Emotion
2011, Vol. 11, No. 5, 1223–1229

1528-3542/11/$12.00 DOI: 10.1037/a0024356

BRIEF REPORT

Judgments of Facial Expressions of Emotion in Profile

David Matsumoto and Hyi Sung Hwang
San Francisco State University and Humintell, LLC, Berkeley, CA

Despite the fact that facial expressions of emotion have signal value, there is surprisingly little research examining how that signal can be detected under various conditions, because most judgment studies utilize full-face, frontal views. We remedy this by obtaining judgments of frontal and profile views of the same expressions displayed by the same expressors. We predicted that recognition accuracy when viewing faces in profile would be lower than when judging the same faces from the front. Contrarily, there were no differences in recognition accuracy as a function of view, suggesting that emotions are judged equally well regardless of from what angle they are viewed.

Keywords: profile, face, emotion, angle, recognition

Facial expressions of emotion have signal value. They aid in helping solve social problems by providing information about the expressor's emotions, intentions, relationship with the target, and/or the environment; by evoking responses from others; and by providing incentives for desired social behavior (Dimberg & Ohman, 1996; Eisenberg et al., 1989; Esteves, Dimberg, & Ohman, 1994; Marsh, Ambady, & Kleck, 2005; Winkielman, Berridge, & Wilbarger, 2005). They signal the nature of interpersonal relationships (Gottman & Levenson, 1992; Gottman, Levenson, & Woodin, 2001) and are important regulators of social interaction (Klinnert, Campos, & Sorce, 1983; Sorce, Emde, Campos, & Klinnert, 1985). Facial expressions have signal value in other primates as well (Itakura, 1993; Miller, Banks, & Kuwahara, 1966; Miller, Banks, & Ogawa, 1963; Miller, Caul, & Mirsky, 1967; Miller, Murphy, & Mirsky, 1959). Views concerning the importance of the signal value of facial expressions has its modern roots in the writings of Darwin (1872), who argued that they are part of an evolved universal, biologically based signal system that aided in adaptation. This tradition continues today through neo-evolutionary theorists (Fridlund, 1994; Keltner & Haidt, 1999; Keltner & Kring, 1998).

Much of the impetus for these views comes from judgment studies demonstrating the universal recognition of facial expressions of emotion (Elfenbein & Ambady, 2002; Matsumoto, 2001). In these studies, observers typically see full-face views of faces from the front and make judgments of them, oftentimes selecting emotion labels to portray the emotion displayed. To date, there is evidence for the universal recognition of anger, contempt, disgust, fear, happiness, sadness, and surprise at above chance levels.

To the extent that emotional expressions have signal value, it is worth exploring how well that signal can be detected under various conditions. If faces are part of an evolved signal system that aids in adaptation and survival, they should be reliably decoded at various angles, not just head on in full-face view. After all, if a person displayed intense fear when confronting a life-threatening object, decoding that expression only from the front would mean that the decoder is in the same line of vision as the threatening object. Of course there are times when decoders are in the line of sight of the emotion elicitor, and, even when they are not, expressors can turn to face others while displaying expressions. But the ability to decode expressions accurately from multiple views increases the potential social signal value of the expression by reducing the need for expressors to turn to face decoders, allowing decoders to obtain information about the expressor's emotional and motivational states more rapidly and efficiently.

But facial expressions may not be judged as accurately when viewed from the side at a right angle (in profile) compared to full-face, frontal views because of reduced signal clarity (Matsumoto, Olide, Schug, Willingham, & Callan, 2009; O'Sullivan, 1982). Profile views provide less visibility to the surface area of the face, where morphological changes can occur and where appearance changes are more visible. The landmark wrinkle patterns produced by the movements of the facial musculature that are familiar in full-face, frontal expressions may not be as apparent in profile (e.g., whites above and around the eyes are harder to detect). And most interactions are likely to occur relatively more frequently face-to-face rather than in profile; observers are likely to be more familiar, practiced, and proficient in judging faces from the front compared to the side. Thus, one may expect that while facial expressions of emotion viewed in profiles are judged reliably at rates

David Matsumoto and Hyi Sung Hwang, Department of Psychology, San Francisco State University, and Humintell, LLC, Berkeley, CA.

