

The Voice Conveys Emotion in Ten Globalized Cultures and One Remote Village in Bhutan

Daniel T. Cordaro
Yale University

Dacher Keltner
University of California, Berkeley

Sumjay Tshering
Sherubtse College

Dorji Wangchuk
Royal Thimphu College

Lisa M. Flynn
Yale University

With data from 10 different globalized cultures and 1 remote, isolated village in Bhutan, we examined universals and cultural variations in the recognition of 16 nonverbal emotional vocalizations. College students in 10 nations (Study 1) and villagers in remote Bhutan (Study 2) were asked to match emotional vocalizations to 1-sentence stories of the same valence. Guided by previous conceptualizations of recognition accuracy, across both studies, 7 of the 16 vocal burst stimuli were found to have strong or very strong recognition in all 11 cultures, 6 vocal bursts were found to have moderate recognition, and 4 were not universally recognized. All vocal burst stimuli varied significantly in terms of the degree to which they were recognized across the 11 cultures. Our discussion focuses on the implications of these results for current debates concerning the emotion conveyed in the voice.

Keywords: emotion, universal, culture, voice, expression

Evolutionary approaches to emotional expression seek to document brief patterns of behavior that convey distinct emotions. Knowing which states have distinct displays is critical to several lines of inquiry, including studies of mammalian homologues of human expression (Keltner & Buswell, 1997) as well as of emotion-specific neurophysiological correlates and the functions expressions serve within social interaction (Hess & Thibault, 2009; Keltner & Cordaro, in press; Keltner & Kring, 1998; Matsumoto et al., 2008; Shariff & Tracy, 2011). For these and other reasons, studies of expressive behavior have long been pivotal to the conceptual tasks of defining distinctions drawn between emotions (e.g., Ekman, 1992) and constructing emotion taxonomies (Keltner & Lerner, 2010).

Early studies focused on documenting how static photographs of prototypical facial expressions communicate a limited set of emotions in different cultures (Elfenbein & Ambady, 2002; Matsumoto, Yoo, & Fontaine, 2008). More recently, this science has broadened in two significant ways. First, researchers have turned to other modalities of emotional expression than facial muscle movement, focusing on tactile contact (Hertenstein, Holmes, McCullough, & Keltner, 2009), dance (Hejmadi, Davidson, & Rozin, 2000), gaze activity (Adams & Kleck, 2005), bodily movement (Dael, Mortillaro, & Scherer, 2012), and even odors (de Groot, Smeets, Kaldewaij, Duijndam, and Semin (2012). Second, scientists have broadened the range of emotions studied, focusing on states such as *love, gratitude, sympathy, pride, amusement, contentment, embarrassment, awe, and interest* (see Hejmadi et al., 2000; Hertenstein et al., 2009; Keltner, Tracy, Sauter, Cordaro, & McNeil, in press; Tracy & Robins, 2004). In the present research, we bring together these two developments to ask: How many emotions can be conveyed with the human voice?

In previous studies, two kinds of emotional vocalizations have been studied. A first is emotional prosody, the emotional tone a speaker provides when uttering words (Grandjean, Sander, Pourtois, Schwartz, Seghier, Scherer, & Vuilleumier, 2005). Emotional prosody necessitates incidental speech and is considered a *verbal* emotional vocalization. There has been extensive work on the acoustic patterns (i.e., pitch, intensity, duration, etc.) of prosodic displays of *anger, fear, happiness, and sadness* (see Juslin & Laukka, 2003; Scherer, Johnstone, & Klasmeyer, 2003), as well as recognition studies examining the extent to which emotional prosody can be decoded at above-chance accuracy across cultures and

This article was published Online First September 21, 2015.

Daniel T. Cordaro, Department of Psychology, Yale University; Dacher Keltner, Department of Psychology, University of California, Berkeley; Sumjay Tshering, Department of History, Sherubtse College; Dorji Wangchuk, Department of External Relations, Royal Thimphu College; Lisa M. Flynn, Department of Psychology, Yale University.

During the course of these studies, Daniel T. Cordaro and Lisa M. Flynn changed affiliations to the Department of Psychology, Yale University. These authors also conducted this research under affiliations with UC Berkeley (DTC) and UC Santa Barbara (LMF).

During the course of these studies, Dorji Wangchuk changed affiliation to the Royal University of Bhutan. He also conducted this research under an affiliation with Sherubtse College.

Correspondence concerning this article should be addressed to Daniel T. Cordaro, Department of Psychology, Yale University, New Haven, CT 06511. E-mail: dtcordaro@gmail.com

linguistic boundaries (e.g., Beier & Zautra, 1972; Kramer, 1964; van Bezooijen, Otto, & Heenan, 1983; Scherer, Schorr, & Johnstone, 2001).

A second kind of emotional vocalization is vocal bursts—nonlinguistic sounds that occur either between speech incidents or without them altogether, which can communicate emotional states (Scherer & Wallbott, 1994). Examples of vocal bursts are shrieks, groans, growls, howls, and oohs and ahhs of different kinds. Vocal bursts are old evolutionarily, almost certainly predating the spoken word: other primates emit calls that resemble human vocal bursts, including vocalizations related to food, care, sex, affiliation, and aggression (Seyfarth & Cheney, 2003; Snowdon, 2003). In humans, vocal bursts can convey emotion even when the decoder is unable to see the encoder (Sauter, Eisner, Ekman, & Scott, 2010), and are particularly important in how infants communicate emotions to caregivers before the visual system matures (Mehler, Bertoncini, Barriere, & Jassik-Gerschenfeld, 1978). It is historically noteworthy that in Darwin's analysis (Darwin, 1872), at least half of the over 40 emotional states he described included references to nonverbal sounds—screams of fear, snorts of contempt, retches of disgust, and roars of triumph (Keltner, 2009). Most germane to the present study, nonverbal vocal bursts lend themselves to cross-cultural study, because they are free of the syntax and prosody of a culture's language.

Three studies set the stage for the present investigation, all grounded in the work of Ekman, Sorenson, and Friesen (1969), but moving beyond the six-emotion approach in that research. Sauter and colleagues documented that vocal bursts of *achievement/triumph, contentment, amusement, sensual pleasure, and relief* can be reliably judged at above chance levels of accuracy (Sauter & Scott, 2007). Building upon these findings, Simon-Thomas and colleagues found that United States participants could reliably recognize vocal bursts of *anger, disgust, fear, sadness, surprise, contempt, embarrassment, amusement, awe, interest, relief, pleasure, enthusiasm, and triumph* but not those of *guilt, shame, compassion, gratitude, love, contentment, and desire* (Simon-Thomas, Keltner, Sauter, Sinicropi-Yao, & Abramson, 2009). More recently, Laukka and colleagues (2013) tested vocal bursts of 18 emotions from India, Kenya, Singapore, and the United States with Swedish listeners using a within-valence, forced-choice procedure, and found high recognition rates for *anger, contempt, disgust, fear, sadness, surprise, happiness, interest, lust, relief, and serenity*, but *affection, amusement, pride, distress, guilt, and shame* were not recognized. All naïve observers in this past research, it is critical to note, were from industrialized, Western European cultures.

Building upon three studies, the present investigation aimed to ascertain whether a much wider array of cultures would recognize the emotions previously investigated in the Simon-Thomas et al. (2009) and Laukka et al. (2013) studies. The present investigation focused on *anger, disgust, fear, interest, sadness, awe, embarrassment, triumph, amusement, contentment, desire (savoring/sensory pleasure), contempt, relief, surprise, pain (distress), and compassion (sympathy)*.¹ We did not test *gratitude, guilt, love/affection, pride, or shame* because recognition rates were low for these emotions in previous studies. Following the methods of Simon-Thomas and colleagues (2009) we gathered vocal bursts of 16 emotions. In Study 1, we examine whether participants from 10 industrialized cultures can match 16 vocal bursts to simple emo-

tional situations, using a story matching methodology developed in previous studies (Gendron, Roberson, van der Vyver, and Barrett, 2014; Sauter et al., 2010; Scott & Sauter, 2006; Simon-Thomas et al., 2009). In Study 2, we used a similar methodology with participants in an isolated village in the Himalayas of remote Bhutan, a culture never studied before in the science of emotion.

