

Cross-Cultural Study of Tactile Interactions in Technologically Mediated Communication

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Abstract. In order to design tactile devices for technologically mediated communication, we investigated what tactile and gestural interactions would be spontaneously used for sharing emotions in mediated communication. In an experiment with 40 participants, we identified relations between hand gestures performed with a concept device and emotions that a “sender” intends to convey to a “receiver”. Among others, our results show that squeezing and shaking are the most popular chosen hand gesture interaction. Gesture intensity and speed follow the arousal (intensity) and temperature follows the valence (pleasure). Emotions that subjects are most willing to share with such a tactile are gratitude, love, happy, sad, astonished, excited, angry and worried.

Keywords: Tactile interactions · Emotion · Communication · Culture · Design

1 Emotions and Tactile Communication

A number of communication devices have been designed to explore tactile interactions in communication [Picard 1997], as ComTouch [Chang et al. 2002], Hand Data Glove [Piyush et al. 2012], a vibro-tactile device [Rantala et al. 2013], a mid-air haptic device [Obrist et al. 2015]. A comprehensive review of 143 communication devices for mediating intimate relationships, which includes touch-based devices, has been reported by [Hassenzahl et al. 2012]. Indeed, it has been shown that touch is an effective way to communicate emotions [Hertenstein et al. 2006, 2009]. From a biological point of view, there is some evidence that touch triggers the release of oxytocin hormone, which decreases stress [Uvnas-Moberg and Petersson 2005]. In this context, our goal is to find a systematic way to design touch-based long-distance communication devices. More specifically we aim at identifying correlations between tactile interactions and emotions that are felt by the users of such a device.

In all aforementioned studies, the participants were people from one single cultural background. In a study by Nummenmaa et al. [2013], the focus was on the differences between cultures. The authors proposed maps of bodily sensations associated with different emotions and they did not observe any differences between European and East Asian subjects. They concluded that emotions were represented in the somatosensory system as culturally universal categorical somatotopic maps. With a similar approach applied to technologically mediated communication, our study aims at identifying

differences between two groups of people, Japanese and French, in the way they would use such a tactile device for mediated communication.

In this study, we specifically focus the gestures of a sender who is willing to share emotions with another person, through a handheld technological device, as described in Fig. 1. Thus we conducted an experiment to identify the characteristics of such hand gestures and analyzed the results with a special focus on the differences between the Japanese participants and the French participants.

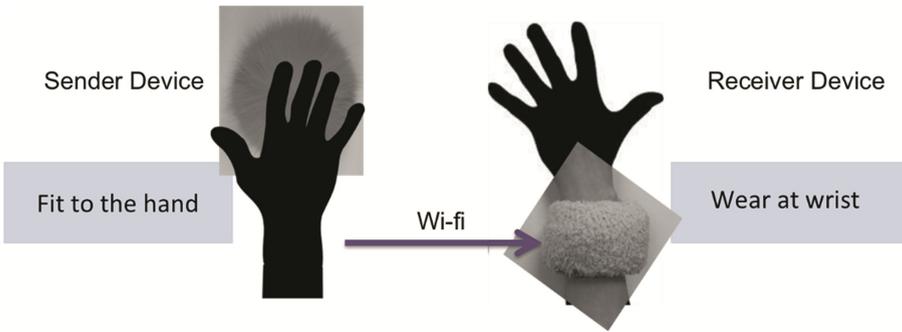


Fig. 1. Design concept of our tactile communication device



Fig. 2. Experimental setting

2 Experiment

Participants. 40 people participated in the experiment, half were French nationals, the other half Japanese nationals, aged 21 to 37 years ($M = 24.9$). In both groups, around half of the subjects were female subjects.

Procedure. In an individual one-hour session, the participants received a list of 35 emotions extracted from [Paltoglou et al. 2013], an extended version of the Circumplex Model of Emotion [Russell 1980]. Three interpersonal emotions, gratitude, love and sympathy, were added to the list, as in [Obrist et al. 2015]. For each emotion, the subjects were individually asked to perform one hand gesture that they thought was the best way to communicate the given emotion and to describe the properties of the gesture they

performed: type of gesture, intensity (5-point Likert scale), speed (5-point Likert scale), temperature that they would like the receiver to feel (cold /neutral /hot). The participants were also asked to select the emotions they would like to be able to communicate with a tactile long-distance emotional communication device.

Data Analysis. Data were analyzed with SPSS software, two-way between-groups ANOVA and Fisher’s test, and in some cases independent samples t-test.

