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Reading Emotions From Faces in Two Indigenous Societies

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That all humans recognize certain specific emotions from their facial expression—the Universality Thesis—is a pillar of research, theory, and application in the psychology of emotion. Its most rigorous test occurs in indigenous societies with limited contact with external cultural influences, but such tests are scarce. Here we report 2 such tests. Study 1 was of children and adolescents ($N = 68$; aged 6–16 years) of the Trobriand Islands (Papua New Guinea, South Pacific) with a Western control group from Spain ($N = 113$, of similar ages). Study 2 was of children and adolescents ($N = 36$; same age range) of Matemo Island (Mozambique, Africa). In both studies, participants were shown an array of prototypical facial expressions and asked to point to the person feeling a specific emotion: happiness, fear, anger, disgust, or sadness. The Spanish control group matched faces to emotions as predicted by the Universality Thesis: matching was seen on 83% to 100% of trials. For the indigenous societies, in both studies, the Universality Thesis was moderately supported for happiness: smiles were matched to happiness on 58% and 56% of trials, respectively. For other emotions, however, results were even more modest: 7% to 46% in the Trobriand Islands and 22% to 53% in Matemo Island. These results were robust across age, gender, static versus dynamic display of the facial expressions, and between- versus within-subjects design.

Keywords: facial expressions, indigenous societies, emotion perception, cross-cultural diversity

In the study of emotion in the 20th century, arguably the most influential research conducted were studies of emotional facial expressions in relatively isolated, illiterate, indigenous societies (Boucher & Carlson, 1980; Ekman, 1972; Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969; Sorenson, 1975, 1976). These studies seemed to show that certain emotions are signaled by certain specific facial expressions in a way recognized by all human beings—a claim we here call the Universality Thesis. The Universality Thesis is a current subject of much debate. In a survey conducted in 2014, the Universality Thesis was endorsed by a large majority (but not all) of emotion researchers (Ekman, 2016). In this article, we report two studies that challenge that thesis.

The initial studies of facial expressions in small-scale, indigenous societies contradicted then prevailing notions of emotions as social constructions and gave dramatic support to what became one of the prevailing research programs on emotion. These studies laid a foundation for a psychology of emotion in terms of a small number of biologically determined discrete emotions: basic emotion theory (Ekman, 1992; Izard, 1971). The signaling of emotion by the face has remained a key element in other research projects as well. The studies of facial signaling in indigenous societies inspired research on emotion signaling in other primates (Chevalier-Skolnikoff, 1973; Parr, Waller, & Fugate, 2005) and human infants (Camras & Shutter, 2010; Meltzoff & Moore,

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José-Miguel Fernández-Dols and Carlos Crivelli developed the study concept. All authors contributed to the study design. Carlos Crivelli and Sergio Jarillo performed data collection. All authors performed the data analysis and contributed to the interpretation of the results. Carlos Crivelli, James A. Russell, and José-Miguel Fernández-Dols drafted the article, and Sergio Jarillo provided critical revisions and wrote parts of the main text. All authors approved the final version of the manuscript for submission.

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1977). The theory of basic emotions, in turn, guided research in the neuroscience of emotion, in the psychophysiology of emotion, and on the cognitive antecedents of emotion (Ekman & Cordaro, 2011; Levenson, 2011). The theory led to applications from education (Izard & Bear, 1999; Izard, Fine, Schultz, Mostow, Ackerman, & Youngstrom, 2001; Izard, Trentacosta, King, & Mostow, 2004) to airport screening (Matsumoto, Frank, & Hwang, 2013). And, the theory continues to inspire important research, application, and theorizing.

Many cross-cultural studies of the Universality Thesis have been reported (e.g., Ekman et al., 1987; Izard, 1971; Kayyal & Russell, 2013; for review, see Nelson & Russell, 2013), but most were of literate societies in or in contact with Western culture and media. Indeed, participants were often college students whose textbooks might have presented the Universality Thesis (Russell, 1994). As Darwin (1872/1965) emphasized, only in relatively culturally isolated societies can a rigorous test be conducted of the thesis free from Western culture and media. As important as the studies of indigenous societies are, too few have been studied: the Sadong of Borneo and the Fore of Papua New Guinea (Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969; Sorenson, 1976), the Bahinemo of Papua New Guinea (Sorenson, 1975), and the Grand Valley Dani of Papua New Guinea (Ekman, 1972). To these were recently added participants from Burkina Faso of Western Africa (Tracy & Robins, 2008) and the Himba of Namibia, Southwestern Africa (Gendron, Roberson, van der Vyver, & Barrett, 2014). Plus, results from these indigenous societies do not present a consistent or convincing case for the Universality Thesis. Doubts can be summarized in three points: methodological challenges, range of results, and alternative explanations.

Methodological Challenges

A term for a predicted emotion may simply be absent in the local language; for example, Ekman (1972) found no term for disgust in the language of the Fore of Papua New Guinea. Even where a term exists, the translation might not be exact (Barger, Nabi, & Hong, 2010; Hurtado-de-Mendoza, Molina, & Fernández-Dols, 2013; Schweiger Gallo, Fernández-Dols, Pablo-Lerchundi, & Gollwitzer, 2014). In an indigenous society, psychological research presents more problems. The simple question-and-answer format familiar to Western college students can be intimidating in other cultures. Interaction with a stranger who does not look or speak as the participants do can invoke cultural norms unknown to the experimenter. Sorenson (1976), a member of Ekman's expedition to Papua New Guinea, described problems faced by experimenters who must use a translator because they do not speak the vernacular. Conversation between the local translator and the participants may have led participants to align their answers to the experimenter's expectations, at least as understood by the translator.

Range of Results

The Universality Thesis does not predict the precise proportion of participants who will match a specific facial expression with the predicted emotion. Haidt and Keltner (1999) suggested between 70% and 90%. By this standard, the studies of indigenous societies conducted in the 1960s and 70s produced mixed results (see Nelson & Russell, 2013, for a review). The smile was matched to happiness as predicted, but no other emotion consistently achieved this level of support. The two more recent studies of this question in indigenous societies similarly produced mixed results. With the Burkina Faso participants, Tracy and Robins (2008) found the predicted matching in proportions significantly above chance (set at 12.5%) but with a considerable range: overall matching was 47.5% with values ranging from 30% for fear and 33% for anger, to 84% for happiness.

With the Himba, on the other hand, Gendron, Roberson, van der Vyver, and Barrett (2014) used a method different from that used in previous studies of remote societies. They asked the Himba to sort photographs of facial expressions into groups. Sorting took place in one of two conditions. In a free sort, participants were left on their own. In a sort with concepts specified, the participants were first familiarized with the predicted emotion concepts. In the free sort, Himba participants failed to generate the groupings seen in the Western control group. In the concepts-specified sort, Himba participants generated groupings more similar to those seen in the Western control group. Gendron et al. concluded that their data challenged the Universality Thesis and provided an alternative explanation for previous findings with indigenous societies in studies in which the experimenters specified the emotion concepts to be used.

Alternative Explanations

When almost everyone in a sample matches a facial expression to the predicted emotion, then basic emotion theory provides the most straightforward explanation. But when a lower proportion of the sample does so, then other explanations become more plausible. For example, the statistically significant degree of recognition seen in indigenous societies might be sufficiently accounted for simply in terms of basic affective dimensions of valence and activation (Russell, 1980, 2003). Evidence supporting such an account has been found from preschoolers to adults (Russell & Bullock, 1985; Widen & Russell, 2004, 2008) as well as across several Western and Eastern societies (Russell, Lewicka, & Niit, 1989). If a participant recognizes that the expression is negative in valence and high in activation, then the choice among six emotion terms (*happy, surprised, afraid, angry, disgusted,* and *sad*) is reduced to a choice among three (*afraid, angry,* and *disgusted*). Such an outcome would be above chance if chance is taken to be one of six. Similarly, other than a specific emotion, participants might, when asked, reasonably have guessed the emotion if they recognized the expresser's appraisal of the situation faced (Scherer, 2009) or an action the expresser was prepared to enact (Fridja & Tcherkassof, 1997). Fridlund (1994) offered four such alternative explanations for matching that is significantly above chance but lower than that anticipated by the Universality Thesis. Russell (1994) offered four more alternatives.

