Journal of Personality and Social Psychology
2007, Vol. 92, No. 2, 179–190

0022-3514/07/$12.00 DOI: 10.1037/0022-3514.92.2.179

The Confounded Nature of Angry Men and Happy Women

D. Vaughn Becker
Arizona State University at the Polytechnic Campus

Douglas T. Kenrick, Steven L. Neuberg, and K. C. Blackwell
Arizona State University

Dylan M. Smith
Veterans Affairs Ann Arbor Healthcare System and University of Michigan

Findings of 7 studies suggested that decisions about the sex of a face and the emotional expressions of anger or happiness are not independent: Participants were faster and more accurate at detecting angry expressions on male faces and at detecting happy expressions on female faces. These findings were robust across different stimulus sets and judgment tasks and indicated bottom-up perceptual processes rather than just top-down conceptually driven ones. Results from additional studies in which neutrally expressive faces were used suggested that the connections between masculine features and angry expressions and between feminine features and happy expressions might be a property of the sexual dimorphism of the face itself and not merely a result of gender stereotypes biasing the perception.

Keywords: face perception, sex differences, anger, emotional expressions, ecological psychology

Close your eyes for a moment, and imagine an angry face. In fact, try to conjure up the prototypical angry face. Is the face that of a man or a woman? Does your answer arise from random chance, or is it the answer that many would give? To what extent is your answer determined by your cultural expectations about masculinity and femininity, on the one hand, and by the characteristic features of the male and female faces themselves, on the other?

The evolutionary analysis of emotional expression dates back to Darwin (1872) and James (1890). Both authors postulated that the function of basic expressions involved communicating information relevant to the expresser's (and sometimes to the recipient's) well-being and reproductive fitness. Neither spent a great deal of effort discussing sex differences in the display of emotion; indeed, their emphases were on the universality of these expressions. Since that time, however, many researchers have investigated differences in the extent to which the sexes make, or are believed to make, different expressions (e.g., Fabes & Martin, 1991; Grossman & Wood, 1993; Plant, Hyde, Keltner, & Devine, 2000).

In the research reported here, we present a series of studies examining the extent to which decisions about the sex of a face and decisions about the emotional expressions of anger and happiness are not entirely independent of each other. More specifically, this research explores the possibility that anger is easier to identify on a man's face and happiness is easier to identify on a woman's. This pattern of effects could arise from a decision bias acquired through social learning or media portrayals of men and women. An ecological approach to social perception, on the other hand, suggests that such a bias might emerge early in the stream of visual processing from fundamental properties of the human face itself.

Ecological Perspectives on Face Perception

Gibson's (1979; Reed, 1996) ecological approach to psychology began with the recognition that perception and action systems are directly coupled to one another, either through individual experience or, more generally, through natural selection. From this perspective, social perception exists for social action and has been designed to direct our behaviors toward others in adaptive ways—to help us know whether it would be beneficial to approach or to avoid them, to choose them as friends or to ask them for a date (McArthur & Baron, 1983). Gibson further suggested that perceptible attributes, or *affordances*, differ for perceivers as a function of their particular needs and abilities. For example, a long stick may afford a supportive crutch for someone with an injured leg, a tool for shaking an apple from a tree for a hungry person, and a protective weapon for someone threatened by a snarling dog. An affordance is thus not only a function of the raw qualities of things

D. Vaughn Becker, Applied Psychology Program, Arizona State University at the Polytechnic Campus; Douglas T. Kenrick, Steven L. Neuberg, and K. C. Blackwell, Department of Psychology, Arizona State University; Dylan M. Smith, Center for Practice Management and Outcomes Research, Health Services Research and Development Service, Veterans Affairs Ann Arbor Healthcare System, and Department of Internal Medicine, University of Michigan.

This research was supported by National Institute of Mental Health Grant 5R01MH64734 awarded to Douglas T. Kenrick and Steven L. Neuberg. Dylan M. Smith is supported by a Career Development Award from the Department of Veterans Affairs. We thank Don Homa, Steve Goldinger, Peter Killeen, Jon Maner, Josh Ackerman, and Craig Nagoshi for their helpful feedback on earlier versions of this article and J. Michael Plavcan for his direction in thinking about sexual dimorphism in primates. We also thank Dacher Keltner and James Cutting for thought-provoking comments and criticisms that have contributed greatly to the final form of our arguments and to this article.

Correspondence concerning this article should be addressed to D. Vaughn Becker, Applied Psychology Program, Arizona State University at the Polytechnic Campus, Mesa, AZ 85212. E-mail: vaughn.becker@asu.edu

in the world but also of the capacities and aims of the perceiver, and as such, it is an opportunity for action. When it comes to perceiving other people, affordances correspond with the opportunities and threats that they hold for us.

Signals of affordances are sometimes generalized beyond their useful contexts, however. The bright coloration of the viceroy moth mimics the coloration of the monarch butterfly. Birds that prey on insects rapidly learn to avoid eating monarchs: The near-indigestible toxins in the plants on which monarchs feed give them a very foul taste. The viceroy moth, however, benefits from this bird's-eye affordance without itself having to commit metabolic resources to digesting poisonous chemicals. This example illustrates how signals from one type of animal can come to resemble those connoting another type with a different affordance entirely. Similar effects might underlie distortions in some human social judgments. One classic example is that adults that have facial proportions resembling infants are seen as affording kinder and gentler social interactions (Berry & McArthur, 1986).

The "baby-face" effect reveals how stable features like cranial morphology can reveal affordances (see Shaw & Pittenger, 1977). Affordances can also be communicated via changing features of faces, as in the case of facial expressions. Expressions can, among other things, provide cues about opportunities and threats in those we observe: A smiling face says, "Approach me"; an angry face says, "Stay away." From an ecological perspective, approach versus avoidance is one of the simplest and most fundamental behavioral decisions.

Some circumstances have an inherently higher degree of risk associated with approach versus avoidance. For example, the costs of mistakenly approaching a dangerous person are greater than the costs of mistakenly avoiding a safe person (Haselton & Buss, 2000). Hence, an adaptively tuned perceptual system could be biased toward identifying cues of danger—such as angry facial expressions—in those who indeed have the potential to afford greater physical threat (such as large, muscular, weapon-bearing strangers), even if many such individuals carry no immediate risk. When bodily harm is involved, missing an angry expression on the face of a physically imposing stranger is more costly than mistakenly seeing anger where there is none.

Although approach is often risky, people also afford positive opportunities, such as a willingness to share resources, contribute effort, and provide social support or mating opportunities. Because failing to approach a person possessing positive affordances can also be costly (albeit less critically), an adaptively tuned perceptual system might also be biased toward identifying cues suggesting approach-worthy opportunities—like happy, smiling facial expressions—in those who indeed have the ability and inclination to afford such opportunities (such as cooperative and supportive people). Of course, such a bias might only be cost-effective when the happy, smiling person is not also large, muscular, and bearing a weapon. In that case, another affordance opposes the positive one and will likely cancel it, eliminating any bias to approach until further information is obtained.

Decisions About Expressions as a Function of Gender

All species have innate perceptual mechanisms that help them to identify members of their own species and, more specifically, qualities of these conspecifics such as their sex, age, and likelihood of affording mating opportunities. Across species, males and females also afford different opportunities and threats. Human males, relative to females, are more likely to hurt others, for example, committing the great majority of homicides and other violent crimes in societies all around the world and throughout history (Daly & Wilson, 1994). Assuming people have some sense of this threat, they should be more hesitant to approach unknown males. The regularity with which human males are larger and more dangerous than human females could have given rise to a perceptual system that associates immediate cues to danger (e.g., angry facial expressions) with those people likely to have greatest potential to be physically threatening—men.

