

# Perceptions of Emotion From Facial Expressions Are Not Culturally Universal: Evidence From a Remote Culture

Maria Gendron  
Northeastern University

Debi Roberson  
University of Essex

Jacoba Marietta van der Vyver  
University of Namibia and Massachusetts General Hospital,  
Boston, Massachusetts

Lisa Feldman Barrett  
Northeastern University; Massachusetts General Hospital,  
Boston, Massachusetts and Harvard Medical School

It is widely believed that certain emotions are universally recognized in facial expressions. Recent evidence indicates that Western perceptions (e.g., scowls as anger) depend on cues to U.S. emotion concepts embedded in experiments. Because such cues are standard features in methods used in cross-cultural experiments, we hypothesized that evidence of universality depends on this conceptual context. In our study, participants from the United States and the Himba ethnic group from the Keunene region of northwestern Namibia sorted images of posed facial expressions into piles by emotion type. Without cues to emotion concepts, Himba participants did not show the presumed “universal” pattern, whereas U.S. participants produced a pattern with presumed universal features. With cues to emotion concepts, participants in both cultures produced sorts that were closer to the presumed “universal” pattern, although substantial cultural variation persisted. Our findings indicate that perceptions of emotion are not universal, but depend on cultural and conceptual contexts.

*Keywords:* emotion, perception, facial expression, universality, culture

*Supplemental materials:* <http://dx.doi.org/10.1037/a0036052.supp>

One of the most widely accepted scientific facts in psychology and human neuroscience is that there are a small number of emotions (anger, sadness, fear, etc.) that are expressed on the face and universally recognized (Ekman, 1972; Ekman & Cordaro, 2011; Izard, 1971, 1994; Matsumoto, Keltner, Shiota, Frank, & O’Sullivan, 2008; Tomkins, 1962, 1963). It is further assumed that

because people all around the world can automatically recognize emotions in these expressions (e.g., scowls are recognized as anger, pouts as sadness, and so on), facial expressions transcend concepts for emotion and the language that we use to refer to them, such that emotion “recognition” ability is prelinguistic (Izard, 1994) and words are simply a medium for communicating already formed perceptions. We refer to this as the *universality hypothesis*. This view is standard curriculum in introductory psychology, is used by government agencies to train security agents (Weinberger, 2010), and is a popular example when social science is communicated to the public (e.g., stories in *National Geographic*, on *Radiolab*, etc.).

There are thousands of experiments that casually claim that emotions are universally perceived from the face, based on hundreds of studies that performed cross-cultural comparisons (e.g., comparing U.S. and Japanese perceivers; for a meta-analysis, see Elfenbein & Ambady, 2002) appearing to support this claim. Yet, only a handful of studies—those that compare individuals from a Western cultural context (e.g., the United States) with perceivers from remote cultural contexts with little exposure to Western cultural practices and norms—provide a strong test of whether people around the world *universally* recognize emotions in facial expressions. The strength of this “two-culture” approach is that cultural similarities cannot be attributed to cultural contact or shared cultural practice, suggesting that similarities are, in fact, due to the presence of a psychological universal (Norenzayan & Heine, 2005). Only six published experiments tested universality

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Maria Gendron, Affective Science Institute and Department of Psychology, Northeastern University; Debi Roberson, Department of Psychology, University of Essex, Essex, United Kingdom; Jacoba Marietta van der Vyver, School of Nursing and Public Health, University of Namibia, Windhoek, Namibia; Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, Massachusetts; Lisa Feldman Barrett, Affective Science Institute and Department of Psychology, Northeastern University; Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, Massachusetts; Department of Psychiatry, Massachusetts General Hospital, Boston, Massachusetts, and Harvard Medical School.

Preparation of this article was supported by the National Institutes of Health Director’s Pioneer Award DP1OD003312 to Lisa Feldman Barrett. We thank K. Jakara for his translation work. We thank J. Vlassakis, A. Matos, J. Fischer, S. Ganley, P. Aidasani, O. Bradeen, and E. Muller for their help with data collection, entry, or coding. We also thank S. Caparos and J. Davidoff for use of their supplies and support regarding data collection in Namibia.

Correspondence concerning this article should be addressed to Maria Gendron, 125 Nightingale Hall, Northeastern University, Boston, MA 02115. E-mail: [m.gendron@neu.edu](mailto:m.gendron@neu.edu)

of emotion perception using a two-culture approach (two in peer-review outlets) and all but one were conducted nearly 40 years ago (see Table S1 in the online supplemental materials; Ekman, 1972; Ekman & Friesen, 1971; Ekman, Heider, Friesen, & Heider, 1972; Sorensen, 1975).

In addition, four of the experiments, (Ekman, 1972; Ekman & Friesen, 1971; Ekman et al., 1972), as well as virtually all of the studies that tested participants who were not isolated from Western culture (see Elfenbein & Ambady, 2002), contain an important methodological constraint: They asked perceivers to match a facial expression to an emotion word or description (i.e., they included a conceptual context in the experimental method).<sup>1</sup> By examining Table S1 in the online supplemental materials, we can see that it is only the experiments that contain this conceptual context that produced robust evidence of universality. For example, participants might be presented with an orally translated story, such as “He is looking at something which smells bad” (describing a disgust scenario; Ekman & Friesen, 1971, p. 126), and then asked to select the matching expression from two or three options. Yet, the two studies using isolated samples that did not provide a conceptual context (e.g., asking participants to freely label posed facial expressions; Sorensen, 1975) did not find evidence that emotion is perceived universally in facial expressions.

Recent experiments conducted with Western samples provide additional evidence that the presumed universal pattern of emotion perception is dependent on conceptual constraints. For example, studies that temporarily reduce the accessibility of emotion concept knowledge also impair emotion perception, such that the presumed universal pattern of emotion perception is not even obtained in a sample of homogeneous U.S. undergraduate students (Gendron, Lindquist, Barsalou, & Barrett, 2012; Lindquist, Barrett, Bliss-Moreau, & Russell, 2009; Roberson, Damjanovic, & Pilling, 2007; Widen, Christy, Hewett, & Russell, 2011). These studies indicate that evidence for “universality” appears to be conditional on the experimental methods being used (cf. Russell, 1994), pointing toward a more nuanced model of emotion perception in which culture and language are key to constructing emotional perceptions.

