The Communicative Function of Sad Facial Expressions

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Abstract
What are the communicative functions of sad facial expressions? Research shows that people feel sadness in response to losses but it's unclear whether sad expressions function to communicate losses to others and if so, what makes these signals credible. Here we use economic games to test the hypothesis that sad expressions lend credibility to claims of loss. Participants play the role of either a proposer or recipient in a game with a fictional backstory and real monetary payoffs. The proposers view a (fictional) video of the recipient's character displaying either a neutral or sad expression paired with a claim of loss. The proposer then decided how much money to give to the recipient. In three experiments, we test alternative theories by using situations in which the recipient's losses were uncertain (Experiment 1), the recipient's losses were certain (Experiment 2), or the recipient claims failed gains rather than losses (Experiment 3). Overall, we find that participants gave more money to recipients who displayed sad expressions compared to neutral expressions, but only under conditions of uncertain loss. This finding supports the hypothesis that sad expressions function to increase the credibility of claims of loss.

A person with a sad expression on their face conveys a potent message. Drooping eyelids, downcast eyes, lowered lip corners, and slanting inner eyebrows have an arresting effect on observers. However, the social functions of sad expressions are not well understood. We test whether sadness functions to enhance a person's credibility when they claim to have suffered a loss.

We can better understand sad faces by considering the evolutionary functions of facial expressions more generally. Darwin (1998) proposed that facial expressions serve mainly physiological functions by changing the configuration of facial muscles in response to environmental stimuli. For example, fear expressions widen the eyes and raise the eyebrows to increase peripheral vision (Susskind, Lee, Cusi, Grabski, & Anderson, 2008), and disgust expressions protrude the tongue and constrict the nose to reduce exposure to pathogens (Chapman, Kim, Susskind, & Anderson, 2009). Furthermore, Darwin's *antithesis principle* holds that some emotions cause the opposite facial movements of opposite emotions. For example, happiness causes raised cheeks and lip corners because negative emotions depress (sadness), dimple (contempt), or widen (fear) the lip corners (Darwin, 1998; Ekman, 2003). More recently, evolutionary theorists proposed that some emotional expressions serve communicative functions by showing how initial physiological responses later evolved as signals (Dawkins & Krebs, 1978; Eibl-Eibesfeldt, 1989; Ekman, 1992; Krebs & Dawkins, 1984; Shariff & Tracy, 2011).

What messages might sad expressions function to communicate? People feel sadness in response to losses such as losing resources, status, friends, or romantic partners (Nesse, 1990). Furthermore, sadness is more intense when the lost resources had greater value for biological fitness (Tooby & Cosmides, 1990). For example, parents experience more intense grief in response to the death of a child when they are closer to reproductive age (Crawford, Salter, & Jang, 1989). One function of

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the emotion of sadness might be to update multiple cognitive systems to integrate the implications of the loss, which has been referred to as a recalibration function (Tooby, Cosmides, Sell, Lieberman, & Sznycer, 2008). By drawing attention inward, an individual can dwell on misfortunes in order to invest cognitive resources toward learning to avoid similar hardships in the future and developing plans to mitigate the loss in the present. The sad expression could complement this function by signaling losses to others in order to recruit help toward recovering from the misfortune. Related, one theory proposes that the chronic state of sadness found in depression functions in part to communicate losses (Fridlund, 1994) in order to solicit help from other people (Ekman, 2003; Lewis, 1934; Nesse, 2001; Watson & Andrews, 2002).

The theory that sad expressions signal losses raises two important questions. The first question is why receivers might altruistically help a sad signaler who has experienced a loss. Several theories can potentially explain a desire to compensate losses. Direct and indirect reciprocity theories imply that compensating a loss could create a debt that the creditor can redeem in the future (Nowak & Sigmund, 1998; Trivers, 1971). The welfare-tradeoff theory is a version of reciprocity theory in which people are more likely to help a person who has suffered a loss when there is a favorable ratio of costs to self versus benefits to the recipient, creating a good opportunity to invest in valuable social relationships (Delton & Robertson, 2016; Sell, 2011; Sell, Tooby, & Cosmides, 2009). Last, the risk-pooling theory holds that humans help others who suffer misfortunes in order to pool risk and smooth consumption over time (H. Kaplan, Hill, Lancaster, & Hurtado, 2000; H. S. Kaplan, Schniter, Smith, & Wilson, 2012).

