Touch and Voice in Communicating Positive and Negative Emotions

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Abstract

Previous research has revealed that nonverbal touch can communicate several emotions. This study compared the perception of emotions expressed by touch with that expressed by voice to examine the suitability of these channels to convey positive or negative emotions. In our experiment, the encoder expressed 12 emotions, including complex ones, by touching the decoder's arm or uttering a syllable /e/, and the decoder judged the emotion. The results showed that positive emotions, such as love and gratitude, tended to be perceived more correctly when expressed by touch, while negative emotions such as sadness and disgust were perceived more correctly when expressed by voice. Interestingly, the average accuracy for touch and voice did not differ under the free expression method. These results suggest that different channels (touch and voice) have different superiority on the perception of positive and negative emotions.

Keywords

Emotion, perception, touch, voice

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Introduction

Humans communicate emotions through various nonverbal cues, such as face, voice, and touch. Many studies have investigated the perception of emotion expressed through face and voice, suggesting that it is possible to perceive different emotions (Ekman, 1973; Scherer et al., 2011, as a review). For example, anger, fear, happiness, sadness, disgust, and surprise have been studied well to examine whether these can be detected from facial expressions. As for the voice, these six emotions and some complex emotions such as contempt, awe, amusement, enthusiasm, and so forth can be perceived from vocal expressions (Simon-Thomas et al., 2009).

Other research has shown that anger, love, and gratitude can be perceived from touch (Hertenstein et al., 2006; Oya & Tanaka, 2021; Thompson & Hampton, 2011). Hertenstein et al. (2006) examined whether 12 emotions, including the above six, which have been studied well in the domain of facial expression, prosocial emotions, and self-focused emotions, can be communicated by touching of the arm. Based on the theory on the origins of cooperation and altruism (Frank, 2002; Sober, 2002), these authors assumed that it is possible to communicate prosocial emotions related to cooperation and altruism, such as love, gratitude, and sympathy, via nonverbal display,

especially touch. The results revealed that anger, fear, disgust, and prosocial emotions were perceived. Moreover, Oya and Tanaka (2021) conducted almost the same experiment as Hertenstein et al. (2006) for Japanese dyads and examined the cultural similarities and specificities regarding the perception of emotion through touch. The results pointed that anger, love, and gratitude are indeed communicated, suggesting that touch can communicate these emotions both in Japan and in Western countries.

As shown, the literature suggests that various nonverbal channels can communicate various emotions. However, the suitability of each channel for conveying specific emotions has not yet been examined, to the best of our knowledge. It is difficult to compare channels due to the differences in emotional categories and the methodology used in previous research. First, previous research has used different emotional categories for different channels. For example, App et al. (2011) tried to compare channels and demonstrated that there was an association between an emotion and a particular nonverbal channel. These authors selected and used 11 emotions that have been shown as perceivable through one or more of the channels of interest (body, face, and touch). They then divided these emotions into three types according to their social function: social status, survival, and intimate relationship. The results suggested that channel preferences were related to the social function associated with each emotion. Their classification provided important suggestions for understanding the channel preferences. However, these authors did not examine preferences using the

classification of emotional valence. It would also be necessary to examine the association not only from the social and complex perspectives but also from the classical and primitive perspectives of emotional valence (positive/negative). Therefore, it is important to examine the association between emotional valence and nonverbal channels.

In addition to emotional valence, the number of emotional categories differed among the studies examining different channels. This leads to differential chance levels among the studies. Additionally, Oya and Tanaka (2021) pointed out that the accuracy of emotion perception from touch is lower than that of face and voice. This may happen because the number of response alternatives and chance levels varied between the channels (see discussion in Oya & Tanaka, 2021). To compare channels appropriately, we should match the number of emotional categories between channels.

