

## American-Japanese Differences in Multiscalar Intensity Ratings of Universal Facial Expressions of Emotion<sup>1</sup>

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*This study reanalyzes American and Japanese multiscalar ratings of universal facial expressions originally collected by Matsumoto (1986), of which only single emotion scales were analyzed and reported by Matsumoto and Ekman (1989). The nonanalysis of the entire data set ignored basic and important questions about the nature of judgments of universal facial expressions of emotion. These were addressed in this study. We found that (1) observers in both cultures perceived multiple emotions in universal facial expressions, not just one; (2) cultural differences occurred on multiple emotion scales for each expression, not just the target scale; (3) the directions of those differences differed according to the rating scale used and the expression being observed; and (4) no underlying dimension was evidenced that would account for these differences. These findings raise new questions about the nature of the judgment process and the role of judgment studies in supporting the universality thesis, the bases of which need to be explored in future research and incorporated in future theories of emotion and universality.*

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Cultural differences in intensity ratings of facial expressions are well documented (e.g., Biehl *et al.*, 1997; Ekman *et al.*, 1987; Matsumoto, 1989, 1990; Matsumoto & Ekman, 1989), and one of the most reliable findings has been that Americans tend to rate faces more intensely than Japanese. This finding, however, is limited to ratings of single emotion categories. Some studies only obtained one

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scalar rating, asking judges to rate the intensity of the single emotion they perceived in the face (i.e., what emotion did they see, and how strongly? see Biehl *et al.*, 1997; Matsumoto, 1989, 1990; Matsumoto & Ekman, 1989, Study 2). Other studies that obtained scalar ratings on multiple emotion categories only used a single scale in the analyses (Ekman *et al.*, 1987; Matsumoto & Ekman, 1989, Study 1).

That observers see multiple emotions when judging emotional expressions considered to be universal is well documented (see, for example, Russell & Bullock, 1986; Russell & Fehr, 1987; Russell, Suzuki, & Ishida, 1993). While these studies typically used a recognition task, some of the studies cited above that included multiple scalar ratings have also shown that observers see more than one category when judging a universal expression (Ekman *et al.*, 1987; Matsumoto & Ekman, 1989). These studies showed that some emotion categories are reliably seen as second most intense for some expressions across the cultures studied (e.g., surprise seen as second most intense in fear expressions).

Despite the fact that observers see multiple emotions in the face, previous cross-cultural studies that obtained scalar intensity ratings of emotion on multiple category scales (i.e., Ekman *et al.*, 1987; Matsumoto & Ekman, 1989) have not examined whether people of other cultures also see multiple emotions (beyond the analyses of second most salient emotion). Consequently, they have also not investigated whether cultures differ in their intensity ratings on scales beyond that intended in the expression, and the nature of the differences, if obtained.

This study addressed these possibilities by reexamining data originally collected by Matsumoto (1986), a portion of which was reported by Matsumoto and Ekman (1989). This data set is one of only two in which ratings were made on multiple emotion scales by observers in more than one culture. In the original study, American ( $N_A = 107$ ) and Japanese ( $N_J = 110$ ) observers viewed Matsumoto and Ekman's (1988) widely used Japanese and Caucasian Facial Expressions of Emotions (JACFEE) set. This set contains 56 slides of seven emotions (anger, contempt, disgust, fear, happiness, sadness, surprise) depicted by 56 individuals (four Caucasian and four Japanese—two male and two female—in each emotion). The expressions were verified as those typically considered universal (cf. Ekman & Friesen, 1975) by Ekman and Friesen's (1978) Facial Action Coding System (FACS), and have reliably produced high agreement in categorical emotion judgments (Biehl *et al.*, 1997) in many cultures. The judges saw the stimuli twice, and made two ratings. On the first viewing, they used a 9-point scale to rate the intensity of seven emotion categories (anger, contempt, disgust, fear, happiness, sadness, surprise) in each expression as either *absent* (0) or, if present, for strength from *slight* (1) to *moderate* (4) to *strong* (8). The seven emotion terms were always presented in the English alphabetical order. In the second judgment task, they made an overall intensity rating of each expression, without mention of any specific emotion terms. This study reexamined the data from the first, multiscale

intensity rating task, testing the ratings made on all scales, exploring the following questions:

1. Do Americans and Japanese see multiple emotions in the expressions?
2. Do the two cultures differ on the emotion scales not corresponding to the expression (i.e., the nontarget scales), and if so, in what direction?