The second question, and our primary interest, is why receivers should take sad expressions at face value. If the function of sad expressions is to solicit resources, then individuals could fake the signal in order to manipulate receivers into providing resources even when a loss did not occur. That is, receivers can benefit from helping cooperative partners, but only at the risk of being duped by cheaters who fake or exaggerate their losses (Dawkins & Krebs, 1978). This presents a difficult adaptive problem. Receivers who indiscriminately share resources with requesters are vulnerable to cheaters. On the other hand, receivers who shun all requesters could damage their reputations and lose valuable partners who have honestly suffered a loss. This reasoning suggests that people should be moderately skeptical toward claims of loss in order to distinguish honest from deceptive pleas for help.

Previous research has addressed this issue by arguing that emotional expressions are designed to increase the credibility of the messages they accompany (R. H. Frank, 1988; Hirshleifer, 1987; Nesse, 2001; Pinker, 1997). Individuals could potentially fake emotions such as anger, sadness, or disgust which would lead receivers to eventually ignore the associated expressions as deceptive "cheap talk" (Dawkins & Krebs, 1978). However, emotional signals can still be favored by evolution if they are difficult or costly to fake (R. H. Frank, 1988; Hirshleifer, 1987; Nesse, 2001; Pinker, 1997). More generally,

evolutionary theories of communication (Maynard Smith & Harper, 2003) have shown how honest signals can be maintained by evolution in multiple ways including when (a) the signaler and receiver have the same goals instead of conflicting interests, (b) the signal is an index of the underlying trait that is difficult to fake (e.g., when a roar is an index for body size), (c) the signal is more costly to send for one type than another, generating a separating equilibrium (the same can occur for a constant cost with a differential benefit); importantly, these differential costs can be costs of producing the signal or costs associated with the consequences of faking the signal, for example, if liars are punished when detected.

For emotions, it is clear that emotional expressions are, at least, difficult to consciously fake (which is not the same as difficult for faking to evolve, see below). A characteristic feature of emotions is that they are mostly involuntary and difficult to consciously control. Even with professional training, actors often find it difficult to fake realistic emotional expressions. Studies show that people's emotional expressions reliably coincide with their self-reported feelings as well as physiological states (Ekman, Levenson, & Friesen, 1983; Rosenberg & Ekman, 2005). Furthermore, the facial muscles used in expressions are difficult to activate in the absence of relevant emotions and difficult to inhibit in the presence of relevant emotions (Ekman & Friesen, 1982; Ekman, Levenson, & Friesen, 1985). These include two facial actions involved in the expression of sadness: the inner eyebrow raiser (medial frontalis) and the lip corner depressor (triangularis). Finally, facial expressions have been shown to accurately reflect both emotional experiences (Izard, 1971) and action tendencies (Fridlund, 1994; Kraut & Jonston, 1979).

Importantly, the fact that emotions are difficult to consciously fake does not by itself mean that it is difficult for faked expressions to evolve. Hence, additional arguments are required to explain why emotional expressions might remain outside of conscious control, rather than natural selection favoring mutants who can fake them. Several of the standard evolutionary arguments about signals could apply to emotional expressions, including common interests, reliable indices, or differential costs (or benefits).

Most commonly, credibility theories hold that evolution favored emotional expressions that were both honest and difficult to consciously fake because individuals with these characteristics attracted better social partners than their more rational competitors (R. H. Frank, 1988; Tooby & Cosmides, 1996). Hence, the basic idea is that liars suffer greater social costs by losing quality partners. For example, in the context of romantic love, people prefer mates who are emotionally and involuntarily attached to them, since this predicts that the mate is less likely to desert the individual for a romantic competitor (Buss, 1988, 2016). Given this preference, individuals who can signal their irrational romantic emotions thereby gain an advantage in competing for mates. In contrast, cheaters who fake their attachment while in fact courting additional mates are typically found out and abandoned. The same idea applies to altruism and cooperation: People prefer partners who help

based on involuntary altruistic feelings rather than partners who only calculate the future benefits to themselves for helping. In this social world, people who help based on involuntary emotions gain an evolutionary advantage in the competition for quality partners.

Evolution could also favor honesty if liars suffer greater costs of punishment. Punishments could come in the form of withheld resources, direct attacks, or reputational damage. If these costly consequences outweigh the immediate benefits of dishonesty, then evolution can favor honest emotional expressions (McCullough, 2016; Searcy & Nowicki, 2005).