The data gathered in the present investigation are germane to three questions. The first is: *How many emotions can be communicated with vocal bursts?* In the present study, our first hypothesis was that 16 of the emotions previously tested by Laukka et al. (2013), Sauter et al. (2010), and Simon-Thomas et al. (2009) and would be recognized at above-chance rates using similar methods in 10 industrialized nations (Study 1). The 10 cultures sampled differ profoundly in religion, political structure, degree of economic development and inequality, and social values, and represent the widest range of cultures studied to date in emotion recognition studies of vocal bursts.

The second question guiding this work is: *Will people from a remote culture recognize western vocal bursts that might convey emotion?* Data from remote cultures reveal whether people can recognize emotion in expressive behavior absent the potential influences of western media and the globalized culture on the Internet. Guided by this conceptual analysis, Sauter et al. (2010) performed a two-way cross-cultural vocal burst experiment with United Kingdom participants and members of the Himba, a culturally isolated group in Namibia. Vocal bursts for *amusement, anger, disgust, fear, sadness, and surprise* were decoded accurately across cultures (i.e., Himba vocal bursts were reliably decoded by United Kingdom participants, and vice versa) but those of *achievement* and *sensual pleasure* were not bidirectionally recognized, and *relief* vocal bursts were similarly recognized, although not bidirectionally recognized. More recently, Gendron and colleagues (2014) found that Himba participants could only reliably recognize vocal bursts derived from Sauter and colleague's 2010 (Sauter et al. (2010)) study when the target vocal burst and foils given were of a different valence (Gendron et al., 2014), although in their reanalysis of their own data, Sauter and colleagues (in press) found recognition rates that were significantly above chance, regardless of whether the foils were the same valence as the target or not.

The data from Study 2 are relevant to this debate (although designed and carried out before it), and extend it significantly by examining whether naïve observers from a remote culture in Bhutan can identify 16 distinct emotions in vocal bursts that are matched in terms of their valence. In line with the findings from the Sauter et al. (2010) study, our second hypothesis held that vocal bursts related to achievement (triumph), sensory pleasure (desire), and relief would not be reliably identified in remote Bhutan. We also hypothesized that vocal bursts of *amusement, anger, awe, contempt, contentment, disgust, embarrassment, fear,*

¹ Given the lack of consensus in the field about which states are considered emotions, it can be questioned whether the states of interest in this investigation are emotions. Answers to that question will vary, and depend on the particular investigator's theoretical approach and definition of emotion. We chose to include these states in this investigation because of past research on vocal bursts, and because each of these states has been studied by other investigators in terms of its brief, emotion-like, expressive characteristics (see Keltner & Lerner, 2010).

interest, pain, sadness, surprise, and sympathy would be recognized at above-chance levels in Bhutan, even when presented with foils matching in valence.

The third question guiding the present investigation is: *To what extent does emotion recognition vary as a function of culture?* Cultural variation in emotion recognition can be placed on recognition gradients, which reveal that emotions vary systematically in how well they are recognized (Keltner & Haidt, 1999). For example, in research on the recognition of emotion from static photos of facial expression, some emotions were readily judged across methods, such as anger, whereas others were less reliably judged, such as sympathy and shame (Haidt & Keltner, 1999). Emotion expression recognition rates vary as a function of culture for at least three reasons (Mesquita & Leu, 2007). First, cultures vary in their display rules, that is the norms that govern the context-specific expression of emotion, which likely influences the frequency with which emotions are expressed and recognized in different cultures (Matsumoto et al., 2008). Second, cultures vary according to which emotions they privilege or value in day-to-day interactions, which again should yield cultural variations in emotion recognition (Tsai et al., 2006). For example, excitement is an “ideal affect,” privileged in the United States, as evident for example, European American preschool children’s preferences for books that depict excited, happy characters, and Taiwanese preschool children’s preferences for story characters with calm, contented expressions (Tsai, Louie, Chen, & Uchida, 2007). Cultural variations in which emotions are valued could also produce gradients of emotion-specific recognition. Finally, cultures vary in nonverbal “accents,” culturally specific ways of expressing specific emotion (Marsh, Elfenbein, & Ambady, 2003). These three sources of cultural variation in the understanding and expression of emotion should plausibly produce variants in recognition across cultures. In the present study, we relied on several criteria to capture such a gradient of emotion recognition accuracy across the widest array of vocal bursts and cultures studied to date, hypothesizing that cultural variations in emotion recognition could be placed on a gradient of recognizability, with the exception of contempt, relief and sympathy, which have not fared well in recognition studies across cultures (on sympathy, see Haidt & Keltner, 1999; on relief, see Sauter et al., 2010; on contempt, Russell, 1991).

Study 1: Vocal Burst Recognition in Ten Globalized Cultures

Native college students from 10 different nations—*China, Germany, India, Japan, South Korea, New Zealand, Pakistan, Poland, Turkey, and the United States*—were recruited to take part in a study on recognizing vocal bursts. Participants were asked to match one-sentence stories of 16 emotions (one male and one female pronoun version of each story) to nonverbal bursts of these 16 emotions. In light of recent critiques of this story matching paradigm (Gendron et al., 2014), participants matched each of the 16 emotion-specific stories to one of three vocal bursts—one target and two randomly generated foils, all in the same valence category—or chose “none of the above.”

Method

Participants. Participants were native college students who were notified through email, in person, or through online social

networks that an online test was available that would test their understanding of emotional expression (mean age = 25; 64% female, 36% male worldwide). Participants accessed the test at their home computers through a link from <http://ucbpsych.qualtrics.com>. In situations where participants did not have a personal computer, one was provided to them at the universities with which we collaborated. We selected for participants who: (a) were between the ages of 18 to 30; (b) who had minimal experience living in other cultures (maximum of 1 month self-reported lifetime travel experience); (c) who had no prior knowledge of the scientific study of emotional expressions, which was ascertained through self-report; and (d) who did not have a significant hearing impairment, which was ascertained through self-report and by identifying a test sound. The students were recruited from universities in China, Germany, India, Japan, South Korea, New Zealand, Pakistan, Poland, Turkey, and the United States. These industrialized countries represent a wide spectrum of values, beliefs, and traditions (Hofstede, 1998).

Vocal burst stimuli. The stimuli were 32 nonverbal vocal bursts produced by three female and three male native English speakers. Guided by the results of Simon-Thomas et al. (2009), we used high-definition sound equipment and an anechoic recording environment to record vocal bursts of 16 emotions: *amusement, anger, awe, contempt, contentment, desire, disgust, embarrassed, fear, interest, pain, relief, sadness, surprise, sympathy, and triumph*. These vocal bursts were similar in duration and acoustic qualities to vocal bursts from previous studies (Gendron et al., 2014; Sauter et al., 2010; Simon-Thomas et al., 2009). Guided by the stimulus production methods of previous studies, six posers—three female and three male—were presented with a definition of each emotion (see Simon-Thomas et al., 2009) and then asked to produce sounds without words that would express the subjective state described. In a pilot study, we pretested the full array of vocal bursts gathered to 54 college students in the United States, who chose the emotion from a list of 9 emotion words (all of the same valence) that best described each sound that they heard. For each of the 16 emotions, we selected two vocal bursts—one male and one female version—based on fulfilling three criteria: (a) they had the highest recognition rates from our pilot sample; (b) the correct word was paired with the stimuli by at least half of our pilot participants; and (c) the target word was selected with the greatest frequency of all the choices. Our pretest participants were comprised of 13 self-identified males, 40 self-identified females, and 1 self-identified as neither male nor female. The median self-reported age was 20, all participants reported that English was their primary language, and all participants reported having normal hearing. In Table 1 we present descriptions of what the vocal bursts sounded like (example vocal bursts are available at <http://socrates.berkeley.edu>). In Table 2 we present the accuracy rates for the stimuli which fulfilled the above three criteria.

