On the Evaluation of a Huggable Interface to Mediate Remote Affective Communication

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ABSTRACT

In the context of computer-mediated remote communication, the effect of touch-based messages has been studied as a way to transfer affective information. Based on this potential we developed Macaron, a huggable interface designed to mediate human-human remote communication of affective messages. The evaluation is divided into two separated studies. The first one aims to explore the huggable aspect of Macaron. The second one explores the perception of Macaron as a communication device. The results provide some insights on the role of Macaron from the user's perspective.

1. INTRODUCTION

People have the necessity to keep healthy and strong social relationships. Motivated by this, different studies in Human-Computer interaction (HCI) explores the way technology can affect and augment human relationships for those people geographically separated. Current communication devices commonly support the exchange of information via text, audio or video. The future communication devices should also include the sense of touch. By touch, humans convey different affective messages and enhance verbal or auditory communication (Van Erp and Toet, 2015: 1).

Based on this potential, different studies worked on exploring communication devices that support touch-based interaction (Larsson, 2014:2). Typically, these technologies are designed in the shape of wearable devices, tangible objects or robotic devices. Among the different tangible gestures, hugs contain a high affective connotation.

On this report, we introduced Macaron, a huggable interface designed to mediate human-human remote communication of affective messages. Our product was designed with the appearance of cushion, and it is composed of three characteristics: 1) Sensing of tangible affective cues, 2) Convey the message to the users using colored lights patterns and 3) Connectivity between two or more devices. The evaluation is divided into two separated studies. The first one aims to explore the huggable aspect of Macaron. The second one explores the user's perception of Macaron as a communication device. This methodology aims to involve the users in the design process. The results provide some insights of the role of Macaron as a mediator of remote human-human communication.

2. SYSTEM OVERVIEW

Macaron has a simple and round appearance (Figure 1A). It is broadly composed of three elements: sensing, feedback, and communication. The sensing part involves the design of a sensor able to distinguish hugs; feedback is made with LED and vibration patterns and communication is managed by a server connected via Bluetooth with Macaron (Figure 2).

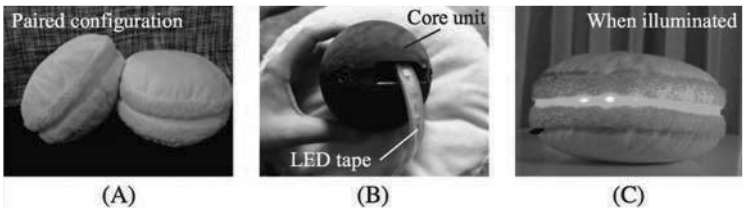

Figure 1: (A) Macaron works with a paired-devices configuration, (B) Sensors are contained in a plastic sphere placed in the center of a rounded cushion, (C) Macaron lights up with different colored lights patterns to convey messages to the user.

The hardware design was proposed by (Sugiura et al., 2011:3) and it is an array of photo reflective sensors used to sense the deformation of a soft cushion where the plastic case is embedded (Figure 1B). Macaron is made of a modified cushion, which was emptied leaving only the fabric-made case, and then re-filled using the proposed granulated filling material necessary to facilitate the detection of the cushion deformation. In our implementation, we used six photo reflective sensors distributed around a plastic sphere of 8.5cm of diameter. Inside the sphere we included the circuit: a board with an Arduino mini pro 5V, a SparkFun Bluetooth module, a vibration motor, the socket for the LED strap (Neopixel, 30 LED), a charging circuit with a lithium battery (1400mAh), a 3.3V regulator, an ON/OFF switch and a micro USB connector for charging the battery. The plastic case has a hole to the USB connector and switch (Figure 1B), and from which the LED strap connects to its socket. The LED strap is placed around the circumference of the cushion (Figure 1C).

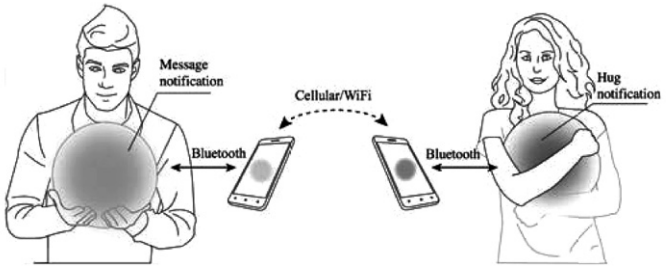

Figure 2: L Illustration of Macaron concept: two people living in different places can communicate affective messages mediated by Macaron.

The server client configuration allows to connect multiple clients, and the communication among them is managed by a server. Figure 2 illustrates a scenario of two users geographically separated, using Macaron to communicate affective messages driven by hugs. The color for hug detection is red, and for message notification is blue.

