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Touch Communicates Distinct Emotions

Matthew J. Hertenstein
DePauw University

Dacher Keltner
University of California, Berkeley

Betsy App, Brittany A. Bulleit, and Ariane R. Jaskolka
DePauw University

The study of emotional signaling has focused almost exclusively on the face and voice. In 2 studies, the authors investigated whether people can identify emotions from the experience of being touched by a stranger on the arm (without seeing the touch). In the 3rd study, they investigated whether observers can identify emotions from watching someone being touched on the arm. Two kinds of evidence suggest that humans can communicate numerous emotions with touch. First, participants in the United States (Study 1) and Spain (Study 2) could decode anger, fear, disgust, love, gratitude, and sympathy via touch at much-better-than-chance levels. Second, fine-grained coding documented specific touch behaviors associated with different emotions. In Study 3, the authors provide evidence that participants can accurately decode distinct emotions by merely watching others communicate via touch. The findings are discussed in terms of their contributions to affective science and the evolution of altruism and cooperation.

Keywords: emotion communication, touch, physical contact, tactile stimulation

Touch is central to human social life. It is the most developed sensory modality at birth, and it contributes to cognitive, brain, and socioemotional development throughout infancy and childhood (Field, 2001; Hertenstein, 2002; Stack, 2001). In most cultures, adults touch in specific ways when flirting, expressing power, soothing, playing, and maintaining proximity between child and caretaker (Eibl-Eibesfeldt, 1989). Nonhuman primates use touch to groom, to reconcile following aggressive encounters, to initiate sexual encounters, to reward cooperative acts of food sharing, to maintain proximity with caretakers, and to soothe conspecifics (de Waal, 1989).

With respect to the communication of emotion, two general claims have been offered regarding touch. First, touch is thought to communicate the hedonic tone of emotion (Hertenstein, 2005; Hertenstein & Campos, 2001; Jones & Yarbrough, 1985; Knapp & Hall, 1997). That is, touch communicates either positively valanced warmth and intimacy or negatively valenced pain or discomfort. Second, touch is thought to be an intensifier of emotion-related communication. That is, touch intensifies the emotional displays from other modalities (Knapp & Hall, 1997).

In the studies reported in this article, we provide an answer to the following question: Can touch communicate specific emotions? Our studies were guided by three motivations. The first pertains to modality. Studies of the communication of emotion have almost exclusively focused on the face and voice (Ekman, 1993; Scherer, Johnstone, & Klasmeyer, 2003). In the present studies, we asked whether individuals could communicate distinct emotions through tactile stimulation (Tronick, 1995) and whether they could accurately decode emotions by merely observing other individuals communicate via touch.

Our second aim was to address whether humans can communicate more emotions than previously thought. Studies of facial and vocal communication of emotion have identified displays of anger, contempt, disgust, fear, happiness, sadness, and surprise (Ekman, 1993) and, more recently, embarrassment and shame (Keltner & Buswell, 1997) and varieties of laughter (Smoski & Bachorowski, 2003). Our study is the first to provide rigorous evidence showing that humans can reliably signal love, gratitude, and sympathy with nonverbal behavior (for discussions on the empirical failures to document a facial display of sympathy, see Haidt & Keltner, 1999; Keltner & Buswell, 1996).

Recent theorizing about the origins of cooperation and altruism assumes that humans can communicate these prosocial emotions with nonverbal behavior (R. H. Frank, 2002; Sober, 2002). This theorizing asserts that altruism and cooperation can emerge in long-term interactions when (a) altruistic interactions are rewarding for the benefactor and (b) people can identify cooperative individuals, which increases the benefits and reduces the risks of cooperative and altruistic exchanges. When these two conditions

Matthew J. Hertenstein, Betsy App, Brittany A. Bulleit, and Ariane R. Jaskolka, Department of Psychology, DePauw University; Dacher Keltner, Department of Psychology, University of California, Berkeley.

