

# Research on User Experience Interaction Integrating Emotional Design and Artificial Intelligence

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**Abstract.** The rapid development of artificial intelligence (AI) technology has brought new possibilities and challenges for emotional design in human-computer interaction. This paper aims to systematically sort out the current situation of the integration of emotional design and AI, and conduct case studies to explore its future trends, to provide theoretical and practical guidance for intelligence-driven interaction design. In this paper, the theoretical framework of emotional design and the integration path with AI technology were summarized through a combination of literature review and case study. It was found that although emotional design is effective in enhancing users' emotional experience through intelligent algorithms, it still faces key issues such as technical limitations, privacy, security, and ethical regulation. Combined with case studies, the value of emotional interaction in enhancing user stickiness and brand loyalty was verified. The conclusion points out that in the future, it is necessary to deepen interdisciplinary collaboration, optimize algorithm robustness, and promote the development of emotional intelligent design towards standardization and scenario, in order to achieve a balance between technology and humanized experience.

**Keywords:** Emotional Design; Artificial Intelligence; User Experience; Interaction Design.

## 1. Introduction

### 1.1 Background of the Research:

Against the backdrop of rapid evolution of digitalization and intelligence, the focus of user experience design is gradually shifting from function-oriented to emotion-oriented. According to the Gartner UX Trends 2024, user demand for emotional AI interactions has grown by about 37% in the past year. Compared with earlier interaction methods that emphasized efficiency and usability, today's users expect products to build emotional resonance with them, bringing a sense of pleasure, identity, and trust[1]. This emotional experience not only enhances user satisfaction but also strengthens user stickiness and brand loyalty, becoming a key factor for products to stand out in a highly homogenized market.

At the same time, emerging technologies such as AI, Internet of Things, and Virtual Reality continue to integrate, subtly changing the way of human-computer interaction and expanding the boundaries of emotional design. These technologies not only give the system smarter perception, contextual understanding, and emotional feedback, but also provide diversified possibilities for emotional design, and present brand new theoretical and practical challenges.

### 1.2 Purpose and Significance of the Research:

This study aims to systematically investigate the current status, core methods, and future development trends of the integration of emotional design and AI technology, focusing on the key issues in technical implementation, user experience optimization, and ethical regulation of emotional interaction. The study sorted out the theoretical framework of emotional design and its synergistic path with artificial intelligence technology, analyzed the potential and limitations of the application of multimodal emotion recognition, personalized response and other technologies, combined with typical cases to refine the practical experience of emotional intelligent design in enhancing user stickiness and brand loyalty, and finally summarized the future development trend.

This study constructed a theoretical framework for emotional interaction in the context of AI by integrating the multidisciplinary perspectives of design, psychology, and computer science, promotes

the systematic development of emotional design theory, provides multi-dimensional theoretical support for emotional intelligent interaction, and fills in the gaps in the current research in the mechanism of dynamic emotional response and multimodal fusion. The research results can provide methodological guidance for user experience optimization in multiple fields. In addition, the privacy protection and ethical balance strategy proposed are expected to provide actionable solutions for enterprises to avoid the risk of data abuse and enhance user trust, helping them to build differentiated advantages in homogeneous competition.

### **1.3 Research Methods:**

This study combined literature review and case study analysis, selected research cases in the field of integration of emotional design and AI in recent years, and introduced the user satisfaction scale analysis method for in-depth analysis of the cases, so as to enhance the empirical and instructive nature of the study.

## **2. Theory of Emotional Design**

### **2.1 Definition and Connotation of Emotional Design**

Emotional design is built on top of humanized design and is more committed to the pursuit of strengthening the emotional impact of products on users from an emotional point of view. Emotional design not only focuses on the basic functions and ease of use of products, but also attaches importance to satisfying people's inner emotional and spiritual needs through the careful design of form, behavior, and content[2].

### **2.2 Hierarchy and Theoretical Framework of Emotional Design**

The development of emotional design is built on the support of multidimensional theories, which build a complete cognitive framework of design from the emotional hierarchy, cognitive mechanisms, to user experience dimensions.

