Original Article

The Impact of Emotional Experience on AI Product Perception

Olga Khryapchenkova

NIO Europe.

Corresponding Author : olga.khryapchenkova@nio.io

Abstract - This article examines the emotional aspects of user experience when interacting with AI, focusing on conversational AI and robotics, both with and without voice or physical embodiment. The key factors of emotional AI perception are explored, such as emotion detection, emotional design, AI anthropomorphization (including the uncanny valley effect), and how these influence empathy and cognitive trust. The role of chatbot persona, text-to-speech systems, and user mental models are also discussed, highlighting their impact on AI adoption, value realization, engagement, and the sense of companionship. The article offers insights for designing emotionally intelligent AI systems that promote positive human-AI interactions.

1. Introduction

As AI becomes increasingly integrated into daily life, understanding how humans emotionally perceive these technologies - especially humanlike systems with distinct personas- during interactions is crucial. From conversational agents to robotic systems, the design of AI interfaces can evoke emotions ranging from comfort and empathy to discomfort and unease.

Emotions play a significant role in shaping user experiences influencing trust, engagement, and adoption. Exploring how emotions affect perceptions of AI aims not only to enhance the effectiveness of these systems in performing their intended tasks, leading to more user-friendly interactions, but also to increase their naturalness and empathy, fostering a more enjoyable user experience that creates positive memories and boosts mood.

Though there has been some research in this area, given the novelty of the probabilistic conversational AI products and the user perception of those from a non-functional perspective, further, more extensive research is needed, which should combine a thorough literature review (combining the topics of affective computing, anthropomorphization, uncanny valley, and more) with real-world market examples.

At NIO, the user experiences in the car are always investigated, including digital experience, focusing on the smart cabin. This is why understanding the emotional, non-pragmatic, non-functional aspects associated with the perception of smart technologies, particularly the AI voice assistant NOMI, is of utmost importance.

This article aims to explore the scientific foundations of this topic, review relevant literature and practical studies, and offer insights into the best practices for designing conversational AI and robotics, blending scientific research with practical applications to benefit both professionals in the field and a broader audience, offering fresh perspectives on this multi-faceted topic.

2. Emotional Experience and AI Products: Scope of the Study

As an emotional experience, we understand users' feelings and emotional responses while interacting with products, services and systems. Along with cognitive experience, it plays a key role in user adoption, user engagement, user retention, value realization, customer satisfaction, and brand loyalty.

As measuring methodologies for emotional experience, particularly in sectors where customer satisfaction is paramount, multi-dimensional approaches are suggested [1]. They include questionnaires and other cognitive and behavioral measurements, such as behavioral observations, user interviews, self-reports, implicit association tests, brain activity measurements, and more.

Since user experience, normally manifested in the user interface (whether graphical, voice, physical, or another), is often an emotional touchpoint, creating a quantitative user experience map quantifies UX emotions. For that, describing "the emotional expression of user's behavioral touchpoints", as well as "accurately quantifying and visualizing the emotional experience of the user", is needed [2].

This article focuses on the emotional experience of AI-powered product perception, specifically conversational AI (products that use natural language understanding either within an intent-based system, with large language model integration, or as a hybrid architecture). These primarily include chatbots and voice assistants. Additionally, we examine humanoid and social robots, as their physical embodiment adds another layer to perception. In conversational AI, emotional experience is essential for driving user engagement and adoption (with further retention), helping to build trust, as well as a sense of connection, and increasing user satisfaction.

3. Computers and Emotions

Since the 1990s, when affective computing, as a technical means for recognizing, interpreting and responding to human emotions with machines, came to the research and development scene, emotional AI topics have been of interest to both researchers and industry, integrating machine learning algorithms with psychology, neuroscience and linguistics. It refers to AI systems capable of recognizing human emotions and processing this information (interpreting it and responding to it) through sensors, AI and multimodal data. It saw a real boom when generative capabilities enhanced conversational AI, mainly in the 2020s. KIT, TUM, MIT, University of Stanford, Google, IBM and many more companies and research institutions invest their resources into emotional AI and related technologies. China is another big player in this topic, with Tsinghua University, Chinese Academy of Sciences and Peking University as players, studying topics like emotional AI in HCI and context-specific emotional experience [3], user experience aspects, measurement of emotions, and more

Emotion detection, a key topic within emotional experience in HCI, has recently gained increased attention, particularly with the EU AI Act classifying certain applications of emotion detection as high-risk.

AI perception in sensitive user data fields—such as banking, customer service, marketing, smart home assistants, and voice assistants—raises concerns about data privacy, manipulation, bias, and misinterpretation, which should not be overlooked. These issues form a significant field of study on their own and are closely linked to transparency and consent, which will be discussed later in the article. For the purpose of this study, the scope in this regard will be kept limited.

Despite these concerns, the industry remains vast, including both foundational technologies and downstream applications. Some solutions focus on image processing, others specialize in vocal pattern and intonation recognition, while some combine facial expression analysis with vocal cues for a more comprehensive approach. These technologies are applied across various industries, from media and automotive to healthcare and entertainment, serving diverse purposes, such as assessing consumer reactions (with real-time or delayed analytics), improving customer service, enhancing safety, and optimizing user experience.