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The interested reader may contact Matthew J. Hertenstein for complete confusion matrices of the data.

Correspondence concerning this article should be addressed to Matthew J. Hertenstein, Department of Psychology, DePauw University, 7 Larabee Street, Harrison Hall, Greencastle, IN 46135. E-mail: mhertenstein@depauw.edu.

are met, altruistic actions are more rewarding for the actor and are more likely to be reciprocated. Reliable signals of gratitude, love, and sympathy help meet these two conditions. Nonverbal displays of prosocial emotion, in particular gratitude, should act as rewards for altruistic acts, through the intrinsic pleasure derived from touch and the social significance of expressing gratitude. Nonverbal displays of prosocial emotions are also likely signals of an individual's cooperative intent; that is, people who frequently communicate compassion, gratitude, or love through any modality, including touch, are likely to have more prosocial dispositions and are thus more likely to be cooperative interaction partners. For these reasons, we expected gratitude, love, and sympathy to be communicated via touch.

Our final aim was to provide descriptions of the tactile signals that people use to communicate emotion. The field of emotion has been advanced by precise characterizations of emotion-specific signals (Ekman, 1993; Scherer et al., 2003). Here, we provide descriptions of emotion-specific touch behaviors.

Study 1

In the first study, we asked whether participants can communicate three classes of emotions via touch: (a) six emotions that have proven to be decoded in the face and voice in different cultures (anger, fear, happiness, sadness, disgust, and surprise), (b) three prosocial emotions related to cooperation and altruism (love, gratitude, and sympathy), and (c) three self-focused emotions (embarrassment, pride, and envy), which served as an interesting comparison category to the other-oriented prosocial emotions. We used a modified forced-choice methodology similar to that used in studies of facial and vocal emotional communication (M. G. Frank & Stennett, 2001; Keltner, Ekman, Gonzaga, & Beer, 2003).

Method

Participants. The sample consisted of 212 participants (106 unacquainted dyads) from a large public university in California who ranged in age from 18 to 40 years (M = 20.15 years, SD = 3.20). Participants received extra credit for an introductory psychology course for participating. The self-identified ethnic background of the sample was primarily Caucasian (34%), Chinese (30%), and Korean (12%). One member of the dyad was randomly assigned to the role of encoder, the other to the role of decoder.[1] The gender breakdown of the four possible dyads was as follows (encoder–decoder): female–female (n = 24), female–male (n = 27), male–male (n = 27), and male–female (n = 28).

Procedure and materials. On arrival, the encoder and decoder sat at a table and were separated by an opaque black curtain. The participants could neither see nor talk to each other during any part of the experiment, to preclude the possibility that they might provide nontactile clues to the emotion being communicated. Twelve emotion words were displayed serially to the encoder on sheets of paper in a randomized order. The encoder was instructed to think about how he or she wanted to communicate each emotion and then to make contact with the decoder's bare arm from the elbow to the end of the hand to signal each emotion, using any form of touch he or she deemed appropriate. The decoder could not see any part of the touch because his or her arm was positioned on the encoder's side of the curtain. Participants were not told the partner's gender and all tactile displays were video recorded. After each tactile display was administered, the decoder was administered a forced-choice response sheet reading "Please choose the term that best describes what this person is communicating to you." The response sheet contained the following 13 response options: *anger, disgust, fear, happiness, sadness, surprise, sympathy, embarrassment, love, envy, pride,* and *gratitude*, as well as *none of these terms are correct,* to reduce artificial inflation of accuracy rates (see M. G. Frank & Stennett, 2001). These emotions were listed in random order across participants. The dependent measure of interest was the proportion of participants selecting each response option when decoding the tactile stimulus.