On the other hand, women afford a number of positive opportunities that are not as often associated with men. There is some evidence that women, more than men, adopt a strategy of "tending and befriending" under stressful circumstances (Taylor et al., 2000), which might imply a greater capacity for nurturing others. Consistent with this, other research suggests that women are seen as more compassionate and warm (Martin, 1987). People should thus have a somewhat greater inclination to approach women (relative to men), an inclination that might be supported by a perceptual system that associates immediate cues of socially supportive opportunities (e.g., happy facial expressions) with those seen to have greater potential to create them—women.

The Speed and Accuracy of Evaluative Decisions

How might these sex differences in affordance play out when decisions about another person's anger or happiness must be made rapidly? Several general patterns seem plausible, but two have a strong precedence in the social cognition literature.

First, there is a large body of literature on evaluative classification suggesting that affective processes are automatically engaged by pleasant and unpleasant stimuli. According to this literature, both words and pictorial stimuli of negative and unpleasant items tend to be identified less rapidly than those of positive and pleasant items (Fazio, 2001). One explanation for this slowdown is that negative stimuli automatically activate subcortical vigilance and threat-monitoring mechanisms that delay the ability to classify these items because they channel cognitive resources to other self-protective processes. Consistent with this explanation is the finding that it takes participants longer to count the number of schematic faces in a crowd when the faces bear negatively valenced rather than positively valenced expressions (Eastwood, Smilek, & Merikle, 2003). From this perspective, we should predict faster detections of pleasant expressions overall. Moreover, if it is also the case that men are more physically dangerous than women, then we might further predict from this perspective that the slowest expression classifications should occur for angry male faces. In other words, the affective response to the angry male face might delay even more the cognitive processes and motor movements that register the classification decision because the body is preparing a more ecologically valid set of responses to threat.

Two other theoretical positions make an alternative prediction—that happy expressions should be more quickly and accurately detected on female faces (relative to both angry female and happy male expressions) and that angry expressions should be more quickly and accurately detected on male faces (relative to both happy male and angry female expressions). This prediction follows

from the associations that might arise through social learning, whether these associations reflect stereotypes or true frequency effects. The same prediction also follows from a functionalist/ecological perspective, in which regularities in the social environment may have come to shape either the perceptual mechanisms of the receiver or even the form of the signal itself. We explore each of these possibilities in turn.

More efficient identification of angry male and happy female faces may be largely a learned and conceptual phenomenon. Psychologists have long accepted that features of the environment can come to be linked together through simple learning mechanisms, such that the perception of one feature rapidly and spontaneously brings to mind the other. Contemporary cognitive psychology is largely built on such an associationist foundation. If women indeed smile more than men (LaFrance, Hecht, & Levy Paluck, 2003) and men express anger more frequently than women (Fabes & Martin, 1991), this raises the possibility that the male–angry and female–happy associations may be reducible to the same kind of mechanisms that can account for word frequency effects (C. A. Becker & Killion, 1977), category prototypicality effects (Neely, 1991; Van Orden, 1987), and top-down explanations of semantic priming effects (e.g., D. V. Becker, Goldinger, & Stone, in press; Schvaneveldt & McDonald, 1981). Even in the absence of true covariation, it is plausible that cultural stereotypes about the way the sexes express themselves could give rise to greater efficiency in identifying anger on male faces and happiness on female faces. In addition, we might see other social regularities generating the associations of masculinity with anger on the one hand and femininity with happiness on the other. For example, learning that men are associated with high-power roles and women are associated with low-power roles and also knowing that high-power roles provide more opportunities to aggress against those in low-power roles might lead to a situation in which human perceivers are vigilant to signs of anger in the male face. This could, of course, be a culturally relative phenomenon and exist to the extent that one buys into or observes such stereotypical regularities, but it is not incompatible with the ecological perspective.

To truly take an ecological perspective, however, we must also consider how more efficient detection of angry men and happy women may arise from properties of the signaling system itself. From a psychophysical perspective, if there are two dimensions along which a stimulus type varies, they can sometimes be shown to lack separability, such that the perception of one attribute facilitates or interferes with the perception of another (e.g., see Ashby & Townsend, 1986; Garner, 1974). Such a perceptual confound could take the form of a bias selected at the early stages of perception, but it could also arise from selective pressures acting on the attributes of the signal. It is important to remember that from the perspective of ecological psychology, the coevolution of signal and receiver is inherent in the very nature of a perceptual system (Gibson, 1979).

The Present Research

The aim of these studies was to investigate how and why decisions about angry and happy expressions might be confounded with decisions about target sex. As noted above, one plausible prediction is that angry men would garner the slowest reaction times, precisely because their ecological import delays any actions irrelevant to vigilance and avoidance (like pressing a button to classify them as angry). We instead hypothesized that judgments and speeded decisions about expression would be dependent on the sex of the displayer of the emotion, revealing correlations of maleness with anger and femaleness with happiness. These predictions are readily derived from an ecological/functionalist perspective, but they could also emerge from other perspectives (e.g., the social learning of sex stereotypes). We thus sought to use multiple methods and approaches to first examine whether correlations between gender and speed of decisions about anger and happiness exist and then to explore the extent to which the correlations might be linked to perceptual features of the stimuli as opposed to learned stereotypical associations in the perceiver.

Study 1

We first used a variation of the simple visualization task with which we opened this article as a verification that there might be an implicit association between "male" and "angry" and "female" and "happy."

Method

Participants. In exchange for partial course credit, 48 male and 78 female undergraduate students participated in the study.

Materials and procedure. At the beginning of a class period, participants were presented with one of two packets. The first page of each packet instructed the participant to clear his or her mind and to think of either (a) an angry face or (b) a happy face. On the second page, participants answered a series of questions about the characteristics of the face they imagined, including the sex and physical attractiveness of the person with that face.

Results and Discussion

Table 1 shows the percentages of men and women in each of the two conditions that visualized a male face. Participants were especially likely to imagine men when instructed to generate an angry face and women when instructed to generate a happy face.

When asked to think of an angry face, both sexes were more likely to think of a man. A binomial test revealed that this differed significantly from chance (50%) across all participants, $p = .001$, and for both male ($p = .002$) and female ($p = .012$) participants separately. When asked to think of a happy face, the majority of men and just over half of women thought of a woman. A binomial test showed that this was marginally different from the expected value of 50% across all participants, $p = .098$, and for male

Table 1
Percentage of Participants Visualizing a Male Face in Study 1 as a Function of the Emotion Envisioned and Participant Gender

Emotion envisioned	Participants					
	Female		Male		*M*	
	%	*n*	%	*n*	%	*n*
Angry	71	41	83	23	75	64
Happy	49	37	24	25	39	62

participants in particular, $p = .014$. Although female participants did not think about female faces at an above-chance rate when asked to generate a happy face, they were much more likely to generate a female face than were other female participants who had instead been asked for control purposes merely to think of "a face," $p = .001$.

This procedure, in which people were allowed to conjure up their own exemplars of angry and happy faces, provided the advantage of tapping the participants' default associations between anger/happiness and male/female without specifically cueing gender in any way. There are several disadvantages to such a method, however. The procedure does not address whether these associations affect the processing of real faces; it does not address how rapidly the associations emerge; and most important, the default conceptual associations, although surely affected by stereotypes and schemas, may also have a number of deeper sources, among which this procedure cannot distinguish. Thus, in Studies 2–5, we took a more tightly controlled experimental approach by systematically exposing participants to faces that were obviously either male or female and that had clear emotional expressions. The task was to make rapid decisions about either the target's emotional expression or its gender.

Study 2

Method

Participants. Undergraduate students in introductory psychology (17 women and 21 men) participated in the study in exchange for course credit. Each had normal or corrected-to-normal vision.

Materials. Black and white images of emotional expressions made by six male and six female targets from Ekman and Friesen's *Pictures of Facial Affect* (1975) were cropped, scanned, and digitized for use in this study. We displayed stimuli on 17-in. monitors using Pentium II PCs (Intel, Santa Clara, CA), and participants responded using the computer keyboard. The E-Prime software program (Psychology Software Tools, Pittsburgh, PA) was used to implement this and subsequent experimental procedures.