In summary, a pillar of one of the prevailing research programs in the psychology of emotion is the Universality Thesis that all humans recognize certain emotions from certain facial expressions. Science strives for repeated tests of its theories with increasingly rigorous methods. The reproducibility of all findings in psychology is currently in question (Open Science Collaboration, 2015). Available data testing the Universality Thesis in indigenous societies fails to converge on an agreed upon conclusion. Thus, a central question for theories of emotion is whether the results from

the original studies of indigenous societies can be replicated and, if so, to what extent.

Our Larger Research Project

The present studies are part of a larger project for which we assembled a multidisciplinary team to study emotions and facial expressions in two small-scale, indigenous societies of subsistence horticulturalists and fishermen relatively isolated from outside cultural influence: the Trobrianders (Milne Bay Province, Papua New Guinea) and the Mwani (Cabo Delgado Province, Mozambique). The researchers gathering data from these indigenous societies consisted of a psychologist (Carlos Crivelli) and an anthropologist (Sergio Jarillo). This same research team gathered the data in both locations (and in a Spanish control group reported here), thus increasing the similarity of the inevitable informal aspects of data collection.

Conducting research in an indigenous society is obviously challenging. Strangers are rare, strangers whose physical appearance is very different from that of the indigenous people even rarer, and answering questions posed by these strangers rarer still. Tasks common in Western schools may be unfamiliar in other societies. Something can be lost when questions are conveyed through translators. To lessen such methodological challenges, we took special precautions. The two researchers both learned the local vernacular and spent a long period of familiarization in the communities from which participants were recruited. They carried out a large number of studies in both sites.

Jarillo spent a total of 21 months in the Trobriand Islands, obtaining a knowledge of the vernacular and Trobriand sociocultural practices and values and creating a valuable network of informants and collaborators in Kiriwina, Kaileuna, Kitava, Vakuta, and Tuma islands. His Trobriand adopted family and primary field site is in Yalumgwa (Kiriwina Island). Crivelli spent a total of seven months in the Trobriand Islands, similarly establishing a network of informants and collaborators in Kiriwina, Kaileuna, Vakuta, Kuyawa, and Munwata. His adopted family and primary field site is in Kaisiga (Kaileuna Island).

Prior to fieldwork, both Jarillo and Crivelli studied the grammar and vocabulary of Kilivila, the language of the Trobriand Islands, based on previous work by a linguist (Senft, 1986, 2010), missionaries (Baldwin, n.d.; Fellows, 1901), and anthropologists (e.g., Hutchins, 1980). Nonetheless, this prior work had to be supplemented with work in the community interviewing locals, especially to map the vernacular lexicon for emotion.

Jarillo selected Matemo Island, whose inhabitants are called Mwani, as the second field site with the aid of an anthropologist with extensive knowledge of some Bantu languages. The official Mozambican language is Portuguese, a language that Jarillo and Crivelli speak fluently, but few Mwani speak it fluently. Instead, Mwani of Matemo Island speak Kimwani, a language of the Kiswahili cluster (Petzell, 2002). Still, there is some overlap in vocabulary (e.g., the concept of emotion itself, "ku-sintiri," is a word borrowed from the Portuguese "sentir"). The researchers studied the grammar and vocabulary available for Kimwani (e.g., Abudo, Aquimo João, Bacar, Buana, & Sousa, 2009; Floor, 2000), but again had to extend their knowledge of the language locally, in part with the help of bilingual (Portuguese-Kimwani) informants. To do so, Jarillo and Crivelli spent 2 months together doing fieldwork in Matemo Island.

Adults in both field sites have occasional contact with outsiders. Thus, in the studies reported here the participants were children and adolescents, who are less likely to have been influenced by contact with Western culture. Our team carefully observed and then adopted native ways and manners for adult-child interaction.

Study 1: The Trobrianders of Papua New Guinea

The Trobriand Islands (Milne Bay Province, Papua New Guinea; see Malinowski, 1935/1965; Weiner, 1988) are a small archipelago of raised coral atolls in the Solomon Sea (South Pacific). Trobrianders are characterized by similar sociocultural traits and the exclusive use of the Austronesian Kilivila language (Senft, 1986). The Trobriand Islands' geographic and cultural isolation has largely preserved myths, rituals, sorcery, and witchcraft, as well as other ancient customs (e.g., gardening, traditional healing methods, material and immaterial culture), becoming a key place for anthropological fieldwork since the foundation of social anthropology (Young, 1998).

Trobrianders live in villages and hamlets traditionally built with bush materials (trees, palms, and coconut fronds), although recent governmental antideforestation plans have introduced corrugated iron roofing and other building materials from the mainland. Nowadays, there is no electricity, no running water, and no sewers, with chiefs and commoners sharing similar standards of living. Population density in the main island (Kiriwina) is high. The absence of extractive, industrial, and commercial enterprises in the archipelago has favored isolation from outside influences as well as the preservation of traditional gardening and fishing subsistence practices.

Christian religion has been the major external influence upon the Trobrianders' customs. Although Methodist and Catholic missions have been present in the archipelago since the beginning of the 20th century, a syncretic acculturation process has developed with the years. For instance, education—although not customary—is controlled by the Christian missionaries. Attempts to teach schoolchildren how to read and write in their own vernacular have failed, provoking high dropout rates because of the scarce number of teachers, poor infrastructure, and the need to support the extended family's daily activities. In all elementary and some primary schools, children are instructed in Trobriand culture, such as environmental knowledge (e.g., names of botanical and animal species), traditional folklore (e.g., dancing, storytelling) and more practical manual endeavors (e.g., woodcarving and weaving). During school hours, children often engage in tasks such as cutting the grass adjacent to the school with bush knives, cleaning the classrooms, or planting subsistence crops. Practical knowledge and hands-on experience is a key element to prepare children and adolescents for adult life.

In the present study, photographs of six faces were spread before the participant, who was asked to point to the person who felt a specific emotion. We used this choice-from-array procedure with children and adolescents from the Trobriand Islands and with a Western control group (Spaniards). It was the simplest task we could find requiring nothing more from participants than pointing, and all participants readily performed the task. Five emotions were queried represented by emotion labels translated from English

(*happy, sad, anger, fear*, and *disgust*) in a between-subjects design. The facial stimuli to be matched to an emotion label were still images displaying prototypical facial expressions of alleged basic emotions plus one neutral expression.

Method

Indigenous participants. Sixty-eight children and adolescents (M age = 11.57 years, SE = 0.29, age range: 6–16 years; 43 male) were recruited in schools in the south of Kaileuna Island and in the southwestern, northeastern, and central areas of Kiriwina Island. Fifty-two participants neither spoke nor understood English, 15 spoke some English words, and one was fluent in spoken English. Participants had nonexistent to very limited visual contact with Western culture.

Prior to fieldwork, we asked the highest traditional authority in the Trobriand Islands (the Paramount Chief) as well as the members of Wapipi and Gusaweta Catholic Missions for their permission. We informed them of the scope of our studies but never disclosed the hypotheses we were testing. Locally, informed consent and authorization was obtained from headmasters, teachers, and other adults in charge. All participants freely agreed to collaborate with us, and they were thanked and rewarded with candy at the end of their participation.

