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The influence of the fear facial expression on prosocial responding

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Perceiving distress cues appears to be associated with prosocial responding. This being the case, it was hypothesised that the fear facial expression would elicit prosocial responding in perceivers. In Study 1, participants indicated that fear and sadness expressions would be associated with greater sympathy and willingness to help the expresser than would neutral expressions. In Study 2, participants were primed with fear or neutral expressions before reading vignettes featuring protagonists in mild distress. Fear-primed participants reported more sympathy and desire to help the protagonists than neutral-primed participants. Moreover, participants who recognised fear most accurately, as measured by a standard facial expression recognition task, showed the greatest increases in prosocial responding following fear expression primes. This corroborates the notion, supported by research as disparate as behavioural research on bystander intervention and clinical research on psychopaths, that exposure to and correct interpretation of certain distress cues may predict an individual's likelihood of behaving prosocially.

What is the point of expressing fear? The expression indicates the expresser to be weak, helpless, subordinate, and (naturally) afraid. One could speculate that this would be the last thing an expresser would wish to convey in a potentially dangerous situation: weakness and helplessness that

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might invite attack from a more powerful aggressor. Yet evidence suggests that expressing fear is—as is also the case for other facial expressions such as anger, disgust, and happiness—innate to humans (see Ekman & Friesen, 1971; Elfenbein & Ambady, 2002). That humans are born predisposed to display a fear facial expression in certain circumstances suggests that this expression might serve one or more adaptive purposes rather than being maladaptive. In this paper, we present evidence for an adaptive function that the fear expression may serve. Specifically, we provide data to suggest that the fear expression elicits prosocial responding—sympathy or the urge to provide help—from those who see it.

The origins of the fear facial expression

Evidence that the expression is universal, innate, and a likely product of natural selection bolsters the argument that the fear facial expression serves an adaptive function of some kind. Universality is supported by the wealth of research demonstrating that basic facial expressions are displayed and recognised accurately across many if not all cultures (Ekman & Friesen, 1971; Elfenbein & Ambady, 2002; Fridlund, 1994; Izard, 1971; but see Russell, 1995). Research on infants and children supports the notion that these expressions are innate. Such research has shown that elements of basic facial expressions are present in newborns (Rosenstein & Oster, 1988) and children blind from birth (Castanho & Otta, 1999; Eibl-Eibesfeldt, 1971; Freedman, 1964), neither of whom could have learned facial expressions observationally. Finally, gestures akin to the fear expression are homologous to those shown by many nonhuman primates, suggesting that the gestures have been conserved across species. The existence of the silent bared-teeth display, an expression described by Preuschoft (1960/1995) and others as signalling affiliation or appeasement in some primate species, supports the evolutionary continuity of the human smile and perhaps the fear expression. The raised brow movement of the human fear expression also characterises the fear or submission-related facial behaviour of some nonhuman primates (see Keating, 1985). Keating interprets the distribution of the raised-brow movement across many varieties of primates as evidence that the gesture has been conserved by evolution.

The evidence that the fear facial expression, as well as the other basic facial expressions of emotion, is universal, innate, and the product of natural selection is reasonably consistent. Strong evidence also supports the possibility that the adaptive functions served by facial expressions may be social in nature. While facial expressions have been shown to serve certain physiological functions (e.g., Zajonc, Murphy, & Inglehart, 1989), other major or primary functions of these expressions are likely social. Facial

expressions often alter the social expectations or the behaviour of perceivers in ways that are beneficial for the expresser (Hecht & Lafrance, 1998; Hess, Blairy, & Kleck, 2000; Purvis, Dabbs, & Hopper, 1984; Sabatelli & Rubin, 1986). In line with this notion, Fridlund (1994) developed the *behavioural ecology* view of facial expressions that describes expressions as tools that "aid the negotiation of social encounters" (p. 129). The idea is that expressions like fear help perceivers understand the intentions and likely actions of the expresser and to behave appropriately toward the expresser. The notion that the fear expression makes perceivers more likely to behave in ways that are beneficial for the expresser is in keeping with this line of reasoning.

Distress and prosocial behaviour

One function of the fear facial expression may be to elicit prosocial behaviour from perceivers. The stem *pro* and the root *socius* signify roughly, "for a companion" (*American Heritage Dictionary*, 2000), and prosocial behaviour is broadly defined as behaviour that benefits someone other than the actor. The term encompasses actions ranging from expressing condolences to offering a hug to donating money. The phrase is sometimes used interchangeably with *altruism*, although the latter can carry additional connotations regarding sacrifices made by the actor or the actor's motivations. Thus, the term prosocial will be used here simply to denote responses commensurate with sympathy and the intent to help another person. Self-reports on measures of sympathy and desire to help are consistently highly correlated (Eisenberg & Miller, 1987).

The perception of distress cues is commonly associated with prosocial behaviour (Hoffman, 1981; Nichols, 2001). Many decades of work on bystander intervention have indicated that when distress is unambiguous and the perceiver will not undergo grave risks in offering assistance, the incidence of helping approaches one hundred percent (Clark & Word, 1974; Shotland & Huston, 1979). Also supporting this notion is that the perception of distress-related emotions such as sadness and anxiety in others tends to elicit caregiving behaviours and related prosocial behaviours from those who see them (Batson, Duncan, Ackerman, Buckley, & Birch, 1981; Radke-Yarrow, Zahn-Waxler, Richardson, Susman, & Martinez, 1994). *Distress* is defined by the *American Heritage Dictionary* (2000) as, "anxiety or mental suffering." Given this definition, the fear expression can reasonably be considered to be a type of distress cue (although there are many others, such as vocalised screams and weeping), and may therefore elicit prosocial behaviour. Also supporting this contention is the fact that fear displays appear to elicit prosocial responses in nonhuman species as well. In social species ranging from primates to canines, showing displays

associated with fear improves the expresser's chances of receiving care from conspecifics (Blair, 1995; Preuschoft, 1999; Schenkel, 1967; Smith & Price, 1973). Human fear facial expression, then, may also be adaptive in part due to its capacity to elicit prosocial responding.

Fear expressions also convey a second characteristic that might be conducive to eliciting prosocial behaviour: helplessness. The fear expression is consistently found to convey attributes like weakness and low social status relative to other expressions (Hess et al., 2000; Marsh, Adams, & Kleck, 2005a). This is important because victims perceived to be low-status and helpless may receive more sympathy than higher status victims (Baker & Reitz, 1978; Kanekar, Mazumdar, Pinto, Bulsara, & Kolsawalla, 1981). Moreover, the impression of helplessness reinforces an expresser's lack of responsibility for his or her plight, an impression that is a strong predictor of the likelihood of perceivers' experiencing sympathy and the desire to help (Rudolph, Roesch, Greitemeyer, & Weiner, 2004).