Procedure. Participants were tested in groups of as many as 8, with each participant working on an individually assigned computer workstation separated from the others by office dividers. For their first task, they were asked to rapidly identify the emotional expression (anger or happiness) appearing on faces presented individually on the computer screen. On each trial, the participant viewed a fixation point (a plus sign) in the center of the screen for 1 s; this was followed by a randomly selected image of a face (approximately 45 cm [1.5 in.] wide and 60 cm [2 in.] tall) that remained visible until the participant made an emotion identification judgment by pressing the "H" key for happy or the "A" key for angry. Accuracy and latency feedback was provided for 1 s immediately following each judgment. There were 120 trials in all, with each face appearing five times.

After a short break, participants were given an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). Using key presses, they first rapidly categorized words as being synonymous with happy or angry. Then in a second block of trials, using the same keys as in the first block, participants rapidly categorized names as male or female. The third block combined these tasks: Participants either saw a name or a word, and they had to press the relevant key (the categorization labels remained on the screen so that confusion about the value of the two keys would be minimized). A fourth block involved categorizing names with the male and female key assignments switched, and a final block again combined the categorization tasks, with keys for male and female assignments switched. By comparing the average correct latencies in Blocks 3 and 5, we calculated a measure (closely following the procedures advocated by Greenwald et al., 1998) of each participant's implicit association between the words *angry* and *male* and between the words *happy* and *female*.

Results

Each participant's mean accuracy lay within 2.5 standard deviations of the mean for the group ($M = .964$, $SD = .027$). For the expression decision task, median correct reaction times and mean accuracies were computed for each combination of target gender and target emotion for each participant. Both measures were subjected to separate three-way analyses of variance, with target gender and target emotion as within-subjects factors and participant sex as a between-subjects factor.

Reaction time. There was a main effect of target emotion, such that participants identified angry faces ($M = 579$) more slowly than they identified happy faces ($M = 564$), $F(1, 37) = 5.96$, $p = .020$, partial $\eta^2 = .14$. There was also an interaction of target emotion and participant gender, $F(1, 37) = 4.40$, $p = .043$, partial $\eta^2 = .11$, indicating that the aforementioned advantage in identifying happiness more rapidly than anger was much greater for female participants than it was for male participants. Most important, consistent with predictions, there was an interaction of target gender and target emotion, $F(1, 37) = 34.23$, $p < .001$, partial $\eta^2 = .49$. Anger was identified faster on male faces relative to female faces, $t(37) = 4.581$, $p < .001$, whereas happiness was identified more rapidly on female faces relative to male faces, $t(37) = 3.76$, $p = .001$ (see Figure 1). No other effects were significant.

Accuracy. There was a main effect of target gender, $F(1, 37) = 19.63$, partial $\eta^2 = .35$, such that decisions were made more accurately for female faces ($M = .980$) than for male faces ($M = .948$). There was also a main effect of target emotion, $F(1, 37) = 28.60$, partial $\eta^2 = .44$, such that decisions were made more accurately for angry faces ($M = .982$) than for happy faces ($M = .946$). These main effects were qualified, however, by the significant interaction of these factors, $F(1, 37) = 46.50$, $p < .001$, partial $\eta^2 = .56$. Anger was recognized more accurately on male faces than on female faces, $t(37) = 2.13$, $p = .039$, whereas

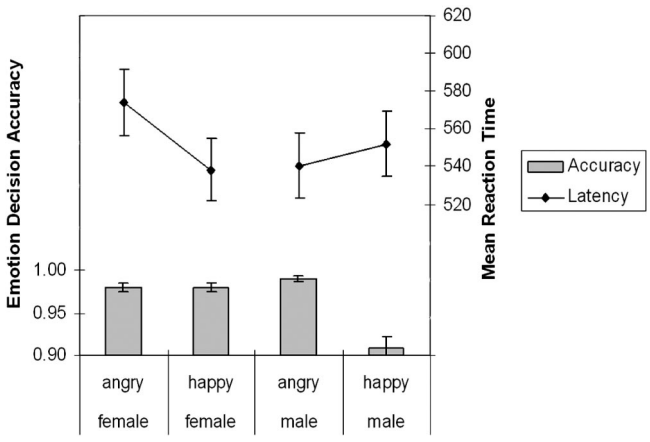

Figure 1. Accuracy and reaction times in Study 2 for decisions about the emotional expressions on each face. Error bars indicate standard errors across participants.

happiness was recognized more accurately on female faces than on male faces, $t(37) = 5.80$, $p < .001$.

Implicit association measure. Following conventional IAT procedures (Greenwald et al., 1998), we calculated each individual's tendency to associate angry synonyms with male names and happy synonyms with female names. It is widely believed that the IAT assesses implicit conceptual associations between items. We did indeed find a significant association of male with angry and of female with happy. When the response keys were assigned to consistent categories (e.g., the same key being used for decisions about both male and angry), participants were 124 msec faster than when the keys were assigned to the opposite (i.e., inconsistent) values, $t(37) = 2.56$, $p = .013$.

To test whether the latency differences could be accounted for by these implicit associations, we reanalyzed the above data in three ways. First, we conducted an analysis of covariance on the entire sample with the implicit association as a covariate, and we still obtained a robust interaction of target sex and target emotion for reaction times, $F(1, 37) = 32.81$, $p < .001$, partial $\eta^2 = .48$. We then calculated the difference in decision times for the male and female angry faces and then for male and female happy faces. We then regressed the IAT scores on these measures. Neither was significant, both rs $< .02$. Finally, we conducted the analyses on only those participants who showed an implicit association opposite to that observed in our emotion detection data—that is, on those whose conceptual associations linked male names with happy words and female names with angry words (7 men and 6 women). We reasoned that if conceptual associations underlie participants' responses on the categorization task, then those participants should exhibit opposite or nonsignificant categorization findings. Like the full sample, however, these participants, too, were both faster and more accurate in categorizing male faces as angry than as happy and faster in categorizing female faces as happy than as angry, yielding a significant Target Sex × Target Emotion interaction: reaction times, $F(1, 12) = 9.66$, $p = .009$, partial $\eta^2 = .45$; accuracy, $F(1, 12) = 32.03$, $p < .001$, partial $\eta^2 = .73$.

Discussion

We obtained some evidence that angry expressions elicit slower performance than do happy expressions, as has often been found in the evaluative classification literature, but this main effect was qualified by the predicted interaction: Reaction times and errors were both significantly lower for angry male faces than reaction times and errors for happy male faces, and happy female faces were identified significantly faster than were angry female faces. Furthermore, although we did find evidence of implicit cognitive associations between maleness and anger and between femaleness and happiness, the analyses in which we controlled for these associations suggested that the tendency to perceive male faces as angry and female faces as happy may be more than merely a conceptual bias at the decision stage: Even those who showed no such conceptual associations (for masculine and feminine verbal stimuli) still showed the predicted categorization advantages. These results may be suggestive of mechanisms operating from the bottom-up at an early level of perception rather than from the top-down with preexisting conceptual associations.

Study 3

In Study 3, we explored gender–emotion associations in a different way—by asking participants to judge not the emotion but rather the gender of the individuals whose faces were used in Study 2.

Method

Participants. The 20 women and 12 men who participated in the study (in exchange for course credit) had normal or corrected-to-normal vision.

Procedure. Participants made rapid decisions about the gender of the individuals with the same happy and angry male and female faces used in Study 2. Except for the minor change in instructions (the responses were registered with the "M" and the "F" keys), the trials in this experiment were identical to those in the expression decision task in Study 2. No IAT task was included in this study.

Results

All participants' mean accuracy lay within 2.5 standard deviations of the mean for the group ($M = .964$, $SD = .044$).