Portions of this report were prepared with the support of research Grant W91WAW-08-C-0024 from the Army Research Institute, and FA9550-09-1–0281 from the Air Force Office of Scientific Research, to the first author.

Correspondence concerning this article should be addressed to David Matsumoto, Department of Psychology, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA 94132. E-mail: dm@sfsu.edu

exceeding chance, their accuracy rates should be lower than that of full-face, frontal expressions.

Unfortunately, to date, only one study has examined possible differences in emotion recognition between full-face, frontal views of emotional expressions and nonfrontal views.[1] Kleck and Mendolia (1990) had expressors view two positive and two negative emotion-eliciting stimuli, and expressions were selected for use in a judgment task on the basis of two coders' global, qualitative categorizations of the expressions as happiness or disgust. The expressions were shown to observers who judged whether the expression was positive, negative, or neutral. There were no differences in recognition accuracy as a function of view angle.

In the current study, we extend these findings by examining a wider range of expressions (seven), utilizing a greater number of emotion categories as response alternatives (nine), and by employing a different method of validating the stimuli (directed facial action followed by facial measurement). Full-face, frontal expressions and the corresponding hemiface profiles of the same expression of each expresser were judged by naïve observers using a fixed-choice judgment task involving a range of emotion-label alternatives. We hypothesized that recognition accuracy would be worse for expressions viewed in profile compared to frontal views.

Method

Participants

Participants were 993 university undergraduates (211 males, 782 females; mean age = 22.5 years) participating in partial fulfillment of class requirements. They were divided into four groups of observers (*n* = 210, 232, 322, and 229, for Groups 1 through 4, respectively), each group judging one of the four stimulus sets described in the next section. None of the observers judged more than one set.

Facial Stimuli

Expressers were professional actors from six ethnic groups—European, Asian, Hispanic, African, Middle Eastern, and South and Southeast Asian—who were compensated. They were provided with photograph examples of anger, contempt, disgust, fear, happiness, sadness, and surprise from the Japanese and Caucasian Facial Expressions of Emotion set (JACFEE; Matsumoto & Ekman, 1988) and were asked to practice making those faces prior to coming to a photo shoot. At the shoot, they were given Directed Facial Action instructions (DFA; Ekman, 2007) to move specific facial muscles corresponding to those that were theoretically and empirically related to emotion signaling (Darwin, 1872; Ekman, 1999). Three shots of each expression were taken simultaneously by synchronized, high resolution, high-speed digital cameras from different angles from the expresser's frontal straightaway: 0 degrees, in which a full-face, frontal shot was obtained; 45 degrees, in which a three-quarter view of the face was obtained; and 90 degrees, in which a profile shot of the expresser's left hemiface was obtained. In this study, the full-face, frontal expressions (frontal) and the hemiface profiles (profile) of each expresser were used.

Two stimulus sets with frontal views were then selected such that each expresser contributed one expression of two different emotions to each set. The six ethnic groups were equally represented in each of the emotions, and males and females were equally represented in each of the ethnicities to the extent possible. Sets 1 and 2 initially included 91 and 84 expressions, respectively. The expressions were coded using the Facial Action Coding System (FACS; Ekman & Friesen, 1978) by two coders independently (reliability = .86). The FACS coded expressions were chosen for testing in this study only if they met the following criteria: (a) they had to include only the FACS Action Units (AUs) that were associated with prototypic expressions of emotion and no other extraneous AUs; (b) a profile view of the face existed (some profile shots did not exist for some frontal expressions because of technical difficulties); (c) for contempt expressions only, the side on which contempt was expressed was the side on which the profile shot was taken. These procedures ensured that the expressions corresponded to those portrayed in stimuli used in original judgment studies supporting the universality of emotion recognition (Ekman, 1972, 1993; Ekman, Sorenson, & Friesen, 1969); to descriptions of the these expressions in *Unmasking the Face* (Ekman & Friesen, 1975); to the stimuli in *Pictures of Facial Affect* (Ekman & Friesen, 1976) and the *Japanese and Caucasian Facial Expressions of Emotion* (Matsumoto & Ekman, 1988); and to the facial configurations identified as emotion signals in Ekman and Friesen's EMFACS coding system (Matsumoto, Ekman, & Fridlund, 1991). The AUs considered to comprise the prototypic emotional expressions were as follows:

Anger: 4, 5, 7, 23 (16 for Open mouth)

Contempt: Unilateral 12 or Unilateral 14

Disgust: 9 or 10

Fear: 1, 2, 4, 5, 7, 20

Happiness: 6 or 7, 12

Sadness: 1 (or 1 and 4), 6 or 7, 15 (17 allowed)

Surprise: 1, 2, 5, 25 or 26 or 27[2]

---

[1] Relatedly, Hess, Adams, and Kleck (2007) presented observers with frontal, left-angle, and right-angle views of facial expressions, and reported that angry expressions were decoded more accurately from the front, whereas fearful expressions were more accurately decoded at an angle. This study did not involve profile expressions, however, and thus will not be mentioned further.

[2] All of the AUs have different appearance changes in profile compared to frontal views. Raising the inner corners of the brow (AU 1), for example, can be seen in both frontal and profile. But the "omega" wrinkle in the middle of the forehead with AU 1 or AU 1 + 4 can only be seen clearly from the front. The whites above and around the eyes are more clearly seen from the front, highlighting the actions of AUs 5 and 7 in frontal views, but not so for profile views. Lip stretching (AU 20) produces a wide, horizontal stretch of the lips in frontal views, which is diminished in profile views.

These procedures resulted in a final pool of stimuli that included two different sets of frontal images. Set 1 Frontal included 69 images, consisting of 11 anger, 11 contempt, 7 disgust, 11 fear, 10 happiness, 8 sadness, and 11 surprise. Set 2 Frontal included 60 images, consisting of 4 anger, 8 contempt, 7 disgust, 12 fear, 6 happiness, 12 sadness, and 11 surprise.[3] Two additional sets of stimuli were created using the corresponding profile views of each of the images in the two frontal expression sets. Thus, there were a total of four stimulus sets (Set 1 Frontal and Set 2 Frontal, and Set 1 Profile and Set 2 Profile), both profile sets including the same expressions as those in both frontal sets, respectively, but from profile view (see Figure 1 for examples).

Figure 1. Frontal and profile examples of anger (top), fear (middle), and sadness (bottom) expressions used in the study.

Judgment Tasks and Procedures

Data were collected using an online data collection system, and observers participated individually. To minimize demand characteristics, observers judged only one of the four sets; thus, view was a between-subjects factor. Groups 1 and 2 viewed Set 1 Frontal and Set 1 Profile, while Groups 3 and 4 viewed Set 2 Frontal and Set 2 Profile, respectively. Within each set, expressions were presented in different random orders. Each expression appeared on the screen and remained until the participant judged the expression and clicked to the next one. While each was presented, participants completed a fixed-choice task in which they judged the emotion portrayed by selecting a label from the following list: anger, contempt, disgust, fear, happiness, sadness, surprise, and neutral. An "other" alternative was also provided. Participation ended when all expressions were judged for a set.

Results

We computed confusion matrices for each set of stimuli. Table 1 presents the confusion matrix averaged across all expressions within each emotion across both sets separately for frontal and profile views. The recognition rates for the frontal faces were comparable to those previously reported using similar stimuli (e.g., Biehl et al., 1997). Surprisingly, the mean accuracy rates for the profile views also appeared very comparable.

Response classification chi-squares were computed separately for each expression; all were statistically significant. To examine differences between frontal and profile views, we computed differences in proportion tests (McNemar, 1949), comparing the frontal and profile views on the intended emotion response label, expression by expression. As can be seen from Table 2, across all expressions (129), half (65) produced nonsignificant results. Of the remainder, 35 produced significant results, indicating that the frontal view was judged more accurately than the profile view, but 29 produced significant results indicating the opposite. On the level of specific emotions, contempt, disgust, sadness, and surprise had slightly more expressions that were recognized more accurately in frontal views, but anger, fear, and happiness had slightly more expressions that were recognized more accurately in profile views. These findings indicated that some expressors were more easily judged in one view than the other; overall, however, there appeared to be no reliable differences in recognition accuracy as a function of view. This interpretation also matches the averaged accuracy rates in the confusion matrix presented in Table 1.