In 2004, Donald A. Norman first proposed a three-level theory of emotional design from the visceral, behavioral, and reflective levels[3]. The theory states that the visceral level focuses on the appearance and initial impression of the product, the behavioral level is concerned with the user's interactive experience with the product, and the reflective level is about the product's impact on the user's personal identity, values, and emotional connection[4][5].

JORDAN P W. deeply analyzed the emotional connection between users and products from the dimensions of physio-pleasure, socio-pleasure, psycho-pleasure, and ideo-pleasure[6]. The Four Pleasures further extends the assessment dimension of emotional experience and provides designers with quantifiable perceptual benchmarks and cognitive paths.

### **2.3 The Role of Emotional Design in User Experience Interaction**

In the process of human-computer interaction, emotion transfer is a complex and dynamic process. In terms of the dynamic development process of emotional experience, it usually includes three phases, the initial contact, the interaction process, and the feedback after use. In the initial contact stage, users form a first impression of the product by understanding its appearance and initial functions. In the interaction process stage, users experience its functions and performance by actually using the product. Then, in the feedback stage after use, users evaluate the product and give feedback based on their overall experience. Each stage can be targeted to stimulate emotional responses through design strategies, forming a complete emotional closed loop.

Through the synergy of the above multimodal emotional elements and the guidance of the dynamic experience path, emotional design has a significant positive effect on user experience. It not only enhances user satisfaction and emotional value but also strengthens brand identity and loyalty. Furthermore, it also effectively promotes users' continuous participation, improves product memory

points, and subtly guides users' behaviors. The construction of emotional experience is no longer just a stimulus at the sensory level, but transforms into an emotional connection between users and the product with a deep-level interactive relationship.

### **3. Application of AI Technology in Emotional Design**

#### **3.1 Intelligent Algorithms and Emotion Recognition Technology**

With the increasing maturity of AI technology, multimodal emotion recognition has become an important means for improving user experience. AI systems realize real-time and accurate perception of the user's emotional state through multimodal means such as computer vision, natural language processing (NLP), speech emotion recognition, and physiological signal detection.

Specifically, through computer vision technology, the system can recognize the user's facial expression in real time and then judge their emotional state. Speech recognition technology can extract emotional clues from the tone of voice, speech speed, and volume. NLP analyzes the user's emotional tendency by parsing the content of the user's utterance, realizing the effective communication between man and machine and the dual comprehension of semantics and emotion[7]. The synergy of these multimodal technologies enables the system to accurately identify the user's current emotion and make personalized responses.

#### **3.2 Technical Principles of AI to Improve User Experience Interaction**

With the technical advantages of AI, the emotional interaction system can break through the traditional technical limitations in recognition and response efficiency[8]. The role of AI in emotional design is not only embodied in the recognition of the user's emotional state, but also extends to the prediction of the user's potential needs and the dynamic adaptation of interactive behavior. Through deep learning and pattern modeling of user behavioral data and emotional feedback information, the system is able to adjust the interface layout, interaction tone, and content push in real time according to the context, realizing a highly personalized human-machine communication. For example, voice assistants with integrated semantic understanding and emotion recognition modules are able to respond with more emotional warmth according to the tone and context of the user's expression, while smart home systems can sense the user's emotional changes and life preferences to automatically optimize environmental elements such as light, music and room temperature, providing users with an emotionally resonant living experience. These cases fully demonstrate the great potential of AI in transcending the boundaries of traditional interactions and enhancing emotional experiences[9].

### **4. Feasibility of Integrating Emotional Design and AI**

#### **4.1 Feasibility at the Technical Level**

At the technical level, the current AI technology has been able to lay a solid foundation for emotional design.

Machine learning technology has shown excellent ability in personalized recommendation, intelligent customer service and automatic Q&A, and user behavior prediction, etc. It can carry out rapid learning and adjustment with the help of big data, deeply understand the user's emotional state, and accurately capture complex user preferences[10].

Examples of the application of natural language processing technology in speech recognition and synthesis, semantic understanding and dialogue management, and sentiment analysis make human-computer interaction more natural and emotional. Relying on sentiment analysis technology, it is workable to recognize the user's emotional posture and reply to the user with a matching emotional tone, making human-computer interaction more intimate.