While emotion detection aims to recognize specific emotional states across multiple modalities, another closely related approach, sentiment analysis (as part of the affective computing and also natural language processing field), focuses primarily on interpreting affective meaning from text. Combining traditional machine learning models with deep learning helps companies improve their experience based on customer opinion detection: increased customer engagement, crisis management, customer retention, churn rate reduction, proactive customer service, feedback loops, feature enhancement, marketing campaign planning and optimization, building connections, storytelling, sales strategy improvement, and much more.

By responding to human emotions and intentions, empathetic computing goes one step further than emotion detection and sentiment analysis, fostering more natural and emotionally aware interactions between humans and machines. It emerges as a new paradigm that enables machines to know who, what, where, when and why so that machines can anticipate and respond to our needs gracefully [4]. It comprises contextual query understanding, user understanding, and interpersonal response generation [5]. Since, in the end, everything is done for the users, the mental models of users (according to which people perceive the world by applying certain clues underlying their brain's behavior, whether with a focus on internal mental processes or cognitive phenomena) are a significant factor in the usability and persistence of usage, as well as in the long-term adoption.

Depending on how exactly the voice assistant is used, empathy (like a friend's) or actual help in problem-solving (as a secretary's) can be more important to the users. Different results can be achieved by combining certain qualities of voice and attitude with certain types of response content [6]. Some studies show that "empathetic and reassuring expressions from a digital assistant can compensate for the lack of human-to-human interaction in such services" [7]. Digital assistants providing emotional support can increase customer satisfaction and persistence on tech-related tasks, which helps the brand in two ways: helping the users and making them feel good.

Measuring how the users' mental models work towards evaluating robots and assistance and responding to those is difficult. However, possible ways of such measuring are "(a) scales for rating anthropomorphic and mechanistic dimensions of people's mental model of a robot, (b) measures of mental model richness or certainty, and (c) measures of compliance with a robot's requests". All of these should contribute to understanding the social and cognitive nature of user-AI interactions [8].

4. Emotional Design

Emotional design, as "a means to establish consumer expression, and as a representation of the user's identity or

personality" [9], includes three dimensions, following Don Norman's approach:
- visceral (immediate reactions based on the aesthetics of a product),
- behavioral (usability and functionality of a product), and
- reflective (emotional connections to the product in a long-term perspective, based on personal, cultural, and social aspects - on beliefs, habits and acquired experience in general).

Visceral design concerns itself with appearances [...] Behavioral design has to do with the pleasure and effectiveness of use [...] Finally, reflective design considers the rationalization and intellectualization of a product. Can I tell a story about it? Does it appeal to my self-image, to my pride?..." [10].

The term is often connected to affective design, which focuses on creating products that evoke emotions in users.

NIO's AI voice assistant NOMI, with the friendly animated interface, including emojis - an emotional user interface - for NOMI Mate or light for NOMI Halo, displays an example of such design. It provokes immediate user reactions by its physical qualities (triggering experiences through different senses, such as visual and audio), convinces the user with its functionality and usability (typical voice capabilities: wake-up-word detection, automatic speech recognition, natural language understanding, HMI behavior, text-to-speech, smart voice, and - last but not least - integrated large language models). Personalization (e.g. user nickname), context awareness (e.g. in the multi-round chitchat feature), and entertainment options (jokes and other content) all contribute to the reflective dimensions of the emotional design.

5. Does AI Need a Face? A Word on Anthropomorphization

To enhance usability and make interactions with the product more enjoyable while establishing a deeper emotional connection with the user, brands often design AI products to mimic human behavior. The goal is to trigger similar neural responses in the brain during human-to-human interaction, prompting the body to activate the same neurons that engage when talking to a person. Ideally, this AI interaction should stimulate both basic and secondary emotions, engaging both subcortical and cortical brain areas, respectively. Emphasizing the cognitive component is crucial to ensure that the conversation feels authentic.

In product design and development, this authenticity is created mostly by functional and emotional experience.

Functional experience manages to convince the user because it helps solve the problem, thus creating cognitive trust. Feature usability, accuracy, stability, and a good feature portfolio are important in this regard [11, 12]. Emotional experience, per se, brings the user some added value, too: it is mostly translated into a good mood and into

something that can be called emotional trust, as opposed to cognitive trust (eventually complementing it). "... Trust is significantly and positively correlated with AI virtual assistant acceptance, and its ability to reduce users' negative emotions toward AI virtual assistants plays a key role in improving AI virtual assistant acceptance" [13]. Perceived anthropomorphization might influence the user's emotional attachment towards the product [14].

Anthropomorphic forms can be defined as "structural (is there a body part?), character (does it imitate human relationships?), gestural (is there action or expression?), and aware (does it appear to be aware?)." [15].

The impact of anthropomorphization varies across cultures. In many Asian cultures, there is greater curiosity about humanlike AI that exhibits less control and more unpredictability, creating opportunities for exploration and engagement. In contrast, Western cultures often approach AI and technology more pragmatically, prioritizing functionality over emotional or humanlike traits. Emotional aspects of AI in these contexts are often dismissed as gimmicks or distractions. Instead, control, reliability, and minimalistic design tend to be more highly valued, reflecting the "less is more" lifestyle trends in these societies. The uncanny valley threshold is generally lower, making overly humanlike AI less appealing.

A prominent example of such cultural differences found at NIO is that Chinese users seem more tolerant towards chimes and proactive NOMI speaking. In contrast, European users are more minimalist in this regard. Our experience at NIO has shown that Chinese users are more likely to relinquish control, allowing smart assistants to surprise them. In contrast, European users prefer to maintain control over technology, favoring more toggles to deactivate functions, often coupled with greater awareness of data security, which is reflected in the UXUI design.

