Exploring How Human-AI Collaborative Systems Can Enhance Social Connectedness between Parents and Children Living Apart

Chenwei Liang
Indusrial Design
c.liang1@student.tue.nl

Project coaches: Jun Hu

ABSTRACT

Nowadays, due to global migration and the pursuit of better education and job opportunities, more and more family members experience long-distance geographical separation. Maintaining social connectedness between children and separated parents has become a key challenge. This study built a Gen AI Painting system to visualize based on sound data and emotional prompts and pictures. In this work, we designed three visualization methods with different levels of human involvement. We conducted an in-group mixed method experiment and invited 3 participants to conduct a pilot test in M2.1. The results showed that the participants had a higher perception of the works with a higher degree of human involvement, and the works had more perceived value. Due to the limited number of participants, this report focuses on qualitative analysis. This study confirmed in detail which level of human involvement intervened in the works produced by Gen AI with more perceived value, and the qualitative analysis provided design principles for the Gen AI painting system.

Keywords

Social connecctedness, Gen AI, Human computer interaction.

INTRODUCTION

The World Health Organisation reports[36] that an unprecedented number of people are recocating from their homelands, with the current global migrant population but also those who seek better job and education opportunities who have to choose to live apart from their parents[17]. Geographical separation over long distances challenges the emotional connection between parents and thier children. This situaion weakens the social connectedness betweeen children and their parents [6].

As technology continues to develop, it is becoming increasingly integrated into our daily lifes [44]. Previous research has shown that technology can offer opportunities to strengthen parent-child bonds, enabling people to share their stories and feelings with their parents or children anytime, anywhere they are [17，29，34，28]. Today, technology extensively supports the use of social media platforms like WhatsApp, Facebook, and Instagram for messaging, audio and video calls, interactive communication, and more[7]. However, despite these advancements, social connectedness between parents and children living apart remains limited[31]. Differences in living conditions, time zones, and work schedules often make it difficult for parents and children to find time to connect and understand each other's daily lives[29]. This can hinder the ability to maintain constant communication and companionship. In recent years, the close integration of art and technology has led to the rise of digital artworks as a significant part of people's everyday experiences[9]. These digital creations are no longer just objects to be viewed; they also serve as tools for fostering connectedness between people by creating shared experiences. This fusion of art and technology offers a new, creative avenue for communication and expression, helping to bridge the gap in relationships, particularly between those separated by distance.

In recent years, with the rise of generative artificial intelligence (Generative AI), numerous studies have explored the differences between AI-generated and human-created works[12,35]. These studies examine how people perceive, prefer, and respond to such works, revealing that human supervision or involvement may enhance people's perception of the content. However, the specific impact of different levels of human involvement remains underexplored.

The widespread application of generative AI offers convenience across various scenarios, allowing ordinary people—even those without artistic skills—to create digital artworks simply by providing descriptions or photos[20,21]. For individuals who are shy about expressing their emotions, this technology introduces a new form of emotional communication, enabling them to embed their feelings or thoughts into digital artworks and share them with close ones[20].

Building on this, this work proposes research direction that explores different levels of human involvement in AI-generated paintings. This project uses sound data as the starting point, allowing generative AI to analyze sound features and create visual artworks. We identified three visualization methods based on existing Gen AI models[13]:

1: Method 1- Pure AI Generation Mode – The AI independently processes the sound data and automatically generates visual representations without human intervention.

2: Method 2- Emotional Prompt Mode – The AI processes the sound data, while human provide emotional prompts to supplement the generation of visual results.

3: Method 3- Multi-layer Involvement Mode – In addition to sound data and emotional prompts, a photo is introduced as an additional reference to collaboratively generate the final image.

Based on the above motivations and feasibility, we propose the following research question:

"How do different levels of parental involvement in AI-generated painting affect the social connectedness between children and their parents living apart?"

This project aims to explore how generative AI can enhance social connectedness while investigating the influence of varying levels of human involvement in this process.

RELATED WORK

This work is inspired by the previous literature comparing Huamn agency and AI agency. In this section, we first introduce the theoretical background of social connectedness and the application of emerging technologies in recent years to improve social connectedness, to find possible research opportunities. Then we briefly review the previous work comparing AI and human-made in human-computer interaction to explain our research questions and design principles.

Social connectedness

Social connectedness refers to the degree to which individuals perceive a sense of connection, belonging, and emotional bond with others or groups. It emphasizes emotional interactions, communication, and mutual support between people[37]. This connection fosters psychological satisfaction, a sense of security, and overall well-being. Social connectedness is divided into three tiers, with the most intimate tier being partner family members, the next closest being close friends and acquaintances, and then strangers with whom we interact[33]. Previous research has shown that a strong sense of positive social connectedness primarily emerges within the context of mutual care and understanding, specifically among the most intimate relationships such as family members and partners [3]. Retired older people who live alone are lonely in such relationships because they have little contact with other people, have a lot of free time after retirement, and are not surrounded by their loved ones. So they are more likely to feel lonely. This feeling of loneliness often stems from the lack of intimate attachment relationships[14,11].

Social connectedness is closely tied to the concept of social support, which refers to the network of people we rely on—those who show us care, appreciation, and love. Research indicates that stable connections with younger family members play a vital role in promoting the mental well-being of older adults. These relationships act as protective factors against age-related mental health challenges, such as death anxiety, depression, and loneliness [1,26,30,38]. Beyond mental health, studies suggest that greater social support and stronger social bonds contribute to physical health by helping maintain a healthy body mass index, regulating blood sugar levels, and lowering the risk of cardiovascular disease mortality [19]. In this context, fostering social connectedness between parents and children becomes particularly significant [32].

Emerging technologies to support social connectedness

Of the many systems working to improve home connectivity, most of them focus on showing the current state of life and health of family members[4]. For example, the Digital Family Portrait[22] and CareNet[8] systems both provide information to remote caregivers about the health status and living conditions of older adults. Some works have also provided systems for bi-directional emotional transmission. Robo-Shoe-Files[42] is a small device that has been given a special requirement to interact with other users wearing the same device. This interaction is facilitated through specific movements between the devices, such as shaking feet together. The device uses built-in sensors (such as infrared sensors) to detect the presence of other devices nearby and prompts the wearer to interact through light and sound feedback.