We also tested for view differences by transforming the nominal judgment data for each expression into accuracy scores (1 = intended emotion label, 0 for all others) and averaging across all expressions separately for each stimulus set and emotion. We then computed a mixed two-way ANOVA on these averaged accuracy

[3] There were unequal numbers of stimuli for different emotions because of expression-level differences in the DFA performances. For example, some expressors activated AU 6 when performing the unilateral AU 12 or 14 for contempt. Some activated AUs 4 or 7 when performing AU 9 for disgust. Some did not activate AUs 6 or 7 when performing AU 12 for happiness. These individual differences in performance led to differential exclusion of certain expressions from the stimulus set, which consequently resulted in unbalanced numbers of stimuli across emotions and sets.

Table 1
Confusion Matrix of Judgments: Percentage of Observers Selecting the Emotion Labels, Averaged Across the Expressions Within Each Emotion and Stimulus Set

		Response label								
Expression	View	Anger	Contempt	Disgust	Fear	Happiness	Sadness	Surprise	Neutral	Other
Anger	Frontal	**83.4%**	5.5%	1.7%	1.7%	.2%	2.2%	.4%	.9%	3.9%
	Profile	**86.7%**	5.9%	2.5%	1.0%	.0%	1.0%	.3%	.5%	2.0%
Contempt	Frontal	1.1%	**32.4%**	3.8%	.2%	2.0%	4.3%	.2%	44.2%	12.5%
	Profile	1.1%	**29.7%**	4.9%	.1%	7.2%	2.2%	.4%	46.3%	7.5%
Disgust	Frontal	10.8%	9.8%	**75.7%**	.3%	.1%	.2%	.3%	.7%	2.1%
	Profile	14.7%	11.3%	**70.5%**	.2%	.0%	.3%	.4%	1.4%	1.3%
Fear	Frontal	1.9%	.5%	5.9%	**65.8%**	.2%	1.0%	19.3%	.4%	4.9%
	Profile	1.5%	.7%	5.2%	**68.9%**	.0%	1.6%	18.0%	.3%	3.8%
Happiness	Frontal	.0%	1.2%	.1%	.1%	**93.1%**	.1%	.5%	3.1%	1.7%
	Profile	.1%	2.3%	.2%	.1%	**92.6%**	.2%	.1%	3.0%	1.4%
Sadness	Frontal	.2%	1.2%	.9%	2.6%	.1%	**88.8%**	.4%	1.8%	4.1%
	Profile	.7%	1.9%	1.1%	1.6%	.1%	**85.3%**	.4%	5.2%	3.7%
Surprise	Frontal	.3%	.3%	.2%	7.2%	.3%	.7%	**85.8%**	1.5%	3.8%
	Profile	.2%	.5%	.3%	7.5%	.1%	.6%	**84.5%**	2.3%	4.0%

scores using view (frontal v. profile) and emotion as factors separately for Sets 1 and 2. For both sets, the two-way ANOVA was significant, $F(6, 2640) = 3.37$, $p < .01$, $\eta_p^2 = .008$; and $F(6, 3294) = 4.16$, $p < .001$, $\eta_p^2 = .008$. Simple-effects analyses of view produced significant differences for anger and sadness in Set 1, and disgust and happiness in Set 2 (see Table 3). These effects, however, were associated with negligible effect sizes (η_p^2 ranging from .015 to .021), as were the two significant two-ways. For all intents and purposes, therefore, we interpreted these findings as indicating no overall differences in recognition accuracy rates between the views.

