
Why Do Fear and Anger Look the Way They Do? Form and Social Function in Facial Expressions

Abigail A. Marsh
Reginald B. Adams Jr.
Harvard University

Robert E. Kleck
Dartmouth College

The origins of the appearances of anger and fear facial expressions are not well understood. The authors tested the hypothesis that such origins might lie in the expressions' resemblance to, respectively, mature and babyish faces in three studies. In Study 1, faces expressing anger and fear were judged to physically resemble mature and babyish faces. Study 2 indicated that characteristics associated specifically with babyishness are attributed to persons showing fear, whereas characteristics associated with maturity are attributed to persons showing anger. In Study 3, composite faces were used to minimize the possibility that the attributions were based on associations to the anger and fear emotions alone rather than to the physical resemblance of the expressions to static facial appearance cues. These results suggest that fear and anger expressions may serve socially adaptive purposes for those who show them, similar to the social adaptations associated with a babyish or mature facial appearance.

Keywords: *facial expression; facial maturity; anger; fear; emotion*

Despite the warning against judging a book by its cover, we form many of our opinions about others based on their outward appearances. The face, which is the center of visual attention in social interactions, provides much of the information on which these judgments are based (see Alley, 1988; Laser & Mathie, 1982; Zebrowitz, 1997). Research on such perceptions has tended to focus on one of two aspects of facial appearance: the structure of static facial features or the appearance of the face due to expressive movements. This article will link these two lines of research. Specifically, we propose that anger and fear facial expressions may approximate the appearance of, respectively, the mature face and the babyish face. In this way, fear and anger expressions could systematically affect attributions and reactions in a way until now

thought to be largely a function of static facial structure. Because these attributions and their associated behaviors could be socially beneficial to the individual displaying the emotion, the emergence of expressive displays of fear and anger may have in part been shaped by their ability to mimic important facial morphological cues.

Functions and Origins of Facial Expressions

There is a long-running controversy among psychologists as to the origins of facial expressions of emotion. Some claim that for “basic” emotions—for example, fear, anger, surprise, joy, sadness, and disgust—facial expressions communicate similar social messages or states across many if not all cultures (Darwin, 1872/1965; Ekman, 1994; Ekman & Friesen, 1971; Izard, 1994; Keating, 1985b). Others point to evidence that some if not all aspects of facial emotional displays are specific to particular cultures (e.g., Matsumoto, 1989; Russell, 1994) and therefore are probably socially learned. A recent meta-analysis (Elfenbein & Ambady, 2002) indi-

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cated that despite some cross-cultural variation, basic emotional expressions are recognized across cultures at levels too high to have resulted from social learning alone. Certain core components of emotional expressions may be universal, and likely innate, a proposition supported by cross-species and ontogenetic evidence (e.g., Andrew, 1965; Camras, Malatesta, & Izard, 1991; Ekman, 1993, 1997; Ekman et al., 1987; Geen, 1992; Keating, 1985a).

A reasonable question would then be, "why these *particular* expressions?" Would arbitrary constellations of facial movement have come to represent certain emotions or social signals over the millennia? Why would geographically diverse populations have continued to use a similar set of basic facial expressions? Charles Darwin (1872/1965) explored the answers to such questions in his now classic book *The Expression of the Emotions in Man and Animals*. Darwin proposed three principles of expression: the principle of serviceable associated habits, the principle of antithesis, and the principle of action of the nervous system. These principles were put forth to bolster Darwin's theory of natural selection by suggesting emotional expressions to be vestigial. For example, the components of the prototypical anger expression may be vestiges of once-useful aggressive or biting behaviors, and angry eyes may narrow and angry brows lower to protect an aggressor's eyes. This explanation seems logical, although it lacks, to our knowledge, empirical support. However, there does not seem to be any clear behavior for which the characteristic movements of the fear expression—raised brows, widened eyes, lips drawn down and back—could be vestiges. Moreover, it is not clear why aggressors but not victims would wish to protect their eyes. Both parties face a potentially harmful conflict. But the dominant parties lower their brows and narrow their eyes and the submissive parties do just the opposite—they widen their eyes and raise their brows. Thus, the question as to why these opposing behaviors originated remains unanswered.

A few recent investigators have put forth theories on the possible functions expressions may serve in modern humans. For example, Rosenstein and Oster (1988) interpreted results of research on infant facial expressions in terms of the functions expressions might serve in response to various flavors. The mouth gaping and shifts in the tongue that accompany the expression of disgust might, they suggested, help protect an expressor against bitter substances that could be toxic. Others have emphasized examining individual components of facial expressions separately in that they may serve distinct functions. For example, the brow movements involved in frowning may be associated with anticipated expenditure of effort, although this relationship may be medi-

ated by the unpleasantness associated with that effort (C. A. Smith, 1989).

These explanations are all notable in that the functions they consider facial expressions to serve are essentially nonsocial. The effects that emotional expressions have on perceivers may, however, be among those that have made facial expressions adaptive elements of humans' behavioral repertoire (Fridlund, 1997). Social signals like emotional expressions, along with more static elements of appearance, such as cues to age and social status, are crucial elements of intraspecies communication (Preuschoft, 1995).

Facial Babyishness and Maturity

It has long been understood that certain static facial features are associated with specific personality trait attributions or perceived action tendencies (see Zebrowitz, 1997, for a review). McArthur and Baron's (1983) *ecological theory of facial perception* describes how a person's appearance provides knowledge relevant to interacting with that person, and as such, the transmission of this information can provide an adaptive advantage. However, observers attuned to the informative traits may overgeneralize, or find their attributions similarly affected by characteristics that only resemble the truly informative cues. People who appear infantile, for example, are expected to provide certain affordances, such as the opportunity to care for, cuddle, or protect them (Berry & McArthur, 1986).