Some work has also designed prototypes that require active information sharing so that family members can learn about each other's lives and exchange information. Examples include digital sticky notes[14] , scanned information and the dissemination of information between families displayed on a website[23]. eKiss[10] enables efficacy between children and parents through photo software, which is displayed on the family's monitor or on the parents' mobile phones. Some prototypes have also explored dedicated connections between long-distance families to allow for better interaction among family members, such as the shared storytelling system proposed by René Vutborg[33], which provides a platform forgrandparents and grandchildren living apart to interact with each other by integrating features such as story reading, photo sharing, interactive drawing and audio dialogue. The platform not only simulates the intimate activities that grandparents and grandchildren do when they spend time together, such as reading stories together, but also enhances their emotional connection and communication by sharing daily photos and interactive drawings. The Messaging Kettle[5]can detect kettle usage via a heat sensor while the user is making tea, sharing it with a similar device in another home, making the daily use of the boiling kettle visible off-site. Users can also exchange voice messages and doodles using the Smart Tea Box. The Fitbit Flex[43] wristband offers new opportunities for parents to monitor their children when they are separated by sharing their children's sleep and physical data across the family, which studies have found parents often use to ask their children for information about specific activities.

Although these systems have made significant progress in promoting social connectedness among family members, they often rely on specific hardware devices or single forms of interaction, such as photo sharing, voice messages, or sensor-prompted interactions. While these methods enhance the perception and sense of connection between remote family members to some extent, they are often limited to passive data sharing or pre-set interaction modes, lacking personalized and emotionally rich dynamic feedback, as well as certain privacy protections. Moreover, many systems focus solely on one-way information transmission or limited two-way communication, overlooking the importance of continuity, interactivity, and personalization in fostering social connectedness.

Against this backdrop, the introduction of Generative AI offers new possibilities for further enhancing social connectedness. AI can analyze voice data in real time and adapt interactions based on the unique needs of different users[36], creating family connection systems that foster greater emotional resonance and dynamic interaction. Unlike traditional sensor- and device-driven systems, AI can leverage technologies such as natural language processing, voice recognition, and affective computing to make interactions between family members more human-like and generate outcomes that better align with expectations, serving as an "invisible bond embedded in daily life[27]."

Human involvemetn on the emotional perception of AI-created works

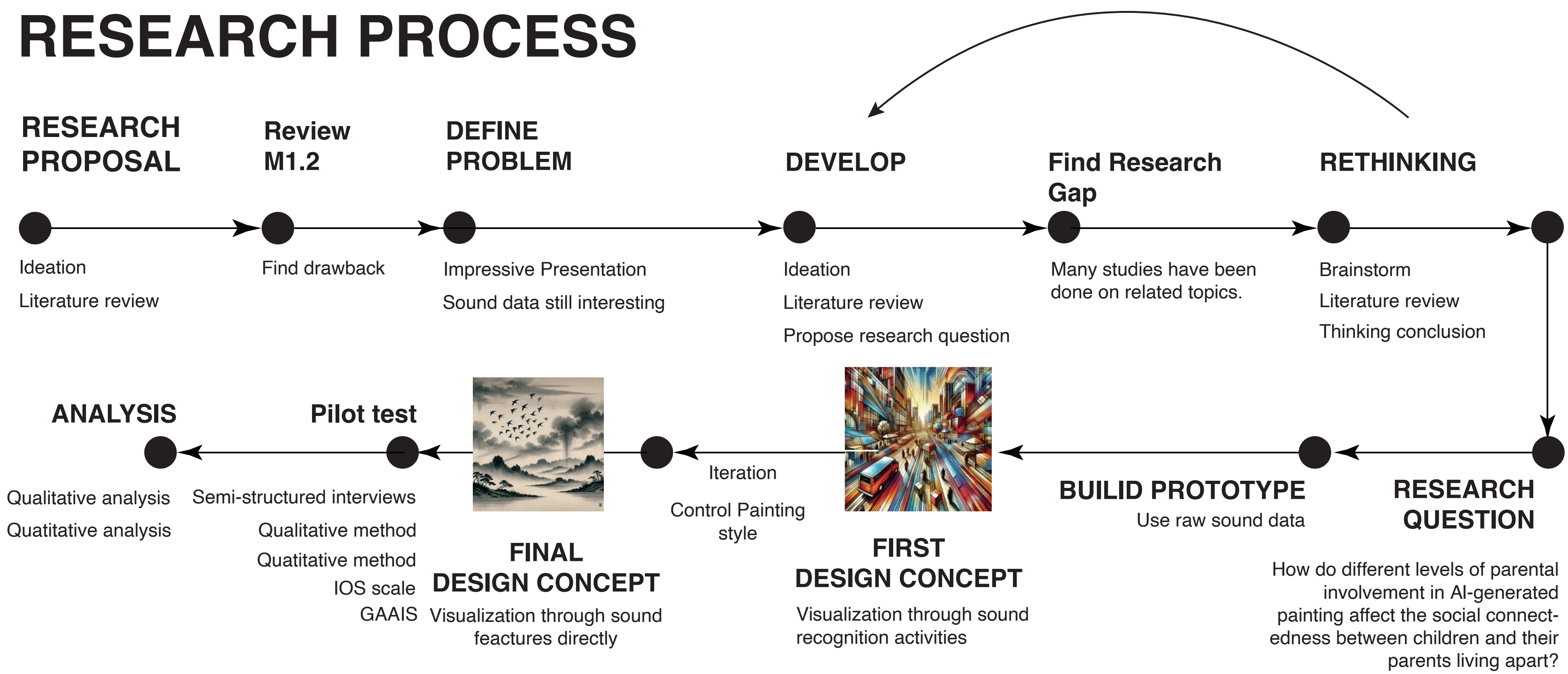
With the development of Gen AI works, current research predominantly focuses on comparing the emotional value and acceptance of human-created content with that generated independently by AI[12,34,39]. In areas such as text creation, painting, and music, extensive discussions have emerged regarding the differences between AI-generated and human-created works[40]. For example, Fiona's study explores how individuals perceive a sense of ownership over AI-created works, demonstrating that participants' sense of control and leadership positively correlates with their sense of ownership. The study also highlights that the mode of interaction with Gen AI significantly influences this sense of control and leadership[12].

An experimental study on the perception of creativity in AI-generated works [20]reveals that the use of AI enhances individuals' positive evaluations of artistic works. However, excessive reliance on AI tends to diminish the perceived quality of the works. This suggests that achieving a balance between human and AI involvement is crucial for enhancing the perceived value of creative outputs.

Zhang's research further investigates how individuals perceive AI-created content by comparing works produced through different methods. The study examines participants' reactions under conditions where they were aware or unaware of the creation process. The results indicate a phenomenon of "human preference," wherein participants were more inclined to positively evaluate works they knew were created by humans. Conversely, when unaware of the creation process, participants often favored AI-generated works. Additionally, the study posits that human supervision or involvement may significantly enhance the perceived value of AI-generated content[41].