Our psychological constructionist model of emotion hypothesizes that emotion perception is dependent on emotion concepts that are shaped by language, culture, and individual experience (Barrett, 2009; Barrett, Lindquist, & Gendron, 2007; Barrett, Mesquita, & Gendron, 2011; Barrett, Wilson-Mendenhall, & Barsalou, in press; Lindquist & Gendron, 2013). This model predicts that perceptions of discrete emotion are unlikely to be consistent across widely distinct cultural contexts because language, cultural knowledge, and situated action will all exert different influences on emotion perception. In our view, emotion categories themselves are flexible and embodied and are grounded in knowledge about situated action (Wilson-Mendenhall, Barrett, Simmons, & Barsalou, 2011). Variability in perceptions of emotion even within a cultural and linguistic context is predicted by the flexible nature of emotion concepts. Yet, some commonalities in perceptions of emotion across cultures are predicted to the extent that there are similar patterns of situated actions across cultural contexts. This type of cultural consistency is likely to be particularly evident in experimental tasks that explicitly invoke knowledge of situated action, such as “He is looking at something which smells bad” (Ekman & Friesen, 1971, p. 126), as is common in the previous

universality literature. This stands in contrast to the adaptationist “basic emotion” approaches in which perceptions of emotion are thought to be the product of a reflexive ability to “decode” nonverbal “signals” embedded in the face, voice, and body, free from learning or language (e.g., Izard, 1994). As a consequence, in this “basic emotion” view, shared culture, language, and context should all be unnecessary to establish robust cross-cultural emotion perception.

The emerging empirical picture challenges the widespread conclusion that the “universal” pattern of discrete emotion perception is achieved on the basis of the perceptual features of faces (and other nonverbal cues) alone, but critical gaps in the literature still exist. No single study has explicitly manipulated the presence versus absence of emotion concept knowledge in an emotion perception task and examined the consequence for emotion perception in both a Western sample and a sample from a remote cultural context. This study fills that gap. We examined emotion perception in members of the Himba ethnic group, who live in the remote villages within the Keunene region of northwestern Namibia and have relatively little contact with people outside of their immediate communities (and therefore limited exposure to emotional expressions outside their own cultural context). Also key, Himba individuals speak a dialect of Otji-Herero that includes translations for the English words *anger*, *sadness*, *fear*, *disgust*, *happy*, and *neutral* (Sauter, Eisner, Ekman, & Scott, 2010), allowing us to manipulate the presence or absence of similar concepts across cultures.

To manipulate the presence or absence of emotion concept information, we started with a relatively unconstrained perception task in which participants were asked to sort photographs of posed portrayals of emotion into piles. Half of the participants were asked to structure their sort on the basis of a set of emotion words, and the other half of participants freely sorted the faces. If scowling faces are universally perceived as angry, pouting faces as sad, smiling faces as happy, and so on, then participants in both cultures would freely sort the facial portrayals into six piles (based on the perceptual regularities in the stimulus set) and emotion concepts should not be necessary to observe this pattern. A strict universality view would predict that there should be strong consistency across cultures with virtually no variation across cultural contexts. More recent accounts that assume variability across cultures, but a core innate mechanism for the production and perception of discrete emotions (e.g., dialect theory; Elfenbein & Ambady, 2003; Elfenbein, Beaupré, Lévesque, & Hess, 2007; Shariff & Tracy, 2011) would predict only higher than chance consistency across the cultural contexts, even if there are significant differences in what they term *recognition accuracy*. Of course, rejecting the null hypothesis (no consistency at all) is not evidence for a discrete emotion universalist hypothesis; it would also be necessary to rule out the possibility that any consistency in perception could not be explained as universal perception of the affective properties of the faces (e.g., valence or arousal; cf. Russell, 1994) or as situated action.

<sup>1</sup> The forced-choice method in which a set of emotion word choices are provided to perceivers in emotion perception tasks is so prevalent that this meta-analysis was unable to use this as an attribute in its analysis.

Such a view, called *minimal universality* (Russell, 1995), is consistent with our constructionist approach in which affective events are perceived as emotions using emotion concepts and related emotion language. Still, our view hypothesizes strong cultural variability in emotion perception. Specifically, we hypothesized that if emotion words impose structure on emotion perception, as suggested by recent research (Gendron et al., 2012; Lindquist et al., 2006; Widen et al., 2011), then both Himba and U.S. participants would differ in perceptions (measured as their sorting behavior) depending on whether participants were sorting into piles anchored by emotion words or not. We expected that U.S. anchored-sort responses would better resemble the expected “universal” solution when compared with U.S. free-sort responses. Furthermore, if emotion concept words are linked to universal perceptual representations (e.g., furrowed brow and pressed lips in *anger*) across distinct cultural contexts, then Himba participants would also produce a more “universal” (i.e., Western) solution in the anchored-sort procedure. If the perceptual representations linked to emotion concept words vary across distinct cultural contexts as recent evidence suggests (Jack, Garrod, Yu, Caldara, & Schyns, 2012), however, then Himba participants’ sorting of facial expressions should differ with the introduction of emotion words, but would not be clearly in line with the presumed universal (i.e., Western) cultural model.

## Method

### Participants

Participants were 65 individuals (32 men, 33 women; mean age = 30.84 years,  $SD = 13.04$ ) from the Himba ethnic group of Herero speakers and 68 individuals (30 men, 38 women; mean age = 38.27 years,  $SD = 12.77$ ) from an American community sample. Eleven Himba participants were excluded from analysis (resulting in a final sample of 54 participants) based on compliance (i.e., four participants decided not to finish sorting the stimuli), failure to sort into piles by emotion (two participants), and feasibility (three participants—one with low visual acuity, two with an inability to sort the stimuli at all and low forward digit span in a separate experiment). In addition, two participants’ data were dropped from further analysis because of data recording issues that were discovered during data entry (i.e., not all image placements were recorded).

Individuals from the Himba ethnic group constitute a strong sample for the two-culture approach (Norenzayan & Heine, 2005) to test the universality of emotion perception. Most of the Himba ethnic group lives in an ancestrally “traditional” culture, such that they do not take part in their country’s political or economic systems, but rather live as seminomadic pastoralists, tending to herds of goats and cattle. In our study, Himba participant data were collected in two remote villages, both located in the mountainous northwestern region of Namibia, Kunene.<sup>2</sup> The first village contained a mobile school as well as a missionary church; all members of the village otherwise lived traditionally and did not show significant signs of Westernization. The second village did not contain an established school or outside presence in the community. Both locations were far from the regional towns, and there was no evidence of tourism to these communities as is typical of “show” villages closer to the main regional town of Opuwo.

Although several of the participants (particularly in Location 1) had some conversational English (greetings), none of the participants were English-language speakers. All participants in this sample were native speakers of the Herero language.

Our U.S. sample was tested at the Boston Museum of Science in the Living Laboratory environment (<http://www.mos.org/discoverycenter/livinglab>). One participant’s data were dropped from further analysis because of data recording issues that were discovered during data entry (i.e., not all image placements were recorded). The Living Laboratory is a well-suited site for the collection of control data given the hectic environment that mirrors the busy and often social context of testing in the field. In addition, the Living Laboratory affords the collection of data from a community sample, such that individuals from a range of ages and backgrounds can be included.