A wealth of empirical studies have suggested that people do judge and respond to babyish-looking adult faces as they would to the faces of actual infants. Adult faces that appear babyish are judged to be more cute, cuddly, dependent, naïve, pleasant, physically weak, socially weak or submissive, warm, feminine, and honest than are faces that appear mature (e.g., Berry & McArthur, 1985; Friedman & Zebrowitz, 1992; Gross et al., 1997; Keating, 1985a; McKelvie, 1993; Zebrowitz, Kendall-Tackett, & Fafel, 1991; Zebrowitz & Montepare, 1992; Zuckerman, Miyake, & Elkin, 1995). These attributions appear to translate across cultures (Keating, Mazur, Segall, et al., 1981; Keating, Mazur, & Segall, 1981; McArthur & Berry, 1987; Zebrowitz, Montepare, & Lee, 1993). The features found most consistently to elicit attributions associated with babyishness include low placement of facial features on the vertical plane; short features; high or thin brows; a small, round, or receding jaw; and especially, large or round eyes and thick lips. Conversely, low brows, small eyes, and large jaws are more often seen as mature looking (Berry & McArthur, 1985; Friedman & Zebrowitz, 1992; Keating, 1985a; McArthur & Apatow, 1983/1984; Pittenger, Shaw, & Mark, 1979; Zebrowitz & Montepare, 1992).

The Appearance of Fear and Anger Facial Expressions

Historically, it has been thought that more stable cues, such as facial morphology, inform perceivers about long-lasting traits such as gender or honesty, whereas expressions are thought to signal more transient information, such as whether the person presently means us harm. However, the roles that these two aspects of facial appearance play in social interactions cannot be altogether uncoupled. For example, when a person's nonexpressive facial structure resembles an emotional expression, an observer may extend the "state" in these facial features to associated personality traits (Berry & McArthur, 1986; Laser & Mathie, 1982). Furthermore, heavy, low eyebrows or narrow eyes on an otherwise neutral face may appear angry to perceivers, whereas thin or arched eyebrows or widely opened eyes appear fearful (Boucher & Ekman, 1975; Keating, Mazur, & Segall, 1977; Laser & Mathie, 1982; Paliwal & Goss, 1981).

We are arguing for a different sort of relationship between the underlying physical structure of the face and the role of transient facial expressions. Specifically, we are hypothesizing that prototypical anger and fear expressions may take the forms they do in part *because* a face reconfigured by these expressions serves to momentarily mimic a physically babyish or mature face. Individuals being able to indicate their submissiveness or dominance quickly through facial expressive cues could reduce the chances of violent altercations.

It is necessary to understand exactly how anger and fear serve to reconfigure the facial features to understand how such changes could mimic static facial appearance. Ekman and Friesen (1978) devised the Facial Action Coding System (FACS), a comprehensive analysis of these configurational properties. Subjective reports of emotion or observers' attributions of emotion have supported FACS's predictions of the facial action units most commonly associated with fear, anger, and other emotions (Ekman et al., 1987). Actions commonly associated with *fear* are raising the brows, raising the upper lids, pulling the mouth open, pulling the lips backwards horizontally, and drawing the eyebrows together. Actions associated with *anger* include lowering and knitting the brows (wherein the skin across the brow ridge can furrow or bulge), raising the upper lids, tightening the eyelids, narrowing the eye openings, raising the mound of the chin and lower lip upward so that the mouth appears as a \cap , tightening and narrowing the lips, and pressing the lips together.

A person expressing fear, then, would acquire bigger and rounder looking eyes, higher and more arched brows, and a babyish flattened and smoothed brow ridge. Although Ekman and Friesen identify these actions as components of a fear expression, the compo-

nents would give the person's face recognizably babyish qualities as well. A person expressing anger, conversely, would acquire low, straight brows and a bulging, furrowed brow ridge; narrow eyes; and thin lips. These actions would constitute a prototypical anger expression but could also serve to enhance the apparent maturity of the person's face as well. (It should be noted that anger, as described by Ekman and Friesen, 1978, can also manifest as widened eyes instead of narrowed eyes. However, the brows of an angry expression are always lowered, producing hooded-looking eyes even when the upper lids are raised.)

Functions of Fear and Anger Expressions

Across species, stereotyped nonverbal displays of subordination or fear may help individuals avoid becoming the target of more dominant conspecifics' aggression (Blair, 1995; Preuschoft, 1999; Schenkel, 1967; J. M. Smith & Price, 1973). Subordination displays, in contrast to dominance displays, typically appear nonthreatening and appeasing and may make the organism appear smaller, weaker, or more juvenile (Darwin, 1872/1965; Schenkel, 1967). A babyish appearance is thought to appear "disarming" (Zebrowitz, 1997). Konrad Lorenz (1943; cf. Sternglanz, Gray, & Murakami, 1977) suggested a *Kindenschema*, or infantile appearance, to be a "releasing stimulus," priming conspecifics to provide caregiving behavior and to inhibit aggression. The results of more recent research also have shown the appearance of babies to elicit attentive, nonaggressive behaviors (E. H. Hess & Polt, 1960; Mischkulnig, 1989; Sternglanz et al., 1977; Zebrowitz, 1997).

Other social species, such as wolves and many nonhuman primates, display stereotypical dominant and submissive behaviors that seem to serve just such a purpose. Using nonverbal behavior designed to communicate relative status may minimize the incidence of potentially harmful aggression that usually results when individuals compete (Darwin, 1872/1965; Marler, 1961; McLeod & Fentress, 1997; J. M. Smith & Price, 1973). The establishment of dominance hierarchies among primates, for example, seems to reduce the incidence of aggression (Smuts, Cheney, Seyfarth, Wrangham, & Struhsaker, 1987). By expressing anger in a way that makes them appear more mature, eliciting attributions of dominance and strength, high-status individuals might similarly reduce the likelihood of challenges to them. Guilford and Dawkins (1991) argue that the evolutionary "design" of social signals should reflect those cues that perceivers will be best able to detect and interpret. What better way for an individual to indicate dominance clearly and rapidly than to mimic facial appearances that are universally perceived to look mature and dominant?

If in fact the prototypical fear expression does approximate a babyish face and the anger expression a mature face, we would expect to find that persons showing fear expressions would be attributed the same youth-related traits as persons with babyish faces, and that persons showing anger expressions would be attributed the same maturity-related traits as persons with mature faces. Study 1 established that particular facial features do change appearance in ways consistent with babyish faces and mature faces across fear and anger expressions. This study also assessed how ratings of dominance and babyishness vary across the two expressions to confirm that babyishness and dominance are independent constructs—that fear and anger differ in apparent facial maturity, not simply in terms of dominance, as has been shown previously (e.g., Algoe, Buswell, & DeLamater, 2000; U. Hess, Blairy, & Kleck, 2000; Knutson, 1996). The second study demonstrated that the particular attributions made to babyish and mature-faced individuals regarding personality traits and apparent age are also made to those expressing fear and anger. In addition, the traits rated in Study 2 are essentially unrelated to the emotions of anger and fear, making it more likely that the attributions pertained specifically to the appearance of the faces. Study 3 examined whether observers make these judgments under conditions where they do not recognize the faces as showing fear or anger. It also explored whether the same attributions would be made for stimulus persons of different races who show anger and fear expressions.