3 Results

Types of Gesture. The most chosen gestures are mapped on the Circumplex Model of Emotions, with percentage of subjects who chose the gesture (Fig. 3). The most popular gestural interactions are squeezing, for intense emotions, and shaking, for pleasant emotions. Fisher’s Exact Probability Test is used for comparing the differences between nationalities. French and Japanese subjects have differences in choosing gesture types for 6 out of 35 emotions: bored, determined, disgusted, frustrated, pleased and sleepy.

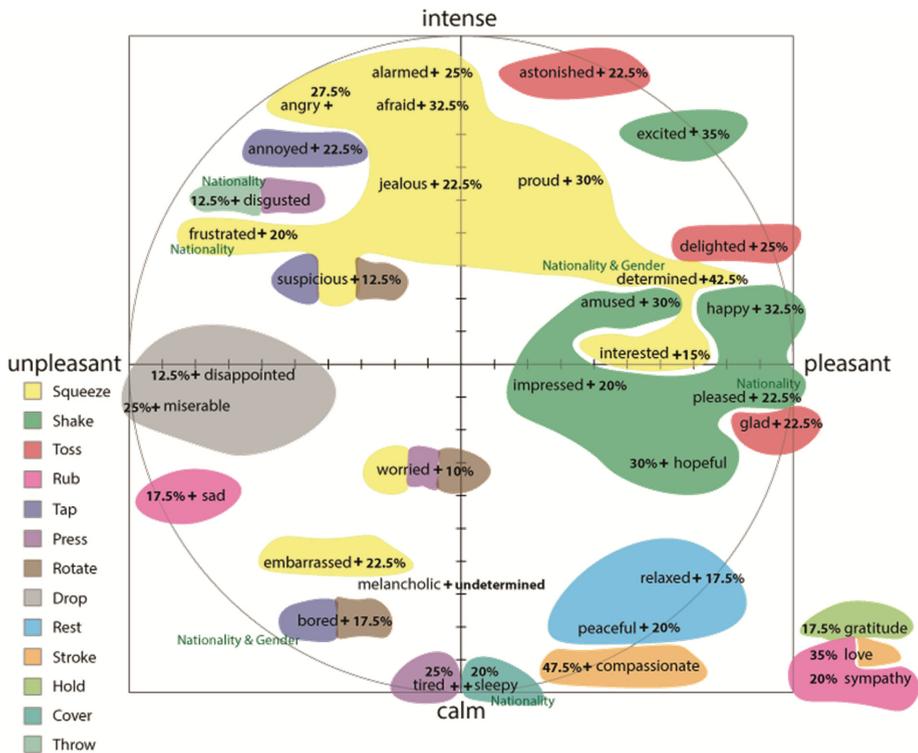


Fig. 3. Most frequent types of gesture shown on the Circumplex Model of Emotions Note: “Nationality” and “Gender” mean that this gesture was significantly used differently across nationalities or genders.

Gesture Intensity. Gesture intensity tends to follow the arousal (intensity), gesture intensity increasing with the emotion intensity. There is a nationality effect in 7 out of 35 emotions: astonished, bored, compassionate, frustrated, hopeful, sympathy, and worried. Between Japanese and French subjects, there was a significant difference in gesture intensity for only astonished emotion $t(38) = 2.77, p = .01$.

Gesture Speed. Gesture speed tends to follow the arousal (intensity), speed increasing with the intensity. Between Japanese and French subjects, there was a significant difference for ‘determined’: $t(38) = -2.58, p = .01$, and ‘excited’: $t(38) = -2.18, p = .04$.

Temperature. Temperature tends to follow the valence (pleasure), with high temperature chosen for pleasant emotions and low temperature for unpleasant emotions. Between Japanese and French subjects, there was a significant difference in gesture speed for embarrassed $t(38) = 4.04, p = .00$, two-tailed), and sympathy $t(38) = -4.64, p = .00$, two-tailed).