Western participants. One hundred and 13 children and adolescents (M age = 10.04 years, SE = 0.10, age range: 8–12 years; 51 male) from Madrid (Spain) were recruited at Joyfe School (primary school division). Although 115 parents signed the informed consent form (previously approved by the schoolmaster), two participants did not attend school the day the study took place.

Emotion words. In an exploratory and descriptive phase of fieldwork in the Trobriand Islands, we conducted interviews aimed at mapping English emotion concepts onto Kilivila concepts. The experimenters' knowledge of the vernacular helped to clarify Kilivila emotion categories (Fernández-Dols & Crivelli, 2014) and to ascertain the feasibility of obtaining translations from English into the vernacular. Additionally, we relied on a prior ethnographic database of Trobrianders' emotion concepts generated in several islands of the archipelago with the help of mono- and bilingual informants (Senft, 1986, 2010). Adequate translations into Kilivila were found for happiness, sadness, anger, fear, and disgust: *mwasawa*, *ninamwau*, *leya*, *kokola*, and *minena,* respectively. No one-to-one translation for surprise was found (Crivelli, Jarillo, & Fridlund, 2016). For the Spanish sample, the emotion labels were the standard translations used in many previous studies: *alegría* (happiness), *tristeza* (sadness), *enfado* (anger), *miedo* (fear), and *asco* (disgust).

Facial expressions. Two sets (one male and one female) each consisting of six still photographs—five prototypical facial expressions of "emotion" and one neutral expression—were randomly selected from the Amsterdam Dynamic Facial Expression Set (ADFES, van der Schalk, Hawk, Fischer, & Doosje, 2011) and the Radboud Faces Database (RaFD, Langner, Dotsch, Bijlstra, Wigboldus, Hawk, & van Knippenberg, 2010). Images were formatted to a similar size (average size 7.4 cm × 5.2 cm), color-printed, and laminated. Details about the facial stimuli are provided in the Appendix.

Some researchers (Pochedly, Widen, & Russell, 2012; Barrett, Mesquita, & Gendron, 2011) advocate using behavioral descriptors for the facial stimuli (such as smile, pout, and scowl). A descriptive approach is consistent with ethological practice (Blurton-Jones & Woodson, 1979) and avoids the assumption that facial expressions are linked one-to-one to emotions (Fridlund, 1994). Nevertheless, we opted to add the traditional emotion descriptors customary in psychological research, although we add scare quotes to remind everyone that the descriptors need not imply a one-to-one correspondence to an emotion. The stimuli that we used were smiling "happy" faces, pouting "sad" faces, scowling "anger" faces, gasping "fear" faces, nose scrunching "disgust" faces, and "neutral" faces. In the remainder of this article, we occasionally add the emotion descriptors for clarity.

Procedure. The study was carried out entirely in the Trobrianders' vernacular, Kilivila, during class time. To avoid leaking of information, participants arrived sequentially to an isolated testing area. Instead of returning to class, participants were sent to an isolated playing area with no contact with yet-to-be-tested children. At the testing area, participants sat on a mat while the experimenters introduced themselves and conducted a brief interview to establish rapport.

Participants were randomly assigned to one of 5 conditions (one for each of 5 emotion labels). The experimenter next read the instructions: "Today, I brought pictures of one child from my village. I want you to see these pictures and touch the picture of the X [happy, sad, anger, fear, or disgust] face only. Just touch it with your hand." Participants had to choose, from an array of six faces (i.e., smiling "happy," pouting "sad," scowling "anger," gasping "fear," nose scrunching "disgust," and "neutral" faces), the facial expression they thought matched the emotion label given. Participants completed two trials sequentially, one with the set of male faces and the other with the set of female faces. The order by which the male or female poser's sets were presented was random.

The procedure followed for Spanish participants was identical to that followed with Trobrianders.

Placement of target face. There were two conditions regarding the placement of the target faces in the array: contrast versus no contrast. In the contrast condition, the target face was placed between the neutral and an opposite valence face (e.g., the smiling "happy" face was placed between neutral face and, e.g., the pouting "sad" face; the pouting "sad" face was placed between neutral and the smiling "happy" face). In the no-contrast condition, target faces were placed randomly in the array. Participants were randomly assigned to receive the contrast or no-contrast order on the first trial with the other condition on the second. The contrast versus no-contrast position of the target face among distractors had no impact on Trobrianders' or on Spaniards' matching of faces and emotions. McNemar tests showed no significant differences between conditions, $\chi^2(1, N = 68) = 0.06$, $p = .999$, $\varphi = 0.46$ for the Trobriand sample and $\chi^2(1, N = 113) = 0.9$, $p = .344$, $\varphi = 0.34$ for the Spanish sample. The contrast versus no-contrast variable was therefore omitted from subsequent analyses.

Results

Matching faces to words. The overall mean proportion of participants who matched the given emotion label to the predicted face was, among Trobrianders, .32, but, among Spaniards, .93. The difference between Spaniards' and Trobrianders' proportions was significant for both the first trial (estimated difference between

proportions = .57, 95% CI [0.44, 0.69]) and the second trial (estimated difference between proportions = .64, 95% CI [0.51, 0.74]).

Matching did not improve from the first to the second trial for either society. For Trobrianders, estimated difference of proportions between the second (.31, 95% CI [0.21, 0.43]) and the first trial (.34, 95% CI [0.24, 0.46]) was close to zero (−0.03, 95% CI [−0.19, 0.13]). For Spaniards, estimated difference of proportions between the second (.95, 95% CI [0.89, 0.98]) and the first trial (.91, 95% CI [0.84, 0.95]) was also close to zero (0.04, 95% CI [−0.04, 0.11]).

Responses varied with facial expression. In the Trobriand sample, only the smiling "happy" face was matched with the predicted emotion, happiness, by a majority of respondents (.58). Pouting "sad" and gasping "fear" faces were chosen as the modal category for their predicted emotion labels (.46 for sadness and .31 for fear), although not by a majority. Predicted emotions for the nose scrunching "disgust" and scowling "anger" faces were not modal, but were the second (.25) and last (.07) choices, respectively. In the Spanish sample, all the predicted facial expressions were matched to their predicted emotion labels by a majority and were modal choices; the nose scrunching "disgust" face had the lowest (.83) and the smiling "happy" face (1.0) the highest proportion of matches (see Table 1).

Nonpredicted responses were revealing. Trobrianders selected neutral faces as their second choice for happiness (.23) and as third choice for sadness labels (.19). The inclusion of a neutral face as a response option might explain a 30% difference in results for happiness between present data and previously published forced-choice studies in indigenous societies (see Nelson & Russell, 2013, p. 11; *Mdn* = 88% for smiling "happy" faces where no neutral face was included). The low proportion of matching the "anger" scowl to the label anger (.07) was related to confusions among scowling "anger," nose scrunching "disgust," and gasping "fear" faces. For example, the gasping "fear" face was equally distributed across anger (.30), fear (.31), and disgust (.29) labels (chi-square goodness-of-fit tests for given probabilities with simulated *p* value based on 10,000 replicates for the female poser, $\chi^2 = 7.64$, $p > .05$, and the male poser, $\chi^2 = 3.88$, $p > .05$). In the same vein, the nose scrunching "disgust" face was homogeneously selected as the corresponding face for sadness (.23), anger (.20), fear (.27), and disgust (.25) labels (chi-square goodness-of-fit tests for given probabilities with simulated *p* value based on 10,000 replicates for the female poser, $\chi^2 = 4$, $p > .05$, and the male poser, $\chi^2 = 3.09$, $p > .05$).

In the Spanish sample, what is called a "confusion" appeared between fear and disgust. Although nose scrunching "disgust" faces were mostly matched to the disgust label (.83), 15% of the participants matched the disgust label to the gasping "fear" face instead. The "disgust" nose scrunch was selected for the label anger.

