The Research of Emotional Design Theory and AI Technology in Modeling User Experience Model

Yao Xiao[1,a], Ying Sun[2,b]

[1]Hunan University of Technology, Zhuzhou, China

[2]Guangzhou Panyu District Shiqiaojin Valley Student School, Guangzhou, China

[a]1304962484@qq.com, [b]569508060@qq.com

Keywords: Emotional Design; AI Technology; User Experience Model; Personalization; Emotion Recognition; Human–computer Interaction; Product Design Innovation; Data-driven Analysis

Abstract: In the digital age, users' requirements for product experience are increasing. Integrating emotional design theory and AI technology has become key to improving user experience. This study deeply analyzes the feasibility and advantages of integrating the two and constructs a corresponding user experience model. The research found that this integration is feasible regarding technology, user needs, and industry trends, and can significantly improve the personalization of user experience, enhance emotional interaction, and promote product design innovation. The constructed model is user-centric and follows the principles of emotional resonance and data-driven, providing a scientific guiding framework for product design and development. It is of great significance to the development of related fields and also points out the direction for subsequent research. The user experience model and related theoretical viewpoints proposed during the research process will further expand the research boundaries of emotional design theory and AI technology application, lay a solid theoretical foundation for subsequent research, and promote cross-disciplinary integration and coordinated development.

1. Introduction

With the advancement of the digital wave, products and services are becoming increasingly rich, and users' requirements for experience are constantly rising. They not only pay attention to functions, but also pay more attention to emotional experience and psychological satisfaction. Emotional design aims to integrate emotions into product design, trigger emotional resonance among users, and enhance the connection between users and products. With powerful data processing and analysis capabilities, AI technology can achieve personalized recommendations, intelligent interactions, and optimize user experience. However, the current integration of the two is still in its early stages and faces many challenges. In this context, in-depth research on constructing a user experience model that integrates the two has important practical and theoretical significance for improving product competitiveness and enriching related theoretical research. This study aims to deeply explore the integration of emotional design theory and AI technology, and construct a comprehensive and practical user experience model to provide scientific and systematic guidance for product design and development to meet users' growing emotional and functional needs.

At the practical level, the results of this study have a wide range of application value. Constructing a user experience model that integrates emotional design theory and AI technology can provide practical methods and strategies for enterprises' product design and development. Based on this model, enterprises can accurately grasp the emotional needs and behavioral habits of users, integrate emotional design elements in a targeted manner in the product design process, and use AI technology to realize personalized recommendations, intelligent interaction, and other functions to improve the usability of products and user satisfaction. For example, in the design of smart home products, AI technology is used to analyze the living habits and emotional state of users, automatically adjust the parameters of the home environment, and create a comfortable and warm living experience for users; in the design of mobile applications, the principles of emotional design are used to optimize the

  DOI: 10.25236/gemmsd.2025.036

interface layout and interaction methods, and personalized content recommendations are provided in combination with AI technology to enhance the emotional connection between users and applications, and increase the frequency and loyalty of users. It will not only help enterprises improve the market competitiveness of their products but also promote the innovation and development of the entire industry, and promote products and services to move towards a more humane and intelligent direction.

From a theoretical perspective, this study is of great significance for enriching and improving the research on emotional design theory and AI technology application. Emotional design theory and AI technology have achieved certain research results in their respective fields. However, integrating the two is still in its infancy, with many theoretical gaps and research deficiencies. This study will provide new ideas and methods for research in this field by deeply analyzing the integration mechanism and application mode of emotional design theory and AI technology.

2. Basic Analysis of Emotional Design Theory and AI Technology

2.1 Key Points of Emotional Design Theory

Emotional design was proposed by Donald Norman. It focuses on satisfying the emotional needs of users and establishes an emotional connection between users and products through the careful design of product appearance, color, material, interaction mode and other elements. Emotional design covers three important levels: instinctive level, behavioral level and reflective level. Each level satisfies the emotional needs of users from different angles, and together constitutes the rich connotation of emotional design [1]. Instinctual level design focuses on the direct stimulation of the five senses (sight, hearing, smell, taste, touch) of the user by the physical properties of the product, triggering the user's first reaction and instinctive emotion. For example, a sofa made of high-quality soft material can make users feel comfortable when touching it, thus generating pleasant emotions. Behavioral level design focuses on the functionality, ease of use and user experience of the product during operation. A product with simple operation and clear functions can enable users to complete tasks easily, thereby improving user satisfaction and favorability of the product. For example, the operation interface design of smart watches is simple and intuitive, and users can quickly check the time, receive notifications, monitor health data, etc. This convenient operation experience can enhance users' sense of identity and dependence on the product. The reflective layer design focuses on the cultural connotations and brand values of the product, as well as the reflection and emotional resonance of the user after using the product. Some traditional handicrafts with profound cultural heritage can not only inherit and display culture, but also arouse the user's love and respect for traditional culture. In addition, the unique brand image and values of well-known brand products can enable users to have self-identification and a sense of belonging during use [2].