While these studies emphasize the influence of human involvement in the creative process and how individuals perceive and evaluate works they have created or contributed to, there remains limited exploration of the extent to which human involvement affects the perceived value of works. Moreover, the potential impact of such involvement on the emotional value experienced by recipients—particularly close family members or friends—has yet to be thoroughly investigated. This highlights a critical avenue for future research, focusing on the emotional resonance and social connectedness fostered through collaborative human-AI creative processes.

RESEARCH PROCESS



Only Sound Data

Figure 1: Generated by Method 1

Sound Data

Emotion prompts:
Sad

Figure 2: Generated by Method 2

Sound Data

Emotion prompts:
Sad

Photo Content:
rainbow

Figure 2: Generated by Method 3

FORMATIVE STUDY

We designed three different visualization methods based on the current mainstream processes of Gen AI image creation, which typically involve text-to-image and image-to-image generation. We assumed these three visualization methods represent varying levels of human involvement, ranging from low to high, corresponding to Method 1 to Method 3:

1: Method 1- Pure AI Generation Mode – The AI independently processes the sound data and automatically generates visual representations without human intervention.

2: Method 2- Emotional Prompt Mode – The AI processes the sound data, while human provide emotional prompts to supplement the generation of visual results.

3: Method 3- Multi-layer Involvement Mode – In addition to sound data and emotional prompts, a photo is introduced as an additional reference to collaboratively generate the final image.

We conducted a formative study to assess whether recipients can perceive different levels of human involvement in images.

Paticipants

We recruited 23 participants (aged 18 to 35) for an online user study, with 13 of them having no prior experience with Gen AI art creation. No specific criteria were applied in participant selection, and these participants did not overlap with those involved in subsequent formal experiments.

Procedure

Before the experiment began, participants were shown examples of images generated by the three Gen AI visualization methods. The example images used here are not the ones used in the experiment, but are just some generated examples to show participants.We explained the principles behind each method and highlighted the differences in the level of human involvement across the condition.

The experiment officially begins, we provided participants with the emotional prompt used for the images in Methods 2 and 3 in the experiment, as well as the reference photos used in Method 3. After this, participants were given a questionnaire with three images generated by the three visualization methods (Figure1,2,3). However, the specific condition under which each image was created was not disclosed. Participants were asked to rate the perceived level of human involvement in each image based on their intuition and subjective impression.

Result

A one-way ANOVA test was conducted to compare participant ratings across the three methods (Figure 4), revealing significant differences in perceived human involvement among the methods, $F(2, 66) = 22.49$, $p < 0.001$. Post-hoc comparisons using Tukey's HSD test confirmed significant differences between all methods. These findings are consistent with results from independent t-tests conducted for pairwise comparisons (Method 1 vs. Method 2: $t = -4.22$, $p = 0.00035$; Method 2 vs. Method 3: $t = -2.23$, $p = 0.0361$; Method 1 vs. Method 3: $t = -6.78$, $p = 0.0000008176$), further supporting the hypothesis that participants can perceive varying levels of human involvement in AI-generated painting across the three methods.

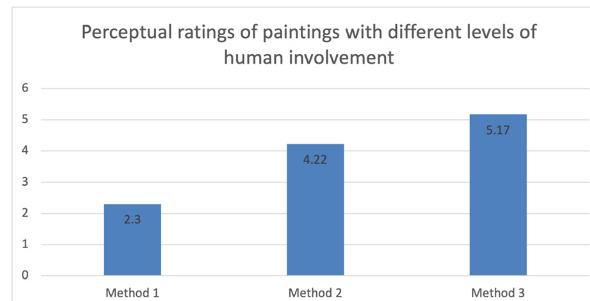


Figure 4: add captions to describe the content of the visuals and point to the figures in the text whenever appropriate

FINAL DESIGN AND IMPLEMENTATION

The inspiration for this project comes from other's previous research findings that human involvement influences users' perceived value of AI-generated works. The project aims to further explore how varying levels of human involvement affect social connectedness. In this section we introduce our design considerations, and how they were implemented in practice.

Design Consideration

This project aims to explore how Generative AI can be used to create artistic works to enhance social connectedness between parents and children in long-distance family settings. The project selects raw sound data as the foundational input for generation, based on the idea that sound vividly and authentically reflects an individual's state of life. Sound carries diverse types of information, conveying important emotional and behavioral cues from daily life. Key features of sound—such as frequency, loudness, and duration—can effectively reveal or indicate a person's emotional state and activities. Therefore, this project utilizes ChatGPT-4o's audio analysis capabilities to extract and interpret these essential sound features, facilitating AI-generated artistic creations.

Visual Mapping Mechanism

To ensure consistency and coherence in AI-generated painting and to control experimental variables, the design principles of generative AI [18] play a crucial role. We developed dedicated GPT models in the GPT Store and established a set of mapping rules to translate sound features into visual elements. These rules include:

- *Sound frequency determines the number of birds in the artwork;*
- *Sound duration influences the complexity and richness of the image;*
- *Loudness reflects the height and quantity of trees and mountains;*
- *Sound variability is mapped to the intensity and movement of water waves.*

Through this dynamic transformation of sound into visual form, users can observe subtle details in the generated images, allowing them to infer the emotional and situational states of distant family members. This artistic process fosters emotional closeness and strengthens connections through creative interaction.

Visualization Methods

To further investigate the impact of human involvement on social connectedness, the project introduces three methods that progressively increase the level of human participation in the generative process, ensuring both comparability and control in the experiment:

1.*Method 1*- Pure AI Generation Mode – *In this method, images are generated solely based on predefined mapping rules applied to the sound data, with no human intervention. The process is fully automated by AI (Figure 5).*

2.Method 2- Emotional Prompt Mode – This method integrates sound data with emotion prompts provided by users to enhance control over the visual output. The GPT model analyzes the sound features while simultaneously adjusting generation rules according to the emotional input (Figure 6).

3.Method 3- Multi-layer Involvement Mode – The method 3 combines sound data, emotion prompts, and reference images to guide the AI generation process. Users provide reference photos, and the GPT model is trained to extract and incorporate key visual elements from these references into the final artwork. Alongside this, the system continues to analyze sound features and interpret emotional prompts to refine the output further (Figure 7).

By progressively increasing human involvement in the generative AI art process, this project seeks to gain a deeper understanding of how human intervention affects the perceived value of AI-generated works and their influence on social connectedness.

