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The effect of relationship status on communicating emotions through touch

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Research into emotional communication to date has largely focused on facial and vocal expressions. In contrast, recent studies by Hertenstein, Keltner, App, Bulleit, and Jaskolka (2006) and Hertenstein, Holmes, McCullough, and Keltner (2009) exploring nonverbal communication of emotion discovered that people could identify *anger*, *disgust*, *fear*, *gratitude*, *happiness*, *love*, *sadness* and *sympathy* from the experience of being touched on either the arm or body by a stranger, without seeing the touch. The study showed that strangers were unable to communicate the self-focused emotions *embarrassment*, *envy* and *pride*, or the universal emotion *surprise*. Literature relating to touch indicates that the interpretation of a tactile experience is significantly influenced by the relationship between the touchers (Coan, Schaefer, & Davidson, 2006). The present study compared the ability of romantic couples and strangers to communicate emotions solely via touch. Results showed that both strangers and romantic couples were able to communicate universal and prosocial emotions, whereas only romantic couples were able to communicate the self-focused emotions *envy* and *pride*.

Keywords: Emotion; Touch; Communication; Couples; Strangers.

Despite the importance and pivotal influence of touch in a variety of social domains (Eibl-Eibesfeldt, 1989; Field, 2001; Keltner & Kring, 1998), research has paid very little attention to how touch is used in the communication of emotion. The majority of investigations into emotional communication have focused on facial and vocal expressions (Banse & Scherer, 1996; Ekman & Friesen, 1975; Juslin & Laukka, 2003; Russell, 1991) rather than touch, even though

tactile signals represent a unique part of intimate relationships and emotional communication, as they require close proximity. The present study is the first to observe the communication of emotion between romantic couples solely through touch, and to compare it to that between strangers.

In a pioneering study, Hertenstein, Keltner, App, Bulleit, and Jaskolka (2006) explored whether people could communicate emotions to a stranger using touch alone. Participants were

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separated by an opaque barrier, and encoders (touchers) were asked to convey twelve different emotions by touching the forearm of the decoder (recipient) who had to choose which emotion was being communicated. This experiment, carried out in the United States and in Spain, found that participants could accurately communicate *anger*, *fear*, *disgust*, *love*, *gratitude* and *sympathy*. These are broadly the same set of emotions that have been claimed to have universal means of facial expression across cultures (Ekman, 1992, 2003; Izard, 1992). However, strangers in Hertenstein et al.'s study were unable to communicate the prosocial emotions *surprise*, *happiness* and *sadness*, in addition to the self-focused emotions *embarrassment*, *envy*, and *pride*. Hertenstein et al. suggested that communication of self-focused emotions via touch may be particularly difficult relative to other emotions.

Hertenstein, Holmes, McCullough, and Keltner (2009) conducted a follow-up study using the same methodology but allowing encoders to touch the whole body of decoders, and found that now strangers could communicate two additional emotions, *happiness* and *sadness*, as well as the emotions previously successfully communicated (self-focused emotions were not included in this study).

Hertenstein et al.'s studies (2006, 2009) used randomly allocated pairs of strangers in the communication task. As yet there has been no exploration of communication of emotion through touch between people in romantic relationships. The present study therefore aimed to explore the effect of relationship status on distinguishing emotions solely through touch. The question to be addressed was the following: Is there a difference between strangers and romantic partners in the emotions that can be distinguished via touch? More specifically, can the self-focused emotions (*embarrassment*, *envy*, *pride*), which could not be communicated between strangers, be communicated to a romantic partner?

Earlier research on touching indicates that the person whom one is touching or by whom one is being touched can have an effect on the interpretation of the meaning of that touch (Coan,

Schaefer, & Davidson, 2006; Heslin & Alper, 1983). The aim of the present study was to observe whether relationship status has an effect on emotional communication and interpretation. Hertenstein et al.'s (2006) methodology was used. However, to provide a closely matched control, participants repeated the experiment twice, once with their romantic partner and once with a stranger. The primary dependent variable was the match between the emotion label given to the encoder and the emotion label subsequently chosen by the decoder. Touch analyses were conducted on the type of touch used to observe how the distribution differed between successful and unsuccessful actions, and between couples and strangers. Additional analyses were carried out to establish the confusability of emotions when transmitted by touch to observe whether the confusability was related to their similarity in arousal and valence (Russell, 1994).