Emotion stories. Humans have a rich spoken language used to communicate emotion, a language that varies in number of words and denotative and connotative content (Heider, 2006; Mesquita & Frijda, 1992; Russell, 1991). This poses challenges to the reliance upon single words in emotion recognition studies (see Russell, 1994). Cultures vary in the lexical equivalents of emotion words (Russell & Sato, 1995), whether or not emotion words refer to interior states (Lutz, 1982), and whether or not words refer to single or multiple states (Frijda, Markam, Sato, & Wiers, 1995). In

Table 1
Descriptions of the Vocal Bursts

Experience	Vocal burst
Amused	Laughter
Angry	Growl
Awe	“Wow”
Contempt	“Thuh,” spit sound
Content	“Ahh,” long sigh
Desire	“Mmm” savoring sound
Disgust	“Ughh,” retching
Embarrassed	Self-conscious laughter, groan
Fear	Scream
Interested	“Mmhmm”
Pain	“Ouch”
Relief	“Whew,” short sigh
Sadness	Crying
Surprise	Gasp
Sympathy	“Aww”
Triumph	“Woo-hoo”

light of these concerns, an alternative approach in emotion recognition studies to using single words is to match nonverbal stimuli to emotion stories (Camras & Allison, 1985; Dashiell, 1927; Ekman & Cordaro, 2011; Ekman et al., 1969; Russell, 1997), a method used in recent studies on nonverbal vocal bursts (Gendron et al., 2014; Sauter et al., 2010; Scott & Sauter, 2006; Simon-Thomas et al., 2009). Stories add critical information about the situation within which a subjective experience is arising, allowing for more precise communication than what a single word could offer (Izard, 1994; Russell, 1991).

We derived our stories from recent studies of vocal bursts (Sauter et al., 2010; Simon-Thomas et al., 2009). In these studies, one-sentence stories that focused on an elicitor and a descriptor of the subjective experience were used as prompts for participants to choose a nonverbal vocal burst. This method can be traced back to the cross-cultural work of Ekman et al. (1969), who crafted simple, one sentence stories, each of which matched one of the six emotions under investigation. Gendron et al. (2014), Sauter et al. (2010), and Simon-Thomas et al. (2009) all derived their stories from these originals, which were edited with the assistance of cross-cultural informants so that cultures under investigation would understand them. For previously unstudied emotions, Sauter et al. (2010) and Simon-Thomas et al. (2009) wrote new one-sentence stories. For the present investigation, we used the Sauter et al. (2010) and Simon-Thomas et al.'s (2009) stories with minimal or no modifications as suggested by our cultural informants, such that the original meanings were not significantly altered; stories were matched to the intended emotion at above-chance rates in the United States, consistent with ratings from previous studies.

The story translation procedure was similar to that of previous studies that inspired the present one. We iteratively revised these 16 stories in collaboration with 33 cultural informants—3 native speakers from each of the 11 countries in the present investigation—until consensus was reached that we had achieved 16 simple stories that could be readily translated into each language (see Table 3). None of the original stories was altered significantly from the initial meaning. For desire, we wrote two stories, one for sex, and one for food, the latter being included because our cultural informants advised that some

participants may not be comfortable responding to a story about sex. Consistent with the stimuli production methods of previous studies (Ekman et al., 1969; Sauter et al., 2010; Simon-Thomas et al., 2009) and the concept of distress from Laukka et al.'s (2013) vocal burst study, we also added a story for physical pain, involving hitting one's leg on a rock.

Translations. A double-back translation method was used for all surveys and the emotion stories. Three translators from each culture were chosen if they were fluent in both English and the target language. Translator 1 converted all text from English to the target language. Translators 2 and 3 each separately backtranslated the initial translation into English. The two backtranslated documents were returned to the experimenters, who compared the two backtranslations for consistency and correctness with respect to the original. Any discrepancies were discussed with all three translators, and edits were made accordingly. The translators were also instructed to make the stories sound colloquial, rather than an obvious translation from English. Table 3 presents the emotions of interest in this investigation (first column), the original emotion stories from past investigations (Column 2), and the stories we created in collaboration with our cultural informants in 11 cultures (Column 3).

Procedure. On a given trial, participants read a one sentence story-situation and then listened to three nonverbal vocal bursts—one target and two foils, which were randomly chosen but matched the valence of the target and story (Gendron et al., 2014). Participants were instructed to choose the sound that best represented what the person in the story might do, or choose “none of these” if none of the sounds matched their interpretation of the story. Each story was presented twice—one “he” version accompanied by male-produced sounds and one “she” version accompanied by female-produced sounds.

Because participants across-cultures can readily distinguish between positively/negatively valenced expressions and stories (Barrett, 1998; Sauter, 2007), our target and foil vocal burst choices were of the same valence, either all positive or all negative, which—in combination with the “none of the above”

Table 2
Pilot Test Recognition Rates for Vocal Bursts Selected for Use in the Present Investigation (N = 98)

	Female	Male
Amused	92	96
Angry	94	91
Awe	88	80
Contempt	64	76
Content	76	62
Desire	58	52
Disgust	91	87
Embarrassed	71	55
Fear	77	87
Interested	75	67
Pain	95	87
Relief	80	73
Sadness	87	83
Surprise	85	88
Sympathy	79	81
Triumph	73	91

Table 3
Emotions, Emotion Stories Used in Previous Studies, and Emotion Stories Used in Present Research

English	Original story	Emotion story that contains this word
Amused	You find something humorous. ^a	His/her friend just told him/her a very funny story, and s/he feels very amused by it.
Angry	Someone is being treated in a rude way deliberately, and is very angry about it. ^a	He/she has been insulted and is very angry about it.
Awe	You feel that you are in the presence of something greater than yourself. ^b	He/she sees the biggest waterfall in the world for the first time, and s/he is awed by how enormous and powerful it is.
Contempt	You feel superior to someone because of them doing something negative. ^b	He/she sees a wealthy person throwing expensive clothing into the garbage, and s/he feels contempt over such a wasteful act.
Content	You are deeply satisfied with your current condition. ^b	He/she has been resting comfortably on a peaceful day, and s/he feels contented.
Desire	You are sexually attracted to someone. ^b	He/she sees someone who is very sexually attractive, and s/he feels a strong desire to have sex with them.
Disgust	Someone has just eaten rotten food and feels very disgusted. ^a	He/she is hungry and sees some delicious food that s/he desires. He/she has just eaten some rotten food and feels very disgusted.
Embarrassed	Someone discovers that you have made a social gaffe. ^b	He/she had been passionately singing his/her favorite song until s/he realized his/her friends were watching, and now s/he feels embarrassed.
Fear	Someone is suddenly faced with a dangerous animal and feels very scared. ^a	S/he is suddenly faced with a dangerous animal and feels very afraid.
Interested	You are curious about something and want to explore it. ^b	He/she is learning some useful information which s/he finds very interesting.
Pain	Based on cultural informant agreement. ^c	S/he just hit his/her leg on a rock, and it feels painful.
Relief	Someone has just found their child after it was lost and they feel very relieved. ^a	He/she has just escaped a dangerous situation and feels very relieved that s/he was not harmed.
Sadness	Someone finds out that a member of their family has died and they feel very sad. ^a	His/her cousin has just died, and s/he feels very sad.
Surprise	Someone sees a bright light in the middle of the night and is very surprised. ^a	S/he sees a bright light in the middle of the night and is very surprised.
Sympathy	You are moved by someone else's suffering. ^b	S/he sees someone with an injury, and s/he feels sympathy for them.
Triumph	You celebrate a victory. ^b	S/he has just won a very challenging competition and feels triumphant.

Note. In Column 2, stories designated with a ^a are from Sauter, Eisner, Ekman, and Scott (2010), those accompanied by a ^b are from Simon-Thomas, Keltner, Sauter, Sinicropi-Yao, and Abramson (2009), and stories designated with a ^c are based on the agreement between cultural informants across 11 cultures.

choice—made for a more conservative test of the recognizability of the vocal bursts of 16 emotions (Gendron et al., 2014). By controlling for valence in this way, the present data also contribute to the current debate about whether recognition of discrete emotion in vocal bursts is confounded by valence (Gendron et al., 2014; Sauter et al., in press). Positive emotions in the present study were: *amusement*, *awe*, *contentment*, *desire*, *interested*, *relief*, *sympathy*, and *triumph*. Negative emotions included: *anger*, *contempt*, *disgust*, *embarrassment*, *fear*, *pain*, and *sadness*. *Surprise*, a neutral emotion, was included in both categories. To illustrate this method, a participant may read the story for *contentment* (“He is resting comfortably on a peaceful day and feels contented.”) and hear the vocal bursts for *contentment* (“ahhh”), *interest* (“mhmm”), and *desire* (“mmm”). In another example, the participant may read the story for *anger* (“She has been deliberately insulted and feels very angry about it.”) and hear the vocal bursts for *disgust* (“ugh”), *anger* (“grrr”), and *fear* (“ahhh!”). In all cases, the participant would choose one vocal burst, or none of the above.