## RESULTS

The ratings were averaged across both photos for each of the four poser types (Caucasian and Japanese males and females) within each emotion, and a six-factor analysis of variance (ANOVA) was computed using judge country (2) and judge sex (2) as between-subject factors and emotion (7), poser race (2), poser sex (2), and scale (7) as within-subject factors. A nonsignificant main effect for country,  $F(1, 344) = 3.15$ , n.s., suggested that cultural response sets were not operating; thus, all subsequent analyses were performed using raw data.

### *Did the Judges See Multiple Emotions in the Expressions?*

Based on a significant Country  $\times$  Emotion  $\times$  Scale interaction,  $F(36, 5184) = 38.57$ ,  $p < .001$ , we collapsed ratings across poser race and sex within each emotion, separately for each emotion category and judge country. We then tested the deviation of each cell mean from zero using single sample  $t$ -tests (see Table I for means). We opted for these as they would test whether the judges saw each emotion category in each expression at a level significantly greater than not at all. Of the 98 comparisons (7 Emotion Categories  $\times$  7 Expressions  $\times$  2 Judge Cultures), only two were *not* significant: American judgments of happiness in angry expressions, and American judgments of happiness in fear expressions. These findings provided very strong support for the notion that the judges saw the entire range of emotion categories in the universal expressions.

### *Did the Two Countries Differ on Nontarget Emotion Scales?*

*Main Analyses.* Based on the significant three-way interaction reported above, and on the fact that almost all of the emotion scale means were significantly different from zero, we tested the simple effects of country separately for each expression and scale (Table I). The cultures clearly differed on nontarget as well as target emotion scales, and in different directions. When viewing angry expressions, not only did Americans see more intense anger; they also saw more contempt and disgust than did the Japanese. Japanese judges, however, saw more sadness than the Americans. When viewing contempt expressions,

Table I. Simple Effects Analysis of Judge Country, Separately for Each Emotion and Scale

Emotion portrayed	Emotion being rated	Judge country		<i>F</i>	<i>P</i>
		U.S. mean	Japan mean		
Anger	Anger	6.4708	4.5845	258.44054	<.001
	Contempt	3.4210	1.1956	358.01054	<.001
	Disgust	2.5369	2.0849	14.56324	<.001
	Fear	0.0922	0.1963	0.76743	n.s.
	Happiness	0.0036	0.0150	0.00932	n.s.
	Sadness	0.5649	1.3408	42.70689	<.001
	Surprise	0.1442	0.1495	0.00203	n.s.
Contempt	Anger	0.9798	1.8739	58.03446	<.001
	Contempt	2.3250	4.3216	289.39432	<.001
	Disgust	3.0515	2.0648	69.62959	<.001
	Fear	0.0643	0.0287	0.09162	n.s.
	Happiness	0.5385	0.2199	7.26541	<.01
	Sadness	0.7621	0.1114	30.44230	<.001
	Surprise	0.1820	0.0115	2.08216	n.s.
Disgust	Anger	1.8386	2.5310	34.30635	<.001
	Contempt	2.4228	3.6273	103.30608	<.001
	Disgust	5.8144	5.4289	10.41851	<.01
	Fear	0.1113	0.1147	0.00081	n.s.
	Happiness	0.0563	0.0344	0.03365	n.s.
	Sadness	0.2961	0.3933	0.67662	n.s.
	Surprise	0.4175	0.1491	5.15514	<.025
Fear	Anger	0.2512	0.4713	3.48500	n.s.
	Contempt	0.1541	0.1591	0.00176	n.s.
	Disgust	0.8325	0.8034	0.06095	n.s.
	Fear	5.7888	3.6021	342.21784	<.001
	Happiness	0.0332	0.0057	0.05284	n.s.
	Sadness	0.7071	2.1078	139.70014	<.001
	Surprise	4.7019	5.5401	50.53108	<.001
Happiness	Anger	0.0238	0.0182	0.00230	n.s.
	Contempt	0.3101	0.1625	1.59014	n.s.
	Disgust	0.0377	0.0852	0.16459	n.s.
	Fear	0.0297	0.0367	0.00351	n.s.
	Happiness	7.2613	6.6204	28.81919	<.001
	Sadness	0.0925	0.0637	0.05973	n.s.
	Surprise	0.6038	0.0750	20.39635	<.001
Sadness	Anger	0.3940	0.4375	0.13703	n.s.
	Contempt	0.2694	0.3205	0.18730	n.s.
	Disgust	0.5440	2.0264	158.80324	<.001
	Fear	0.5086	0.5310	0.03568	n.s.
	Happiness	0.0206	0.0273	0.00311	n.s.
	Sadness	6.2050	4.8034	139.05419	<.001
	Surprise	0.1815	0.0591	1.08230	n.s.
Surprise	Anger	0.0389	0.0562	0.02162	n.s.
	Contempt	0.0366	0.2626	3.71108	n.s.
	Disgust	0.1250	0.1881	0.28892	n.s.
	Fear	1.5405	0.2351	123.15365	<.001
	Happiness	0.4195	0.6732	4.62878	<.05
	Sadness	0.2157	0.1933	0.03554	n.s.
	Surprise	6.4119	4.8647	173.01257	<.001