It was hypothesised that (as in Hertenstein et al.'s 2006 study) both strangers and couples would be able to communicate universal emotions such as *anger*, *disgust* and *fear*, and prosocial emotions *gratitude*, *love*, and *sympathy*. However, it was predicted that romantic couples would be better at communicating emotions than strangers and that only romantic couples would be able to distinguish self-focused emotions via touch (*envy*, *embarrassment*, *pride*). The sample included all gender combinations (male to male, female to female, male to female, female to male) although given the scope of the study it was not possible to test all gender combinations equally, and there was an unbalanced design. Half of the encoders were male and half female; the majority of decoders within couples were of the opposite gender to the encoder, while the majority of stranger decoders were of the same gender to the encoder. Thus the couple/stranger factor was partly confounded with opposite/same gender. This design was chosen in order to minimise the possible inhibition people might feel about touching or being touched by a stranger of the opposite gender. Research has shown that receiving touch from a stranger is generally disliked, although touch on certain parts of the body, including the hands, arms and back,

is considered more acceptable (Heslin & Alper, 1983). On the basis of Hertenstein et al.'s 2006 and 2009 results, gender was in any case not expected to influence success in the task, and, indeed, the analysis by gender reported below failed to show significant gender effects.

METHOD

Participants

Participants were recruited via advertisements throughout the campus of a London university and in nearby locations to invite both students and a wider population. Only couples were eligible to take part in the study, and a minimum length of time together was not required. The length of relationships ranged from 1 to 84 months, with an average of 26.4 months, and a standard deviation of 19.8 months. All participants were entered into a draw to win £40 and a bottle of champagne, and first-year psychology students received one academic credit for their participation. Thirty couples (60 participants) took part in the experiment. Participants ranged in age from 18 to 54, with a mean age of 24.2 and a standard deviation of 6.3 years. The ethnic background of the sample was primarily White European (78%) but included a variety of other ethnicities; Indian (10%), African (8%) and Mixed (4%). The majority of participants were students from a diversity of London universities ($n = 35$) and the sample also included a variety of professionals ($n = 25$). Sexual preference was noted; 26 couples were heterosexual and 4 couples were homosexual.

Participants within each couple were randomly assigned to the roles of encoder and decoder.

Design

The experiment was run by taking a foursome of participants (two couples) who together provided two measures for each of the two conditions of Couples vs. Strangers. Two relationship couples were booked into each testing time-slot enabling each participant to be tested once with their partner and once with the accompanying stranger. Each participant was designated as either an encoder or a decoder, and performed the task twice, once with their partner, and once with a stranger. Figure 1 illustrates how a unit of 4 participants (2 couples) created 4 testing sessions. Every participant remained as either an encoder or a decoder for both communication tasks.

Fifteen testing sessions, each with 2 couples, were performed yielding a total of 60 participants. All participants were aware of whether they were communicating with their romantic partner or a stranger, as well as the gender of the stranger. The order in which the 4 dyads from a foursome were tested was determined randomly on each occasion. On each testing session, the encoder was given 12 emotion terms to convey, and the decoder had to choose from a given list which term they thought had been intended. Accuracy was recorded, as well as the type of touch used. The repeated-measures design ensured that each decoding participant finished the experiment having provided two scores; a score out of 12 for participation with a stranger and a score out of 12 for participation with their romantic
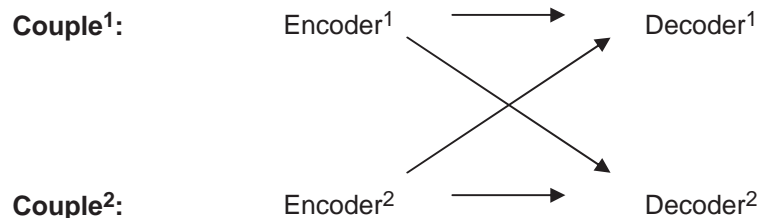

Figure 1. *Illustration of design; unit of analysis as a foursome of participants.*

partner. Thus, a total of 30 decoders provided 60 sets of results.

