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Design of Multi-Sensory Keyboard for Enhancing Communication Among Long Distance Lovers

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ABSTRACT

Due to distance limitations, some long-distance romantic groups can only communicate with each other online. It is common for young people to use computers to communicate online. However, through investigation, it was found that this communication method gradually becomes monotonous and boring in terms of content and form over time, reducing the desire to communicate. As a computer input device, the keyboard has strong technical functionality and neglects the possibility of emotional care, leaving room for optimization and improvement. This study focuses on the communication needs of long-distance couples and designs a multi-sensory keyboard that integrates multiple sensory interaction methods of visual and tactile senses. After preliminary user testing, the keyboard has achieved certain results in enhancing emotional connections, meeting personalized needs, and improving interactive fun.

Keywords: Long-distance intimacy, Multi-sensory keyboard, Human-computer interaction

BACKGROUND

Long Distance Relationship and Communication

Sometimes people are forced to stay away from their loved ones for a specific period of time, such as going to other cities for study or work. Long distance brings great challenges to couples' intimacy (Belus et al., 2019). Tiktok has made statistics on the difficulties faced by long-distance lovers in 2024 (Hathu, 2024). The chat tends to be dull, difficult to meet, worried about not being able to last, different life rhythm, lack of care, etc. will become obstacles to the stability of the relationship between long-distance lovers. Among them, monotonous and boring communication has become the main difficulty for long-distance relationships.

In the in-depth study of media usage, through statistical analysis of the data, more than 40% of people use computers for online communication every day (An, 2020). This also means that computers have become the main medium for people to communicate across geographical limitations.

Similarly, the main communication medium for long-distance couples is currently concentrated online. Through phone and video calls, the changes in tone and expression of both parties can intuitively reflect the changes in

individual emotional states. Such auditory and visual perceptions can make the transmission of emotions and feelings more accurate and immediate, thereby improving the convenience of communication between both parties. Meanwhile, "gaming" has also become an important shared activity for long-distance partners. In addition, mutual supervision and companionship of each other's learning and work have also begun to be achieved through online means (Wang and Ye, 2024).

Multi-Sensory Interaction

The senses are mainly divided into visual, tactile, olfactory, gustatory, etc. Through these multi-sensory interactive designs, the fun of the product can be increased and the user's usage time can be extended (Schifferstein and Desmet, 2008). Min et al. (2024) conducted research on the transformation of XR equipment through experiments in visual, acoustic, tactile, thermal, and odor feedback, and the results showed that multi-sensory XR experiences can increase audience immersion in virtual environments, thereby affecting users' emotional and cognitive evaluations.

The hedonic attributes of a product perceived via one modality can "pull" a person's estimates of the quality and pleasantness of the product derived from other sensory modalities into alignment, and by so doing, modulate a person's overall product experience (Spence and Gallace, 2011). This study applies multisensory design to keyboard design to enhance the fun of communication between long-distance couples.

INVESTIGATION

User Research

This study recruited 200 subjects (108 female, 92 male) to fill out a questionnaire, which included the basic situation of long-distance couples and their satisfaction with the existing communication media.

In the questionnaire statistics, unmarried individuals aged 18–25 are the main group, accounting for 78%. 70% of the survey respondents are in a learning state. 120 survey respondents indicated that long-distance relationships involve both parties being in the same province but not in the same city, with the highest proportion being 30% who meet their partner 1–3 times a year. More than half of the survey respondents have the most frequent and necessary communication with each other during the evening, and 57% of the survey respondents prefer to communicate with each other through text information. Therefore, the keyboard has become an important physical medium for communication between both parties.

Figure 1 shows that these two groups spend most of their day sitting at a desk facing a computer. This not only reveals their dependence on computers in daily life, but also reflects the important role of work or study scenarios in communication.

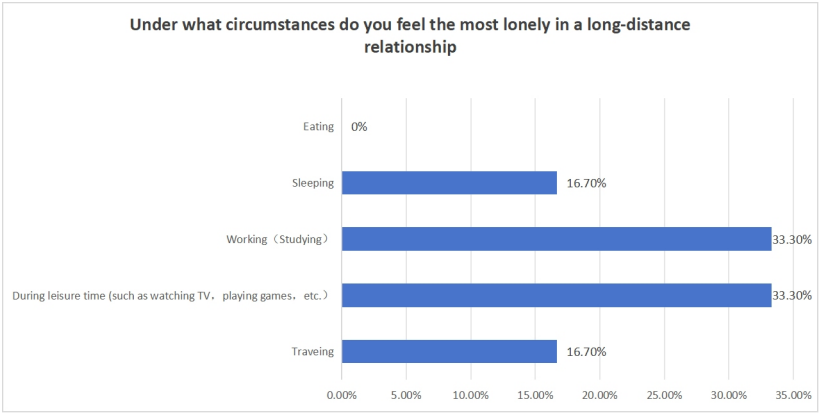

Figure 1: Under what circumstances do you feel the most lonely in a long-distance relationship.