Cross-cultural comparisons. The reliability of cross-cultural comparisons mentioned so far was confirmed with statistical tests. To combine data from the two trials, in this analysis, we summed a participant's matches for each label, with a response scored as a match when the participant selected the predicted face for the given label, zero otherwise. For each label, matching scores thus varied from 0 to 2: Participants could mismatch on both trials (0), match the predicted face on only one trial (1), or match on both trials (2). Matching scores from Trobrianders were lower than those from Spaniards. A Mann–Whitney test comparing Trobrianders' ($M = 0.65$, $SE = 0.10$, 95% CI [0.45, 0.85]) and Spaniards' ($M = 1.86$, $SE = 0.04$, 95% CI [1.78, 1.94]) matching scores showed that overall performance was significantly higher for Spaniards ($U = 1067$, $p < .0001$, $A = 0.86$). For each emotion label, the 95% confidence interval showed no overlap between Trobrianders' and Spaniards' matching scores (see Figure 1).

The results reported so far were robust over differences in gender. We found no significant difference in matching scores (range = 0–2) between female ($M = 0.76$, $SE = 0.18$, 95% CI [0.39, 1.13]) and male ($M = 0.58$, $SE = 0.12$, 95% CI [0.34, 0.82]) Trobrianders ($U = 483.5$, $p = .465$, $r = -.09$). In the same vein,

Table 1
Proportion of Trobrianders and Spaniards Who Matched a Facial Expression to an Emotion Label

	Facial expression					
Emotion label	"Happy": Smiling	"Sad": Pouting	"Angry": Scowling	"Fear": Gasping	"Disgust": Nose scrunching	Neutral
			Trobrianders (n = 68)			
Happiness	**.58**	.08	.04	.08	.00	.23
Sadness	.04	**.46**	.04	.04	.23	.19
Anger	.20	.17	**.07**	.30	.20	.07
Fear	.08	.27	.04	**.31**	.27	.04
Disgust	.18	.11	.08	.29	**.25**	.11
			Spaniards (n = 113)			
Happiness	**1.00**	.00	.00	.00	.00	.00
Sadness	.00	**.98**	.00	.00	.00	.02
Anger	.00	.00	**.91**	.00	.09	.00
Fear	.00	.07	.00	**.93**	.00	.00
Disgust	.00	.02	.00	.15	**.83**	.00

Note. Proportions are rounded up. Proportion of responses to the facial expression predicted by Ekman (2003) is in boldface.

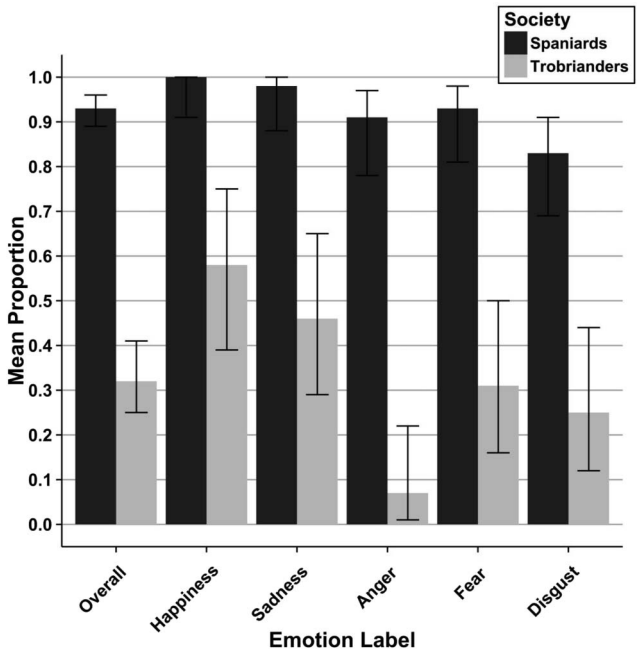

Figure 1. Matching scores and 95% CIs for Trobrianders ($N = 68$) and Spaniards ($N = 113$). Matching score is a mean across two trials (one trial for male faces and one for female faces) with a score of 1 for selection of the predicted face, 0 otherwise. Matching score is also the proportion of total trials in which the predicted face was chosen.

overall matching scores' proportion when participants selected their same- or opposite-gender arrays of faces were low (0.31 and 0.34, respectively). As an alternative to parametric approaches, we computed all possible permutations for the distribution under the null hypothesis, creating an empirical distribution of all permutations from observed data using R's *exactRankTests* library (Good, 2005; Hothorn & Hornik, 2015). The estimated difference between participants' and posers' opposite- and same-gender matching scores' proportions was negligible overall (0.03, 95% CI [−0.13, 0.19]) and showed a similar pattern when a two-sample permutation test was computed for every emotion label (see Table 2).

Uneven distribution within each sample as to age and gender raised the question whether the observed cultural difference was, at least in part, due to differences in age or gender. Table 3 shows the results of two additive binary logistic regression analyses: one in which participant and poser were of the same gender, the other for opposite gender (Hosmer, Lemeshow, & Sturdivant, 2013). In both models, the only predictor to retain in the final model was society (for same gender as poser, $\chi^2(1, N = 181) = 55.80$, $p < .0001$; for opposite gender from poser, $\chi^2(1, N = 181) = 52.68$, $p < .0001$). That is, in Step 1, age and gender were not significant and were, therefore, removed in Step 2. In Step 2, model fit was optimal, and the reduction of deviance was significant. As anticipated by Figure 1, the effect of society on matching scores was large. The odds of selecting the predicted face for every emotion label were 32.56 times greater for Spaniards than for Trobrianders in the trials with same gender, and 37.34 times greater in the opposite participant-poser gender.

Similarly, we found no significant relation of level of education (not speaking or understanding English vs. speaking and understanding a little English) to Trobrianders' matching scores (mismatching both trials vs. matching at least one trial), $\chi^2(1, N = 68) = 1.25$, $p = .388$, $\varphi = 0.14$. The estimated difference of proportions between speaking or not some English on matching the emotion label to its target face in at least one trial was close to zero (0.16, 95% CI [−0.11, 0.40]).

Correspondence analysis. Correspondence analysis is a technique for examining the underlying dimensionality for two- and multiway contingency tables, displaying multivariate categorical data graphically (Greenacre, 1984, 1993). The goal of correspondence analysis is to extract a reduced number of dimensions to portray the structure of the data in a contingency table. To accomplish this goal, correspondence analysis relies on chi-square distances (a weighted euclidean distance) and principal inertias (which, like eigenvalues, show the amount of inertia accounted for by each dimension).

We used R's *ca* library to compute a correspondence analysis on Trobrianders' Table 1 values (Nenadic & Greenacre, 2007). The first and second axes' cumulative principal inertias accounted for 97.7% of the total inertia (see Table 4). We therefore retained a two-dimensional structure to model the pattern

Table 2
Proportion of Trobrianders Who Matched the Predicted Facial Expression to Its Corresponding Emotion Label as a Function of Participants' and Posers' Gender

		Participants' and posers' gender					
		Same		Opposite			
Emotion label	*n*	Matching	Mismatching	Matching	Mismatching	*p*	95% CI
Happiness	13	.62	.38	.54	.46	.999	[−.50, .33]
Sadness	13	.46	.54	.46	.54	.999	[−.43, .40]
Anger	15	.07	.93	.07	.93	.999	[−.20, .17]
Fear	13	.31	.69	.31	.69	.999	[−.40, .40]
Disgust	14	.14	.86	.36	.64	.385	[−.17, .56]
M		.31	.69	.34	.66	.855	[−.13, .19]

Note. Proportions are rounded up. *P*-values and 95% CIs for the difference of matching scores' proportions between participant's and poser's opposite and same gender were computed through two-sample permutation tests. The distribution under the null hypothesis was computed from all possible permutations. CI = confidence interval.