Reaction time. The only significant effect was the predicted interaction of target gender and target emotion, $F(1, 30) = 25.34$, $p < .001$, partial $\eta^2 = .46$. Happy faces were correctly categorized as female faster than as male, $t(31) = -1.90$, $p = .034$, whereas angry faces were correctly categorized as male faster than as female, $t(31) = 3.70$, $p < .001$.

Accuracy. Again, the predicted interaction of target gender and target emotion was the only significant effect, $F(1, 30) = 10.64$, $p = .003$, partial $\eta^2 = .26$ (see Figure 2). The sex of happy faces was categorized as female more accurately than as male, $t(31) = 3.71$, $p < .001$, whereas the sex of angry faces was categorized as male more accurately than as female, $t(31) = -1.57$, $p = .063$.

Discussion

The findings from Study 2 indicated that angry faces were judged as angry more quickly and accurately if they were male, whereas happy faces were judged as happy more quickly if they

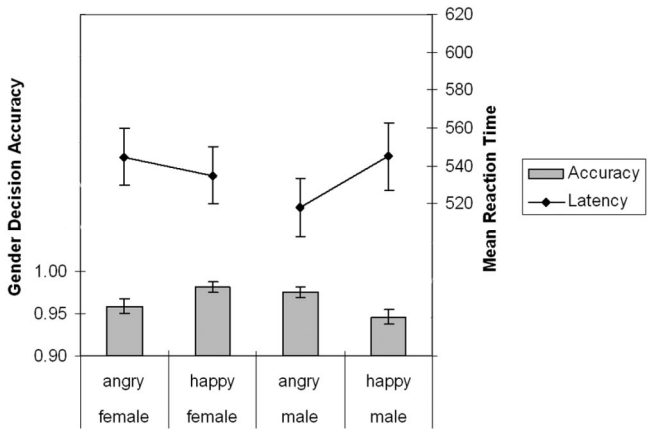

Figure 2. Accuracy and reaction times in Study 3 for decisions about the sex of each face. Error bars indicate standard errors across participants.

were female. Study 3 offered complementary findings, such that male faces were judged as male faster and more accurately if they were angry, whereas female faces were judged as female faster and more accurately when they were happy.

The results of Study 3 strike us as especially interesting. Whenever one sees an angry or happy expression, it has to be on a male or a female face. If anger is more prevalent on male faces, it might make sense that, given the task of recognizing an emotional expression, one might find it easier to recognize anger on a male face. On the other hand, male faces are most frequently seen without angry expressions; hence, it is more surprising that it is easier to judge a face as male if it is angry. These findings are consistent with the possibility that the sex of the individual whose face is being judged and expression on that face are correlated in participants' perceptions: To appear angry is to look more masculine, whereas to appear happy is to look more feminine.

Study 4

Despite the convergence of findings across two different decision tasks (expression and face gender), male and female targets could have been expressing the posed emotions with differential intensity, such that the men were more intensely posing anger whereas the women were more intensely posing happiness. We should emphasize that the actors portraying these emotions had been trained to produce the best angry and happy faces they could, and the researchers had chosen the best exemplars they obtained. Nevertheless, one might hypothesize that men are more practiced in expressing anger and women are more practiced in expressing happiness and that these qualitative differences in expressive fluency drove the perceptual effects. Therefore, in our next study, we made irrelevant any natural ability of men and women to differentially produce different emotional expressions by using faces generated with computer software that allowed us to precisely control the expressive intensity of each face.

Method

Participants. We drew 12 women and 10 men from the introductory psychology research pool. One man was dropped from final analyses for having error rates in excess of 25%; his exclusion did not alter the results.

Materials. We constructed a new set of faces using six male and six female prototypes from Poser 4 (Curious Labs, Santa Cruz, CA), a software package widely used in the graphic arts to create lifelike figures (see Hugenberg & Bodenhausen, 2003, 2004, for other uses of Poser stimuli in psychological experimentation). Independent controls allowed us to deflect the mouth and brows such that the two expressions were clearly identifiable as angry and happy, while simultaneously controlling the magnitude and number of changes (from neutral) to be identical (see Figure 3). Note that the stimuli had no hair or other features useful for discriminating between the sexes aside from those of facial morphology. Nevertheless, 22 additional participants were able to discriminate the faces as male or female with greater than 94% accuracy (and no stimulus had misclassification rates in excess of 9%).

Procedure. The Poser stimuli were substituted into the design of Study 2, such that the procedure was identical, except that there was no subsequent IAT task.

Results and Discussion

All participants' mean accuracy lay within 2.5 standard deviations of the mean for the group ($M = .970$, $SD = .043$).

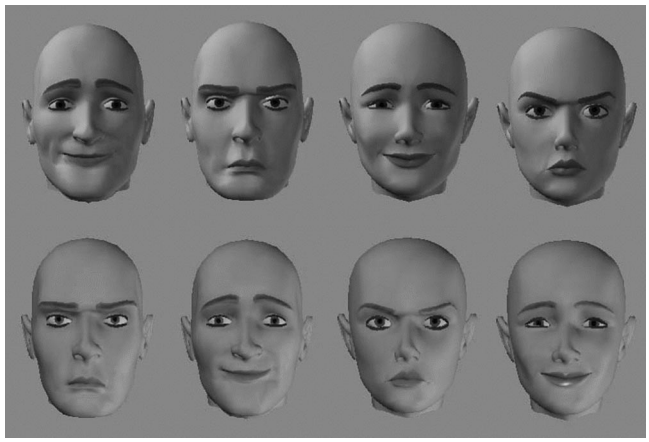

Figure 3. A sample of the faces used in Study 4.

Reaction time. The only significant effect was again the predicted interaction of target gender and target emotion, $F(1, 30) = 6.90$, $p = .014$, partial $\eta^2 = .19$ (see Figure 4). Anger was identified faster on male faces than on female faces, $t(30) = 2.31$, $p = .014$, and happiness was identified more rapidly on female faces than on male faces, $t(30) = 2.43$, $p = .011$.

Accuracy. Again, the interaction of target gender and target emotion was the only significant effect, $F(1, 30) = 7.68$, $p = .009$, partial $\eta^2 = .20$. Happy female faces were categorized as happy more accurately than were happy male faces, $t(30) = 2.10$, $p = .022$, and angry male faces were more accurately categorized as angry than were angry female faces, $t(30) = 2.75$, $p = .005$.

These results again replicate those of Study 2 and support our principal hypothesis: When actual happy and angry expressions are controlled, female faces are readily identified as happy, and male faces are readily identified as angry.

Study 5

Thus far, we have not presented any results that shed light on how nonexpressive faces are perceived as a function of gender. A correlation between masculinity and anger on the one hand and femininity and happiness on the other might suggest that neutrally expressive male faces may more often be mistaken for being angry, whereas neutrally expressive female faces might more often be mistaken for being happy.

In our next study, we presented photographs of angry, happy, neutral, and fearful faces very briefly, and participants had to identify which emotional expression they saw. This allowed us to explore how face gender influenced the detection of expressions under conditions of incomplete information. It also allowed us to test whether neutral faces were misidentified as angry when male and as happy when female. Finally, this experiment allowed us to test whether male faces were linked with negative emotions in general; we could examine whether accuracy for identification of fearful faces and misclassification of faces as fearful were greater for the male faces relative to the female faces.

Method

Participants. Our 49 participants (28 men and 21 women) took part in this experiment in exchange for course credit.

Figure 4. Accuracy and reaction times in Study 4 for decisions about the emotional expression on each face. Error bars indicate standard errors across participants.

Stimuli. Photographs of angry, happy, neutral, and fearful faces were taken from the Ekman and Friesen's (1975) stimulus set. Preratings of the faces indicated that only four male and four female expressers had equivalent expressive intensity on the two new expressions, so only these faces were used.

Procedure. We used the same procedure in this study that we used in Studies 2–4. However, the emphasis was now on accuracy instead of on speed. Faces were presented for 14, 27, 41, 54, or 67 (± 2) ms, followed by a poststimulus mask (a jumble of nonexpressive face parts) for 6 s or until a response was made. Across 160 trials, participants had to categorize these expressions by pressing keys representing each expression.