### Stimuli

Stimuli were thirty-six 4 × 6-in. cards containing photographs of facial expressions of emotion posed by African American individuals. Stimuli were selected based on the following criteria: (a) The facial structure of the identities included in the stimulus set was rated as closest to that of several example within-gender identities from the Himba ethnic group (as judged by a set of 120 perceivers from a largely Western cultural context using Amazon’s Mechanical Turk system); the final set of face stimuli (three male and three female identities) was selected from a larger set of 23 male and 20 female identities from Gur (Gur et al., 2002), IASLab (<http://www.affective-science.org>), and NimStim (<http://www.macbrain.org/resources.htm>) face sets. (b) A given identity posed a facial expression depicting anger, fear, sadness, disgust, neutral affect, and happiness, with a final stimulus set of 36 faces. Each face stimulus was edited in Adobe Photoshop such that visual background information was removed. A uniform white collar (as is found on NimStim identities) was added to all photographs to make the stimuli uniform and remove variation that might distract from facial actions. (c) Additional norming conducted on Amazon’s Mechanical Turk confirmed that the face stimuli were indeed rated as depicting the expected emotions, with only a few exceptions (see Table S2 and Table S3 in the online supplemental materials).

### Procedure

All participants were consented prior to performing the experiment. Participants from the Himba ethnic group were verbally consented with the use of a translator. Participants within each culture were randomly assigned to either the free-sorting or anchored-sorting condition. In the free-sorting condition, participants were instructed to sort the faces by feelings so that each person in a given pile was experiencing the same emotion. Participants were instructed to create as many piles as needed with

<sup>2</sup> Studying emotion perception in the Himba is additionally important given a recent paper concluding that Himba and British individuals have universal emotion perception in nonword human vocalizations (Sauter, Eisner, Ekman, & Scott, 2010). Participants in our study were from different villages from those tested in prior research on emotion perception with the Himba.

unlimited time. The participant was then allowed to freely sort the images into piles. Participants were reinstructed if initial sorting appeared to be based on identity rather than emotion (this took place in less than 25% of Himba participants). All but two participants were able to sort by emotion following reinstruction.

Participants in the word-anchored-sort condition heard slightly modified instructions in which they were told that they might find certain emotions on the faces of people. The labels for those emotions (*anger, fear, disgust, sadness, happy, and neutral*, or their translation in the Himba dialect of Otji-Herero as *okupindika, okutira, okujaukwa, oruhoze, ohange, and nguri nawa*, respectively) were then provided.<sup>3</sup> Label anchors were delivered verbally to all participants, rather than written, because the Himba participants we tested are from a preliterate culture. To ensure that the emotion concepts remained accessible throughout the task, we reminded participants of the six emotions every six cards that they placed down. If participants initially looked through the stimuli before beginning to sort, they were also reminded every six stimuli that were closely examined by the participant. For American participants, a few modifications to the anchoring protocol were set in place based on piloting. American participants were given the option of waiving further repetition of the list of emotion terms if they (a) indicated that they did not wish to hear it again and (b) were able to repeat the list back to the experimenter without error.

Once sorting was complete, all participants (regardless of culture or task version) were asked to provide a label to describe the content of each pile. Labels were directly translated into English by an interpreter who worked on a prior study with Himba participants supporting the universality hypothesis (see Table S1, Row 3, in the online supplemental materials; Sauter et al., 2010). This question was initially phrased in an open-ended manner (i.e., “What is in this pile?”) to minimize expectancy effects regarding what type of content to produce. The experimenter recorded any behavioral descriptors or mental state descriptors that the participant produced. All participants were also asked specifically for facial expression and emotion labels that were not spontaneously provided during open-ended questioning. Because many Himba participants failed to provide additional information in response to these prompts, prompted responses (both for American and Himba samples) were not subjected to further analysis.

## Results

### New Evidence of Cultural Relativity Rather Than Universality in Emotion Perception

**Labeling analysis.** The words that participants freely offered to name their piles indicated, as predicted, that Himba participants did not perceive the posed, facial expressions according to the “universal” pattern (see Figure 1). As expected, U.S. participants tended to use discrete emotion words such as *sadness* or *disgust* to label their piles ( $M = 4.45, SD = 1.091$ ) more so than did Himba participants ( $M = 0.81, SD = 0.939$ ),  $t(55) = 2.644, p < .001$ . Overall use of each discrete emotion term by Himba and U.S. participants can be found in Table S4 in the online supplemental materials.

Interestingly, U.S. participants more generally named their piles with a wide array of additional mental state words such as *surprise* or *concern* ( $M = 2.32, SD = 1.447$ ) at greater frequency than did

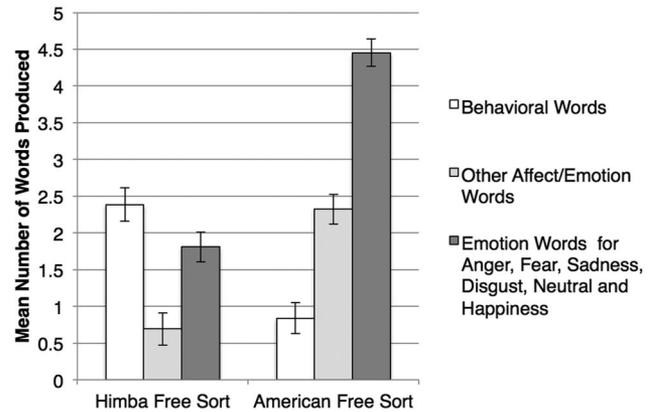


Figure 1. Pile labels used by Himba and U.S. participants. Mean number of words produced by each group ( $\pm$  standard error) is plotted on the y-axis broken down by word type. We observed cross-cultural differences in label use when participants were asked to freely sort facial expressions,  $F(1, 55) = 24.952, p < .001, \eta_p^2 = .312$ , and this effect was qualified by the type of label produced,  $F(2, 110) = 56.719, p < .001, \eta_p^2 = .508$ .

Himba participants ( $M = 0.69, SD = 0.838$ ),  $t(55) = 1.630, p < .001$ . In contrast, Himba participants were more likely to label face piles with descriptions of physical actions such as *laughing* or *looking at something* ( $M = 2.38, SD = 1.098$ ) when compared with U.S. participants ( $M = 0.84, SD = 1.098$ ),  $t(55) = -1.546, p < .001$ , suggesting that individuals in Himba culture used action descriptors more frequently than mental state descriptors to convey the meaning of facial actions. Indeed, extensive research on action identification theory (Vallacher & Wegner, 1987) indicates that it is possible to describe another person’s actions in either physical or mental terms (Kozak, Marsh, & Wegner, 2006). For example, perceiving a face as “fearful” requires mental state inference because an internal state is assumed to be responsible for the observable “expression”; this stands in contrast to perceiving actions on the face in more physical (and less psychological) terms (e.g., looking) that might be observed in any number of emotional or nonemotional instances (e.g., see Table S5 and Table S6 in the online supplemental materials).

**Cluster analysis.** Using a cluster analysis approach, we examined whether participants’ sorts mapped onto the Western discrete emotion categories from which the photographs were sampled (i.e., *anger, fear, sadness, disgust, neutral, and happiness*). A hierarchical cluster analysis (Sokal & Michener, 1958) produces a set of nested clusters organized in a hierarchical tree. Unlike other clustering procedures (e.g., K-means; Hartigan & Wong, 1979), the number of clusters can be discovered rather than being pre-specified. We used an agglomerative approach, starting with each item as its own cluster and progressively linking those items together based on an estimate of their distance from one another

<sup>3</sup> The translation of English-language emotion terms into Otji-Herero was originally achieved in Sauter et al. (2010), and the same translator was used in our own work. Kemuu Jakara conducted extensive translation work in the area, with more than 12 years of experience working as a guide and translator for various academics. In addition, the translations that were provided were consistent with provided translations in the newly developed Otji-Herero/English dictionary by Nduvaa Erna Nguaiiko.