Table 3
Logistic Regression Model for Same and Opposite Participant-Poser Gender

Step	Predictor	B	*SE*	95% CI for odds ratio (*OR*) Lower	*OR*	Upper
		Same participant-poser gender				
1	Constant	−5.21	1.92			
	Society	.19	.50	12.20	32.56*	86.89
	Gender	−.81	.44	.19	.45	1.05
	Age	.19	.13	.94	1.21	1.57
2	Constant	−4.06	.63			
	Society	3.25	.44	11.02	25.86*	60.72
		Opposite participant-poser gender				
1	Constant	−5.76	1.92			
	Society	3.62	.52	13.43	37.34*	103.88
	Gender	−.49	.45	.26	.61	1.47
	Age	.20	.13	.95	1.22	1.57
2	Constant	−4.06	.64			
	Society	3.39	.47	11.87	29.63*	73.98

Note. Substantive significance for modeling the selection of the predicted face in the same participant-poser gender condition (final model): Nagelkerke $R^2 = .49$, Model (G^2) $\chi^2_{(2)} = 77.06$, $p < .0001$.
* $p < .0001$.

of association between rows (emotion labels) and columns (facial expressions).

A large proportion (67.1%) of the total inertia was displayed along the first principal axis (i.e., the first dimension). This dimension was readily interpretable as the traditional valence dimension. As shown in Figure 2, smiling faces, neutral faces, and the label happiness fell on the right. Pouting, nose scrunching, gasping, and scowling faces with their corresponding predicted emotion labels fell on the left. The strength of the association was high: for the smiling face, $r = .99$; for happiness label, $r = .98$; for fear label, $r = -.79$; and for nose scrunching face, $r = -.93$.

The second dimension explained 30.4% of the total inertia and was readily interpretable as the traditional activation dimension found in studies of perception of facial expressions. It contrasted the sad label at one end with the anger label, disgust label, and the "fear" face at the other.

Table 4
Trobrianders' Principal Inertias and Relative Percentages of Explained Inertia

Dimension	Principal inertia	Explained inertia %	Cumulative %
1	.281	67.1	67.1
2	.127	30.4	97.6
3	.009	2.2	99.7
4	.001	.3	100
Total	.418	100	

Note. Principal inertias and percentages of explained inertia are rounded up. The inertia is the weighted average of squared χ^2 distances between the row/column profiles and their average profile. Principal inertias are the amount of inertia accounted for by every dimension.

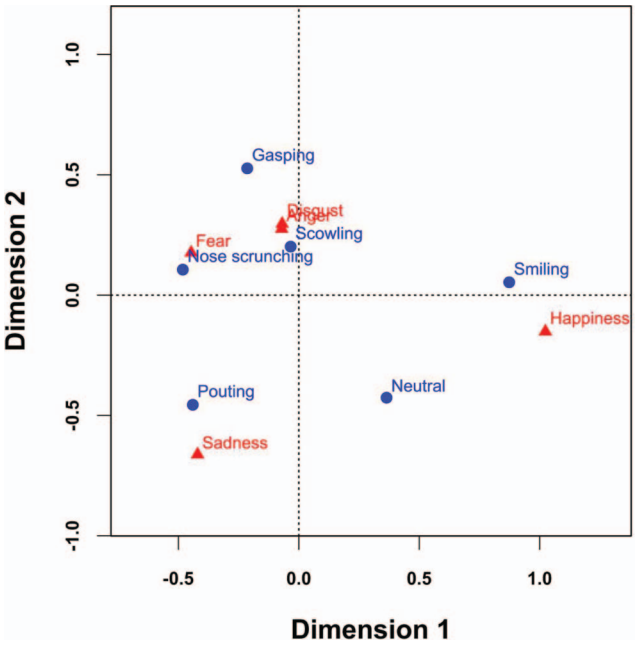

Figure 2. Two-dimensional solution for correspondence analysis applied to Trobrianders matching a prototypical facial expression of "emotion" (projected in the biplot as dots) to an emotion label (projected in the biplot as triangles). See the online article for the color version of this figure.

Discussion

In associating facial expressions with discrete categories of basic emotions, participants from an indigenous society showed some but very little resemblance to participants from a Western society. This finding speaks against the theory that perception of these discrete emotions from facial expressions is universal. With a method similar to that used in prior studies, Spaniards yielded results highly similar to those previously found with Western societies (Nelson & Russell, 2013). With the same method, however, Trobrianders yielded results that differed markedly from those found in Western societies. This finding with Trobrianders was robust across differences in gender, age, and education. The differences between Spaniards' and Trobrianders' matching of discrete emotions to facial expressions invites alternative interpretations that emphasize cultural diversity in human judgments of emotions (Medin & Bang, 2014).

On the other hand, Trobrianders' pattern of association between emotion labels and facial expressions was far from random and was highly consistent with Westerners' associations in one respect. In both groups, face-emotion matching suggested underlying perceptual dimensions of valence (first axis of Figure 2) and activation (second axis). This pattern is consistent with a dimensional account of the perception of emotion from facial expressions (Gerber et al., 2008; Russell, 1997; Russell, Bachorowski, & Fernández Dols, 2003; Schlosberg, 1954). This pattern also reinforces the alternative interpretation offered by Russell (1994) for above-chance matching of facial expressions to discrete emotions found in prior cross-cultural studies.

Study 2: The Mwani of Mozambique

Despite the addition of Study 1, the number of indigenous societies studied remains very low. Accordingly, Study 2's main goal was to test the same hypotheses in another indigenous society, but with certain methodological changes from the design of Study 1. We tested whether greater evidence of matching faces to discrete emotions might occur (a) with a within-subjects design than occurred with the more conservative between-subjects design of Study 1 (see Yik, Widen, & Russell, 2013) and (b) with more ecologically valid dynamic facial expressions rather than the static expressions of Study 1 (Fernández-Dols & Ruiz-Belda, 1997; Krumhuber, Kappas, & Manstead, 2013).

Study 2 was conducted with the Mwani of Matemo Island, an indigenous African small-scale society that differs from Trobrianders of Papua New Guinea in many cultural dimensions (e.g., kinship, social and religious practices, language, social organization, economic system of subsistence, and diet). Matemo Island (Cabo Delgado Province, Mozambique) is located within the Quirimbas National Park at an approximate distance of 10 km east of mainland Mozambique. Matemo Island's estimated population is approximately 3,000 distributed in five villages (Palussança, Misaula, Secani, Namba, and Manacombo) spread from the Northern to the Southeastern coastal line. The island's interior and Western areas are almost entirely covered in coral outcrops, allowing for subsistence gardening (mostly papaya). Houses are made of coral stone and bush material, with some more recent dwellings built with cement and iron sheets. There is no running water, no sewers, and no electricity on the island.

Local people refer to themselves as Mwani ("people from the beach"), sharing unanimously two sociocultural features: religious practices (a mild syncretism between Sunni Islam and some pre-Islamic local customs) and a mating system (polygyny). Kimwani is a Bantu language with high lexical similarity to Kiswahili (although mutually unintelligible) that all Mwani speak in daily life (Maho, 2003; Petzell, 2002). Although Portuguese is Mozambique's official language and is taught at primary school, only the most educated speak it fluently.

The Mwani of Matemo are mostly subsistence fishermen. Men use basic fishing tools and techniques—line, net, trap, and spearfishing—whereas women and children exclusively engage in mollusk harvesting in the intertidal zones of the Northern and Western coast. Local men export to the Mozambican and Tanzanian mainland dried fish, octopus, and seashells in exchange for commodities or cash. A high rate of school dropout by adolescents results from the possibility of earning an income by fishing and mollusk harvesting as well as the tradition of early marriage.