Additionally, an emotional expression could potentially be an index of an underlying emotional state that is difficult to fake. This could occur if emotional expressions are components within a larger suite of processes included in an emotion that are together activated involuntarily (Cosmides & Tooby, 2000). There are good functional reasons why basic emotions like fear and disgust remain outside of conscious control—so individuals cannot easily override them to engage in damaging behaviors like jumping off of cliffs or eating rotten corpses. If emotional expressions are contained within the larger cognitive architecture of an emotional program, then they would be involuntary by default and hence reliable indices of the emotional state. Of course, in principle, evolution could favor a mutant with a dissociated emotional expression that is under conscious control; however, this might be unlikely to occur due to developmental constraints. By analogy, although it could be advantageous and is certainly possible for a human to mutate a third eye on the back of the head, this possibility is limited by developmental constraints (Williams, 1997). For similar reasons, it might be difficult for mutations to dissociate a complex facial expression from its origin within an involuntary emotional program. If so, this would maintain emotional expressions as reliable indices of underlying emotional states.

Hence, there are several possible evolutionary pathways that could theoretically maintain honest emotional expressions. However, whether a particular emotional expression in fact tends to be honest and whether it is interpreted by receivers as honest (at least more likely to be honest) are empirical questions that need to be addressed case by case for each emotional expression.

Credibility theories have been investigated in several studies of specific facial expressions. Reed, Zeglen, and Schmidt (2012) measured participants' facial expressions during their promises to cooperate in an anonymous, one-shot, prisoner's dilemma game. Receivers judged participants who smiled during their promises to be more likely to cooperate. Furthermore, the receivers were correct: Smiles were associated with increased rates of cooperation. Similar findings for smiles were found in other studies examining the dictator game (Brown & Moore, 2002) and trust game (Berg & McCabe, 1995; Centorrino, Djemai, Hopfensitz, Milinski, & Seabright, 2015).

Angry expressions, on the other hand, were found to increase the credibility of threats. Using an ultimatum game, Reed, DeScioli, and Pinker (2014) found that a responder's written threats paired with an angry facial expression resulted in higher proposer offers in comparison to threats paired with a neutral expression. Furthermore, the effects of anger were greater when the responder's demand was excessive (70% of money) and hence doubtful, compared to a fairer and inherently credible demand of 50%. This suggests that angry expressions have particularly potent effects on a receiver when the resolve of the sender might otherwise be in doubt.

Here we propose the credibility hypothesis for sad facial expressions. This hypothesis holds that signalers use sad expressions to add credibility to claims of loss in order to solicit help. In response, receivers attribute greater credibility to claims of loss that are bolstered by sad expressions. This hypothesis predicts that receivers will be more willing to share resources with requesters who show sad versus neutral expressions. In contrast, a cheap-talk hypothesis that sad faces are unreliable and manipulative signals predicts that a receiver's contributions will not be swayed by a show of sadness. We test these possibilities in Experiment 1.

The Current Investigation

We designed an economic game to investigate the communicative functions of sad expressions. In this game, one participant is the proposer who has 90 cents and another participant is the recipient who can ask the proposer for money after facing a risk of losing their own 90 cents (see below). The recipient sends a message to the proposer about whether they lost their money, which might or might not be true. Then the proposer decides whether to send up to 30 cents to the recipient, based on whether they want to help and whether they believe the recipient's message. This is a variant of the dictator game in which a proposer decides how much money to transfer to a recipient (Camerer, 2003).

The credibility hypothesis predicts that proposers will be more likely to believe and send money to the recipient when their message is paired with a sad face compared to a neutral face. In contrast, if participants view a sad face as only cheap talk, then we will observe no effects on how much money participants send to recipients.

Experiment 1

Method

Participants were proposers or recipients in a modified dictator game. Proposers were paired with a real participant as the recipient, but they viewed a video and message that were actually from a confederate actor. This allowed us to control and manipulate the content of the video and message. The video clips showed either a neutral or sad facial expression paired with a written message stating that the recipient suffered a loss of their endowment (see below). Proposers did not know whether this message was true.