(computed from the number of times face stimuli appeared in the same vs. separate piles; see description of co-occurrence matrix below). We employed a cluster distance measure of average linkage because it balances the limitations of single and complete linkage methods, which can be influenced by noise and outliers or force clusters with similar diameters, respectively (Aldenderfer & Blashfield, 1984). The average linkage clustering method uses information about all pairs of distances to assign cluster membership, not just the nearest or the farthest item pairs. We performed a cluster analysis on the data from each cultural group separately, further broken down by sorting condition, resulting in four different multidimensional scaling (MDS) solutions: Himba free sort, Himba anchored sort, U.S. free sort, and U.S. anchored sort.

To accomplish the cluster analysis for each of the four conditions, we computed a co-occurrence matrix (Coxon & Davies, 1982). Each co-occurrence matrix contained a row and column for each of the 36 items in the set, resulting in a  $36 \times 36$  symmetric matrix. Each cell in the matrix represented the number of times a given pair of face items was grouped by participants in the same pile (i.e., across participants). The larger the number in a cell, the more frequently those two items co-occurred, and thus the higher perceived similarity between those items at a group level. We then converted this co-occurrence similarity matrix into a distance matrix, in which a higher cell value was an indication of less similarity between items. The cluster analysis was then performed on each dissimilarity matrix and we examined the resulting dendrogram for each (see Figures S1 and S2 in the online supplemental materials). Based on large within-cluster average item distance when the solution contained fewer than six clusters (i.e., as items were grouped into larger, increasingly inclusive clusters, the clusters became less coherent; see dendrograms in Figure S1 in the online supplemental materials) and for theoretical reasons (because six discrete expression portrayal types were included in the set), we report the results of the six-cluster solutions.

Using cluster analysis, we found, as expected, that the U.S. participants (see Figure 2A) grouped smiling (happy), scowling (angry), wide-eyed (fearful), and neutral faces into distinct piles. The resulting clusters did not recapitulate separate categories for pouting (sad) and nose-wrinkled (disgusted) faces, indicating that these photographs were not sorted by U.S. participants into their own piles.<sup>4</sup> Himba participants, in contrast (see Figure 2B), grouped smiling (happy) faces together and wide-eyed (fearful) faces together. Resulting clusters did not recapitulate separate categories for scowling (angry), pouting (sad), and nose-wrinkled (disgusted) faces, indicating that these items were not sorted into their own piles. Furthermore, when compared with the Himba sample, the six-cluster solution provided a better “fit,” as demonstrated graphically by the shorter bracket lengths in the dendrogram (see Figure S1 in the online supplemental materials) for the U.S. sorts.

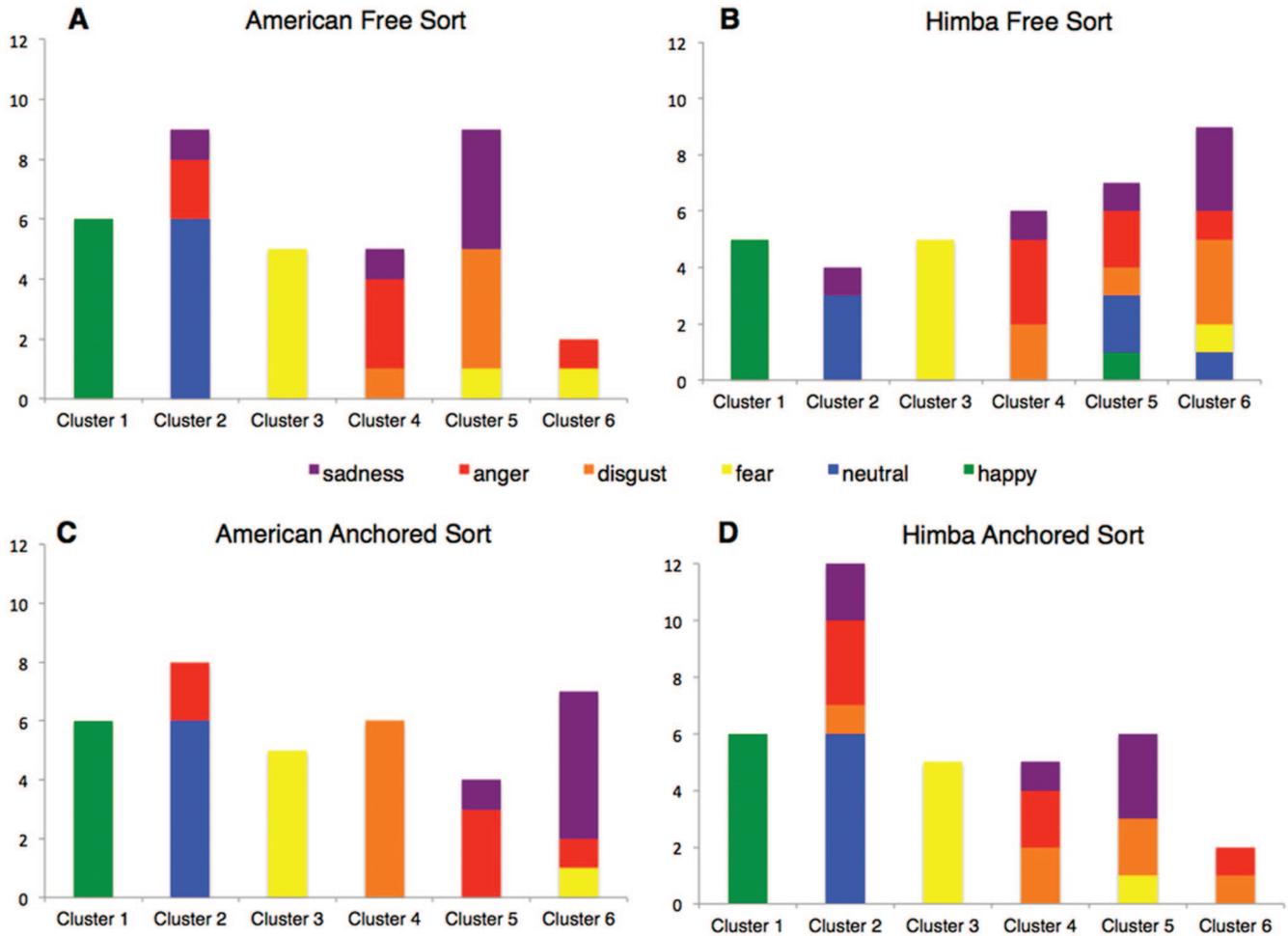
**Multidimensional scaling.** Whereas the cluster analyses revealed whether the emotion perception sorts from each culture neatly conformed to the presumed universal solution, they did not reveal the underlying properties that were driving sorting in each culture. Posed expressions could be placed in the same pile because they share an emotional meaning (e.g., fearful) or because they share a behavioral meaning (e.g., looking). This is a particularly relevant distinction given that the majority of Himba participants identified their pile contents with behavioral and situa-

tional descriptors rather than with mental state descriptors. We conducted MDS analyses because this approach can reveal a cognitive map of the sorting pattern for each group of participants, along with the underlying dimensions that best represent how participants perceived the similarities and differences among the face stimuli (Kruskal & Wish, 1978).