Coding procedure. All of the tactile displays were coded on a second-by-second basis by research assistants who were naïve to the emotion being communicated. The coding system was informed by a survey of coding systems used by researchers investigating touch (e.g., Argyle, 1975; Jones & Yarbrough, 1985; Weiss, 1992). The specific types of touch that were coded included squeezing, stroking, rubbing, pushing, pulling, pressing, patting, tapping, shaking, pinching, trembling, poking, hitting, scratching, massaging, tickling, slapping, lifting, picking, finger interlocking, swinging, and tossing (i.e., tossing the decoder's hand). For each second the encoder touched the decoder, a code was assigned: (a) no touch, (b) light intensity, (c) moderate intensity, or (d) strong intensity.[2] In addition, the duration that each encoder touched the decoder for each emotion was calculated. Interrater agreement on all of the codes, based on 20% overlap in coders' judgments, ranged from .83 to .99.

Results

To assess potential gender differences, we conducted a two-way analysis of variance (ANOVA), using the gender of the encoder and the gender of the decoder as the independent variables and an overall accuracy score as the dependent variable. The latter variable was computed by summing the number of times the decoder accurately chose the target emotion across all emotions. The ANOVA revealed no main effects for the encoder's gender (men: $M = 4.59$, $SD = 1.84$; women: $M = 4.59$, $SD = 1.85$), $F(1, 102) = 0.00$, $p > .05$, $\eta^2 = .00$, or the decoder's gender (men: $M = 4.35$, $SD = 1.64$; women: $M = 4.84$, $SD = 2.00$), $F(1, 102) = 1.83$, $p > .05$, $\eta^2 = .02$, as well as no significant interaction, $F(1, 102) = 0.52$, $p > .05$, $\eta^2 = .01$.

Binomial tests were conducted on the proportion of participants who chose each emotion for a given target emotion. Following Frank and Stennett (2001), we set chance at 25% according to the following rationale. Critics of forced-choice methodology have argued that in judging emotional displays respondents are choosing from four emotion options defined by two orthogonal dimensions: arousal and valence (Russell, 1994). People's judgments of emotional stimuli, this view continues, may be guided by the four categories along the axes of those two dimensions: pleasant and aroused, pleasant and unaroused, unpleasant and aroused, and unpleasant and unaroused. This suggests a chance guessing rate of 25%.

In Table 1, we present the emotion most frequently chosen by participants for each of the target emotions. Of the well-studied emotions, anger, fear, and disgust were decoded at significantly

[1] Like Banse and Scherer (1996), we used *encoding* and *decoding* because they connote the research method and the underlying process; no inference should be made that a "code" exists in the emotional signal.

[2] Intensity was defined as follows: (a) light intensity—indentation on the touchee's skin or movement of the touchee's body is not apparent or barely perceptible; (b) moderate intensity—there is some skin indentation or movement of the touchee's body but not extensive; (c) strong intensity—indentation on the touchee's skin is fairly deep or movement of the touchee's body is substantial as a result of the pressure or force of the touch.

Table 1
Percentage of Most Frequent Types of Touch Used in Study 1 and Percentage of Decoding Accuracy of Most Frequently Chosen Emotion for Studies 1 and 2

Emotion and tactile behavior	Most frequent types of touch in Study 1 (%)	Decoding accuracy (%)	
		Study 1 (United States)	Study 2 (Spain)
Ekman's emotions			
Anger		Anger, 57**	Anger, 59**
Hitting	23		
Squeezing	20		
Trembling	11		
Fear		Fear, 51**	Fear, 48**
Trembling	50		
Squeezing	27		
Shaking	6		
Happiness		Happiness, 30	Gratitude, 38
Swinging	55		
Shaking	15		
Lifting	7		
Sadness		Sympathy, 35*	Love, 31
Stroking	26		
Squeezing	6		
Lifting	6		
Disgust		Disgust, 63**	Disgust, 83**
Pushing	55		
Lifting	14		
Tapping	5		
Surprise		Surprise, 24	—
Squeezing	24		
Lifting	12		
Shaking	12		
Self-focused emotions			
Embarrassment		Embarrassment, 18	—
Shaking	14		
Tapping	11		
Pushing	10		
Envy		Envy, 21	—
Pulling	22		
Lifting	12		
Stroking	11		
Pride		Gratitude, 25	—
Shaking	39		
Lifting	16		
Squeezing	15		
Prosocial emotions			
Love		Love, 51**	Love, 62**
Stroking	40		
Finger interlocking	13		
Rubbing	12		
Gratitude		Gratitude, 55**	Gratitude, 66**
Shaking	67		
Lifting	9		
Squeezing	6		
Sympathy		Sympathy, 57**	Sympathy, 48**
Patting	35		
Stroking	15		
Rubbing	7		