The application of computer vision technology in image recognition and classification, gesture recognition and somatosensory interaction, scene understanding and intelligent recommendation has further broadened the scope of emotional design, assisting designers to more accurately adjust the emotional expression of the product based on the visual effect, so that the user experience is more three-dimensional and diverse[11].

## 4.2 Feasibility at the Design Concept Level

At the level of design concept, emotional design emphasizes user-centeredness, taking into account the emotional needs of users, while AI technology can accurately access and analyze the user's emotions with the help of data-driven paths. The complementary nature of the two makes the design not only stay at the level of functionality and efficiency, but also a form of artistic expression at the emotional level. Modern design concepts emphasize the use of emotional design to enhance the emotional resonance between the product and the user, thus achieving deeper trust and connection. This is highly compatible with the user-centered concept, thus providing solid theoretical and practical support for the deep integration of technology and design.

## 5. Case Analysis of Emotional Design and AI Integration

### 5.1 Case Analysis of Intelligent Voice Assistants: NOMI of NIO Vehicles

#### 5.1.1 Characteristics of NOMI's Emotional Design and AI Integration

The NOMI in-vehicle voice assistant, as shown in Fig.1, integrates a voice interaction system and an intelligent emotion engine to turn the car into a living organism, aiming to provide drivers with an emotional link to the car[12].

NOMI relies on a multimodal emotion engine that recognizes the user's voice tone, facial expression, and in-vehicle environment data in real time, and responds accordingly to the user's emotional changes. At the same time, the emotion engine allows NOMI to truly have "personality" and memory. Short-term memory records the context of the current conversation, and long-term memory continuously learns the preferences of car owners and high-frequency passengers, such as frequently used apps, favorite songs, and frequent destinations etc. When the user says "I want to listen to a song" but forgets the title, NOMI can actively recommend it based on historical preferences, so that people can truly feel understood.



Figure 1 Intelligent Voice Assistant NOMI of NIO Vehicles

### 5.1.2 Impact on User Experience Interaction and Effectiveness Evaluation

In order to better understand the impact of NOMI’s emotional design and AI integration on user experience, a satisfaction survey was conducted with 20 NIO vehicle owners to sort out their subjective evaluations in the dimensions of emotional interaction, intelligent response, and system trust. The results are hierarchically summarized as follows.

Table 1 Evaluation Index System of User Satisfaction Based on NOMI Emotional Interaction Design

| Level 1 Index           | Level 2 Index                      | Level 3 Index   |
|-------------------------|------------------------------------|---|
| Emotional Experience    | Anthropomorphic Perception         | Natural and smooth tone of voice, accurate emotion recognition, rich emotion expression   |
|                         | Emotional Response                 | Able to actively comfort/encourage users, empathize with driving emotions   |
|                         | Sense of Companionship and Rapport | Vivid and interesting facial expressions, lovely and friendly tone of voice, and varied styles of intonation                    |
| Intelligent Performance | Cognitive Ability                  | Understanding of fuzzy commands, rich personalization features, accurate semantic understanding                                 |
|                         | Memory and Learning                | Ability to memorize user preferences and support long-term and short-term memory  |
|                         | Multimodal Perception              | Able to recognize owner's mood/passenger's state and adapt its response to the scene outside the vehicle                        |
| Interactive Experience  | Speech Interaction                 | Sensitive command recognition, immediate and effective voice feedback, and high error tolerance                                 |
|                         | Animation                          | Natural response, rich expression and movement of on-screen anthropomorphic images, making users continue to explore the use of |
|                         | Scenario-based Emotion Adaptation  | Automatically adjust interactions in different scenarios  |
| Satisfaction Tendency   | Overall Satisfaction               | Pleasant emotional interactions, functionality, and personalized features   |
|                         | User Loyalty                       | Willingness to recommend to others and interact with NOMI for a long time   |

Based on the results, more than 85% of the respondents said they were satisfied with NOMI in the dimensions of “emotional response” and “anthropomorphic interaction”. In particular, its performance in terms of changes in tone and animation, active care, and scene adaptation was rated as “real”, “friendly”, and “vivid”. Among them, 12 owners especially pointed out its memory and learning ability, which is the key to differentiating NOMI from ordinary voice assistants. Overall, emotional experience is the primary reason for users to continue using the system, rather than a single functional requirement.