Coding analysis of touch

All communication events were filmed and the type of touch used to express each emotion was coded. To validate the coding, 10 randomly selected testing sessions were also coded by an assistant, and the results were compared. Judges agreed 97% of the time, and kappa was .73. Because of equipment failure, one session was not filmed, so there were 59 testing sessions × 12 emotions = 708 events to code. The following codes, taken from Hertenstein et al. (2006) were used: *finger interlocking, handshake, hitting, lifting, massaging, patting, picking, pinching, poking, pressing, pulling, pushing, rubbing, scratching, shaking, slapping, squeezing, stroking, swinging, tapping, tickling, tossing, trembling*. In addition the following three codes were created for three further common types of touch used: "*body-touch*" for when the encoder used the decoder's hand or arm to touch part of the encoder's body, for example, to pat their chest or stroke their face, "*lift-dropping*" for the action of lifting the hand and dropping it from mid-air, and "*flicking*" for a quick flicking movement of the finger. Coding of touch was done by judges who were ignorant of the relationship status of the dyad involved.

Materials and apparatus

Participants were seated at opposite sides of a table separated by an opaque black curtain. The curtain was held up by a wooden device which was clamped to the table. The same emotion words were used for the experiment as used in Hertenstein et al.'s (2006) study. They were: six universal emotions: *anger, disgust, fear, happiness, sadness, surprise*; three prosocial emotions: *love, gratitude, sympathy*; and three self-focused emotions: *embarrassment, envy*, and *pride*.

Procedure

On each testing session the encoder and decoder were seated at a table on opposite sides of the

opaque curtain. Encoders had the role of translating the emotional words specified to them into forms of touch; they were asked to focus on how they would effectively communicate the emotions and were encouraged to respond to each emotion with a representation of touch as they perceived it. Decoders had the role of interpreting which emotion was being communicated through the touch sensation on their arm, and were instructed to place their forearm underneath the black curtain to expose it to the encoder performing the touch. Encoders were encouraged to use any form of touch they considered appropriate to each of the specified emotions. There was no time limit.

Encoders were given a booklet with 12 emotion words, one per page, and were instructed to communicate one emotion at a time to the decoder's forearm. Decoders were given a booklet with 12 answer sheets, each of which listed the 12 emotion words. They were required to circle the word they believed matched the tactile sensation and then progress onto the next answer sheet without looking back at previous responses. The emotion words were presented in alphabetical order on the answer sheets which also included the option "*none of these terms are correct*" in the event that the decoder did not feel that the touch they had experienced represented any of the emotion words listed. Decoders always received the emotions in different random orders from the partner and the stranger encoders. Participants were not allowed to talk to each other at any point during the testing session. A camera was used to film the experiments for the purpose of touch analysis.

RESULTS

Preliminary analyses

Hertenstein et al. (2006) reported no influence of the gender of decoders and encoders on the success of emotional communication, a result confirmed in a more recent study with 124 dyads (Hertenstein et al., 2009). In the light of their results, and given the constraints of the present study, gender was allowed to be confounded to some degree with the couple/stranger factor, in

an unbalanced design in which most decoders received touch from opposite gender romantic partners, and same gender strangers. As a check on the validity of this decision, we compared success of communication between two groups of participant pairs. Group A consisted of 21 decoders who were communicated to by opposite sex partners, and by same sex strangers. Group B consisted of the 9 remaining decoders who had either same sex partners, or opposite sex strangers, or both. If an opposite-gender advantage in communication were responsible for any difference between partners and strangers, then we should find a stronger effect of Relationship status in Group A (where the effects were confounded) than in Group B (where they were not), as reflected in a significant interaction of Group with Relationship Status. Analysis of variance (ANOVA) was run across the 30 decoders with Relationship status as a within-subjects factor, and Group (A vs. B) as a between-subjects factor. The interaction between Group and Relationship status was completely absent ($F < 1$), with the same mean advantage in accuracy of 1.6 for partners over strangers in each Group. While acknowledging the low power of this analysis, taken together with the results reported by Hertenstein et al. (2006, 2009) we were confident that our results were unlikely to reflect gender effects to any significant extent.

