EXPLORING THE INTERACTION BETWEEN GENERATIVE AI AND KANSEI DESIGN PROCESSES

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ABSTRACT

Under the wave of the modern "experience economy," the focus of industrial design has shifted from functional satisfaction to experience shaping. The success of a product highly depends on its ability to precisely induce positive emotions in users, making "Kansei design" the core of contemporary design. However, with the widespread adoption of generative artificial intelligence (GenAI), its inherent lack of authentic emotion and empathy has raised academic concerns regarding potential negative interference when applied to such tasks that heavily rely on emotional connections. This study aims to investigate whether the intervention of generative AI leads to a deterioration in the quality of final Kansei design outcomes. Adopting a primarily qualitative case-controlled design, this study arranged for two professional designers with highly similar backgrounds to execute a Kansei design task for a "companion robot for children with autism" under "AI-assisted" and "non-AI-assisted" conditions. Cognitive dynamics were captured via the think-aloud method, and a retrospective analysis was conducted by cross-validating the think-aloud data with double-blind expert evaluation results. The results indicate that the design outcomes from the AI-assisted group performed better in emotional connection and Kansei quality. By providing domain knowledge, AI successfully served as an "empathy navigator," helping designers transcend cognitive blind spots, while the critical form-giving decisions that determined product approachability remained dominated by human intuitive aesthetics.

Keywords: *Kansei design, Generative AI, Human-AI collaboration, Think-aloud*

1 INTRODUCTION

At the beginning of the 21st century, traditional markets driven by functional satisfaction became saturated, accompanied by severe technological homogenization. The concept of the "Experience Economy," proposed by Pine and Gilmore (1998), swept the globe, prompting industrial design to officially shift its focus from a "service economy" to "staging experiences."

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This transition fully highlights the importance of Kansei design. Today, the success of a product depends not only on the novelty of its physical attributes, such as function or form, but more importantly, on its ability to accurately evoke positive emotions in users (Nagamachi, 1999; Norman, 2005).As the wave of Generative Artificial Intelligence (GenAI) sweeps across the globe, its ability to generate contextually coherent content based on user inputs and support highly sustained interactions through real-time responses (Firat, 2023) has been proven to increase the quantity and novelty of ideas, as well as expand the solution space in the design field (Bouschery, Blazevic, & Piller, 2023; Chandrasekera, Hosseini, & Perera, 2025). Despite AI's immense potential in enhancing design novelty, its inherent lack of emotional understanding becomes an unavoidable challenge in current human-AI collaborative design, particularly when dealing with design cores that heavily rely on emotional connections.

From the perspective of computational linguistics, Bender, Gebru, McMillan-Major, and Shmitchell (2021) explicitly point out that large language models are inherently products of probabilistic prediction based on massive datasets. They act like "Stochastic Parrots"—while their outputs possess the "form" of language, they entirely lack genuine understanding, meaning-making, and communicative intent regarding the real world. This is because their text generation is not grounded in communicative intent or the psychological state of the user, nor does the machine itself possess the ability to share thoughts with a listener.From a psychological perspective, Turkle (2011) also notes in her book Alone Together: Why We Expect More from Technology and Less from Each Other that the care displayed by robots or AI is essentially a superficial performance by algorithms: "Simulated thinking might be thinking, but simulated feeling is not feeling; simulated love is never love." Therefore, AI inherently lacks empathy and certainly cannot genuinely empathize with human emotions.

Based on the aforementioned limitation of AI's lack of empathy, it is easy to intuitively assume that introducing AI into "Kansei design" tasks—which require a high degree of resonance—will inevitably interfere with designers, steering them in a negative direction that fails to adequately consider the users' authentic emotions.

However, in actual design practice, AI does not produce outcomes independently but serves as a collaborative tool for human designers. To explore its impact on design outcomes, it is necessary to further clarify the timing of its intervention. If AI only intervenes in the later stages of design (e.g., rendering techniques, technical execution, or visualization), the emotional core of the design has already been established by the human designer, resulting in relatively limited interference with Kansei design. Nevertheless, research indicates that the current intervention of generative AI primarily occurs in the concept generation phase (Chen et al., 2025). At the dawn of conceptualization, when AI—which fundamentally lacks real emotion—is deeply involved in design ideation, will its highly rational output lead to a design outcome lacking Kansei qualities? This remains unclear in current human-AI collaboration research.Therefore, the research question of this study is: When AI intervenes in designers' Kansei design tasks, does it truly exert a negative impact on the final design outcome?