STUDY 1

Method

Participants. Thirty college students were recruited via e-mail and via posted advertisements on a college campus and were paid for their participation. Sixteen of the participants were women and 14 were men.

Stimuli. The experimental stimuli were black-and-white photographs of 10 male and 10 female Caucasian adults posing both anger and fear expressions (40 expressions total). These expressions were drawn from sets previously validated to ensure that the expressions were recognizable (Beaupré, Cheung, & Hess, 2000; Ekman & Friesen, 1976). Two stimulus sets of the facial expressions were created so that no participant would rate any stimulus individual's face twice. In each set were photographs of 10 men and 10 women, and half of the individuals of each sex were posing anger expressions while the other half posed fear expressions. Five photographs of adults posing sad expressions also were included in each set to reduce the likelihood that participants would discern that the study aimed to identify dif-

ferences in the appearances of fear and anger expressions in particular. Four different random orders were created for each of the two sets of stimuli, resulting in a total of eight stimulus sets, each with a different stimulus sequence. Each stimulus photograph was printed on standard typing paper at a size of approximately 3" × 4".

Procedure. Participants came to a large laboratory room in small groups (two to six people) and were seated at individual tables. They were randomly assigned to one of the eight stimulus sequences and were given a questionnaire. Participants were asked to read the instructions on the first page of the questionnaire. The instructions informed the participants that they would be rating the individuals whose faces they saw in their packet on a number of personality traits. The ratings were made on 7-point scales anchored with bipolar adjectives. Five trait pairs were chosen to assess trait attributions made to those expressing anger and fear (babyish/mature, dominant/submissive, strong/weak, warm/cold, kind/unkind) and six trait pairs were selected to assess the appearance of the features of the face (large eyes/small eyes, high eyebrows/low eyebrows, prominent brow ridge/flat brow ridge—the brow ridge was the only characteristic explicitly defined and was described as “the bony ridge underlying and between the eyebrows”—large jaw/small jaw, full lips/thin lips, and rounded features/angular features). Across participants, the scales in the questionnaire were presented in two different orders and participants rated all stimuli on one bipolar dimension before proceeding to the next. When they had completed their ratings they were asked to report their gender, race, and age. A brief explanation of the goals of the research was provided, any questions they had were answered, and they were paid and thanked for their participation.

Results

The data were first analyzed using the participant as the unit of analysis to test for any effects of perceiver sex. For each participant, means were created of the ratings of anger and fear faces on each of the 11 variables (22 scores for each participant). Next, we reverse-coded four of the variables such that for all variables, a higher score would indicate a rating expected to be associated with greater maturity (e.g., lower brows, more dominant). A 2 (expression) × 2 (sex of perceiver) MANOVA with repeated measures was performed on these means. There were no significant main effects or interactions for the sex of perceiver variable (all p s > .10). There was a significant main effect for emotion, $F(1, 28) = 372.09$, $p < .001$, indicating that perceivers rated the two emotional expressions differently across the trait ratings as a group.

TABLE 1: Ratings for Anger and Fear Expressions in Three Studies

	Trait Ratings	Anger		Fear		F	r
		M	SD	M	SD		
Study 1 (Pure expressions)	Babyish	3.39	0.76	4.15	0.80	39.05***	0.76
	Flat brow ridge	3.32	0.71	4.58	0.77	46.02***	0.78
	Full lips	2.80	0.73	4.11	0.51	79.81***	0.86
	High brows	2.68	0.61	5.05	0.64	195.27***	0.93
	Kind	2.75	0.69	4.56	0.61	148.08***	0.91
	Large eyes	4.21	0.50	5.13	0.65	50.91***	0.80
	Rounded	4.31	0.56	4.70	0.38	14.56***	0.58
	Small jaw	3.56	0.50	3.46	0.68	0.49*	0.13
	Submissive	2.61	0.59	4.99	0.47	265.10***	0.95
	Warm	2.43	0.62	4.09	0.80	140.78***	0.91
Study 2 (Pure expressions)	Weak	2.81	0.71	5.03	0.80	129.73***	0.90
	Dependent	3.04	0.92	4.91	0.91	13.96***	0.61
	Feminine	2.78	0.71	4.20	0.77	39.36***	0.79
	Honest	3.03	0.96	4.89	0.75	45.34***	0.81
Study 3 (Pure expressions)	Naïve	2.84	0.93	5.57	0.77	86.88***	0.89
	Dependent	3.63	1.11	5.14	0.95	56.45***	0.69
	Feminine	3.24	0.76	4.40	0.79	72.72***	0.74
	Honest	4.14	1.02	4.66	1.00	11.19***	0.39
Study 3 (Composite expressions)	Naïve	3.32	0.99	5.21	0.89	122.18***	0.82
	Youthful	4.28	1.05	4.59	0.94	4.06*	0.25
	Dependent	3.11	0.91	4.20	0.90	49.23***	0.67
	Feminine	3.13	0.51	4.41	0.57	148.38***	0.84
Study 3 (Composite expressions)	Honest	3.32	1.06	4.44	0.94	49.81***	0.67
	Naïve	2.97	0.83	4.88	0.80	181.20***	0.86
	Youthful	3.23	0.75	4.78	0.87	121.46***	0.82

NOTE: Mean ratings, standard deviations, and *F* scores for pure and composite anger and fear expressions in Studies 1, 2, and 3.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Paired-sample *t* tests for each of the trait ratings were then performed to determine which of the traits could be used to distinguish between anger and fear expressions. The results of a Bonferroni test indicated that each *t* test needed to exceed a significance level of $p < .005$ to counteract the fact that 11 *t* tests were calculated. The difference between scores for fear and anger expressions met this test for all of the traits except small jaw/large jaw (see Table 1 for the relevant statistical values). Thus, fear expressions, relative to anger expressions, were judged to appear significantly more babyish, round, warm, kind, submissive, and weak and to possess higher brows, flatter brow ridges, larger eyes, and fuller mouths.