Implementation

The design is ultimately deployed through GPTs and integrated into social media platforms (such as WeChat) via LinkAI and JavaScript. By connecting to the GPT-4 API on the backend,users can access the system by scanning a QR code to log into a WeChat account, which then functions as a chatbot. Users who add the chatbot can interact with it by engaging in conversations and providing data. The backend processes the collected text and data, transmitting them to GPT-4o for analysis. Based on this analysis, the system generates prompts that are sent to the DALLE-3 model to create visual outputs. The final images, rendered at a resolution of 512x512, are returned to the user upon completion of the inference process.

Figure 5: Generated by Method 1

Only Sound Data

Figure 6: Generated by Method 2

Sound Data

Emotion prompts: Happy

Figure 7: Generated by Method 3

Sound Data

Emotion prompts: Happy

Photo Content: Running with three friends

METHODOLOGY-PILOT TEST

This work investigates the impact of three levels of human involvement in generative AI visualization methods on social connectedness between parents and their children living apart. We begin by introducing the participants and the study apparatus, followed by a detailed outline of the study procedure and data analysis methods

Participants

A total of three participants who were living apart from their parents were recruited for this pilot test (1 female and 2 males, M = 24). All participants were unmarried, aged between 18 and 35, and had been separated from their parents for at least three months.

Apparatus

To better simulate real-life conditions, the experiment will create a social media account(Wechat) posing as a chatbot. We used Chatgpt's LLM and Dalle3 model.

In this experiment, we utilized the Inclusion of Other in the Self Scale (IOS)[2], the General Attitudes towards Artificial Intelligence Scale (GAAIS)[24,25], and a questionnaire adapted from Fiona's research.

Procedure

Before the study began, we contacted the participants' parents directly. We obtained their consent to use the data they provided. With their permission, parents submitted three audio recordings, a description of their current emotional state, and an image they wished to share with their child. They were instructed not to discuss this content with their child during the experiment.

The chatbot used in this experiment operated through WeChat. First, we processed the data collected from the parents. Visual images were generated using different methods by Chatgpt (Figure 9). After this step, participants received the GAAIS. We explained the purpose and details of the experiment to them. Participants were informed that they should not discuss the data or the experiment with their parents during the study.

This experiment used a within-subject design, where each participant experienced visualizations generated by three different methods. To avoid order effects, we applied a complete randomization method to determine the sequence of conditions.

Before each experimental condition began, participants completed the IOS scale to establish a baseline measure of their closeness with their parents. The experiment lasted for one day. The chatbot sent participants a visualization image and visualization process and data information in the morning, noon, and evening to help them understand how the image was generated (Figure 10). At the end of the day, we conducted a 10-minute semi-structured interview in the evening. Participants also retook the IOS Scale to assess post-experiment closeness.

It is important to note that to ensure the three visualization methods effectively reflected different levels of parental involvement, we conducted a manipulation test through questionnaires for double-checking. Additionally, to prevent interference between methods and ensure participants' closeness returned to baseline before the next experiment, we reviewed psychological studies on interpersonal closeness. The findings indicated that a 48-hour interval was appropriate for this experiment. Therefore, a two-day interval was set between each method.

Measure

This experiment utilized three scales, two of which have been validated by researchers. The GAAIS was used to assess participants' attitudes toward AI, providing insights to explain any anomalies observed during the experiment. The scale consists of 20 questions, rated on a 5-point Likert scale.

Additionally, the IOS scale was used to measure the closeness between participants and their parents. The IOS Scale includes seven levels, with each level corresponding to a specific score.

The third scale was designed to test whether participants could perceive different levels of parental involvement under various experimental conditions, serving as a manipulation test. This scale was adapted from Fiona's work[12], which measured a sense of belonging and control, with scoring methods referenced from the original study.

Data Analysis

Due to the current lack of sufficient experimental data, quantitative analyses, such as ANOVA tests, have not yet been conducted. This experiment primarily focuses on qualitative analysis.

The analysis of our qualitative study data was informed by the paradigm of interpretative phenomenological analysis[30].During the analysis, our goal was to explore how these three visualization methods with different levels of human involvement affect the social connectesness of children and parents, ultimately answering the question with a rich narrative of how users understand these three methods, the intermediate results, and the final results. We explored each user's case, how they perceive it, and their opinions and suggestions.

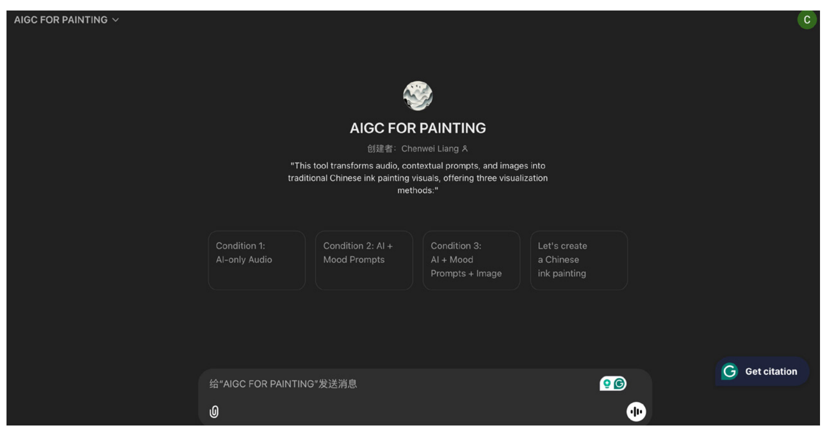


Figure 9: The GPTs created for the experiment can be visualized by uploading audio files, emotion prompts, and pictures.

