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Research on the Design Strategies of AI Companion Robot Emoji Packs Based on Users' Emotional Needs

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Abstract

This study focuses on the design of emoji packs for AI companion robots, exploring their role in promoting emotional connection and enhancing interaction experiences based on emotional design theory. By analyzing the cases of the NOMI and Moxie robots, the research reveals how to optimize the emotional expression of AI robot emojis from the instinctive, behavioral, and reflective levels, aiming to build more empathetic and user-friendly intelligent interaction systems. An emotional design framework for AI robot emoji packs is constructed. Furthermore, the study explores how AI robots can establish emotional bonds through dynamic emojis, providing insights into the integration of affective computing and intelligent interaction technologies in the future.

1. Introduction

1.1 Research Background

With the continuous advancement of artificial intelligence (AI) and robotics, intelligent social robots are gradually becoming part of people's daily lives, serving multiple roles such as companionship, assistance, and emotional support. In modern society, the fast-paced lifestyle, high-intensity pressures, and widespread use of digital communication have reduced face-to-face social interactions, leading to growing issues of loneliness and social isolation. Groups such as only children, single young adults, and empty-nest elderly individuals often have unmet social needs, making effective emotional companionship increasingly necessary.

Studies have shown that building harmonious relationships with intelligent social robots can enhance emotional connection and well-being. During interactions with these robots, users tend to develop trust, familiarity, and a sense of belonging, which in turn strengthens their sense of security and satisfaction. Human-robot emotional relationships can improve users' acceptance of robots and, to some extent, compensate for the lack of real-world social relationships, thereby promoting mental health (Liu Wei, 2024).

1.2 Current Status and Development Trends of Robotics

In the field of human-computer interaction research, robots have gradually evolved from mere tools into intelligent agents with autonomous interaction capabilities, enabling them to communicate naturally with humans through language, facial expressions, gestures, and other means (Liu Wei, 2024). However, most intelligent social robots still lack rich emotional expression capabilities during interactions with users, particularly facing significant limitations in facial expression feedback (Zhang Sihuang, 2024). Compared to traditional text or voice communication, facial expressions, as a vital component of non-verbal communication, can effectively convey emotional information and enhance the emotional depth of interactions. Therefore, optimizing the facial expression design of intelligent social robots to better meet users' emotional needs has become a key research focus in the field of human-computer interaction design.

Market research indicates that China's companion robot market holds enormous potential, with the market demand expected to reach trillions of yuan (Guotai Junan, 2025). These robots demonstrate broad application prospects in areas such as children's education, elderly care, and psychological support. In particular, with the empowerment of AI technology, companion robots are evolving toward greater humanization and intelligence (CES 2025). In summary, exploring how to optimize the design strategies of emoji packs to enable AI companion robots to better understand and respond to users' emotional needs is of great practical significance for enhancing human-robot interaction experiences and driving industry development.

2. The Role of Emojis in Human-Computer Emotional Interaction

2.1 Emotional Design Theory

Emotional design is a design methodology based on users' psychological experiences and emotional needs, emphasizing the emotional connection between people and products. Norman's emotional design theory consists of three levels: the visceral level, the behavioral level, and the reflective level.

Visceral Level: This focuses on users' first impressions and instinctive reactions, primarily involving sensory stimuli such as visual, tactile, and auditory experiences. In AI companion robot design, robots can use vivid facial expressions to attract users' attention and enhance emotional engagement.

Behavioral Level: This concerns the user's operational experience during the interaction, including the product's usability, functionality, and user feedback. Intelligent robots can enhance the interactive experience by using smooth and emotionally expressive emojis when communicating with users.

Reflective Level: This involves the emotional resonance and value recognition formed by users over long-term product usage. Social robots, through continuous companionship, can foster users' emotional dependency, increasing product stickiness.

With the advancement of artificial intelligence and affective computing, emotional design is widely applied in AI interaction systems, particularly in products such as chatbots and companion robots. AI emojis, as a key form of emotional design, convey various emotional messages visually, deepening the emotional dimension of human-computer interaction.

2.2 Human-Computer Interaction Theory

Human-Computer Interaction (HCI) is the field that studies how humans effectively communicate and interact with computer systems. With the development of AI technology, HCI theory has evolved from focusing solely on task efficiency to placing greater emphasis on user experience and emotional needs. One of the core principles of HCI is User-Centered Design (UCD), which highlights the importance of considering users' needs, habits, and psychological expectations throughout the design process to optimize system usability and user experience.

In the design of emojis for AI companion robots, flexibility is reflected in the diversity of expressions, enabling the robot to dynamically adjust its emoji style and emotional expression based on the dialogue context. Meanwhile, adaptability refers to the robot's ability to perceive context, adjusting its emoji presentation according to the user's tone, input content, or sentiment analysis results, thereby providing a more personalized interaction experience.

Supported by affective computing technology, AI companion robots can recognize and respond to users' emotional changes through facial expression recognition, speech emotion analysis, and other techniques. The design of emojis should become increasingly intelligent, automatically selecting the most appropriate emoji based on the user's emotional state, thereby enhancing emotional resonance in the interaction.