Results and Discussion

Because exposure duration was included to test hypotheses irrelevant to this article, we collapsed across this factor in these analyses. Table 2 presents the participants' accuracy rates for identifying the different faces and the mistakes they made when classifying neutral faces.

We predicted that neutral male faces would be misidentified as angry and neutral female faces would be misidentified as happy. Consistent with this prediction, a greater number of neutral male faces were misclassified as angry relative to number of female faces that were misclassified as displaying anger, $F(1, 48) = 15.3$, $p < .001$, partial $\eta^2 = .24$. The parallel comparison revealed marginally more misclassifications of happiness for neutral female faces than for neutral male faces, $F(1, 48) = 3.08$, $p = .081$, partial $\eta^2 = .06$.

We then tested whether accuracy in classifications of fearful faces and misclassifications of faces as fearful were greater for the male faces than for the female faces, which might be the case if male faces were evaluated negatively in general. Classification accuracy for fearful faces was significantly higher for female than for male targets, $F(1, 48) = 9.80$, $p = .003$, partial $\eta^2 = .17$. There was no difference in the misclassifications of neutral faces as fearful as a function of target gender, $F < 1$. These results do not support the contention that male faces garner more negative classifications in general and instead support the hypothesis that male faces look specifically angry.

We next tested our hypothesis that accuracy in identifying anger and happiness varied as a function of target gender. As a preliminary step, we performed an omnibus multivariate analysis of variance, with target gender and expression as repeated measures and participant gender as a between-subjects factor, and found a significant interaction of target gender and emotion, $F(3, 46) = 8.53$, $p < .001$, partial $\eta^2 = .39$, and the higher order interaction with participant gender was not significant, $F < 1$. We then restricted the analysis to the expressions of anger and happiness. Emotions on female faces were generally judged more accurately than were male faces, $F(1, 48) = 12.40$, $p < .001$, partial $\eta^2 = .21$, and happiness was detected the best overall, $F(1, 48) = 123.40$, $p < .001$, partial $\eta^2 = .72$. The predicted interaction of target gender with the expression was significant, $F(1, 48) = 29.10$, $p < .001$, partial $\eta^2 = .38$. Angry male faces were not more accurately identified than were angry female faces, $F < 1$, but happy female faces were identified with more accuracy than were happy male faces, $F(1, 48) = 49.0$, $p < .001$, partial $\eta^2 = .51$.

Interlude: A Concordance of Gender and Expressive Features?

Across two stimulus sets (and a third not reported here), the present experimental findings were consistent with the idea that to appear angry is to look more masculine, whereas to appear happy is to look more feminine. What might account for this? Le Gal and Bruce (2002) have suggested that the expression of surprise feminizes a face by increasing the distance between the eyebrow and the eye, whereas anger, by decreasing this distance, makes a face look more masculine. Furthermore, there are several structural differences between male and female faces that might also connote differences in the expressions studied here. Darwin (1872) noted that anger is conveyed by (a) the center of the brow being drawn down strongly, often producing vertical furrows between the eyes, (b) a compressed mouth, (c) flared nostrils, and (d) "flashing eyes" (in other words, retraction of the eyelids such that more of the eye

Table 2
Study 5 Participants' Accuracy in Identifying Expressions and Percentage of Misclassifications of Neutral Faces as Angry, Happy, or Fearful

	Female faces		Male faces	
Emotion	*M*	*SE*	*M*	*SE*
	Accuracy			
Overall	59.4	0.023	53.5	0.024
Angry	49.3	0.026	51.2	0.024
Happy	75.1	0.017	62.5	0.018
Fearful	54.1	0.026	44.7	0.026
Neutral	59.2	0.024	55.4	0.026
	Misclassification of neutral faces			
Angry	12.1	0.013	19.3	0.017
Happy	13.6	0.014	11.0	0.015
Fearful	13.8	0.012	13.3	0.015

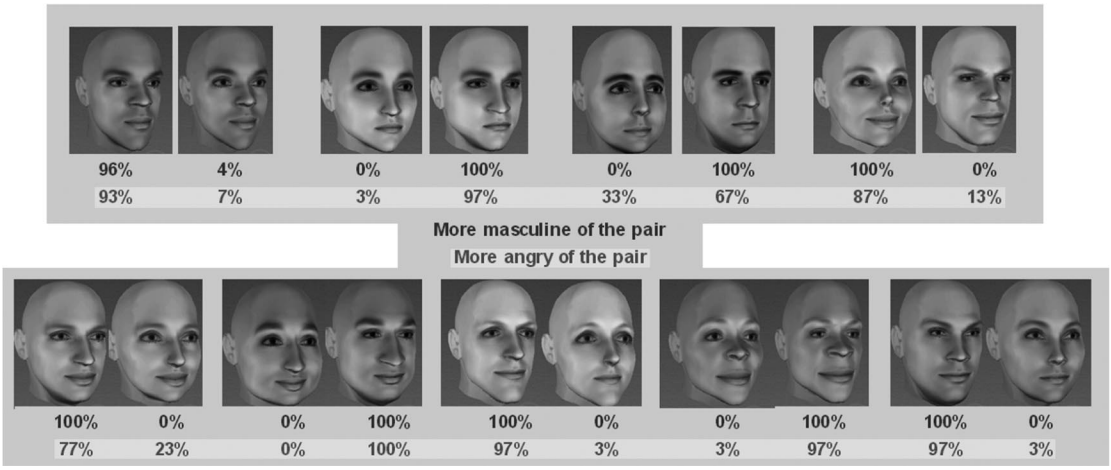

Figure 5. Each of the stimulus pairs used in Study 6. Participants had to choose either which face looked more masculine or which face looked angrier. The resulting percentages are presented below the faces. The top number indicates the percentage of participants perceiving the left face as the more masculine, and the bottom number indicates the percentage of participants perceiving the left face to be the angrier of the two.

is visible as in a glare).[1] Aside from the flashing eyes, each of these features is also characteristic of the male face. Men have larger, heavier brows; the size of the brow can make it look drawn down even when relaxed. Men also have a more angular jaw and thinner lips relative to women, which together may make the mouth look compressed. Finally, men generally have larger noses, which can give rise to the appearance of the nostrils being flared.

On the other hand, women have rounder, more neotenous features. Shaw and Pittenger (1977) have shown that changes in the shape of the skull from infancy to old age follow a particular kind of transformation—a cardioid deformation—that is a highly reliable cue to age across species. This consistency across different animal types opens up the possibility that innate perceptual mechanisms might have been selected that allow humans to discriminate youth from old age, and these mechanisms would likely also be sensitive to the greater neoteny of the female face. Bowlby (1969) argued that adult humans have innate positive reactions and approach-related behaviors with regard to babies, and Berry and McArthur (1986) showed that even adults with baby-faced features seem to receive positive evaluations. Thus, the shape and proportions of female faces could very plausibly suggest happiness and other positive affordances.

These considerations support the contention that angry and happy expressions may be intrinsically confounded with the sexual dimorphism of the face itself. In our final two studies, we developed new stimulus sets to further investigate this possibility.

Study 6

In Study 6, we used more recent Poser software (Version 5) than we used in Study 4. With this software, we had precise control of the emotional expressions and the masculinity and femininity of the faces generated.

Method

Participants. There were 59 participants, with 28 judging which face was more masculine (14 women, 9 men, and 5 who neglected to indicate their sex) and 31 judging which face was more angry (16 women, 10 men, and 5 who neglected to indicate their sex).