2 METHOD

This study aims to investigate whether the intervention of generative AI brings negative interference to the final outcomes of designers executing Kansei design tasks. Using a single Kansei design topic as the assignment, this study compares the differences in the final design outcomes of designers under two conditions: "AI-assisted" and "non-AI-assisted." To deeply dissect the cognitive black box of collaboration between human designers and AI, this study adopts a case-controlled approach primarily based on qualitative analysis, utilizing the think-aloud method to retrace and examine the process of design generation.

2.1 Participant Criteria

Participant Criteria To minimize interference in the design process caused by variations in individual professional backgrounds, design experience, or cognitive styles, this study recruited two designers with highly similar backgrounds to participate in the experiment. The demographic profiles of the two participants and their respective experimental condition assignments are shown in Table 1.

Table 1. Participant Background and Experimental Task Conditions

	Participant Background	Experimental Task Conditions
AI Group	Graduated with a Master's degree from the Department of Industrial Design, National Cheng Kung University, with an undergraduate major in the same discipline (Industrial Design), and possesses six months of relevant professional experience in industrial design.	GPT assistance was permitted across all stages of the design process, with the sole exception of the "sketching phase," during which the use of GPT for image generation was prohibited.
Non-AI Group	Graduated with a Master's degree from the Department of Industrial Design, National Cheng Kung University, with an undergraduate major in the same discipline (Industrial Design), and possesses six months of relevant professional experience in industrial design.	No generative AI tools were permitted at any point throughout the entire design process.

2.2 Experimental Procedure

Both participants were required to independently complete a Kansei design task under identical constraints and environmental conditions: "designing a companion robot for children with autism." Within a 60-minute timeframe, the participants navigated the stages of problem understanding, concept development, and solution ideation, ultimately producing a conceptual sketch. The data collection and experimental procedure of this study were systematically divided into the following four core stages:

Task Description and Think-Aloud Practice: Prior to the experiment, the researcher provided a detailed briefing on the design topic and deliverable specifications. A think-aloud practice session was also conducted, during which participants were required to continuously verbalize their real-time thought processes throughout the design task.

Design Execution and Think-Aloud: Participants commenced the design task according to their assigned condition (AI group or non-AI group). The entire design process was documented via full audio and screen recording to capture real-time cognitive dynamics. Upon completion of the task, the audio recordings were fully transcribed into "think-aloud transcripts," serving as the raw textual data for subsequently tracing the designers' cognitive threads.

Sketch Style Standardization: To prevent external visual styles—such as individual sketching techniques or aesthetic line-work qualities—from interfering with the subsequent expert evaluation, the researcher utilized AI post-experiment to standardize the rendering style of both sketches.

Expert Evaluation and Interview: The two standardized conceptual sketches were presented to an expert—a PhD candidate in industrial design with professional teaching experience—for comparative evaluation to determine which concept demonstrated superior design quality. Following the evaluation, the researcher conducted a semi-structured interview with the expert (e.g., "Which concept performed better overall? What were the reasons? Why was the other concept less ideal?"). This aimed to deeply excavate the critical design features that influenced the expert's decision. The interview was fully audio-recorded and transcribed into "expert interview transcripts," establishing the data foundation for subsequent causal analysis.

2.3 Data Analysis

The data analysis in this study aims to elucidate the causal relationship between the "quality of the final Kansei design" and "AI intervention." The study adopts an outcome-oriented, retrospective analysis that cross-validates the expert evaluation data against the think-aloud process data. The specific analysis workflow is illustrated in Figure 1: Data Analysis Process Diagram.