The second factor that makes it difficult to compare channels is the method used to present stimuli. Previous studies have used different methods for different channels. The lower accuracies observed in previous studies on touch may be attributable to different methods employed in research on face, voice, and touch. Most studies on the perception of emotion from face and voice use have recorded and controlled stimuli. Contrastingly, studies on touch use the free expression method because it is not possible to record and present the same physical contact. These studies employed a method in which the encoder freely expressed emotions by touching the decoder's arm or body

(Hertenstein et al., 2006, 2009; Oya & Tanaka, 2021). This method may lead to lower accuracy than a method using recorded and controlled stimuli. To determine whether lower accuracy is specific to emotion perception coming from touch or due to different presentation methods, it is necessary to compare emotion perception from touch and other channels using the free expression method, which has been used previously in studies on touch.

This study investigated whether different channels (touch and voice) have different superiority on the perception of positive and negative emotions. We chose vocal expressions, rather than facial expressions, for comparison with touch because vocal expressions can discriminate between positive emotion categories other than happiness, such as amusement, pleasure, relief, and triumph, whereas facial expressions cannot discriminate between positive emotions (Sauter, 2010). We adopted the same paradigm as the one used in previous research on touch. In the experiment, the encoder freely expressed basic, self-focused, and prosocial emotions by touching the decoder's arm or uttering /e/. Therefore, the chance level and methodology were matched between touch and voice. Furthermore, we examined whether the decoder could perceive the intended emotion of the encoder correctly and compare the superiority of touch and voice in the perception of positive and negative emotions.

Method

Experimental design

The emotion (anger, fear, happiness, sadness, disgust, surprise, embarrassment, envy, pride, love, gratitude, and sympathy) expressed by the encoder and modality (touch and voice) served as independent variables, and the decoder's response served as the dependent variable.

Participants

Fifty-four Japanese women, who were students at Tokyo Woman's Christian University ($M = 20.33$ years, $SD = 1.16$), participated in this study. We recruited only female participants to control for potential gender effects. They provided their verbal consent, and the study was approved by the Ethics Committee of Tokyo Woman's Christian University.

The participants were randomly assigned to dyads. One member of each dyad was assigned the role of touching (encoder, $n = 27$), whereas the other member was assigned the role of being touched (decoder, $n = 27$). The participants did not know any information about their partners.

The statistical power of our sample size was calculated using the G*Power Program (Faul et al., 2007) following data collection. The statistical power was almost 80% (78.8%), assuming α (two-sided) equaled .05.

Apparatus

A desk (Sanwa Supply, RAC-EC2SN) was divided into two sections using a black curtain. The encoder and decoder were seated on the two opposite sides of the

desk with a curtain between them. A video camera (Sony, HDR- PJ540) mounted on a tripod was placed on the side of the encoder (Libec, TH-650DV), which recorded the encoder's display.

Procedure

In the experiment, there were two sessions included, namely a touch session and a voice session. We conducted 12 trials in each session (anger, fear, happiness, sadness, disgust, surprise, embarrassment, envy, pride, love, gratitude, and sympathy) for 24 trials in total. The order of sessions and trials was counterbalanced.

Touch session. First, the encoder expressed each emotion once by touching a hand mannequin. After the practice, the experimenter instructed the encoder to touch the decoder's arm as far as she could see from behind the curtain in any way she thought appropriate, as long as she did not hurt the decoder. Moreover, the experimenter told the encoder not to speak until the end of the experiment. Next, the experimenter informed the other participant, who had been waiting in another room, that she was going to play the role of the decoder, and requested her not to speak until the end of the experiment. The decoder then entered the laboratory. When the experiment started, the decoder extended her arm to the encoder's area. The encoder then touched the decoder's arm and tried to convey the instructed emotion through touch. The order of the instructed emotions was randomized across participants. Once the encoder finished touching, the experimenter handed out a response sheet to the decoder. The decoder indicated the

perceived emotion by selecting 1 of 13 response options, which included the names of the 12 emotions and the statement, “None of these terms are correct.” The instruction in the response sheet stated, “Please choose the term that best describes what this person is communicating to you.” The procedure used in the current study was nearly identical to that employed in the study by Hertenstein et al. (2006). The placement of the 12 emotions on the response sheet was randomized across the participants. After the response sheet was recovered, the next trial began. This process was repeated 12 times.