2.3 The Emotional Connection Role of Emojis

Emojis, as non-verbal social cues in human-computer interaction, play a significant role in strengthening users' emotional connection. Research indicates that all human interactions involve emotions, including interactions with the material world. In human-computer interaction environments, emojis use anthropomorphic expressions to make AI agents more social, thereby reducing the psychological distance between humans and AI (Wang Xinlei, 2025).

Over time, emojis have evolved from simple symbolic text into multimodal forms combining text and images, making emotional expression more intuitive and rich. As a result, in AI interaction, emojis can more accurately convey the robot's emotional state, enhancing users' sense of immersion and identification.

People often perceive social robots as social entities and transfer social norms and expectations from interpersonal communication to their interactions with AI (Deng Jun, Yi Xinyan, et al., 2023). During human-computer interaction, the use of emojis by AI can increase its anthropomorphism, triggering users' social responses and making them more likely to accept and

trust AI companionship.
In emotional interactions, the use of emojis enhances users' perception of the AI's sociality and improves the overall user experience. Emojis can compensate for the limitations of text-based interaction, making AI expressions more vivid, thereby boosting users' engagement (Wang Xinlei, 2025). The contextual use of emojis also helps users better understand the robot's intentions, improving the fluency of the interaction.

3. Existing Emoji Design Cases in Companion Robots

3.1 NIO's In-Car Intelligent Robot NOMI

In smart interactive devices, NIO's in-car intelligent robot NOMI enhances interaction with users through a diverse range of emojis, strengthening emotional connections and improving the overall user experience during vehicle operation.

Visceral Level: Visual Intuitiveness and Emotional Triggers

The Visceral Level focuses on users' instinctive reactions and first impressions. NOMI's emojis feature a minimalist design with a black background and white lines, creating a sleek and futuristic aesthetic. By using expressive eyes, mouths, and additional symbols, NOMI conveys various emotional states. This design approach aligns with the user-friendliness emphasized in HCI theory, allowing users to quickly interpret NOMI's "emotions," thereby fostering a natural emotional bond.
Furthermore, the diversity of emojis enables NOMI to adapt to different scenarios, such as expressing happiness, confusion, contemplation, or celebration, adding playfulness to the interaction. This also reinforces the social cue function of emojis, allowing users to perceive the robot's "emotional feedback" even in non-verbal exchanges.

Behavioral Level: Interactive Experience and Social Presence

The Behavioral Level concerns product usability and the interactive experience. NOMI's emojis are not merely static emotional expressions—they dynamically adjust in real time based on driving conditions, user needs, and system feedback. For example:

During navigation, NOMI may display a focused expression.

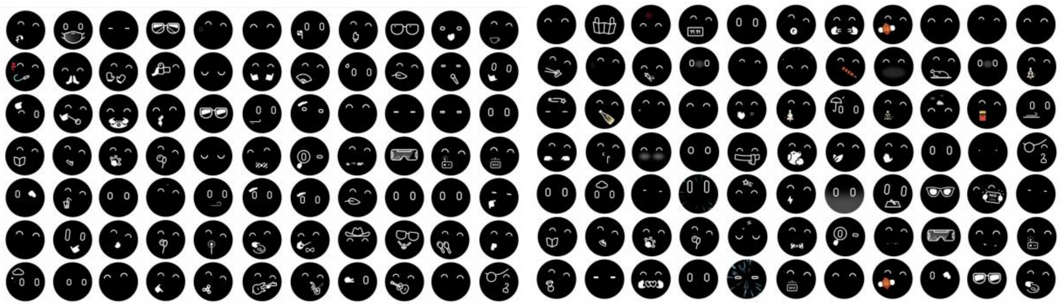
In relaxed driving scenarios, it might show a smile or a cheerful look to create a pleasant atmosphere.
This dynamic adaptability reflects the User-Centered Design (UCD) principle in HCI theory, as it optimizes the interaction experience according to users' behavioral patterns. Additionally, NOMI's emoji usage enhances social presence, making the interaction with the in-car AI system feel more like communicating with a human. This anthropomorphic design strategy boosts users'

social perception of NOMI, making them more likely to accept and trust the AI assistant.

Reflective Level: Brand Emotional Recognition and User Loyalty

The Reflective Level emphasizes users' long-term emotional identification with the product and brand loyalty. Through its emoji design, NOMI reinforces NIO's personalized brand identity, making it more than just a functional tool—it becomes an integral part of the user's daily driving experience.
Over time, as users repeatedly engage with NOMI, they develop a sense of familiarity and emotional attachment, strengthening their emotional bond with the NIO brand.

Overall, NIO's in-car intelligent robot NOMI achieves a highly anthropomorphic interaction experience by applying the three levels of emotional design. It captures attention through visual design (visceral level), enhances the interactive experience through dynamic interaction (behavioral level), and ultimately fosters long-term emotional loyalty (reflective level). This provides valuable insights for the future development of emotionally intelligent interactive products.