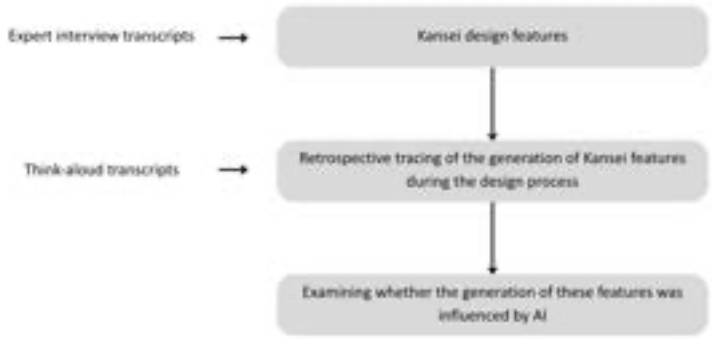

Figure 1. Data Analysis Process Diagram

First, the "expert interview transcripts" are analyzed. From the expert's evaluations, specific design features and conceptual details that led her to perceive a concept as superior are extracted. Next, using the design features identified by the expert as analytical anchors, the analysis traces back to the corresponding participant's (either from the AI or non-AI group) "think-aloud transcripts" to locate the critical cognitive segments where that specific feature was generated and developed during the design process. Finally, an analysis of the cognitive context

within these critical segments is performed to examine the source of inspiration for the design feature. This allows the researcher to retroactively deduce the underlying cause of the feature: whether it stemmed from the designer's pure projection of personal experience, or was actively stimulated by the information provided by the AI. Conversely, if the expert notes that a certain design failed to adequately address the user's emotions, the analysis similarly traces back to examine whether this deficiency resulted from the negative interference of the AI's formulaic output.

3 RESULTS

During the quality evaluation phase of conceptual sketches, under group-blind scoring conditions, the expert determined that the design solution from the "AI group" performed better in terms of overall design quality. According to the expert interview transcripts, the expert explicitly stated that three design features in the AI group's design (Figure 2) were the primary factors driving the overall design quality evaluation, namely: the "healing plush material," the "endearing 'ugly-cute' appearance," and the "core device compatible with various plush toys."

Notably, in the evaluation of manufacturing and mass-production feasibility, the expert considered both solutions to possess a high degree of maturity. The expert emphasized in the interview: "In fact, the feasibility of implementing this [Figure 3, non-AI group] is extremely high. Its molding... whether for the facial expressions or the camera component, is actually very easy to achieve. It can be put this way—both of them are definitely feasible." Having ruled out the technical barriers of physical manufacturing, the core reason the expert awarded a higher evaluation to the AI group's solution primarily rests on the fact that the aforementioned three design features could more precisely align with the specific behavioral habits and emotional needs of children with autism.



Figure 2. AI Group Design



Figure 3. Non-AI Group Design

3.1 Design Feature 1: Healing Plush Material

In the expert interview, the expert repeatedly noted that the "plush" material in the AI group's solution served as a significant basis for their preference. The expert explicitly stated: *"Usually,*

children prefer this kind of plush toy or material because it feels a bit softer." The expert further explained that the presentation of the plush material could convey warmth and enhance the sense of companionship, thereby making children with autism more willing to approach and accept it. By contrast, the companion robot presented in the sketches of the non-AI group resembled a generic companion robot, which felt relatively colder and was comparatively deficient in establishing an emotional connection.

Retrospective analysis of the think-aloud process of the participant in the AI group reveals that the generation of this feature is directly correlated with the contextual information provided by the AI. Transcript analysis indicates that during the early stage of concept development, the participant received background descriptions from the AI regarding *"multi-sensory experiences"* for children with autism, which specifically highlighted the soothing role of touch in companionship contexts. Stimulated by this information, the participant stated: *"Basically, I'm thinking, what I want to make right now is something like a plush toy, because I think it mentioned touch just now. This robot itself will definitely have vision and hearing—it will definitely have sound—and then adding touch will make it feel like a healing toy."*

3.2 Feature 2: Core Device Compatible with Various Plush Toys

The expert also particularly emphasized that the concept of *"separating the core device from the outer shell"* in the AI group's design possessed a high degree of creativity. The expert pointed out that this design approach allows the core functions to remain consistent while the external appearance can be replaced according to needs; this type of customization-like design strategy is uncommon among similar companion products, yet it perfectly aligns with the specific context of autistic children who often exhibit *"fixed preferences and a strong sense of routine."*