Anthropomorphization is pervasive, extending beyond conversational AI. Nowadays, people apply social and emotional responses (earlier reserved to human-to-human communication only) to communicate with all types of technology, suggesting similar psychological mechanisms functioning there [16]. It extends further to personifying recommendation algorithms (e.g., "My app is so smart, it always knows the right song for me" or "So creepy - my e-commerce app just suggested headache relief products; how does it know I have a headache?"), as well as stock market prediction algorithms, assisted driving systems, navigation apps, and more.

How do we leverage it for usability enhancement? Exploring a fictional smart assistant, Kiro, a group of researchers from the University of Siegen in Germany, found that using design fiction is valuable in developing emotionally engaging AI, as it allows designers to question assumptions and explore potential user experiences and emotional dynamics before actual development [17]. Besides positive factors, the anthropomorphization of AI products can also become a lightning rod for users'

frustration and anger. If the frustration level of the system increases, the chatbot can be blamed for the system's inefficiencies and failures. It could result in cursing or addressing the chatbot as if it were a customer service representative after a poor user experience. An experiment conducted on this topic shows that "an increase in the average level of anger exhibited by the consumer during their session resulted in a lower level of satisfaction with the service encounter, but only when the chatbot was treated anthropomorphically. In situations where the bot was not treated anthropomorphically, higher levels of anger did not meaningfully affect consumer satisfaction" [18]. Considering, of course, the limitations of this experiment, it still gives food for thought to the brands who choose human likeness as a way of bonding with their customers. Though some negative effects are possible, anthropomorphization can still be considered a power tool, which is also confirmed experimentally, e.g. in a study from 2022 concerning commercial chatbots, "the results confirm the vast potential of anthropomorphic cues in chatbot applications and show that they are positively associated with customer satisfaction and mediated by the variables enjoyment, attitude, and trust" [19]. Paired with brand research and choosing the right visual representation, as well as based on careful UX research, the human-likeness of conversational AI can achieve truly great results.

Anthropomorphization is just one side of the story, seen from the developer's perspective. How users actually personify it opens up limitless possibilities, but, on the other hand, "encouraging users to relate to automated systems as if they were human can lead to high-risk scenarios caused by over-reliance on their outputs" [20]. Different groups of users can opt for more or less anthropomorphization, and often, users decline the humanlike agent option towards a classic device [21].

6. The Uncanny Valley Effect

Within the anthropomorphization of AI, the uncanny valley effect - "feeling of eeriness and discomfort towards a given medium or technology that frequently appears in various kinds of human-machine interactions" [22] - is an issue to be properly addressed, risking otherwise mismatched expectations, broken trust, and cognitive dissonance, as significant consequences to the brand.

Based on amygdala-rejection signals and responses, the uncanny valley is a psychological framework showing the non-linearity of artificial agent acceptance by users, which, according to some research, may be the result of nonlinear value-coding in the ventromedial prefrontal cortex, one of the crucial components of the brain's reward system [23].

It's also connected to the intentions, to the aesthetics, as well as to the cultural context [24]. Supported by art and fiction, it paved the way for people's fear of artificial intelligence. Along with the cognitive and sociocultural components, the moral aspect also plays a role in this topic. Thus, "moral decisions of robots appearing humanlike tend to be depreciated, compared with humans and artificial-

looking robots making the same decisions" [25]. There will undoubtedly be more research in the future as AI bots continue to advance and societal attention towards them increases.

For companion bots, some research suggests that after the users get more familiar with those (and become long-term users, as opposed to first-time users) and as their engagement grows, the uncanny valley effect tends to reduce. People become more comfortable and at ease. While both anthropomorphism and AI authenticity are crucial for user engagement in the long term, sparking curiosity and positive surprise is essential for encouraging initial usage. It, of course, also might depend on the motivation behind those people using the chatbot in the first place, sometimes deviating from the original purpose the chatbot was designed for (that might have to do with social motivation dominance), but balancing the human-likeness (as adherence to social norms) and moving within the tech boundaries (to mitigate the uncanny valley) is one of the clues towards successful conversational AI design [26, 27]. UX research and cultural awareness are crucial in mitigating the uncanny valley effect by helping design more relatable and culturally resonant AI interfaces.

7. Cultural Differences in AI Perception

Along with the task context (as well as with the emotional design decision of product creators), cultural background also plays a paramount role in attributing personality traits to technology [28]. In some cultures, humanlike AI is seen as a gimmick. In others - it's widely accepted. There are many possible reasons for this acceptance, such as tapping into the inner child of the user, the joy of experiencing cutting-edge technologies in everyday life, the desire for more intuitive interactions that the user can relate to, enhanced trust through comfort, satisfying the need for social connection, and more. Some users are early adopters, driven by curiosity about new technology and a testing mindset as they engage with the product.

Some research suggests that the concepts of consciousness, human likeness and responsiveness (which are important within the anthropomorphization discussion) are different between Western and Eastern Asian individuals: "The first would consider these concepts through an anthropocentric view while the latter would have a less human centred view" [29].