Our next analyses used the facial expressions as the units of analysis. With these analyses, we wished to test the extent to which ratings of babyishness and dominance were independent, or whether ratings of dominance mediated ratings of babyishness. Because every stimulus individual provided both a fear and an anger expression, for each stimulus person we calculated the average rating made by all participants of the fear and anger expression on these two traits. For one variable to be said to mediate another, several conditions must be met. First, both variables must vary significantly across

conditions (Judd, Kenny, & McClelland, 2001). This condition was met here, as anger and fear expressions were judged significantly differently in terms of how dominant, $t(19) = 14.04$, $p < .001$, and how babyish, $t(19) = 3.87$, $p < .001$, they appeared. Second, covarying out the effects of the proposed mediator must eliminate the effect of the mediated variable across conditions. In this case, covarying out the ratings of dominance across fear and anger expressions should eliminate the effects of babyishness if dominance indeed mediates the effects of babyishness. To test this possibility, a MANOVA with repeated measures (anger expressions, fear expressions) was performed on ratings of facial maturity, using ratings of dominance as a covariate. Although ratings of dominance were significantly correlated with ratings of maturity as calculated by the regression, $F(1, 18) = 16.29$, $p < .001$, the effects of maturity remained significant after accounting for the effects due to dominance, $F(1, 18) = 5.36$, $p < .05$. This corroborates a related analysis performed by Montepare and Dobish (2002) that found dominance and maturity to be independent constructs.

Discussion

The appearance of a face reconfigured by a fear expression differs from the appearance of a face reconfig-

ured by anger in specific ways. Angry faces appear to have lower brows, more prominent brow ridges, smaller eyes, and thinner lips than do fearful faces. Angry faces also appear more generally angular than fearful faces. All of these are also characteristic of faces that look physically more mature as compared to those that look babyish (see Zebrowitz, 1997). Accordingly, like physically mature faces, angry faces are rated to appear more mature and more dominant than fearful faces.

What might the relationship be between facial maturity and dominance? The hallmark features of the anger expression, for instance, are narrowed eyes, lowered brows, a compressed mouth, and a jutted jaw. There is nothing *intrinsically* dominant about any of these features—low brows are not directly related to muscular strength or social dominance, for example. Rather, these features all contribute to a perception of dominance because they are characteristic of a physically mature human as compared to a physically immature one. Mature humans have lower brows and smaller appearing eyes than immature ones; thus, these features have come to be associated with various attributes of maturity, such as social dominance. Of importance, this relationship could not logically be inverted—faces could not look babyish and mature because they look, respectively, dominant and subordinate. This is because the appearances of dominance and submissiveness are not inherent to facial features. Instead, they are emergent properties that arise because of the appearance of the features. Babyishness and maturity, on the other hand, are properties of features, features from which attributions of dominance and submissiveness may emerge.

We next wished to test in Study 2 whether facial expressions of fear and anger would elicit dispositional attributions similar to those elicited by people with physically babyish and mature faces. In particular, we wanted to see if perceived age varies as a function of facial expression. In addition, we wished to test trait ratings that are essentially unrelated to the emotions of anger and fear. The traits tested in Study 1, such as dominant, strong, and kind, all pertain to the emotions anger and fear, which means that the ratings could be derived from knowledge about what an angry or fearful person is like rather than strictly from changes in the appearance of the features.

STUDY 2

Method

Participants. Twenty-nine young adults of both sexes were recruited in a college dining facility. Four participants with missing data were removed from the data matrix before any analyses were computed. No personal

information concerning the participants was collected and participants were not compensated for their participation.

Stimuli. Ten pairs of black-and-white photographs were digitized and printed on standard typing paper, one pair per page. The photographs showed the faces of five male and five female adults posing different expressions of emotion and each photograph was approximately 3" wide and 4" high. The stimuli were selected from a larger validated set, developed by Kirouac and Doré (1982). The two photographs comprising each pair showed the same person posing two different expressions. For each sex, there were two pairs containing both an angry and a fearful expression and three pairs that depicted expressions other than fear and anger, included to prevent participants from guessing the study hypothesis.

Procedure. Each volunteer was seated at a table and was given a binder containing one of three different random orders of the stimuli as well as a sheet on which to record their ratings. Written instructions asked them to rate both photographs in each stimulus pair on four 7-point scales. The four scales were anchored by the bipolar adjectives independent/dependent, shrewd/naïve, deceitful/honest, and feminine/masculine. These traits were selected for two reasons. Babyish faces are consistently rated to appear more dependent, feminine, honest, naïve, and youthful than are mature faces. However, to our knowledge, there is no evidence that links any of these traits to the emotions of anger or fear. Thus, we could use these traits to assess the extent to which the fear and anger expressions physically appeared babyish or mature.

Participants were asked to rate Photograph A and Photograph B in each pair separately but along the same scale. They were instructed to not give both photographs in a pair the same numeric rating on any trait. After the trait ratings had been made for all stimuli, each participant was asked to go back through the set and decide, for each pair, which of the two pictures made the person appear younger.

Results

The central question was whether perceivers would appraise the anger and fear expressions on the four trait measures in a manner similar to that earlier found for baby-faced and mature-faced adult stimuli. Because the design involved only two exemplars of male and female stimulus persons, exemplar was included as a factor in the analysis. A 2 (sex of stimulus person) \times 2 (emotion) \times 2 (exemplars) with repeated measures (four traits) MANOVA was performed on the ratings for the four stimulus pairs. There was no main effect for exemplar,

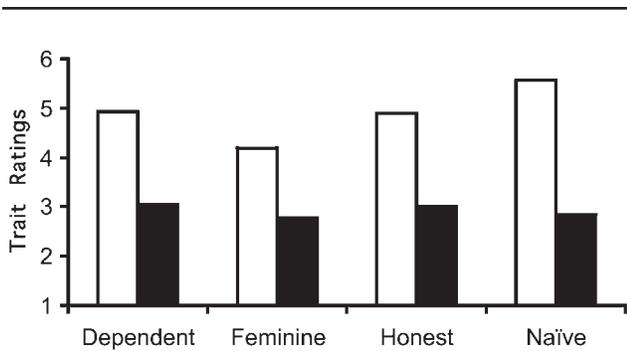


Figure 1 Mean ratings of fear and anger expressions on the four traits associated with babyishness (higher ratings) in Study 2.