MDS analyses of the free-sort data (see Figure 3A, 3B) confirmed that Himba participants possessed a cognitive map of the posed facial expressions that was anchored in action identification, whereas the U.S. participants’ cognitive map also contained information about mental state inferences of discrete emotions. To conduct the MDS analyses, we subjected each co-occurrence matrix (i.e., the same similarity matrices used in the hierarchical cluster analyses) to an ALSCAL MDS procedure (Young & Lewycky, 1979). MDS provides an  $n$ -dimensional map in which the dimensions themselves can reveal the properties that perceivers use to structure their sorts. Based on the stress-by-dimensionality plots for solutions between one and six dimensions (see Figure S2 in the online supplemental materials), a four-dimensional solution was selected as the best fit for the two U.S. data sets (free sorting and anchored) and a three-dimensional solution was selected as the best fit for the two Himba data sets (free sorting and anchored).

To objectively identify the MDS dimensions (rather than to label them subjectively as most experiments do), we opted for an empirical approach (as in Feldman, 1995), in this case using hierarchical regression to identify the dimensions. To empirically identify the MDS dimensions required that the face stimuli be normed on a variety of properties. Fourteen independent samples of participants rated the 36 images in the stimulus set to estimate the extent to which each face depicted a given behavior (crying, frowning, laughing, looking, pouting, scowling, smelling, and smiling; see Table S5 in the online supplemental materials) or a given emotion as a mental state (anger, fear, disgust, sadness, neutral, and happiness; see Table S2 in the online supplemental materials). Each sample of 40 participants rated the 36 faces on one property only, resulting in a total of 560 participants. Ratings for each property were on a Likert scale ranging from 1 (*not at all*) to 5 (*extremely*). The images were rated by participants recruited on Amazon’s Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011) and restricted to IP addresses located in North America. Because our experiments on Mechanical Turk would not allow us to collect responses by Himba individuals, we decided to limit our normative ratings to the U.S. cultural context. This allowed us to test the applicability of the U.S. cultural model of emotions (captured by these ratings) to both U.S. and Himba cultural contexts. We computed the mean property rating for each image, resulting in 14 attribute vectors with 36 means, which we then used to empirically identify the MDS dimensions (following Feldman, 1995). In a series of hierarchical multiple regression analyses, we examined the extent to which behavior and emotion vectors explained variance in the MDS item coordinates for each dimension. By entering behavior vectors as the first block of predictors and the emotion

<sup>4</sup> Importantly, these piles are not accounted for by the items included in the set that were relatively “poor” exemplars. Four images, three of which were portrayals of anger and one portrayal of fear, had forced-choice ratings that diverged from the expected category. Yet, the cluster that most clearly diverged with the “discrete emotion” and presumed universal model comprised disgust and sadness portrayals.



*Figure 2.* Six-cluster solutions derived from a hierarchical cluster analysis. The cluster analyses are plotted in A–D with cluster on the *x*-axis. The *y*-axis represents the number of items grouped into a given cluster, with contents stacked by the emotion portrayed in each posed facial expression. Stacked bars containing several different colors indicate that faces portraying different discrete emotions were clustered together. Bars with a single color (or predominance of a given color) indicate relatively clean clustering of faces depicting one emotion category. The U.S. free-sort (A) cluster solution contains discrete emotion (i.e., the presumed “universal”) clusters with the exception of Cluster 5, which appears to contain portrayals of both disgust and sadness. The Himba free-sort (B) has three clear clusters (1–3) that map on to discrete emotion (i.e., the presumed “universal”) pattern. Both U.S. (C) and Himba (D) conceptually anchored sorting appears to yield relatively distinct cluster solutions compared with free sorting.

vectors as the second block, we were able to estimate the extent to which each dimension captured mental state (emotion) inferences (e.g., sadness) over and above merely describing the physical action of a face (e.g., pouting). Following action identification theory (Kozak et al., 2006; Vallacher & Wegner, 1987), we always entered behavior vectors as the first block of predictors and emotion vectors as the second. We performed a series of *F* tests (see Table S7 in the online supplemental materials) examining whether the behavior vectors (see Table S5 in the online supplemental materials) sufficiently explained a given MDS dimension, and whether discrete emotion vectors (see Table S2 in the online supplemental materials) accounted for that dimension over and above behaviors. A summary of the dimension variance accounted for by the behavioral and emotion vectors is presented in Table 1.

We predicted, and found, that the MDS dimensions for the Himba solution reflected behavioral distinctions (e.g., smiling, looking), whereas the dimensions for the U.S. solution largely reflected mental state distinctions (over and above behavior; see Table 1 for summary; see Table S7 in the online supplemental materials for *F* tests).

Taken together, MDS solutions for Himba and U.S. free-sort data confirmed strong cultural differences in emotion perception. It is unlikely that these findings were simply due to “poor” task-related performance in Himba participants, who have performed well on other psychological testing with significant demands (de Fockert, Caparos, Linnell, & Davidoff, 2011). Furthermore, stress was relatively low for the MDS solutions themselves and the *R*<sup>2</sup> values for identification of the MDS dimensions were large for

Himba participants' data ( $R^2$  values ranged between .597 and .865), indicating that there was robust and meaningful group-level consistency in how Himba participants sorted the face stimuli.

### Emotion Words Impact Emotion Perception in a Culturally Relative Manner

As predicted, the introduction of emotion word anchors prior to and during sorting influenced both U.S. and Himba participants' perceptions of the facial expressions. Participants from the United States (and to a limited extent Himba participants) conformed more to the presumed universal discrete emotion pattern, suggesting that it is emotion concepts that help to structure perceptions into discrete categories. The hierarchical cluster analysis produced a much clearer "universal" pattern for the U.S. participants in the conceptually anchored condition. Each of the six clusters appeared to represent a distinct discrete emotion category, with nose-wrinkled (disgust) and pouting (sadness) expressions now appearing in separate clusters (see Figure 2C, Clusters 4 and 6, respectively) compared with the free-sorting solution in which those expressions ended up in the same cluster (see Figure 2A, Cluster 5). For Himba participants, conceptually anchored sorting did not produce a cluster solution that recapitulated the discrete emotion portrayals embedded in the set. Only two of six clusters (see Figure 2D) contained a predominant emotion portrayal type: Cluster 1 contained only smiling faces and Cluster 3 contained only wide-eyed faces. Although at first this might appear to provide support for the universal perception of happiness and fear, an alternative interpretation is that there was universal perception for valence and arousal, respectively. For example, fear expressions are higher in arousal level than the other expressions included in the set and happy expressions were the only positive expressions included in the set. This is only speculation, however, because the stimulus set did not include other posed, positive expressions or surprised expressions that are equivalently high in arousal to fear expressions, which would be needed to more clearly test between discrete emotion versus affect views. There was also a difference in the composition of Cluster 2 (the predominantly neutral cluster) of Himba participants between the free and conceptually anchored conditions, with the cluster becoming more "inclusive" in the conceptually anchored condition, such that there were a number of negative emotion portrayals grouped with the neutral portrayals.