Results and Discussion

Analysis. Each participant made 32 judgments, matching 16 emotion stories (one female, one male) to vocal bursts of the same valence. In Tables 4 and 5, for each emotion we present

the mean levels of accuracy observed in judging the vocal bursts in each of the 10 cultures, and, in parentheses, the effect size for the recognition rates for each emotion, which control for boosts in accuracy produced by chance guessing (Elfenbein & Ambady, 2002). These guessing-corrected effect sizes were calculated using the standard formula for accuracy rating effect size: $(\text{proportion correct} - (1/\text{number of choices})) / (1 - (1/\text{number of choices}))$. In the case of the present study, the specific effect size formula would be: $((\text{proportion correct} - .25) / .75)$. For example, a value of .70 indicates that when participants were not merely guessing, they chose the target response 70% of the time. A value of zero indicates that only chance guessing can account for the observed accuracy rate. Finally, in the last column of Tables 4 and 5 we present overall accuracy observed in judging the positive vocal bursts and the negative vocal bursts. Footnotes indicated significant differences between cultures in this composite measure of accuracy at $p < .01$.

Cultural agreement in recognizing vocal bursts. Overall, participants across the 10 cultures matched the story to the correct vocal burst 79.5% of the time for positive emotions, and 80.4% for negative emotions, accuracy levels that are comparable to other studies of similar samples (Laukka et al., 2013). Nonparametric binomial t tests determined whether participants chose the target expression at higher rates than chance, which was 25% for this task

Table 4

Recognition Rates and Effect Sizes (in Parentheses) in Judgments of Positively Valenced Vocal Bursts Across 10 Cultures

	Amused	Awe	Content	Desire (food)	Desire (sex)	Interest	Relief	Sympathy	Triumph	Overall accuracy
China $N = 52$	88% (.85)	96% (.95)	76% (.66)	62.5% (.49)	60.5% (.46)	81.5% (.74)	82% (.77)	69.5% (.58)	95% (.92)	79% (.71)
Germany $N = 43$	87% (.81)	90% (.88)	82.5% (.75)	90.5% (.88)	57.5% (.44)	88% (.81)	89.5% (.84)	69.5% (.60)	87% (.81)	82.4% (.76)
India $N = 45$	83% (.76)	84.9% (.79)	65.1% (.61)	64.2% (.53)	71.7% (.61)	76.4% (.67)	77.6% (.70)	75.5% (.67)	97.2% (.97)	77.3% (.70)
Japan $N = 55$	69% (.59)	89.5% (.85)	60.5% (.47)	64% (.47)	51.5% (.34)	76% (.68)	80.5% (.73)	55.5% (.39)	88.5% (.85)	70.6% (.60)
S. Korea $N = 50$	66% (.55)	83% (.76)	65.5% (.54)	40% (.20) (ns)	48% (.31)	76.5% (.68)	79% (.71)	34% (.12) (ns)	86.5% (.81)	64.3% (.52) ^a
New Zealand $N = 11$	87.5% (.88)	100% (1.0)	87.5% (.88)	87.5% (.88)	87.5% (.88)	75% (.76)	75% (.64)	87.5% (.88)	100% (1.0)	87.5% (.87)
Turkey $N = 46$	76% (.68)	92% (.88)	93% (.91)	68% (.57)	77.5% (.71)	59.5% (.45)	75.5% (.68)	75% (.65)	92.5% (.91)	78.8% (.71)
Poland $N = 64$	94% (.91)	96% (.93)	88% (.89)	96% (.93)	87.5% (.89)	89.5% (.89)	94% (.91)	45% (.32)	94.5% (.91)	87.2% (.84)
Pakistan $N = 35$	89% (.85)	84% (.77)	92% (.89)	90% (.85)	56.5% (.43)	85.5% (.81)	95% (.92)	84% (.77)	88.5% (.85)	85% (.79)
U.S. $N = 52$	81% (.74)	86% (.82)	84.5% (.79)	84.5% (.85)	73.5% (.64)	88% (.85)	83.5% (.77)	83% (.77)	85.5% (.82)	83.4% (.78)

Note. Values marked as not significant (ns) represent nonverbal vocal bursts that were not recognized at above-chance rates. Footnotes indicate cultural differences in composite accuracy rating at $p < .01$.

^a Significant differences in effect sizes were found between Germany > S. Korea (.24), NZ > S. Korea (.35), Poland > S. Korea (.32), Pakistan > S. Korea (.27), U.S. > S. Korea (.26).

(three vocal burst choices and none of the above).² We present the results using two significance levels: the Bonferroni correction ($\alpha = .003$) to control for the possibility of Type I error (Wilkinson, 1999), and the standard α level ($\alpha = .05$), to avoid the risk of Type II error due to the Bonferroni correction (Silverstein, 1986). In keeping with our first hypothesis, across the 10 cultures, 14 vocal bursts were recognized at significantly above-chance levels at the Bonferroni-corrected α level: *amusement, anger, awe, contempt, contentment, desire (sex), disgust, embarrassed, fear, interest, pain, relief, sadness, and triumph*. Contrary to our first hypothesis, two vocal bursts were not recognized at above-chance levels at the Bonferroni-corrected α level: *desire (food)* failed in South Korea and *surprise* failed in India.

Cultural differences in recognizing vocal bursts. Consistent with previous findings (Gendron et al., 2014; Jack, Garrod, Yu, Caldara, & Schyns, 2012; Russell, 1994; Scherer & Wallbott, 1994), the effects of cultural membership on both positive and negative vocal burst recognition were significant, Pillai's Trace = .298, $F(18, 806) = 7.848, p < .001$. Univariate analyses revealed that the effects of cultural membership were significant for both positive vocal bursts, $F(9, 403) = 14.707, p < .001$ and negative vocal bursts, $F(9, 403) = 6.490, p < .001$.

Study 1 provided the broadest support, in terms of range of cultures and emotions studied, for our first hypothesis, that vocal bursts communicate emotion. The cultures we studied varied in terms of religion, political structure, self-construal, power distance, and gender roles. Yet importantly, college students were the participants in each culture. They were all educated, often wealthier, living in more industrialized regions of their country, and exposed to western culture through traditional and new social media (Henrich, Heine, & Norenzayan, 2010). Furthermore, college students are generally familiar with multiple choice testing, are regularly exposed to global media, and many have some degree of comfort participating in psychology experiments. The results from Study 1 may represent an upper limit of how well these vocal bursts may be recognized. The less charitable interpretation of the results from Study 1 is that the levels of accuracy obtained were largely the product of exposure to similar media, and portrayals of emotion in those media. In light of these concerns, in Study 2 we presented the vocal bursts of the 16 emotions of interest to a remote people in Bhutan, who had had no contact with the West.

Study 2: Vocal Burst Recognition in an Isolated Culture in Bhutan

Bhutan is one of the most isolated and culturally preserved countries in the world, covered completely by the Himalayas with steep terrain and remote outskirts (see Lebo & Schelling, 2001). This has allowed the age-old Buddhist culture and traditions of Bhutan to flourish throughout the centuries. Bhutan's original 18 languages and dialects are still spoken regionally between the 720,000 people that make up the country's population, however, transformation of Bhutan has occurred most rapidly since 1961, when the Third King launched plans for modernization (Ura, 2005; Van Driem, 1993). In 1999, the Kingdom of Bhutan became the last country on earth to legalize and introduce TV and the Internet, and while much of the country has limited access to some form of mediated communication, there are still some remote communities that have not been exposed to modern amenities or any form of contact to the globalized world (Dorji & Pek, 2005).

In Study 2, native villagers with no access to modern amenities living in the isolated northeastern Himalayas of remote Bhutan were recruited to take part in a study on recognizing vocal bursts. In the region of the participating village, there are no roads, no electricity, no TV, no Internet, no smartphones, no tourists, and no regular contact with anyone who has experienced the above. The villagers live as a small, autonomous community of farmers and cow herders, and nearly all livelihood is dependent on cultivating potato, eggplant, rice, and cheese.

In Study 2 we used the same vocal burst stimuli and stories from Study 1, but the testing took place face-to-face. Again participants matched each emotion story to one of three vocal bursts—one target and two foils all in the same valence category—or chose none of the above. Emotion recognition studies of the remote Himba have yielded contrasting results. Sauter and colleagues found that the Himba could reliably identify vocal bursts of *amuse-*

² Across both studies and all 11 cultures, "none of the above" was used by Participants 30% of the time when they chose a foil, revealing this option to be a commonly used one; chance was therefore set at 25%. We also note that these baserates in the frequency of using the none of the above option are similar to those obtained in Simon-Thomas et al.'s (2009) studies, the most comparable with the two studies presented here.