NOTE: Black bars represent ratings of anger expressions; white bars represent ratings of fear expressions.

although the three-way interaction between exemplar, emotion, and sex of stimulus did reach significance, $F(1, 21) = 3.37, p = .03$. An examination of the means for this effect revealed that one of the two female stimulus persons was rated consistently higher than the other female stimulus on all four traits for the anger expressions but not for the fear expressions. Conversely, one of the male stimulus persons was rated consistently higher than the other male on the fear expressions but not on the angry ones. This interaction does not qualify the other effects to be discussed here and will not be pursued further.

A significant main effect for emotion was present, $F(4, 21) = 26.68, p < .001$. Univariate analyses for the four trait ratings indicated that when persons displayed fear expressions they were judged to appear more dependent, $F(1, 24) = 13.96, p < .001$, more naïve, $F(1, 24) = 86.88, p < .001$, more honest, $F(1, 24) = 45.34, p < .001$, and more feminine, $F(1, 24) = 39.36, p < .001$, than when they displayed anger (see Figure 1).

Sex of stimulus person also generated a significant main effect, $F(4, 21) = 14.06, p < .001$. Univariate tests on the four traits revealed significant effects for the ratings on dependent/independent, $F(1, 24) = 4.67, p = .04$, and on masculine/feminine, $F(1, 24) = 41.42, p < .001$. As might be expected, female stimulus persons were consistently rated to appear more feminine and less independent than were male stimulus persons. The sex of stimulus person and emotion factors also significantly interacted, $F(4, 21) = 11.28, p < .001$. This interaction was driven by a significant effect on the dependent/independent trait scale, $F(1, 24) = 36.68, p < .001$. Although both male and female stimulus persons were rated as more independent when showing anger than when showing fear, this effect was much larger for the male stimuli than for the female stimuli. The three other univariate comparisons did not approach significance.

After they had made the trait ratings, participants were asked to indicate, for each stimulus pair, in which photograph the person “appeared to be younger.” The 25 participants thus made a total of 100 such forced choices between the anger and fear photographs. Of these, 21 choices favored anger and 79 fear. Across the four stimulus persons, the percentage identifying the photograph showing the fear expression as younger in appearance ranged from a low of 62% to a high of 91%.

Discussion

The fear expressions used in this study elicited trait attributions associated with babyish faces, whereas the anger expressions elicited attributions associated with mature faces. Furthermore, stimulus persons were consistently judged to look younger when they displayed fear expressions as compared to anger expressions. The words “young” and “babyish” are not synonymous but a primary hallmark of babyish-looking people is that they are judged to appear younger than mature-faced people. We would like to argue, on the basis of these data, that the appearance of the fear expression may result in behavioral responses from others of a nurturing and protecting sort, much as the morphological features associated with babyishness have been demonstrated to do. Conversely, the anger expression may elicit trait attributions that parallel those made to morphologically mature-looking faces.

There are, however, alternative explanations of these results. It may be, for example, that the perceivers’ judgments were based not on the physical appearances of the facial expressions but on the knowledge that the expressors appeared to feel fearful or angry. Alternately, perhaps children display fear more than adults, and adults display anger more than children. If this were the case, perceivers might associate a fear expression with youthful attributes and an anger expression with more mature attributes. The limited available evidence does not strongly support this possibility. From a developmental perspective, it appears that anger and fear expressions appear contemporaneously in the infant (see Izard, 1994, for a review). Furthermore, the anger expression has actually been found in some studies to be the most commonly seen of all negative expressions in young children (Camras et al., 1991). Among adults, there do not seem to be disparities in the expression of anger and fear that could explain the results, either. Rather, it appears that older adults experience and express a range of emotions, including anger and fear, less than do younger adults (Gross et al., 1997).

Another plausible explanation involves gender stereotypes. North American women are traditionally considered to feel and to express more of all manner of emotions than men, but particularly emotions indicating

affiliation or powerlessness. Men, on the other hand, are expected to display emotions more consistent with social dominance, such as anger (Timmers, Fischer, & Manstead, 1998). If this were the case, stereotypically feminine traits might be attributed to people displaying fear, and more stereotypically masculine traits to persons displaying anger. It should be noted, however, that in Study 2, the different trait attributions made to our stimulus persons as a function of whether they were displaying anger or fear were consistent for both male and female stimuli.

The primary goal of Study 3 was to extend the findings of Study 2 employing stimuli that were unlikely to be perceived as expressions of anger and fear even though they included important components of these expressions. We also wished to determine whether the effect would generalize to stimulus persons of Asian background. There is reason to expect that this will be the case, because Zebrowitz and her colleagues (Zebrowitz et al., 1993) have demonstrated that babyish morphology elicits the same sorts of trait attributions with Korean stimuli as with Caucasian stimuli.

STUDY 3

Method

Participants. Sixty-five male and female college students participated in the study. Twenty-three were recruited at various locations on a college campus and were paid \$5 for completing the dependent measures; another 42 participants received partial course credit. Gender information was not available for the former but of those who participated for course credit 17 were men and 25 were women.

Stimuli. Photographs of 16 male and 16 female adult individuals served as the stimuli. For each stimulus person, the two 4" × 3" photographs showing a neutral expression and an emotional expression were printed on separate sheets of white typing paper. For three men and three women, the expressions used were sadness, happiness, or contempt. These six stimuli served as fillers and were included in both stimulus sets described below. The expression photographs for 16 of the individuals (8 women, 8 men) were either of anger or of fear. Of this group, 4 male and 4 female stimulus persons were of obvious Asian descent and 4 men and 4 women were Caucasian. These photographs were taken from the JACFEE set (Matsumoto & Ekman, 1988).

Composite stimuli. For an additional 10 stimulus persons (5 men, 5 women), composite expressions were created. The composites were constructed starting with the happiness expressions for each stimulus person. The eye regions (including the brows and nose bridge) of happi-

ness expressions were then replaced with the eye regions from the anger and fear expressions, respectively. Thus, for each individual, one composite was created using a happiness expression on which fear eyes were superimposed, and one composite was created using a happiness expression on which anger eyes were superimposed. These modifications were accomplished with Adobe Photoshop, which also permitted the removal of any lines or shadows that might cue the perceiver to the fact that these were composites. No stimulus person appeared more than once in each set. Thus, if one set contained a particular stimulus individual's fear expression, the other set would contain that individual's anger expression. Because each participant rated only one set, no participant rated any given stimulus individual more than once. Within each of the two sets, the photographs were assembled into four different random orders and placed in three-ring binders. Each stimulus person's neutral photograph always appeared immediately ahead of his or her expressive photograph.

