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THE CATEGORICAL PERCEPTION OF EMOTIONS AND TRAITS

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Facial expressions of happiness and anger have been suggested to share morphological features with certain personality markers in the face. A study was conducted to assess the hypothesis that angry and dominant faces on one hand and happy, fearful, and affiliative faces on the other hand would be categorized together based on the features they share. A total of 89 participants (22 men) completed a double oddball task. Reaction time data confirmed the hypothesis for angry/dominant and happy/affiliative faces. This supports the notion that the perceptual markers for anger and dominance as well as happiness and affiliation have some morphological characteristics in common.

Men's and women's emotion expressions are not perceived in the same way. Specifically, anger is perceived more readily when shown by men and happiness is perceived more readily when shown by women (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007; Hess, Blairy, & Kleck, 1997). Becker et al. (2007) also demonstrated that faces in which brow ridge distance was manipulated were rated as more angry to the same degree that they were rated as more masculine. They trace this link to the fact that angry features have evolved to mimic masculinity and happy features to mimic neoteny and femininity.

Hess, Adams, and Kleck (2007b) suggest a mediating variable. According to them it is not masculinity/femininity per se which drives this effect but rather the related but more proximal constructs of dominance, and affiliation, which have

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more direct behavioral implications. Specifically, they have shown that the tendency to attribute anger more readily to men and happiness more readily to women is partially mediated by differences in their respective levels of perceived dominance and affiliation. Importantly, a number of aspects of facial appearance that entrain perceptions of dominance and affiliation are highly confounded with sex markers. Thus, a high forehead, a square jaw and thicker eyebrows have been linked to perceptions of dominance (e.g., Keating, Mazur, & Segall, 1981; Zebrowitz, 1997) and are typical for men's faces (Brown & Perrett, 1993; Burton, Bruce, & Dench, 1993). On the other hand, a rounded baby-face with large eyes is more feminine (Brown & Perrett, 1993; Burton, Bruce, & Dench, 1993), perceived as more approachable and warm (Berry & Brownlow, 1989), and is more typical for women's faces. Thus, anger, dominance and male sex markers on the one hand and happiness, affiliation, and female sex markers on the other are partially overlapping and functionally equivalent. This functional equivalence hypothesis (Hess et al., 2007b) predicts that angry and dominant faces on the one hand and happy and affiliative faces on the other hand are perceptually categorized together.

This prediction can be reconciled within a face space perspective. Specifically, faces that are close together in face space are more likely to be confused in a discrimination task, whereas those which are separated in face space are more readily discriminated (Valentine, 1991). Extending this logic, which has mostly been applied to face recognition (for a review see Valentine, 2001), one could argue that if dominant and angry faces on one hand and happy and affiliative faces on the other share morphological features, then such faces should be closer together in face space. This implies that when embedded in a context of happy faces, dominant faces should be more distinct and hence easier to recognize and the converse should obtain for affiliative faces embedded in a context of angry faces (see also Potter, Corneille, Ruys, & Rhodes, 2007 for a related argument).

The present research had the aim to test this hypothesis using an adaptation of an elegant paradigm by Campanella et al. (2002). This paradigm is based on the oddball task used in ERP studies. An oddball paradigm consists of presenting a frequent or standard stimulus most of the time as well as an infrequent, deviant one. This paradigm usually serves to assess attentional processes and P300 is recorded as the relevant dependent measure (Garcia-Larrea, Lukaszewicz, & Mauguière, 1992). Campanella et al. (2002) adapted this paradigm with the goal of testing whether two facial expressions belong to the same or a different perceptual category than the standard stimulus expression. For this, they employed one facial expression as a standard stimulus and added not one but two oddballs such that one of the two deviant stimuli belonged to the same perceptual category as the standard stimulus (within category stimulus) whereas the other belonged to a different category (between category stimulus). The behavioral data presented by Campanella et al. (2002) shows that participants react faster and more accurately to the between category deviant stimulus than to the within category stimulus.

In the present study we adapted the paradigm to measure only reaction times. ERPs were not included because in the Campanella et al. (2002) study this measure and the reaction time data were highly correlated. To test our hypothesis, we presented participants with blocks of facial expressions as standard stimuli as well as a small number of neutral faces as deviants. The neutral faces had been preselected to be either highly dominant or highly affiliative. The participants' task was to click a mouse button as fast as possible on seeing a neutral face.