Post-Hoc Analyses

We aggregated accuracy scores across the expressions within each expressor ethnicity and computed mixed two-way Expressor Ethnicity x View ANOVAs separately for each emotion and the two sets of data. Of the 14 analyses (7 emotions × 2 sets of data), 11 produced statistically significant Expressor Ethnicity x View interactions, and three produced marginally significant interactions. The effect sizes associated with these effects, however, were negligible (mean $\eta_p^2 = .015$, range $= .004$ to .043). We thus interpreted these findings as indicating no differences in judgment accuracies by view as function expressor ethnicity.

We also aggregated scores across expressions within each expressor gender and computed mixed three-way Expressor Gender x View x Judge Gender ANOVAs separately for each emotion and the two sets of data. Each of these analyses produced three effects involving an interaction between gender and view: Expressor Gender x View, Judge Gender x View, and Expressor Gender x Judge Gender x View. Across the 42 effects obtained (3 effects per analysis × 7 emotions × 2 sets of data), only six were statistically significant and associated with negligible effect sizes (mean η_p^2 across emotions and sets = .015, .002, and .001, for the three types of effects, respectively). We interpreted these findings as indicating no differences in judgment accuracies by view as function expressor or judge gender.

Discussion

Emotion recognition accuracy did not differ as a function of angle of viewing; profile views of facial expressions of emotion were recognized at comparable levels to full-face, frontal views of the very same expressions. These findings occurred when examining differences expression by expression, and when transforming judgments into accuracy scores and computing these across expressions within emotions. There were no reliable ethnicity or gender differences. Given the relatively large number of stimuli and sample sizes, the findings appear to be quite stable. While differences did indeed emerge, these differences were not reliable across expressors but appeared to represent individual differences in the expressors. Given that the recognition accuracy rates were comparable to those obtained with other similar stimuli, the findings were not likely due to sampling bias.[4]

The lack of differences in emotion recognition accuracy rates for these expressions as a function of viewing angle speaks to the adaptive, social signal value of these expressions. These findings suggest that emotional expressions can be decoded rapidly because expressors do not need to turn toward decoders in order for their expressions to be decoded. Decoding facial expressions, therefore, is reliable and efficient. This makes sense given that their function is to communicate important information about the environment and the expressor's internal states, intentions, and motivations. Because, in real life, faces are dynamic, individuals need to be able to read emotions quickly and efficiently, even given minimal stimulus input, thereby sharing important information. Although the decreased signal value afforded by profile views, because of the limited surface area of the face, would suggest that recognition

[4] We note that the agreement rates for contempt expressions were substantially lower than for the other emotions, although still significantly greater than chance. Previous research has also documented quite low recognition rates for these expressions, especially for American observers (Matsumoto & Ekman, 2004).

Table 2
Summary of Results of Differences in Proportions Tests

Emotion	Total no. expressions	No. nonsignificant results	No. significant results, Frontal > Profile	No. significant results, Profile > Frontal
Anger	15	6	2	7
Contempt	19	9	7	3
Disgust	14	5	7	2
Fear	23	12	3	8
Happiness	16	11	2	3
Sadness	20	11	7	2
Surprise	22	11	7	4
Total	129	65	35	29

rates should be lower than full-face frontal views, this was not the case.

These findings open the door to a number of interesting future research possibilities examining the effects of other aspects of the viewing context on emotion judgments. For instance, Kappas, Hess, Barr, and Kleck (1994) examined the effect of vertical viewing angle on emotion judgments. They created stimuli (real and schematic faces) that differed in the vertical angle to the face. Faces seen from below were perceived as more positive and less negative, while faces seen from above appeared more negative and less positive. Certainly, future research can follow up on this interesting and important line of research. While one study, conducted over three decades ago, examined the effect of viewing distance (Ekman, Brattesani, O'Sullivan, & Friesen, 1979), other studies like it can examine the degree to which facial expressions of emotion can be recognized at a distance. And, to our knowledge, no studies have examined the effect of facial hair, glasses, or head and face coverings (e.g., burkhas) on the recognition of emotion in faces. This is curious especially given the fact that the clean-cut, well-shaven faces of men is a product of some (not all) modern cultures and is probably a relatively recent trend in our evolutionary history. It may be that emotion recognition accuracy rates differ for males with facial hair, and, given that most arguments about the importance of facial expressions of emotion are rooted in evolutionary theory, it would be very interesting to examine if emotions can be reliably judged in stimuli of men with facial hair.