The present research

The fear expression is predicted to elicit prosocial responses because it signals the expresser to be helpless and in distress (Marsh et al., 2005a). Whether the fear expression elicits prosocial responding does not appear to have been empirically tested to date, however. In order to test this hypothesis, in Study 1, participants rated fear and neutral facial expressions, as well as sadness and anger expressions, in terms of how much sympathy and helping they would elicit. In Study 2, participants were primed with fear or neutral expressions and the extent to which they subsequently responded prosocially to a series of vignettes was compared across the two conditions. Study 2 also assessed whether accuracy in identifying the fear expression would predict individual differences in self-reported prosocial responding.

STUDY 1

In this study, we aimed to show that the fear expression is associated with increased prosocial responding—specifically, reported sympathy and desire to help the expresser. Fear and neutral expressions, as well as anger and sadness expressions, were rated for elicitation of sympathy and the desire to help. Scales pertaining to liking, capability, and the elicitation of angry responses were also added to achieve two goals. First, we wished to show that fear expressions do not elicit prosocial behaviour as a function of their being responded to more positively in all respects, in a sort of an attributional halo effect. We also wished to confirm that fear expressions would be distinguished from neutral expressions not only in terms of the prosocial behaviour they

elicit but also in terms of how helpless they appear. Finally, we aimed to provide additional support for the hypothesis that distress expressions that convey helplessness elicit prosocial behaviour by including sadness and anger expressions to be rated. If any negative emotion-relevant emotion elicits prosocial behaviour, then all three emotional expressions would be expected to elicit prosocial responses. However, if the appearance of helplessness is also required, only sadness and fear expressions should do so.

Method

Participants. Forty participants (M age = 24.6 years, SD = 6.89) completed the questionnaire. All participants were volunteers recruited through posters in exchange for payment. Of the participants, 21 were women and 18 were men, and one participant did not provide gender information. Twenty-five participants identified themselves as Caucasian, six as Asian American, two as Latino, one as Black, and six opted not to provide information about their race/ethnicity.

Stimuli. The stimuli consisted of four facial expressions (neutral, fear, sadness, and anger) of eight male and female stimulus exemplars, all of whom were young Caucasian adults. These stimuli have been validated as showing prototypical and recognisable expressions of emotion (Tottenham, Borscheid, Ellertsen, Marcus, & Nelson, 2002), and were printed in greyscale at approximately 4×3 inches. The 32 stimuli were divided into four sets, each containing one of the four photographs of each of the eight exemplar individuals. Thus, participants saw each exemplar once, and rated each of the four types of expressions twice. The stimuli were divided so that each set contained equal numbers of males and females. The order in which the stimulus photos were presented was randomised, and in half the packets the order was then reversed.

Each expression was printed above ten 7-point rating scales, anchored by 1 (*Definitely No*) and 7 (*Definitely Yes*). Eight of the scales were selected to relate to four constructs: *Prosocial responding* (Is this a person for whom people are likely to feel sympathetic? Would people be likely to offer help to this person?); *Liking* (Does he/she seem like a warm person? Would many people want to be this person's friend?); *Angry responding* (Would someone who was upset be likely to yell at him/her? Would others get angry at this person very often?); and *Capability* (Does he/she seem like a capable person? Does he/she seem like an independent type of person?). An additional scale measured attributions of dominance (Does he/she seem like a socially dominant person?). In addition, as a manipulation check one scale addressed how upset each individual appeared (Does he/she seem upset?).

Procedure. Participants each completed the questionnaire in a private room monitored by the experimenter. Participants rated the faces in their packet on the ten scales, and then provided comments about the study and their gender, race, and age. All participants were thanked for their participation, debriefed, and paid.

Results

This study aimed to determine the extent to which fear expressions were associated with prosocial responding, liking, attributions of capability, and likelihood of angry responding compared to neutral, sadness, and anger expressions. For each participant, separate averages of their responses to all questions were calculated for each expression. These averages were then collapsed into the relevant constructs, each of which showed acceptable reliability (*Prosocial*, $\alpha = .61$, *Liking*, $\alpha = .55$, *Anger*, $\alpha = .45$, and *Capability*, $\alpha = .61$). Although it was intended that the dominance rating scale would be analysed separately, this rating was highly correlated with the Capability variable ($\alpha = .76$) and therefore was included with this variable.

Five 2 (participant gender) $\times 2$ (stimulus gender) $\times 2$ (expression) ANOVAs with repeated measures on the second and third variables were then performed to assess participants' ratings of the faces. The manipulation check rating ("Does s/he seem upset?"), which assessed whether anger, sadness, and fear expressions were perceived to show negative emotion, showed the predicted effect. There were no main effects of any variable (all $ps > .10$) except Expression, $F(3, 108) = 68.29$, $p < .001$, $\eta^2 = .66$. *T*-tests revealed that persons showing fear, sadness, and anger expressions were all judged to appear more upset than neutral expressions, respectively, all $ps < .001$.

Prosocial responding. Ratings of prosocial responding showed a main effect of Expression, $F(3, 111) = 46.67$, $p < .001$, $\eta^2 = .56$. *T*-tests indicated that fear ($M = 4.75$, $SEM = 0.15$), $t(39) = 3.61$, $p = .001$, $r = .38$) and sadness ($M = 5.04$, $SEM = 0.16$), $t(39) = 4.30$, $p < .001$, $r = .44$, expressions would elicit more prosocial responding than neutral expressions ($M = 4.03$, $SEM = 0.13$), and anger expressions would elicit less ($M = 2.80$, $SEM = 0.14$), $t(39) = 6.75$, $p < .001$, $r = .61$. Prosocial responding to fear and sadness expressions did not differ, $t(39) = 1.31$, $p = .20$, $r = .15$.

There was also a main effect of Stimulus gender $F(1, 37) = 17.97$, $p < .001$, $\eta^2 = .33$. The means indicated that females ($M = 4.45$, $SEM = 0.11$) would elicit more prosocial responding than males ($M = 3.85$, $SEM = 0.09$). No other main effects or interactions were significant (all $ps \geq .10$).

Capability. Ratings of capability showed a main effect of Expression, $F(3, 111) = 32.98$, $p < .001$, $\eta^2 = .47$. *T*-tests indicated that neutral expressions ($M = 4.84$, $SEM = 0.13$) were judged to look significantly more capable than sadness ($M = 3.32$, $SEM = 0.16$), $t(39) = 7.24$, $p < .001$, $r = .63$; or fear ($M = 3.52$, $SEM = 0.14$), $t(39) = 7.27$, $p < .001$, $r = .64$, expressions. Anger ($M = 4.41$, $SEM = 0.15$) was also judged to appear more capable than both sadness, $t(39) = 7.11$, $p < .001$, $r = .63$, and fear, $t(39) = 6.25$, $p < .001$, $r = .58$, but sadness and fear did not differ from one another, nor did neutral and anger differ from one another.