Table 5
Recognition Rates and Effect Sizes (in Parentheses) in Judgments of Negatively Valenced Vocal Bursts Across 10 Cultures

	Anger	Contempt	Disgust	Embarrassment	Fear	Pain	Sadness	Surprise	Overall accuracy
China <i>N</i> = 52	88% (.84)	93% (.90)	85.5% (.79)	87.5% (.82)	90% (.87)	89.5% (.87)	94% (.92)	58% (.44)	85.7% (.81)
Germany <i>N</i> = 43	77% (.69)	74.5% (.66)	80.5% (.75)	82.5% (.75)	76.5% (.69)	76% (.69)	85% (.81)	79.5% (.72)	78.9% (.72)
India <i>N</i> = 45	55.7% (.41)	92.5% (.91)	67% (.56)	79.3% (.73)	70.8% (.61)	83% (.76)	90.6% (.88)	31% (.11) (ns)	71.2% (.62) ^a
Japan <i>N</i> = 55	60% (.47)	75% (.66)	83.5% (.78)	80% (.73)	91% (.88)	68% (.56)	93% (.90)	74% (.64)	78.1% (.70)
S. Korea <i>N</i> = 50	66.5% (.55)	75.5% (.68)	81% (.73)	85.5% (.81)	69% (.57)	64.5% (.52)	88% (.84)	63% (.49)	74.1% (.65)
New Zealand <i>N</i> = 11	100% (1.0)	50% (.39)	87.5% (.88)	87.5% (.88)	87.5% (.88)	87.5% (.88)	100% (1.0)	75% (.63)	84.4% (.82)
Turkey <i>N</i> = 46	79% (.71)	48% (.30)	91% (.88)	83% (.77)	85% (.80)	79% (.71)	90.5% (.88)	59.5% (.45)	76.9% (.69)
Poland <i>N</i> = 64	83% (.83)	75% (.72)	100% (1.0)	88% (.93)	95% (.93)	83% (.82)	92.5% (.89)	94% (.91)	88.8% (.87)
Pakistan <i>N</i> = 35	76% (.70)	72.5% (.62)	92% (.89)	85.5% (.81)	87% (.81)	81% (.73)	87% (.81)	67.5% (.58)	81.1% (.74)
U.S. <i>N</i> = 52	81% (.74)	55.5% (.41)	88.5% (.85)	82% (.77)	87.5% (.82)	78.5% (.72)	85% (.79)	71% (.62)	78.6% (.71)

Note. Values marked as not significant (ns) represent nonverbal vocal bursts that were not recognized at above-chance rates. Footnotes indicate cultural differences in composite accuracy rating at $p < .01$.

^a Significant differences in effect sizes were found between Poland > India (.25).

ment, anger, disgust, fear, sadness, and surprise (Sauter et al., 2010). By contrast, Gendron and colleagues found that the ability to recognize vocal bursts of these emotions dropped to chance levels when vocal burst response alternatives were of the same valence (Gendron et al., 2014). The present investigation builds on these findings and methods, and examines whether 16 different emotions, portrayed by individuals from the west, can be communicated in vocal bursts to a remote people.

Method

Participants. The Silambi village is a completely isolated community that has retained its Buddhist values, traditions, culture, language and way of life throughout the centuries (Rinzin, Vermeulen, & Glasbergen, 2007). Located in Monger District at an altitude of 1,800 m, the people are completely dependent on the land. There is no electricity or modern amenities of any kind. We chose this village to conduct Study 2 because there are no Internet access points, cinemas, TV, computers, smart phones, access to newspapers, magazines, or any printed media whatsoever.

Participants were 38 native villagers in a remote Himalayan community who were notified through the village messenger, who is a local responsible for carrying news from house to house, that an experiment was being conducted to test understanding of emotional expressions (mean participant age = 36.5; 66% female, 34% male). The villagers have no formal system for keeping track of age, so the median we report is based on participants' estimates of their own age. Participants conducted the experiment at the study site, which was the sitting room of a single-family cottage. All participants verified through self-report that they had no prior experience with: (a) TV, (b) movies, (c) the Internet, (d) foreign print media, (e) foreign travel, (f) non-Bhutanese foreigners, and (g) any person who has regular experience with the above.

Stimuli. The stimuli were the same audio files used in Study 1. The same context stories were also translated using the same methods as in Study 1.

Procedure. On a given trial, a translator (D.W. and S.T.) read a one-sentence story and then played the three nonverbal vocal bursts on a laptop computer to each participant. Two other experimenters (D.C. and L.F.) were present to record participant responses, and were silent throughout the experiment. The participant was instructed to choose the sound that best represented what

the person in the story might do, or choose none of these if none of the sounds were reasonable responses. The participant responded by pointing to an icon representing each response on a laptop screen. Two translators with experience in remote Himalayan village culture and fluent in both the local language and English conducted the study. After each block of five stories in our task, the translators—who were naïve to the target responses—would ask the participant to summarize the emotion story as they had heard it. If the participant could not summarize the story, the translator would repeat the story and the task instructions, and ask the participant to explain the story and task instructions again. If the participant could not explain the task instructions, the participants' data were later excluded from analysis. In the present study, nine participants (four females and five males) were excluded from analysis based on this exclusion criterion. The most common responses leading to exclusion were "I can't remember" or "I don't understand." There were no differences in participant responses by translator, $F(1, 38) = 1.9, p > .05$.

Results

Analysis. For each emotion, we again calculated the percentage of respondents who chose the target response. Nonparametric binomial t tests using a Bonferroni-corrected α level ($\alpha = .003$) and the standard α level ($\alpha = .05$) determined whether participants chose the target expression at higher rates than chance, which was set again at 25%. In keeping with our second hypothesis, participants from the remote village of Silambi in Bhutan achieved an accuracy rate of 50% in judging the 16 emotions from vocal bursts. A one-way multianalysis of variance (MANOVA) found no effect of gender on the ability to judge positive and negative vocal bursts, $F(2, 34) = 0.52, p > .05, \text{Wilk's } \Lambda = .970, \text{partial } \eta^2 = .03$.

Remote Bhutanese villagers' recognition of vocal bursts. The remote Bhutanese villagers recognized nine vocal bursts of emotion at significantly above-chance levels at the Bonferroni-corrected α level: *amusement, awe, contentment, desire (food), disgust, fear, pain, sadness, and surprise*. Five additional vocal bursts were recognized at above-chance rates at the $\alpha = .05$ level: *anger, desire (sex), embarrassed, interest, and sympathy*. The vocal bursts for *contempt* and *relief* were not recognized at above-chance rates. In Figure 1 we present the mean levels of accuracy observed in Bhutanese villagers' recognition of emotion from

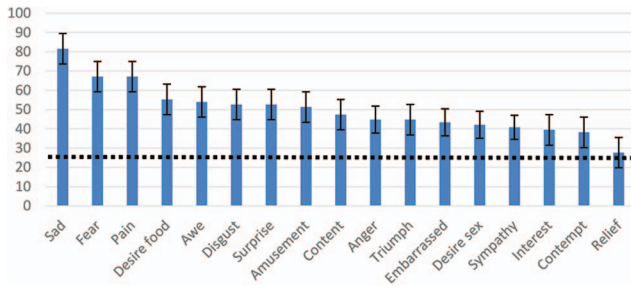


Figure 1. Average recognition rates for remote Bhutanese villagers in the vocal burst recognition task. The hashed line represents chance for the nonparametric *t* test. Error bars are shown at the 95% confidence level. See the online article for the color version of this figure.

vocal bursts, and in Table 6 we present the guessing-corrected effect sizes using the standard correction formula.

General Discussion

Building upon recent advances in the study of vocal bursts (e.g., Gendron et al., 2014; Sauter et al., 2010; Simon-Thomas et al., 2009), the present investigation examined whether people in 10 different industrialized cultures (Study 1) and remote people in Eastern Bhutan (Study 2) could identify the emotion conveyed in 16 vocal bursts. Table 7 summarizes the results of our two studies, presenting the emotion recognition rates (Column 2) and effect sizes (Column 3), and whether the emotion-specific vocal burst was recognized at above chance levels in terms the more lenient ($\alpha = .05$) and stringent ($\alpha = .003$) α levels across all 11 cultures (Columns 4 and 5).