We predicted that when anger faces are standard stimuli, dominant neutral faces will be reacted to slower as they will be perceived as within category stimuli and affiliative faces will be reacted to faster as they will be perceived as the between category stimuli. Conversely, when happy faces are standard stimuli, affiliative neutral faces will be reacted to slower as they will be perceived as within category stimuli and dominant faces will be reacted to faster as they will be perceived as the between category stimuli. Based on recent arguments by Marsh, Adams, and Kleck (2005) that fear faces are both affiliative and share appearance cues with female faces, we included fear faces as well.

METHOD

PARTICIPANTS

A total of 89 (22 men) participants were recruited at Dartmouth College. Due to a clerical error, data from two female participants were lost.

STIMULUS MATERIAL

Nine male and nine female stimulus persons showing anger, happiness, and fear were selected from the NimStim Stimulus Set (Tottenham, Borscheid, Ellertsen, Marcus, & Nelson, 2002). Each emotional face appeared three times in the stimulus sequence. Based on a pretest, we selected from a database of neutral faces three male and three female highly dominant and highly affiliative faces. The selected deviant stimuli were all above the 90th percentile for ratings of dominance and affiliation respectively. Standard and deviant stimuli were matched on sex.

This resulted in 6 experimental blocks: two blocks of either male or female anger, happiness, or fear standards with matching male or female dominant and affiliative deviants. Each participant saw one block with male and one block with female faces for one emotion. Each block contained 27 emotion faces along with three affilative and three dominant deviants. The order of these two blocks was counterbalanced between participants. Each face was presented for 500 ms followed by a 500 ms ISI.

PROCEDURE

Participants performed the task in groups of up to four. After completing informed consent, participants were seated in front of a computer. Instructions were presented on screen. The participants' task was to press a button as fast as possible whenever they saw a neutral face.

DATA TREATMENT

Reactions that occurred more than 1000 ms after stimulus onset (that is, after the onset of the following face) were deleted. If participants failed to identify an oddball as neutral, the longest possible RT (1000ms) was used as the value for that trial. The RTs were averaged within condition.

RESULTS

Initial analyses did not reveal any significant main effect or interaction involving participant sex. This factor was therefore dropped from the subsequent analysis.

We predicted that participants who saw neutral faces within angry standard expressions would react faster to affiliative oddballs than to dominant oddballs, because dominant and angry faces belong to the same perceptual category. Conversely, when the standard was a happy or fear face, we expected faster reactions to dominant oddballs. These predictions were confirmed for anger and happiness.

A 3 (emotion) x 2 (target gender) x 2 (facial appearance: dominant versus affiliative) mixed model analysis of variance with emotion as between and target gender and facial appearance as within subject factors was conducted on the reaction times. A main effect of emotion emerged, $F(2, 84) = 4.16$, $p = .019$, $\eta^2 = .09$, such that overall reaction times were slower during anger blocks ($M = 651$, $SD = 97$) than during fear ($M = 577$, $SD = 75$, $p = .003$) and happiness ($M = 608$, $SD = 107$, $p = .079$) blocks which did not differ ($p = .214$).

As predicted, an emotion by facial appearance interaction emerged, $F(2, 84) = 16.23$, $p < .001$, $\eta^2 = .28$, (see Figure 1) such that in anger blocks reaction times were faster to affiliative than to dominant neutral faces, whereas in happiness blocks reaction times were faster to dominant than to affiliative faces. No difference between dominant and affiliative deviants emerged for fear blocks. This interaction was qualified by an emotion x facial appearance x target gender interaction, $F(2, 84) = 4.84$, $p = .014$, $\eta^2 = .10$. Post-hoc tests ($p < .05$) revealed that for female faces the difference between the affiliative and dominant deviants was significant for anger and happiness. For male faces the pattern of means was the same, but the difference reached significance only for the anger condition.

DISCUSSION

As predicted by the functional equivalence hypothesis and consistent with what would be predicted in an extension of the face space perspective, angry and dominant faces on one hand and happy and affiliative faces on the other hand were categorized together, even though the latter effect was attenuated for male faces.