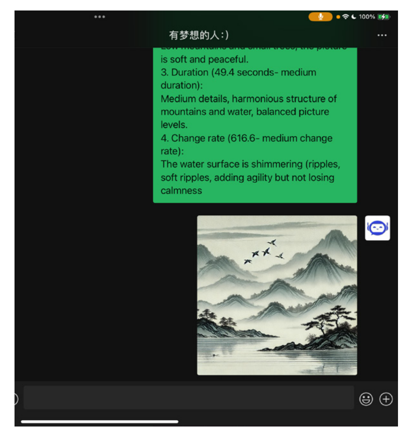


Figure 10: Chatbot send the images and prompt to participants

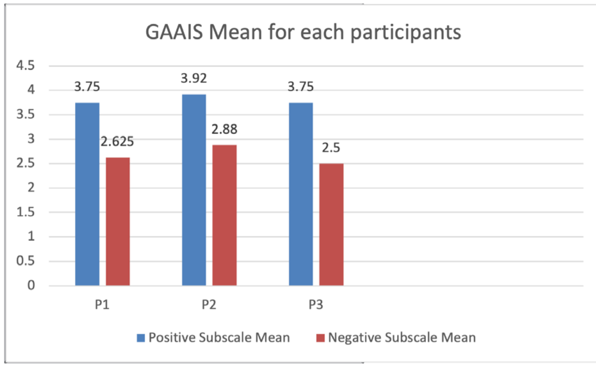


Figure 11: GAAIS Scale Mean Value

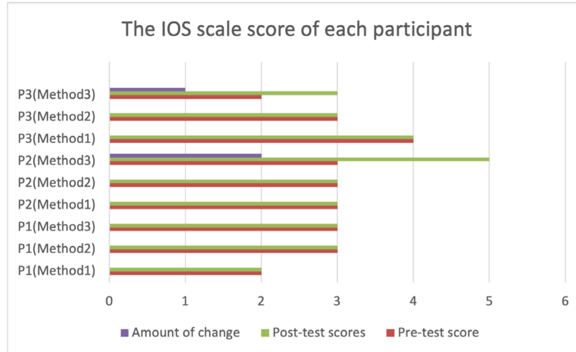


Figure 12: The IOS scale score of each participant

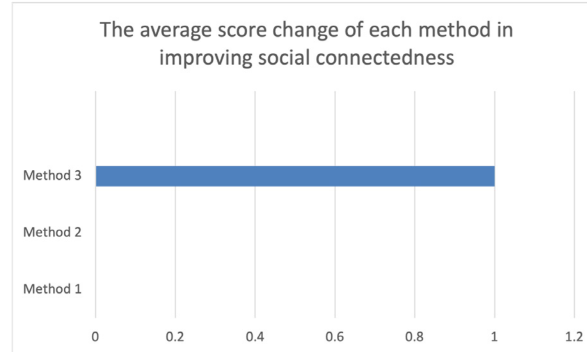


Figure 13: IOS scale score change values for the three methods

RESULTS

Quatitative Data

Due to the limited sample size, we have opted not to conduct a full quantitative analysis. However, we will present results for the existing GAAIS and the IOS scale. The results of the manipulation test require a larger dataset to ensure statistical validity, and as such, they will not be included in this report.

GAAIS

The GAAIS Scale was used to evaluate participants' attitudes towards AI, divided into positive and negative subscales. Higher scores on each subscale indicate a more positive attitude, with a high negative subscale score reflecting greater tolerance for AI's potential drawbacks.

The following results were obtained for the three participants (P1, P2, P3):

- *Participant 1 (P1):*
    - *Positive subscale mean: 3.75*
    - *Negative subscale mean: 2.625*
- *Participant 2 (P2):*
    - *Positive subscale mean: 3.92*
    - *Negative subscale mean: 2.88*
- *Participant 3 (P3):*
    - *Positive subscale mean: 3.75*
    - *Negative subscale mean: 2.5*

The results indicate that all participants scored within the moderate range on the positive subscale, with scores ranging from 3.75 to 3.92. Negative subscale scores varied more noticeably, with P3 scoring the lowest at 2.5 and P2 scoring the highest at 2.88 (Figure 11).

IOS Scale

To evaluate the effectiveness of three methods (Method1, Method2, Method3) in enhancing social connectedness, we analyzed the changes in participants' scores before and after each method.

The results are shown in the figure. Among the three participants, only participants 2 and 3 experienced an increase in social connectedness after engaging with Method3, while no changes were observed for participant 1 across all methods (Figure 12).

The average score change for each method is as follows (Figure 13):

- *Method1: Average change = 0.0*
- *Method2: Average change = 0.0*
- *Method3: Average change = +1.0*

Although Method3 showed a higher average change, due to the limited sample size, this result was only used as a trend reference and no further analysis was performed.

Qualitative Data

This section reports the results of the qualitative analysis and provides a preliminary answer to our research questions by summarizing users' experiences with the visualization method at different levels of parental involvement.

Absence of Social Connectedness and Weak Triggers

All three participants highlighted the limitations of AI-generated images in fostering social connectedness, especially when only audio data was used (Method 1 and Method 2). The abstract landscapes generated solely from audio input often failed to convey the individuality or emotional state of their parents effectively.

For Method 1 (audio data only), P1 directly stated:

"There is no sense of connection because this doesn't feel like my mom's style at all."

He elaborated:

"The content of the image didn't remind me of anything related to my mother. It's just an image. However, based on the changes in the images, butlike the waves or the number of birds, I could get a sense of environmental changes around her."

"Looking at these images, I don't feel any connection. It feels like it could be from anyone."

P3 similarly remarked:

"It feels like random audio data was used to generate something and labeled as my mom's. There's nothing concrete that represents my parents."

Despite these limitations, some participants found subtle points of connection in specific details. For instance, P1 noted during Method 2:

"The sunlight made me feel like it might correspond to her mood a little, but the change wasn't obvious."

The element of sunlight became a rare visual cue that evoked emotional resonance.

P3 mentioned:

"If there were no prompts, I wouldn't notice much difference. But after reading the prompt, I could feel a slight connection.

P2 reflected:

"The sunlight element helped a bit – it seemed to represent my mom's mood. I might feel that it's something she would send, but overall, I didn't feel much because these images are still too AI-driven. I need something that can directly trigger my memories."

Concrete Visuals and Emotional resonance

In Method 3, the inclusion of photos provided by the parents significantly enhanced participants' perception of parental presence and narrative coherence, fostering a stronger sense of social connectedness.

When the generated image contained relatable content, participants found it more meaningful. P1 noted:

"The part with people is definitely the most important because it directly reflects my mom's actions."

He further elaborated:

"There's a story now – people and relationships. I feel like my mom was hanging out with friends, which made me feel closer to her."

P3 expressed similar feelings:

"Seeing that person standing there, I immediately felt like it was a photo my mom took and sent to me. It felt like communication."

However, not all images successfully fostered social connectedness. When the content lacked personal relevance,it is very hard to establish emotional resonance for participants. P2 pointed out:

"I didn't feel anything special. This kind of photo could come from anyone – my dad, mom, or uncle. When I talk to my mom, our conversations have distinctive characteristics, but these images don't reflect that uniqueness for my mom."

Comparison of the perceptions of the three methods

Method 1: Lowest Parental Involvement and Weakest Connection

Participants agreed that parental involvement in the image generation process plays a crucial role in enhancing social connectedness. However, in Method 1, where parents only provided audio data, the AI's dominance in the generation process left participants feeling nothing from their parent.