Chinese and German users, for example, may have different understandings of enjoyable user interfaces due to factors like power distance, masculinity, gender perception, or uncertainty avoidance. These cultural differences can be considered ineffective UI recommendations, for example, for in-car interfaces. Research shows that even in highly functional cases, such as parking or navigation (reactive scenarios) or certain proactive scenarios (which, contrary to common assumptions, are not necessarily paternalistic), users prefer UIs that account for not only pragmatic but also emotional and even hedonic aspects [30].

8. Can We Be Friends, or Are You Just a Tool? Cognitive Trust and Beyond

What are the possible positive consequences of AI anthropomorphization, taking product engagement to the next level? Depending on the product, those can be classified into customer experience-related (giving satisfaction, switching intentions, continuance intentions, compliance as examples) and relational (attachment, love, appreciation, friendship). While these categories are correlated, their relationship is not always linear [31]. While customer experience-related ones are of primary importance for most brands, emotional side effects (or, for some products, primary effects) are quite significant, too, especially in the long-term perspective.

Can we take it further and speak about companionship between humans and AI companions? This discourse examines the intersection of human emotions and machine interaction. While AI can simulate emotional connections and offer companionship, true emotional reciprocity remains (at least) quite one-sided due to machines' absence of consciousness and genuine feelings. Nevertheless, the growing sophistication of AI technologies is challenging traditional notions of these bonds, raising new questions about affection, attachment, and trust in human-AI relationships.

Of course, a deterministic chatbot cannot achieve levels of intimacy such as friendship or love. But which chatbot or voice assistant can? Research suggests that multiple factors must come together to enable long-term emotional bonding. For example, one relevant study states: "We established a set of necessary conditions that these robots must meet to elicit this type of love in humans. The set includes visual similarity, speaking and kinesthetic skills, and emotional, social, and cultural intelligence. If these conditions are met, a synthetic android can simulate human life..." [32]. Such findings highlight that achieving deep emotional connections with AI requires a combination of advanced capabilities.

But does the user need to know the technology behind and does such knowledge destroy the magic? Research demonstrates that users are more likely to trust an AI product when they understand how the technology behind it works, as this builds cognitive trust. For voice assistants, transparency in data processing, learning mechanisms, and interactions is crucial for fostering trust. This is especially important for older populations, who may feel left behind in understanding such technology. Research shows that involving users in co-creating the assistant and explaining its functionality could positively impact acceptance [33]. Other examples include clearly explaining data usage and storage, employing explainable AI (XAI) to clarify decision-making, and providing robust privacy controls that allow users to manage their data. Understanding AI systems holistically is a crucial yet unsatisfied societal need. Mechanistic interpretability is among the closest methods to addressing it, though it requires future improvements to fully resolve this gap [34].

The willingness to connect with AI extends beyond cognitive trust, perceived usefulness, and understanding of technology. Emotional responsiveness and personalization foster a sense of connection by making the AI feel relevant and attuned to the user's needs. Reliability and consistency build trust, while non-judgmental responses create emotional safety, encouraging openness. Ease of use reduces interaction friction, and transparency about the AI's capabilities helps manage expectations. These factors enhance user engagement and strengthen the bond between humans and AI.

Additionally, novelty and intrigue attract users seeking fresh or unique experiences, enhancing their willingness to connect. It all boils down to well-being and addiction, influenced by individual factors (vulnerability and such), technology (how the chatbot is), and relational (the history of the relationship with this AI so far [35]. Linked to novelty, surprise plays an important role in shaping AI product perception. It impacts interaction dynamics, increasing engagement through naturalness, capturing interest, prompting exploration, enhancing the feeling of social presence, and, when positive, elevating happiness during and after use. Humour, as a special manifestation of surprise, plays a critical role in the dynamics of interactions between AI and humans, creating a more meaningful and lasting relationship between the consumer and the product.

9. Persona and Voice

When considering the emotional aspects of AI perception, it's important to acknowledge that emotions are often better conveyed through voice [36], as it adds an extra dimension for possible connection between the user and the product. Stress, pitch, tone, intonation, segment length, volume, and pauses are all crucial elements in this perception. They influence how effectively AI conveys emotions and - ideally - elicits the desired emotional response from the user. While within deterministic bots with traditional intent-based architecture, all this is easier to control, and probabilistic chatbots can still be influenced.

The output is not fully controlled, but the right TTS model can be picked, reflecting the brand's and conversational designer's requirements. With hardcoded answers of a deterministic chatbot (e.g. for high-frequency use cases), to make the prompt sound more natural, it might make sense to listen to the designed voice assistant answer in the TTS synthesizer and then reformulate to change the orthography or to put another punctuation mark. For extremely high-traffic cases, especially where embedded support is needed, prerecording might be an option. The speed of the prompt broadcasting is important, too, and this can be adjusted in collaboration with the TTS model provider.

For our AI smart assistant, voice is paramount, and a lot of attention is paid to the vocal qualities, like the scales between rich and flat, hoarse and smooth, enthusiastic and calm, empathetic and independent, exploring and disciplined, casual and formal. The voice's gender is female,

which, of course, has implications for persona perception. Like gender, the persona's age, as conveyed through voice, becomes especially important in advice-giving contexts, such as the car. Our experience shows that, for example, Chinese users tend to choose voice assistants with younger personalities and voices than European users, who prefer mature ones.

However, the impact of voice on AI perception is not uniform across all individuals. In one study, participants rated the human-voiced computer more positively. They were more likely to follow its suggestions compared to the strongly synthetic voice. However, this effect was observed only among those with a less analytical or more intuitive cognitive style. This suggests that individual differences influence susceptibility to anthropomorphic cues in the interface [37].