Note. Dashes indicate that the emotion was not used.
* $p < .05$. ** $p < .01$.

above-chance levels. Participants were significantly inclined to interpret attempts to communicate sadness as sympathy. None of the self-focused emotions—embarrassment, envy, or pride—was decoded via touch. And, consistent with recent claims about the role of emotion in the evolution of cooperation, the prosocial emotions—love, gratitude, and sympathy—were all decoded by participants.

What were the tactile actions associated with the communication of the different emotions? In Table 1, we present the three most frequent types of touch used, and in Table 2, we present the duration and intensity of touch in instances in which the encoder accurately conveyed the emotion to the decoder, decomposed for each emotion. There were some systematic differences in the types of touch encoders used to communicate different emotions. For example, sympathy was associated with stroking and patting, anger was associated with hitting and squeezing, disgust was associated with a pushing motion, gratitude was associated with shaking of the hand, fear was associated with trembling, and love was associated with stroking. In addition, the emotions were characterized by differences in duration and intensity. For example, anger was characterized by a strong-intensity touch of moderate duration, whereas love and sympathy were characterized by a moderate-intensity touch that was of longer duration.

Study 2

Emotions with evolved signals should be reliably communicated in different cultures (although there are cultural explanations of cross-cultural similarities in emotional expression as well). In Study 2, therefore, we partially replicated Study 1 with a sample from a different culture—Spain—and a more limited set of emotions, which included anger, fear, happiness, sadness, disgust, love, gratitude, and sympathy. We chose to replicate Study 1 in Spain because touch is thought to be more common and highly valued there than in U.S. culture (Andersen, 1999; McDaniel & Andersen, 1998). Spain, therefore, is an interesting culture in which to extend the results of Study 1, because of its contrasting norms regarding tactile communication.

Method

The sample included 58 participants (29 unacquainted dyads) from the University of Granada (Granada, Spain) who ranged in age from 19 to 48 years (M = 22.13 years, SD = 3.45). Participants received extra credit for participating. As in Study 1, 1 member of the dyad was randomly assigned to the role of encoder, the other to the role of decoder. The number of dyad groups was as follows (encoder–decoder): female–female (n = 22); female–male (n = 1); male–male (n = 2); and male–female (n = 4).

The procedure of Study 2 was the same as that of Study 1 with two exceptions: The tactile displays were not recorded on videotape and the encoder attempted to communicate only eight emotions. The nine response options were as follows in Spanish (the English translation was not included on the response sheet): *cólera* (anger), *repugnancia* (disgust), *miedo* (fear), *felicidad* (happiness), *tristeza* (sadness), *simpatía* (sympathy), *cariño* (love), *agradecimiento* (gratitude), and *ninguno de estos términos* (none of these terms are correct). These emotions were listed in alphabetical order for all participants.

Results

We computed the results reported in Table 1 by averaging the accuracy rates of all four gender combinations (weighted by number of participants in each dyad group). As in Study 1, encoders communicated anger, fear, and disgust to decoders at above-chance levels. Moreover, encoders communicated all three prosocial emotions—love, gratitude, and sympathy—at above-chance levels of accuracy. None of the above emotions was confused for a nontarget emotion.