Americans saw more disgust, happiness, and sadness, while Japanese saw more anger and contempt. When viewing disgust expressions, Americans saw more disgust and surprise, while Japanese saw more anger and contempt. When viewing fear expressions, Americans saw more fear, while Japanese saw more sadness and surprise. When viewing happy expressions, Americans saw not only more happiness, but also more surprise. When viewing sad expressions, Americans saw more sadness, while Japanese saw more disgust. Finally, when viewing surprise expressions, Americans saw more surprise and fear, while Japanese saw more happiness.

Simple effects of country were also tested separately for each level of poser race and sex within each emotion. These analyses produced essentially the same findings as those presented above. Collectively, they indicate strongly that cultures differed on nontarget emotion scales, and in different directions.

*Additional Analyses: Discriminant Analyses.* Because observers saw multiple emotions in the expressions, and because cultures differed on multiple scales for each expression, it was possible that they made ratings according to underlying dimensions (e.g., positive-negative) rather than on discrete emotion categories. Indeed, this possibility has been raised in numerous reports (Davitz, 1969; Duffy, 1941; Plutchik, 1980; Russell, Lewicka, & Niit, 1989; Schlosberg, 1954). To examine this possibility, a five-factor multivariate analysis of variance (MANOVA) was conducted using judge country (2) and judge sex (2) as between-subject factors, emotion (7), poser race (2), and poser sex (2) as within-subject factors, and the seven scalar ratings as dependent variables. Wilks's lambda was used as the criterion statistic. Based on a significant Country  $\times$  Emotion interaction,  $F(42, 103) = 11.12, p < .001$ , one-way MANOVAs testing country differences were conducted separately for each emotion. Significant multivariate  $F$ s were then followed by discriminant analyses (Table II). Discriminant analyses were selected as the appropriate follow-up tests because they create linear combinations of the dependent variables that maximally discriminant the between-subject variables (in this case, country). The linear discriminant functions can then be analyzed to interpret underlying dimensions that contribute to between-group differences through inspection of structure coefficients. Analysis of the contribution of each dependent variable to the discriminant function is achieved through interpretation of the standardized discriminant coefficients.

All seven multivariate  $F$ s were highly significant. We used a criterion of  $\geq .3$  to interpret structure and standardized discriminant coefficients. In most cases, the variables that had important contributions to the significant discriminant function were those that were significant in the univariate analyses reported earlier. Inspection of the structure coefficients did not suggest any interpretable dimension underlying the ratings (provided for the reader in detail in Table II). Similar analyses produced separately for each poser race and sex within each emotion [justified on the basis of a significant Country  $\times$  Emotion  $\times$  Poser Race  $\times$  Poser Sex

Table II. Results of One-Way Multivariate Analyses of Variance and Discriminant Analyses, Separately for Each Emotion

