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In press: *Affective Science*

Beyond face value: Evidence for the universality of bodily expressions of emotion

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Abstract

Research on emotion communication typically focuses on facial expressions, yet scientists dating back to Darwin have noted the importance of the body in conveying emotions. In fact, studies have found that the body is reliably used to express and recognize anger, fear, and sadness, by individuals in several industrialized populations. Here, we provide the first evidence that bodily expressions of these three emotions are reliably recognized by members of an isolated small-scale traditional society: the Mayangna of Nicaragua. Specifically, we found that recognition rates for sadness and anger bodily expressions were high, and recognition rates for a fear bodily expression were lower but still significantly greater than chance. Given that the Mayangna are unlikely to have learned these bodily expressions through cross-cultural transmission, their ability to recognize these displays provides strong evidence for the universality of each expression.

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Beyond face value: Evidence for the universality of bodily expressions of emotion

Over 50 years ago, Ekman and colleagues demonstrated that facial expressions associated with a small set of emotions are reliably recognized across numerous populations, including small-scale traditional societies that have little-to-no contact with the Western world (Ekman, Sorenson, & Friesen, 1969; Ekman & Friesen, 1971). Given that the preliterate, culturally isolated participants in some of these studies could not have learned about Western emotion expressions through cross-cultural transmission, these findings are among the strongest pieces of evidence supporting the case that emotions are functional universals: core mental attributes that are cognitively available, functionally similar, and shared by nearly all adult non-brain-damaged humans across cultures (Norenzayan & Heine, 2005). Although studies have also provided strong evidence for cross-cultural variation in the expression and recognition of these expressions (e.g., Crivelli, Jarillo, Russell, & Fernandez-Dols, 2016), the evidence that they are reliably recognized (i.e., at rates indicating participants were not merely guessing) among small-scale isolated populations who could not have learned them from Western cultural sources indicates that humans likely share a universal ability to recognize certain facial expressions of emotion (e.g., Ekman, Sorenson, & Friesen, 1969; Ekman, 1994, 1972; Sorenson, 1975; Ekman & Friesen, 1971; Keltner & Haidt, 1999; Tracy & Robins, 2008).

These findings led to the emergence of a large literature on facial expressions of emotion (see Elfenbein & Ambady, 2002), and to an emphasis on the importance of the face in communicating emotions. Partly as a result, relatively fewer studies have examined how the body is used to communicate emotion – a topic that Darwin (1872/1998) and James (1932) addressed. Yet there is good reason to suspect that humans, like many other animals, express

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emotions with bodies as well as faces. Most notably, bodily expressions of emotion would likely be functional in human societies, as they enable emotion communication when the face is not visible and across large distances (de Gelder, 2009; Hager & Ekman, 1979).

Several studies have explored the possibility of bodily communication of emotion and found that several emotions are reliably communicated through bodily behaviors, often along with corresponding facial movements (see Witkower & Tracy, 2019, for a review). For example, one study found that professional actors asked to portray several emotions spontaneously used distinctive patterns of bodily behaviors (e.g., Dael, Mortillaro, & Scherer, 2011). Other key findings from this literature are that: (a) observers shown bodily expressions of emotion can reliably recognize them (e.g., Aviezer, Trope, & Todorov, 2012); (b) negative emotion expressions are generally recognized at higher rates than positive (e.g., de Gelder & Van den Stock, 2011); and (c) three negative emotions, in particular, are reliably recognized and discriminated from body-only (i.e., no visible face) expressions at high rates (i.e., greater than 90%): anger, sadness, and fear (e.g., de Gelder & Van den Stock, 2011; Nelson & Russell, 2011; Witkower, Tracy, Pun, Baron, 2021). Importantly, all of these studies examined recognition among populations that are educated, industrialized, wealthy, and familiar with Western culture (i.e., WEIRD; Henrich, Norenzayan, & Heine, 2010).