In the present study, Mwani children and adolescents were asked to match emotion labels to facial expressions. As a between-subjects factor, they were randomly assigned to see either static (i.e., photographs) or dynamic (i.e., video clips) facial expressions. As a within-subjects factor, each participant was asked about five emotions represented by emotion labels—*happy, sad, anger, fear*, and *disgust*—as translated into the vernacular.

Method

The method was the same as in Study 1, except as noted and that the study was conducted entirely in Kimwani.

Participants. Thirty-six children and adolescents (M age = 9.33 years, SE = 0.44, age range: 6–15 years; 14 male) were recruited in Misaula, Namba, and Manacombo elementary and primary schools. One participant spoke Portuguese fluently, but the other participants had little or no knowledge of spoken Portuguese. No participant had ever traveled outside the island, and their visual contact with Western culture and interaction with non-Mwani people was nonexistent or very limited.

We asked the highest religious authority (the main imam of the island), the civil authorities, and the director of the three Matemo schools (Misaula, Namba, and Manacombo) for their permission, informing them of the scope of our studies, but never disclosing the hypotheses we were testing. Locally, informed consent and authorization was obtained from teachers and other adults in charge. All participants accepted freely to collaborate with us, and they were thanked and rewarded with candy at the end of their participation.

Emotion words. Emotion labels in Kimwani corresponding to happiness, sadness, anger, fear, and disgust were *radi*, *uzuni*, *nyongo*, *kopa*, and *kunua,* respectively (Petzell, 2002). We consulted bilingual informants such as school teachers, who confirmed that these emotion labels were in everyday use. We had conducted an ethnographic account of emotion concepts in Kimwani as part of our initial descriptive phase of fieldwork.

Facial expressions. Two sets (one male and one female) of smiling "happy," pouting "sad," scowling "anger," gasping "fear," nose crunching "disgust," and "neutral" faces were selected randomly from the Amsterdam Dynamic Facial Expression Set (ADFES, van der Schalk et al., 2011) with the proviso that posers were different from those of Study 1. For the dynamic condition, 12 clips were selected. From these, for the static condition, still images were framed to similar sizes (average 7.3 cm × 4.95 cm), color-printed, and laminated. During the study, video clips were displayed on one 13.3-in. monitor with a refresh rate of 60 Hz and resolution of 1440 × 900 (MacBook Air Intel HD Graphics 4000 512 MB). Details of the facial stimuli are provided in the Appendix.

Procedure. As in Study 1, similar procedures to avoid leaking of information among participants were observed. At the testing area, participants were randomly assigned to either static (n = 19) or dynamic (n = 17) display condition, to one of two orders of presentation of the labels (one random, the other its reverse), and to gender of poser.

The experimenter read the instructions in Kimwani. For the static condition, instructions were: "I brought some pictures of a boy and a girl from my village. I want you to see these pictures and point the X [*happy*, *sad*, *anger*, *fear*, or *disgust*] face only. Just show it to me with your hand." For every trial, an array of six static faces (one for each emotion plus neutral) was randomly displayed on the floor at an approximate viewing distance of 40 cm. As in Study 1, participants had to match one facial expression to the previously mentioned basic emotion label (see Figure 3A).

For the dynamic condition, the instructions were as follows: "I brought some short movies of a boy and a girl of my village. I want you to see these movies and point to the X [*happy*, *sad*, *anger*, *fear*, or *disgust*] face only. Just show it to me with your hand." Participants had to match, from an array of six dynamic faces (i.e., same as in the static condition), one facial expression to the previously mentioned basic emotion label. All six dynamic faces

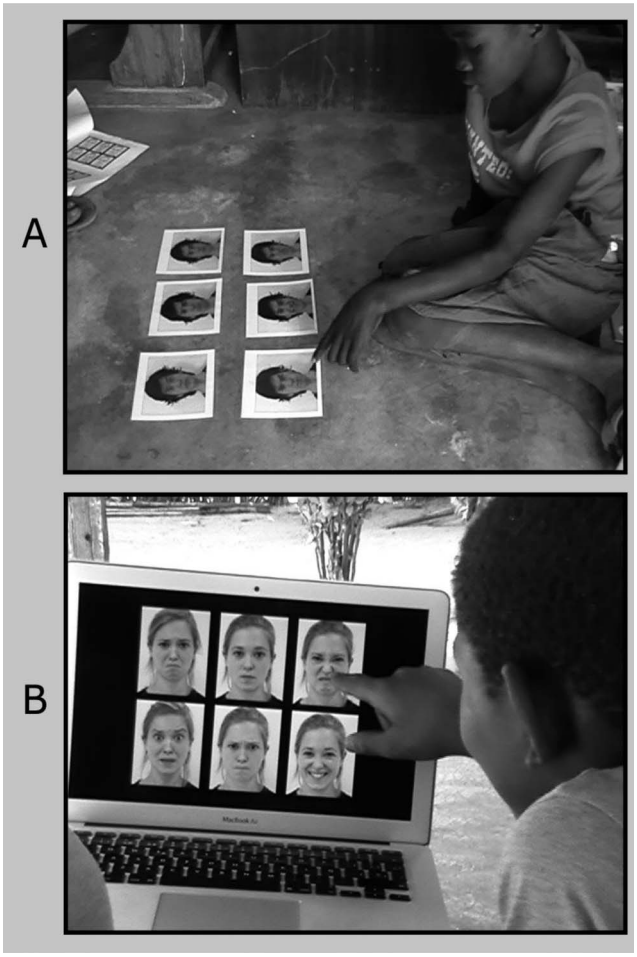

Figure 3. Mwani matching an emotion label to an array of static (A) or dynamic (B) facial expressions of "emotion."

were displayed on the screen simultaneously, and they were looped three times (see Figure 3B). Participants sat on the floor at an approximate distance of 26 cm from the screen and next to the experimenter who was holding the laptop, with animations (average size 6.5 cm × 4 cm) subtending 14.25° (vertical) and 10.08° (horizontal) of visual angle.

Scoring. A response was scored as a match if, given an emotion label, the participant selected the predicted face, 0 otherwise. Overall matching scores could range from nonpredicted responses on all trials (0) to matching the predicted face on all five trials (5).

Manipulation checks. Mann–Whitney tests showed that the order of stimulus presentation (for randomized order, $M = 1.78$, $SE = 0.30$, and for the reversed order, $M = 2.06$, $SE = 0.27$), and being randomly assigned to a male ($M = 2.00$, $SE = 0.31$) or a female ($M = 1.82$, $SE = 0.26$) poser had no significant impact on overall matching scores ($U = 139$, $p = .427$, $r = -.13$ and $U = 150.5$, $p = .763$, $r = -.06$, respectively).

Although we allowed participants, in the dynamic condition, to watch the videos a maximum of three times, all participants pointed at a moving face on the screen before three repetitions were completed. Several debriefing interviews showed that the dynamic condition task was not reported as difficult, but as compelling.

Results

Matching faces to words. The overall mean proportion of Mwani who selected the predicted face for the discrete emotion specified was low (.38). Smiling "happy" (.56) and gasping "fear" (.53) faces were selected as predicted by a majority of respondents, whereas nose scrunching "disgust" (.39), pouting "sad" (.22), and scowling "anger" (.22) faces were not. McNemar tests for given probabilities computed with simulated *p*-values based on 10,000 replicates to assess the distribution of facial expressions' frequencies along the different emotion labels showed that only dynamic "happy" faces showed a clear pattern of predicted matching (all $\chi^2 > 6.4$, $ps > .05$; see Table 5).

Selection of nonpredicted faces was again revealing. Neutral faces were matched to both happy (.26 for the static and .29 for the dynamic condition) and sad labels (.32 for the static and .24 for the dynamic condition). Mismatching occurred between emotion labels and nonpredicted facial expressions such as pouting "sad," scowling "anger," and nose scrunching "disgust" in the static condition and pouting "sad," scowling "anger," and gasping "fear" in the dynamic condition.