MDS analyses more clearly revealed how emotion words influenced the sorting behavior of Himba participants. Specifically, we found that facial expressions depicting emotion categories were more tightly clustered in multidimensional space for Himba participants exposed to emotion word anchors compared with Himba participants who freely sorted the faces into piles (see Figure 3A, 3C); this increase in clustering was most apparent for smiling and neutral faces. For U.S. participants (see Figure 3B, 3D), there was little change in the distances between within-category facial expressions.

As in the free-sorting data, the MDS dimensions anchoring the U.S. cognitive map were identified in emotion terms, reflecting that U.S. participants were making mental state inferences about the facial expressions (see Table 1; see Table S7 in the online supplemental materials for  $F$  tests). The Himba

cognitive map for the anchored-sort data was described more in terms of mental states when compared with the map representing the freely sorted faces. But only one of the three MDS dimensions was empirically identified in emotion terms, and two remained in behavioral terms (although one of these dimensions was trending for emotion;  $p = .064$ ). Taken together, these data indicate that emotion words have a powerful effect on emotion perception, even under relatively unconstrained task conditions.

### Computing "Accuracy"

In typical studies of the universality hypothesis, researchers compute the extent to which participants choose a word or description for each facial expression, or freely label that expression, in a way that matches the experimenter's expectations, and this is reported as *recognition accuracy*. We were not able to compute a similar recognition accuracy score because we do not have a model of what "chance" responding might look like in the sorting task. Nonetheless, we were able to compute a "consistency" score as the number of faces from a given emotion category that comprised the "dominant" content in a given pile. This score allowed for items from the same category to be broken into multiple piles and also allowed singletons (i.e., images that are placed alone and not grouped with other items) to be counted as "consistent." "Consistency," then, was defined as the percentage of items representing a discrete emotion category that were grouped and made up the majority of the content in a given pile.

A mixed-model analysis of variance, with consistency as the dependent variable, emotion category as the repeated measure (portrayals of anger, fear, sadness, disgust, neutral, and happiness), and cultural group as the between-participants factor (American or Himba) produced a main effect for cultural group, such that Himba participants had lower consistency for sorting discrete emotion faces together than did U.S. participants, with a mean consistency score of 49.615% ( $SD = 33.559$ ) compared with U.S. participants' mean of 67.101% ( $SD = 22.350$ ),  $F(1, 56) = 53.412$ ,  $p < .001$  (see Table S8 in the online supplemental materials). Lower discrete emotion sorting consistency was found regardless of emotion category. In both Himba and U.S. cultures, discrete sorting consistency was marginally higher for participants exposed to words ( $M = 58.576$ ,  $SD = 24.669$ ) than participants who were not ( $M = 54.223$ ,  $SD = 25.158$ ),  $F(1, 118) = 3.422$ ,  $p = .067$  (for means, see Table S8 in the online supplemental materials). The three-way interaction was not statistically significant,  $F(5, 280) = 0.816$ ,  $p = .510$ , Greenhouse–Geisser corrected.

The overall level of consistency that we computed in this study should not be compared with those obtained in traditional emotion perception tasks (which are provided for interested readers in Table S1 in the online supplemental materials) because of computational differences between these scores and traditional recognition accuracy scores. In addition, "consistency" is not the only way that an approximate "accuracy" score can be computed. For an additional approach called "discrimination," see the online supplemental materials.

### Discussion

The Western cultural script for what it means to be human includes the ability to "recognize" emotional expressions in a

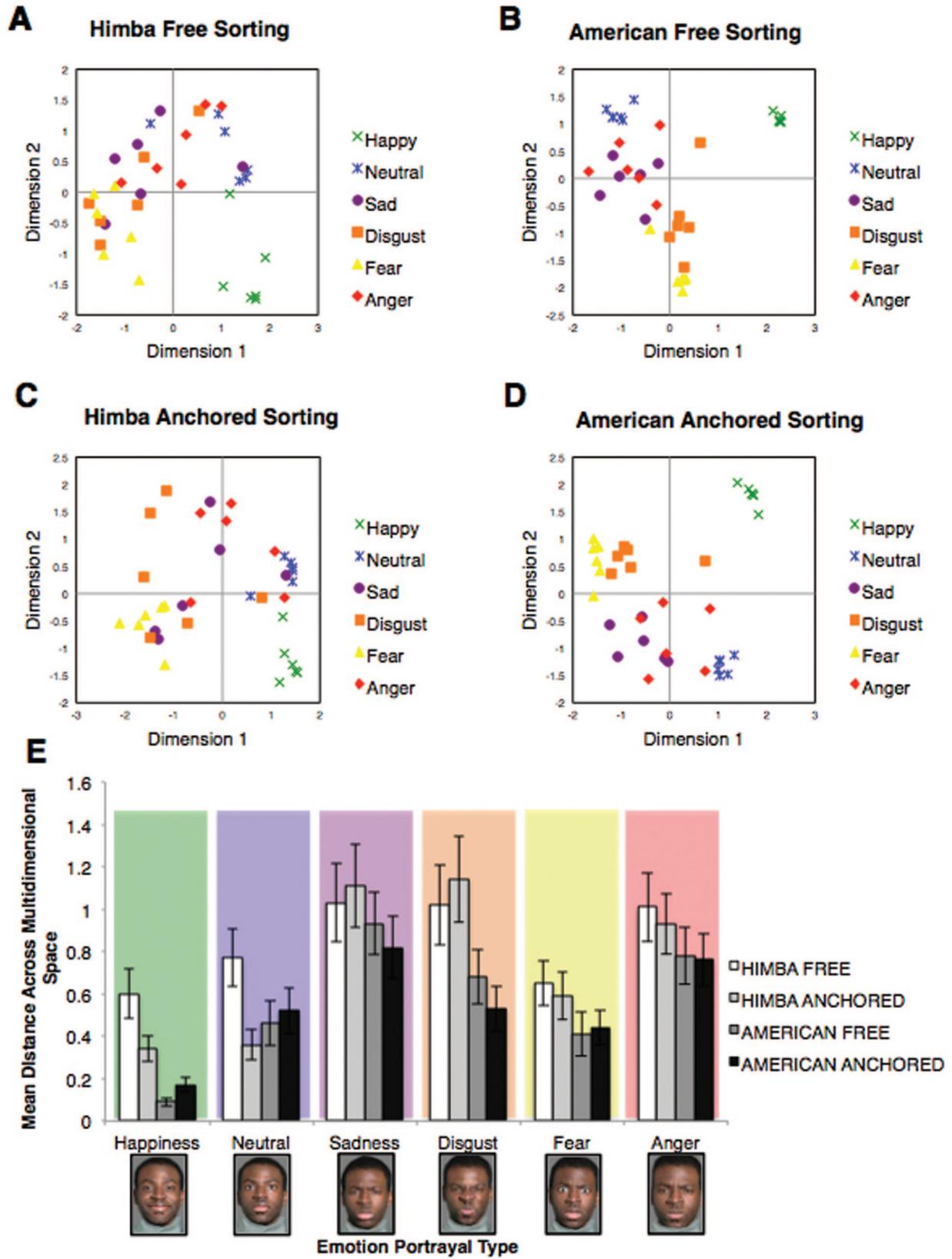


Figure 3 (opposite).