More specifically, prior research has found that anger, fear, and sadness are recognized from bodily movements alone by individuals from the U.S. (Lopez, Reschke, Knothe, & Walle, 2017), the U.K. (Atkinson, Dittrich, Gemmell, & Young, 2004), the Netherlands (de Gelder & Van den Stock, 2011), China (Ma et al., 2017), Israel (Abramson, Marmom, Petranker, & Aviezer, 2017), and Japan (Sogon & Matsutani, 1989). In all of these studies, recognition was assessed using a similar set of behaviors: expansive and forward movements with arms raised

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and hands in fists for anger (Atkinson et al., 2004; Coulson, 2004; Wallbott, 1998; Hubbard, 2016); backwards leaning and backwards movement, collapsed upper body, and raised arms with hands held out protecting the body and face for fear (Atkinson et al., 2004; de Gelder & van den Stock, 2011); and slumped shoulders, collapsed upper body, and a downwards head tilt with eye gaze averted towards the ground for sadness (Wallbott & Scherer, 1986; Nelson & Russell, 2011; see Figure 1).



Figure 1. Bodily expressions of neutral (far left), sadness (left middle), anger (right middle), and fear (far right) posed by a male (top row) and female (bottom row) target. Photos retrieved from the Bodily Expression Action Stimulus Test (BEAST; de Gelder & Van den Stock, 2011).

In the present pre-registered research (<https://osf.io/zrgc5>), we conducted the first test of whether these three bodily displays of emotion are recognized by individuals living in a small-scale traditional society separated from the industrial world. This approach has been referred to as the “maximally divergent population” test of universality (Heine & Norenzayan, 2005). If

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individuals from culturally isolated small-scale societies who are unlikely to have learned about Western emotion expressions through cross-cultural transmission reliably recognize bodily displays of emotion, it would provide strong support for the universality of these expressions. We addressed this question by examining recognition among the Mayangna – indigenous individuals living in the Bosawás Reserve, Nicaragua.

Notably, one prior study examined whether emotion-specific bodily behaviors reliably convey distinct emotions among members of an isolated small-scale society. However, this prior research used a different population (Kreung villagers in Ratanakiri, Cambodia) to study biological motion that can be inferred from points of light, rather than fully visible static bodily expressions (Parkinson, Walker, Memmi, & Wheatley, 2017). Kreung participants ($n = 16$) reliably identified anger expressions from moving points of light, but recognition of fear and sadness was not significantly greater than chance. Point-light displays are notably different from visible bodily expressions, as they isolate movement cues by minimizing or completely removing visual information about the behaviors themselves. As a result, a bodily expression in which arms are held in front of the body with hands in fists (i.e., anger) would, in a point-light display, appear identical to an expression in which arms are held in front of the body with the hands facing palm-out protectively (i.e., fear). Indeed, this may be one reason that point-light displays yield lower recognition rates than fully visible bodily expressions (e.g., Atkinson et al., 2004).

In a separate study, Parkinson and colleagues (2017, Study 1) tested whether fully visible bodily expressions displayed by a performer from the Kreung community were recognized by North American participants. These displays were not developed in a systematic way, and thus represented one Kreung individual's beliefs about the movements involved in each expression.

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The study's finding, that several Kreung displays were reliably recognized by Americans, is therefore informative but addresses a somewhat different question than the present research.

The current research, in contrast, tests whether individuals living in a small-scale traditional society recognize fully visible bodily displays of emotion that have been validated to be recognizable among Western populations (de Gelder & Van den Stock, 2011). In doing so, it adds to a small but growing literature suggesting that nonverbal behavior beyond the face may constitute a universal feature of emotion communication (e.g., Sauter, Eisner, Ekman, & Scott, 2010). Although prior studies examined similar questions for facial expressions of emotion, little research has examined this issue for bodily expressions, and, in fact, several early researchers suggested that bodily expressions are unlikely to generalize across cultures (Ekman & Friesen, 1967). The present research challenges this assumption.

Method

Participants

One hundred nineteen adults over the age of 17 were recruited from the Mayangna community in the Bosawas Reserve, Nicaragua. This community was comprised of indigenous Mayangna¹ horticulturalists living primarily in the forested region of the Bosawas Biosphere Reserve (Winking, Eastwick, Smith, & Koster, 2018; Koster, 2018; Koster, Grote, & Winterhalder, 2013). We aimed to recruit as many members of this community as possible. Six participants did not complete the study, and were therefore removed from analyses. Our final sample thus consisted of 113 individuals (62 Female, M age = 34.45 years; SD = 14.68 years).