Procedure. Participants came to a large laboratory room in small groups (two to six people) and were seated at individual tables. They were randomly assigned to one of the eight stimulus sets and were asked to read the instructions. They were told that if they understood the instructions they could proceed with the task; otherwise, they were to privately ask the experimenter for clarification (no participant did so).

The instructions informed the participants that they would be rating individuals on a number of personality traits. For each rating, they would see two photographs of the person, a "neutral" photograph followed by an "expressive" one. They were instructed to examine the neutral photograph before turning to the expressive photograph but to base their trait ratings only on the latter. The convention of showing participants a person's neutral expression first was used to loosely approximate a social interaction, in which one does not see a person making only one static expression but more typically sees an emotion-related display after having seen a person's face without such a display. The ratings were made on 7-point scales anchored with bipolar adjective pairs: dependent/independent, masculine/feminine, shrewd/naive, honest/deceitful, and youthful/mature. Across participants, these scales were presented in four different orders and participants rated all expressive photographs on one bipolar dimension before proceeding to the next. When they had completed their ratings they were asked, as a manipulation check, to indicate which of the photographs in the set they had rated (i.e., the neutral, the expressive, or some neutral and some expressive). A brief explanation of the goals of the research was provided, any questions they

had were answered, and they were thanked for their participation.

Results

Each individual participant examined and rated 24 faces, 18 of which were experimental stimuli. As noted above, the questionnaire was designed so that participants rated all faces on one dimension (e.g., dependent/independent) before moving on to the next dimension. Also, participants did not examine faces in pairs and assess them relative to one another, as in Study 2. Rather, each expression of a pure emotion or composite expression was rated individually.

*Composite stimuli.*¹ A MANOVA with repeated measures was first run on the ratings for the composite stimuli using the data from only the 42 participants for whom we had gender information. For each of the 10 stimulus persons an average rating on each of the bipolar trait dimensions was first calculated. These scores were entered into a 2 (sex of stimulus person) \times 2 (emotion: fear, anger) \times 2 (sex of perceiver) analysis. There were no main effects or interactions for sex of perceiver. The analysis was therefore repeated, but this time the total sample of 62 participants was used.

A 2 (sex of stimulus person) \times 2 (emotion: fear, anger) MANOVA with repeated measures was run on the ratings averaged across the five exemplars for each experimental condition (e.g., there were five different women with composite anger expressions). The analysis revealed significant main effects for both sex of stimulus person, $F(5, 57) = 40.06, p < .001$, and emotion, $F(5, 57) = 46.67, p < .001$.

Univariate comparisons for each of the trait dimensions within the emotion main effect revealed a pattern consistent with our hypotheses and with the previous findings. Composites involving fear eye regions were rated as more dependent, $F(1, 61) = 49.23, p < .001$, honest, $F(1, 61) = 49.81, p < .001$, feminine, $F(1, 61) = 148.38, p < .001$, youthful, $F(1, 61) = 121.46, p < .001$, and naïve, $F(1, 61) = 181.2, p < .001$, than were composites involving anger eye regions (see Figure 2).

Univariate comparisons for each of the trait scales within the sex of stimulus main effect revealed that male stimulus persons, compared to women, were seen as more independent, $F(1, 61) = 54.68, p < .001$, more deceitful, $F(1, 61) = 11.72, p < .001$, more masculine, $F(1, 61) = 161.31, p < .001$, and more shrewd, $F(1, 61) = 11.78, p < .001$. There was no difference in the average ratings given to male and female stimuli on the maturity dimension, $F(1, 61) = 0.11, ns$. Of importance, the analysis did not reveal any interactions between sex of stimulus person and emotion. In short, although men were consistently rated higher on the dimensions of independence,

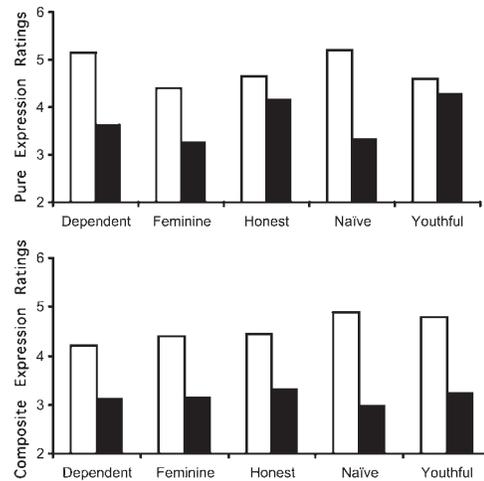


Figure 2 The top graph displays the mean ratings of the pure expressions from Study 3 on the five traits associated with babyishness (higher ratings); the bottom graph displays the same ratings, but for composite expressions of anger/happiness and fear/happiness.

NOTE: White bars represent ratings of fear and black bars represent anger expressions.

masculinity, deceitfulness, and shrewdness, the effects of fear and anger eye regions on the ratings of men and women were remarkably parallel.

Our next analyses used the facial expressions themselves as the units of analysis. These analyses were performed to test potential explanations for the differences in the various trait ratings across anger and fear expressions. With the first analyses, we wished to test the extent to which ratings of maturity could account for ratings on the other four dimensions. Given that the apparent maturity differences are assumed to drive the ratings of anger and fear expressions for the other trait ratings, covarying maturity out of these ratings should eliminate these effects. Again, for one variable to be said to mediate another, both variables must first vary significantly across conditions (Judd et al., 2001). Thus, for each stimulus person, we calculated the average rating made by all participants of the fear and anger expression on maturity and on the remaining four traits. The results showed that anger and fear expressions were judged significantly different in terms of how mature, $t(9) = 9.54, p < .001, r = .95$, deceitful, $t(9) = 5.33, p < .001, r = .87$, independent, $t(9) = 6.53, p < .001, r = .91$, masculine, $t(9) = 7.91, p < .001, r = .94$, and shrewd, $t(9) = 11.92, p < .001, r = .97$, they appeared.