2.2 Development and Application of AI Technology

The development of AI has gone through twists and turns. Since its birth in 1956, it has achieved certain results in the early stage, but it has entered a trough due to technical limitations. The emergence of expert systems in the 1980s promoted the development of AI applications. In the 21st century, with the development of the Internet and big data, technologies such as machine learning and deep learning have enabled AI to achieve a leap forward. Today, AI has been widely used in medical care, transportation, finance, smart homes and other fields. The core algorithms of AI technology include machine learning and deep learning. Supervised learning in machine learning trains models through labeled data for image classification, spam filtering, etc.; unsupervised learning analyzes unlabeled data to discover potential structures and patterns. Deep learning automatically learns data features by constructing multi-level neural networks. Convolutional neural networks play an important role in image recognition and recurrent neural networks in speech recognition.

AI technology affects user experience through personalized recommendations, intelligent interactions, and automated services. In the era of information explosion, AI builds portraits based on multi-dimensional information about users and provides personalized content and product recommendations, such as recommendation services for e-commerce and music platforms. AI

technology enables natural and smooth intelligent interactions, and voice assistants and intelligent customer service improve interaction efficiency and service quality. At the same time, AI realizes automated services in office, logistics, finance and other fields, reducing user operations and waiting time, and improving service efficiency and quality.

3. The Feasibility and Advantages of Integrating Emotional Design Theory with AI Technology

3.1 Feasibility Analysis of Fusion

From a technical perspective, AI's powerful data processing and analysis capabilities provide support for emotional design. E-commerce platforms use AI to analyze user browsing and comment data, optimize product display and recommendations, and enhance the emotional connection between users and the platform. In intelligent voice interaction, voice assistants use AI to understand user instructions and emotional states and give humanized responses. Computer vision technology provides a basis for emotional design by identifying user facial expressions and body language, and is applied in security monitoring and retail fields. Figure 1 shows the trend of integrating emotional design theory and AI technology.

Fig. 1 The integration of emotional design theory and AI technology

In terms of user needs, consumption upgrades have made user needs more diverse and personalized, and there is a strong demand for emotional and intelligent products. Smart speakers not only provide functional services, but also meet users' emotional needs and improve their quality of life. The integration of emotional design and AI technology can accurately understand user needs and provide customized products and services, such as personalized recommendations for mobile applications. At the same time, the integration also meets users' requirements for product intelligence and convenience, and the smart home system realizes automatic adjustment and remote control.

In terms of industry development trends, various industries are moving towards intelligence and humanization, providing broad space for the integration of the two. In the smart home industry, smart home appliances realize intelligent interaction and personalized services; in the field of smart cars, autonomous driving and intelligent interaction improve the driving experience; in the medical industry, AI-assisted diagnosis and humanized medical equipment design improve the medical experience.

3.2 Analysis of the Advantages of Integration

In the era of information explosion, the integration of emotional design and AI technology significantly enhances the personalization of user experience. E-commerce platforms use AI to analyze user behavior data, build accurate user portraits, provide personalized product recommendations, and improve user shopping efficiency and conversion rates. The music platform recommends personalized music content based on users' musical tastes and emotional states, optimizes interface design, and enhances users' identification with and loyalty to the platform. This fusion enhances the user's emotional interaction with the product. Through voice recognition, natural

language processing and emotion recognition technologies, smart speakers understand users' emotional states, provide care and personalized services, and become users' life companions. Virtual companion products use AI to simulate human emotions and behaviors, have deep emotional exchanges with users, meet social needs, and provide emotional support for users with social difficulties. In terms of product design and innovation, the integration of the two optimizes product design. Smart home products such as smart lamps use AI to sense the environment and user status, automatically adjust the lighting, achieve emotional interaction, and improve the comfort of home life. Smart watches integrate emotional design and AI technology to monitor physiological data, provide health advice and personalized interactive functions, transforming from simple devices into health and emotional communication partners, and promoting product innovation and development [3].