There was also Stimulus gender × Participant gender × Expression interaction, $F(3, 111) = 2.95$, $p < .05$, $\eta^2 = .07$. This interaction was broken down by examining the 2 × 2 gender interaction for each expression. The only significant effects found were a Stimulus gender main effect for neutral expressions, $F(1, 37) = 5.83$, $p < .05$, $\eta^2 = .14$, such that males were judged to appear more capable than females; and a Stimulus gender × Participant gender interaction for sadness expressions, $F(1, 37) = 4.30$, $p < .05$, $\eta^2 = .10$, such that females judged females to look less capable than males when both were showing sadness expressions, but the opposite was true for males (neither direct contrast was significant, *p*s > .10). No other main effects or interactions were significant (all *p*s ≥ .10).[1]

Liking. Ratings of liking showed only a main effect of Expression, $F(3, 111) = 27.85$, $p < .001$, $\eta^2 = .43$ (all other *p*s > .10). *T*-tests for Expression indicated that persons showing anger expressions were judged to appear less likable ($M = 2.42$, $SEM = 0.15$) than persons showing the three remaining expressions: neutral ($M = 3.75$, $SEM = 0.09$), $t(39) = 6.75$, $p < .001$, $r = .61$; fear ($M = 3.87$, $SEM = 0.16$), $t(39) = 8.76$, $p < .001$, $r = .70$; and sadness ($M = 3.84$, $SEM = 0.14$), $t(39) = 6.88$, $p < .001$, $r = .61$. The remaining expressions did not differ from one another (all *p*s > .10).

Angry responding. Ratings of angry responding showed only a main effect of Expression, $F(3, 111) = 9.44$, $p < .001$, $\eta^2 = .20$. *T*-tests for Expression indicated that anger expressions were more likely to elicit angry responses ($M = 4.58$, $SEM = 0.19$) than three remaining expressions: neutral ($M = 3.49$, $SEM = 0.12$), $t(39) = 5.37$, $p < .001$, $r = .52$; fear ($M = 3.66$, $SEM = 0.15$), $t(39) = 3.92$, $p < .001$, $r = .41$; and sadness ($M = 3.79$, $SEM = 0.17$), $t(39) = 3.16$, $p < .005$, $r = .34$. The remaining expressions did not differ from one another (all *p*s > .05).

There was a marginally significant main effect of Stimulus gender ($p = .09$) such that females elicited less angry responding than males. A

[1] When the Capability variable was analysed to exclude dominance ratings, the significance of the various effects did not change.

marginally significant interaction was found between Stimulus gender and Expression as well ($p = .07$), however, an examination of the means showed similar patterns across genders. No other main effects or interactions were significant (all $ps \geq .10$).

Mediation analyses. In the ANOVAs described above, the only ratings for which both sadness and fear significantly diverged from both neutral and anger expressions were those for prosocial responding and those for capability. Thus, post hoc hierarchical regressions were run to assess whether the appearance of capability mediates prosocial responses to these expressions. Results for fear showed that expression (fear vs. neutral) predicts prosocial responding, $t(78) = 3.77$, $p < .001$, $\beta = .39$, but that controlling for ratings of capability does not significantly affect the extent to which the expression predicts prosocial responding, $t(78) = 2.95$, $p < .005$, $\beta = .39$. The same pattern holds true for sadness expressions: for expression predicting prosocial responding, $t(78) = 4.90$, $p < .001$, $\beta = .49$; for expressions predicting prosocial responding after controlling for ratings of capability, $t(78) = 2.55$, $p = .01$, $\beta = .33$. These data suggest that ratings of capability alone do not fully mediate prosocial responses to fear and sadness expressions.

Given prior findings that expressions like fear and sadness may represent affiliative as well as helpless stimuli (Hess et al., 2000; Marsh et al., 2005a), two additional hierarchical regressions were also run, controlling this time for both capability and liking. Controlling for ratings of both these variables reduces the relationship between fear expressions and prosocial responding to nonsignificance, $t(78) = 1.65$, $p = .10$, $\beta = .21$. These ratings also partially mediate prosocial responses to sadness, although less effectively than for fear, $t(78) = 2.39$, $p = .02$, $\beta = .27$. This suggests that the appearance of helplessness combined with affiliation may mediate prosocial responding, and this may be true somewhat more for fear than for sadness. However, ratings of liking in this study did not fully meet the definition of a mediator as defined by Baron and Kenny (1986), and so this conclusion will require further testing.

Discussion

Participants in this study judged fear expressions to elicit more sympathy and offers of help than neutral expressions. This supports the proposition that the perception of the fear expression may be associated with prosocial tendencies. Moreover, the sadness expression also elicited more prosocial responding than did the neutral expression, whereas the anger expression elicited less. Ratings of these two expressions thereby provide, respectively, convergent and divergent validation for the contention that it is not simply

any negative emotional expression that will elicit prosocial responding, but specifically negative emotional expressions that are judged to convey helplessness.

As predicted, the fear expression elicits relatively specific attributions related to prosocial behaviour, not generally positive attributions. Thus, fear expressions do not simply elicit sympathy because they appear more generally favourable. People showing fear expressions are considered to appear less capable than people showing neutral expressions, they are equally likely to elicit negative social repercussions such as anger or yelling, and are not liked more.

Some evidence indicates that the combination of helplessness and warmth indicated by a fear expression contributes to its ability to elicit prosocial responses. Prior studies have shown the fear expression to appear highly affiliative relative to other expressions—nearly as affiliative as the happy expression, in fact (Hess et al., 2000; Marsh et al., 2005a). The fear expression also elicits behavioural approach from perceivers, as indexed by their motoric behaviours (Marsh, Ambady, & Kleck, 2005b). Motoric approach is associated with appetitive stimuli, which is consistent with the notion that the expression may elicit affiliation. Although not conclusive, the present data suggest that an affiliative as well as helpless appearance may enable an expression to induce perceivers to respond in appropriately prosocial ways.

The results of this study provide initial support for the notion that the fear expression is associated with prosocial responses such as reported sympathy and a desire to help the expresser. However, the relatively transparent design of this study led us to run a second study. In Study 2, we used unconscious priming to test whether the fear expression elicits reports of sympathy and prosocial behaviour. We also assessed whether the ability to correctly identify the fear expression would predict prosocial responding.

The ability to identify fear was included as a variable in Study 2 because evidence suggests that the extent to which distress elicits prosocial responding may be moderated by the perceiver's ability to *interpret* this cue correctly. Data to support this possibility comes from two divergent lines of research: research on bystander intervention, mentioned earlier, and clinical research on psychopaths. Research on bystander intervention has shown that the correct interpretation of distress increases the bystander's likelihood of providing help. Originally, the bystander effect was studied in an effort to understand failures to behave prosocially. Study results indicated that bystanders typically neglects to help a target when they fail to interpret the distress cues and thus are not certain that the target requires help, or when helping might be dangerous (Clark & Word, 1974; Shotland & Huston, 1979).