Voice session. First, the encoder practiced expressing each emotion once by uttering /e/, which is often used as an interjection in Japanese, with affective prosody (Arimoto & Okanoya, 2011). The experimenter instructed the encoder that she could utter an /e/ in any way she deemed appropriate. This session began after the practice session. The experimenter instructed the encoder with an emotion, which the encoder then expressed by uttering /e/ once for each of the 12 emotions. The order of the instructed emotions was randomized across the participants. Once the encoder finished the utterance, the experimenter handed out a response sheet to the decoder, who answered it in the same manner as in the touch session.

Results

Data analysis

To examine whether the decoder could perceive the encoder’s expressed emotion as categorical, we calculated categorical accuracy showing the degree to which

the decoder's response (perceived emotion) was congruent with the emotion expressed by the encoder (expressed emotion). Then, to examine whether the channel affects categorical accuracy, an analysis of variance (ANOVA) was conducted for the emotion (12 emotions) $\times$ channel (touch or voice) in participants. Thereafter, to examine whether each channel was suited to convey positive and negative emotions, ANOVA was conducted for the expressed emotional valence (positive or negative) $\times$ channel (touch or voice) in participants on the average of the categorical accuracies in each emotional valence.

Both channels communicate emotions

The categorical accuracies are presented in Table 1. To examine whether the channel affects categorical accuracy, an ANOVA of the emotion (12 emotions) $\times$ channel (touch or voice) within subjects was conducted. The main effect of emotion ($F(6.29, 163.59) = 5.37, p < .001, \eta^2_p = .17$) and the two-way interaction between emotion and channel ($F(7.26, 188.63) = 7.01, p < .001, \eta^2_p = .21$) were significant. However, the main effect of channel ($F(1, 26) = 1.99, p = .17, \eta^2_p = .07$) was not significant. The results of the simple main effects analyses are shown in Table 1.

Different channels have different superiority in the perception of positive and negative emotions

To examine whether different channels convey different emotional valences, 11 of the 12 emotions examined in this study (excluding surprise, which has both positive

and negative valences) were divided into positive (happiness, pride, love, gratitude, and sympathy) and negative emotions (anger, fear, sadness, disgust, embarrassment, and envy). We then averaged the categorical accuracy of each emotion for positive and negative emotions and conducted an ANOVA of the expressed emotional valence (positive or negative) $\times$ channel (touch or voice) within participants.

Although the main effect of channel was not significant ($F(1, 26) = 0.15, p = .70, \eta^2_p = .01$), the main effect of emotional valence was significant ($F(1, 26) = 3.93, p < .10, \eta^2_p = .13$). Importantly, the two-way interaction between emotional valence and channel ($F(1, 26) = 7.40, p < .05, \eta^2_p = .22$) was significant. Simple main effects analyses showed that the categorical accuracy of negative valence was higher for voice than for touch ($F(1, 26) = 5.08, p < .05, 95\%CI [0.01, 0.18]$), whereas that of positive valence tended to be higher for touch than for voice ($F(1, 26) = 3.94, p < .10, 95\%CI [0.00, 0.24]$). Thus, the results suggest that touch and voice have advantages for positive and negative emotions, respectively.

Discussion

In this study, we investigated whether different channels (touch and voice) had different superiority on the perception of positive and negative emotions. In the experiment, the encoder freely expressed 12 emotions by touching the decoder's arm or by uttering /e/. The decoder was asked to judge the emotion expressed. The chance level and methodology for touch and voice were matched.