Static and dynamic faces. Static ($M = 1.95$, $SE = 0.30$, 95% CI [1.32, 2.58]) and dynamic ($M = 1.88$, $SE = 0.27$, 95% CI [1.31, 2.45]) stimuli showed similar overall matching, with no significant differences between the two conditions by a Mann–Whitney test ($U = 159$, $p = .980$, $A = 0.51$). The estimated difference of proportions between static and dynamic conditions was negligible for happiness and disgust labels (−.05, 95% CI [−0.34, 0.25], and .04, 95% CI [−0.25, 0.33], respectively). With the other emotion labels (sadness, anger, and fear), there were no significant differences in matching scores between static and dynamic stimuli (see Table 6).

Further, the pattern of faces selected for a given emotion similarly showed (with one exception) no significant difference between the static and dynamic conditions—as evidenced by chi-square goodness-of-fit tests on Table 5's rows (i.e., emotion labels) for given probabilities with simulated *p*-values based on 10,000 replicates. The exception was the gasping "fear" face, which was selected as the modal category for anger in the dynamic (.41) but not in the static condition (.21).

Gender and age. The results reported so far were robust over participants' gender and age. We found no significant differences in matching scores between female ($M = 1.95$, $SE = 0.26$, 95% CI [1.41, 2.49]) and male ($M = 1.86$, $SE = 0.33$, 95% CI [1.15, 2.57]) participants ($U = 147.5$, $p = .859$, $r = -.04$). For age, a Kendall's tau-b correlation test showed that older participants did not perform better than younger participants; there was no significant monotonic relationship between age and overall matching scores ($\tau = 0.10$, 95% CI [−0.18, 0.37]).

Correspondence analysis. As in Study 1, we used R's *ca* library to compute a correspondence analysis on the mean proportions of Mwani who matched a face to an emotion label on two trials. The cumulative principal inertia for the first axis accounted for 74.1% of the total inertia. The next two dimensions accounted for similar residual percentages of the total inertia (12.7% and 10.6%, respectively). Mwani's total principal inertia (0.658) and Trobri-

Table 5
Proportion of Mwani Who Matched a Facial Expression to an Emotion Label as a Function of the Type of Stimuli

	Facial expression							
Emotion label	"Happy": Smiling	"Sad": Pouting	"Angry": Scowling	"Fear": Gasping	"Disgust": Nose scrunching	Neutral	χ^2	*p*
				Static				
Happiness	$.58^{*}_{b}$	0_{a}	$.11_{a}$	0_{a}	$.02_{a}$	$.26_{ab}$	28.68	<.001
Sadness	$.21_{ab}$	$.16_{ab}$	$.16_{a}$	0_{a}	$.16_{a}$	$.32_{b}$	5.95	.345
Anger	0_{a}	$.16_{ab}$	$.26_{a}$	$.21_{ab}$	$.32_{a}$	$.02_{ab}$	8.47	.144
Fear	$.02_{a}$	$.16_{ab}$	$.11_{a}$	$.58^{*}_{b}$	$.11_{a}$	0_{a}	24.90	<.001
Disgust	$.02_{a}$	$.32_{b}$	$.11_{a}$	$.16_{a}$	$.37^{*}_{a}$	0_{a}	12.26	.031
				Dynamic				
Happiness	$.53^{*}_{b}$	$.06_{a}$	0_{a}	$.06_{a}$	$.06_{ab}$	$.29_{a}$	21.47	.001
Sadness	$.06_{a}$	$.29_{a}$	$.18_{a}$	$.24_{ab}$	0_{a}	$.24_{a}$	6.65	.284
Anger	$.06_{a}$	$.06_{a}$	$.18_{a}$	$.41^{*}_{b}$	$.29_{ab}$	0_{a}	13	.023
Fear	0_{a}	$.18_{a}$	$.18_{a}$	$.47^{*}_{b}$	$.18_{ab}$	0_{a}	15.12	.012
Disgust	$.06_{a}$	$.12_{a}$	$.12_{a}$	$.24_{ab}$	$.41^{*}_{b}$	$.06_{a}$	9.47	.094

Note. Proportions are rounded up. To obtain *p* values, chi-square goodness-of-fit tests were computed on rows by bootstrapping 10,000 replicates for simulation. Proportions with different subscripts in the same column differed significantly at $p < .05$ according to McNemar tests after bootstrapping 10,000 replicates for simulation.
* Values with standardized residuals higher than 2.

anders' (0.427) showed a greater association between rows (facial expressions) and columns (emotion labels) for the Mwani. Mwani's data higher association reflected a wider dispersion of the profile points in the dimensional space, especially along the first axis.

The first dimension, displayed along the first principal axis, opposed smiling faces, neutral faces, and the label happiness, on the right, against the anger label on the left. Happiness ($r = .96$) and fear ($r = .78$) labels as well as smiling ($r = .92$) and neutral faces ($r = .82$) were highly correlated with the first dimension. Mwani's chi-square distances (i.e., the distance between profiles and their average) on smiling "happy" and neutral faces as well as the label happiness were higher in comparison to Trobrianders'. For example, chi-square distance for Mwani's neutral faces ($\chi^2 = 1.04$) produced a higher shift toward the first axis' right pole in comparison to Trobrianders' ($\chi^2 = 0.58$).

The second and third axes were weaker and not readily interpretable. The second axis explained hardly more than the 13% of the total inertia and correlated weakly with stimuli: fear label ($r = .36$), disgust label ($r = .34$), and the scowling "fear" face ($r = .33$).

Table 6
Difference of Matching Scores' Proportions Between Dynamic and Static Stimuli

	Stimuli			
Emotion label	Static	Dynamic	P(2) − P(1)	95% CI
Happiness	.58	.53	−.05	[−.34, .25]
Sadness	.16	.29	.14	[−.14, .40]
Anger	.26	.18	−.09	[−.34, .19]
Fear	.58	.47	−.11	[−.39, .20]
Disgust	.37	.41	.04	[−.25, .33]
M	.39	.38	−.01	[−.15, .13]

Note. Proportions are rounded up. P(2) − P(1) = the difference of matching scores' proportions between dynamic and static facial expressions. CI = confidence interval.

Discussion

The Mwani provided little support for predictions derived from the theory that facial expressions universally signal the specific discrete emotions we studied. No emotion label was matched to the predicted face by the 70 – 90% of participants required by Haidt and Keltner (1999) to support the Universality Thesis. Only two emotion labels (translations of *happy* and *fear*) were matched by a majority to the predicted face. Mwani's low matching scores were produced under design conditions that might overestimate recognition of emotions through facial expressions (Nelson & Russell, 2013; Russell, 1994). Thus, the results of Study 1 with Trobrianders were not somehow unique. The same experimenters found similar results in two highly different but indigenous groups, each with limited contact with Western media. This similarity supports the robustness of each study's results.

Correspondence analysis of the Mwani's judgments suggested that their associations between expressions and labels of emotion can be summarized along a single dimension that heavily accounts for the higher dispersion and association we found. That dimension was readily interpretable as the valence continuum of pleasure-displeasure. On the other hand, no further dimensions were interpretable from this analysis.

General Discussion

Spanish children studied here shared with others in the Western cultural tradition a system of discrete emotion categories, each associated strongly with a prototypical facial expression (Nelson & Russell, 2013). Emotion labels (translated into Spanish from the English terms happiness, anger, fear, disgust, and sadness) were consensually matched to the predicted facial expressions. Such

data have been taken to support a theory of emotion signaling articulated by Ekman (1980) when he wrote, "When someone feels an emotion and is not trying to disguise it, his or her face appears the same no matter who that person is or where he or she comes from" (p. 7).