Meanwhile, according to questionnaire statistics, 70% of survey respondents believe that current media can meet some of the needs of long-distance couples. Another 30% of people have expressed their opinions on the shortcomings of current media, with most of them believing that the biggest flaw in current media is the lack or absence of sensory experience. Both video and text cannot meet certain sensory needs in real time.

Analysis of Competitive Products

In fact, various issues related to long-distance relationships have been noticed by the public, and as a result, many products have emerged in today's market attempting to address the underlying problems. These products are mainly divided into two categories: online apps (mobile applications) and physical products.

First of all, among the existing online products, the main representative software includes Tiktok, countdown, etc. These applications have great advantages in terms of convenience, but with the introduction of too many similar software, their similar functions have limited their fun. At the same time, the main function of these software is limited to recording.

Secondly, for existing physical products, the main representatives are Induction Bracelet, Electronic Photo Album, and Long Distance Kissing Device. For Induction Bracelet, it is easy to carry and can interact anytime. However, for Electronic Photo Album, it records past moments and moments in the form of pictures and tends towards intuitive visual output, but lacks real-time communication. For the Long Distance Kissing Device, it enriches sensory experience and is more interesting, but not equipped with communication function.

This study analyzed existing products from four dimensions: fun, recording, specialization, and interaction. As shown in the Figure 2, there are gaps in the existing products in terms of both being interesting and having communication skills.

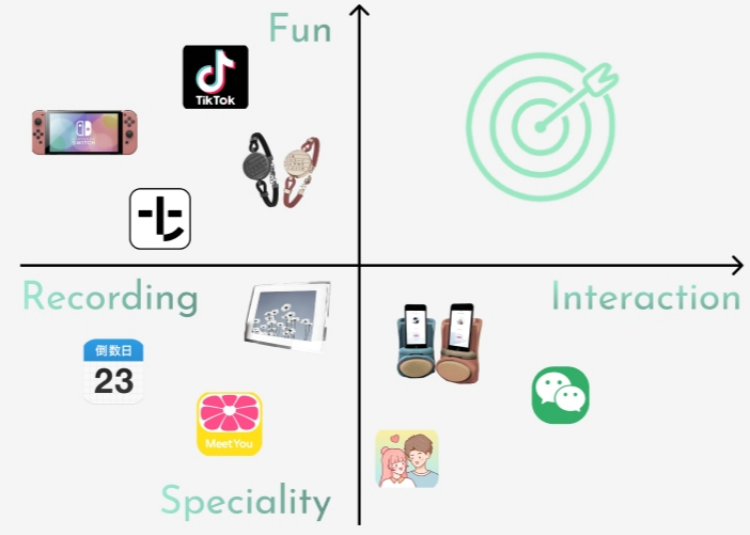

Figure 2: Analysis of different dimensions of competitive products in the market.

However, the long-distance relationship communication products currently on the market are mainly mobile products, lacking the design of computer hardware products, and failing to meet the needs of people in long-distance relationships who need to use computers for long-term work, study, and games.

Further analysis reveals that during this process, the keyboard, as a physical intermediary for communication, exhibits particularly prominent functionality. The use of keyboards makes information transmission faster and more accurate, thereby greatly improving communication efficiency. At the same time, the keyboard has also become a bond that connects people's emotions, allowing couples and colleagues in different places to maintain close contact.

Therefore, the keyboard, as a necessary physical mediator in communication, may also have potential emotional maintenance functions.

In order to compensate for the lack of interest or interactivity in long-distance conversations, this article intends to apply the method of Multi-sensory interaction design to physical product design to enhance the fun of interaction.

MULTI-SENSORY KEYBOARD DESIGN

This study tries to make modifications to the most commonly used medium for long-distance romantic groups - the keyboard, to make it more diverse and interesting for them to communicate.

Figure 3 shows the Multi-sensory keyboard B-E Catcher and its main functions. B-E Catcher mainly enhances the fun of communication between long-distance couples through the combination of visual and tactile interactions. Visually, the keyboard uses the built-in screen to display expressions and print receipts for human-computer interaction. Tactilely, the keyboard uses keys of different materials to convey different emotions to lovers.

Figure 3: B-E Catcher and its functions.

(1) Screen: The screen reflects the user's actions on the keyboard in real-time and is generated in the form of simple emojis. Correspondingly, the corresponding emoji information will also be displayed on the screen when the other party uses the keyboard as shown is Figure 4.

Figure 4: B-E Catcher screen.

(2) Receipt: A receipt is also a form of information visualization, where the content will be classified according to emotions and behaviours, and the actions of both parties on the keyboard will be displayed in real-time in text format in chronological order on the receipt (Figure 5).