We presented the game to participants using a fictional story with real payoffs. We used a fictional scenario to provide a

concrete situation in which an individual could be uncertain about another person's claim of loss. Participants played the roles of two people going fishing to earn money. Participants read that they usually catch 90 fish but might not catch any if they are unlucky. Furthermore, the fishers knew that a storm was coming and there was a 50% chance that the storm would make them lose any fish they caught. Participants read that each fish was worth 1 cent in real money.

The proposer learned that they caught 90 fish without losing any in the storm. Then the proposer viewed a brief, prerecorded video along with a written message from the recipient. In reality, the message was preset and the video was previously recorded with a confederate actress. The video showed either a sad or neutral facial expression. The written message paired with the video stated: "I caught 90 fish, but I lost them all in the storm." According to the scenario, the proposer could not know for sure if this message was true and whether the recipient really lost their fish. The proposer had to decide for themselves whether to believe the recipient's message. Finally, the proposer decided whether to send up to 30 of their own fish to the recipient.

Participants

We recruited 302 participants (180 males and 122 females) using Amazon's Mechanical Turk (MTurk), an online crowdsourcing website in which individuals sign up to complete tasks (Buhrmeister, Kwang, & Gosling, 2011; Horton, Rand, & Zeckhauser, 2011). We chose a sample size with sufficient power to detect a medium effect size ($d = 0.5$, power $= 0.86$). Participants' mean age was 34.81 ($SD = 12.84$) and their racial distribution was: 87.7% Caucasian, 5.3% African American, 6% Asian American, and 1% other.

Procedure

Participants were randomly assigned as proposer or recipient. Participants read a consent form followed by a description of the fishing scenario. Each participant was paid US$0.50 for completing the study and could earn extra money (paid in MTurk bonus payments) depending on their decisions. Participants read the instructions describing the interaction between a proposer and a recipient in a fictional fishing scenario. Importantly, participants read that although the scenario was fictional, their partner and the payments were real. Participants were required to correctly answer three comprehension questions in order to proceed. Each question presented a hypothetical number of fish that were caught and shared and then asked how much money the participant would earn (e.g., "Say that you catch 30 fish. Let's also say that the other participant catches 70 fish. If you give 15 fish to the other participant, how much money will you earn?"). Participants were given as many opportunities to answer these questions as needed and could only proceed after each was correctly answered. No participants were excluded on this basis. After the game, participants reported demographic information and were debriefed.

Table 1. Participants' Emotion Ratings of Neutral and Sad Expressions, Experiment 1.

| Emotion | Neutral | | Sad | | | |
	M	SD	M	SD	t	d
Happy	1.99	1.20	1.25	0.84	**4.37**	0.71
Sad	4.55	1.80	5.82	1.42	**4.78**	0.78
Angry	2.95	1.68	2.17	1.26	**3.24**	0.53
Fearful	2.65	1.72	2.98	1.75	1.14	0.19
Disgusted	2.46	1.65	2.05	1.30	**1.70**	0.28

Note. Bold *t* indicates *p* < .05. SD = standard deviation.

For the bonuses from the game, proposers received US$0.90 minus the amount that they sent to the recipient, and recipients received the amount that their partner sent to them (in addition to the base pay of 50 cents). Each participant completed a single trial of this task in 5–7 min.

In the game, proposers decided how much of their 90 cents to send to recipients, and recipients did not make a decision. Before deciding, proposers viewed a written message and brief video purportedly sent by their partner (see Figures 4 and 5 for still images of the neutral and sad clips, respectively). The written message stated "I caught 90 fish, but I lost them all in the storm." The videos showed the same, female, college-aged confederate with either a sad or neutral expression. For the sad expression, we trained and instructed the confederate to create the facial action units (AUs) described for sadness in the Facial Action Coding System (Juslin & Scherer, 2005). These consisted of AU1; inner eyebrow raiser, AU4; brow furrower, AU15; lip corner depressor, AU43; upper eyelid lowerer; and AU64; eyes down (Ekman, Friesen, & Hager, 1978). We showed video clips instead of static pictures because they provide richer emotional content (Ambadar, Schooler, & Cohn, 2005). Video clips were recorded at 30 frames per second and lasted 6 s in length. This duration is similar in length to the average 4–6 s reported for spontaneous expressions (M. G. Frank, Ekman, & Friesen, 1993; Schmidt, Ambadar, Cohn, & Reed, 2006). After viewing the video and message, proposers decided how many fish to send to the recipient and how many to keep for themselves. Proposers then rated how happy, sad, angry, fearful, and disgusted their partner appeared in the video on a 7-point Likert-type scale (1 = *not at all* to 7 = *extremely*).