4. Construction of User Experience Model Integrating Emotional Design Theory and AI Technology

4.1 Principles of Model Construction

User-centeredness is the core principle of building a user experience model that integrates emotional design theory and AI technology. It runs through the entire process of model construction to ensure that the model can accurately meet the needs and expectations of users and provide users with a high-quality, personalized experience. An in-depth understanding of user needs and expectations is the primary task in model construction. It requires the comprehensive use of multiple research methods, such as user interviews, questionnaires, focus group discussions, etc., to collect user opinions and feedback from different angles. Through direct communication with users, understand their pain points, needs, and expectations in using products or services, including the demand for product functions, expectations for emotional experience, and preferences for interaction methods. When designing smart health monitoring equipment, it was found through user interviews that users not only hope that the equipment can accurately monitor physiological indicators, but also expect the equipment to provide personalized health suggestions and warm care reminders, such as providing suggestions on diet, exercise, rest, etc. based on the user's health status and living habits, and timely reminders when the user forgets to take medicine or exercise [4].

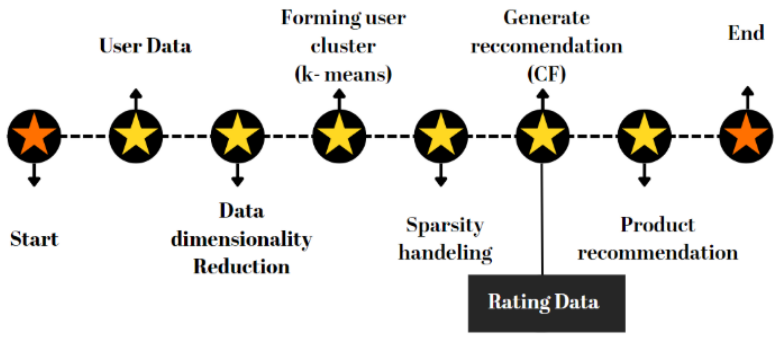

Fig. 2 Product recommendation system flow

Based on the in-depth understanding of user needs and expectations, the user's emotional and behavioral characteristics need to be fully considered during the model construction process to achieve a personalized user experience. AI technology is used to analyze the user's behavioral and emotional data, build user portraits, and accurately grasp the user's interest preferences, usage habits, and emotional state. According to the user portrait, users are provided with personalized product recommendations, interface design, and interaction methods. In the e-commerce platform, based on the user's purchase history and browsing history, recommend products that meet their interests and needs to users, and adjust the product display method and copywriting according to the user's emotional state to enhance the user's desire to buy. For users who like fashion trends, recommend fashionable clothing and accessories, and use fashionable and dynamic pictures and copywriting on

the product display page; for users who pay attention to quality and health, recommend high-quality health foods and fitness equipment, and emphasize the quality and health value of the products in the copywriting [5]. Figure 2 is a product recommendation system, showing the process from collecting data to generating personalized product recommendations.

In addition, the user-centric principle is also reflected in the emphasis on and timely response to user feedback. The model should have a mechanism for collecting user feedback in real time, and timely understand the problems and suggestions of users during use through user evaluations, online customer service, social media and other channels. According to user feedback, the model can be quickly adjusted and optimized to continuously improve the user experience. If users report that the interface operation of a mobile application is not convenient enough, the model can analyze the user's operation behavior data to find out the problem, optimize the interface layout and interaction process, and improve the ease of use of the application; if users make suggestions for improvement on the emotional interaction function of a smart product, the model can improve the emotion recognition algorithm and interaction strategy according to user needs to enhance the emotional connection between the product and the user.

4.2 Model Construction Method

The user demand analysis method based on multi-source data fusion integrates multi-source data such as user behavior, emotion, preference, and social factors. Behavioral data reflects user usage habits and demand tendencies, emotional data reflects user emotional state, preference data shows user preferences, and social data helps to understand social needs and influence. Through data cleaning, feature extraction, and selection, machine learning and deep learning algorithms can accurately predict and analyze user needs.

Emotion recognition technology supports the formulation of emotional design strategies. This technology identifies the emotional state of users by analyzing facial expressions, voice intonation, physiological signals and text content. Based on the recognition results, the color, layout and elements are adjusted in the product interface design, personalized interaction methods are provided in the interaction design, and functions that meet emotional needs are added or optimized in the functional design [6].