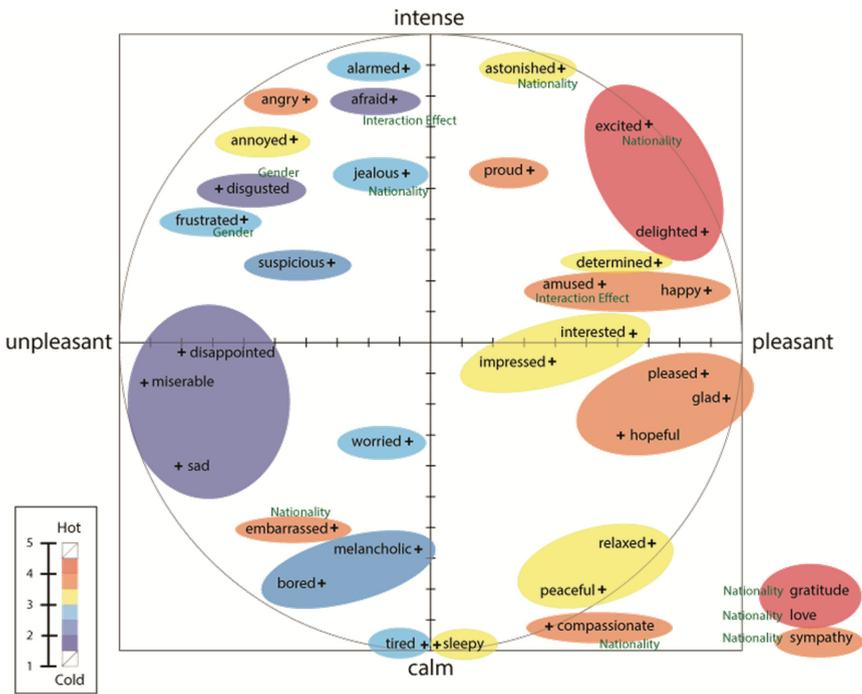


Fig. 4. Gesture temperature levels shown on the Circumplex Model of Emotions Note: “Interaction”, “Nationality” and “Gender” mean there is an interaction effect, a nationality effect, or a gender effect for each emotion.

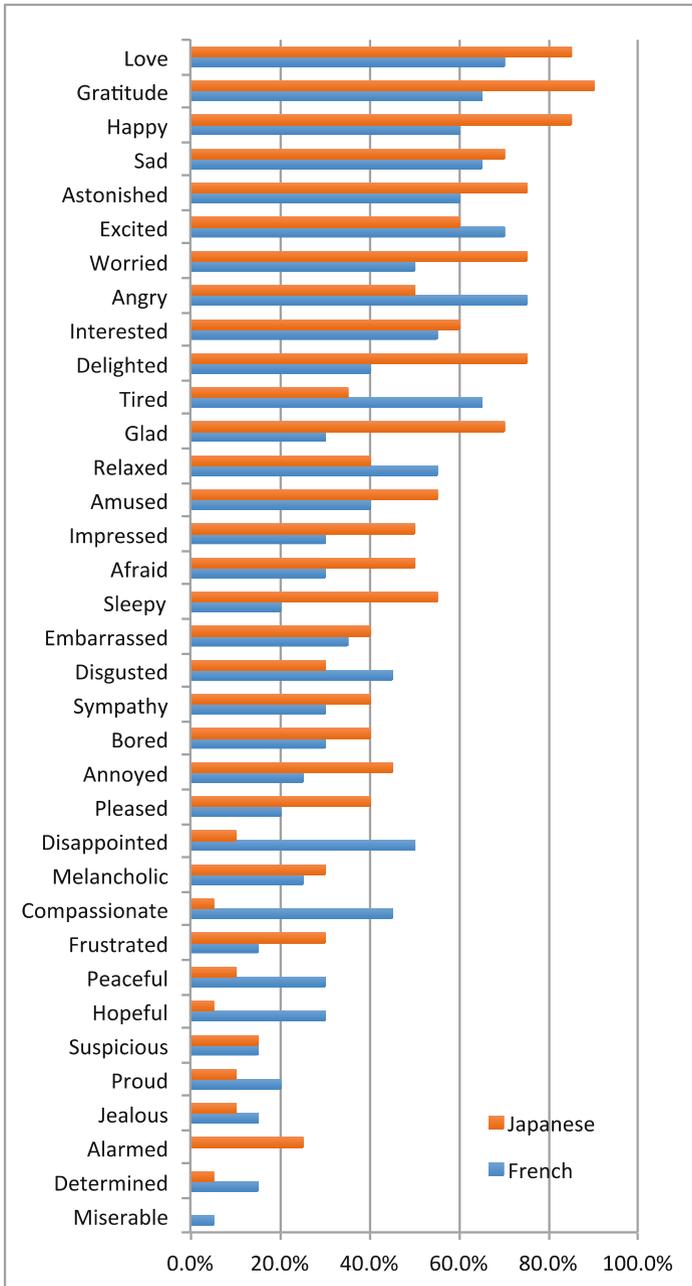


Fig. 5. Percentage of respondents who are ‘Willing to Share’ the emotion with a tactile device

Emotions which participants are “willing to share”. Emotions in Fig. 5 are listed from most “willing to share” to least “willing to share” (counted from the total frequency of all subjects). Love, gratitude, and happy are emotions that participants are most “willing to share”, while alarmed, determined, and miserable are emotions that participants are least “willing to share”. The emotions that were most chosen by Japanese subjects were gratitude, happy, love, while French subjects chose: angry, excited, love. Japanese subjects want to share alarmed, glad, and sleepy significantly more than French subjects, but compassionate and disappointed significantly less than French subjects.