In keeping with our first two hypotheses concerning the recognition of vocal bursts in industrialized and remote cultures, 13 emotions were recognized at above chance levels across the 11 cultures (Column 4). Overall recognition rates were quite robust, and comparable with others studies, as noted before. Overall effect sizes across the 11 cultures ranged from .40 to .49 for positive emotions and .51 to .69 for negative emotions. The overall effect size for Bhutanese villagers was lower (.40), which could be accounted for by many factors such as globalization, shared Internet, education, experience with testing and laptop based technologies, and economic development.

Based on the results represented in the Columns 2 through 5, we classify each emotion into one of four categories of recognition strength, following similar criteria as Keltner and Haidt (1999). We present these results in the last column of Table 7. Across the two studies, 13 emotions could be recognized in vocal bursts at strong or moderate levels in 11 different cultures: *amusement*, *anger*, *awe*, *contentment*, *desire (food)*, *desire (sex)*, *disgust*, *embarrassed*, *fear*, *interest*, *pain*, *sadness*, and *triumph*. The emotions *surprise*, *contempt*, *relief*, and *sympathy* failed to be recognized in all 11 cultures. These findings represent the broadest support to date—in terms of emotions and cultures studied—that vocal bursts are a rich medium in which humans communicate emotion, and do so in similar ways across different cultures (Sauter et al., 2010; Scherer & Wallbott, 1994; Simon-Thomas et al., 2009).

In Table 8 we compare the findings in the present investigation with those from similar studies of vocal bursts (Gendron et al.,

2014; Laukka et al., 2013; Sauter et al., 2010; Simon-Thomas et al., 2009). When taken together, these studies provide strong evidence for universal vocal bursts of *anger*, *disgust*, *fear*, *sadness*, and *interest*, moderate evidence of universality for vocal bursts of *awe*, *embarrassment*, *amusement*, *triumph*, *surprise*, and *contentment/serenity*, and conflicting evidence for vocal bursts of *desire/lust*, *contempt*, *relief*, and *pain*. Lastly, there is general consensus against recognizable vocal bursts for *pleasure*, *sympathy*, *guilt*, *love/affection*, *pride*, *shame*, and *gratitude*. These findings indicate that some emotions may be more universally recognized than others, again for intriguing reasons having to do with medium of communication (Goetz, Keltner, & Simon-Thomas, 2010) and function of the emotion (e.g., Keltner & Haidt, 1999).

In this comparison it is notable that studies of college students yield higher recognition rates (e.g., Russell, 1994). For example, in the present investigation the participants from the remote village in Bhutan achieved average levels of recognition accuracy of 45.2% for positive emotions (compared with 79.5% in Study 1) and 54.2% for negative emotions (compared with 80.4% in Study 1).

Important methodological differences in studies might account for why above chance levels of accuracy were observed in certain studies of remote people but not in Gendron et al.'s (2014) study. In that latter study, no comprehension validation check was used, which in the present investigation revealed that a significant number of participants did not understand the recognition task. It will be important for future studies of remote peoples to include such comprehension checks, given that remote peoples have little reason to have experience with psychological testing methods.

Alongside this evidence for moderate to strong degrees of universality in recognizing 13 vocal bursts, the present studies also demonstrated significant cultural variations in emotion recognition, in keeping with our third hypothesis. There was variation across cultures in how well specific emotions were recognized. For example, the vocal burst of *contempt* was recognized 48% of the time in Turkey but 93% in China. Findings such as these might be accounted for by cultural variations in focal emotion (Mesquita &

Table 6
Effect Sizes in Recognition Accuracy Achieved by Bhutanese Villagers for All Vocal Bursts

	Effect size
Amused	.37
Angry	.33
Awe	.61
Contempt	.22
Content	.33
Desire food	.41
Desire sex	.25
Disgust	.61
Embarrassed	.25
Fear	.65
Interested	.22
Pain	.65
Relief	.14
Sadness	.76
Surprise	.61
Sympathy	.22
Triumph	.29

Table 7
Recognition Rates for Vocal Bursts Across 11 Cultures and 17 Emotion Story Contexts

Vocal burst	Overall percent accuracy	Overall effect size	Succeeds $\alpha = .05$ level for all cultures	Succeeds $\alpha = .003$ level for all cultures	Recognition strength rating
Sadness	85.8	.69	Yes	Yes	Very strong
Disgust	69.3	.59	Yes	Yes	Strong
Fear	75.7	.67	Yes	Yes	Strong
Awe	71.8	.41	Yes	Yes	Strong
Amusement	66.4	.41	Yes	Yes	Strong
Pain	72.6	.67	Yes	Yes	Strong
Contentment	62.9	.40	Yes	Yes	Strong
Triumph	67.8	.49	Yes	No	Moderate
Desire (food)	64.4	.40	Yes	No	Moderate
Embarrassment	63.7	.58	Yes	No	Moderate
Interest	59.8	.41	Yes	No	Moderate
Anger	59.8	.51	Yes	No	Moderate
Desire (sex)	54.2	.40	Yes	No	Moderate
Surprise	60.2	.61	No	No	None
Contempt	55.6	.54	No	No	None
Relief	55.7	.43	No	No	None
Sympathy	52.7	.45	No	No	None

Note. Overall percent accuracy ratings and effect sizes are calculated assuming two cultures: industrialized nations as one group, and remote Bhutan as the other.

Leu, 2007) or ideal affect (Tsai, Knutson, & Fung, 2006). We also observed cultural differences in emotion recognition accuracy. Even within our globalized sample of college students, all with regular access to modern media, there were still certain cultures who fared better in recognizing positive emotion—Poland, China, Pakistan, Turkey, and the United States—and other cultures—Turkey, China, Japan, Pakistan, Poland, and the United States—who performed better in recognizing negative emotions.

Finally, we note that our stories for desire (food) and desire (sex) were both matched with the same target vocal burst in all cultures, but the recognition ratings for these story-vocalization combinations were different. Participants found it easier on average to pair the desire vocal burst to a story about food (74.7% in Study 1; 55.3% in Study 2) as compared to sex (67.1% in Study 1; 42.1% in Study 2). This finding is in keeping with recent claims that slight changes in judgment context—in the present study the

Table 8
Summary of Whether Nonverbal Emotional Vocal Bursts Were Recognized Across All Cultures Studied in Five Investigations

Emotion	Simon-Thomas, et al. (2009)	Sauter et al. (2010)	Laukka, et al. (2013)	Gendron, et al. (2014)	Present Study (2015)
	1 culture	2 cultures	5 cultures	2 cultures	11 cultures
Anger	Yes	Yes	Yes	No	Yes
Disgust	Yes	Yes	Yes	No	Yes
Fear	Yes	Yes	Yes	No	Yes
Sadness	Yes	Yes	Yes	No	Yes
Interest	Yes	—	Yes	—	Yes
Awe	Yes	—	—	—	Yes
Embarrassment	Yes	—	—	—	Yes
Amusement	Yes	Yes	No	No	Yes
Triumph	Yes	No	—	No	Yes
Surprise	Yes	Yes	Yes	No	No
Contentment/serenity	No	—	Yes	—	Yes
Desire/lust	No	—	Yes	—	Yes
Contempt	Yes	—	Yes	—	No
Relief	Yes	No	Yes	No	No
Enthusiasm	Yes	—	—	—	—
Distress/pain	—	—	No	—	Yes
Pleasure	Yes	No	—	No	—
Compassion/sympathy	No	—	—	—	No
Guilt	No	—	No	—	—
Love/affection	No	—	No	—	—
Pride	No	—	No	—	—
Shame	No	—	No	—	—
Gratitude	No	—	—	—	—

Note. The number of cultures tested is indicated in the second row. Hashed entries (—) indicate that the emotion was not studied.

themes of the emotion story—may significantly alter the perception of the target emotion (Barrett, Mesquita, & Gendron, 2011). It will be important for future research to explore how such contextual variations might systematically alter interpretations of vocal bursts in theoretically cogent ways.