In contrast, Trobriand and Mwami children and adolescents, largely isolated from the West, did not associate their own corresponding emotion labels with the same facial expressions to the degree Spanish (and other Western) children did. These results are at odds with the prediction—the Universality Thesis—that human beings, whatever their age or culture, recognize basic emotions from their facial expressions. Haidt and Keltner (1999) required 70% agreement to support the Universality Thesis. Although our Spanish children surpassed this criterion for every emotion, Trobrianders (32%) and Mwami (38%) did not. The differences found here between our Western control group and our two indigenous societies reinforces the concerns about the Universality Thesis voiced in reviews of the classical studies of the University Thesis with indigenous societies (Russell, 1994) and of more recent studies of it (Gendron et al., 2014; Jack et al., 2009; Jack, Garrod, Yu, Caldara, & Schyns, 2012).

Neither the Trobriand nor Mwami children were random in their association of emotions with facial expressions. Almost 60% of Trobrianders associated the "happy" smile with happiness, and close to 50% the "sad" pout with sadness. Similarly, almost 60% of Mwami associated the "happy" smile with happiness, and almost 55% of them matched the "fear" gasp with fear. There are many possible explanations for nonrandom responding, which therefore does not support any one specific theory. Although our results challenge the claims of the specific theory of an emotion signaling system advanced by Ekman (1972) and Izard (1971), at the same time, the results add to the growing idea that we need to develop a richer understanding of how humans interpret facial movements, an understanding that includes cultural diversity.

We used the phrase "Universality Thesis" as shorthand for the claim that the specific emotions we listed are recognized universally from universal facial expressions. The phrase has served in other publications as shorthand for a much broader range of claims, such as the ideas offered by Darwin (1872/1965) or more recent accounts that broaden the means by which emotion is signaled, lengthen the list of possible emotions signaled, and soften the degree of recognition expected. Our studies do not address these other claims.

The differences found here concerning emotion recognition reinforce other research showing cultural differences in other areas—research that challenges the pervasive presupposition of universal cognitive processes (Kitayama & Uskul, 2011; Ojalehto & Medin, 2015a). Indeed, Ojalehto and Medin (2015b) wondered whether the pervasive presupposition of universality might be insufficiently sensitive to counterevidence because it can always be defended by attributing observed differences to performance factors.

We do not believe that performance factors account for our data. We took extensive precautions to avoid performance difficulties. Each expedition lasted several months. We began by obtaining close first-hand knowledge of the culture and language of our participants. We watched for circumstantial variables that might distort our data. We achieved a close, friendly relationship with the participants and their families. The experiment took place in a familiar environment with an extremely simple task. The same task produced high matching scores in Western children much younger than our participants (Izard, 1971; Widen & Russell, 2004, 2008). We used the classical set of terms for allegedly basic universal emotions and a relatively new standardized set of facial stimuli, both dynamic and static.

Our results are limited to the specific canonical facial displays postulated in basic emotion theory and shown in standardized sets. Our results do not rule out the possibility that the people of the Trobriand Islands or Matemo Island use other facial displays to convey emotions, even the same emotions postulated in basic emotion theory. Our studies, like prior studies on the Universality Thesis, did not examine the possibility of *indigenous* emotion facial signals, a possibility raised by Elfenbein's (2013) demonstration of cultural accents of facial signals and by Jack, Caldara, and Schyns (2012) finding of cultural differences in the mental representation of the facial signals of basic emotions. Cumulative results on the Universality Thesis suggest that it will be useful to move to more bottom-up strategies, such as psychophysical methods that provide per-subject data patterns capturing within-group diversity (Jack, Garrod, et al., 2012) or unobtrusive observations of spontaneous behavior (Crivelli, Carrera, & Fernández-Dols, 2015; Fernández-Dols, Carrera, & Crivelli, 2011; García-Higuera, Crivelli, & Fernández-Dols, 2015). Such studies can model indigenous mental representations for facial signals or document the production of facial displays (if any) in highly emotional situations. Future cross-cultural work could usefully expand the theories that are tested and emphasize bottom-up research strategies (Kagan, 2007). Two questions might guide future thinking.

The first question concerns the possible processes and dimensions through which facial movements are interpreted. Humans move their faces and interpret those facial movements. Yet, we know too little about spontaneous interpretation in any society, let alone indigenous ones relatively isolated from Western influence. Interpretation of facial displays need not be focused on emotions. Indeed, interpretation might even include a hardwired, reliable, and universal system, just not one focused on emotions. If so, then the initial interpretation might help the observer answer questions about emotion, but only as a secondary process. For example, facial features (e.g., sclera's visibility) might be used to infer perceptual-cognitive processes (Lee, Susskind, & Anderson, 2013), preparations for behavioral actions (Frijda & Tcherkassof, 1997), social motives and threats (Fridlund, 1994), or core affect (Russell, 1997). The studies reported in this article were not aimed at testing any of these hypotheses (although some support for a dimensional hypothesis with valence and activation emerged), but the nonrandom responding found suggests some such processes might underlie the children's performance.

The second question concerns cultural diversity in interpretation of faces (Norenzayan & Heine, 2005). The processes and dimensions in terms of which interpretation takes place might or might not vary with culture. Categorization of facial expressions in terms of emotion, for example, might depend on the local lexicon for emotions (Gendron et al., 2014). Few studies of facial expressions have also examined the emotion categories that indigenous people have available and accessible in interpreting the facial changes they observe. When alleged translations of English emotion terms are examined carefully, they sometimes turn out to be approximate rather than exact (Hurtado-de-Mendoza, Molina, & Fernández-

Dols, 2013). Similar differences might exist for the other processes and dimensions suggested above. Even with a universal, hardwired system of interpretation, cultural differences might exist in the accessibility of that system. It has been suggested, for example, that some societies in the Pacific hold the belief that others' minds are opaque to the receiver (Ojalehto & Medin, 2015b). Such a belief could inhibit any conscious process of interpretation of facial expressions in terms of mental states.

Bottom-up strategies and a broader range of questions asked can enhance the value of studies (rare and difficult to carry out) in indigenous societies. Such studies might well open a path to a "new look" in the study of emotion and faces.

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Appendix

Stimulus Sets for Study 1 and Study 2

	Study 1				Study 2 (ADFES set)			
	Male (RADF set)		Female (ADFES set)		Male		Female	
Behavioral description	ID (Rafd_70)	FACS	ID (F09)	FACS	ID (M06)	FACS	ID (F03)	FACS
Smiling	Happy	6 + 12 + 25	Joy	6 + 12 + 25	Joy	6 + 12 + 25	Joy	6 + 12 + 25
Pouting	Sad	1 + 4+15 + 17	Sad	1 + 4+15 + 17	Sad	1 + 4+15 + 17	Sad	1 + 4+15 + 17
Scowling	Angry	4 + 5+7 + 17 + 23 + 24	Anger	4 + 5+7 + 17 + 23 + 24	Anger	4 + 5+7 + 17 + 23 + 24	Anger	4 + 5+7 + 17 + 23 + 24
Gasping	Fearful	1 + 2+4 + 5+20 + 25	Fear	1 + 2+4 + 5+20 + 25	Fear	1 + 2+4 + 5+20 + 25	Fear	1 + 2+4 + 5+20 + 25
Nose scrunching	Disgusted	9 + 10 + 25	Disgust	9 + 10 + 25	Disgust	9 + 10 + 25	Disgust	9 + 10 + 25
Neutral	Neutral		Neutral		Neutral		Neutral	

Note. RADF = Radboud Faces Database (Langner et al., 2010); ADFES = Amsterdam Dynamic Facial Expression Set (van der Schalk et al., 2011); FACS = Facial Action Coding System.

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