P1 commented:

"I feel like my mom's only involvement was providing the audio. The image translat-ed from audio felt like an objective representation, and the style didn't match what she would choose."

P2 added:

"If you hadn't told me these images were from my mom, I wouldn't have known. AI is leading the process – my mom just recorded audio and left it there."

Method 2: Additional Data but Limited Connection

In Method 2, parents provided emotional prompts along with audio, introducing slight variations in the images. However, participants still found it difficult to perceive their parents' emotional state directly.

P1 remarked:

"The sun helped a little – it felt like it corresponded to her mood, but not much. I understood her a bit more, but not significantly."

P3 noted:

"Without context, I wouldn't see the difference between these images."

P2 said:

"It doesn't feel like something my mom would send, but it could be. Older people love to send pictures of sunshine and flowers. Still, it didn't really make me think of her specifically."

Method 3: Highest Parental Involvement and Stronger Connection

In Method 3, the inclusion of both photos and audio from parents enhanced the personalization of the generated images, resulting in a stronger sense of connectedness.

In Method 3, the inclusion of both photos and audio from parents enhanced the personalization of the generated images, resulting in a stronger sense of connectedness.

P1 explained:

"There's a story now – people and relationships. I feel like my mom was with friends, which made me feel closer to her. The human figures made me think of her activities, but the AI-generated landscape still felt too abstract."

P2 added:

"This feels more like something my mom would send compared to the previous ones, but it's mainly the photo part. The rest still feels AI-driven."

P3 remarked:

"Without you telling me, I might think it's randomly generated… but with the photo, it felt like my mom chose a picture, and AI built on it. It's like receiving a message from her."

Participants' summary of the three methods

Method 3 (photos + audio + prompt) was regarded as the most effective in fostering social connectedness.

P1 and P3 highlighted that adding personal elements, such as photos, made it easier to relate to their parents compared to only AI-generated images in Method 1 and 2.

P1 stated:

"The method with photos and people felt the closest to my mom because it involved more interesting elements. There were people and activities, so I felt some concrete actions, and I felt connected to my mother."

P3 emphasized:

"This method makes me feel like I'm communicating with my mother, while the other methods felt like empty voice messages."

However, P2 remained skeptical:

"None of the three methods really enhanced social connectedness for me – they all felt too AI-driven."

The importance of personalization for Social Connectedness

All participants highlighted personalization as essential for improving social connectedness.

P1 said:

"If it was decided by my mother, for example, the style she likes, I might be able to understand his preferences better. Well, and given that I have a certain understanding of my mother, the style he chooses may also make it easier for me to associate with his feelings."

P2 added:

"When I send an image, it reflects my style. It's the same for my parents – personalization directly reflects their choices."

P3 suggested greater parental control*:*

"I want my parents to directly choose the result. It would feel like something they specifically selected for me, not something randomly generated by AI."

DISCUSSION

This study explores how different levels of human involvement affect social connectedness between parents and their children living apart in Gen AI Painting. The experiment found that the higher the level of parental involvement, the more emotional connection the children have with their parents. At the same time, the participants expressed their understanding and needs of the system.

GAAIS and IOS Scale

Due to the limited sample size, quantitative analysis can only reveal some trends and cannot be used as a conclusion. The results of the GAAIS scale revealed that participants held a moderately positive attitude towards AI, indicating that although they recognized the advantages of AI, they were still cautious about the potential risks of AI. The IOS scale further pointed out that only Method3 improved the sense of social connectedness among some participants (P1, P3), while other methods did not show significant effects. This means that the more involved parents are, the more data information they provide, and the higher the perceived value of the works generated by Gen AI to participants.

Qualitative analysis

Social connectedness & Personalization

The study preliminarily shows that among the three visualization methods, participants prefer method 3, mainly because the rich amount of information can enhance the perception and understanding of the parent's status. On the other hand, if the work is driven more by AI, the participants will have a lower perceived value of the work and feel that it is not what their parents want to express. All participants also emphasized the importance of personalization. Images that reflected parental preferences, emotions or specific memories were more likely to promote a sense of connection, while generic AI-generated content was seen as lacking emotional value.

"If the style was chosen by my mother, it might be easier for me to understand her feelings." (P1)

The criticality of personalization in promoting a sense of social connection was reflected in the feedback from all participants. Images that reflected parental preferences, emotions, or specific memories significantly increased participants' sense of empathy. The generic images generated by AI, although also of high visual quality, were regarded by participants as "indifferent" and "irrelevant" due to the lack of more parent-related information and parent-personalized elements.

The impact of information content on social connectedness

Although Method 3's more informational involvement brings participants closer to their parents, this does not mean it can must lead to a higher sense of social connectedness. The ability to provide information that resonates emotionally with participants is also critical in this process. In the experience of Method3, P2's sense of social connection did not change significantly. The main reason is that he believed that the pictures provided by his mother were "too ordinary" and lacked elements that could represent his mother's personality:

"These photos look so ordinary, like anyone could send them to me. They don't look like the style of my mother chatting with me." (P2)

This phenomenon shows that even if the information data provided comes from parents, if the emotions or memories it carries are not enough to resonate with participants, the improvement in social connectedness will still be limited. Therefore, in subsequent experiments, it is crucial to ensure that the information provided by parents is representative and emotionally triggering.

Conflict between experimental control and user expectations

During the experiment, we set strict generation rules to ensure the controllability of the output process and reduce unnecessary interference. However, this approach has limited the participants' expectations for personalized expression to a certain extent, resulting in the overall experience of the three methods not meeting the participants' ideal effects. Participants hope that the system can generate images that are more in line with the personality of their parents, rather than standardized outputs that follow preset rules. Nevertheless, the purpose of this study is to explore how the different levels of human involvement affects social connectedness, so the control of variables and the reduction of personalized input are necessary in the experimental design. By comparing the three methods and conducting a complete experiment, the study may further reveal the impact of personalized and information resonance on social connectedness.

Limitation

Because the experiment has not yet ended, we cannot propose future research directions and design inspirations, but there are still some deficiencies in this pilot test experiment.

In the visualization of Method 3, the pictures provided by parents should be related to their children, with information integrated into their memories and uniqueness. Because of this lack, P2 did not improve social connectedness in Method 3. At the same time, the interview questions in the experiment are still flawed. Some participants will focus on the creation of AI in the interview and ignore the intervention of their parents. At the same time, the answers to some questions are similar, which makes it difficult for participants to answer and needs to be modified before the start of subsequent experiments.