Emotion portrayed	Emotion being rated	U.S. mean (SD)	Japan mean (SD)	Wilks's $\lambda$	Wilks's $df_n$	Wilks's $df_d$	Wilks's $F$	Wilks's $p$	Standardized structure coefficients	Correlation between dependent and canonical variables	
Anger	Anger	6.448 (0.996)	4.619 (1.526)	0.48361	7.00	192.00	29.28740	<.001	0.62699	0.68717	
	Contempt	3.509 (2.249)	1.190 (1.246)						0.61552	0.62353	
	Disgust	2.540 (1.922)	2.110 (1.566)						-0.22542	0.11929	
	Fear	0.089 (0.277)	0.201 (0.427)						-0.06876	-0.15012	
	Happiness	0.004 (0.038)	0.011 (0.053)						-0.04518	-0.07571	
	Sadness	0.526 (0.726)	1.347 (1.166)						-0.48313	-0.40948	
	Surprise	0.143 (0.406)	0.135 (0.264)						0.05823	0.01148	
	Contempt	Anger	1.005 (1.033)	1.879 (1.401)	0.52885	7.00	196.00	24.94554	<.001	0.46642	0.37521
		Contempt	2.365 (1.758)	4.346 (1.694)						0.49568	0.61078
Disgust		3.059 (1.727)	2.080 (1.542)						-0.62577	-0.31866	
Fear		0.068 (0.249)	0.029 (0.141)						0.07225	-0.10116	
Happiness		0.534 (0.758)	0.215 (0.396)						-0.34071	-0.28473	
Sadness		0.777 (1.164)	0.111 (0.260)						-0.35512	-0.42772	
Surprise		0.168 (0.421)	0.012 (0.056)						-0.28752	-0.28256	
Disgust		Anger	1.776 (1.401)	2.531 (1.705)	0.81694	7.00	191.00	6.11401	<.001	-0.23074	-0.50626



Table II—Continued

Emotion portrayed	Emotion being rated	U.S. mean (SD)	Japan mean (SD)	Wilks's $\lambda$	Wilks's $df_n$	Wilks's $df_d$	Wilks's $F$	Wilks's $p$	Standardized structure coefficients	Correlation between dependent and canonical variables
Happiness	Sadness	0.101 (0.322)	0.063 (0.133)						0.30860	0.12920
	Surprise	0.585 (0.888)	0.077 (0.192)						0.73859	0.66697
Sadness	Anger	0.382 (0.634)	0.442 (0.617)	0.57218	7.00	195.00	20.82868	<.001	-0.09649	0.05620
	Contempt	0.268 (0.419)	0.326 (0.652)						-0.19114	0.06056
	Disgust	0.545 (0.928)	2.012 (1.355)						0.84622	0.72423
	Fear	0.532 (0.804)	0.523 (0.831)						0.06901	-0.00597
	Happiness	0.022 (0.108)	0.028 (0.112)						-0.12056	-0.02843
	Sadness	6.201 (1.249)	4.801 (1.546)						-0.58661	-0.57399
	Surprise	0.186 (0.406)	0.060 (0.180)						-0.30080	-0.23694
Surprise	Anger	0.034 (0.159)	0.054 (0.260)	0.55912	7.00	198.00	22.30386	<.001	-0.05088	-0.05168
	Contempt	0.038 (0.153)	0.264 (0.573)						-0.25486	-0.29794
	Disgust	0.093 (0.195)	0.172 (0.382)						-0.03558	-0.14585
	Fear	1.573 (1.442)	0.234 (0.371)						0.65759	0.73452
	Happiness	0.406 (0.600)	0.675 (0.735)						-0.27043	-0.22552
	Sadness	0.191 (0.380)	0.193 (0.366)						-0.12440	-0.00297
	Surprise	6.395 (1.214)	4.869 (1.407)						0.56857	0.65405



interaction,  $F(42, 103) = 12.50, p < .001$ ] indicated basically the same results. Collectively these findings indicated that there was no interpretable dimension underlying the scales that contributed to these differences.