These results also raise interesting questions about the nature of the decoding process from profile views. There is evidence to suggest that face perception and recognition is neurologically localized and organized differently than object perception, and that face recognition is holistic rather than featural (Farah, Wilson, Drain, & Tanaka, 1998). Moreover, expression recognition appears to occur in different areas of the brain than face recognition, and different emotions may utilize different brain regions (Calder & Young, 2005). This work suggests that profile decoding may also be localized and occur as a configural whole rather than as featural components, a speculation that can be tested in future research.

Future research can also examine the nature of the individual differences we observed; some people are more easily recognized from the front, others from the side. We speculate that these differences are driven by differences in facial physiognomies. That is, the structure of some faces would make the appearance changes that occur when facial expressions are produced more pronounced when viewed from the front; other facial structures, however, may make those appearance changes more pronounced from the side. These physiognomies may include the degree of protrusion of the brow ridge or chin and the structure of the eyelids. Future research may endeavor to measure such cues and vary them systematically in order to determine how they influence emotion signaling from different angles.

The current study was not conducted without limitations, most notably concerning the artificial nature of the stimuli.

Table 3
Results of Simple Effects Analyses Comparing Frontal vs. Profile Views, Separately for the Two Stimulus Sets and Emotions

Set	Emotion	Frontal mean (*SD*)	Profile mean (*SD*)	*df*	*F*	*p*	η_p^2
1	Anger	.82 (.18)	.87 (.16)	1, 440	7.51	.006	.017
	Contempt	.29 (.29)	.27 (.26)	1, 440	.50	ns	.001
	Disgust	.71 (.23)	.68 (.25)	1, 440	1.45	ns	.003
	Fear	.64 (.25)	.66 (.24)	1, 440	1.36	ns	.003
	Happiness	.90 (.15)	.92 (.11)	1, 440	1.62	ns	.004
	Sadness	.89 (.16)	.84 (.18)	1, 440	9.62	.002	.021
	Surprise	.82 (.20)	.82 (.18)	1, 440	.03	ns	.000
2	Anger	.83 (.21)	.84 (.21)	1, 549	.45	ns	.001
	Contempt	.36 (.33)	.32 (.29)	1, 549	1.66	ns	.003
	Disgust	.78 (.25)	.71 (.26)	1, 549	10.69	.001	.019
	Fear	.66 (.24)	.69 (.25)	1, 549	2.53	ns	.005
	Happiness	.94 (.13)	.90 (.16)	1, 549	8.10	.005	.015
	Sadness	.87 (.16)	.84 (.21)	1, 549	2.74	ns	.005
	Surprise	.87 (.17)	.86 (.19)	1, 549	.39	ns	.001

Although the expressions matched the facial configurations previous research has demonstrated to be produced when emotions are elicited (Matsumoto, Keltner, Shiota, Frank, & O'Sullivan, 2008), spontaneously produced expressions involve extraneous muscle movements and are produced in a dynamic situation that unfolds across time, all of which decreases signal clarity (Hess & Blairy, 2001; Matsumoto et al., 2009; Naab & Russell, 2007; Wagner, 1990; Wagner, Lewis, Ramsay, & Krediet, 1992; Wagner, MacDonald, & Manstead, 1986). Whether profile views of spontaneous expressions with noise are judged equally well as frontal views is an interesting and important question for future research to address.

References

Biehl, M., Matsumoto, D., Ekman, P., Hearn, V., Heider, K., Kudoh, T., & Ton, V. (1997). Matsumoto and Ekman's Japanese and Caucasian Facial Expressions of Emotion (JACFEE): Reliability data and cross-national differences. *Journal of Nonverbal Behavior, 21,* 3–21.

Calder, A. J., & Young, A. W. (2005). Understanding the recognition of facial identity and facial expression. *Nature Reviews Neuroscience, 6,* 641–651.

Darwin, C. (1872). *The expression of emotion in man and animals.* New York, NY: Oxford University Press.