These individuals are likely to have little knowledge of Western global culture, for several reasons. Only 16% indicated that they could read and write fluently in Spanish – the

¹ Roughly 15% of participants in this community identify as Miskito, rather than Mayangna. Given that the large majority identify as Mayangna, we refer to the sample as Mayangna.

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national language of Nicaragua. They had little formal education ($M = 5.97$ years, $SD = 4.15$ years) and minimal exposure to western media (73% had never seen a US movie, 84% had never seen a US television program, and 79% had never used the internet). Nearly all participants had never left Central America (97%) or Nicaragua (95%). Roughly half (47%) reported leaving their village once per year or less, and the other half (49%) reported leaving the village roughly once per month. That said, some of these individuals might have experienced some minimal exposure to western culture as a result of meeting members of the current research team (or previous research teams) as well as sporadic visits from non-indigenous health officials, conservationists, or representatives. Older members of the community might have encountered American military personnel during the Contra war in the 1980s.

Materials

Two targets (1 male, 1 female) posing bodily expressions of anger, sadness, fear, and neutral were selected from the Bodily Expressive Action Stimulus Test (BEAST; see Figure 1). The BEAST is comprised of whole-body expressions of anger, fear, sadness, neutral, and happiness, with the face of each actor blurred and bodies fully visible. We chose to focus on expressions of anger, fear, and sadness for several reasons. First, by exclusively examining negatively valenced emotions, we ensure that recognition accuracy is not attributable to an ability to discriminate on the basis of valence alone. Second, there is strong evidence for recognition and discrimination of these three bodily expressions, whereas recognition and discrimination of positive emotion bodily expressions is much weaker (see Witkower & Tracy, 2019; de Gelder & Van den Stock, 2011). Finally, displaying and recognizing distinct bodily expressions of anger, fear, and sadness would likely have had adaptive advantages for both

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expressers and perceivers in humans' evolutionary history, raising the possibility that these displays are human universals.

Expressions of anger, fear and sadness from the BEAST were recognized at rates greater than 90% across all targets in the original study validating the set among 19 European undergraduate students (de Gelder & Van den Stock, 2011). For the two specific targets used in the current study, all three bodily expressions were recognized at rates greater than 95% in the original validating study. Nonetheless, to ensure that these images are reliably recognized by Western, Educated, Industrialized, Rich, Democratic (i.e., WEIRD; Henrich, et al., 2010) participants using the method we intended to use with our non-WEIRD sample, we recruited 150 Americans from Amazon Mechanical Turk to participate in a pilot study with a procedure nearly identical to that used among the Mayangna. All four nonverbal expressions were recognized by American M-Turk workers at rates greater than 90% (all $ps < .001$; see SOM for methodological details and more results).

Procedure

Given our goal of recruiting individuals who are unlikely to have knowledge of Western emotion expressions as a result of cross-cultural transmission, we first endeavored to assess participants' familiarity with global popular culture, by asking them to identify images of 13 highly recognizable cultural icons: Donald Trump, Barack Obama, Hillary Clinton, Oprah Winfrey, Will Smith, Brad Pitt, Taylor Swift, LeBron James, Lionel Messi, Cristiano Ronaldo, Michael Jordan, Elvis Presley, and Abraham Lincoln. To assess participants' exposure to the culture of industrialized Nicaragua, we also showed them an image of Daniel Ortega, the current President of Nicaragua who served as head of state in non-concurrent terms for 22 of the 40 years preceding data collection. For each image, participants were asked "Who is this?". On

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average, participants correctly identified fewer than one of the 13 cultural icons ($M= 0.54$ images, $SD = .86$, Mode = 0; Range = 0 to 3), and 67% correctly identified Ortega. Next, all participants completed a separate study examining how nonverbal behavior influences perceptions of prestige and dominance (see Witkower, Hill, Pun, Baron, Koster, & Tracy, under review).