#### 4.1.3 Summary and Inspiration

From the design practice of NOMI, it can be seen that the deep integration of emotional design and AI not only enhances the emotional connection of the product to the user but also strengthens the brand recognition. NOMI effectively improves user stickiness and satisfaction through a series of “warm” emotional interactions and companionship, such as anthropomorphic expression animation and multi-mode perception. This case provides an effective reference for the development of emotional design, and also inspires to redefine the emotional boundary between humans and technology in the AI era.

### 5.2 Case Analysis of Smart Home System: Xiaomi Smart Home

#### 5.2.1 Xiaomi Smart Home Integration Mode and Innovation Points

As a leading smart home brand in China, Xiaomi has realized the deep integration of emotional design and AI in home scenes through its AIoT strategy. Taking “XiaoAi” as the core interaction hub, it systematically links various terminal devices such as TV, lights, air conditioning, etc., to build a smart ecosystem with the user as the core and emotion as the bond, as seen in Fig.2.

In terms of design innovation, Xiaomi focuses on embedding emotional experiences into daily life scenarios. On the one hand, multi-device linkage is achieved with the help of user-defined personalized scene modes. For example, “home mode” automatically triggers soft light, music, and curtains closed, creating a sense of belonging ceremony. On the other hand, the MiHome system can adapt itself to adjust the scene parameters based on the user’s behavioral habits and life routines data, making the smart home system better adapt to the user’s emotional needs and promoting the transformation of the smart home from “functional control” to “emotional space creation”.



Figure 2 Xiaomi Smart Home

#### 5.2.2 User Feedback and Data Analysis

In order to more comprehensively understand the performance of the user experience of Xiaomi Smart Home in the emotional design and intelligent fusion application, this study has collated the feedback from 18 typical users. The data was summarized around the dimensions of life scene

adaptability, emotional interaction experience, and system ease of use, and the representative satisfaction evaluation elements were distilled as follows.

Table 2 Evaluation Index System of User Satisfaction Based on Emotional Interaction Experience of Xiaomi Smart Home

| Level 1 Index                    | Level 2 Index                     | Level 3 Index  |
|----------------------------------|-----------------------------------|--|
| Life Scene Adaptability          | Scene Linkage Experience          | Harmonized equipment response and natural mode switching                       |
|                                  | Daily Routines Perception         | Ceremonial homecoming, routine perception, prepare in advance thoughtfully     |
|                                  | Personalized Scene Customization  | Customizable scene modes to meet individual needs                              |
| Emotional Interaction Experience | Anthropomorphic Voice Interaction | Relaxed conversation atmosphere, approachable and natural language             |
|                                  | Emotional Expression and Response | Accurate conversation recognition, gentle and appropriate responses            |
| Ease of Use                      | Ease of Operation                 | Smooth App/voice control, easy to customize settings                           |
|                                  | Multi-device Linkage              | Fast response to appliance synergy, voice/button control, no delay in response |
|                                  | Overall Satisfaction              | Convenient life, immersive homecoming  |
| Overall Satisfaction Tendency    | User Loyalty                      | Willing to recommend and buy products of the same series                       |

In the feedback of 18 Xiaomi smart home users, 78% of the users listed “life scene adaptability” as the biggest source of satisfaction in the process of using, and emotional scene linkage experience was widely mentioned. More than 60% of users believe that the “personalized scene customization” function, although slightly difficult to operate, significantly improves the sense of family atmosphere and the convenience of life after use. In addition, about half of the users expressed the hope that the stability of “multi-device collaboration” would be improved, indicating that the emotional experience is largely dependent on the consistency and smoothness of the technical response.

**4.2.3 Summary and Inspiration**

Although Xiaomi Smart Home has remarkable results in the integration of emotionality and intelligence, it still faces some challenges in the process of practical application. For example, the stability of multi-device linkage needs to be improved, the threshold of user personalization is relatively high, and errors of recognition exist in a multi-user environment. This case also shows that the adaptability and personalized expression of emotional design in complex life scenarios is still a key breakthrough in the future development of smart homes, which reminds designers to pay more attention to the balance between the warmth of the technology and the family relationship when constructing the “smart space”.