*Post Hoc Analyses: The Relative Contribution of Target and Nontarget Emotions to the Total Variance in the Ratings of the Expressions*

Because observers saw multiple emotions in the expressions, we examined the amount of variance nontarget scales contributed to the total variance in the ratings. It was possible, for example, for the contribution of the nontarget emotion scales to be small compared to the target emotion scales, even though they significantly differed from zero. Inspection of the means also suggested this possibility, as there were more than a few close-to-zero cell means, raising questions about their meaningfulness despite the fact that they were statistically significant. To examine this possibility, we computed  $R^2$  effect sizes for scale, separately for each level of poser race and sex, emotion, and judge country. Effect sizes were computed first for all seven emotion scales, then recomputed excluding the intended emotion scale. We then subtracted the 6-scale effect size from the 7-scale effect size, which resulted in an effect size estimate attributable to the intended emotion scale. We divided this estimate by the original 7-scale effect size to obtain an estimate of the proportion of the total variance directly related to the intended emotion scale. Then we averaged these data across all levels of poser race and poser sex within each emotion (Table III). A considerable proportion of the total variance in American ratings of happy and sad expressions were accounted for by the target emotion scale, as were Japanese ratings of happy and surprise expressions. Other expressions were associated with less variance attributable to the target emotion category for both cultures.

**Table III.** Effect Size Analysis of the Amount of Variance Attributable to Target Emotion Scales<sup>a</sup>

Emotion	U.S.				Japan			
	$R_7^2$	$R_6^2$	$R_d^2$	$R_d^2/R_7^2 \times 100$	$R_7^2$	$R_6^2$	$R_d^2$	$R_d^2/R_7^2 \times 100$
Anger	0.7447	0.5204	0.2244	30.0597	0.6061	0.3354	0.2707	42.9550
Contempt	0.4134	0.4500	0.0366	8.4881	0.6364	0.4619	0.1745	27.4909
Disgust	0.7039	0.3968	0.3071	43.7436	0.6744	0.5744	0.1000	14.8278
Fear	0.7677	0.6966	0.0711	9.2163	0.6859	0.7390	0.0531	7.7172
Happiness	0.9192	0.1189	0.8003	87.1070	0.9394	0.0433	0.8962	95.3597
Sadness	0.8498	0.0906	0.7592	89.3575	0.7005	0.4000	0.3005	41.7793
Surprise	0.8544	0.3235	0.5309	62.2177	0.7681	0.1433	0.6248	82.6302

<sup>a</sup>  $R_7^2$  = effect size of scale with all scales included;  $R_6^2$  = effect size of scale excluding target emotion;  $R_d^2 = R_7^2 - R_6^2$ ;  $R_d^2/R_7^2 \times 100$  = proportion of original effect size attributable to target emotion scale.

## DISCUSSION

Observers in both cultures saw multiple emotions in the universal expressions, and effect size analyses indicated that ratings on the nontarget scales for some of the emotions were not trivial. The two countries differed on nontarget as well as target scales, and the direction of the differences differed depending on expression and scale. These results replicate previous studies reviewed above that documented that viewers see multiple emotions in facial expressions considered universal, and extend those findings by demonstrating that judges of other cultures also see multiple emotions. These results also replicate and extend previous findings regarding cultural differences in intensity ratings of universal facial expressions of emotion by uncovering cultural differences on multiple rather than single emotion scales, and in different directions.

The fact that judges see multiple emotions in expressions considered universal raises interesting and important questions about the role of judgment studies in supporting claims of universality. Moreover, the fact that this study demonstrates that this effect occurs cross-culturally adds to these concerns. There is little doubt that previous cross-cultural judgment studies have played a major role in establishing that some facial expressions of emotion are universal. Some psychologists (e.g., Russell, 1994, 1995) have suggested that, if observers see multiple rather than single emotions when judging expressions thought to be universal, such data would argue against the existence of discrete, universal emotion categories, which the expressions supposedly represent (but, see rebuttals by Ekman, 1994; Izard, 1994). Thus, the argument goes, these types of findings argue against the universality thesis.

We do believe that judgments of universal expressions should produce agreement or consensus in the target emotion category that the expression signals. This is precisely what all judgment studies of universal expressions have demonstrated, whether conducted by those who support it (e.g., Ekman, 1982; Ekman *et al.*, 1987; Izard, 1994) and those who challenge it (Russell, 1994, 1995; Russell & Bullock, 1986). If judgment studies did not demonstrate this agreement, then of course such data would argue against the universality of that expression.