Participants then completed the main study, which involved responding to a series of eight trials in which they were shown one target individual posing four bodily expressions: anger, sadness, fear, and neutral. Participants were asked to “Please select the image in which the person is angry [afraid, sad, neither happy nor sad]”.² We used the phrase “neither happy nor sad” to refer to the neutral expression because the local language does not have a clear translation for the word neutral, or the word calm – a close synonym that is sometimes used to refer to neutral expressions in emotion recognition studies (Tottenham et al., 2009). As a result of this unanticipated translation issue that forced us to deviate from our pre-registered plan, the resulting prompt is somewhat vague (i.e., bodily expressions of anger or fear could be considered “neither happy nor sad”), so neutral-expression recognition rates should be interpreted with caution.³ All instructions and prompts were translated from English to Spanish, then back-translated from Spanish to English, prior to the study. They were subsequently translated from Spanish to the Mayangna and Miskito languages on-site by J.K. and two research assistants

² Although adding multi-word or full phrase definitions, instead of relying on single-word prompts, might have been helpful in ensuring accurate translations, the addition of contextualizing information can also result in culturally biased representations of each emotion, opening the door to a different set of limitations. However, it is possible that recognition rates would be different—and in all likelihood, higher—if more information was provided for each emotion; future studies are needed to probe this issue.

³ Given that participants selected an image from a set of four in response to an emotion-word prompt, and did *not* select an emotion label from a list of options, the noted translation issue applies only to prompts, not to participants’ selections.

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fluent in Spanish, Mayangna, and Miskito (for all original materials in English, Spanish translations of those materials, and Spanish-to-English back-translations, see osf.io/tg3fe).

Participants completed eight randomly ordered trials in which they were asked all four prompts for both target individuals. The order in which the four nonverbal displays appeared (from left to right) was randomized across the eight trials. We preregistered our hypothesis that participants would accurately recognize all bodily expressions at rates significantly greater than chance (<https://osf.io/zrgc5>). Prior to completing any part of the study participants provided informed consent.

Results

To determine whether participants reliably recognized bodily expressions of emotion, we used binomial tests to compare the proportion of participants who selected the expected emotion expression in response to each prompt to the proportion that would have selected that option just by chance (i.e., 25%, given the four options).

Pre-registered analyses

In line with our pre-registered analysis plan, we first analyzed recognition rates collapsing across participant and target sex. Recognition rates were significantly greater than chance for all expressions: 86% for sadness (95% CI: [81% to 90%]), 73% for anger (95% CI: [66% to 78%]), 54% for neutral (95% CI: [47% to 60%]), and 47% for fear (95% CI: [40% to 54%]), all $ps < .001$; see Table 1, Table 2, and Figure 2). None of these rates varied by target sex, $\chi^2s < 2.15$, $ps > .18$, or participant sex, $\chi^2s < 2.15$, $ps > .18$. Recognition rates separated by target and participant sex, as well as unbiased hit rates reflecting a similar pattern to that reported here, are reported in the SOM.