A further preliminary analysis examined the time spent touching. Romantic couples took significantly longer than strangers ($M = 7.4$ s vs. 4.9 s). ANOVA was run on time spent touching with Relationship status and Accuracy of communication (Correct vs. Incorrect) as within-group factors. For this, and subsequent ANOVAs reported below, to achieve independence the unit of analysis was a "foursome", the group of four participants tested on a given occasion. The data for partner versus stranger communication were collapsed over the two decoders in each pair, in order to remove the statistical dependence in the data generated by the design (the partner encoder for one decoder was the stranger encoder for the other in each foursome). Because of equipment failure, no times were recorded for one of the

pairs, so the analysis of time taken was conducted over 14 foursomes. There was a strong main effect of Relationship status, $F(1, 13) = 41.3$, $p < .001$, but no effect of Accuracy on time taken, and no significant interaction (both Fs < 1). Thus, while it was confirmed that partners took longer to communicate, neither type of pair took any longer over trials where they were successful and those where they failed to communicate the emotion. At least at the group level, there was no relation between time and accuracy. The relationship between accuracy and time across individuals within groups is considered further below. Finally, length of relationship did not correlate significantly with success for romantic couples, $r(28) = .1$. Given that longevity of a relationship is not a perfect predictor of its closeness, it will be interesting to pursue this question further in future studies.

Success at communicating emotions

To address our first two questions, the data were collated to provide a measure of accuracy for each emotion in each condition. Decoders had twelve emotions and a neutral item ("*none of these terms are correct*") to choose from. The latter option, chosen very rarely (strangers = 1.1%, couples = 1.4%), was treated as an error. Both groups showed a good rate of success. Table 1 provides a full breakdown of success for each type of dyad and for each emotion. Couples succeeded in communicating the selected emotion 51% of the time, and strangers 38%. Mean kappa for a decoder choosing the correct emotion term was .47 for couples and .31 for strangers. Compared to a conservative estimate of a chance rate of 25% (as used by Hertenstein et al., 2006, 2009), both groups performed significantly above chance, $t(29) = 6.61$, $p < .001$, for couples, $t(29) = 3.47$, $p < .005$, for strangers. Taking each foursome as a unit of analysis, mean accuracy was greater with partners within a foursome than with strangers in 11 of the 15 foursomes, and only worse in 1 (Wilcoxon $T = 2$, $p < .001$). We can conclude, therefore, that both partners and strangers were

Table 1. *Mean success of communication (hits out of 30) for each couple and stranger dyad, together with kappa, and significance of a test for the difference between the two probabilities (see text). Both types of dyad communicated all emotions successfully, except for strangers with envy and pride*

Emotion	Couples	Kappa	Strangers	Kappa	Sig.
Universal					
Anger	60%	.59	47%	.47	*ns*
Disgust	53%	.49	57%	.41	*ns*
Fear	47%	.47	40%	.33	*ns*
Happiness	53%	.56	40%	.38	*ns*
Sadness	47%	.46	30%	.31	*ns*
Surprise	53%	.57	20%	.22	*ns*
MEAN	**52%**	**.52**	**39%**	**.35**	*p* < .05
Prosocial					
Gratitude	50%	.42	37%	.24	*ns*
Love	80%	.69	67%	.58	*ns*
Sympathy	50%	.34	63%	.41	*ns*
MEAN	**60%**	**.48**	**56%**	**.41**	*ns*
Self-focused					
Embarrassment	33%	.34	27%	.23	*ns*
Envy	40%	.35	7%	.01	*p* < .01
Pride	43%	.36	17%	.13	*p* ≤ .05
MEAN	**39%**	**.35**	**17%**	**.12**	*p* < .01
OVERALL MEAN	**50.8%**	**.47**	**37.5%**	**.31**	*p* ≤ .001

Note: *ns* = non-significant.

successful at the task, but that partners were more successful than strangers.