Results and Discussion

We analyze only the proposers' ($n = 151$) decisions, since recipients did not make a decision in the game. As a manipulation check, we first examined participant ratings of the (confederate) recipient's emotions depicted in the video clip (see Table 1). Importantly, participants rated the sad clip as more sad ($M = 5.82$, $SD = 1.42$) than the neutral clip ($M = 4.55$, $SD = 1.80$), $t(149) = 4.78$, $p < .01$, $d = 0.78$. In addition, participants rated the sad clip as less happy ($M = 1.25$,
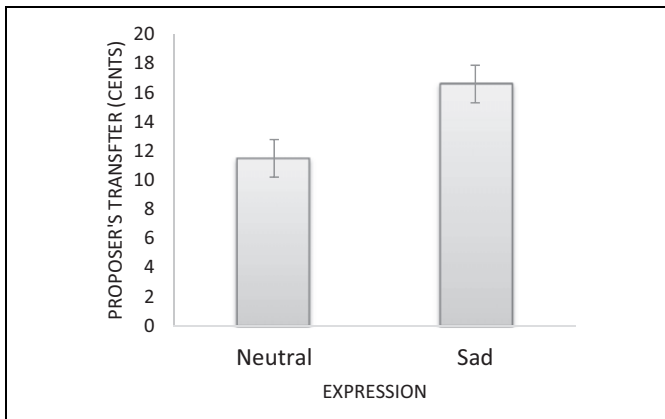
Figure 1. Money given by proposers to recipients with neutral or sad facial expressions in Experiment 1. Error bars represent ±1 standard error.

$SD = 0.84$) than the neutral clip ($M = 1.99$, $SD = 1.20$), $t(149) = 4.37$, $p < .01$, $d = 0.71$. Proposers' offers did not differ by gender or ethnicity (all $ps > .05$), so we aggregated across these categories in subsequent analyses.

Figure 1 shows the main results. Proposers gave more money to a recipient with the sad expression ($M = 16.58$, $SD = 13.42$) compared to the neutral expression ($M = 11.48$, $SD = 18.52$), $t(149) = 6.83$, $p = .010$, $d = .32$. These data support the hypothesis that a sad expression adds credibility in situations of loss, eliciting greater resources from a helper compared to a neutral expression.

Experiment 2

Method

Experiment 1 confirmed a prediction of the credibility hypothesis by finding that proposers gave more money to recipients with sad expressions compared to neutral expressions. However, an alternative interpretation of these results is that sad expressions automatically evoke empathy and helping, whether or not the loss is uncertain. Experiment 2 distinguishes these two accounts by testing the effects of sad faces when the proposer is certain about the recipient's loss. The credibility hypothesis predicts that in this case, sadness will no longer boost contributions because there is no uncertainty to resolve, whereas the automatic-empathy hypothesis predicts similar effects of sadness when loss is certain.

Participants

We recruited 302 participants on MTurk (189 males and 113 females), choosing a sample size with sufficient power to detect a medium effect size ($d = 0.5$, power $= 0.86$). Their mean age was 32.43 ($SD = 9.97$); their racial distribution was as follows: 81.2% Caucasian, 6.1% African American, 9.7% Asian American, and 2.9% other.

Table 2. Participants' Emotion Ratings of Neutral and Sad Expressions, Experiment 2.

Emotion	Neutral		Sad			
	M	SD	M	SD	t	d
Happy	1.79	1.01	1.11	0.26	**5.68**	0.92
Sad	4.75	1.84	6.40	0.80	**7.20**	1.16
Angry	3.06	2.10	2.10	1.43	**3.95**	0.64
Fearful	2.57	2.91	2.91	1.95	1.18	0.19
Disgusted	2.32	2.03	2.03	1.40	1.26	0.21

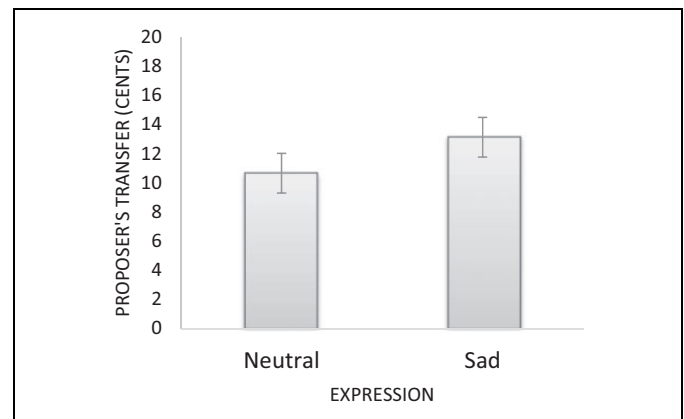*Note.* Bold *t* indicates *p* < .05. SD = standard deviation.