CONCLUSION

In this report, we built a Gen AI painting system to explore how different levels of human involvement affect social connectedness between children and their parents living apart. This work designs three visualization methods to collect sound data for visualization. According to the conclusion drawn from the Pilot test, the higher the level of parental involvement, the stronger the child's ability to perceive the work, and the more perceived value the work has. In addition, the study also found that the personalization of the image style and the resonance of the input to the generative AI data (Photos provided by parents) have a significant impact on enhancing the social connectedness. The experiments of this study will continue until the FMP Project is completed. We aim to provide research contributions to the fields of social computing and emotional design. While focusing on how the degree of human intervention affects the perception and social connectedness of AI works, we will also refine through experimental analysis that can be applied to generative formulas. Design principles for AI. Contribute to the subsequent design and research of building the Gen AI painting system.

ACKNOWLEDGEMENTS

I would like to thank my coach Dr. Jun Hu for his patient and meticulous guidance. His expertise and help enabled me to smoothly advance my M2.1 project and transition to the FMP project. I would also like to thank Dr. Pengcheng An for his valuable guidance during the experimental design and concept building process. In addition, I would like to thank PhD candidate Rui Wang for his help and support during the project.

REFERENCES

1. Aarts, S., Peek, S. T. M., & Wouters, E. J. M. (2015). The relation between social network site usage and loneliness and mental health in community-dwelling older adults. International Journal of Geriatric Psychiatry, 30(9), 942–949.
2. Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. Journal of Personality and Social Psychology, 63(4), 596-612.
3. Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. Psychological Bulletin, 117(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497
4. Bernheim Brush, A. J., Inkpen, K. M., & Tee, K. (2008). SPARCS: Exploring Sharing Suggestions to Enhance Family Connectedness. In Proceedings of the 2008 ACM Conference on Computer Supported Cooperative Work, 629–638. https://doi.org/10.1145/1460563.1460661
5. Brereton, M., Chai, M. Z., Soro, A., Ambe, A. H., Johnson, D., Wyeth, P., Roe, P., & Rogers, Y. (2017). Make and connect: enabling people to connect through their things. In Proceedings of the 29th Australian Conference on Computer-Human Interaction, 612–616. https://doi.org/10.1145/3152771.3156182
6. Chen, B., & Li, X. (2024). Understanding Sociotechnical Opportunities for Enhancing Communication Between Older Adults and their Remote Family. In Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems, Article 1013, 1–16. https://doi.org/10.1145/3613904.3642318
7. Chen, S., Wang, M. P., Chu, J. T. W., Wan, A., Viswanath, K., Chan, S. S. C., & Lam, T. H. (2017). Sharing Family Life Information Through Video Calls and Other Information and Communication Technologies and the Association With Family Well-Being: Population-Based Survey. JMIR Mental Health, 4(4), e57. https://doi.org/10.2196/mental.8139
8. van der Vlist, B. J., Niezen, G., Hu, J., & Feijs, L. M. (2010, June). Semantic connections: Exploring and manipulating connections in smart spaces. In The IEEE symposium on Computers and Communications (pp. 1-4). IEEE.
9. Dadswell, A., Bungay, H., Wilson, C., & Munn-Giddings, C. (2020). The impact of participatory arts in promoting social relationships for older people within care homes. Perspectives in Public Health, 140(5), 286–293. https://doi.org/10.1177/1757913920921204
10. Dalsgaard, T., Skov, M. B., & Thomassen, B. R. (2007). eKISS: Sharing Experiences in Families Through a Picture Blog. In Proceedings of the 21st British HCI Group Annual Conference on People and Computers: HCI…but not as we know it -Volume 1, 49–58. https://doi.org/10.14236/ewic/HCI2007.7
11. Davis, K., Owusu, E., Van Den Boomen, G., Apeldoorn, H., Marcenaro, L., Regazzoni, C., Feijs, L., & Hu, J. (2017). Presenting a Real-Time Activity-Based Bidirectional Framework for Improving Social Connectedness. Springer International Publishing, 356–367. https://doi.org/10.1007/978-3-319-59147-6_31
12. Draxler, F., Werner, A., Lehmann, F., Hoppe, M., Schmidt, A., Buschek, D., & Welsch, R. (2024). The AI Ghostwriter Effect: When Users do not Perceive Ownership of AI-Generated Text but Self-Declare as Authors. ACM Transactions on Computer-Human Interaction, 31(2), Article 25, 40 pages. https://doi.org/10.1145/3637875
13. Gozalo-Brizuela, R., & Garrido Merchan, E. E. (2024). A Survey of Generative AI Applications. Journal of Computer Science, 20(8), 801-818. https://doi.org/10.3844/jcssp.2024.801.818
14. Hazer, O., & Boylu, A. A. (2010). The examination of the factors affecting the feeling of loneliness of the elderly. Procedia - Social and Behavioral Sciences, 9, 2083–2089.
15. Hutchinson, H., Mackay, W., Westerlund, B., Bederson, B. B., Druin, A., Plaisant, C., Beaudouin-Lafon, M., Conversy, S., Evans, H., Hansen, H., Roussel, N., & Eiderbäck, B. (2003). Technology probes: inspiring design for and with families. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 17–24. https://doi.org/10.1145/642611.642616
16. Jørgensen, M. S., Nissen, F. K., Paay, J., Kjeldskov, J., & Skov, M. B. (2016). Monitoring children's physical activity and sleep: a study of surveillance and information disclosure. In Proceedings of the 28th Australian Conference on Computer-Human Interaction, 50–58. https://doi.org/10.1145/3010915.3010936
17. Kelly, R. M., Cheng, Y., McKay, D., Wadley, G., & Buchanan, G. (2021). "It's About Missing Much More Than the People": How Students use Digital Technologies to Alleviate Homesickness. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, Article 226.
18. Hu J, Le D, Funk M, Wang F, Rauterberg M. Attractiveness of an interactive public art installation. InDistributed, Ambient, and Pervasive Interactions: First International Conference, DAPI 2013, Held as Part of HCI International 2013, Las Vegas, NV, USA, July 21-26, 2013. Proceedings 1 2013 (pp. 430-438). Springer Berlin Heidelberg.