The present studies are not without limitations. Though we tested many cultures—more than in any other cross-cultural study of vocal bursts—a more critical interpretation is that we have tested two “groups”: one international, globalized group and one isolated group. Additional research is needed to explore cultural similarities and differences in noncollege-educated samples within each of these globalized cultures. Related to this is that we have only tested one isolated culture; people in other remote cultures. Furthermore, although a recent study in the cross-cultural recognition of vocal bursts found that remote Namibian participants did no better than chance when the foil-target valence was matched (Gendron et al., 2014), future research would benefit from submitting this extensive array of vocal bursts to even more stringent testing, such as free response, free labeling, and no-story contexts (see LeDoux, 2015). It is important to ask: what is meant when a story is matched to a vocal burst? This is an important question, because stories contain context—social, cultural, and personal—that may anchor perceptions and inform specific behaviors and emotions that accompany the story (see LeDoux, 2015). Free response methods control for context and therefore behavioral cues cannot be implied by the task, which is a likely limitation of the present method.

Perhaps most critically, our vocal bursts were selected from a wider array of vocal bursts, some of which were less readily recognized in our pilot study, and they were voluntarily produced. It is not known whether spontaneous vocal bursts that have been collected in naturalistic settings differ from those that are voluntarily produced in their acoustic qualities or recognizability. This stands out as a critical next step in future research. We do note, though, that in early conceptual analyses of vocal bursts, the focus was on different communicative functions of these expressive acts—for example, conveying the recognition of an emotion or a possible experience of an emotion—in the context of speech (Scherer & Wallbott, 1994). On this, the present two studies suggest that these brief sounds can richly convey a wide array of emotions (at least 13) in a broad array of cultures, including one untouched by the media and western influence.

The results from the present investigation point to several promising lines of inquiry. What is the developmental unfolding of the recognition of this more diverse array of emotions? What precursors to this broader array of expressions can be found in other primates? What expressions are produced when non-Westerners experience the same set of subjective experiences? What neurophysiological responses covary with the production of these vocal bursts? Answers to these questions are vital to understanding the origins and functions of emotions, and await a next wave of emotion expression research, which we hope is enabled by the present findings.

References

Adams, R. B., Jr., & Kleck, R. E. (2005). Effects of direct and averted gaze on the perception of facially communicated emotion. *Emotion, 5*, 3–11. <http://dx.doi.org/10.1037/1528-3542.5.1.3>

- Barrett, L. F. (1998). Discrete emotions or dimensions? The role of valence focus and arousal focus. *Cognition and Emotion, 12*, 579–599. <http://dx.doi.org/10.1080/026999398379574>
- Barrett, L. F., Mesquita, B., & Gendron, M. (2011). Context in emotion perception. *Current Directions in Psychological Science, 20*, 286–290. <http://dx.doi.org/10.1177/0963721411422522>
- Beier, E. G., & Zautra, A. J. (1972). Identification of vocal communication of emotions across cultures. *Journal of Consulting and Clinical Psychology, 39*, 166. <http://dx.doi.org/10.1037/h0033170>
- Camras, L. A., & Allison, K. (1985). Children's understanding of emotional facial expressions and verbal labels. *Journal of Nonverbal Behavior, 9*, 84–94. <http://dx.doi.org/10.1007/BF00987140>
- Dael, N., Mortillaro, M., & Scherer, K. R. (2012). Emotion expression in body action and posture. *Emotion, 12*, 1085–1101. <http://dx.doi.org/10.1037/a0025737>
- Darwin, C. (1872). *The expression of the emotions in man and in animals*. New York, NY: Philosophical Library. <http://dx.doi.org/10.1037/10001-000>
- Dashiell, J. F. (1927). A new method of measuring reactions to facial expression of emotion. *Psychological Bulletin, 24*, 174–175.
- de Groot, J. H., Smeets, M. A., Kaldewaij, A., Duijndam, M. J., & Semin, G. R. (2012). Chemosignals communicate human emotions. *Psychological Science, 23*, 1417–1424. <http://dx.doi.org/10.1177/0956797612445317>
- Dorji, K., & Pek, S. S. (2005). The Bhutanese media: In the service of the public. *Proceedings of the Second International Conference on Gross National Happiness*. Centre for Bhutan Studies, Thimphu, pp. 78–96.
- Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion, 6*, 169–200. <http://dx.doi.org/10.1080/02699939208411068>
- Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic. *Emotion Review, 3*, 364–370. <http://dx.doi.org/10.1177/1754073911410740>
- Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science, 164*, 86–88. <http://dx.doi.org/10.1126/science.164.3875.86>
- Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin, 128*, 203–235. <http://dx.doi.org/10.1037/0033-2909.128.2.203>
- Frijda, N. H., Markam, S., Sato, K., & Wiers, R. (1995). Emotions and emotion words. In J. A. Russell, J. Fernandez-Dols, A. S. R. Manstead, & J. C. Wellenkamp (Eds.), *Everyday conceptions of emotion: An introduction to the psychology, anthropology and linguistics of emotion* (pp. 121–143). Dordrecht, The Netherlands: Kluwer Academic. http://dx.doi.org/10.1007/978-94-015-8484-5_7
- Gendron, M., Roberson, D., van der Vyver, J. M., & Barrett, L. F. (2014). Cultural relativity in perceiving emotion from vocalizations. *Psychological Science, 25*, 911–920. <http://dx.doi.org/10.1177/0956797613517239>
- Goetz, J. L., Keltner, D., & Simon-Thomas, E. (2010). Compassion: An evolutionary analysis and empirical review. *Psychological Bulletin, 136*, 351–374. <http://dx.doi.org/10.1037/a0018807>
- Grandjean, D., Sander, D., Pourtois, G., Schwartz, S., Seghier, M. L., Scherer, K. R., & Vuilleumier, P. (2005). The voices of wrath: Brain responses to angry prosody in meaningless speech. *Nature Neuroscience, 8*, 145–146. <http://dx.doi.org/10.1038/nn1392>
- Haidt, J., & Keltner, D. (1999). Culture and facial expression: Open-ended methods find more expressions and a gradient of recognition. *Cognition and Emotion, 13*, 225–266. <http://dx.doi.org/10.1080/026999399379267>
- Heider, K. G. (2006). *Landscapes of emotion: Mapping three cultures of emotion in Indonesia*. New York, NY: Cambridge University Press.
- Hejmadi, A., Davidson, R. J., & Rozin, P. (2000). Exploring Hindu Indian emotion expressions: Evidence for accurate recognition by Americans and Indians. *Psychological Science, 11*, 183–187. <http://dx.doi.org/10.1111/1467-9280.00239>
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences, 33*, 61–83. <http://dx.doi.org/10.1017/S0140525X0999152X>