Table 2
Duration and Intensity of Tactile Behaviors That Were Accurately Decoded in Study 1

Encoded emotion	Duration (seconds)		Intensity (%) None		Light		Moderate		Strong	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Ekman's emotions										
Anger	4.5	3.7	2.4	9.1	0.8	6.5	42.4	42.8	54.5	43.3
Fear	6.5	5.3	0.5	2.9	6.0	22.1	53.4	44.5	40.1	44.1
Happiness	8.1	5.6	0	0	3.1	12.3	74.8	35.5	22.1	35.3
Sadness	7.2	5.0	0.7	2.9	18.0	35.1	81.3	36.7	0	0
Disgust	3.8	3.3	3.9	12.3	0.9	6.9	66.7	40.2	28.6	38.8
Surprise	4.6	4.7	6.7	20.0	1.5	7.5	56.7	45.3	35.1	42.3
Self-focused emotions										
Embarrassment	7.7	3.0	11.8	18.3	18.4	31.7	69.5	41.9	0.4	1.8
Envy	7.1	4.7	5.7	21.7	10.6	29.8	70.1	39.8	14.3	25.1
Pride	6.1	2.7	0.5	2.3	0	0	79.4	36.1	20.1	36.3
Prosocial emotions										
Love	9.5	6.5	0	0	15.5	35.1	80.1	38.2	4.4	17.9
Gratitude	5.7	2.8	0.2	1.7	0.1	0.8	77.1	36.7	22.6	36.8
Sympathy	7.6	5.2	0	0	4.8	18.8	91.0	23.8	4.3	16.0

Study 3

In our first two studies, decoders could not see the encoder's behavior, so we infer that they detected different emotions solely on the basis of their tactile experience. The purpose of Study 3 was to ask, for the first time in the empirical literature, whether observers can decode distinct emotions from observations of other individuals communicating emotion via touch. If this proves to be the case, this would suggest that people can discern emotion in tactile behavior without the experience of being touched. To address this aim, we presented a new sample of observers with video clips of the tactile communications from Study 1. These decoders were given the task of judging which emotion was communicated, and they based this judgment solely on the tactile interactions they observed.

Method

The sample included 114 participants (67 women and 47 men) enrolled at DePauw University who ranged in age from 18 to 22 years (M = 19.89 years, SD = 1.30). Participants received extra credit for participating. The self-identified ethnic background of the sample was primarily Caucasian (93%).

Seventy-two video clips taken from Study 1 were shown to participants in the current study (an additional 12 clips were presented for practice). Each video clip presented a view of the decoder's arm (elbow to fingertips) on which the encoder provided tactile stimulation to communicate an emotion. Six clips of each of the 12 emotions investigated in Study 1 were presented to participants, 3 of which were accurately decoded in Study 1 and 3 of which were not accurately decoded. Including both accurately and inaccurately decoded clips allowed us to ascertain whether observers could discern emotion in tactile communications that did not convey emotion in Study 1 through experienced touch alone. These clips were randomly presented to participants in the current study. There was a 15-s delay between each video clip to allow participants to mark the same forced-choice response sheet used in Study 1 (but with fewer emotion options). The video clips were shown to groups of participants (10–30 per sitting) on a 2.1-m × 1.6-m screen via a video display projector. All participants were well within viewing range of the video screen, and they were not allowed to communicate with each other during the study. Moreover, they were instructed to look only at the video screen and their response sheets.

Results

To assess potential gender differences, we conducted a one-way ANOVA, using the gender of the decoder as the independent variable and an overall accuracy score as the dependent variable. The latter variable was computed by summing the number of times the decoder accurately chose the target emotion across all trials. The ANOVA indicated that men (M = 6.23, SD = 2.83) and women (M = 7.21, SD = 2.60) did not differ statistically in the accuracy with which they decoded the tactile expressions of emotion, $F(1, 111) = 3.60$, $p > .05$, $\eta^2 = .03$. Percentage of accuracy scores are reported below only if they surpass the 25% criterion at the $p < .05$ level. For the accurately decoded clips from Study 1, participants accurately identified anger (44%), fear (38%), happiness (61%), disgust (71%), love (60%), and sympathy (53%) at above-chance levels. For the inaccurately decoded clips from Study 1, participants accurately identified disgust (48%) and sympathy (66%) at above-chance levels, whereas gratitude (38%) was chosen at above-chance levels when happiness was intended to be encoded.