A key aim of this study was to investigate accuracy of communicating different kinds of emotion. Our third question was whether either of the groups would be able to communicate the self-focused emotions. To answer the question more generally, the 12 emotions were classed into universal (anger, disgust, fear, happiness, sadness and surprise), prosocial (gratitude, love and sympathy), and self-focused emotions (embarrassment, envy and pride; see Table 1). Success was calculated across foursomes for each of these classes of emotion. Couples achieved success rates of 52%, 60% and 39% across universal, prosocial and self-focused emotions, compared to rates of 39%, 56% and 17% for strangers. ANOVA showed strong effects of Relationship, $F(1, 14) = 17.3$, $p < .001$, and Type of Emotion, $F(2, 28) = 21.5$, $p < .001$, but the interaction was not significant, $F(2, 28) = 1.87$, $p < .2$. Thus, although strangers appeared to have particular

difficulty with the self-focused emotions, this effect was consistent with strangers being generally less accurate, and this type of emotion being the hardest to convey. Our hypothesis called for two planned tests of the ability of each type of pair to communicate self-focused emotions. Taking a 25% chance rate (Hertenstein et al., 2006), it is clear that the strangers, with a mean of 17% correct, were not succeeding. On the other hand, the couples, with 30% correct were well above the chance rate, $t(14) = 3.3$, $p < .01$.

To unpack the data further, an analysis was performed for each emotion separately, using a statistical rather than an arbitrary definition of chance levels. Fisher exact tests (Siegel, 1956) were used to test whether there was significant agreement between the decoders and the encoders for each emotion for each type of pair. Alpha was set at .001 in recognition of the 12 tests that were made. Frequency of success at identifying emotions for couples and strangers is displayed in Table 1 together with Cohen's kappa. Couples successfully communicated all emotions better

than chance, whereas strangers were successful on all except for Envy (7%) and Pride (17%), two of the self-focused emotions. The final column of Table 1 shows the significance of tests for the difference between couples and strangers for each emotion. Wilcoxon tests were used for individual emotions, comparing the number of foursomes in which couples were better with the number where strangers were better. For tests of the mean for each type of emotion and the overall mean, related t-tests were used across the 15 foursomes.

Accuracy and time taken

The fact that couples both took longer and were more accurate than strangers raises the possibility that across dyads success was a consequence of greater time taken. To assess this notion, two measures were calculated across the 14 foursomes (an equipment failure meant that no times were recorded for one pair). First an overall measure of the Couple's Accuracy advantage within each foursome was taken by subtracting the stranger pairs' total of successfully communicated emotions from that for the couple pairs. Second, a similar measure was calculated for each foursome for the overall Time Difference between couples and strangers. If variation in time taken accounted for the difference in accuracy, then we would expect a positive correlation between these two measures. That is to say that those foursomes where the couples took a lot longer than strangers should show a correspondingly bigger accuracy advantage for couples than those foursomes where the difference in time taken was less extreme. The correlation between the two measures was positive but not significant, $r(12) = .20$, $p > .5$. Thus there was no evidence that accuracy differences were attributable to differences in time taken (although the low power of the test means that this account can not be entirely ruled out).

Use of different types of touch

Our next analysis considered how different types of touching actions were used in the communication of different emotions. Touches were cate-

gorised into 27 types, according to the scheme described in the methods section. On average each communication used 1.9 types of touch. Table 2 shows the types of touch commonly used for each emotion, between couples, between strangers, and in Hertenstein et al.'s (2006) study, together with the percentage of trials on which they were used. Particular types of touch were strongly associated with particular emotions, across all three groups. For example, positive emotions tended to be communicated with *lift*, *shake* and *squeeze* regardless of interpretation success or relationship status. Overall, it appears that couples and strangers communicated emotion via touch in very similar ways. The distribution of types of touch used to communicate each emotion allows us to examine the similarity between emotions. Table 3 shows the correlation between each pair of emotions calculated across the two frequency distributions of touch-types used for each emotion. The emotions have been clustered to illustrate the fact that positive emotions (pride, happiness, gratitude and surprise) formed a cluster, as did what might be termed tender emotions (sadness, sympathy and love). The middle group of negative emotions (embarrassment, envy, anger, disgust and fear) formed a third cluster.