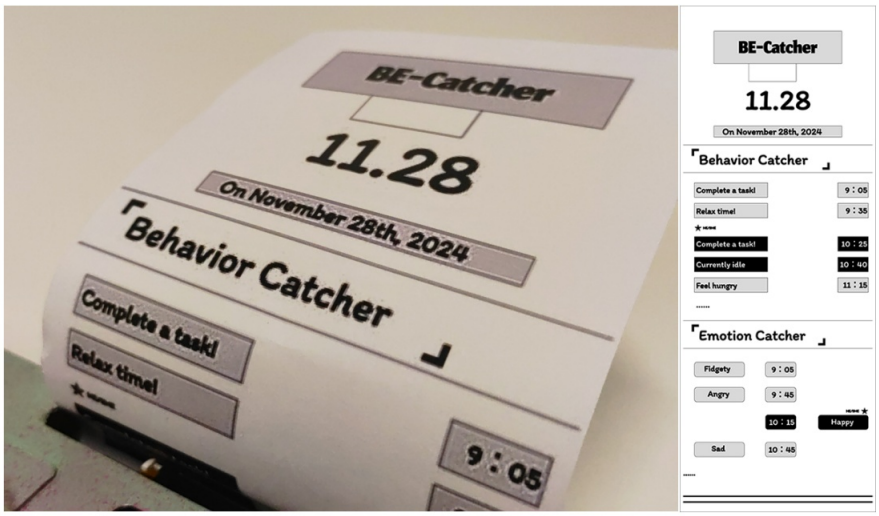

Figure 5: B-E Catcher receipt.

(3) Keys for emotional feedback and behavioural feedback: Through previous questionnaire surveys, it was found that the most common content in daily communication between both parties is divided into two categories: behavioral actions and emotional changes. Therefore, when redesigning the keyboard, its key functions are mainly divided into two categories: behavioral feedback and emotional feedback, achieving different sensory feedback effects through different key materials and usage methods.

Table 1: Keys for emotional feedback and behavioral feedback with different materials.

		Material	Feedback
Behavioural Feedback	①	Rubber roller	Meal time (hunger)
	②	Plastic switch	Idle time
	③	Hard plastic button	A task completed
	⑧	Multi-layer silicone	Recreation & Entertainment
Emotional Feedback	④	Frosted acrylic board	Miss
	⑤	Elastic rubber ball	Feel pressure
	⑥	Automatic retractable drawstring	Feel irritable

Continued

Table 1: Continued

	Material	Feedback
⑦	Iron knob	Adjust happiness level (four levels)
⑨	Iron track	Anxious
⑩	Sponge	Sad
⑪	Woolen yarn	Angry

Figure 6: B-E Catcher emotional feedback and behavioral feedback.

Figure 7 shows the process of using the multi-sensory keyboard for enhancing communication between long distance lovers.

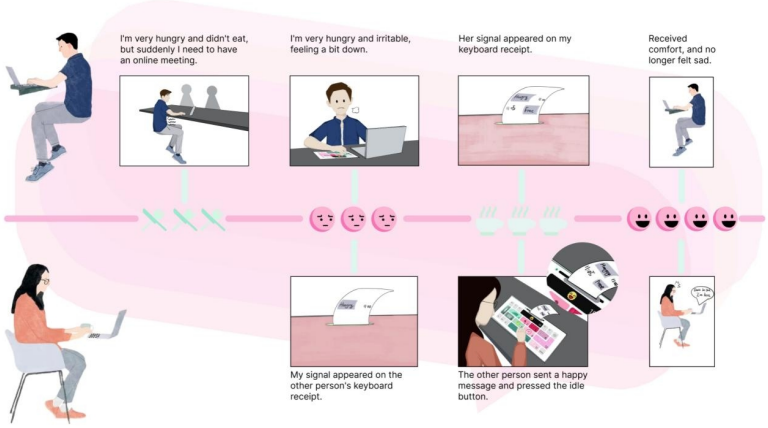

Figure 7: The process of using the multi-sensory keyboard for enhancing communication between long distance lovers.

USER TESTING

20 people were recruited to participant a user experience survey. 14 of them believed that this design was novel and willing to try it out. All subjects were asked to use the multi-sensory keyboard and they are interviewed afterwards. 40% of the subjects believed that this design have increased communication interest between long distance lovers. However, several subjects pointed out that although the design was interesting and personalized, it lost its original functionality as a keyboard and lacked aesthetic appeal as a visual symbol. They hoped to preserve its original functionality and make it truly indispensable in the corresponding scene.

CONCLUSION

As time goes by, communication between long-distance lovers becomes boring. In order to enhance the desire and fun of communication between long-distance lovers, this study uses multi-sensory method to design keyboards, including visual interaction and tactile interaction. In terms of vision, the built-in screen of the keyboard is used to express different emoticons, and printed receipts are used to record communication information. In terms of tactility, keys of different materials are used for behavioral feedback and emotional feedback. According to user test, the multi-sensory keyboard can enhance the fun of communication and has strong interactivity, but it loses the original functionality of the keyboard. In the future, when improving the design of this communication medium, it is necessary to achieve a combination of functionality and fun.

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