Another factor of AI anthropomorphization that is not to be overlooked is gender: whether the assistant has a male or female personality, it's perceived differently by different demographic groups. Research supports the idea that the "right" gender for the target audience can have a positive impact on chatbot perception [38]. It's especially prominent for voice assistants, where text-to-speech technology strongly supports the persona. This can be particularly sensitive with AI assistants that provide advice, such as in-car assistants offering turn-by-turn navigation or ADAS feedback. In some cultures, there may be resistance to women's voices, giving driving instructions to men and highlighting the importance of culturally aware design. Voice replication, too, is a technology whose acceptance is arguable and society- and culture-dependent.

Voice interaction design is also impacted by the modality of the assistant: whether it's a smart home assistant, a phone assistant, or an in-car assistant, voice can be different to reflect different personas, different use cases, different perception scenarios and possible user preferences. Some experiments (e.g. [39]) confirm that those preferences and perceptions are different across devices, which encourages personalization.

Voice per se is just another perception dimension, but what makes it truly important is the personality it reflects. In a study on bot personality reflection in neural speech synthesis, it was confirmed that both perceived extroversion and agreeableness in such voices were affected significantly by altering the bot's personality trait features. Naturalness is a paramount aspect in this regard, and personality traits are correlated with each other [40].

In addition to enhancing emotional experience and enabling more natural human conversation, the voice in bots reduces friction in information processing, promotes greater inclusivity, and improves accessibility. For example, it supports individuals with visual impairments, helps people with dyslexia by offering alternative formats, and enables hands-free communication, essential in scenarios like in-car conversations. It also saves time, as voice interactions are typically faster and reduce the need for screen time, which is crucial in today's fast-paced society yet striving for minimalism.

In persona constitution, archetypes (roles) also play their part. Some researchers divide between butler, aunt, friend and admirer, working with dimensions "equivalent - subordinate" and "formal - casual" [41]. Others [42] go back to the theory of Jung and analyze the associated personalities with archetypes such as creator, caregiver, wizard, explorer, and more, and show attributes indispensable for representing the personality of some voice assistants present on the market: practical, informed, up-to-date, well-mannered, logical and helpful. Such research provides valuable insights for brands that use chatbots and voice assistants with strong personas, emphasizing the importance of emotional experience in user engagement. Different emotional effects can be achieved by altering various aspects and dimensions based on UX research.

10. Physical Embodiment and Perception Effects

In robotics, studies comparing physical and simulated embodiments reveal differences in product perception, highlighting factors like task focus and enjoyment [43]. Other research shows that physical embodiment fosters perceptions of the robot as helpful, attentive, and engaging [44].

With NOMI, the experience is taken beyond voice, extending itself into the physical world through a dynamic physical embodiment. By integrating an adaptive emotional UI and 3D movement (including both horizontal and vertical rotations), NIO aims to express its core design principles: human, pure, progressive, and sophisticated. This holistic approach helps create a seamless, intuitive, multi-sensory experience integrated into the smart cabin - a crucial aspect for cars where space is key. Of course, physical embodiment is not a must and may not suit all cases. However, when used appropriately, it can constitute another channel for expressing product principles and connecting the brand with its users.

At NIO, it was observed that making the in-car voice assistant physically embodied—beyond its anthropomorphized personality—leads the users to attribute more distinct qualities to it.

Here are some prominent examples of those attributions that were communicated by the users through different channels (NIO app, social media, user meetings, explicitly or implicitly):

1. Digital co-driver / co-pilot/pilot/assistant to the driver (the feeling of the presence in the car, especially during long-distance driving alone, particularly at night, e.g. "NOMI keeps the right distance to the car in front);
2. Travel companion/buddy;
3. A creature that can feel emotions (e.g. "NOMI is tired", "NOMI had the last laugh");

4. Host of the car/atmosphere creator (e.g. "NOMI makes the mood in the car friendlier");

5. Brand representative/brand outstanding feature ("Unique feature that is easy to remember", "Hi NOMI, what's your next car model"), representative of the team behind, user feedback receiver;

6. Car guard (stays in the car at all times);

7. Curiosity point for kids (tells stories to the children, keeping them busy and entertained) and a humor artifact;

8. Physical center of attention and connection in the car;

9. An alternative entry point for the functions (menu facilitator);

10. Navi map owner;

11. DJ and dancer;

12. Memory of the car;

13. Additional product belonging to the user;

14. A knowledge source, a connection to the world, an Internet connection point;

15. Extension of the user's digital life.

All of this suggests that the human brain tends to perceive conversational AI as similar to itself, attributing humanlike qualities to the AI based on voice, visuals, interaction style (incl. vocabulary choices), physical embodiment and other emotional cues. When designing human-machine interactions in cars, it's crucial to consider these aspects to enable smooth, productive, and enjoyable conversations between the users and the smart assistant.

11. Latency

Response time is critical in shaping user perceptions and emotional experiences in human-computer interaction. As users increasingly engage with AI systems like chatbots, the timing of responses significantly influences whether interactions are perceived as smooth, natural, and satisfying.

Striking the right balance in response latency is essential, as it impacts not only user satisfaction but also trust and the overall perception of the AI's intelligence and emotional sensitivity.