- Hertenstein, M. J., Holmes, R., McCullough, M., & Keltner, D. (2009). The communication of emotion via touch. *Emotion, 9*, 566–573. <http://dx.doi.org/10.1037/a0016108>
- Hess, U., & Thibault, P. (2009). Darwin and emotion expression. *American Psychologist, 64*, 120–128. <http://dx.doi.org/10.1037/a0013386>
- Hofstede, G. (1998). Attitudes, values and organizational culture: Disentangling the concepts. *Organization Studies, 19*, 477–493. <http://dx.doi.org/10.1177/017084069801900305>
- Izard, C. E. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin, 115*, 288–299. <http://dx.doi.org/10.1037/0033-2909.115.2.288>
- Jack, R. E., Garrod, O. G., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. *Proceedings of the National Academy of Sciences of the United States of America, 109*, 7241–7244. <http://dx.doi.org/10.1073/pnas.1200155109>
- Juslin, P. N., & Laukka, P. (2003). Communication of emotions in vocal expression and music performance: Different channels, same code? *Psychological Bulletin, 129*, 770–814.
- Keltner, D. (2009). *Born to be good: The science of a meaningful life*. New York, NY: WW Norton & Company.
- Keltner, D., & Buswell, B. N. (1997). Embarrassment: Its distinct form and appeasement functions. *Psychological Bulletin, 122*, 250–270. <http://dx.doi.org/10.1037/0033-2909.122.3.250>
- Keltner, D., & Cordaro, D. (in press). Universality of emotional expression: Advances in the basic emotion theory. *Science of Facial Expression*.
- Keltner, D., & Haidt, J. (1999). Social functions of emotions at four levels of analysis. *Cognition and Emotion, 13*, 505–521. <http://dx.doi.org/10.1080/0269993993979168>
- Keltner, D., & Kring, A. M. (1998). Emotion, social function, and psychopathology. *Review of General Psychology, 2*, 320–342. <http://dx.doi.org/10.1037/1089-2680.2.3.320>
- Keltner, D., & Lerner, J. (2010). Emotion. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *Handbook of social psychology* (Vol. 1, pp. 317–342). New York, NY: Wiley.
- Keltner, D., Tracy, J., Sauter, D. A., Cordaro, D., & McNeil, G. (in press). Expression of emotion. *Handbook of Emotion*.
- Kramer, E. (1964). Elimination of verbal cues in judgments of emotion from voice. *The Journal of Abnormal and Social Psychology, 68*, 390–396. <http://dx.doi.org/10.1037/h0042473>
- Laukka, P., Elfenbein, H. A., Söder, N., Nordström, H., Althoff, J., Chui, W., . . . Thingujam, N. S. (2013). Cross-cultural decoding of positive and negative non-linguistic emotion vocalizations. *Frontiers in Psychology, 4*, 353. <http://dx.doi.org/10.3389/fpsyg.2013.00353>
- Lebo, J., & Schelling, D. (2001). Design and appraisal of rural transport infrastructure: Ensuring basic access for rural communities. *World Bank Publication Technical Paper no. 496*, World Bank, Washington, DC.
- LeDoux, J. E. (2015). Emotional construction in the brain. In L. F. Barrett & J. A. Russell (Eds.), *The psychological construction of emotion* (pp. 459–464). New York, NY: The Guilford Press.
- Lutz, C. (1982). The domain of emotion words on Ifaluk. *American Ethnologist, 9*, 113–128. <http://dx.doi.org/10.1525/ae.1982.9.1.02a00070>
- Marsh, A. A., Elfenbein, H. A., & Ambady, N. (2003). Nonverbal “accents”: Cultural differences in facial expressions of emotion. *Psychological Science, 14*, 373–376. <http://dx.doi.org/10.1111/1467-9280.24461>
- Matsumoto, D., Keltner, D., Shiota, M., O’Sullivan, N., & Frank, M. M. (2008). Facial expressions of emotion. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 211–234). New York, NY: Guilford Press.
- Matsumoto, D., Yoo, S. H., & Fontaine, J. (2008). Mapping expressive differences around the world: The relationship between emotional display rules and individualism versus collectivism. *Journal of Cross-Cultural Psychology, 39*, 55–74. <http://dx.doi.org/10.1177/0022022107311854>
- Mehler, J., Bertoncini, J., Barriere, M., & Jassik-Gerschenfeld, D. (1978). Infant recognition of mother’s voice. *Perception, 7*, 491–497. <http://dx.doi.org/10.1068/p070491>
- Mesquita, B., & Frijda, N. H. (1992). Cultural variations in emotions: A review. *Psychological Bulletin, 112*, 179–204. <http://dx.doi.org/10.1037/0033-2909.112.2.179>
- Mesquita, B., & Leu, J. (2007). The cultural psychology of emotion. In S. Kitayama, & D. Cohen (Eds.), *Handbook of cultural psychology* (pp. 734–759). New York, NY: The Guilford Press.
- Rinzin, C., Vermeulen, W. J., & Glasbergen, P. (2007). Public perceptions of Bhutan’s approach to sustainable development in practice. *Sustainable Development, 15*, 52–68. <http://dx.doi.org/10.1002/sd.293>
- Russell, J. A. (1991). Culture and the categorization of emotions. *Psychological Bulletin, 110*, 426–450. <http://dx.doi.org/10.1037/0033-2909.110.3.426>
- Russell, J. A. (1994). Is there universal recognition of emotion from facial expression? A review of the cross-cultural studies. *Psychological Bulletin, 115*, 102–141. <http://dx.doi.org/10.1037/0033-2909.115.1.102>
- Russell, J. A. (1997). Reading emotions from and into faces: Resurrecting a dimensional-contextual perspective. In J. A. Russell & J. M. Fernández-Dols (Eds.), *The psychology of facial expression* (pp. 295–320). New York, NY: Cambridge University Press. <http://dx.doi.org/10.1017/CBO9780511659911.015>
- Russell, J. A., & Sato, K. (1995). Comparing emotion words between languages. *Journal of Cross-Cultural Psychology, 26*, 384–391. <http://dx.doi.org/10.1177/0022022195264004>
- Sauter, D. (2007). *An investigation into vocal expressions of emotion: The roles of valence, culture and acoustic factors* (Doctoral dissertation, University of London).
- Sauter, D. A., Eisner, F., Ekman, P., & Scott, S. K. (2010). Cross-cultural recognition of basic emotions through nonverbal emotional vocalizations. *Proceedings of the National Academy of Sciences of the United States of America, 107*, 2408–2412. <http://dx.doi.org/10.1073/pnas.0908239106>
- Sauter, D. A., Eisner, F., Ekman, P., & Scott, S. K. (in press). Emotional vocalizations are cross-cultural regardless of valence. *Psychological Science*.
- Sauter, D., & Scott, S. K. (2007). More than one kind of happiness: Can we recognize vocal expressions of different positive states? *Motivation and Emotion, 31*, 192–199. <http://dx.doi.org/10.1007/s11031-007-9065-x>
- Scherer, K. R., Johnstone, T., & Klasmeyer, G. (2003). Vocal expression of emotion. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 433–456). New York, NY: Oxford University Press.
- Scherer, K. R., Schorr, A. E., & Johnstone, T. E. (2001). *Appraisal processes in emotion: Theory, methods, research*. New York, NY: Oxford University Press.
- Scherer, K. R., & Wallbott, H. G. (1994). Evidence for universality and cultural variation of differential emotion response patterning. *Journal of Personality and Social Psychology, 66*, 310–328. <http://dx.doi.org/10.1037/0022-3514.66.2.310>
- Scott, S., & Sauter, D. (2006). Non-verbal expressions of emotion—acoustics, valence and cross cultural factors. *Speech Communication, 40*, 99–116.
- Seyfarth, R. M., & Cheney, D. L. (2003). Signalers and receivers in animal communication. *Annual Review of Psychology, 54*, 145–173. <http://dx.doi.org/10.1146/annurev.psych.54.101601.145121>
- Shariff, A. F., & Tracy, J. L. (2011). What are emotion expressions for? *Current Directions in Psychological Science, 20*, 395–399. <http://dx.doi.org/10.1177/0963721411424739>
- Silverstein, A. B. (1986). Statistical power lost and statistical power regained: The Bonferroni procedure in exploratory research. *Educa-*

- tional and Psychological Measurement*, 46, 303–307. <http://dx.doi.org/10.1177/001316448604600202>
- Simon-Thomas, E. R., Keltner, D. J., Sauter, D., Sinicropi-Yao, L., & Abramson, A. (2009). The voice conveys specific emotions: Evidence from vocal burst displays. *Emotion*, 9, 838–846. <http://dx.doi.org/10.1037/a0017810>
- Snowdon, C. T. (2003). Expression of emotion in nonhuman animals. In R. J. Davidson, K. R. Scherer & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 457–534). New York, NY: Oxford University Press.
- Tracy, J. L., & Robins, R. W. (2004). Putting the self into self-conscious emotions: A theoretical model. *Psychological Inquiry*, 15, 103–125. http://dx.doi.org/10.1207/s15327965pli1502_01
- Tsai, J. L., Knutson, B., & Fung, H. H. (2006). Cultural variation in affect valuation. *Journal of Personality and Social Psychology*, 90, 288–307. <http://dx.doi.org/10.1037/0022-3514.90.2.288>
- Tsai, J. L., Louie, J. Y., Chen, E. E., & Uchida, Y. (2007). Learning what feelings to desire: Socialization of ideal affect through children's storybooks. *Personality and Social Psychology Bulletin*, 33, 17–30. <http://dx.doi.org/10.1177/0146167206292749>
- Ura, K. (2005). *The Bhutanese development story. Monograph No. 15.* Thimphu, Bhutan: Centre for Bhutan Studies.
- Van Bezooijen, R., Otto, S. A., & Heenan, T. A. (1983). Recognition of vocal expressions of emotion a three-nation study to identify universal characteristics. *Journal of Cross-Cultural Psychology*, 14, 387–406. <http://dx.doi.org/10.1177/0022002183014004001>
- Van Driem, G. L., (1993). *Language policy in Bhutan.* School of African & Oriental Studies, Universities of London.
- Wilkinson, L. (1999). Statistical methods in psychology journals: Guidelines and explanations. *American Psychologist*, 54, 594–604. <http://dx.doi.org/10.1037/0003-066X.54.8.594>

Received February 8, 2015

Revision received May 11, 2015

Accepted May 28, 2015 ■