Dimberg, U., & Ohman, A. (1996). Behold the wrath: Psychophysiological responses to facial stimuli. *Motivation & Emotion, 20,* 149–182.

Eisenberg, N., Fabes, R. A., Miller, P. A., Fultz, J., Shell, R., Mathy, R. M., & Reno, R. R. (1989). Relation of sympathy and distress to prosocial behavior: A multimethod study. *Journal of Personality and Social Psychology, 57,* 55–66.

Ekman, P. (1972). Universal and cultural differences in facial expression of emotion. In J. R. Cole (Ed.), *Nebraska Symposium on Motivation* (Vol. 19, pp. 207–283). Lincoln, NE: Nebraska University Press.

Ekman, P. (1993). Facial expression and emotion. *American Psychologist, 48,* 384–392.

Ekman, P. (1999). Basic emotions. In T. Dalgleish & T. Power (Eds.), *The handbook of cognition and emotion* (pp. 45–60). Sussex, United Kingdom: Wiley and Sons.

Ekman, P. (2007). The directed facial action task: Emotional responses without appraisal. In J. A. Coan & J. J. B. Allen (Eds.), *Handbook of emotion elicitation and assessment* (pp. 47–53). New York, NY: Oxford University Press.

Ekman, P., Brattesani, K. A., O'Sullivan, M., & Friesen, W. V. (1979). Does image size affect judgments of the face? *Journal of Nonverbal Behavior, 4,* 57–61.

Ekman, P., & Friesen, W. V. (1975). *Unmasking the face; a guide to recognizing emotions from facial clues.* Englewood Cliffs, NJ: Prentice Hall.

Ekman, P., & Friesen, W. V. (1976). *Pictures of facial affect.* Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., & Friesen, W. V. (1978). *Facial action coding system: Investigator's guide.* Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pancultural elements in facial displays of emotion. *Science, 164,* 86–88.

Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin, 128,* 205–235.

Esteves, F., Dimberg, U., & Ohman, A. (1994). Automatically elicited fear: Conditioned skin conductance responses to masked facial expressions. *Cognition and Emotion, 8,* 393–413.

Farah, M. J., Wilson, K. D., Drain, M., & Tanaka, J. N. (1998). What is "special" about face perception. *Psychological Review, 105,* 482–498.

Fridlund, A. (1994). *Human facial expression: An evolutionary view.* San Diego, CA: Academic Press.

Gottman, J. M., & Levenson, R. W. (1992). Marital processes predictive of later dissolution: Behavior, physiology, and health. *Journal of Personality and Social Psychology, 63,* 221–223.

Gottman, J. M., Levenson, R. W., & Woodin, E. (2001). Facial expressions during marital conflict. *Journal of Family Communication, 1,* 37–57.

Hess, U., Adams, R. B., & Kleck, R. E. (2007). Looking at you or looking elsewhere: The influence of head orientation on the signal value of emotional facial expressions. *Motivation & Emotion, 31,* 137–144.

Hess, U., & Blairy, S. (2001). Facial mimicry and emotional contagion to dynamic emotional facial expressions and their influence on decoding accuracy. *International Journal of Psychophysiology, 40,* 129–141.

Itakura, S. (1993). Emotional behavior during the learning of a contingency task in a chimpanzee. *Perceptual & Motor Skills, 76,* 563–566.

Kappas, A., Hess, U., Barr, C. L., & Kleck, R. E. (1994). Angle of regard: The effect of vertical viewing angle on the perception of facial expressions. *Journal of Nonverbal Behavior, 18,* 263–280.

Keltner, D., & Haidt, J. (1999). Social functions of emotion at four levels of analysis. *Cognition and Emotion, 13,* 505–521.

Keltner, D., & Kring, A. M. (1998). Emotion, social function, and psychopathology. *Review of General Psychology, 2,* 320–342.

Kleck, R. E., & Mendolia, M. (1990). Decoding of profile versus full-face expressions of affect. *Journal of Nonverbal Behavior, 14,* 35–49.