A large latency creates a negative impression because it feels unnatural and not human. Long waiting times can lead to negative responses and frustration [45]. However, responses that are too fast, especially in emotionally charged contexts like psychological conversations, can also seem unnatural. Striking the right balance is crucial for comfortable interaction. While latency shouldn't be artificially extended, it should allow enough time for users to process the audio information.

Ideal latency varies across different age groups [46], with young adults being more used to fast-paced environments and older generations sometimes still struggling to keep up with AI speed.

12. AI Disclosure and Transparency

Among all, human behavior towards chatbots and the perception of those are impacted by the sense of agency - a feeling of having control of one's actions [47]. The users need to be informed that they are conversing with an AI system, ensuring transparency and accountability in AI usage, even if this AI disclosure can inadvertently diminish emotional engagement and undermine the perceived emotional value of the interaction. While AI can help people feel heard, the mere presence of an AI label can reduce the emotional impact and user connection during the interaction [48]. Nevertheless, from both legal and ethical standpoints (particularly under the EU AI Act, which, among other aspects, emphasizes transparency and accountability), it's the only correct course of action.

Ultimately, it comes down to skepticism: for example, people are cautious about headlines labeled as AI-generated, even when the content is factually accurate or human-created. This skepticism stems from the belief that such content is entirely automated by AI, leading to concerns about its authenticity and reliability [49].

On the other hand, knowing that they are interacting with an AI, which cannot judge or reject them, can be quite liberating for users. There is less trust compared to interacting with a human conversation partner and less fear of exposure and vulnerability, as the anonymity of AI interactions can provide a sense of security [50]. Moreover, the availability problem is solved, and the AI can be talked to at any time without the user feeling guilty for disturbing other people during the night.

This effect is further amplified when the AI chatbot, through intentional UX design (conversation flows or prompt engineering) or through adapting to contextual factors during the conversation (such as recognizing emotional cues in real-time), reciprocates by sharing or acknowledging similar experiences. Rather than being fixed in the prompt, these adaptive, context-driven self-disclosures create a deeper emotional connection, enhancing the user's feeling of being understood [51].

Research indicates that the manner in which AI (especially in robotic forms) is presented to observers has a greater impact on social inclusion than prior knowledge of the technology itself [52].

What about the conversation with deterministic (rule-based or partly rule-based) systems, as opposed to fully probabilistic systems? First, people often don't know the difference, and/or after November 2022, when ChatGPT became publicly available, most chatbots are expected to be probabilistic. When users know they are interacting with a generative AI, their perceptions may be influenced by expecting more surprising responses. Of course, in less emotional contexts, within fixed domains (e.g. banking or travel chatbots), users normally prefer reliable routines, high performance and robustness over novelty and flexibility. While limitations, such as lack of support for multi-round conversations or anaphora resolution, can reduce perceived smartness and naturalness, still easier control over the persona and predictable user experience scenarios can mitigate the lack of response options and humorous,

surprising, variable responses. Paired with output control and reduced risks of brand exposure, deterministic chatbots continue to be a valuable option, offering consistent and reliable interactions.

13. Conclusion

This article aims to comprehensively examine how emotional aspects shape human perception of AI, particularly in interactions with AI voice assistants. It explores key factors such as anthropomorphization, the uncanny valley, latency, persona and voice qualities, persona archetypes, emotional design, emotion detection, AI disclosure, and cultural differences, each playing a crucial role in user engagement and trust. By analyzing real-world examples, the article highlights current challenges and opportunities in designing emotionally resonant AI, which could be of practical use for AI product managers, UX/UI designers, conversational designers, testers, developers, UX researchers and people interested in theory and practice of conversational AI product development, chatbots, and voice assistants (whether deterministic, probabilistic or hybrid). Future research could focus on refining AI's emotional intelligence and adapting interactions to diverse cultural and social contexts.

References

[1] Dai-In Danny Han, and Xander D. Lub, "Measuring User Experiences (UX) through Emotion Measurements," *4th World Research Summit for Tourism and Hospitality*, 2017. [Google Scholar]

[2] Faren Huo et al., "A User Experience Map Design Method Based on Emotional Quantification of In-Vehicle HMI," *Humanities and Social Sciences Communications*, vol. 10, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[3] Lilu Tang, Peijun Yuan, and Dan Zhang, "Emotional Experience during Human-Computer Interaction: A Survey," *International Journal of Human-Computer Interaction*, vol. 40, no. 8, pp. 1845-1855, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[4] Yang Cai, and Julio Abascal, *Ambient Intelligence in Everyday Life*, Springer, pp. 67-85, 2006. [CrossRef] [Google Scholar] [Publisher Link]

[5] Li Zhou et al., "The Design and Implementation of Xiaoice, An Empathetic Social Chatbot," *Computational Linguistics*, vol. 46, no. 1, pp. 53-93, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[6] Dasom Park, and Kiechan Namkung, "Exploring Users' Mental Models for Anthropomorphized Voice Assistants through Psychological Approaches," *Applied Sciences*, vol. 11, no. 23, pp. 1-32, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[7] Katja Gelbrich, Julia Hagel, and Chiara Orsingher, "Emotional Support from a Digital Assistant in Technology-Mediated Services: Effects on Customer Satisfaction and Behavioral Persistence," *International Journal of Research in Marketing*, vol. 38, no. 1, pp. 176-193, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[8] Sara Kiesler, and Jennifer Goetz, "Mental Models and Cooperation with Robotic Assistants," pp. 1-8, 2001. [Google Scholar]