General Discussion

The findings from this investigation extend the literature on the communication of emotion in three ways. First, the evidence indicates that humans can communicate several distinct emotions through touch; touch communicates more than the hedonic tone and intensity of emotions. We documented that the tactile modality can signal at least six emotions: anger, fear, disgust, love, gratitude, and sympathy. Accuracy rates ranged from 48% to 83%, which are comparable to those observed in studies of facial displays and vocal communication (Elfenbein & Ambady, 2002; Scherer et al., 2003). Moreover, we identified specific tactile behaviors used by participants to communicate distinct emotions, demonstrating the richness of the physical properties of touch (Hertenstein, 2002).

Several features of the first two studies increase our confidence in the robustness of these findings. Whereas in most previous judgment studies observers judged highly prototypical displays or those posed by actors or people adept at emotional communication, in our studies people decoded emotion from the idiosyncratic tactile actions of other untrained participants. Our response format included the response option "none of these terms are correct," which reduces the likelihood of inflated accuracy rates (M. G. Frank & Stennett, 2001). Finally, we restricted the tactile stimulation to one location on the body, thus eliminating one aspect of tactile communication—location on body of the touch recipient—that is likely to provide additional information with respect to the emotion communicated.

There are plausible alternative interpretations of our findings. The most prominent concerns what participants were inferring from tactile communication. We have conceptualized the studies in terms of the communication of emotions. A clear alternative is that encoders may have been communicating intentions rather than emotions. Fridlund (1997) has argued that facial displays communicate intentions rather than subjective feeling. The same may be true in our studies investigating tactile signals. Future research should explore this alternative explanation.

Our investigation advances the understanding of emotional communication in a second fashion, by providing evidence that individuals can, from visual observation alone, detect emotion in tactile behavior. With the exception of gratitude, all of the emotions in Studies 1 and 2 that were accurately decoded by touch (anger, fear, disgust, love, and sympathy) were accurately decoded by participants who only viewed the tactile signals but did not experience tactile stimulation. These findings raise the interesting question of whether decoding accuracy would be enhanced, or diminished, when touch is both seen and felt—a question for future research.

Our three studies advance the study of emotional communication in a third way, by documenting that people can readily communicate three prosocial emotions with nonverbal behavior—love, gratitude, and sympathy. These findings fit evolutionary claims that cooperation is facilitated by clear signals of prosocial intent, for we assume that tactile communications of love, gratitude, and sympathy reward prosocial behavior and signal prosocial intent—claims warranting empirical attention. These findings also raise the interesting possibility that touch may convey more positive emotions than other modalities, such as the face.

A number of important questions related to the current studies await empirical attention. Are distinct emotions communicated via touch in cultures that are not known to be high-contact cultures (e.g., some Asian cultures)? How does both seeing and tactilely perceiving touch concurrently influence the decoding of emotions? How might touch influence the decoder's central and peripheral physiology? Are the tactile signals of sympathy, love, and gratitude more or less reliable depending on whether the encoder is intending to deceive? These and other questions related to the communication of emotion via touch are ripe for investigation.

References

Andersen, P. A. (1999). *Nonverbal communication: Forms and function.* Mountain View, CA: Mayfield.

Argyle, M. (1975). *Bodily communication.* Oxford, England: International Universities Press.

Banse, R., & Scherer, K. R. (1996). Acoustic profiles in vocal emotion expression. *Journal of Personality and Social Psychology, 70,* 614–636.

de Waal, F. (1989). *Peacemaking among primates.* Cambridge, MA: Harvard University Press.