Research on psychopaths has similarly shown a relationship between the ability to interpret distress cues and prosocial behaviour tendencies. Psychopaths are a clinical population marked by a reduced predisposition to exhibit prosocial behaviour and to experience associated emotions like sympathy, guilt, or remorse. Psychopaths also show impairments in recognising certain distress cues, most notably expressions of fear, and sadness—albeit less consistently, (Blair, Colledge, Murray, & Mitchell, 2001; Blair, Jones, Clark, & Smith, 1997). Psychopaths recognise other emotional expressions relatively well, thus their specific impairment in recognising distress-related facial expressions suggests an intrinsic link between this ability and prosocial tendencies. Both these lines of evidence suggest that the accurate perception of another's distress contributes to individuals' likelihood of responding prosocially towards others.

STUDY 2

In Study 2, participants were primed with fear or neutral expressions and then indicated their responses to characters described in short vignettes. Fear-primed participants were predicted to respond more prosocially than neutral-primed participants. Moreover, in this study, participants' ability to recognise the fear expression was measured, and the relationship between recognition ability and prosocial responding assessed. Participants who more accurately identified the fear facial expression in the second task were predicted to respond more prosocially following the fear expression primes.

Method

Participants. Twenty-one individuals participated in the study. Participants were mostly college students, recruited either via a subject pool for course credit or via a signup sheet for $5.00. Of the participants who participated in the experiment, two participants reported awareness of the facial expression primes after being asked an increasingly detailed series of questions about the primes (What did you think this study was about? Did you see anything flashing before the letter strings? Did you see faces? Can you describe the faces?) and their data were removed, such that only the data of the 19 participants who did not report awareness of the facial expressions were analysed. Of these participants, 10 were men and 9 were women, with even numbers of men and women in each group.

Stimuli. The facial expression stimuli used as primes in this study were presented in greyscale at the centre of the computer screen at a size of approximately 2×3 inches. They were the fear and neutral expressions of

four young adult Caucasian males and females. These stimuli had been validated for a previous study on facial expressions, for which the expressions had been shown to be consistently recognisable exemplars of fear and neutral expressions (Marsh et al., 2005a).

The six vignettes used to elicit prosocial responding were drawn from those developed by Braine, Pomerantz, Lorber, and Krantz (1991). The vignettes were condensed from the original versions to be only a few sentences long. The experimental vignettes all described characters in positions of little power being required to do something they did not want to do, such as having to stay and work overtime at a disliked job. Also included were eight vignettes not depicting such situations to help conceal the actual intent of the study from participants.

Procedure. Participants were randomly assigned to the two conditions. In both conditions, participants completed 14 series of lexical decision tasks (LDTs), each series containing eight LDTs. Before each LDT, a facial expression prime was presented for 20 ms (Dimberg & Öhman, 1996). Experimental participants were primed with fear expressions, and control participants were primed with neutral expressions. Each prime was followed immediately by a scrambled neutral expression mask, which appeared for 65 ms.

After each LDT series, participants read a vignette and answered four questions about it on 7-point scales: how sympathetic they would be when witnessing the incident; how much they would want to help the target if they were in a position to do so; how dominant the target was; and how upset they believed the target to be. Each of the four scales tests a construct that might be expected to change following the perception of fear. It was primarily hypothesised that the perception of fear would engender sympathy and the desire to help. We also speculated that participants primed with fear expressions might see the protagonists as more upset and more submissive. To explain the pairing of the two different kinds of tasks, participants were told that the study was investigating how making rapid, simple decisions, i.e., the LDTs, affects the way that people make more complex decisions. Participants then completed the state version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), and were paid.

After being paid, participants were informed that the experimenter would be emailing them an electronic document on which they would provide their answers to an online version of the Diagnostic Assessment of Nonverbal Accuracy (DANVA; Nowicki & Duke, 1994). Participants were asked to then email the document back to the experimenter. The DANVA is a well-validated test of accuracy for recognising four types of emotional facial expressions: anger, fear, happiness, and sadness. Participants completed this task after leaving the laboratory so that the fear primes would minimally

influence their ability to identify that expression. No participant responded less than one hour after the task, and the mean response latency was 2.82 days. After the participants returned their answer sheet, they were sent an email explaining the study.

Results

In this study, it was hypothesised that fear-primed participants would respond more prosocially to the characters in the vignettes than neutral-primed participants. In addition, it was predicted that participants' ability to correctly identify the fear expression would moderate this effect, such that greater accuracy would be associated with more prosocial responding in fear-primed participants.

Analyses of variance comparing conditions. To assess differences in responses across conditions, averages of participants' ratings across the six experimental scenarios were calculated. The composite scores on the four scales (sympathetic, helping, dominance, upset) were then analysed using 2 (participant sex) $\times$ 2 (participant condition) ANCOVAs. Because fear recognition accuracy was predicted to moderate the experimental effects (which was confirmed by the correlations reported below), accuracy for fear recognition was included as a covariate in each ANCOVA.

Fear-primed participants reported feeling more sympathy for the protagonists ($M = 5.64$, $SD = 0.67$) than neutral-primed participants ($M = 4.43$, $SD = 1.20$), $F(1, 14) = 9.68$, $p < .01$, $\eta^2 = .41$. The difference between the group means was also significant without the inclusion of the fear-recognition accuracy covariate, $t(17) = 2.67$, $p < .02$, $r = .54$. A main effect for participant sex was also found, $F(1, 14) = 11.65$, $p < .01$, $\eta^2 = .45$, such that females reported feeling more sympathy ($M = 5.62$, $SD = 0.85$) than males ($M = 4.33$, $SD = 1.08$). There were no other significant main effects or interactions.

Fear-primed participants also reported a greater desire to help the protagonists ($M = 5.33$, $SD = 0.88$) than neutral-primed participants ($M = 4.23$, $SD = 1.07$), $F(1, 14) = 6.44$, $p < .05$, $\eta^2 = .32$. Again, the difference remained significant without the inclusion of the fear-recognition covariate, $t(17) = 2.43$, $p < .05$, $r = .51$. A main effect for participant sex was again found, $F(1, 14) = 5.27$, $p < .05$, $\eta^2 = .27$, such that women indicated they would wish to help the protagonists ($M = 5.25$, $SD = 1.17$) more than men did ($M = 4.20$, $SD = 0.83$), $t(17) = 2.27$, $p < .05$, $r = .48$ (see Figure 1). There were no other significant main effects or interactions.

There were no main effects or interactions of either participant sex or experimental condition on participants' ratings of how upset they thought the protagonists were, or how dominant the protagonists seemed to be.

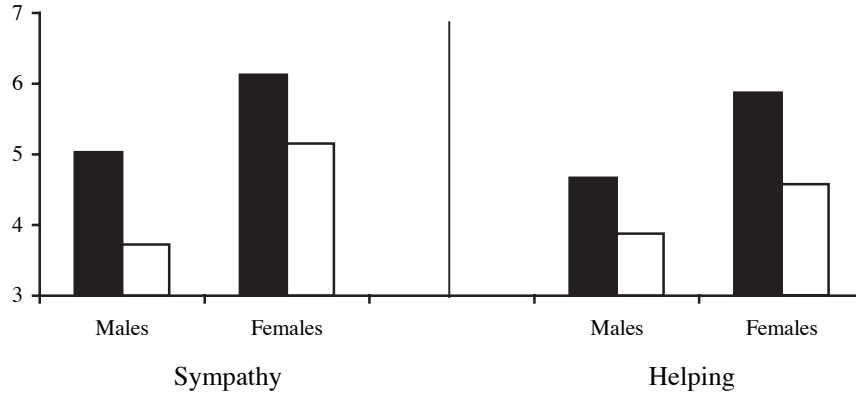

Figure 1. Mean responses of sympathy for and a desire to help vignette protagonists in men and women primed by fear (black bars) and neutral (white bars) facial expressions.