Stimuli. Poser 5 allows users to randomly generate faces by drawing parameters from a database of three-dimensional scans of more than 200 real faces of individuals from a range of ethnicities (S. Rathman, Curious Labs, personal communication, March 8, 2004). Both the underlying cranial morphology and the flesh are modeled and can be manipulated independently in these randomized faces. We began with nine androgynous prototype faces with neutral expressions. For each of these faces, we then produced a slightly masculine and a slightly feminine version by adjusting a single control that is a standard part of the Poser 5 architecture. The algorithm for the gender shift was generated with statistical models that were based on scans of real women and men and thus seems a valid way to manipulate perceived gender in a continuous fashion.

For the first four pairs of faces, we set the emotional expression to be completely neutral on both the masculine and the feminine versions. For the final five pairs, we set the emotional expressions in a direction opposite the associations observed in the first studies, with the feminized versions being made to look either slightly angrier or slightly less happy than the masculinized versions of the faces.

Procedure. The experiment was conducted in a classroom setting via a slide show. Each pair of faces was presented together for approximately 15 s, and participants were assigned to choose either which face in the pair was more masculine or feminine or which face in the pair was more angry or happy.

Results and Discussion

As can be seen in Figure 5, there was substantial agreement about which face was more masculine and which face was angrier. Given our manipulation of the faces, we expected the value of the emotion assignment for the first four face pairs to be 50% (because the faces were constructed to have identical expressions), whereas for the final five pairs, the more feminine face should have always been identified as the angrier of the pair. In fact, in all nine cases, the masculinized face was judged to be the angrier of the two.

[1] The facial characteristics that Darwin identified for anger also agree with characteristics described in Ekman and Friesen's work (1975).

Furthermore, knowing the proportion of people that classified the face as male allowed an almost perfect prediction of the rate at which the face was classified as angry, $r(7) = .97$.

Did the software creators inadvertently build in a confound between gender and expression? In a personal communication (S. Rathman, Curious Labs, March 8, 2004), they assured us that they did not but rather had generated the masculine and feminine parameters by scanning several hundred actual male and female faces. The results of this study suggest, then, that there may be a natural confound between sex and facial expression and that altering a face in the direction of a statistical average of the male exemplars makes the face look more angry.

In our final study, as a final test of the possibility that there is an intrinsic confound between gender-specific morphology and facial expression, we directly manipulated three features that can be used to assess the gender of a face and ascertained how judgments about expression were influenced by these alterations. Specifically, because brow ridge is one of the most important features with which physical anthropologists discriminate male from female skulls (Ravosa, 1989), we lowered or raised the brow ridge by modifying the underlying bony structure (rather than by contracting the muscle tissue and flesh). We also made the jaw either more square or more round, another feature driven by sex hormones.

Finally, we added to these faces bodies clothed in gender-typical ways. One might argue that the findings presented thus far reflect nothing more than straightforward inferences that were based on contemporary cultural stereotypes—that participants were perceiving men to be angry and women to be happy merely because this is what current stereotypes hold. If gender stereotypes fully accounted for our previous findings, then this clothing manipulation also should have led participants to overly ascribe anger to androgynous faces of individuals whose dress makes them appear to be men and happiness to faces of individuals whose clothing makes them appear to be women. Such a finding would challenge the explanation that facial cues to gender are naturally confounded with those for expression.

Study 7

Method

Participants. We drew our participants (51 women and 18 men) from the introductory psychology research pool.

Stimuli. Poser 5 was used to generate six androgynous prototype faces with neutral expressions. For each of these faces, we then created six variations of the prototype by manipulating three cues that could be used to assess a face's gender: a body wearing male or female clothing was added, the jaw was made more square or more round and narrow, or the bony structure of the brow ridge was lowered or raised. Note that these alterations were not combined in a complete factorial design; there were thus seven versions of each of the six faces, for a total of 42 stimuli. Figure 6 illustrates one such prototype and its six modifications.

Procedure. Participants were greeted by the experimenter, assigned a seat, and instructed that their task would be to rate a series of computer-generated faces. Half of the participants were told that these faces had been modified to look slightly angry or slightly happy, whereas the other half were told that the faces had been modified to look slightly masculine or slightly feminine. The participants were to rate these faces on a scale from 1 (labeled either *slightly masculine* or *slightly angry*) to 9 (either *slightly feminine* or *slightly happy*), with 5 explicitly indicated as the midpoint of the scale. Note that participants were explicitly told to make their judgments solely on the basis of aspects of the face and were only aware of the specific rating task to which they had been assigned (i.e., no one knew that faces were being rated on both expression and gender dimensions). The experiment began with a set of written instructions recapitulating these points and was followed by the presentation of the 42 faces in a randomized order, each remaining on the screen until the participant made a keyboard response.

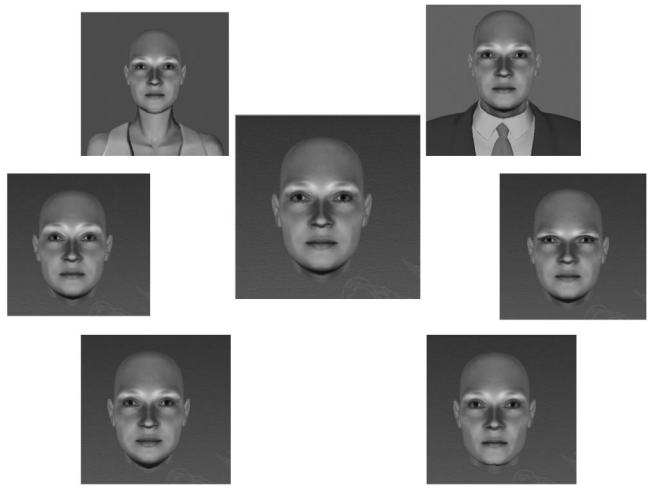

Figure 6. One of the prototype faces (center) and the six variations that constitute the key manipulations in Study 7. The face in the upper left photograph is morphologically identical to the face that appears in the center (androgynous) photograph, but the figure that appears in the upper left photograph is wearing female clothing; the face in the upper right photograph is the same androgynous face with the figure wearing male clothing. The other photographs show faces with morphological variations in brow ridges and jawlines that are prototypical of female (on the left) and male (on the right) faces.

Results and Discussion

For each participant, we first calculated an average rating for the prototype faces. We then calculated the average difference that each modification (e.g., lowered brow ridge) produced, relative to the standard rating for the androgynous, neutrally expressive prototypes. We used these difference scores for all statistical tests.

Despite the explicit instructions to base judgments only on facial characteristics, participants showed reliable tendencies to rate faces as male when male clothing accompanied the depiction of the face, $t(36) = -5.94$, $p < .001$. However, male clothing did not influence the perception of emotional expression, $t(32) = 0.87$, $p > .2$, and in fact pushed the ratings in the direction of happiness—opposite of what the gender stereotype explanation would have predicted. Similarly, female clothing caused participants to rate the faces as more feminine, $t(36) = 8.58$, $p < .001$, but actually generated a marginally significant tendency to rate the faces as angry rather than as happy, $t(36) = -1.96$, $p = .058$. This result is not consistent with the hypothesis that participant expectations about gender-characteristic expressions can fully account for the results of the previous studies. It also seems to exclude any explanation rooted in the different power roles associated with men and women.

Consistent with our primary hypotheses, lowering the brow ridge led participants to rate the faces as more masculine, $t(36) = -3.76$, $p < .001$. Although the manipulation did not cause as great an influence on judgments of masculinity as did the clothing manipulation, it did lead participants to rate the face as more angry relative to the unaltered faces, $t(32) = -6.73$, $p < .001$. Raising the brow ridge made the faces look more feminine, $t(36) = 2.24$, $p = .032$, but did not make the feminine faces appear more happy, $t(32) = -0.84$, $p > .2$.