However, contrary to suggestions by Marsh et al. (2005), fear faces were not categorized together with affiliative faces. This may have been because fear signals less affiliation than does happiness (Hess, Blairy, & Kleck, 2000). It is possible that for the present categorization effects, the perceptual overlap between emotion expressions and facial traits has to be relatively strong as is the case for anger/dominance and happiness/affiliation respectively. This may also explain the somewhat

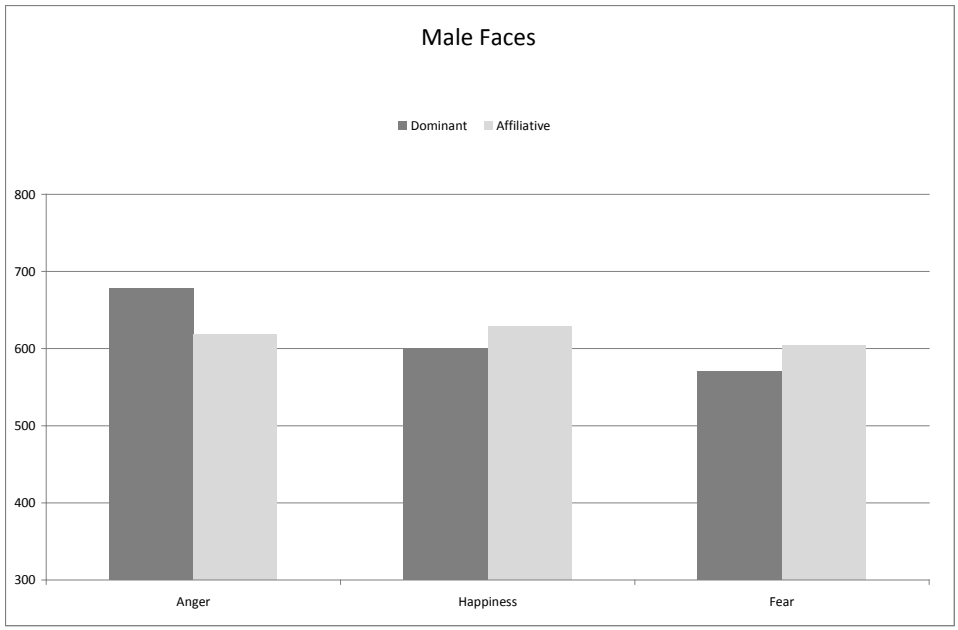

FIGURE 1. Mean reaction time as a function of emotion and facial appearance for female and male faces.

attenuated effect for happiness in male faces. Specifically, the perceptual overlap between happiness and affiliation may depend strongly on the round face as the other feature of a smiling face, wrinkles around the eye, are not a signal of affiliation. It is possible that even a very affiliative male face presents less roundness and hence would be further removed in face space from happiness than would a female face.

Although not the primary finding of the current study, the present data provide further indirect evidence for the notion that anger is better decoded from male faces and happiness from female faces because male faces are more dominant and female faces are more affiliative and these traits share important morphological signals with the respective emotion expressions (Hess et al., 2007b). This finding is in accordance with previous work demonstrating confounding variability between gender and emotion (Becker et al., 2007; Hess et al., 1997) and fits with the overarching functional equivalence hypothesis predicting a link between affiliation/dominance and happiness/anger respectively.

They also provide further evidence that Becker et al.'s (2007) and Hess et al.'s (1997) findings are not due to the simple application of gender stereotypes. Since men are expected to show more anger whereas women are expected to smile more (see e.g., Fischer, 1993), it is conceivable that the higher accuracy for male anger and female happiness observed by Becker et al. (2007) and Hess et al. (1997) is due to a stereotype driven rating bias. However, such a bias would not imply that angry/dominant and happy/affiliative faces would be respectively categorized together. Such a categorization is more parsimoniously explained by the perceptual

closeness of these faces in face space as postulated by the functional equivalence hypothesis.

Yet, it could be argued that angry and dominant faces and happy and affiliative faces respectively share not only perceptual features but also common valences. In fact, it is reasonable to believe that dominance is somewhat negatively valenced in that highly dominant alpha individuals pose a certain threat insofar as they can claim territory or possessions (e.g., food) from lower status group members (Menzel, 1973, 1974). Hence, the presence of a perceived dominant other should lead to increased vigilance and preparedness for withdrawal (Coussi-Korbel, 1994). Conversely, affiliation is strongly linked to nurturing behaviors and should lead to approach when the other is perceived to be high on this behavioral disposition. It is therefore possible that participants were faster to detect the face with the mismatched valence. However, there is little evidence that dominant and affiliative faces are responded to in that way. In fact, there is evidence that neutral faces elicit emotional reactions that are intermediate between happy and angry faces (Hess, Adams, & Kleck, 2007a). That is, if valence where the mediating variable we would expect attenuated effects.

In sum, our findings suggest that anger/dominance and happiness/affiliation not only signal the similar meaning, but under certain conditions are functionally the same. The present research also provides evidence, albeit indirect, for the notion that the male anger and female happiness are more readily decoded because men's faces are more dominant and women's faces more affiliative and anger and happiness share important morphological features with dominance and affiliation respectively--to the point that these emotions and traits are categorized together.

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