Confusability of emotions

The last analysis considered the confusability of one emotion with another. For couples and for strangers separately, a confusion matrix was constructed reflecting how often each emotion was correctly identified or confused with each of the other emotions. Proxscal multidimensional scaling (Busing, Commandeur, & Heiser, 1997) was carried out to provide a spatial representation in which the similarities between the individual emotions, in terms of their confusability, are projected into proximities in the space. The closer two emotions are in the diagram, the more often they were mistaken for each other. Normalised raw stress was .065 for couples and .05 for strangers. (Stress measures the degree of correspondence between the input similarity matrix and the distance between items in the spatial

Table 2. *Percentage of Three Most Frequent Types of Touch Used for each Emotion in Couple and Stranger Dyads, and as reported in Hertentstein et al. (2006)*

Emotion	Couples %		Strangers %		Hertenstein %	
Universal						
Anger	Hit	27	Hit	22	Hit	23
	Squeeze	19	Push	16	Squeeze	20
	Push	17	**Slap**	16	Tremble	11
Disgust	Push	25	Push	22	Push	55
	Toss	15	Toss	15	Lift	14
	Lift-drop	13	**Pinch**	11	Tap	5
Fear	Squeeze	36	Tremble	34	Tremble	50
	Tremble	20	Squeeze	32	Squeeze	27
	Pull	8	Pull	9	Shake	6
Happiness	Lift	27	Lift	36	Swing	55
	Shake	16	Shake	13	Shake	15
	Swing	11	Swing	16	Lift	7
Sadness	Stroke	21	Squeeze	20	Stroke	26
	Squeeze	18	Stroke	20	Squeeze	6
	Body touch	11	**Hidden hand/lift**	12	Lift	6
Surprise	Lift	16	**Poke**	18	Squeeze	24
	Shake	14	Lift	16	Lift	12
	Squeeze	9	Squeeze	14	Shake	12
Prosocial						
Gratitude	Handshake	21	Handshake	25	Shake	67
	Lift	18	Shake	23	Lift	9
	Shake	15	**Pat**	17	Squeeze	6
Love	Stroke	29	Stroke	35	Stroke	40
	Kiss	17	**Squeeze**	16	Finger interlock	13
	Lift	11	Kiss	12	Rub	12
Sympathy	Stroke	38	Stroke	36	Pat	35
	Squeeze	16	Pat	19	Stroke	15
	Pat	11	Squeeze	17	Rub	7
Self-focused						
Embarrassment	Squeeze	19	Squeeze	21	Shake	14
	Push	16	**Press**	13	Tap	11
	Pinch	9	Pinch	9	Push	10
Envy	Squeeze	25	Squeeze	16	Pull	22
	Pull	17	Push	14	Lift	12
	Push	15	**Hit**	12	Stroke	11
Pride	Squeeze	27	Lift	28	Shake	39
	Lift	21	Shake	25	Lift	16
	Shake	20	Squeeze	20	Squeeze	15

Note: Items in **bold** indicate touching actions unique to that type of relationship and emotion.

model. Values below 0.10 indicate a good fit to the data.) Figure 2 illustrates the findings and shows interesting differences between the two groups. For example, strangers found it difficult to differentiate between *envy*, *disgust* and *anger* via touch, as can be seen by their proximity in the diagram. Strangers also confused *love*, *sadness* and *sympathy*. By contrast the Couples' confusion space was more widely spread implying that couples were less likely to confuse emotions. Specifically, couples did not have difficulty differentiating between *love*, *sadness* and *sympathy* in the

Table 3. Correlation between emotions over the frequency distribution of types of touch (N=27) used in communication across all trials. High values indicate similar use of types of touch for communicating the two emotions