[9] Amic G. Ho, and Kin Wai Michael G. Siu. "Emotion Design, Emotional Design, Emotionalize Design: A Review on Their Relationships from a New Perspective," *The Design Journal*, vol. 15, no. 1, pp. 9-32, 2012. [CrossRef] [Google Scholar] [Publisher Link]

[10] Donald Norman, *Emotional Design: Why We Love (or Hate) Everyday Things*, Basic Books, pp. 1-257, 2004. [Google Scholar] [Publisher Link]

[11] Joakim Eklund, and Fred Isaksson, "Identifying & Evaluating System Components for Cognitive Trust in AI-Automated Service Encounters : Trusting a Study & Vocational Chatbot," 2019. [Google Scholar]

[12] Kem Z.K. Zhang et al., "Cognitive Trust, Emotional Trust and the Value-Based Acceptance Model in Mobile Payment Adoption," *ICEB 2015 Proceedings*, Hong Kong, SAR China, pp. 166-174, 2020. [Google Scholar] [Publisher Link]

[13] Shiying Zhang et al., "Motivation, Social Emotion, and the Acceptance of Artificial Intelligence Virtual Assistants—Trust-Based Mediating Effects," *Frontiers in Psychology*, vol. 12, pp. 1-10, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[14] Xiwei Wang et al., "Role of Emotional Experience in AI Voice Assistant User Experience in Voice Shopping," *Wisdom, Well-Being, Win-Win*, pp. 174-190, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[15] Carl DiSalvo, Jodi Forlizzi, and Francine Gemperle,, "Kinds of Anthropomorphic Form," *Futureground - DRS International Conference*, Melbourne, Australia, 2004. [Google Scholar] [Publisher Link]

[16] Byron Reeves, and Clifford Nass, "The Media Equation: How People Treat Computers, Television, and New Media Like Real People and Places," *Center for the Study of Language and Information*, Cambridge University Press, 1996. [Google Scholar] [Publisher Link]

[17] Ronda Ringfort-Felner et al., "Kiro: A Design Fiction to Explore Social Conversation with Voice Assistants," *Proceedings of the ACM on Human-Computer Interaction*, vol. 6, pp. 1-21, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[18] Cammy Crolic et al., "Blame the Bot: Anthropomorphism and Anger in Customer-Chatbot Interactions," *Journal of Marketing*, vol. 86, no. 1, pp. 132-148, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[19] Katharina Klein, and Luis F. Martinez, "The Impact of Anthropomorphism on Customer Satisfaction in Chatbot Commerce: An Experimental Study in the Food Sector," *Electronic Commerce Research*, vol. 23, pp. 2789-2825, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[20] Gavin Abercrombie et al., "Mirages: On Anthropomorphism in Dialogue Systems," *Proceedings of the 2023 Conference on Empirical Methods in Natural Language Processing. Association for Computational Linguistics*, Singapore, pp. 4776-4790, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[21] Corina Pelau, and Irina Ene, "Consumers' Perception on Human-Like Artificial Intelligence Devices," *Munich Personal RePEc Archive*, pp. 197-203, 2018. [Google Scholar] [Publisher Link]

[22] Leon Ciechanowski et al., "In the Shades of the Uncanny Valley: An Experimental Study of Human-Chatbot Interaction," *Future Generation Computer Systems*, vol. 92, pp. 539-548, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[23] Astrid M. Rosenthal-von der Pütten et al., "Neural Mechanisms for Accepting and Rejecting Artificial Social Partners in the Uncanny Valley," *Journal of Neuroscience*, vol. 39, no. 33, pp. 6555-6570, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[24] Valentin Schwind, "Historical, Cultural, and Aesthetic Aspects of the Uncanny Valley," *Collective Agency and Cooperation in Natural and Artificial Systems*, vol. 122, pp. 81-107, 2015. [CrossRef] [Google Scholar] [Publisher Link]

[25] Michael Laakasuo, Jussi Palomäki, and Nils Köbis, "Moral Uncanny Valley: A Robot's Appearance Moderates How its Decisions are Judged," *International Journal of Social Robotics*, vol. 13, pp. 1679-1688, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[26] Andreea Muresan, and Henning Pohl, "Chats with Bots: Balancing Imitation and Engagement," *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, pp. 1-6, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[27] Iryna Pentina, Tyler Hancock, and Tianling Xie, "Exploring Relationship Development with Social Chatbots: A Mixed-Method Study of Replika," *Computers in Human Behavior*, vol. 140, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[28] Astrid Weiss, and Vanessa Evers, "Exploring Cultural Factors in Human-Robot Interaction: A Matter of Personality?," *2nd International Workshop on Comparative Informatics*, Copenhagen, Denmark, pp. 1-7, 2011. [Google Scholar] [Publisher Link]