Making the jaw more angular was intended to make the faces look more masculine, but this manipulation failed to produce any significant differences in that direction and actually led participants to judge the face as marginally more feminine, $t(36) = 1.90$, $p = .066$. The angular jaw did, however, make the face look significantly more angry, $t(32) = -6.18$, $p < .001$. It should be noted that although squaring the jaw widened it perceptibly, the size of the mouth remained unchanged, and this increase in the ratio between jaw width and mouth width may have made the mouth look relatively more pursed and therefore made the face look more angry. Another possibility is that angularity itself is a sign vehicle for anger (see Aronoff, Woike, & Hyman, 1992). In contrast, although softening and rounding the jaw did not lead the participants to judge faces as more feminine, $t(36) = -0.88$, $p > .2$, it did lead participants to judge the faces as more happy, $t(32) = 5.07$, $p < .001$. Thus, even though the jaw manipulation altered an attribute known to differ between the sexes, the change in the jaw was not sufficiently diagnostic to enable correct gender identification. It is of some interest that these changes to the cranial morphology did inspire expression judgments in alignment with our hypotheses, without necessarily producing changes in perceptions of masculinity and femininity, per se.

General Discussion

The results of seven studies suggest that decisions about the sex of an individual based on the appearance of the face and the emotional expressions of anger and happiness do not appear to be independent and furthermore that part of this effect may arise from sex differences in the architecture of the face itself. Study 1 findings indicated that the spontaneous generation of a mental image of an emotional expression is also likely to summon an associated gender: Angry faces are visualized as male, and happy faces are visualized as female. In Study 2, we investigated the perception of anger and happiness with a speeded categorization task and found that participants gave faster and more accurate classifications for the word *angry* with male faces and faster classifications for the word *happy* with female faces. This held true even for those participants who implicitly associated male with *happy* and female with *angry*. Using the same stimuli, we found in Study 3 that angry expressions led to faster and more accurate judgments that a face belonged to a man, whereas happy expressions led to faster and more accurate judgments that a face belonged to a woman. In Study 4, we replicated the Study 2 expression decision results using a computer-generated stimulus set, for which the expressive intensity was precisely equated across the male and female targets. Study 5 revealed that neutral male faces, relative to neutral female faces, were more likely to be misidentified as angry and were less likely to be identified as happy. Study 6 showed that masculinizing a face made it look more angry, whereas feminizing a face made it look more happy.

Finally, in Study 7, we manipulated single features on a new set of androgynous, neutrally expressive faces and found that lowering the brow ridge made faces look both more masculine and more angry. Moreover, although adding gender-typical clothing to the targets did influence judgments of masculinity and femininity, judgments of anger and happiness trended in directions that were opposite to what gender stereotypes and power roles would predict. These latter findings suggest that the results of the earlier studies arose from a natural confound in the structure of the human face itself, not from simple inferences based on cultural stereotypes that men are more likely to be angry and women are more likely to be happy.

At the outset, we identified three general theoretical perspectives that potentially have implications for how decisions about emotional expressions might vary as a function of the sex of the displayer.

The affective priming literature suggests that processing priority is given to positive versus negative information (Fazio, 2001). Such prioritization may occur because negatively valenced stimuli activate more primitive subcortical responses that draw processing resources away from higher order cognitive response systems. This theory led to the prediction that responses to angry faces would be slower (and in a speeded task, potentially less accurate) than responses to happy faces and that angry male faces would garner the slowest responses. Only Study 5, in which the expressions had to be identified after very brief exposures, provided evidence that positive expressions are more efficiently perceived and categorized, and even here, other results from that study favored alternative positions. Across all seven experiments, decisions about facial expressions varied as a function of the gender of the individual whose face was being judged, and we may therefore conclude that expressive faces do not give rise to the same evaluative decision effects that are typically obtained with other word and picture stimuli.

The pattern that we have consistently observed in these studies does follow from both social learning and functionalist/ecological perspectives, however, and distinguishing between these two alternatives is considerably more challenging. So much of modern psychology is predicated on the notion that associations observed in the world can come, through learning, to be reflected in the mind that it would be premature to dismiss it as a possible source of the effects observed here. If most angry faces are male and most happy faces are female, then perceiving the gender of the person whose face is being assessed is bound to influence decisions about the expression of that face. Indeed, every result here is at least partially amenable to this kind of explanation. Several of the results reported here, however, also imply that this associationist account is unlikely to be the whole story.

First, the IAT results in Study 2 presumably arose from such conceptual associations, the strength of which varied from individual to individual. Nevertheless, even after we controlled for these individual differences, anger was still identified more rapidly on male faces and happiness was identified more rapidly on female faces. Second, pure social learning is a less compelling explanation for the results of Study 3, in which the decision task was to identify the gender of the individual whose face was shown. Whereas most of the angry faces encountered might be male, it is certainly not the

case that most male faces are angry. Together, the results of Studies 2 and 3 suggest that the perceptual dimensions of gender and anger or happiness are correlated—that perception of these dimensions are not separable from each other (Ashby & Townsend, 1986; Garner, 1974).

When experimental psychologists observe that one perceptual dimension is integral to the perception of another, the source of this effect often lies deep in the perceptual system but may still arise, via learning processes, from the statistical properties of the environment. It is typically assumed that the expression and identity of faces are processed by separate modules (e.g., Bruce & Young, 1986), but this need not be the case; even if it were—if anger and maleness covaried reliably—pathways between these modules could develop. We note, however, that such attempts to preserve social learning as the sole explanation for the present effects strain the limits of existing models of face perception and cognitive processing. Moreover, the results of Study 7 run counter to this position, as cues to the different power roles associated with men and women—operationalized in the clothing depicted with the faces—gave rise to expression ratings that were in the opposite direction to those that the power roles should predict. We thus believe that parsimony favors an explanation at the level of the signal itself—that there is a natural confound between the features that correspond to maleness and anger, on the one hand, and femaleness and happiness, on the other. Nonetheless, it remains a possibility that social learning processes may also play a role in creating these phenomena.

If the confound between sex and expressions of anger or happiness is indeed a natural one, why might it exist? Considered from an evolutionary perspective, the relative costs and benefits of perceiving anger and happiness on male and female faces might have traditionally differed as a function of physical threat, social dominance, and coalition building. Anger is clearly an emotion associated with physical threat and the expression of social dominance, whereas happiness is an expression associated with cooperativeness, acceptance, and coalition building. As discussed earlier, there is evidence that human females, compared with males, are more likely to engage in a tend and befriend strategy when facing environmental threats (Taylor et al., 2000). Other evidence suggests that human males, compared with females, are generally more likely to be violent with one another and engage in intramale competition, a tendency that has been linked to differential parental investment and sexual selection (Trivers, 1985). Thus, from this perspective, men and women have very different strategies for maintaining their status and position in the social milieu, and these strategies entail a different repertoire of expressive gestures. Moreover, the fossil record clearly indicates that male hominids were larger than their female counterparts (Feder & Park, 2001), and from this single difference, it would be reasonable to assume that male anger was, and is, more dangerous.

These differences could result in selective pressures such that if one wanted to express anger in a way that clearly and rapidly communicated one's displeasure, movements that made the face and body look more masculine would be favored. In fact, another universal characteristic of anger expression is erect posture, which causes the body to appear physically larger and thus more masculine (Darwin, 1872). The ethological literature is replete with examples of this "enlarging" behavior accompanying aggressive and defensive intentions—a nice example of a behavior that is conserved across many species but that would leave no fossil record because of its source in dynamic plasticity of the organism. It thus also seems plausible that the facial muscles would have been subject to similar selective forces.

A similar coevolutionary process might also explain the happy expression: the bow-shaped curve of the smile is made possible by muscles that simultaneously round the cheeks, resulting in two cues to femininity and neoteny—cues that evoke positive prosocial emotions, perhaps even appropriating the same neural circuitry that underlies parent–child bonding (e.g., Panksepp, 2001). Because the human facial expression of happiness is a much more recent development than the features that signal youthful and female members of the species, this prosocial signaling system could have easily capitalized on preexisting recognition systems that allowed primates to recognize female and youthful conspecifics.