	1	2	3	4	5	6	7	8	9	10	11	12
1 Pride	1											
2 Happiness	.83**	1										
3 Gratitude	.72**	.54**	1									
4 Surprise	.73**	.69**	.40*	1								
5 Embarrassment	.52**	.18	.19	.43*	1							
6 Envy	.35	.08	.04	.25	.80**	1						
7 Anger	.15	-.05	-.06	.03	.48**	.61**	1					
8 Disgust	-.13	-.18	-.24	.11	.38*	.37	.53**	1				
9 Fear	.41*	.23	.13	.39*	.56**	.58**	.22	-.07	1			
10 Sadness	.52**	.34	.35	.28	.45*	.3	0	-.19	.37	1		
11 Sympathy	.29	.14	.29	.08	.17	.12	-.07	-.12	.2	.83**	1	
12 Love	.28	.24	.2	.13	.18	.1	-.07	-.09	.19	.84**	.84**	1

same way that strangers did. On the other hand, *anger* and *disgust* were more often confused for couples than for strangers.

DISCUSSION

The present study confirmed that the success of interpreting emotions correctly via touch is influenced by the relationship between the person giving and the person receiving the touch. We supported previous findings (Hertenstein et al., 2006, 2009) that strangers could communicate universal and prosocial emotions via touch, as well as documenting the communication of an additional emotion, *embarrassment*. In contrast, couples were able to communicate universal, prosocial and three different self-focused emotions at levels well above chance.

Additionally, the study showed that people were more likely to confuse particular emotions with one another, if they matched along dimensions of arousal and valence, such as *envy*, *anger* and *disgust* (high arousal, negative valence). Comparing the confusability maps with the data on touching in Table 2 and 3 it is clear that the commonly confused emotions often involved similar types of touch. For example, strangers often confused *love*, *sadness* and *sympathy* (Figure 2), and Table 2 and 3 indicate that these emotions involved very similar types of touch; most often *stroking* and *squeezing*. The confusion between emotions replicates confusion found in facial recognition of emotion (Ekman, 2003; Widen & Russell, 2003), as well as confusion found in distinguishing emotions expressed by body pose (Schindler, Van Gool, & de Gelder, 2008). Couples had fewer confusions between emotions, in particular having an appropriately clear distinction of *love* from *sadness* and *sympathy*, which had been confused by strangers. The only two emotions that couples still tended to confuse were *anger* and *disgust*, which may also not be mutually exclusive emotions in facial recognition (Widen, Russell, & Brooks, 2004).

Despite the higher accuracy of communication shown by couples, analysis of the types of touch
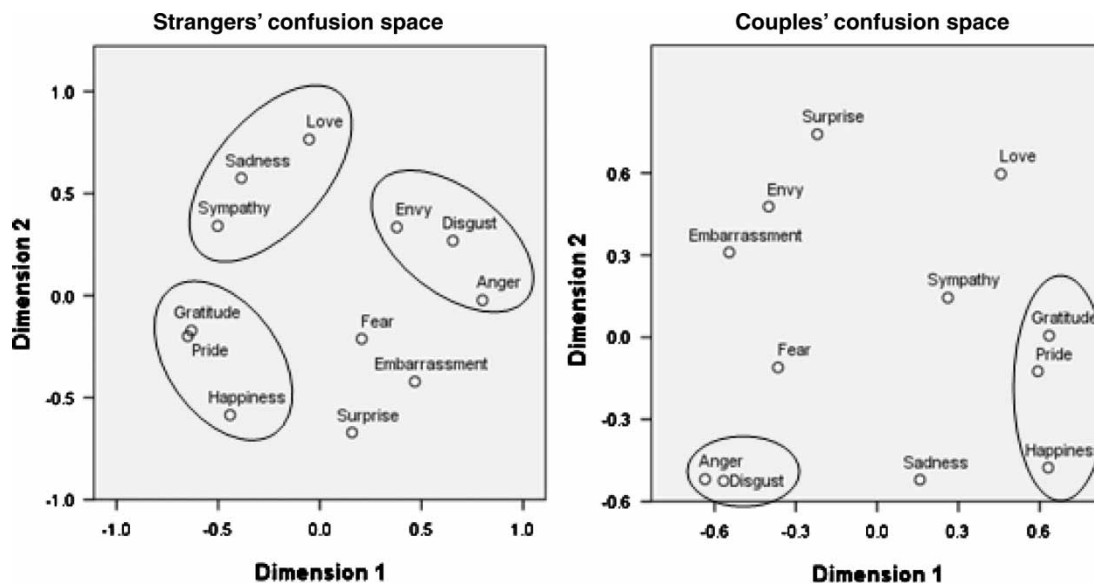
Figure 2. *Confusability maps for strangers and for couples.*