Furthermore, there were no differences across conditions or across sexes on positive affect or negative affect PANAS scores (all $ps > .10$).

Correlations between accuracy and responding. In order to test whether accuracy for recognising the fear expression would be related to prosocial responding following a fear prime, an index of accuracy for recognising the fear facial expressions was first calculated from DANVA responses. The unbiased hit-rate method of calculating accuracy was used in order to account for both false alarms and false identifications (Wagner, 1993). The procedure calculates the conventional percentage accuracy hit rate multiplied by one minus the rate of false alarms, then normalises the score using an arcsine transformation. Then the expected value due to chance guessing is calculated, analogous to calculating expected values for a chi-square analysis. Thus, all accuracy scores used in the analysis represent accuracy above that which would be expected due to guessing. A *t*-test comparing fear recognition accuracy scores in the control and experimental conditions revealed no significant differences, $t(17) = 0.15$, *ns*.

For participants in the experimental and control conditions, correlations were calculated between accuracy rates for recognising fear expressions and responses to the four questions participants answered during the laboratory portion of the study. Both Pearson's *r* and Spearman's *rho* (ρ*) were calculated, the latter being a rank-order correlation that is less susceptible to outliers than Pearson's r.* In general, the two measures showed similar magnitudes of the relationships between variables. This corroborates evidence from a visual inspection of the data as well as the calculation of *Z*-scores that outliers were not unduly influencing the data (all $Zs < 1.80$ for fear-primed participants, all $Zs < 2.15$ for neutral-primed participants).

For neutral-primed participants, accuracy for recognising fear expressions was not correlated with ratings of sympathy, $r = -.26$, *ns* ($\rho = -0.14$, *ns*), desire to help, $r = .13$ ($\rho = 0.03$, *ns*), or target upset, $r = .09$, *ns* ($\rho = 0.13$, *ns*), as predicted. Ratings of dominance were negatively correlated with accuracy for recognising fear, $r = -80$, $p < .01$ ($\rho = -0.57$, $p = .08$). The correlation between willingness to help and feelings of sympathy was significant, $r = .82$, $p < .01$ ($\rho = 0.68$, $p < .05$). No other correlations reached significance. There were no significant correlations between accuracy for any of the other expressions measured by the DANVA and participants' responses, with one exception: accuracy for sadness was negatively correlated with dominance ratings, $r = -82$, $p < .01$ ($\rho = -0.71$, $p < .05$).

For fear-primed participants, the predicted patterns emerged. For these participants, accuracy for identifying the fear expression correlated with ratings of sympathy, $r = .72$, $p < .05$ ($\rho = 0.64$, $p = .06$), and desire to help the target, $r = .78$, $p = .01$ ($\rho = 0.75$, $p = .02$). Accuracy was also marginally correlated with how upset fear-primed participants rated the target to be, $r = .61$, $p = .08$ ($\rho = 0.51$, *ns*). Correlations between how upset the target was perceived to be and how sympathetic participants felt, $r = .56$, $p = .12$ ($\rho = 0.60$, $p = .09$), and how much the participants reported a desire to help, $r = .62$, $p = .08$ ($\rho = 0.59$, $p = .09$), were marginally significant. There remained a relationship between sympathy and willingness to help: $r = .90$, $p < .01$ ($\rho = 0.93$, $p < .01$). No other correlations reached significance. In this condition, there were no significant correlations between accuracy for any of the other expressions and participants' responses.

Discussion

Participants in this study who were primed with fear expressions reported more sympathy and desire to help protagonists than participants primed with neutral expressions. These results support the notion that the fear expression elicits prosocial responding from perceivers. Because the fear primes were presented subliminally, it is possible that the effect of the fear expression on perceivers is automatic. This corroborates a variety of previous studies that have suggested that the effects of facial expressions of emotion on perceivers can be automatic or implicit (e.g., Dimberg & Öhman, 1996). Also, the accuracy with which fear-primed participants recognised the fear expression in a later task predicted *how* prosocially they responded following the fear primes. More accurate participants expressed more sympathy and desire to help the protagonists. These correlations were not found between accuracy for any of the other three expressions tested. This is the most logical outcome, given the hypothesis. If exposure to the fear expression elicited the prosocial responses, one would predict sensitivity to

that particular expression, but not to other expressions, to predict the magnitude of those responses. These results support the conclusion that not only exposure to, but also correct interpretation of, a distress cue such as a fear expression is useful in predicting a perceiver's responses.

Participants' gender played a role in the phenomenon, but only as a main effect. Women reported more sympathy for and desire to help the characters in the vignettes, but gender did not interact with experimental condition. This result differed from the result in Study 1, in which men and women did not show different levels of prosocial responding. Given that Study 1 presented a more transparent design, it is more likely that the results of that study were prone to response biases. Thus, although it is possible that the gender difference in Study 2 resulted from social norms according to which it is more acceptable for women to report "soft" emotions, such as sympathy, women may actually experience greater sympathy in response to the fear expression. It is not, however, possible to conclusively discern the cause of the gender differences based on the design of these studies. It does not appear to have been the case that gender differences in correctly identifying the fear expression were associated with the gender difference in responding, as men's and women's accuracy did not differ, $t(17) = 0.61$, *ns*.

Interestingly, the extent to which participants believed the protagonists to be upset did not vary across conditions, and was only marginally correlated with accuracy for recognising fear, sympathy, or helping in the fear-prime condition. This suggests at least the possibility that the sympathy and desire to help elicited by fear are not the result of an explicit chain of reasoning in which the perceiver thinks, more or less, "This person seems upset! The appropriate response to an upset person is to feel sympathy and a wish to help the person". Rather, prosocial emotions and responses may be more automatically generated from the perception and correct interpretation of a distress cue.

Similarly, ratings of dominance in this study did not appear to be affected by the fear expression primes, despite the fact that prosocial responses were. This is consistent with the data from Study 1. Those data indicated that ratings of helplessness-related traits do not directly mediate the relationship between the fear expression and the elicitation of prosocial responses, although subordination and helplessness appear to be a common feature of cues that elicit prosocial behaviour.