Second, covarying out the effects of the proposed mediator must eliminate the effect of the mediated variable across conditions. In this case, covarying out the ratings of maturity across fear and anger expressions should eliminate the effects of masculinity, indepen-

dence, deceitfulness, and shrewdness if maturity mediates these ratings. To test this possibility, a series of MANOVAs with repeated measures (anger expressions, fear expressions) was performed on ratings of deceitfulness, independence, masculinity, and shrewdness using ratings of maturity as a covariate in each. The maturity covariate eliminated the effects of deceitfulness, $F(1, 8) = 0.50$, ns , $r = .17$, independence, $F(1, 8) = 1.15$, ns , $r = .38$, and masculinity, $F(1, 8) = 2.19$, ns , $r = .61$. The effects of shrewdness, however, remained significant, $F(1, 8) = 7.81$, $p < .05$, $r = .94$, after accounting for facial maturity.

Next, we conducted an analysis to assess whether the perceived masculinity of the faces could be responsible for the differences in rated maturity across anger and fear expressions. One could conceive of the possibility that associations between anger and maleness and between fear and femaleness were driving the trait ratings found in the previous studies. If this were the case, covarying out ratings of masculinity across fear and anger expressions would be expected to eliminate the effects of maturity. Thus, we performed a MANOVA with repeated measures (anger expressions, fear expressions) on ratings of facial maturity using ratings of masculinity as a covariate. The results showed that even after accounting for ratings of masculinity, anger expressions remain more mature looking than fear expressions, $F(1, 8) = 6.32$, $p < .05$, $r = .91$.

Pure emotion expressions. A 2 (sex of stimulus person) \times 2 (emotion: fear expressions, anger expressions) \times 2 (race: Asian, Caucasian) MANOVA with repeated measures was run on the ratings of the pure expressions of anger and fear. In these analyses, ratings were averaged across the two stimulus exemplars for each experimental condition. There were significant main effects for sex of stimulus person, $F(5, 57) = 28.89$, $p < .001$, and for emotion, $F(5, 57) = 30.86$, $p < .001$, but not for race of stimulus person, $F(5, 57) = 1.46$, ns . Univariate tests for the five trait dimension ratings within the emotion main effect revealed that fear expressions, compared to anger expressions, were rated as significantly more dependent, $F(1, 61) = 56.45$, $p < .001$, honest, $F(1, 61) = 11.19$, $p = .001$, feminine, $F(1, 61) = 72.72$, $p < .001$, youthful, $F(1, 61) = 4.06$, $p = .05$, and naïve, $F(1, 61) = 122.18$, $p < .001$. These results parallel the findings for the ratings of the composite anger/happiness and fear/happiness expressions and in Study 2.

Univariate tests for the five trait dimensions within the sex of stimulus person main effect revealed that male stimulus persons were rated to appear significantly more deceitful, $F(1, 61) = 5.41$, $p = 0.02$, $r = 0.29$, masculine, $F(1, 61) = 105.39$, $p < .001$, $r = 0.80$, and mature, $F(1, 61) = 30.18$, $p < .001$, $r = 0.58$. Comparisons across male and female stimuli on the independent and shrewd dimen-

sions did not reach significance. Finally, there was a significant interaction between the sex of stimulus person and emotion factors, $F(5, 57) = 4.81$, $p = .001$. Univariate tests on the five trait dimensions revealed that only in the case of ratings on the independent dimension was there a significant difference, $F(1, 61) = 10.9$, $p < .002$, $r = 0.39$. An inspection of the means involved in this interaction suggests that it is primarily a function of female anger and fear stimuli being differentiated on the independent trait dimension to a greater degree than are the same expressions for men.

Discussion

The results of Study 3 extended the findings of Study 2 to stimulus persons of Asian descent and to fear/happiness and anger/happiness composite expressions that participants failed to identify as corresponding to the emotions fear or anger (see Note 1). People shown expressing fear, or eye region components of fear expressions, were consistently judged to appear more dependent, naïve, feminine, honest, and youthful than were people expressing anger. People shown expressing anger, or components of the anger expression, were perceived to appear more independent, shrewd, masculine, dishonest, and mature. These two sets of traits have consistently corresponded to a particular construct: the degree that an individual looks physiognomically babyish or mature. Of importance, this suggests that it is not merely the fact that a person is angry that makes the person appear mature, or the fact that a person is fearful that makes the person appear babyish. Rather, something about the way the anger expression changes the facial features may make the face appear more mature, and the same may be true for fear expressions and babyishness.

The results of the analyses of covariance described above suggest that the changes in facial appearance of a person expressing anger or fear do not result only from changes in the apparent masculinity of the face. Even when controlling for apparent masculinity, angry expressions were judged to appear more mature than fear expressions. Ratings of facial maturity did, however, seem to account for variation in ratings of masculinity, independence, and deceitfulness. Controlling for ratings of maturity did not account for ratings of shrewdness, however. This may be because the lowered brows of the angry expression suggest apparent thought or concentration in addition to changing a face's apparent maturity.

GENERAL DISCUSSION

In the three studies presented here, people expressing anger were judged to have traits associated with

maturity, such as independence, strength, dominance, masculinity, coldness, and shrewdness, whereas people expressing fear were judged to have traits associated with babyishness, such as dependence, weakness, submissiveness, femininity, warmth, and naïveté. The results were consistent whether tested between subjects (Studies 1 and 3) or within subjects (Study 2). Furthermore, the effects were robust. For example, for the pure emotions in Study 3, the ratings of how masculine the stimulus persons appeared to be were affected to the same degree by their emotional expressions and by their *actual* sex, as can be seen by comparing the relevant effect sizes. These clusters of trait ratings are argued to be due in part to the specific appearances the anger and fear expressions take. For one, the appearance of the brows, brow ridge, eyes, and mouth in those expressing anger and fear are judged to resemble the features of morphologically mature and babyish-looking individuals, respectively. For another, eliminating perceivers' ability to discern the emotions associated with anger and fear expressions does not eliminate the extent to which mature and babyish traits are associated with the two expressions.