Table 1  
*Multidimensional Scaling Dimensions Identified Using Hierarchical Multiple Regressions*

Sort solution	Dimension 1		Dimension 2		Dimension 3		Dimension 4	
	Behavior	Emotion	Behavior	Emotion	Behavior	Emotion	Behavior	Emotion
Himba free	<b>.826***</b>	.064	<b>.732***</b>	.060	<b>.597***</b>	.122		
U.S. free	<b>.938***</b>	.021	<b>.885***</b>	<b>.078***</b>	<b>.913***</b>	.028	<b>.776***</b>	<b>.105*</b>
Himba anchored	<b>.865***</b>	.055	<b>.803***</b>	<b>.100*</b>	<b>.704***</b>	.091		
U.S. anchored	<b>.854***</b>	<b>.098**</b>	<b>.926***</b>	<b>.032*</b>	<b>.786**</b>	<b>.137**</b>	<b>.851***</b>	<b>.080**</b>

*Note.* The first block of regressors comprised eight sets of independent ratings in which the 36 face stimuli were rated for the extent to which they depicted specific behaviors (e.g., smelling, crying; see Tables S5 and S6 in the online supplemental materials for details);  $R^2$  values are presented in the Behavior column under each dimension. The second block of regressors comprised six sets of ratings in which each of the 36 faces was rated for the extent to which it represented emotions (e.g., disgust, sadness); the change in  $R^2$  due to these ratings is presented under each dimension labeled Emotion. The change in  $R^2$  reflects the extent to which the dimension reflects mental state inferences about emotion over and above the variance accounted for by action identification. Himba sorting data was captured by a lower dimensionality solution compared with U.S. sorting data (three dimensions instead of four). As a result, a fourth dimension was identified only for U.S. participants' data. Significant effects appear in bold type.

\*  $p \leq .05$ . \*\*  $p \leq .01$ . \*\*\*  $p \leq .001$ .

universal way. We show that small changes in experimental procedure disrupt evidence for universal emotion perception. By comparing emotion perception in participants from maximally distinct cultural backgrounds, U.S. participants and Himba participants from remote regions of Namibia with limited exposure to Western culture, we demonstrated that facial expressions are not universally "recognized" in discrete emotional terms. Unlike prior experiments, we used a face-sorting task that allowed us to manipulate the influence of emotion concepts on how the faces were perceived. Without emotion concepts to structure perception, Himba individuals perceived the facial expressions as behaviors that do not have a necessary relationship to emotions, whereas U.S. participants were more likely to perceive the expressions in mental terms and as the presumed universal emotion categories. When words for emotion concepts were introduced into the perception task, participants from both cultures grouped the facial expressions in a distinct manner. For U.S. participants, it was in a way that better resembled the presumed "universal" solution. For Himba participants, the difference between free and conceptually anchored solutions was subtle. Part of the sorting pattern of Himba participants was better accounted for by mental state ratings, consistent with the view that the presence of discrete emotion words produces emotion perception closer to the presumed "universal" model. Yet, the data did not neatly conform to this presumed universal model. This nuanced pattern of effects is consistent with recent evidence demonstrating that people from different cultures vary in their internal, mental representations of emotional expressions, even for emotion terms that have available translations across cultures (Jack et al., 2012). That is, linguistically relative emotion perception manifests in a culturally relative way.

The present findings also advance our understanding of what aspects of perception may be consistent across cultures, what

Russell (1995) has referred to as sources of *minimal universality*. In our data, smiling faces, as well as wide-eyed faces, were clustered into distinct piles by perceivers from both Himba and U.S. cultural contexts. Thus, it is possible that perceivers in both cultural contexts understood those same perceptual features as indicative of the same discrete emotional meaning. This would be consistent with a view in which smiles and widened eyes are signals of "basic" and universally endowed states of happiness and fear, respectively. Notably, this would constitute a much more limited set of universal expressions than hypothesized in most universality views. An alternative explanation, however, is that observed cross-cultural consistency in sorting behavior is driven by the universal ability to perceive some other psychological property, such as affect. The present task was not designed to test for this type of cross-cultural consistency given that examining affect perception would require a set of stimuli including multiple portrayal types for each quadrant of affective space (i.e., positive low arousal, positive high arousal, negative low arousal, negative high arousal). In our experiment, smiling faces were the only positive affective expression available to present to participants. In a separate line of work with the Himba culture, we did test this hypothesis using vocalizations because there were multiple exemplars from the different quadrants of affective space that were available. In both free-labeling and forced-choice experimental designs, we found evidence that Himba participants perceived affect in Western style vocal cues, with the most robust cross-cultural perception for the valence (positive and negative) dimension (Gendron, Roberson, van der Vyver, & Barrett, 2013).

Another possibility is that both cultures were able to consistently perceive situated action. Two results are consistent with this view. First, the free-labeling responses of participants from Himba culture revealed that posed facial expressions were understood in

Figure 3 (*opposite*). Multidimensional scaling solutions for free sorting of facial expressions. Free-sort data are plotted in two-dimensional space for Himba (A) and U.S. (B) participants. Anchored-sort data are also plotted in two-dimensional space for Himba (C) and U.S. (D) participants. Items are plotted by emotion type. Clearer evidence of the "universal solution" (closer clustering of facial expressions within the same emotion category) is more evident in the U.S. solutions (B, D) than in the Himba solutions (A, C). We quantified the clustering of items within a category across all dimensions and plotted these mean distances ( $\pm$  standard error) for each cultural group in each task (E).

terms of situated actions—for example, “smiling” and “looking at something.” Second, external perceiver ratings of faces based on situated actions (i.e., “smiling,” “looking,” etc.) were better predictors of how the faces were sorted by Himba perceivers than were external ratings of discrete emotional states, and these dimensions, although not sufficient to explain U.S. sorts, appeared to be important to them as well. Furthermore, neuroimaging evidence indicates that during instances of emotion perception, both the “mirroring” network (important to action perception) and “mentalizing” networks (also called the theory of mind network, the semantic network, or the default mode network; Barrett & Satpute, 2013; Lindquist & Barrett, 2012) are engaged (Spunt & Lieberman, 2012). Thus, consistency across Himba and U.S. participants’ sorting may have been driven by similar behavioral understanding of those facial muscle configurations as “smiling” and “looking” even if a mental state representation of “happiness” and “fear” additionally occurred for U.S. participants. Alternatively, it is possible that emotion concepts were implicated for both cultures, but that these concepts differed in the extent to which they are abstract concepts with mentalizing properties (and requiring language), as opposed to more concrete concepts that are anchored in action identification. This is a matter for future research.