Klinnert, M. D., Campos, J. J., & Sorce, J. F. (1983). Emotions as behavior regulators: Social referencing in infancy. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research, and experience* (pp. 57–86). New York, NY: Academic Press.

Marsh, A. A., Ambady, N., & Kleck, R. E. (2005). The effects of fear and anger facial expressions on approach- and avoidance-related behaviors. *Emotion, 5,* 119–124.

Matsumoto, D. (2001). Culture and emotion. In D. Matsumoto (Ed.), *The Handbook of Culture and Psychology* (pp. 171–194). New York, NY: Oxford University Press.

Matsumoto, D., & Ekman, P. (1988). Japanese and Caucasian Facial Expressions of Emotion and Neutral Faces (JACFEE and JACNeuF). Retrieved from http://www.humintell.com/for-use-in-research/

Matsumoto, D., & Ekman, P. (2004). The relationship between expressions, labels, and descriptions of contempt. *Journal of Personality and Social Psychology, 87,* 529–540.

Matsumoto, D., Ekman, P., & Fridlund, A. (1991). Analyzing nonverbal behavior. In P. W. Dowrick (Ed.), *Practical guide to using video in the behavioral sciences* (pp. 153–165). New York, NY: Wiley.

Matsumoto, D., Keltner, D., Shiota, M. N., Frank, M. G., & O'Sullivan, M. (2008). What's in a face? Facial expressions as signals of discrete emotions. In M. Lewis, J. M. Haviland, & L. Feldman Barrett (Eds.), *Handbook of emotions* (pp. 211–234). New York, NY: Guilford Press.

Matsumoto, D., Olide, A., Schug, J., Willingham, B., & Callan, M. (2009). Cross-cultural judgments of spontaneous facial expressions of emotion. *Journal of Nonverbal Behavior, 33,* 213–238.

McNemar, Q. (1949). *Psychological statistics* (4th ed.). Oxford, England: Wiley.

Miller, R. E., Banks, J. H., Jr., & Kuwahara, H. (1966). The communication of affects in monkeys: Cooperative reward conditioning. *Journal of Genetic Psychology, 108,* 121–134.

Miller, R. E., Banks, J. H., Jr., & Ogawa, N. (1963). Role of facial expression in "cooperative-avoidance conditioning" in monkeys. *Journal of Abnormal and Social Psychology, 67,* 24–30.

Miller, R. E., Caul, W. F., & Mirsky, I. A. (1967). Communication of affects between feral and socially isolated monkeys. *Journal of Personality and Social Psychology, 7,* 231–239.

Miller, R. E., Murphy, J. V., & Mirsky, I. A. (1959). Relevance of facial expression and posture as cues in communication of affect between monkeys. *Archives of General Psychiatry, 1,* 480–488.

Naab, P. J., & Russell, J. A. (2007). Judgments of emotion from spontaneous facial expressions of New Guineans. *Emotion, 7,* 736–744.

O'Sullivan, M. (1982). Measuring the ability to recognize facial expressions of emotion. In P. Ekman (Ed.), *Emotion in the human face* (pp. 281–314). New York, NY: Cambridge University Press.

Sorce, J. F., Emde, J. J., Campos, J. J., & Klinnert, M. D. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. *Developmental Psychology, 21,* 195–200.

Wagner, H. L. (1990). The spontaneous facial expression of differential positive and negative emotions. *Motivation & Emotion, 14,* 27–43.

Wagner, H. L., Lewis, H., Ramsay, S., & Krediet, I. (1992). Prediction of facial displays from knowledge of norms of emotional expressiveness. *Motivation & Emotion, 16,* 347–362.

Wagner, H. L., MacDonald, C., & Manstead, A. S. R. (1986). Communication of individual emotions by spontaneous facial expressions. *Journal of Personality and Social Psychology, 50,* 737–743.

Winkielman, P., Berridge, K. C., & Wilbarger, J. L. (2005). Unconscious affective reactions to masked happy versus angry faces influence consumption behavior and judgments of value. *Personality and Social Psychology Bulletin, 31,* 121–135.

Received April 30, 2010
Revision received March 7, 2011
Accepted May 4, 2011 ■