthen supervision with regular security checks to identify and resolve risks.

6 Conclusion and outlook

This study deeply explores the emotional path of data visualization design driven by artificial intelligence and takes the "AI Van Gogh / AI Data Painting Immersive Experience" project as a typical case for detailed analysis. By sorting out the relevant theoretical basis and research status, it clarifies the important role and development trend of artificial intelligence, data visualization, and emotional design in the field of data visualization. With the continuous development of technology, the integration of emerging technologies such as virtual reality, augmented reality, and blockchain with artificial intelligence and data visualization will bring more possibilities for emotional design. Future research can explore how to better apply these emerging technologies to the emotional design of data visualization. Use blockchain technology to ensure the security and authenticity of data, providing a reliable data basis for emotional design; further deepen the application of virtual reality and augmented reality technologies in data visualization, create more immersive and interactive emotional experience scenarios, and enable users to more deeply feel the emotional connotation behind the data. By continuously expanding research directions, promote the continuous innovation and development of the AI-driven emotional path of data visualization design, and bring users better and richer emotional experiences.

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