Figure 2. Money given by proposers to recipients with neutral or sad facial expressions in Experiment 2. Error bars represent ±1 standard error.

Procedure

The procedure was the same as in Experiment 1 with one exception: prior to viewing the video clip and written message, proposers were explicitly told that the recipient had caught 90 fish, but lost them all in a storm. Following data collection, proposers and recipients were randomly matched and the payouts were calculated accordingly.

Results and Discussion

We analyze only the proposers' ($n = 151$) decisions, since recipients did not make a decision in the game. As in Experiment 1, participants rated the sad clip as more sad ($M = 6.40$, $SD = 0.80$) than the neutral clip ($M = 4.75$, $SD = 1.84$), $t(149) = 7.20$, $p < .01$, $d = 1.16$. In addition, participants rated the sad clip as less happy ($M = 1.11$, $SD = 0.26$) than the neutral clip ($M = 1.79$, $SD = 1.01$), $t(149) = 5.68$, $p < .01$, $d = 0.92$ (see Table 2 for additional emotion ratings). Proposers' offers did not differ by gender or ethnicity (all $ps > .05$), so we aggregated across these categories in subsequent analyses.

Figure 2 shows the main results. Proposers' contributions to the recipient with a sad expression ($M = 13.12$, $SD = 17.11$) did not differ from the recipient with a neutral expression ($M = 10.65$, $SD = 19.35$), $t(149) = 1.31$, $p =$

.193, $d = .14$. This indicates that when a message was already credible for other reasons, sad expressions had little effect on proposer offers, rather than automatically boosting empathy and helping.

Experiment 3

Method

In Experiment 3, we test whether sad faces elicit compensation for losses, specifically, or if they also elicit compensation for failed gains. Previous theories of sadness focus on losses (Nesse, 1990). However, people are also harmed by failing to realize gains which could be another source of sad signals. For example, a person who failed to find a job could be in just as dire of a situation as someone who lost their job.

Even so, there are a few reasons why sadness might elicit greater help for losses than failed gains. One reason is that losses are often due to misfortunes outside of the person's control, whereas failed gains can result both from misfortune and also low effort. Someone who lost a resource must have at least made enough effort to acquire it in the first place, whereas someone who never had the resource might have made little or no effort at all. Hence, individuals who compensate failed gains could be more vulnerable to cheating by those who expend little effort. A second reason is that a person's possible losses are limited to what they have, whereas someone's possible unrealized gains are unlimited. People's compensation behavior might be less attuned to failed gains because they are too open ended and numerous to practically manage.

To test for specificity, we use the same methods as Experiment 1 except that proposers are presented with a recipient's uncertain failed gain rather than loss. The general-compensation hypothesis predicts that sad faces will show the same effect for claims of failed gains, whereas the loss-specific hypothesis predicts that sad faces will have a lesser effect for claims of failed gains.

Participants

We recruited 312 participants on MTurk (211 males and 101 females), choosing a sample size with sufficient power to detect a medium effect size ($d = 0.5$, power $= 0.87$). Their mean age was 31.56 ($SD = 9.34$); their racial distribution was 78.7% Caucasian, 6.1% African American, 9.7% Asian American, and 5.5% other.

Procedure

The procedure was identical to Experiment 1 with one exception: the sad and neutral clips with a statement of representing a lack of gain ("I didn't catch any fish") as opposed to a loss ("I caught 90 fish, but I lost them all in the storm").