Not predicted was that the worse participants in the neutral-priming condition were at recognising fear, the more dominant they perceived the targets in the vignettes to be. The fear expression is associated with subordination (Hess et al., 2000; Marsh et al., 2005a). In the vignettes, all of the targets were in subordinate positions and did not have the power to change their situations. Perhaps people who are poor at recognising subordinate status via facial expression cues are also not good at picking

up on people's lack of power in other ways. This interpretation is also corroborated by the similar correlation between the ability to recognise sadness and perceptions of dominance. Like fear, sadness is an expression indicative of subordination, and, as previously discussed, the ability to correctly identify fear and sadness expressions is related (Blair et al., 1997, 2001; Stevens, Charman, & Blair, 2001). However, it is not clear why the relationship would only have held in the condition in which participants were primed with neutral expressions.

GENERAL DISCUSSION

The fear facial expression appears to elicit responses beneficial to the fearful person. Data from Study 1 suggest that the fear expression is construed as eliciting prosocial responses from those who see it, such as sympathy and a desire to help the expresser. Perception of the sadness expression appears to have similar effects. Study 2 indicated that the fear expression elicits sympathy and a desire to help in perceivers who are primed with the expression. Furthermore, the more accurately the perceiver is able to identify the fear expression, the greater the extent to which that perceiver will experience sympathy and a desire to help after being primed with fear expressions. These data are consistent with evidence from prior studies that suggests that perceiving and correctly interpreting distress cues such as fear and sadness expressions is a reliable predictor of prosocial responses, such as feelings of sympathy and a desire to help (Blair et al., 2001; Clark & Word, 1974; Shotland & Huston, 1979). The fear expression in humans may then function in a way similar to fear displays in other species, which are typically means of eliciting care or inhibiting aggression from perceivers (e.g., Eibl-Eibesfeldt, 1971; Lorenz, 1963; Schenkel, 1967).

Another kind of cue exists which elicits prosocial behaviour and care, inhibits aggression, and appears helpless and subordinate: infantile, or "babyish" cues. A means by which fear expressions in particular may elicit prosocial behaviour may be via their resemblance to infantile cues. This is the case for various nonhuman animals, for which fear and subordination displays elicit prosocial responses by mimicking cues associated with infants (Eibl-Eibesfeldt, 1971; Lorenz, 1963; Schenkel, 1967). Eibl-Eibesfeldt (1971) states, "Use is made of [infantile behaviour patterns] whenever the aim is to release appeasement and cherishing" (p. 116). It is believed that mimicking infantile cues is an effective elicitor of prosocial behaviour because of what Lorenz (1963; cf. Sternglanz, Gray, & Murakami, 1977) called a *kindenschema*, which translates literally to "child pattern", and signifies a babyish or neotenous appearance. Such an appearance is a powerful elicitor of caring, nonaggressive behaviour (Mischkulnig, 1989; Zebrowitz, 1997).

Taylor (2002) has also theorised that one would predict prosocial behaviour to be built upon systems already in place to ensure that the young are tended and protected. "Nature", she states, "is a thrifty designer, and neurocircuitries designed for one purpose—maternal behaviour, for example—may provide the underpinnings of other behaviour patterns—caregiving, more generally" (p. 154).

Some evidence exists to support the notion that the fear facial expression mimics infantile cues. A human face looks infantile if it possesses large eyes, high, flat brow ridges, a generally round (as compared to angular) facial appearance, a small nose and jaw, and a large forehead. The movements of the fear expression simulate many of these appearance characteristics. Data show that the fear expression causes the eyes to appear larger, the brows higher, the brow ridge flatter, the mouth fuller, and the overall appearance of the face rounder (Marsh et al., 2005a). A body of research has indicated that adults whose features merely resemble babies' features are perceived to have babyish personality traits and are treated as such (see Zebrowitz, 1997). Accordingly, individuals expressing fear are, like babyish-faced individuals, perceived to be warm, weak, naïve, feminine, dependent, and subordinate (Marsh et al., 2005a). While being perceived as helpless and dependent would not always be a good thing, it could be highly beneficial if a person were in danger or otherwise needed care or assistance. That the expresser is in danger and requires care or assistance is precisely what the fear expression signals.

It is not clear whether the sadness expression elicits prosocial responding via the same mechanisms as the fear expression. Some data exist to suggest that the extent to which fear and sadness elicit prosocial behaviour, or the means by which this occurs, may differ. Certainly sadness and fear share many features. Both represent subordinate, helpless, distress-related emotions. Both Study 1 and Study 2 revealed similar patterns of data linking helplessness with fear and sadness expressions. In Study 1, both expressions were rated to appear helpless as well as likely to elicit prosocial responses. In Study 2, perceptions of dominance were negatively correlated with the ability to recognise both sadness and fear. Sadness appears less affiliative than fear, however (Hess et al., 2000). Perhaps this is because the features of sadness expressions are less babyish (e.g., less rounded eyes, lower brows) than the features of fear expressions. In any case, affiliation does not appear to as effectively mediate the relationship between prosocial responding and sadness as between prosocial responding and fear, as found in Study 1. This may help to explain why sadness recognition has been less reliably associated with individual differences in prosocial tendencies than fear recognition. Although recognition deficits in psychopaths are seen for both expressions, they are generally stronger and more reliable for fear than sadness (Blair, 1995; Blair et al., 1997, 2001). This may also be related to the notion that sadness is also associated with less pressing needs, such as food,

and so may not elicit the same rapid or reliable prosocial response that fear does (Preston & de Waal, 2002).

Sadness is an expression typically associated with a need for help and thus it is perhaps unsurprising that the present research emphasises its ability to elicit prosocial behaviour. However, psychology research has typically focused on a very different social function served by the fear expression. Researchers investigating physiological and neurological responses to fear expressions commonly interpret these responses in light of the fear expression's threat-related properties. The emphasis in such studies is typically on the extent to which the fear expression signals the presence of a threat in the environment (e.g., Dimberg & Öhman, 1996; Whalen, Shin, McInerney, Fischer, Wright, & Rauch, 1998; Williams, McGlone, Abbott, & Mattingley, 2005). The data presented here suggest, though, that those investigating responses to the fear expression may wish to interpret those responses in light of other empirically demonstrated functions, for example, the fear expression's affiliative and subordinate appearance (Hess et al., 2000), its elicitation of the motivation to approach (Marsh et al., 2005) and its elicitation of prosocial responses.

Having said this, it is not unlikely that fear expressions can and do serve to alert others to the presence of danger. Perhaps factors such as situational context affect perceivers' primary responses to expressions of distress like fear. The studies described herein presented neutral target individuals and emotionally neutral situations. Although fear in these studies may not have been taken to signal threat, perhaps in a situation in which some danger was apparent, fear would be interpreted as a threat cue rather than eliciting prosocial responses. In a building smelling of smoke, for example, seeing fear on the face of another person might inspire the urge to flee before or to a greater extent than it would elicit sympathy.

In still other contexts (for example, the context of an aggressive encounter) expressions like fear and sadness may function less to elicit prosocial behaviour than to inhibit antisocial behaviour, e.g., aggression (Blair et al., 1997). By signalling the expresser to be weak and helpless and unable to challenge a more powerful aggressor, these expressions may effectively function as a symbolic raising of the white flag or a laying down of arms that will prevent a fight, which could be costly to both parties. The ability of fear and sadness expressions to inhibit antisocial behaviour could be a fruitful topic for future research.