The results revealed that positive emotions such as love and gratitude tended to be perceived more correctly from touch, while negative emotions such as sadness were perceived more correctly from voice. Therefore, our results suggest that different channels are superior in terms of the perception of positive and negative emotions. These results are consistent with previous research suggesting that different emotions are associated with different nonverbal channels: body, face, and touch (App et al., 2011). We speculate that the results can be explained in terms of approach-avoidance motivation (Elliot et al., 2013). The general idea is that when the approach-avoidance motivation between the expressed channel (touch or voice) and emotional valence (positive or negative) matches, the expressed emotion is perceived more easily. Regarding the channel, touch is a channel of approach because touching needs to make direct contact with the partner's body, whereas voice does not (Schirmer & Adolphs, 2017). Voice is a channel of avoidance because it is useful in quickly noticing danger. Regarding emotions, positive emotions tend to have an approaching motivation because they increase the benefit for others, and negative emotions tend to have an avoidance motivation because they often function to escape from others (for a similar discussion, see Watson et al., 1999). Assuming these correspondences, the results can be explained as follows: positive emotions tend to be perceived more correctly from touch, whereas negative emotions are perceived more accurately from voice.

In this study, we recruited only female participants. Hertenstein and Keltner

(2011) reported gender differences in Western cultures related to emotion perception from touch, which might also be the case in Japan. Future studies should consider gender differences by including both male and female participants.

Interestingly, the results also showed that the accuracy did not significantly differ between touch and voice. This suggests two possibilities. First, the accuracies of both channels may be essentially equal. A previous study suggested that the accuracy of touch is “apparently” lower than that of face and voice (Oya & Tanaka, 2021). However, our results suggest that the lower accuracy may be caused by the difference in the chance level and that of the presentation method between touch and other channels. Second, the results may reflect some artifacts in the methodology. In this study, there were two possible artifacts: the free expression method and emotional categories. As for the method, we adopted the free expression method because it is not possible to record and present the same physical contact repeatedly. Although it is difficult for interpersonal touch to record and present the same stimuli repeatedly, future research will need to compare various nonverbal channels under controlling emotional stimuli. Tactile representations are composed of multiple parameters, including the location, action, and duration (Hertenstein, 2002). One possible solution is to systematically control one of them. For the emotional categories, we applied the emotional categories used in touch studies to voice. Thus, it might be difficult to perceive the positive emotions used in the current study from the voice. Note that the accuracy did not clearly

differ between touch and voice in positive valence, although it differed significantly in negative valence. A previous study showed that vocal expression can discriminate among positive emotion categories other than happiness, such as amusement, pleasure, relief, and triumph, whereas facial expression cannot (Sauter, 2010). Based on the literature, it is also possible that the accuracy of perceiving positive emotions from voice is comparable to that of touch. In other words, it also remains possible that both touch and voice are suited to convey positive valence, although each channel prefers different positive emotions. Future research should use additional emotional categories, especially positive emotions employed in voice studies, and compare superiority in the perception of positive and negative emotions among channels.

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Figure 1

Mean Accuracy of Touch and Voice Conditions in Positive and Negative Emotions

Note. Error bars represent standard errors. Asterisks indicate significant differences ($p < .01$, $p < .05$, $†p < .10$).

Table 1*Mean Accuracy of Touch and Voice Conditions*

Expressed Emotion	Expressed Channel		Superior Channel
	Touch	Voice	
Anger	37.04	33.33	<i>n.s.</i>
Fear	11.11	14.81	<i>n.s.</i>
Happiness	40.74	44.44	<i>n.s.</i>
Sadness	11.11	51.85	voice
Disgust	25.93	51.85	voice†
Surprise	11.11	70.37	voice
Embarrassment	29.63	37.04	<i>n.s.</i>
Envy	25.93	7.41	touch†
Pride	0.00	3.70	<i>n.s.</i>
Love	37.04	3.70	touch

Gratitude	48.15	0.00	touch
Sympathy	14.81	29.63	<i>n.s.</i>

(%)

Note. The results of simple main effects (i.e., the difference between touch and voice) are shown in the column “Superior Channel.” Asterisks indicate significant difference ($p < .001$, $p < .01$, $\dagger p < .10$), and “touch” or “voice” indicates the channel showing significantly higher accuracies than the other on each emotion.