used revealed that couples and strangers tended to use much the same touch actions for specific emotions, including the self-focused emotions that were decoded by couples only. The similarity in touching actions for couples and strangers and the disparity in their successful interpretation may indicate that more subtle differences in the manner of touch, not picked up by our coding scheme, were responsible for differences in success. However, it is more likely that the same cues are being interpreted differently due to relationship status, which is an exciting new finding deserving of further exploration. Further work could utilise anonymity so that it remains unknown whether the touch is from/to a stranger or a romantic partner to confirm our findings. Anonymity would also eliminate the possibility that people in relationships are more motivated, as opposed to more able, to decode emotions from their partners than strangers. However, achieving anonymity could prove difficult as Kaitz (1992) found that blindfolded couples could identify each other merely by touching their partner's hand.

Although no gender effects in emotional communication via touch have been reported (Hertenstein et al., 2006, 2009), the fact that

gender was partly confounded with relationship status was a major limitation of the present study. Future research using the same methodology would benefit from using a population that would not oppose other-sex touching in a carefully supervised research setting, creating a balanced gender design. Furthermore, it would be interesting to develop extensions of the present paradigm outside the constraints of a laboratory setting, as distinguishing the ambiguous nature of tactile messages may require the presence of other nonverbal cues to put messages into context.

Adding variables to gain more information about the quality of a couple's relationship would be valuable in future studies; for example spouses' ability to decode their partner's nonverbal messages has been found to be related to their marital satisfaction (Gottman & Porterfield, 1981; Noller, 1980, 1981), and couples with a more secure attachment style tend to touch each other more (Tucker & Anders, 1998).

Intricacies of interaction may differ between cultures, and investigations into how manners of touch vary across cultures provide another realm for research. Cross-cultural studies have shown that facial expressions of emotion correlate very

highly among various cultures and races throughout the world (Ekman, Friesen, & Ellsworth, 1972; Fridlund, Ekman, & Oster, 1987). Photos expressing basic emotions such as *happiness*, *surprise*, *fear*, *anger*, *disgust* and *sadness* were significantly recognised at above chance levels in literate and preliterate cultures. These findings have been widely replicated and extended in over a dozen nations (Boucher & Carlson, 1980; Izard, 1971; Shimoda, Argyle, & Ricci-Bitti, 1978). However, despite support for universality, researchers have also reported evidence for systematic cultural differences in the communication of emotion, for example in the form of categorisation of emotions (Russell, 1991), emotion regulation processes and appraisal tendencies (Mesquita & Frijda, 1992), and in-group advantages (Elfenbein & Ambady, 2002). This raises the question of whether emotions can be successfully communicated via touch within and across different cultures.

In developing this research further, the results of the present study give rise to several other interesting questions. Is the advantage shown by couples relative to strangers specific to the communication of emotional material, or is it part of a general superiority in communication via touch? Would the results be successfully replicated with other long-term relationships such as parents and children, or life-long friends, or does sexual intimacy make a difference? Would homosexual couples provide the same results? Do couples share something unique in their emotional communication, and what are the factors that contribute to their success? Is message salience increased if modalities are combined? These questions provide a broad agenda for future studies; the potential for future research in emotional communication via touch is rich.

Summary and conclusions

Romantic couples have the ability to distinguish a broad variety of emotions purely through the sensory modality of touch, including the self-focused emotions *embarrassment*, *envy* and *pride*,

which can be considered highly abstract. In comparison, strangers are successful at interpreting certain universal and prosocial emotions via touch, but not all of the aforementioned self-focused emotions. The present study supports the notion of touch as a diverse and adaptable modality, provides possibilities for future experiments in this field, and possesses relevance for many different disciplines. Our findings extend the literature on the communication of emotion; the nature of particular relationships appears to have the ability to diminish the ambiguity of emotional expression via touch.

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