The identity of the person who is expressing a given distress cue may also influence how the cue is perceived. Generally, in life, people see the facial expressions of known others—be they family members, friends, or enemies—not of strangers. People's experiences with, and expectations of, known others change the way they interpret their facial behaviour (see Elfenbein, Marsh, & Ambady, 2001). The meaning of a facial expression

might be expected to change based on the relationship between expresser and perceiver. Seen on one's own child, a fear or sadness expression could inspire anger or pain, whereas when expressed by an enemy expressions like these could inspire *schadenfreude*, indifference, or even aggressive impulses.

It bears mentioning that the analyses reported here pertained to aggregated responses to emotional expressions and so cannot reflect the effects of a single expression on a perceiver in a given situation. Although on average, a distress-related facial expression may make the expresser more likely to elicit prosocial responses, this may not be true for all individual expressers in all contexts. It is likely that some facial idiosyncrasies, expressive styles, or other personal attributes would reduce, eliminate, or even reverse this effect. Aggregation of data also increases the strength and reliability of statistical findings. Data generated from responses to multiple presentations of facial expressions show that fear and sadness expressions have statistically strong effects compared to neutral expressions, but this cannot prove that the effect of a single expression on a single perceiver will be equally strong. On the other hand, a real person expressing distress should be a much more powerful stimulus than a static black-and-white photograph of a fear expression. Thus, the "real world" effects of perceiving a fear expression could be either weaker or stronger than those found in the present study; more ecologically valid testing in the future might help to resolve this issue.

One must also consider the possibility that emotional expressions serve functions other than social functions. Physiological functions have been proposed in particular for the fear expression. It has been suggested that the widened eyes of the fear expression expand the expresser's peripheral field of vision to facilitate scanning the environment for danger (Darwin, 1872/1965). One weakness of this type of explanation is that it is somewhat post hoc, such that were the situation reversed (fear being marked by narrowed eyes) the explanation could also be reversed. For instance, narrowed eyes could be explained as useful for a fear expression because protecting the eyes would seem important for the victim of an impending attack. And in fact, narrowing the eyes typically accompanies the startle response in mammals, and is thought to be a defensive, protective behaviour (Andrew, 1965). Another possibility is that expressions like fear and sadness function to regulate the experience of the expresser, in accordance with a position known as the *facial feedback hypothesis* (Strack, Martin, & Stepper, 1988; Tomkins, 1962; Zajonc et al., 1989). However, facial feedback may influence emotional valence more than specific emotional states, and the effect sizes are generally small (see Izard, 1990, for a review). In any case, the notion that emotional expressions shape the expresser's physiology is not in conflict with the idea that expressions shape perceivers' behaviour toward the expresser. It is likely

that social behaviours as complex as facial expressions serve multiple purposes.

Further research into the effects of expressions like fear and sadness on perceivers would need to assess not only self-reported behaviour, but also actual behaviour. Prosocial responding is prone to demand characteristics of an experiment; evidence for this includes the extensive efforts to predict actual prosocial responding from self-reported prosocial responding, such as self-reported feelings of sympathy. Eisenberg and Miller (1987) in a review of the literature determined that although self-reported sympathy predicts self-reported prosocial behaviour very well, it only sometimes predicts actual prosocial behaviour. The generally high correlation between self-reported empathy or sympathy and self-reported prosocial behaviour was, in fact, one reason why these two responses were generally considered together in the present studies. But future studies should endeavour to calculate the relationship between the perception and correct identification of distress cues like fear expressions and actual prosocial behaviours.

CONCLUSIONS

Perceiving distress appears to be a reliable antecedent to prosocial responding (Hoffman, 1981). The correct identification of another's distress is thought to "trigger an affective response that generates the motivation to help a person in distress" (Nichols, 2001, p. 444). Indeed, Nichols reviews data that indicate that the only cognitive precursor necessary to generate empathy and concern in a perceiver is the ability to identify another's distressed emotional state upon perceiving it. He has hypothesised the existence of a mechanism responsible for identifying distress cues in others and responding to those cues with an appropriate emotional response. The results of the studies described here suggest that fear and sadness may be effective distress cues for triggering such a mechanism, generating compassionate responses in the human emotional repertoire such as the experience of sympathy and the desire to help those in need.

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REFERENCES

American Heritage Dictionary. (2000). (Retrieved September 2005 from http://www.dictionary.com)

Andrew, R. J. (1965). The origins of facial expressions. *Scientific American*, *213*, 88–94.

Baker, L. D., & Reitz, H. J. (1978). Altruism toward the blind: Effects of sex of helper and dependency of victim. *Journal of Social Psychology*, *104*, 19–28.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality & Social Psychology*, *51*, 1173–1182.

Batson, C. D., Duncan, B., Ackerman, P., Buckley, T., & Birch, K. (1981). Is empathic emotion a source of altruistic motivation? *Journal of Personality and Social Psychology*, *40*, 290–302.

Blair, R. J. R. (1995). A cognitive developmental approach to morality: Investigating the psychopath. *Cognition*, *57*, 1–29.

Blair, R. J. R., Colledge, E., Murray, L., & Mitchell, D. G. V. (2001). A selective impairment in the processing of sad and fearful expressions in children with psychopathic tendencies. *Journal of Abnormal Child Psychology*, *29*, 491–498.

Blair, R. J. R., Jones, L., Clark, F., & Smith, M. (1997). The psychopathic individual: A lack of responsiveness to distress cues? *Psychophysiology*, *34*, 192–198.

Braine, L. G., Pomerantz, E., Lorber, D., & Krantz, D. H. (1991). Conflicts with authority: Children's feelings, actions, and justifications. *Developmental Psychology*, *27*, 829–840.

Castanho, A. P., & Otta, E. (1999). Decoding spontaneous and posed smiles of children who are visually impaired and sighted. *Journal of Visual Impairment & Blindness*, *93*, 659–662.

Clark, R. D., & Word, L. E. (1974). Where is the apathetic bystander? Situational characteristics of the emergency. *Journal of Personality & Social Psychology*, *29*, 279–287.

Darwin, C. (1965). *The expression of the emotions in man and animals*. Chicago: University of Chicago Press. (Originally published 1872)

Dimberg, U., & Öhman, A. (1996). Behold the wrath: Psychophysiological responses to facial stimuli. *Motivation & Emotion*, *20*, 149–182.

Eibl-Eibesfeldt, I. (1971). *Love and hate: The natural history of behavior patterns*. New York: Aldine de Gruyter.

Eisenberg, N., & Miller, P. A. (1987). The relation of empathy to prosocial and related behaviors. *Psychological Bulletin*, *101*, 91–119.

Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality & Social Psychology*, *17*, 124–129.