Our findings underscore that facial actions themselves, regardless of their emotional meaning, can be meaningful as instances of situated action, an observation that is receiving increasing attention in the literature. For example, recent work has argued that the wide eyes of a posed fear expression evolved to increase sensory intake (Susskind et al., 2008), whereas the nose wrinkle of disgust evolved from oral–nasal rejection of sensory input (Chapman, Kim, Susskind, & Anderson, 2009). It is consistent with a psychological construction approach to hypothesize that specific facial actions evolved to serve sensory functions and later acquired social meaning and the ability to signal social information (Barrett, 2012). Although our findings do not speak to this hypothesis directly, they are consistent with the idea that facial actions are not arbitrary and instead may reflect the type of situated action that occurs during episodes of emotion. Yet, as we have seen in our norming data, facial actions and emotions are not redundant for U.S. perceivers in emotion perception, pointing to the importance of considering them separately in any discussion of evolution.

Our findings also help to reveal the limited ability of traditional “accuracy” approaches to quantify meaningful cultural variation in emotion perception. These results simply compare the task performance of participants with a single model of emotion perception. Our own computed consistency and discrimination scores that are based on the “fit” of the discrete emotion model to sorting behavior did not reveal the shifts in sorting that accompanied the presence of emotion words that were revealed by cluster and MDS analyses. In particular, our MDS approach represents a significant innovation in modeling cultural variation in emotion perception because it allowed us to test multiple explanations for the sorting behavior in each cultural context. With this approach, in conjunction with the explicit labeling data, it was revealed that individuals from Himba culture rely on behavioral rather than mental categories to make meaning of facial behaviors.

Our findings are consistent with a growing body of evidence that emotions are not “recognized” but are perceived via a complex set of processes (Barrett et al., 2011) that involve the interplay of different brain networks, such as those that support action identi-

fication and mental state inference (Spunt & Lieberman, 2012; Zaki, Hennigan, Weber, & Ochsner, 2010). Our finding that the presumed universal pattern of emotion perception appears to be linguistically relative is consistent with the pattern of published results (see Table S1 in the online supplemental materials), as well as our own laboratory research. In prior work, we demonstrated that experimentally decreasing the accessibility of emotion words’ semantic meaning, using a procedure called *semantic satiation* (Tian & Huber, 2010), reduces the accuracy with which participants produce the presumed universal pattern of emotion perception (Lindquist et al., 2006) because words help to shape the underlying perceptual representation of those faces (Gendron et al., 2012). Our current findings are consistent with research on patients with semantic deficits due to progressive neurodegeneration (i.e., semantic dementia) or brain injury (i.e., semantic aphasia) who do not perceive emotions in scowls, pouts, smiles, and so on (Calabria, Cotelli, Adenzato, Zanetti, & Miniussi, 2009; Lindquist, Gendron, Barrett & Dickerson, in press; Roberson, Davidoff, & Braisby, 1999). Even research in young children points to the importance of emotion words in emotion perception, because the presumed universal pattern of emotion perception emerges in young children as they acquire conceptual categories, anchored by words, for emotions (Widen & Russell, 2010). Taken together, these findings challenge the assumption that facial expressions are evolved, universal “signals” of emotion, and instead suggest that facial expressions are culturally sensitive “signs” (Barrett, 2012; Barrett et al., 2011). These findings have implications for the broad-scale adoption of a set of canonical, caricatured facial expressions into other disciplines such as cognitive neuroscience and clinical applications that have taken place over the past several decades. To properly understand how humans perceive emotion, we must attempt to move past the Western cultural model as the assumed model for people everywhere.

The present findings are not readily explained by a universality account of emotion recognition, even those that admit some minor cultural variability. It has been suggested, for example, that in addition to universal recognition abilities, cultures have “display rules” (Ekman, 1972) that allow people to regulate their expressions. Cultures are also thought to have “decoding rules” (Matsumoto & Ekman, 1989) that govern how people report on their perceptions of emotion to maintain a culturally appropriate response (e.g., in Japanese culture, individuals will discount the intensity of emotion perceived and report that another person is feeling less intensely). Neither the display nor the decoding rule account has the predictive power to explain the language-based effects we observed in the present study or the published findings demonstrating that, in U.S. samples, the presumed universal solution can be disrupted by interfering with emotion word processing. Display and decoding rules, as instantiations of culture, are relatively rigid and would not predict that emotion perceptions vary based on momentarily accessible concepts. Furthermore, our findings fit with other growing evidence that emotions such as anger and fear are not natural kinds, particularly in light of emerging evidence that central (Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012) and peripheral (Kreibig, 2010) measurements do not reveal consistent, diagnostic markers of distinct emotional states (Barrett, 2006) and that consistency in brain and bodily activation is driven by situations/methods rather than emotions themselves.

Our own study is not without limitations. Although our stimuli were posed by individuals of African origin, it is not known whether the expressions that they portrayed were isomorphic with the facial actions that Himba individuals typically make in everyday life given that they were portrayals based on the Western set of emotion categories. Although these posed expressions set limits to what we can learn about the nature of emotion representations in Himba individuals, they were well suited to the hypothesis at hand, allowing us to test the extent to which the presumed universal (i.e., Western or U.S. cultural) model describes perceptions of emotion in individuals from a remote culture. It is possible that we observed more “action-based” perceptions of these faces in Himba individuals precisely because these presumed facial expressions are not universal at all and are less meaningful as emotions in Himba culture. Future research should investigate whether Himba culture contains its own unique set of expressions, and whether Himba individuals use mental state inferences when presented with them.

A second way in which our study fails to fully characterize emotion perception in Himba individuals relates to the fact that we used translations of U.S. emotion category words. Additional characterization of Himba lexical categories is needed. It is possible that the Herero translations for emotion words used in our study are recently borrowed, as appears to be the case for the color term *burou*, borrowed from the German *blau*, also meaning blue. This might explain why Himba participants infrequently used the Herero discrete emotion words to label their piles, as well as the reduced potency of words to shape the perception of facial expressions. To that end, it would also be important to know the actual frequency with which Himba speakers use emotion words in everyday discourse (which could speak to how functional those words are for shaping perception) and the extent to which Himba individuals engage in action identification versus mental state inference more broadly. Our results suggest that Himba speakers might effectively use behavior categories for making predictions about future actions and their consequences, whereas U.S. individuals rely on mental state inferences for those purposes.

Finally, the present study was only designed to test for action perception as an alternative source of minimal universality. Future research should examine under what conditions affect perception (e.g., dimensions of pleasure-displeasure and arousal) also accounts for cross-cultural consistency in emotion perception.

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Received March 27, 2013

Revision received September 18, 2013

Accepted October 28, 2013 ■