Comparing this with the participant's think-aloud transcripts, this design feature also originated from the guidance of AI information. In the conversational context, the AI mentioned that *"repetition and regularity equal a sense of security"* and that *"children with autism may have their own specific obsessions."* Upon receiving these keywords, the participant verbally deduced: *"Because, just going back to what was said earlier, children with autism might have more of their own principles, and the things they like are very fixed and they're a bit obsessed with them... If it's a plush toy or some doll they liked before, I feel like if you suddenly introduce a companion robot to them today, they might not necessarily be able to accept it—that's not a certainty. So the fastest way to get them to touch and use this product, I think, is to directly attach it to something they already really like, and then they might feel, oh, this thing has come alive."*

3.3 Design Feature 3: Endearing 'Ugly-Cute' Appearance

The third design feature pointed out by the expert in the AI group's design was "asymmetry" (specifically the design with one large ear and one small ear). The expert believed that: *"It's this image... because it's originally facing children with autism. So children with autism should relatively, you know, need something with more warmth... Although this thing looks a bit ugly-cute, it can actually convey that kind of emotional, you know, feeling—that kind of feeling of emotional exchange."* This asymmetrical, somewhat *"ugly-cute,"* and less conventional presentation broke the icy feeling of standardized products; conversely, the design of the non-AI

group was overly symmetrical and regular, making it easily appear rigid and creating a distance from children.

However, the emergence of this feature was likely not influenced by AI. When this study used this feature as an anchor to trace back through the think-aloud transcripts of the AI group participant, no record was found regarding the deductive process of external asymmetry or any influence from AI prompt information. The transcripts show that when drawing the ears, the participant only briefly stated verbally: *"Okay, then first, let's draw a rabbit...",* and immediately proceeded to draw, without consulting the AI or parroting any AI suggestions during the process. This result indicates that the design feature of the *"ugly-cute appearance"* was not an effect of AI intervention, but rather stemmed from the participant's individual aesthetic intuition and design style.

4 DISCUSSION

This study aims to investigate whether the intervention of generative AI in Kansei design tasks, which heavily rely on emotional connections, exerts negative interference on the final design outcomes. Through a comparative analysis utilizing the think-aloud method and single-blind expert evaluation, the results of this case study indicate that the intervention of generative AI did not lead to a deterioration in the quality of Kansei design as expected. On the contrary, within specific contexts, AI assistance facilitates designers in deepening their understanding of the behavioral characteristics of unfamiliar user groups.

The research findings show that the expert evaluation deemed the design solution from the AI-assisted group to possess superior Kansei design quality. Based on this result, the following section will delve into the role and actual impact of AI intervention during the Kansei design process.

4.1 The Correlation Between Domain Knowledge Provided by Generative AI and the Translation of Kansei Design Features

Although previous research, such as Bender et al. (2021), has pointed out that large language models are essentially "stochastic parrots" lacking real-world understanding, and Turkle (2011) questioned whether simulated emotions by machines can truly establish genuine connections with humans, the results of this study overturn the intuitive assumption that "the intervention of emotionless AI will inevitably lead to the deterioration of Kansei design outcomes."

Expert evaluation results indicate that the AI-assisted group outperformed the non-AI group in the quality of establishing emotional connections. Retrospective analysis of the think-aloud transcripts confirms that this advantage stems from a clear cognitive translation path: First, generative AI provides the designer with objective domain knowledge about the specific user group. Second, upon receiving such specialized knowledge, the designer interprets it through their own empathy and translates it into concrete design features. Finally, these features are accurately identified by the expert during the evaluation and deemed effective in establishing an emotional connection with autistic children. This specific process—from "AI providing

knowledge" to "the designer exercising empathy" and finally "translating into design features"—can be validated through the development of two features highlighted by the expert: the "healing plush material" and the "core device compatible with various plush toys."

First, regarding the generation of the "healing plush material," its emergence was not the result of the participant's random exploration. Rather, it originated from extracting descriptions about "multi-sensory experiences" and "the core role of touch in companionship contexts" from the background data provided by the AI. This objective knowledge successfully guided the designer to project empathy toward sensory pain points beyond the visual and auditory realms of autistic children, thereby transforming a conceptual technological device—originally leaning toward functional orientation—into a plush toy offering a warm sense of companionship.