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

Elfenbein, H. A., Marsh, A. A., & Ambady, N. (2002). Emotional intelligence and the recognition of emotion from facial expressions. In L. Feldman-Barrett & P. Salovey (Eds.), *The wisdom in feeling: Psychological processes in emotional intelligence*. New York: Guilford.

Freedman, D. G. (1964). Smiling in blind infants and the issue of innate vs. acquired. *Journal of Child Psychology & Psychiatry*, *5*, 171–184.

Fridlund, A. J. (1994). *Human facial expression: An evolutionary view*. New York: Academic.

Hecht, M. A., & Lafrance, M. (1998). License or obligation to smile: The effect of power and sex on amount and type of smiling. *Personality & Social Psychology Bulletin*, *24*, 1332–1342.

Hess, U., Blairy, S., & Kleck, R. E. (2000). The influence of facial emotion displays, gender, and ethnicity on judgments of dominance and affiliation. *Journal of Nonverbal Behavior*, *24*, 265–283.

Hoffman, M. L. (1981). Is altruism part of human nature? *Journal of Personality and Social Psychology*, *40*, 121–137.

Izard, C. E. (1971). *The face of emotion*. New York: Appleton-Century-Crofts.

Izard, C. D. (1990). The substrates and functions of emotion feelings: William James and current emotion theory. *Personality & Social Psychology Bulletin*, *16*, 626–635.

Kanekar, S., Mazumdar, D., Pinto, N. J. P., Bulsara, R. M., & Kolsawalla, M. B. (1981). Aggression, retaliation, and socioeconomic status. *Journal of Social Psychology*, *114*, 141–142.

Keating, C. F. (1985). Gender and the physiognomy of dominance and attractiveness. *Social Psychology Quarterly*, *48*, 61–70.

Lorenz, K. (1963). *On aggression*. New York: Harcourt, Brace, & World.
Marsh, A. A., Adams, R. B., Jr., & Kleck, R. E. (2005a). Why do fear and anger look the way they do? Form and social function in facial expressions. *Personality & Social Psychology Bulletin*, *31*, 73–86.
Marsh, A. A., Ambady, N., & Kleck, R. E. (2005b). The effects of fear and anger expressions on approach- and avoidance-related behaviors. *Emotion*, *5*, 119–124.
Mischkulnig, M. (1989). Kindenschema und Ärgerreduktion. *Zeitschrift für experimentelle und angewandte Psychologie*, *4*, 567–578.
Nichols, S. (2001). Mindreading and the cognitive architecture: Underlying altruistic motivation. *Mind & Language*, *16*, 425–455.
Nowicki, S., & Duke, M. P. (1994). Individual differences in the nonverbal communication of affect: The Diagnostic Analysis of Nonverbal Accuracy Scale. *Journal of Nonverbal Behavior*, *18*, 9–35.
Preston, S. D., & de Waal, F. B. M. (2002). Empathy: Its ultimate and proximate bases. *Behavioral and Brain Sciences*, *25*, 1–72.
Preuschoft, S. (1995). *'Laughter' and 'Smiling' in Macaques: An evolutionary perspective*. Utrecht, The Netherlands: Rijksuniversiteit. (Originally published 1960)
Preuschoft, S. (1999). Are primates behaviorists? Formal dominance, cognition, and free-floating rationales. *Journal of Comparative Psychology*, *113*, 91–95.
Purvis, J. A., Dabbs, J. M., & Hopper, C. H. (1984). The "opener": Skilled user of facial expression and speech pattern. *Personality & Social Psychology Bulletin*, *10*, 61–66.
Radke-Yarrow, M., Zahn-Waxler, C., Richardson, D. T., Susman, A., & Martinez, P. (1994). Caring behavior in children of clinically depressed and well mothers. *Child Development*, *65*, 1405–1414.
Rosenstein, D., & Oster, H. (1988). Differential facial responses to four basic tastes in newborns. *Child Development*, *59*, 1555–1568.
Rudolph, U., Roesch, S. C., Greitemeyer, T., & Weiner, B. (2004). A meta-analytic review of help giving and aggression from an attributional perspective: Contributions to a general theory of motivation. *Cognition and Emotion*, *18*, 815–848.
Russell, J. A. (1995). Facial expressions of emotion: What lies beyond minimal universality? *Psychological Bulletin*, *118*, 379–391.
Sabatelli, R. M., & Rubin, M. (1986). Nonverbal expressiveness and physical attractiveness as mediators of interpersonal perceptions. *Journal of Nonverbal Behavior*, *10*, 120–133.
Schenkel, R. (1967). Submission: Its features and function of the wolf and dog. *American Zoologist*, *7*, 319–329.
Shotland, R. L., & Huston, T. L. (1979). Emergencies: What are they and do they influence bystanders to intervene? *Journal of Personality & Social Psychology*, *37*, 1822–1834.
Smith, J. M., & Price, G. R. (1973). The logic of animal conflict. *Nature*, *246*, 15–18.
Sternglanz, S. H., Gray, J. L., & Murakami, M. (1977). Adult preferences for infantile facial features: An ethological approach. *Animal Behaviour*, *25*, 108–115.
Stevens, D., Charman, T., & Blair, R. J. (2001). Recognition of emotion in facial expressions and vocal tones in children with psychopathic tendencies. *Journal of Genetic Psychology*, *162*, 201–211.
Strack, F., Martin, L. L., & Stepper, S. (1988). Inhibiting and facilitating conditions of the human smile: A nonobtrusive test of the facial feedback hypothesis. *Journal of Personality & Social Psychology*, *54*, 768–777.
Taylor, S. E. (2002). *The tending instinct*. New York: Times Books.
Tomkins, S. S. (1962). *Affect, imagery, consciousness. Vol. 1: The positive affects*. New York: Springer.

Tottenham, N., Borscheid, A., Ellertsen, K., Marcus, D. J., & Nelson, C. A. (2002, April). *Categorization of facial expressions in children and adults: Establishing a larger stimulus set*. Poster presented at the Cognitive Neuroscience Society annual meeting, San Francisco, CA.

Wagner, H. L. (1993). On measuring performance in category judgment studies on nonverbal behavior. *Journal of Nonverbal Behavior*, *17*, 3–28.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality & Social Psychology*, *54*, 1063–1070.

Whalen, P. J., Shin, L. M., McInerney, S. C., Fischer, H., Wright, C. I., & Rauch, S. L. (1998). A functional MRI study of human amygdala responses to facial expressions of fear versus anger. *Emotion*, *1*, 70–83.

Williams, M. A., McGlone, F., Abbott, D. F., & Mattingley, J. B. (2005). Differential amygdala responses to happy and fearful facial expressions depend on selective attention. *Neuroimage*, *24*, 417–425.

Zajonc, R. B., Murphy, S. T., & Inglehart, M. (1989). Feeling and facial efference: Implications of the vascular theory of emotion. *Psychological Review*, *96*, 395–416.

Zebrowitz, L. A. (1997). *Reading faces: Window to the soul?*. Boulder, CO: Westview Press.