[29] Nicolas Spatola, Serena Marchesi, and Agnieszka Wykowska, "Different Models of Anthropomorphism across Cultures and Ontological Limits in Current Frameworks the Integrative Framework of Anthropomorphism," *Frontiers in Robotics and AI*, vol. 9, pp. 1-16, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[30] Michael Braun et al., "What If Your Car Would Care? Exploring Use Cases for Affective Automotive User Interfaces," *22nd International Conference on Human-Computer Interaction with Mobile Devices and Services*, pp. 1-12, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[31] Iryna Pentina et al., "Consumer-Machine Relationships in the Age of Artificial Intelligence: Systematic Literature Review and Research Directions," *Psychology & Marketing*, vol. 40, no. 8, pp. 1593-1614, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[32] Tõnu Viik, "Falling in Love With Robots: A Phenomenological Study of Experiencing Technological Alterities," *Journal Paladyn, Journal of Behavioral Robotics*, vol. 11, no. 1, pp. 52-65, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[33] Lorena Colombo-Ruano et al., "Technological Acceptance of Voice Assistants in Older Adults: An Online Co-Creation Experience," *Proceedings of the XXI International Conference on Human Computer Interaction*, Málaga, Spain, pp. 1-5, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[34] Lena Kästner, and Barnaby Crook, "Explaining AI through Mechanistic Interpretability," *European Journal for Philosophy of Science*, vol. 14, no. 52, pp. 1-25, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[35] Hannah R. Marriott, and Valentina Pitardi, "One is the Loneliest Number… Two can be as Bad as One. The influence of AI Friendship Apps on Users' Well-Being and Addiction," *Psychology & Marketing*, vol. 41, no. 1, pp. 86-101, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[36] Michael W. Kraus, "Voice-Only Communication Enhances Empathic Accuracy," *American Psychologist*, vol. 72, no. 7, pp. 644-654, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[37] Eun-Ju Lee, "The More Humanlike, The Better? How Speech Type and Users' Cognitive Style Affect Social Responses to Computers," *Computers in Human Behavior*, vol. 26, no. 4, pp. 665-672, 2010. [CrossRef] [Google Scholar] [Publisher Link]

[38] Adnan Zogaj et al., "It's a Match! The Effects of Chatbot Anthropomorphization and Chatbot Gender on Consumer Behavior," *Journal of Business Research*, vol. 155, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[39] Qinglin Liao et al., "Comparing the User Preferences Towards Emotional Voice Interaction Applied on Different Devices: An Empirical Study," *Human-Computer Interaction. Multimodal and Natural Interaction*, pp. 209-220, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[40] Shilin Gao et al., "Synthesising Personality with Neural Speech Synthesis," *Proceedings of the 24th Annual Meeting of the Special Interest Group on Discourse and Dialogue*, pp. 393-399, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[41] Michael Braun et al., "At Your Service: Designing Voice Assistant Personalities to Improve Automotive User Interfaces," *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, pp. 1-11, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[42] Marta Perez Garcia, Sarita Saffon Lopez, and Hector Donis, "Voice Activated Virtual Assistants Personality Perceptions and Desires: Comparing Personality Evaluation Frameworks," *Proceedings of the 32nd International BCS Human Computer Interaction Conference*, pp. 1-10, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[43] Joshua Wainer et al., "The Role of Physical Embodiment in Human-Robot Interaction," *ROMAN 2006 - The 15th IEEE International Symposium on Robot and Human Interactive Communication*, Hatfield, UK, pp. 117-122, 2006. [CrossRef] [Google Scholar] [Publisher Link]

[44] Joshua Wainer et al., "Embodiment and Human-Robot Interaction: A Task-Based Perspective," *ROMAN 2007 - The 16th IEEE International Symposium on Robot and Human Interactive Communication*, Jeju, Korea, pp. 872-877, 2007. [CrossRef] [Google Scholar] [Publisher Link]

[45] Ulrich Gnewuch et al., "Opposing Effects of Response Time in Human-Chatbot Interaction: The Moderating Role of Prior Experience," *Business & Information Systems Engineering*, vol. 64, no. 6, pp. 773-791, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[46] Chi-Wen Lo, and Ya-Ling Wang, "The Effects of Response Time on Older and Young Adults' Interaction Experience with Chatbot," *Research Square*, pp. 1-13, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[47] Wen Wen, and Hiroshi Imamizu, "The Sense of Agency in Perception, Behaviour and Human-Machine Interactions," *Nature Reviews Psychology*, vol. 1, pp. 211-222, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[48] Yidan Yin, Nan Jia, and Cheryl J. Wakslak, "AI Can Help People Feel Heard, But an AI Label Diminishes This Impact," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 121, no. 14, pp. 1-9, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[49] Sacha Altay, and Fabrizio Gilardi, "People are Skeptical of Headlines Labeled as AI-Generated, Even If True or Human-Made," *PNAS Nexus*, vol. 3, no. 10, pp. 1-11, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[50] Emmelyn A.J. Croes et al., "Digital Confessions: The Willingness to Disclose Intimate Information to a Chatbot and its Impact on Emotional Well-Being," *Interacting with Computers*, vol. 36, no. 5, pp. 279-292, 2024. [CrossRef] [Google Scholar] [Publisher Link]

[51] Liz L. Chung, and Jeannie Kang, ""I'm Hurt Too": The Effect of a Chatbot's Reciprocal Self-Disclosures on Users' Painful Experiences," *Archives of Design Research*, vol. 36, no. 4, pp. 67-85, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[52] Cecilia Roselli, Francesca Ciardo, and Agnieszka Wykowska, "Social Inclusion of Robots Depends on the Way a Robot is Presented to Observers," *Journal Paladyn, Journal of Behavioral Robotics*, vol. 13, no. 1, pp. 56-66, 2022. [CrossRef] [Google Scholar] [Publisher Link]