But judgments of nonintended emotion categories, such as those observed in this study and others, do not necessarily challenge the universality contention, provided that there is agreement that the intended emotion category is the most salient. The reason for this is that there are multiple possible sources that may influence the judgment process, irrespective of the universality of the expressions that are judged. That is, these sources may create overlap among emotion categories in the judgment process despite the fact that the expressions being judged may be discrete, just as circularity may be observed when perceiving a square. These sources include the following:

1. *Semantic overlap in the linguistic categories and mental concepts related to emotion that are used in the judgment process.* If there is semantic overlap between the emotion category anger and the categories contempt, disgust, and sadness, in word associations, memories, or other cognitive processes, then the significant, nonzero ratings on these scales when judging angry photos may reflect the overlap in semantic association in these concepts, and not necessarily aspects of the expressions themselves. Previous work on emotion “families” (Ekman, 1992), dimensions underlying emotional space (Russell, 1980; Russell *et al.*, 1989) and “fuzzy” concepts of emotion (Russell & Bullock, 1986) is related to this possibility. Future research involving judgments of other stimuli using these categories should address this issue, along with studies examining directly the emotion categories themselves, and their semantic meanings and associations.
2. *Overlapping facial components in the expressions.* Universal expressions may share facial components that lead to overlap in judgments. Judgment studies of partial and blended expressions would address this possibility. Or, there may be aspects of either the physiognomy or morphology of the faces that contribute to multiple emotion judgments. While we believe that these effects were minimized in this study due to the inclusion of multiple posers in each emotion with different poser race and sex, future research may examine these ideas more formally by measuring facial structure and varying it systematically in judgment research.
3. *Cognitive overlap in events and experiences related to emotion.* Even if emotions are discrete and universal, our considerable experiences with them over the life span may create overlap in our emotion concepts and categories, which may be observed when making judgments of them. Future research examining the role of experience in the judgment of emotion may elucidate on this possibility.
4. *Personality biases in social cognition.* Individuals may develop certain personality traits or characteristics that make it easier to perceive some emotions over others, or in addition to others, regardless of the universality of the expression itself. Research investigating the relationship between personality and judgments of nonintended emotion categories may provide some insights to this process.
5. *Cultural influences on emotion perception.* Different cultures may color the perception of universal emotions in certain ways, depending on their particular dynamics, psychological goals, or characteristics. This would explain why people of different cultures see the intended emotion category as primary when judging a universal expression, yet also see different levels of nonintended emotion categories, as we observed in this study. Future

studies operationalizing specific aspects of culture (e.g., individualism vs. collectivism; see Triandis, 1995, for a review) while incorporating the exploration of multiple meanings of the universal expressions should address this issue.

In addition to these points, it is also important to remember that judgment data are only one type of many sources of data that truly test the universality thesis. Other sources of data, particularly concerning expressive behavior, play an even larger role than judgment studies in providing the evidentiary bases for expression universality. This evidence includes data from humans—adults, children, adolescents—and nonhumans, as well as congenitally blind individuals (see Ekman, 1972, 1973, 1982, 1994; Izard, 1994, for discussion). For these reasons, we do not believe that cultural differences in intensity ratings of multiple emotion categories, as reported in this article, necessarily argue against universality of emotion expression. They do, however, raise important questions about the nature of the judgment process, and should generate interesting work in the future along the lines of those possibilities discussed above.

The results of the discriminant analyses were similar to the univariate analyses, and did not reveal interpretable dimensions underlying the ratings. If, for example, a positive-negative dimension existed in the ratings, the discriminant analyses should have produced structure coefficients that were in the same direction for all negative scales (anger, contempt, disgust, fear, and sadness), and in the opposite direction for happiness. Instead, the direction and degree of the structure coefficients corresponded to the findings from the univariate analyses, with no discernible pattern of consistencies among the scales. These findings supported the concept that, at least for the emotion scales used in this study, judges used the scales as overlapping emotion categories rather than as points on an underlying dimension. To be sure, the study was not originally designed to adequately assess possible underlying dimensions (although if simple dimensions such as positive-negative existed, they certainly should have been discernible). Future studies involving a broader range of emotion terms as response alternatives that allow for adequate representation of *both* discrete emotion categories (and their associated families) across multiple dimensions are necessary to address this issue.

This study, involving the reanalysis of previously partially published data, was not without limitations, especially with respect to the new questions raised by these analyses. These limitations included the number and type of emotion scales used as response categories, the prototypical nature of the expressions rated, and the inclusion of only two cultures. Regardless of these limitations, however, the results presented in this article challenge previous work in this area, and raise important questions about the nature of judgments of universal emotions, and the influence of culture and other variables on this process.

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