3. EXPERIMENT: HUGGABLE ASPECT OF MACARON

3.1 Procedure

This product should support natural hug-driven interaction. Different aspects, like appearance, shape, size, texture or softness, can directly influence on the user's feeling of the product. Macaron was designed with a minimum amount of rigid elements: the circuit encapsulated in a small hard core, and the flexible LED strap around the cushion (Figure 1B). Moreover, it looks like a typical cushion to evoke a feeling of being huggable. To evaluate the user's perception, we asked 16 participants (average age 29.3, 6 females and

10 males) to give their impressions. Participants were asked to sit in front of a desk and hold Macaron. Then they were asked to perform different tangible gestures. Among these gestures, there were included 12 hug instructions. After the participants finished this test, they were asked to answer a short questionnaire about the experience. The questionnaire included three items to evaluate the huggable aspect of Macaron: Q1) I consider this product is huggable, Q2) I consider it is appealing to be hugged, and Q3) I consider it as huggable as a common pillow. Participants used a 5-points scale to give their answers.

3.2 Results

The left side of Figure 3 shows one participant during a session, hugging Macaron after being instructed. On the right side is summarized the results from the questionnaire (n=16): Q1 avg=4.88 and SD=0.34, Q2 avg=4.38 and SD=0.5, Q3 avg=4.38 and SD=0.72.

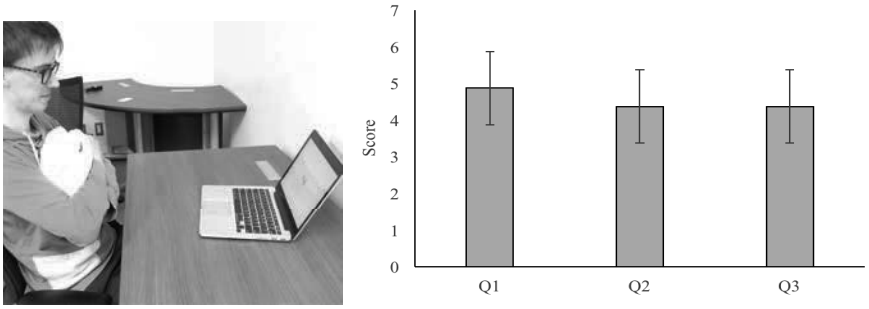

Figure 3: (left) A participant hugging Macaron during the experiment, (right) results from the questionnaire.

4. ONLINE SURVEY: PRODUCT REACTION

4.1 Procedure

Macaron is an unconventional communication device, and it is important to understand participant's impressions. We used an online questionnaire using the system provided on http://www.soscisurvey.com. Participants were invited to answer via email, to avoid repeated answers. 35 participants (average age 27.66, 13 females and 22 males) completed the questionnaire. The nationalities were: 28 Latin Americans, 4 Europeans, and 3 Asians. The questionnaire had three steps. On step 1 participants are instructed to watch a video of a person communicating by Macaron. On the video, a person is interacting with Macaron by hugging it and observing the colored light patterns. The video is followed by two statements that each participant rated by a 5-point scale: 1) I perceived the communication partner to be human and, 2) I perceived the communication partner to be a machine. Following this, on step 2 it is introduced a new video showing each function of Macaron. The video displayed a person interacting with Macaron together with a script explaining the meaning of each type of feedback supported by Macaron. On step 3 participants watched the first video again and answered the same two statements from step 1. The stimuli video displayed on step 1 and 3 showed a fully functional Macaron.

Even though participants were told that the person of the video was communicating by Macaron, we try to investigate if there is a difference in the perception of Macaron as a communication device, before and after being instructed the function and concept of the product. With this, we aim to answer: comparing the condition before and after instruction, can the participants perceive that the person in the video is communicating with a human partner?

4.2 Results

Figure 4 shows the result of the online questionnaire. Before watching the instruction video, more participants tended to perceive that the person in the video is communicating with a machine. On the contrary, the communication partner was perceived as human rather than machine after the instruction video. To test the statistical significance, two-factor repeated measures ANOVA was applied. As a result, the main effect of watching instruction video ($p<.01$, $F(1,34)=7.61$,$\eta 2=.183$) and the interaction of two factors ($p<.001$, $F(1,34)=29.8$, $\eta 2=.467$) were confirmed. There are also significant differences between two answers (perceived as human/machine) in both before ($p<.05$) and after ($p<.05$) watching the instruction video by t-test.

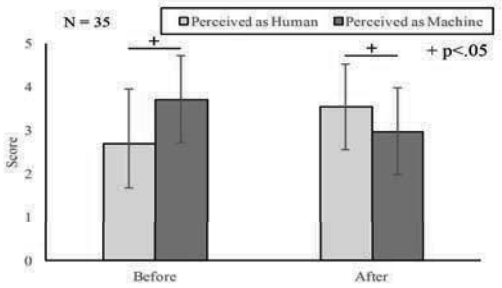

Figure 4: Perception of Macaron before and after being instructed its functions

5. DISCUSSIONS AND CONCLUSIONS

We developed this prototype based on the theoretical need of inclusion of touch-based messages in remote communication as a way to increase affectivity. The result from the first experiment showed that based on the three selected items, Macaron was felt highly huggable, even comparable with a typical cushion. The approach using a minimal rigid core combined with the appearance of a daily life product helped to create a good feeling for the users when they were asked to manipulate Macaron. The results from the online questionnaire showed that even if Macaron does not look like a common communication device, participants could understand its role of mediator. With instruction, the tendency showed that the person in the video was communicating with a human partner. From this, we understood it is possible for the users to perceive Macaron as a communication device, based on the current interaction rule.

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