Connecting People over Distance Using Furry Mediators

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Abstract: Many people are separated from their families or friends by distance. They want to keep a feeling of connectedness with each other but fail due to distance, time zone differences, or busy lives. Besides, they find it hard to transfer implicit information using traditional ways of communicating. This research concentrates on connecting people over distance using furry mediators. These mediators can share users 'presence and status information with their remote families or friends using different gestures. A lab study with 7 participants was conducted to explore whether the different gestures can be successfully interpreted by the users. After that, a diary study with 4 participants was conducted to investigate users' perception of the furry mediators. Our findings illustrate the potential for using furry mediators as a user interface to connect remote people. The furry mediators increased users' communication frequency and provided them with a subtle and ambiguous communication channel.

Keywords: Tangible User Interfaces; Emotional Communication; Human Computer Interaction

Introduction

Keeping a sense of connectedness is vital to people who are separated from their families or friends by distance. Traditional ways of communicating remotely including text messaging, phone calls, video calls, emails, and so on. These technologies mainly focus on transferring meaningful contexts and explicit information. However, in daily social relationships, we also share implicit information and people need to have emotional and subtle communication in close relationships [7]. Besides, traditional technologies need humans' continuous attention to operate but sometimes people fail to spare time to contact each other due to busy lives.

Many solutions are focusing on supporting the connectedness between remote families or friends, including ambient displays [11], haptic wearables [1], or other hybrid interactions [8]. These approaches mainly share messages open to interpretation between users [10]. Follow these approaches, we design a pair of furry mediators that can share implicit information between separated people.

Exchanging the presence and status information persistently can foster a sense of connectedness between individuals [9]. In this study, we use furry mediators to communicate the status information between two separated people. This system is made up of two pairs of furry mediators. Each user has a pair of them. Each mediator represents the status of one user. We aim at creating a tangible communication channel for supporting emotional awareness between people over distance. We choose animal-like furry mediators as our interface to form a feeling of intimacy and friendliness.

Fig. 1. The functional prototype of the furry mediators

A lab study is conducted to explore different gestures of the mediators. Based on the result of the lab research, we design the gestures of this furry interface and collect users' perceptions using the method of a diary study. The result shows that this system can promote users to contact their families or friends and raise their awareness of each other's presence.

This research presents a novel concept that uses furry robotic mediators as a two-way communication channel to connect people over distance. We explore the possible gestures of a furry interface that aims at sharing people's presence information. Our research shows that furry interfaces are effective in promoting connectedness-oriented communication between people separated by distance.

1. Background

1.1 Unconventional user interfaces for connecting people over distance

There are a large number of systems aiming at promoting the connectedness between people over distance. The form factors they use are various, including movable or semi-fixed objects, phones or tablets, carried objects, wearables, and so on [10]. Most of them use touch as an input modality and graphic visual as an output modality [10]. The contributions of these studies are rich, however, they lack long-term user studies (>= one week). More long-term studies in the wild are needed [10].

Early work has presented the Connected Candles concept, which consists of a pair of candle stands [6]. The candle stand is made up of a real candle and an electronic candle. Two candle stands are placed at different locations and the electronic candle mimics the lighting of the real candle at a distant location, which creates a peripheral aesthetic display for people separated by distance. Cheok and Zhang [1] presented the Ring U, a ring-shaped wearable system designed to promote emotional communication between people using tactile and color expressions. It uses color and touch stimuli to express and assess emotional states. Bear-With-Me is a pair of teddy bears that allow users to exchange tangible expressions of emotions such as hugs in real-time [4]. A maintenance strategy for couples in long-distance relationships, which is sharing one robotic pet over distance, has been developed by Chien et al. [2].

Similarly, our work presents a pair of connected furry mediators that can share the status information synchronously between two people separated by distance. We use touch as an input modality and object movement as an output modality. To gain insight from real-world use cases, we evaluate this system in the field for one week.

1.2 Touch for connectedness

Research have been done to explore the relationship between touch and emotion. Touch is a unique channel to convey emotion [14]. It is a powerful conduit for emotional connectedness [12]. The Huggable is a robotic companion inspired by companion animal therapy [13]. It has an animal-like body and gives a pleasant tactile interaction to users. Flagg and MacLean presented a furry zoomorphic machine that is used for affective touch gesture recognition [3].

In this study, we let users touch an animal-like furry robot as input to give users emotional supports. We assume that the furry interface can foster a sense of companion and friendliness. This assumption is evaluated and proved in our field study.