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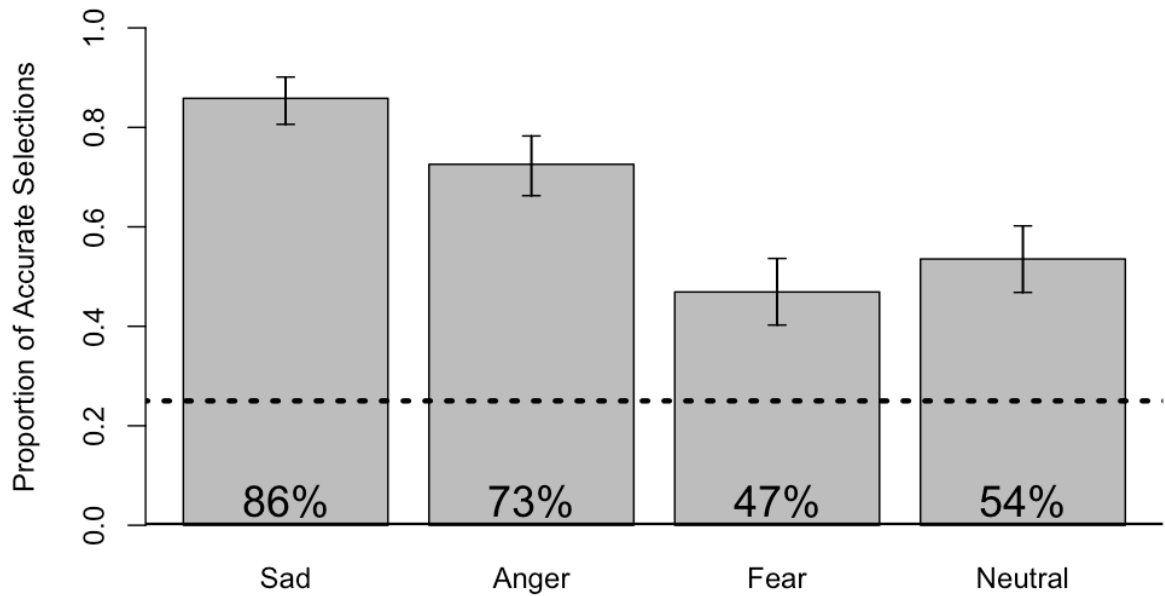


Figure 2. Mean recognition rates for each emotion expression among Mayangna participants. The dotted line indicates chance guessing (25%). Error bars represent 95% binomial confidence intervals.

Table 1. Mayangna participants' accurate selection rates for each expression.

Emotion Expression	Recognition Rate	95% CI	One sample binomial test (chance = 25%)
Sadness	86%	[81% to 90%]	$p < .001^{***}$
Anger	73%	[66% to 78%]	$p < .001^{***}$
Fear	47%	[40% to 54%]	$p < .001^{***}$
Neutral	54%	[47% to 60%]	$p < .001^{***}$

Table 2. Confusion matrix showing the proportion of selections made in response to each prompt.

Prompt	Nonverbal display selected			
	Sadness	Anger	Fear	Neutral
Sadness	86%	1%	2%	11%
Anger	4%	73%	17%	7%
Fear	40%	4%	47%	9%
Neutral	17%	16%	14%	54%

Exploratory analyses

As a more stringent test of our hypothesis, we next analyzed data only for those participants who failed to recognize *any* of the 13 global icons, or the current President of Nicaragua who served as head of state in non-concurrent terms for 22 of the 40 years preceding data collection. We also excluded participants who had ever left Nicaragua, used the internet, or seen an American television show or movie. The resulting subsample, which we refer to as the *highly isolated* subsample, consisted of 30 individuals (23 female, M age = 40.00 years; SD = 17.33 years). Nineteen of these 30 participants (63%) reported leaving their village once a year or less, and seven of these 19 had never left.

Collapsing across participant and target sex, recognition rates were significantly greater than chance for all expressions in this highly isolated subsample: 77% for sadness (95% CI: [64% to 87%]), 65% for anger (95% CI: [52% to 77%]), 50% for neutral (95% CI: [37% to 63%]), and 43% for fear (95% CI: [31% to 57%]), all $ps < .001$; see Tables 4 and 5, Figure 2). However, it is noteworthy that sadness expressions were selected in response to the fear prompt at the same rate as fear expressions were.