In short, to the extent that the features of anger and happiness gave competitive advantage or facilitated cooperation by virtue of their similarity to secondary sexual characteristics, they may have become "fossilized" in a sexually dimorphic way: The angry face now naturally looks more masculine, whereas the happy face looks more feminine. Thus, above and beyond reliance on cognitive systems that reflect statistical regularities in the environment, the present results might be explained as resulting from the physical structure of the face itself (although in a way that is still biologically contingent on the same regularities of the social environment).

It should be emphasized that we are not suggesting that gender stereotypes and expectations do not play a role in the misperception of anger on a male face or of happiness on a female face. The present results may in part have occurred because people have internalized actual differences in the frequency with which the sexes express anger and happiness. Of course, learning and evolutionary constraints are interacting components of psychological explanation, with learning often being biased in a fashion consistent with the enduring ecological realities of human social life (Kenrick, Becker, Butner, Li, & Maner, 2003; Öhman & Mineka, 2001). The association of anger with males and happiness with females represents a likely candidate for an interaction of adaptive biases and learning experiences. Nevertheless, when an emotional expression must be deciphered rapidly, factors at the level of the signal may play the greatest role in successful decisions.

We have taken an ecological and evolutionary perspective in conceptualizing the potential links between biological sex and facial expressions. From this perspective, the physiognomic indicators of maleness and femaleness differ to some extent in the threats and opportunities that they afford others. Similarly, facial expressions of anger and happiness also differ in the affordances they communicate. Our findings provide evidence that these two sets of affordances are not entirely independent. Danger is afforded by expressions of anger and also, to some degree, maleness. Nurturance is afforded by expressions of happiness and also, to some degree, femaleness. Future research should further investigate the extent to which the intersection of these affordances is instantiated in the perceiver, the face, or both.

References

Aronoff, J., Woike, B. A. & Hyman, L. M. (1992). Which are the stimuli in facial displays of anger and happiness? Configurational bases of emotion recognition. *Journal of Personality and Social Psychology, 62,* 1050–1066.

Ashby, F. G., & Townsend, J. T. (1986). Varieties of perceptual independence. *Psychological Review, 93,* 154–179.

Becker, C. A., & Killion, T. H. (1977). Interaction of visual and cognitive effects in word recognition. *Journal of Experimental Psychology: Human Perception and Performance, 3,* 389–401.

Becker, D. V., Goldinger, S., & Stone, G. O. (in press). Reading words and werds: Two-way mirror effects. *Memory & Cognition.*

Berry, D. S., & McArthur, L. Z. (1986). Perceiving character in faces: The impact of age-related craniofacial changes on social perception. *Psychological Bulletin, 100,* 3–18.

Bowlby, J. (1969). *Attachment and loss: Vol. 4. Attachment*. New York: Basic Books.

Bruce, V, & Young, A. (1986). Understanding face recognition. *British Journal of Psychology, 77,* 305–327.

Daly, M., & Wilson, M. (1994). Evolutionary psychology of male violence. In J. Archer (Ed.), *Male violence* (pp. 253–288). New York: Routledge.

Darwin, C. (1872). *The expression of emotion in man and animals.* London: Murray.

Eastwood, J. D., Smilek, D., & Merikle, P. M. (2003). Negative facial expression captures attention and disrupts performance. *Perception & Psychophysics, 65,* 352–358.

Ekman, P., & Friesen, W. V. (1975). *Pictures of facial affect.* Palo Alto, CA: Consulting Psychologist Press.

Fabes, R. A., & Martin, C. L. (1991). Gender and age stereotypes of emotionality. *Personality and Social Psychology Bulletin, 17,* 532–540.

Fazio, R. H. (2001). On the automatic activation of associated evaluations: An overview. *Cogntion & Emotion, 15,* 115–141.

Feder, K. L., & Park, M. A. (2001). *Human antiquity: An introduction to physical anthropology and archaeology.* New York: McGraw–Hill.

Garner, W. (1974). *The processing of information and structure*. New York: Wiley.

Gibson, J. J. (1979). *The ecological approach to visual perception.* Boston: Houghton Mifflin.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in social cognition. *Journal of Personality and Social Psychology, 74,* 1464–1480.

Grossman, M., & Wood, W. (1993). Sex differences in intensity of emotional experience: A social role interpretation. *Journal of Personality and Social Psychology, 65,* 1010–1022.

Haselton, M., & Buss, D. (2000). Error management theory: A new perspective on biases in cross-sex mind reading. *Journal of Personality and Social Psychology, 78,* 81–91.

Hugenberg, K., & Bodenhausen, G. V. (2003). Facial prejudice: Implicit prejudice and the perception of facial threat. *Psychological Science, 14,* 640–643.

Hugenberg, K., & Bodenhausen, G. V. (2004). Ambiguity in social categorization: The role of prejudice and facial affect in race. *Psychological Science, 15,* 342–345.

James, W. (1890). *Principles of psychology.* New York: Holt.

Kenrick, D. T., Becker, D. V., Butner, J., Li, N. P., & Maner, J. K. (2003). Evolutionary cognitive science: Adding what and why to how the mind works. In K. Sterelney & J. Fitness (Eds.), *From mating to mentality: Evaluating evolutionary psychology (*pp. 13–38). New York: Psychology Press.

LaFrance, M., Hecht, M. A., & Levy Paluck, E. (2003). The contingent smile: A meta-analysis of sex differences in smiling. *Psychological Bulletin, 129,* 305–334.

Le Gal, P. M., & Bruce, V. (2002). Evaluating the independence of sex and expression in judgments of faces. *Perception & Psychophysics, 64,* 230–243.

Martin, C. L. (1987). A ratio measure of sex stereotyping. *Journal of Personality and Social Psychology, 52,* 489–499.

McArthur, L. Z., & Baron, R. M. (1983). Toward an ecological theory of social perception. *Psychological Review, 90,* 215–238.

Neely, J. H. (1991). Semantic priming effects in visual word recognition: A selective review of current findings and theories. In D. Besner & G. W. Humphreys (Eds.), *Basic processes in reading: Visual word recognition* (pp. 264–336). Hillsdale, NJ: Erlbaum.

Öhman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. *Psychological Review, 108,* 483–522.

Panksepp, J. (2001). On the subcortical sources of basic human emotions and the primacy of emotional–affective (action–perception) processes in human consciousness. *Evolution & Cognition, 7,* 134–140.

Plant, E. A., Hyde, J. S., Keltner, D., & Devine. P. G. (2000). The gender stereotyping of emotions. *Psychology of Women Quarterly, 24,* 81–92.

Ravosa, M. J. (1989). Browridge development in anthropoid primates. *American Journal of Physical Anthropology, 78,* 287–288.

Reed, E. S. (1996). *Encountering the world: Toward an ecological psychology.* New York: Oxford University Press.

Schvaneveldt, R. W., & McDonald, J. E. (1981). Semantic context and the encoding of words: Evidence for two modes of stimulus analysis. *Journal of Experimental Psychology: Human Perception and Performance, 7,* 673–687.

Shaw, R. E., & Pittenger, J. B. (1977). Perceiving the face of change in changing faces: Implications for a theory of object recognition. In R. E. Shaw & J. Bransford (Eds.), *Perceiving, acting, and knowing: Toward an ecological psychology.* Hillsdale, NJ: Erlbaum.

Taylor, S. E., Klein, L. C., Lewis, B. P., Gruenewald, T. L., Gurung, R. A. R., & Updegraff, J. A. (2000). Biobehavioral responses to stress in females: Tend-and-befriend, not fight-or-flight. *Psychological Review, 107,* 411–429.

Trivers, R. L. (1985). *Social evolution.* Menlo Park, CA: Benjamin/Cummins.

Van Orden, G. C. (1987). A ROWS is a ROSE: Spelling, sound, and reading. *Memory & Cognition, 15,* 181–198.

Received February 6, 2005
Revision received June 14, 2006
Accepted July 25, 2006 ■