2. Method

2.1 Furry mediators

Concept and design. To improve the connectedness and awareness between remote families and friends, we designed a pair of furry mediators that are used by two individuals. The mediator has an animal-like furry body and a movable tail. Each individual has a pair of furry mediators which represent the user and his partner. One of the mediators is controlled by the local user, and the other one is controlled by the remote partner. The user can touch the furry body to change the gesture of the tail to show different statuses to another user. We hypothesize that the animal-like furry appearance of the mediators can create a feeling of intimacy and friendliness.
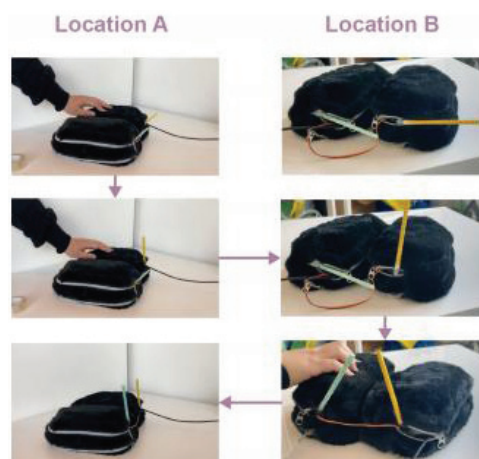

Fig. 2. The furry mediators working at two different locations

Interactive prototypes. The furry mediator prototype is made up of two equal setups. They are controlled by ESP32 microcontrollers which can be connected to Wi-Fi. A pressure sensor is placed under the fur of one of the furry mediators. Two micro servos are used to control the tail of the two mediators. The gesture of the tail which belongs to the user himself can be changed by adding different pressure on the pressure sensor. The two prototypes are linked using the OOCSI network [5] so that the gesture of his partner's mediator will change synchronously. These two prototypes can be freely placed in any location as long as they are connected to Wi-Fi.

2.2 Lab study

Participants. To design the gestures of the mediators, we conducted a lab study. We recruited seven participants (4 female) who were students at university and had a median age of 24 years old. All of them were separated from their families or friends by distance and had regular communication with their families or friends via messages or phone calls. The session was voice recorded and the participants were informed that the audio was recorded and would only be used for conducting the study and improving the prototype.

Set up. The lab study was conducted to explore how people understand the different gestures of the mediators and what do people want to share with their remote families or friends with this prototype. At the beginning of the study, some background questions were asked to know the participant's habits of communicating with their remote families or friends. After that, an explanation of the aim of the study and how the furry mediator work was introduced to the participants. Next, the participants were asked to watch seven gestures of the mediators and match different gestures with different meanings like "I am busy" or "I am available". The participants filled in a table to evaluate the matching degree of each gesture and meaning using a 5-point Likert scale, where from 1 to 5 points to form very not matched to very matched. (Figure 3) Finally, the participants needed to explain why they made these decisions and how they perceive this design. We encouraged participants to give more meaning to the gestures by themselves to explore what kind of information people want to share with their remote families or friends.

	A – Left	B – Upright	C- Right	D – Narrow range high speed	E – Broad range high speed	F – Narrow range low speed	G – Broad range low speed	Rank: 1-5
"I'm not using the device"								
"I'm available to communicate"								
"I have something emergent to share"								
"I'm not available"								

Fig. 3. The scale used in the lab study

2.3 Diary study

Participants. To evaluate whether the furry mediators can increase the connectedness and awareness between remote families or friends, a diary study was conducted. We recruited four participants (2 female) who had a median age of 23.5 years old. Two of the participants were in one pair, they were close friends to each other and lived separately. They contacted each other via messages or phone calls regularly. The participants needed to fill in a diary daily and they knew that the diary would only be used to conduct the study.

Set up. In this study, two of the participants were in one pair. They were asked to use the interactive prototype for one week. Before using the prototype, they needed to fill in a questionnaire that evaluated their connectedness and awareness of their partners and recorded the frequency they contacted another participant. During the week, the participants needed to fill in a diary daily. The dairy was made up of 5-point Likert scales which evaluated how the participants perceived the existence of their partner, questions about the frequency they used the furry mediators and contacted their friends, and a question asking how they interacted with the prototype. After the diary study, semi-structured interviews were conducted to explore how the participants thought about the prototype and their friends.

3. Result

3.1 The information people want to convey: status information and emotional information

In the lab study, we asked participants to match different gestures with different meanings and encouraged them to give more meanings to the gestures. The meanings we provided were all status information like "I am available", "I have something emergent", or "I am busy". Participants thought using these meanings was effective in their communication with their remote families or friends. However, they suggested making the status information more concise and various. P3 said, "It can show my different activities, like cooking, working, playing games, running..." P7 commented, "When it comes to 'I have something emergent', it can be urgent or not so urgent."

Participants also wanted to share emotional information using these mediators. P4 considered it can express messages like "I'm really happy" and "I miss you". The information people want to convey to their remote families or friends is status information and emotional in-

formation. In daily social relationships, we exchange implicit information with others, such as the presence and mood of others [9]. Therefore, sharing the presence and emotional information supports the connectedness-oriented communication between separated people.

3.2 Increased connectedness

The main goal of this research is to explore whether the furry mediators can increase the feeling of connectedness between separated people. We evaluated it by diary study. We asked participants about the effectiveness of the prototype and compared the frequency they contacted their remote friends before and after using the prototype. Both quantitative and qualitative data show that the connectedness between the two participants was increased.