4 Discussion

We identified relations between tactile interactions chosen by a user of a touch-based communication device and the emotion that the person intends to convey. Gesture intensity and speed tend to follow the arousal (intensity). Temperature tends to follow the valence (pleasure). As for the type of gestures, ‘squeezing’ is chosen for emotions with positive intensity level; ‘shaking’ for emotions with positive pleasant level; ‘tossing’ for extreme pleasant and/or intense emotions.



Fig. 6. Most popular gestures chosen for expressing given emotions with a tactile device

Although the sample of participants was somewhat limited, we could identify some significant differences between people with different cultural backgrounds, i.e. Japan and France in this study. Emotions like astonished, determined, excited, embarrassed, sympathy were expressed in significantly different gestures (intensity, speed and temperature) by Japanese and French subjects. We also identified differences in the emotions that participants were willing to share with a ‘receiver’. Gratitude, love, happy, sad, astonished, excited, angry, worried, delighted, interested, glad, and tired are emotions that more than 50 % of subjects would like to be able to share. Interestingly, Japanese subjects mostly chose gratitude, happy and love, while French subjects chose angry, excited and love.

5 Conclusion

Our study allows identifying which hand gestures (types, intensity, speed, and temperature) would be most intuitively used for expressing given patterns of emotions when using a device for mediated long-distance communication. We found some significant differences between the Japanese subjects and the French subjects, especially in the selection of emotions that people are willing to share with a tactile communication device. The findings can inform the design of future tactile communication devices.

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References

- Chang, A., O'Modhrain, S., Jacob, R., Gunther, E., Ishii, H.: ComTouch: design of a vibrotactile communication device. In: Proceedings of DIS 2002, the 4th ACM Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques, pp. 312–320 (2002)
- Hassenzahl, M., Heidecker, S., Eckoldt, K., Diefenbach, S., Hillmann, U.: All you need is love: current strategies of mediating intimate relationships through technology. *ACM Trans.Comput.-Hum. Interact.* **19**(4), Article 30 (2012)
- Hertenstein, M.J., Holmes, R., McCullough, M.: The communication of emotion via touch. *Emotion* **9**(4), 566–573 (2009)
- Hertenstein, M.J., Keltner, D., App, B., Bulleit, B., Jaskolka, A.: Touch communicates distinct emotions. *Emotion* **6**(3), 528–533 (2006)
- Nummenmaa, L., Glerean, E., Hari, R., Hietanen, J.K.: Bodily maps of emotions. *Proc. Nat. Acad. Sci.* **111**, 646–651 (2013)
- Obrist, M., Subramanian, S., Gatti, E., Long, B., Carter, T.: Emotions mediated through mid-air haptics. In: Proceedings of CHI 2015. ACM (2015). <http://dx.doi.org/10.1145/2702123.2702361>
- Paltoglou, G., Thelwall, M.: Seeing stars of valence and arousal in blog posts. *IEEE Trans. Affect. Comput.* **4**(1), 116–123 (2013)
- Picard, R.W., Healey, J.: Affective wearables. *Pers. Technol.* **1**(4), 231–240 (1997)
- Piyush, K., Verma, J., Prasad, S.: Hand data glove: a wearable real-time device for human-computer interaction. *Int. J. Adv. Sci. Technol.* **43**, 39 (2012)
- Rantala, J., Salminen, K., Raisamo, R., Sarakka, V.: Touch Gestures in communicating emotional intention via vibrotactile stimulation. *Int. J. Hum. Comput. Stud.* **71**, 679–690 (2013)
- Russell, J.: A circumplex model of affect. *J. Pers. Soc. Psychol.* **39**, 1161–1178 (1980)
- Uvnas-Moberg, K., Petersson, M.: Oxytocin, a mediator of anti-stress, well-being, social interaction, growth and healing. *Z Psychosom Med Psychother* **51**(1), 57–80 (2005)