19. Martino, J., Pegg, J., & Frates, E. P. (2015). The Connection Prescription: Using the Power of Social Interactions and the Deep Desire for Connectedness to Empower Health and Wellness. American Journal of Lifestyle Medicine, 11(6), 466–475. https://doi.org/10.1177/1559827615608788

20. Moura, F. T., Castrucci, C., & Hindley, C. (2023). Artificial Intelligence Creates Art? An Experimental Investigation of Value and Creativity Perceptions. The Journal of Creative Behavior, 57(4), 534–549. https://doi.org/10.1002/jocb.600

21. Rapp, A., Di Lodovico, C., Torrielli, F., & Di Caro, L. (2025). How do people experience the images created by generative artificial intelligence? International Journal of Human-Computer Studies, 193, 103375. https://doi.org/10.1016/j.ijhcs.2024.103375

22. Rowan, J., & Mynatt, E. D. (2005). Digital Family Portrait Field Trial: Support for Aging in Place. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 521–530. https://doi.org/10.1145/1054972.1055044

23. Saslis-Lagoudakis, G., Cheverst, K., Dix, A., Fitton, D., & Rouncefield, M. (2006). Hermes@Home: supporting awareness and intimacy between distant family members. In Proceedings of the 18th Australia Conference on Computer-Human Interaction, 23–30. https://doi.org/10.1145/1228175.1228183

24. Schepman, A., & Rodway, P. (2020). Initial validation of the General Attitudes towards Artificial Intelligence Scale. Computers in Human Behavior Reports, 1, 100014. https://doi.org/10.1016/j.chbr.2020.100014

25. Feng, Y., Barakova, E. I., Yu, S., Hu, J., & Rauterberg, G. M. (2020). Effects of the level of interactivity of a social robot and the response of the augmented reality display in contextual interactions of people with dementia. Sensors, 20(13), 3771.

26. Schans, D. (2009). Transnational family ties of immigrants in the Netherlands. Ethnic and Racial Studies, 32(7), 1164–1182.

27. Schnitzer, B., Vural, U. C., Schnitzer, B., Sardar, M. U., Fuerst, O., & Korn, O. (2024). Prototyping a Zoomorphic Interactive Robot Companion with Emotion Recognition and Affective Voice Interaction for Elderly People. Proceedings of the ACM on Human-Computer Interaction, 8, EICS, Article 242. https://doi.org/10.1145/3660244

28. Shin, J. Y., Rheu, M., Huh-Yoo, J., & Peng, W. (2021). Designing Technologies to Support Parent-Child Relationships: A Review of Current Findings and Suggestions for Future Directions. Proceedings of the ACM on Human-Computer Interaction, 5, CSCW2, Article 441. https://doi.org/10.1145/3479585

29. Skrbiš, Z. (2008). Transnational families: Theorising migration, emotions and belonging. Journal of Intercultural Studies, 29(3), 231–246.

30. Smith, J. A. (2007). Hermeneutics, human sciences and health: linking theory and practice. International Journal of Qualitative Studies on Health and Well-Being, 2(1), 3–11. https://doi.org/10.1080/17482620601016120

31. Bartneck, C., Hu, J., Salem, B., Cristescu, R., & Rauterberg, M. (2008). Applying virtual and augmented reality in cultural computing.

32. Van Bel, D. T., IJsselsteijn, W. A., & de Kort, Y. A. W. (2008). Interpersonal connectedness: conceptualization and directions for a measurement instrument. In CHI '08 Extended Abstracts on Human Factors in Computing Systems, 3129–3134. https://doi.org/10.1145/1358628.1358819

33. VYalvaç, F., Lim, V., Hu, J., Funk, M., & Rauterberg, M. (2014). Social recipe recommendation to reduce food waste. In CHI'14 Extended Abstracts on Human Factors in Computing Systems (pp. 2431-2436).

34. Wang, J., Yuan, X., Hu, S., & Lu, Z. (2024). AI paintings vs. Human Paintings? Deciphering Public Interactions and Perceptions towards AI-Generated Paintings on TikTok.

35. World Health Organisation. (2020). Refugee and Migrant Health. https://www.who.int/health-topics/refugee-and-migrant-health

36. Ye, Y., Hao, J., Hou, Y., Wang, Z., Xiao, S., Luo, Y., & Zeng, W. (2024). Generative AI for Visualization: State of the Art and Future Directions. Visual Informatics, 8(1), 1-15. https://doi.org/10.1016/j.visinf.2024.01.002

37.Winstone, L., Mars, B., Haworth, C. M. A., et al. (2021).Social media use and social connectedness among adolescents in the United Kingdom: a qualitative exploration of displacement and stimulation.BMC Public Health, 21, 1736. https://doi.org/10.1186/s12889-021-11802-9

38.Zentgraf, K. M., & Chinchilla, N. S. (2012).Transnational family separation: A framework for analysis.Journal of Ethnic and Migration Studies, 38(2), 345–366.

39. Martin Ragot, Nicolas Martin, and Salomé Cojean. 2020. AI-generated vs. Human Artworks. A Perception Bias Towards Artificial Intelligence? In Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems (CHI EA '20). Association for Computing Machinery, New York, NY, USA, 1–10. https://doi.org/10.1145/3334480.3382892

40. Eric, T. G., DI CARO, L., & Rapp, A. (2024). Human-AI Collaboration Insights from Music Composition. In Generative AI and HCI Workshop Proceedings (pp. 1-5). GenAICHI 2024

41. Zhang Y, Gosline R. Human favoritism, not AI aversion: People's perceptions (and bias) toward generative AI, human experts, and human–GAI collaboration in persuasive content generation. Judgment and Decision Making. 2023;18:e41. doi:10.1017/jdm.2023.37

42.Ella Dagan and Katherine Isbister. 2021. Synergistic Social Tech-nology: Designing Systems with 'Needs' that Encourage and Sup-port Social Interaction. In Proceedings of the 2021 ACM DesigningInteractive Systems Conference (Virtual Event, USA) (DIS '21). Assoiation for Computing Machinery, New York, NY, USA, 1419–1432.https://doi.org/10.1145/3461778.3462021

43.Mikkel S. Jørgensen, Frederik K. Nissen, Jeni Paay, Jesper Kjeld-skov, and Mikael B. Skov. 2016. Monitoring children's physicalactivity and sleep: a study of surveillance and information disclosure. In Proceedings of the 28th Australian Conference on Computer-Human Interaction (Launceston, Tasmania, Australia) (OzCHI '16).Association for Computing Machinery, New York, NY, USA, 50–58.https://doi.org/10.1145/3010915.3010936

44. Tim Coughlan, Michael Brown, Sarah Martindale, Rob Comber,Thomas Ploetz, Kerstin Leder Mackley, Val Mitchell, and Sharon Baur-ley. 2013. Methods for studying technology in the home. In CHI '13Extended Abstracts on Human Factors in Computing Systems