The furry mediators increased the communication frequency between the two people. For P1 and P2, the frequency of contact via messages increased from "1-2 times per day" to "3-4 times per day". For P3 and P4 the frequency of contact via messages increased from "3-4 times per day" to "over 5 times per day". The dairies show that the mediators help participants to learn about each other's status. When it comes to interviews, P1 stated, "I think about him more". However, participants also explained that the increase of the communication frequency may result from the freshness of something new and it may decrease with time passing by: "If I use it for a longer time, I may lose my interest." (P1).

The furry mediators also increased the feeling of connectedness between the two participants. P3 said, "When I saw it, I remembered another person." and "It's tangible, it's always next to you, it feels like a companion." Nevertheless, many participants suggested that the mediators are more suitable for long-distance relationships (LDR). P4 stated, "It may be more suitable for couples or families because friends are more independent."

3.3 Subtle and implicit communication channel

Almost all the participants stated that the information conveyed by the furry mediators is ambiguous: "The message it can convey is ambiguous, and that ambiguity is good." (P4). "It can only convey simple information." (P1). Because of this ambiguity, the participants gave new meanings to the gestures of the mediators. P3 and P4 used one of the gestures of the mediators to say morning to another person: "My friend used the furry thing to say morning to me, which made me feel pretty warm and funny." (P3).

P3 emphasized that the mediator was an implicit and subtle communication channel: "There's an implicit way of communicating when I don't want to send a direct message to her. It is implicit because she can choose not to respond." "It is a subtle reminder to me. It tells you what the other person is doing, but you don't have to give a response."

3.4 The furry interface: the feeling of friendliness

Many participants, both in the lab study and diary study, commented that the furry mediators looked like pets such as cats or dogs, and it gave them a feeling of friendliness. P3 stated, "It likes the feeling of a pet. Just like dogs and cats raise their tails when you touch them." They also commented that the feeling of the furry body was good: "The furry appearance has a feeling of friendliness" (P4), "The feeling of a furry body is good." (P3). Additionally, participants said that the tangibility of the mediators created a sense of companionship. However, one participant complained that the current furry mediators were too big: "It's too big and a little bit less practical." (P1). Besides, they want to have more interactions with the furry mediators rather than just touching. P4 stated, "The interaction of touching can be more varied, such as circling, patting."

4. Discussion

Overall, the concept of using furry mediators to promote the connectedness between people separated by distance is effective. This is proved by the increased communication frequency between the two participants according to the diaries. The physical existence of the furry mediators reminded users about the existence of their friends, which increased their awareness of their friends' statuses. It also provided a subtle and implicit communication channel for the participants, which allowed them to send soft and ambiguous messages to their friends.

According to Kuwabara et al., traditional ways of communication transmit the messages with precise contents, while connectedness-oriented communication shares the status and presence information between people [9]. Connectedness- oriented communication fosters a sense of connectedness among people in this way. Our work promotes connectedness- oriented communication between people over distance by sharing two people's status information.

We assumed that the furry and animal-like appearance of the furry mediators can foster a sense of companionship and friendliness. This assumption was proved by the interviews. Based on the result we gained from the participants, the furry mediators reminded them of pets, which are friendly and lovely creatures. Some of the participants liked the feeling of the furry body and tended to touch it.

Criticism towards the furry mediator results from its simple interaction. Participants wanted to have more varied interactions with the mediators. Besides, it only expresses users' status information but not emotional information. This should be considered in further iteration.

Moreover, many participants suggested that the furry mediators should be used in the scenario of long-distance relationship couples. We should reconsider the target user of the furry mediators.

5. Limitation

Although we proved that the furry mediators were successful in connecting people over distance, there are still some limitations to our work. First, we only used people who are close friends to each other as the participants of the diary study but didn't evaluate our design in more intimate relationships like families or couples. Many participants also described that this design may be more suitable for remote couples. Future work should take this into account.

Second, the number of participants is limited both in the lab study and the diary study. We only have seven participants in the lab study and four participants in the diary study, which results in a small amount of data. This is owing to the short time frame of the research. For the same reason, the time for field study is short (only one week). More long-term studies and bigger user groups should be considered in future work.

6. Conclusion

We present a design concept and a functional prototype of a pair of furry mediators which can connect people over distance by exchanging their status information. We ran a lab study with participants who were separated from their families or friends to explore what kind of information people want to convey using the mediators. We evaluate the design by a one-week-long diary study with participants who are close friends with each other. The findings show the design is effective in increasing the communication frequency and participants' awareness of their friends. The furry mediators promote connectedness-oriented communication by providing users with a subtle and implicit communication channel. Positive feedback was also given to the furry and animal-like appearance of the mediators, which fostered a sense of friendliness and companionship. The limitations of the furry mediators lay in the simplicity of the interaction and the limited types of information it can convey.

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