Second, in the development of the "separation of the core device and outer shell," the AI provided information indicating that autistic children might have their own specific obsessions and a strong attachment to fixed routines or objects. This information further directed the designer's empathy toward the users' deeper psychological adaptation levels. Notably, although this critical knowledge was provided by the AI in the early ideation phase, the designer did not immediately generate a corresponding structural solution upon seeing the information. Instead, it was not until the mid-to-late stages of concept development, specifically during concrete form-giving decisions, that this pre-implanted knowledge was retrieved. During the think-aloud process, the designer noted that because autistic children are relatively stubborn about what they like, they might not accept a completely unfamiliar companion robot suddenly introduced to them.

Based on this understanding of user behavioral characteristics, and assisted by the background knowledge provided by the AI, the designer overcame their knowledge blind spots and translated them into a new countermeasure: extracting the core device housing the technical functions so it could be flexibly inserted into existing toys the child is already familiar with. This solution cleverly accommodates the obsessive traits of autistic children and mitigates the defensiveness and anxiety they might experience when encountering new products.

This study postulates that the role generative AI plays in Kansei design tasks is not as a "generator" of emotion, but as a "navigator" of empathy. While human designers possess empathy, they may struggle to focus it when facing unfamiliar user groups due to a lack of concrete understanding of user behavioral patterns. Although AI lacks emotion, the domain knowledge it provides serves as a directional guide for human empathy, pointing designers toward where their empathy can be most effectively applied.

Based on the postulated "navigation" value of AI in the aforementioned analysis, this study further infers that the intervention of generative AI offers a unique advantage in the early stages of Kansei design that traditional search engines cannot easily replace. As Radlinski and Craswell (2017) pointed out when exploring conversational search theory, traditional search engines are essentially one-way searches lacking systemic proactivity; the system does not actively offer guidance. Designers must iterate their searches, figuring out how to learn the correct vocabulary and keywords needed to accurately describe their information needs. In other words, if a designer cannot precisely find the right keywords to ask the question, the search engine cannot provide

the necessary information. However, in the early stages of Kansei design, when facing an unknown and specific user group, designers can easily fall into knowledge blind spots. For instance, if a designer is completely unaware of an autistic child's deep psychological need for "tactile soothing" or their "resistance to change" before conceptualization, a traditional search engine will not proactively compile this relevant information. This could lead to a critical issue: as long as the designers themselves do not anticipate these hidden emotional needs, they cannot acquire the relevant knowledge through traditional search, potentially resulting in missed opportunities to consider and respond to users' emotional needs throughout the design process. This may also account for why the participant in the non-AI group chose to style the product's appearance as a conventional, cute robot featuring a technological aesthetic.

4.2 The Impact of Generative AI Intervention on the Designer's Subjectivity

As discussed in the previous section, generative AI successfully guided the generation and development of design features such as the "healing plush material" and the "core device compatible with various plush toys" by providing domain knowledge in the Kansei design task. However, upon further examining another key feature raised in the expert evaluation—the "endearing 'ugly-cute' appearance"—this study observed a completely different cognitive decision-making path. Retrospective verification of the transcripts confirms that this unconventional form-giving feature was not influenced by any AI prompts during the concept development process; rather, it stemmed purely from the designer's intuitive aesthetics when considering autistic children. This decision-making phenomenon, independent of AI, brings up a frequently discussed question in the design field over the past two years: In a human-AI collaborative environment reliant on AI knowledge navigation, do human designers still possess irreplaceable value? That is, will AI eventually replace human designers?

This study argues that the feature of the "endearing 'ugly-cute' appearance," generated without AI influence, demonstrates that even in an AI-intervened design task environment, human designers retain their aesthetic judgment and decision-making power over form. In other words, while AI can provide knowledge and conceptual direction, the final determination of whether a product possesses approachability and positive emotional traits remains reliant on the designer's own aesthetic intuition and subjective judgment. This echoes the findings of Chen et al. (2025), which indicate that in collaboration with AI, AI primarily assists humans in the problem definition and idea generation phases, while the creative selection and evaluation phases are still predominantly human-led. Furthermore, Booth, Donohew, Wlezien, and Wu (2024) noted in a McKinsey report that although generative AI can significantly accelerate conceptual ideation, it is not an omnipotent magic wand; translating AI outputs into true design value still relies on the human designer's discretion. AI excels at rational tasks such as context analysis and professional knowledge organization; however, establishing an emotional connection between a product and a user through design features remains a task that current AI cannot independently accomplish.