Machine learning algorithms play a core role in optimizing user experience models. By building user behavior prediction models, such as e-commerce platforms predicting user purchase behavior, accurate recommendations and marketing can be achieved. Machine learning can be used for sentiment analysis and user satisfaction prediction to provide early warning of user churn risks. A real-time feedback mechanism is established to collect user behavior and feedback data, update and optimize the model online, and use reasonable evaluation and selection methods to improve model accuracy and generalization capabilities.

4.3 Model Architecture and Element Analysis

The overall architecture of the model consists of the data layer, analysis layer, design layer and interaction layer. The data layer collects and stores various types of user data to provide a basis for subsequent analysis. The analysis layer uses AI technology to analyze data, mine behavioral patterns, identify emotional states, build user portraits and predict future trends. The design layer incorporates emotional design based on the analysis results to optimize the product interface, interaction and functions. The interaction layer realizes emotional human-computer interaction, feeds back user interaction data to the data layer, and optimizes the model.

The key elements of the model include user needs, emotional design elements, AI technology and user experience feedback. User needs are the foundation, which are diverse and complex, and can be deeply understood through various methods. Emotional design elements include colors, shapes, etc., which can trigger emotional responses from users. AI technology provides technical support to achieve accurate analysis and personalized services. User experience feedback is the key to continuous optimization of the model. Feedback is collected through various channels to improve products. These key elements are interrelated [7]. User needs drive the selection of emotional design elements and the application direction of AI technology. Emotional design elements and AI

technology work together to meet user needs. AI technology can also adjust the presentation of emotional design elements. User experience feedback affects the understanding of user needs, the adjustment of emotional design elements and the improvement of AI technology, and jointly promotes the improvement of user experience.

5. Conclusion

This study discusses constructing a user experience model that integrates emotional design theory and AI technology. Research shows that integrating the two is fully feasible in terms of technology, user needs, and industry development trends, and can significantly improve the personalization of user experience, enhance the emotional interaction between users and products, and inject strong impetus into product design and innovation. The user experience model built on this basis is user-centric, follows the principles of emotional resonance, and is data-driven, and forms an organic whole with clear levels and coordinated elements through multi-source data fusion analysis, application of emotion recognition technology, and optimization of machine learning algorithms. This model provides a scientific and effective guiding framework for product design and development, helping companies improve product competitiveness and meet users' growing and diverse needs.

On the one hand, we should expand the application of the model in more industries, such as medical care, education, and finance, and further verify and improve its effectiveness and universality. On the other hand, we should keep up with the development of AI technology, continuously optimize algorithms and models, and improve the accuracy of emotion recognition and the quality of intelligent interaction. In addition, we should strengthen the research and regulation of user privacy protection and ethical issues, ensure the rational application of technology, create a better, smarter, and more humane experience for users, and promote the continuous in-depth development of the research on the integration of emotional design theory and AI technology.

References

[1] Junkyu, Hwang, Eunkyong, et al. DEVELOPMENT OF A RETAIL BRAND ENHANCEMENT TOOL THROUGH THE USE OF EMOTIONAL DESIGN THEORY[J]. Archives of Design Research, 2013, 26(1):7-27. DOI:10.15187/adr.2013.02.26.1.7.

[2] Mao P, Kim Y G, Hong C. Research on integrating emotional design theory into interface interaction of intangible cultural heritage APP[J]. The Korean Society of Science & Art, 2022.DOI:10.17548/ksaf.2022.01.30.71.

[3] Wang Y, Deng X. The design theory and methods of emotional concept product based on Kansei Engineering[J]. IEEE, 2010:26-30. DOI:10.1109/CAIDCD.2010.5681413.

[4] Wu H, Ye J. Research on Emotional Design of Sleep Aid Products Based on the Theory of Design for Sustainable Behavior [J]. Springer, Cham, 2021.DOI:10.1007/978-3-030-78645-8_51.

[5] Yan T, Chen Z. Research on the user experience design of a traditional culture app based on the Kano model[C]//Fung L L C, Puthiya M M G P, Kasim A H B A (eds). Design Studies and Intelligence Engineering. Amsterdam: IOS Press, 2023: 13-24. DOI: 10.3233/FAIA220696.

[6] Gong Q, Zou N, Yang W, et al. User experience model and design strategies for virtual reality-based cultural heritage exhibition[J]. Virtual Reality, 2024, 28(2). DOI:10.1007/s10055-024-00942-z.

[7] Zhou C, Song C. Study of the Design of H5-Technology-Based Information Flow Advertising and Analysis of User Experience Model[J]. 2021 16th International Conference on Computer Science & Education (ICCSE), 2021:1058-1061. DOI:10.1109/ICCSE51940.2021.9569583.