Table 3. Participants' Emotion Ratings of Neutral and Sad Expressions, Experiment 3.

| Emotion | Neutral | | Sad | | | |
	M	SD	M	SD	t	d
Happy	1.99	1.16	1.36	0.84	**3.93**	0.63
Sad	4.55	1.77	5.98	1.30	**5.76**	0.92
Angry	2.75	1.56	1.88	1.34	3.72	0.59
Fearful	2.43	1.60	2.58	1.66	0.57	0.09
Disgusted	2.28	1.52	1.88	1.24	**1.77**	0.28

Note. Bold t indicates $p < .05$. SD = standard deviation
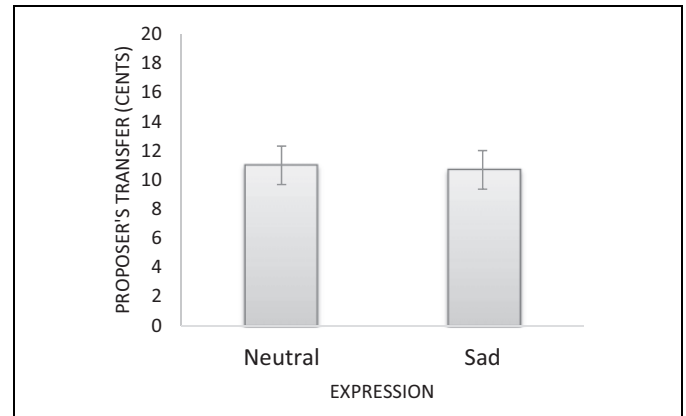

Figure 3. Money given by proposers to recipients with neutral or sad facial expressions in Experiment 3. Error bars represent ± 1 standard error.

Results and Discussion

We analyze only the proposers' ($n = 156$) decisions, since recipients did not make a decision in the game. As in Experiments 1 and 2, we confirmed that participants rated the sad clip as more sad ($M = 5.98$, $SD = 1.30$) than the neutral clip ($M = 4.55$, $SD = 1.77$), $t(154) = 5.76$, $p < .05$, $d = 0.92$. In addition, participants rated the sad clip as less happy ($M = 1.36$, $SD = 0.84$) than the neutral clip ($M = 1.99$, $SD = 1.16$), $t(154) = 3.93$, $p < .05$, $d = 0.63$ (see Table 3 for additional emotion ratings). Proposers' offers did not differ by gender or ethnicity (all ps $> .05$), so we aggregated across these categories in subsequent analyses.

Figure 3 shows the main results. Proposers' contributions to the recipient with a sad expression ($M = 10.99$, $SD = 19.90$) did not differ from the recipient with a neutral expression ($M = 10.68$, $SD = 19.58$), $t(154) = 0.307$, $p = .526$, $d = .02$.

General Discussion

In three experiments, we tested the theory that sad expressions signal loss in order to solicit help. The results support the credibility hypothesis that sad expressions add credibility to claims of loss and motivate receivers to share more resources. In contrast, we did not find evidence for the automatic empathy
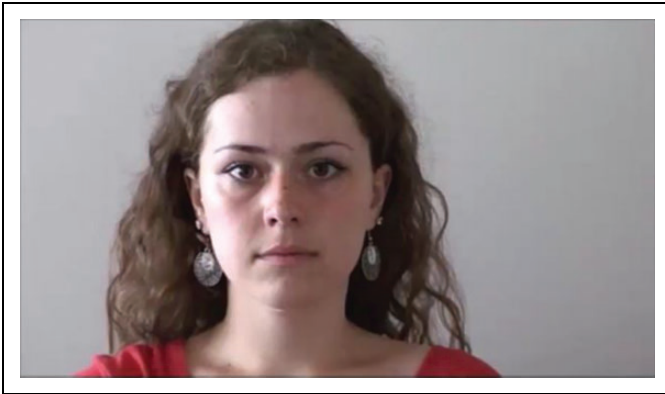
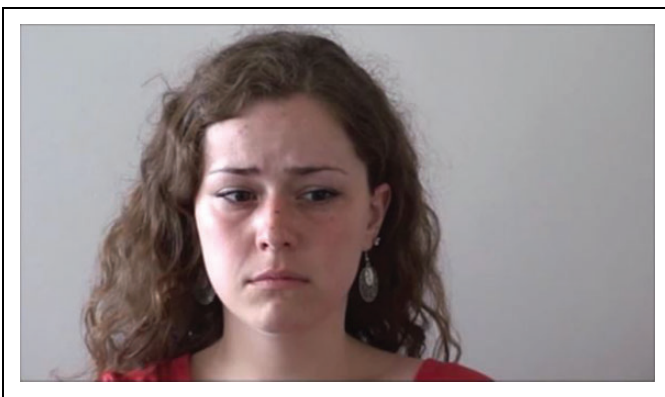**Figure 4.** Single frame of neutral clip.