Eibl-Eibesfeldt, I. (1989). *Human ethology.* Hawthorne, NY: Aldine de Gruyter.

Ekman, P. (1993). Facial expression and emotion. *American Psychologist, 48,* 384–392.

Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin, 128,* 203–235.

Field, T. (2001). *Touch.* Cambridge, MA: MIT Press.

Frank, M. G., & Stennett, J. (2001). The forced-choice paradigm and the perception of facial expressions of emotion. *Journal of Personality and Social Psychology, 80,* 75–85.

Frank, R. H. (2002). Altruism in competitive environments. In R. J. Davidson & A. Harrington (Eds.), *Visions of compassion* (pp. 182–211). New York: Oxford University Press.

Fridlund, A. J. (1997). The new ethology of human facial expressions. In J. A. Russell & J. M. Fernandez-Dols (Eds.), *The psychology of facial expression* (pp. 103–129). Cambridge, England: Cambridge University Press.

Haidt, J., & Keltner, D. (1999). Culture and facial expression: Open-ended methods find more expressions and a gradient of recognition. *Cognition & Emotion, 13,* 225–266.

Hertenstein, M. J. (2002). Touch: Its communicative functions in infancy. *Human Development, 45,* 70–94.

Hertenstein, M. J. (2005). Touch. In N. Salkind (Ed.), *Encyclopedia of human development* (Vol. 3, pp. 1275–1277). New York: Sage.

Hertenstein, M. J., & Campos, J. J. (2001). Emotion regulation via maternal touch. *Infancy, 2,* 549–566.

Jones, S. E., & Yarbrough, A. E. (1985). A naturalistic study of the meanings of touch. *Communication Monographs, 52,* 19–56.

Keltner, D., & Buswell, B. N. (1996). Evidence for the distinctness of embarrassment, shame, and guilt: A study of recalled antecedents and facial expressions of emotion. *Cognition & Emotion, 10,* 155–171.

Keltner, D., & Buswell, B. N. (1997). Embarrassment: Its distinct form and appeasement functions. *Psychological Bulletin, 122,* 250–270.

Keltner, D., Ekman, P., Gonzaga, G. C., & Beer, J. (2003). Facial expression of emotion. In R. J. Davidson & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 415–432). London: Oxford University Press.

Knapp, M. L., & Hall, J. A. (1997). *Nonverbal communication in human interaction* (4th ed.). Fort Worth, TX: Harcourt Brace College.

McDaniel, E., & Andersen, P. A. (1998). International patterns of interpersonal tactile communication: A field study. *Journal of Nonverbal Behavior, 22,* 59–75.

Russell, J. A. (1994). Is there universal recognition of emotion from facial expressions? A review of the cross-cultural studies. *Psychological Bulletin, 115,* 102–141.

Scherer, K. R., Johnstone, T., & Klasmeyer, G. (2003). Vocal expression of emotion. In R. J. Davidson & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 433–456). London: Oxford University Press.

Smoski, M. J., & Bachorowski, J. A. (2003). Antiphonal laughter between friends and strangers. *Cognition & Emotion, 17,* 327–340.

Sober, E. (2002). Kindness and cruelty in evolution. In R. J. Davidson & A. Harrington (Eds.), *Visions of compassion: Western scientists and Tibetan Buddhists examine human nature* (pp. 46–65). New York: Oxford University Press.

Stack, D. M. (2001). The salience of touch and physical contact during infancy: Unraveling some of the mysteries of the somesthetic sense. In J. G. Bremner & A. Fogel (Eds.), *Blackwell handbook of infant development* (pp. 351–378). Malden, MA: Blackwell.

Tronick, E. Z. (1995). Touch in mother–infant interaction. In T. M. Field (Ed.), *Touch in early development* (pp. 53–65). Mahwah, NJ: Erlbaum.

Weiss, S. J. (1992). Measurement of the sensory qualities in tactile interaction. *Nursing Research, 41,* 82–86.

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