## **6. Challenges and Strategies in the Integration Process**

### **6.1 Designer Level: Role Transformation and Ability Reconstruction**

With the continuous development of AI technology, the role and ability of designers are facing new challenges and opportunities. The study points out that although AI technology can efficiently perform tasks such as design generation and behavior prediction, it is still insufficient in understanding complex user emotions or cultural contexts. Therefore, designers need to assume a stronger capacity for emotional understanding, cross-cultural judgment, and ethical adaptation.

At the practical level, traditional design thinking still focuses on the optimization of static interfaces and functional paths. However, in the face of interactive systems with strong real-time and dynamically changing emotional responses, designers need to master a new ability system and gain the ability to use the basic AI tool chain, such as the emotional computing API, AIGC generation tools, to understand the boundaries and possibilities of technology and build a closed-loop prototype thinking of “emotion-behavior-feedback”. Their role also needs to be transformed from “interface beautifier” to “emotional experience architect”, so as to have the ability to define emotional response thresholds, design multimodal feedback priorities, and form an efficient collaborative model.

### **6.2 Technical Level: Algorithm Optimization and Data Governance**

In the process of fusion of emotional design and AI, emotion recognition is the core of realizing emotional resonance, but the current technology still has the problem of insufficient accuracy and robustness. On the one hand, users can have ambiguous, diverse, or even contradictory behaviors and conversations when expressing their emotions, which leads to challenges in emotion modeling. On the other hand, due to the differences in expressions in different languages or cultures, some of the emotional contents are difficult to accurately align in algorithms, which affects the adaptability of the model. Therefore, future research should try to adopt cross-cultural and multi-language training methods to construct more inclusive emotion models[13].

At the data governance level, the interaction between users and devices is often accompanied by the collection and processing of a large amount of sensitive information, especially the modeling of emotional profiles without the explicit authorization of the user, which poses a serious risk to privacy security and ethical trust. For this reason, the future design should further clarify the data use and boundaries, and restrict the system from invoking the user’s emotional data without authorization. Simultaneously, it should construct clearer data authorization, use restriction, and access control, so that the user has the full right to know and the right to choose the use of the data collection and the process of storage to ensure that the user’s privacy is not infringed upon. This way can better enhance the transparency and security of the system.

### **6.3 User Level: Trust Construction and Ethical Balance**

As AI systems become more and more actively involved in users’ emotional states, users’ sense of trust and boundaries towards the systems have become more sensitive. Lack of moderation in emotional design is likely to bring ethical concerns such as “over-responsiveness” and even “emotional manipulation”. Therefore, at the user level, trust construction is no longer just a reflection of system stability and interface friendliness, but also a mechanism of emotional interaction that can be understood and controlled. The system should also clarify the boundaries of emotional recognition and feedback at the beginning of the design, and guide the users to interact under the premise of voluntariness and controllability.

In addition, the anthropomorphic expression of AI systems should be moderated. Its empathic responsiveness, although it enhances the immersion and emotional identity of the interaction, is also prone to triggering cognitive confusion among users, mistaking the generative AI as a real subject with emotions and generating problems of over-dependence and emotional projection, which in turn triggers a series of ethical dilemmas and social risks[14]. In this way, in the design practice, it should strengthen its “tool attributes” to help users build the correct cognitive boundaries, avoiding excessive

empathy and role dislocation. At the same time, it should introduce the mechanism of emotional intervention threshold, so that it does not actively intervene in certain highly sensitive emotional scenes, and make clear the scope of its functions.

## 7. Conclusions

The integration of emotional design and artificial intelligence is injecting more possibilities into the human-computer interaction experience. From product function to emotional accompaniment, the value boundary of the interaction system is expanding. This study explores key issues such as technical support, user experience, and design methodology through theoretical sorting and case analysis, and provides a preliminary response to future challenges. It can be found that truly effective emotional interaction not only relies on technical realization, but also depends on how to balance the relationship between rationality and sensibility, efficiency and warmth. In the future, the design work should continuously promote the deep optimization of interaction experience from an interdisciplinary perspective, so that intelligence and technology can serve people's emotional needs and value identity in a more natural and warm way.

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