Figure 5. Apex frame of sadness clip.

hypothesis: Sad expressions did not elicit greater sharing when there was no uncertainty to resolve. Furthermore, we found that the effects of sadness are specific to losses and did not extend to failed gains. Overall, we find that sad expressions elicit help from others mainly under conditions of uncertainty and loss.

These results dovetail with previous studies finding that certain emotional expressions affect a viewer's behavior in strategic interactions. For instance, participants showed greater cooperation with partners who smiled (Berg, & McCabe, 1995; Brown & Moore, 2002; Centorrino et al., 2015; Reed, Zeglen, & Schmidt, 2012) and they made greater concessions to partners who flashed an angry grimace (Reed, DeScioli, & Pinker, 2014). Furthermore, they provide additional support for credibility theories for emotional expressions more generally (R. H. Frank, 1988; Hirshleifer, 1987; Pinker, 1997). Future research could test this idea with other emotional expressions. For example, fearful expressions may increase the credibility of warnings about danger, while disgust expressions may increase the credibility of claims that a substance is contaminated or that the sender opposes a moral violation (Tybur, Lieberman, Kurzban, & DeScioli, 2013).

In the present experiments, we examined situations in which participants were uncertain about whether a loss occurred. We note that sadness could also convey credibility about how damaging the loss is to the signaler. For example, even if

someone is certain that a worker lost their job, they could still be uncertain about the severity of the unemployed worker's hardship. For instance, the worker might have savings or family to rely on, they might have found temporary unreported work, and they might have passed up possible jobs. In this situation, the unemployed worker's sad expression could add credibility to claims of urgent hardship, distinguishing from less urgent needs. Hence, a sad expression could communicate information that reduces uncertainty about the extent of threat posed by the loss even when there is little uncertainty about whether the loss occurred.

The stimulus expressions in these experiments were actually faked by the confederate which perhaps makes it even more surprising that participants attributed credibility to them. However, we note that our confederate actress had several advantages compared to a typical person who displays an emotional expression. Unlike typical signalers, the confederate received specific training using the Facial Action Coding System that helped them learn to give a convincing display. She had multiple opportunities and multiple takes to make a convincing pitch. And, she had to be convincing only for a few seconds, whereas in a real interaction, the signaler would need to maintain a convincing display for longer and under scrutiny and possibly even interrogation by a receiver. Hence, given these advantages, it might be less surprising that the confederate's posed expression appeared believable to participants. Even so, future research could examine spontaneous expressions to test whether they are even more potent (though this is likely to pose difficult challenges for experimental control).

Future research can also vary other characteristics of sad expressions including the individual's characteristics such as gender, age, ethnicity, attractiveness, formidability, and other key factors. For instance, we used a female actress and a male actor might elicit different responses, for example, a male's sad face might be less convincing or could also be associated with weakness.

Although the current findings shed light on the communicative functions of sad expressions, they do not address why a sad expression (characterized by drooping eyelids, downcast eyes, lowered lip corners, and slanted inner eyebrows) involve the specific changes in facial musculature that they do. Past research has studied the specific muscular configurations of other expressions. For example, fear expressions increase sensory exposure (Susskind et al., 2008) and approximate "babyish" faces (Marsh, Adams, & Kleck, 2005; Marsh, Ambady, & Kleck, 2005), disgust expressions reduce exposure to pathogens (Chapman et al., 2009), and angry expressions exaggerate cues of formidability (Sell et al., 2009). Similar work on the functions of sad expression may shed more light on this question.

These findings help understand the ways that sad expressions affect how people request and share resources in personal, face-to-face interactions, and possibly why people might be less likely to help in response to impersonal requests. Similarly, these results could help charities, foundations, and fundraisers solicit resources through the media. Many charities

have discovered that advertisements that pair a worthy cause with an image of a helpless, sick, or endangered person displaying a sad expression can increase donations. The present findings suggest that these images, in addition to promoting empathy, could unconsciously boost the viewer's perception of the victim's credibility. Charities might be able to make requests for aid even more effective by further enhancing cues of credibility. Finally, these findings show some of the unconscious processes behind our own choices about whether or not to help others in need.

Authors' Notes

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