3.2 Emotional Analysis of Moxie Robot's Emoji Design

Visceral Level: Affinity and Emotion Recognition

Moxie features a soft blue-green color palette, adhering to child-friendly design principles. Its facial expressions, characterized by large eyes, arched eyebrows, and a variety of mouth shapes, create a high level of visual affinity. Moxie's smile can instantly convey positive emotions, attracting children's attention and reducing their sense of caution.
Additionally, Moxie adopts a cartoonish design for its facial expressions, avoiding the potential "uncanny valley effect" caused by overly human-like features. This makes Moxie more approachable and acceptable to children.

Behavioral Level: Dynamic Interaction and Emotional Feedback

Moxie offers dynamic facial expressions combined with voice and body movements for interactive communication. When children express their feelings, Moxie uses speech analysis to display corresponding facial expressions—such as furrowing its brows to indicate understanding or smiling to offer encouragement.

This real-time feedback mechanism enhances the interactivity between children and the robot, creating a more natural emotional resonance during use. Additionally, Moxie employs blinking, nodding, and tilting movements to accompany facial changes, making its emotional expressions more lifelike and authentic.

Reflective Level: Long-Term Companionship and Emotional Bonding

Moxie is not merely an instant-response interaction device—it offers long-term companionship, fostering deeper emotional connections. Through prolonged interaction, children gradually develop emotional attachment to Moxie’s facial expressions and voice style, even perceiving it as a "friend" or "mentor."

Moxie’s emoji design also incorporates Social Learning Theory, enabling it to adjust its emotional expressions based on children's moods. By observing and adapting to the child's emotional changes, Moxie delivers personalized emotional responses, strengthening the sense of companionship. This deeper interaction not only enhances children's social skills but also increases their trust and reliance on the robot.

Comparison with NOMI: Different Emotional Design Strategies

Although both Moxie and NOMI are AI companion robots, their target user groups and emoji design strategies differ significantly:

NOMI is designed for adult users in driving contexts, using symbolic emojis to quickly convey information.

Moxie, on the other hand, is designed for children, featuring highly anthropomorphic and dynamic facial expressions to enhance social interaction.

Both robots effectively deepen emotional engagement and user experience through emotion-centric design, but they do so in different usage scenarios tailored to their respective audiences.


4. Emotional Design Strategies for Robot Emojis

Instinctive Level:

A friendly and anthropomorphic visual style: Use soft colors and rounded shapes to reduce users' psychological defenses and enhance approachability. Draw inspiration from cartoon-style design by employing exaggerated facial expressions to strengthen intuitive emotional expression, enabling users to quickly recognize the robot's emotional state. Customize a variety of emoji styles based on users' cultural backgrounds and usage scenarios to cater to different preferences.

Behavioral Level:

The behavioral level focuses on dynamically responding to users' emotional needs during interactions. By linking voice tones, body movements, and emojis, the robot can express appropriate emotions in different contexts. Combining visual, vocal, and tactile feedback enhances the immersive experience of the emojis. Implementing a gradual change mechanism over time allows the robot to mimic human-like emotional shifts, making the interaction feel more natural.

Reflective Level:

Personalized learning and adaptive emoji adjustments: The robot optimizes its emoji response patterns based on user feedback and historical interaction data to better align with individual preferences. For example, if a user favors humorous styles, the robot can include more playful and funny expressions. Through anthropomorphic design, the robot fosters a sense of social connection, giving users a feeling of belonging. By incorporating emojis that evoke memories or familiarity based on users' interaction history, the robot strengthens emotional resonance.

5. Research Conclusion

With the advancement of AI technology, intelligent robots will play an increasingly important role in fields such as companionship, education, and healthcare. In the future, AI robots will not only need intelligent interaction capabilities but also focus on human emotional needs, enabling communication and expression in a more humanized manner.

Although this study systematically explores the emotional design of AI robot emojis, it has certain limitations. The research primarily analyzes the design concepts of the NOMI and Moxie robots, which may not be applicable to all AI robots. The scope of the user study is limited, as the research mainly relies on the analysis of existing cases, lacking extensive user testing and data validation. Therefore, it cannot fully assess the acceptance and preferences of different user groups toward AI robot emojis. Additionally, the study focuses on design strategies rather than the specific technical implementation of emoji animations.

Based on these limitations, future research can be optimized and expanded in the following directions:

Enhanced emoji generation with deep learning: By integrating deep learning technologies, the emoji generation mechanism of AI robots can be improved, allowing real-time adjustments based on users' emotions to achieve more natural interaction experiences.

User experiments for validation: Conducting user experiments to verify the effectiveness of emotional design strategies, especially regarding their applicability across different age groups and cultural backgrounds.

Exploration of multimodal emotional interaction: Combining visual, vocal, and tactile inputs to enhance AI robots' ability to perceive and express users' emotions.

This study provides a conceptual framework for the emotional design of AI robot emojis. Future research can further integrate artificial intelligence and affective computing technologies to develop warmer, emotionally resonant companion robots, truly achieving a "human-centered" intelligent interaction experience.

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