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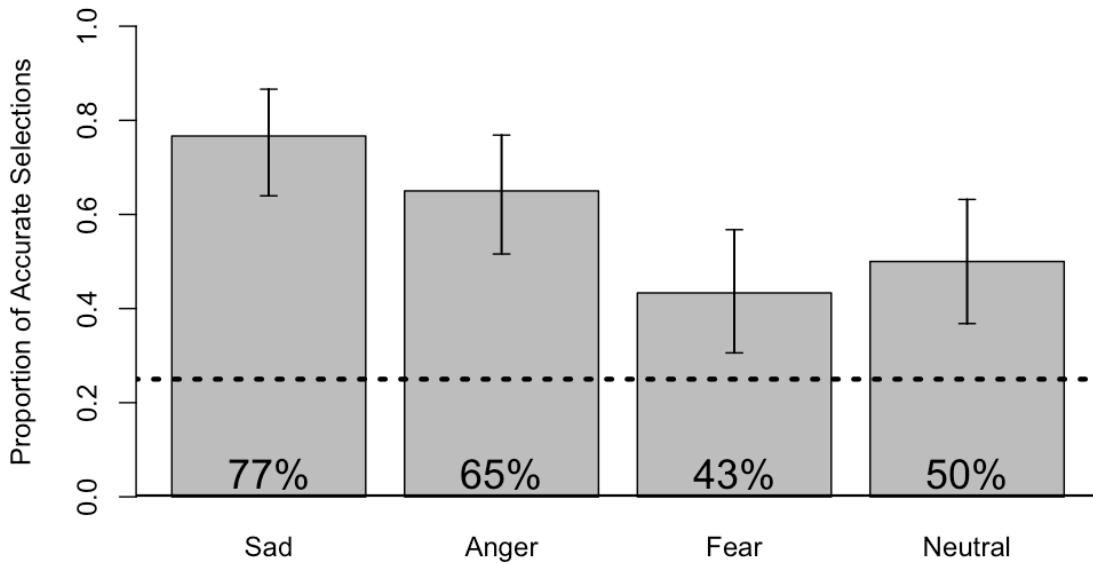


Figure 2. Mean recognition rates for each emotion expression in the highly isolated subsample. The dotted line indicates chance guessing (25%). Error bars represent 95% binomial confidence intervals.

Table 3. Highly isolated participants' accurate selection rates for each emotion expression.

Emotion Expression	Recognition rate	95% CI	One sample binomial test (chance = 25%)
Sadness	77%	[64% to 87%]	$p < .001^{***}$
Anger	65%	[52% to 77%]	$p < .001^{***}$
Fear	43%	[31% to 57%]	$p < .001^{***}$
Neutral	50%	[37% to 63%]	$p < .001^{***}$

Table 4. Confusion matrix showing the proportion of selections made in response to each prompt, for participants in the highly isolated subgroup.

Prompt	Nonverbal display selected			
	Sadness	Anger	Fear	Neutral
Sadness	77%	3%	2%	18%
Anger	7%	65%	22%	7%
Fear	43%	3%	43%	10%
Neutral	17%	22%	12%	50%

Discussion

The present research is the first to test whether bodily expressions of sadness, fear, and anger posed by individuals of Western European descent are reliably recognized by indigenous individuals living in a highly isolated traditional small-scale society. All three expressions were recognized at rates significantly greater than chance, by the full sample and a more highly isolated subsample. Given that the Mayangna—especially those who had never used the internet or seen American TV or films; could not identify popular global icons or their own country’s president; and could not read, write, or fluently speak Spanish—are unlikely to have learned these expressions through cross-cultural transmission, their ability to accurately recognize them provides strong support for the expressions’ universality. That said, recognition rates for fear were more modest, especially among the highly isolated subsample.

These results, at the very least, meet the criteria required for minimal universality laid out by Russell (1995): “a small but statistically significant amount of agreement across cultures in interpreting [facial] expressions” (p. 383). However, these results also suggest that more restricted models of universal affective dimensions, such as valence or arousal (as opposed to universal emotion categories) are unlikely to sufficiently account for the observed cross-cultural recognition, for several reasons. First, all emotions examined were negatively valenced, so participants’ ability to discriminate among them rules out a universal-valence-only account. Second, it is unlikely that participants were using differences in arousal to guide their selections, because in that scenario expressions of fear and anger – two high-arousal emotions (e.g., Russell & Feldman-Barrett, 1999) – would have been frequently confused with one another. Yet, when participants were asked to identify the fear expression, they were *least* likely to confuse it with

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anger. Instead, participants who made inaccurate selections in response to the fear prompt were most likely to select sadness— a *low* arousal emotion – followed by neutral, and then anger.