That facial expressions of emotion can influence personality trait ratings is of course not a novel finding. Here, trait ratings are used as a means to an end, as indices of the construct of interest. This construct is not a test of simply whether the anger expression is perceived as dominant because anger is a dominant emotion and whether the fear expression is perceived as submissive because fear is a submissive emotion. Both statements are likely true (e.g., Algoe et al., 2000; Knutson, 1996; Tiedens, Ellsworth, & Mesquita, 2000). However, both fail to explain why the expressions take the specific forms that they do. Our hypothesis is that because fear is a submissive emotion, it would be logical for a naturally submissive-appearing (babyish) facial expression to have evolved to accompany it. Conversely, because anger is a dominant emotion, it would be logical for a naturally dominant-appearing (mature-looking) facial expression to have evolved to accompany it.

This hypothesis presents at least one potential problem, however: It may be that the attributions participants made referred to the emotions being expressed rather than to the appearance of the expressions. It could be argued that even though participants were not overtly able to label the composite stimuli in Study 3 as anger or fear they were nevertheless processing them as displays of these emotions at some level. This possibility leads to at least two major alternate hypotheses: (a) The emotion of fear is associated with children or babyish-looking individuals, whereas anger is associated with adults or mature-looking individuals; and/or (b) gender stereotypes related to the emotions anger and fear drive the attributions. Each possibility is discussed below.

The emotion fear is associated with children or babyish-looking individuals, whereas anger is associated with adults or mature-looking individuals. As noted earlier, there is little evidence to support the association of the emotions fear and anger with, respectively, youthful or mature individuals. Infants and children do not appear to show either fear or anger predominantly but rather to express a range of emotions more intensely than do adults (Gross et al., 1997; see Izard, 1994, for a review). Furthermore, as noted in the Introduction, there is no evidence to suggest that persons with facial morphology consistent with "babyishness" are any more likely to express fear than are individuals with mature facial appearance. Indeed, young male adolescents who are babyish-faced are more assertive and aggressive than are more facially mature men (see Zebrowitz, 1997).

Gender stereotypes related to the emotions anger and fear drive the attributions. Stereotypes about male and female personality traits are consistent with some of the ratings made by participants. If it is assumed that because fear is a more "feminine" emotion those expressing fear have more feminine traits, it would explain why pure fear expressions were rated to appear more feminine, honest, and youthful in Study 2. However, men and women were rated no differently on the shrewdness and independence scales in this study. In Study 3, there were no sex differences for perceived youthfulness. If gender stereotypes were solely responsible for the patterns of attributions, the ratings of actual men and women on the various traits should have been at least as robust, if not more robust, than the trait ratings to the facial expressions. In addition, covarying ratings of masculinity from ratings of maturity did not eliminate the effects of expression on perceived maturity in Study 3. Thus, although gender stereotypes may have contributed to participants' ratings, another factor must have been responsible as well.

Again, the thrust of our argument focuses on the social communication function of both facial appearance and expression. That is, widened eyes and raised brows look babyish whether as a result of morphology or expression, and so individuals who adopt a more babyish appearance when being threatened might be more successful in avoiding harm than those who do not. Similarly, individuals who adopt a physically mature appearance when threatening others might be more successful in asserting dominance than those who do not. Various past studies have shown that babyish and mature trait ratings have numerous real-world corollaries (Berry & Brownlow, 1989; Zebrowitz et al., 1991). Nonhuman primate perceivers preferentially protect and nurture babyish-looking individuals and cede to dominant or mature-looking individuals as well, supporting the

hypothesis that these tendencies may be inborn (see Zebrowitz, 1997). The results of the present study suggest that there may be more than one means for a person to acquire a babyish or mature appearance.

As is generally the case when positing evolutionary explanations for phenomena, it must be cautioned that the causes of the phenomena in question must always remain open to speculation. One cannot carbon-date facial expressions, or unearth them from layers of sediment, and so any discussions of the timelines and causes surrounding their origins must be approached with some caution. In particular, the origins of the specific appearances of fear and anger expressions may have no single cause. The resemblance of anger and fear facial expressions to mature and babyish facial appearances could be merely coincidental, and perceivers could simply have developed the tendency to recognize these signals and respond to them in particular ways over time.

Only anger and fear expressions were specifically addressed in the present studies because they are antagonistic in the same sense that morphological babyish faces and mature faces are. One could speculate, however, that the surprise expression shares gestures with the fear expression (C. A. Smith & Scott, 1997) as does the sadness expression, and that the situations in which these expressions arise are also related to situations that evoke fear. Apparent babyishness could perhaps relate to the appearance of either of these two expressions. However, any single explanation for why facial expressions take the forms they do probably will not cover all cases. As with any complex behavior, facial displays are likely to be multiply determined. Evidence suggests that different mechanisms are responsible for processing different facial expressions (e.g., Blair & Curran, 1999; Calder, Keane, Manes, Antoun, & Young, 2000). The present hypothesis may be mostly relevant to expressions pertaining to dominance relationships, which could include happiness, sadness, and possibly surprise.

Conclusions

The prototypical appearance of human babies' faces share features (like large eyes, round faces, and high foreheads) with those of the babies of our closest nonhuman primate relatives (Zebrowitz, 1997). This suggests that these appearance characteristics served sufficiently important social functions for evolution to have conserved them across the development of several species of primates. But only humans later evolved highly differentiated facial muscles that enabled more complex social communication via expressions. Certain babyish-looking expressions may have come to be displayed by our species in situations in which it was more adaptive to receive the same nurturing, nonaggressive treatment given babies, whereas more mature-looking facial con-

figurations may have come to be expressed in situations in which being treated as dominant and mature was more functional. These particular expressions then would be considered *exaptations*, that is, they "piggyback" on human perceivers' already inherent responses to babyish and mature facial appearances. For expressors to obtain desired social consequences would require the presence of perceivers already attuned to the relevant cues and prepared to respond to them quickly and reliably (Craig, 1921/1922; Fridlund, 1997). The ensuing rapid, reliable responses of perceivers to fear and anger expressions may have ensured that evolution would conserve these adaptive forms of social communication as well.

NOTE

1. A pilot study ($N = 35$) was run using the composite photographs to determine whether the participants would perceive them to be expressions of anger and fear. Only 9% of responses correctly identified the composites using a free-response format, in which all potential synonyms of fear (e.g., scared, afraid, terrified, frightened, and alarmed) and anger (e.g., pissed off, irritated, yelling at his kids, and snarl) were considered "correct." More common were incorrect responses such as "confused" or "puzzled." The data of respondents who did *not* identify the composites' emotions were analyzed and the patterns of their trait attributions for the faces exactly matched those found in Study 3.

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