Nevertheless, this study discovered in the verbal data of the AI-assisted group that, during the early stages of the design process, participants exhibited a passive tendency to unconditionally accept the massive volume of unfamiliar information output by the AI. In the verbal data, this manifested as blindly parroting the information provided by the AI without immediate feedback

or critical thinking. This phenomenon aligns with the "overreliance" observed by Buçinca, Malaya, and Gajos (2021), where users tend to directly accept AI-generated results, even when the information provided by the AI might be incorrect. To a certain extent, this phenomenon reflects a crisis of the "compromise of subjectivity" among humans during human-AI collaboration.

In conclusion, the intervention of generative AI does not diminish the importance of human designers; on the contrary, within the division of labor in human-AI collaboration, it precisely accentuates and underscores the core value of human intuitive aesthetics. AI functions more as a powerful knowledge repository, responsible for expanding and stabilizing the rational boundaries of the problem space, whereas human designers retain decision-making authority within the solution space, translating their own intuition, style, and empathy into design features with deeper emotional connections. In other words, the core value of generative AI in Kansei design does not lie in replacing the emotional judgment of human designers, but rather in assisting them to more effectively understand unfamiliar user groups; ultimately, it remains the human designers themselves who determine how emotional connections are concretely translated into product forms and design features.

5 CONCLUSION

This study aims to explore a core anxiety in the contemporary design field: when generative AI, which inherently lacks authentic emotion, intervenes in Kansei design tasks, does it exert negative interference on the final design outcomes? Through a comparative analysis utilizing the think-aloud method and double-blind expert evaluation, the results of this study indicate that the intervention of generative AI did not lead to a deterioration in Kansei design quality as expected; on the contrary, it enhanced the emotional connection of the final design by establishing a rational knowledge framework.

This study further reveals the unique collaborative mechanism played by generative AI in Kansei design. The findings confirm that the core value of AI lies in its role as an "empathy navigator." Specifically, when facing unfamiliar user groups, AI can proactively deliver precise medical and behavioral characteristics, helping designers transcend unknown cognitive blind spots and focus their empathy onto the correct pain points and needs. However, this does not imply a weakening of the human designer's subjectivity. This study also found that after clarifying specialized knowledge, the product appearance—which determines the final degree of approachability—is still dominated by the human designer. Nevertheless, the study also uncovered a potential crisis in the early stages of the AI-intervened design process: when confronted with a massive volume of unfamiliar information output by the AI, participants exhibited a tendency toward "overreliance."

Based on the aforementioned findings, this study proposes concrete recommendations for future Kansei design practice and education. Given that AI can effectively establish knowledge frameworks and thereby facilitate the generation of empathetic features, future design practice and education should focus on cultivating designers' ability to effectively translate AI-generated

information into design features. This will enable designers to more efficiently harness AI tools to execute precise and warm Kansei designs tailored to specific or unfamiliar user groups.

Finally, although this study deeply analyzes the cognitive processes of AI intervention through the think-aloud method, several research limitations remain. First, adopting a case-controlled design, this study primarily focuses on the deep exploration of qualitative processes; due to the small sample size, its generalizability for quantitative inference remains limited. Second, the design task in this study was restricted to a "companion robot for children with autism." This task itself possesses a distinct cross-disciplinary medical knowledge background, allowing the knowledge-provision function of AI to be fully leveraged. Future research is suggested to expand the sample size of participants or test other types of Kansei design tasks to investigate whether the impact of generative AI intervention on Kansei design performance remains consistent across different design contexts. Furthermore, whether the phenomenon of overreliance exhibited by users during the early stages of human-AI collaboration is exclusive to rapid design tasks remains a question that warrants further investigation through full-scale, comprehensive design projects. Based on the aforementioned limitations and a synthesis of the findings from this study, concrete recommendations can be proposed for future Kansei design practice and education. Given that AI can effectively establish a rational knowledge framework and thereby facilitate the generation of empathy-driven features, future design practice and education should emphasize cultivating designers' capability to effectively translate AI-generated information into design features. This will enable designers to harness AI tools more efficiently, allowing them to execute precise and warm Kansei design tailored to specific or unfamiliar user groups.

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