One explanation for this pattern of errors is that participants made distinctions based on approach/avoidance (Carver & Harmon-Jones, 2009). If this were the case, we would expect fear and sadness expressions, both of which are avoidance-oriented, to be frequently confused. It is noteworthy, however, that while participants often selected sadness expressions when prompted to identify fear, the reverse was not the case; they clearly distinguished sadness expressions from fear in response to the sadness prompt. In fact, sadness was recognized at a very high rate (77%), and neutral expressions – not fear – constituted roughly 75% of all confusions made in response to this prompt (11% in total); only 2% of participants selected fear. Overall, then, rather than distinguishing between approach and avoidance-oriented emotions, the Mayangna seem to show a specific difficulty responding to the fear prompt; future research is needed to address this issue.

Interestingly, observed recognition rates for sadness and anger bodily expressions were comparable to rates previously uncovered for corresponding facial expressions in small-scale traditional societies. For example, Ekman and Friesen (1971) asked members of the Fore of Papua New Guinea to select the facial expression of sadness from triptychs of photos portraying sadness, anger, and fear. Participants accurately selected the sadness expression 81% of the time – a rate similar to that found here. The methods used here were somewhat more stringent than those used by Ekman and Friesen (1971), as our participants selected from among four images instead of three, and responded to single-word prompts instead of sentence-long stories. It is therefore possible that, in certain cases, bodily expressions of emotions are as cross-culturally recognizable as their corresponding facial expressions, or even more so (see also Aviezer et al., 2012).

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One limitation of the present research is its reliance on a within-subject design, which can inflate recognition rates via a process of elimination and learning (DiGirolamo & Russell, 2017). For example, one possibility is that participants' responses to stimuli on previous trials guided their selections towards or away from certain responses on subsequent trials. Although this is certainly plausible and cannot be ruled out by the present data, the pattern of errors observed is somewhat inconsistent with this possibility. Specifically, 82% of participants selected the same expression posed by the same target in response to multiple trials at least one time, and in 59% of trials participants made a selection that was identical to their selection on a previous trial (i.e., a particular expression posed by a particular target). These error patterns indicate that participants were unlikely to be picking responses from those they had not previously used, and could even suggest that the use of such a strategy might be a culturally specific cognitive artifact of Western test-taking experiences, where a one-to-one question-to-answer assumption is often useful.

Another limitation is our reliance on static photographs rather than dynamic videos. Dynamic stimuli can increase ecological validity, and, perhaps as a result, have been found to yield higher recognition rates than static images (e.g., Wehrle, Kaiser, Schmidt, & Scherer, 2000). Future research is therefore needed to test whether the observed effects hold when using video-graphed displays. More broadly, future research is also needed to test whether the present findings hold across a range of methods, and, ideally, among additional populations. Observed recognition rates are influenced by a number of factors, including (but not limited to) the number of targets included, the number of trials, the number of "foil" displays presented in each trial, the size, quality, and features of the stimuli, the response method used (e.g., forced choice versus free-labeling), and the number and variety of response options (e.g., including "other" or "I don't know" options). All of these methodological options come with both costs and benefits, and

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while the method used here is vulnerable to previously proffered critiques of forced-choice methods (e.g., Russell, 1995), it provides a high level of efficiency and procedural simplicity, necessary for this sample and an entirely oral testing session. It is important to bear in mind, though, that the recognition rates uncovered here are not absolute; in fact, recognition rates should always be considered within the context of the methods used to detect them.

In a related vein, it is important to note that universal recognition does not mean an absence of cross-cultural variation (see Norenzayan & Heine, 2005), or that any variation is exclusively the result of methodological artifacts. Instead, we expect a universal ability to recognize bodily expressions of distinct emotion to be complemented by substantive cross-cultural variation due to processes of cultural evolution and culture-specific usage, valuation, and regulatory norms regarding the experience and display of each emotion.

In conclusion, the present research provides the first evidence that static, fully-visible bodily expressions of anger, sadness, and (to a lesser extent) fear are reliably recognized by members of an isolated small-scale traditional society, supporting the universality of these displays.

Declarations

On behalf of all authors, the corresponding author states that there is no conflict of interest. The study was performed to ethical standards as laid down in the 1964 Declaration of Helsinki. This work was supported by generous funding from a Social Sciences and Humanities Research Council Insight Grant (No. 435-2018-0154).

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