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INTERACTIVE EFFECTS

APPROACH-AVOIDANCE MOVEMENT INFLUENCES THE DECODING OF ANGER AND FEAR EXPRESSIONS

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In two studies, the authors examined whether apparent motion of a face (either toward or away from an observer) influences the recognition of facial displays of anger and fear. Based on theories regarding the signal value of specific threat displays (i.e., shared signal hypothesis), the authors predicted that anger (an approach-oriented threat display) would be more readily recognized in faces that appear to be approaching the observer, whereas fear (an avoidance-oriented threat display) would be more readily recognized in faces that appear to be withdrawing. Consistent with these predictions, the authors found that angry faces were recognized more accurately when approaching versus withdrawing, and vice versa for fearful faces. This occurred not only for faces that were made to appear moving by changing the size of the stimulus (Study 1), but also for faces that were presented after a visual illusion that gave the perception that the faces were approaching or withdrawing (Study 2). These findings suggest that the ability to recognize threat from facial expressions is influenced by apparent motion in an ecologically relevant manner, matching the underlying action tendency (fight/flight) associated with each emotion.

Imagine an unfamiliar person quickly approaching you. Is the person angry at you? Scared? Clearly, the facial muscle patterning associated with emotional expression can be used to help identify an emotion. But other contextual cues, such

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as movement toward or away from you, may also provide additional sources of information about the expression being displayed. Arguably, it would be more beneficial to survival to recognize anger rather than fear on an approaching face, given that a person expressing anger may intend to harm you. Although approach and avoidance behavioral tendencies are considered a fundamental ingredient of emotionality (e.g., Fridlund, 1994; Frijda, 1995), a direct link between emotion and behavior remains debatable (e.g., Baumeister, Vohs, DeWall, & Zhang, 2007). In the current studies, we examine whether emotions and actions are perceptually linked. Specifically, we examine whether apparent approach-avoidance motion moderates the ability to identify anger and fear expressions.

We argue here that the role of motion in emotion perception is traced, at least in part, to the behavioral-signaling function of facial expressions. Given that the etymological derivation of the word "emotion" is "to move out," it is perhaps unsurprising that some theorists have claimed a direct link between emotion and functional behavior (see Weisbuch & Adams, 2012). Although Darwin (1872/1997) theorized that facial expressions do not take their form as a function of sociocommunicative pressures throughout evolution, they can be used to predict behavior. Along these lines, Ekman (1972) suggested that facial expressions serve as a direct external read-out of the emotional state of the expresser. By this approach, expressions reflect their emotion-infused intentions. Fridlund (1994) went even further to suggest that the primary function of emotional expressions is to *signal* basic behavioral intentions. Critically, no theory of emotion, to our knowledge, denies the important signal value of expressions to observers.

Most work examining the role of behavioral intentions in emotion has focused on the *experience* of emotion rather than the perception of it in others (Davidson & Hugdahl, 1995; Harmon-Jones, 2003). The most fundamental behavioral intentions associated with emotional experience have been argued to be approach and avoidance (Davidson & Hugdahl, 1995). Indeed, the close relationship between approach-avoidance and emotional valence (positive/negative) has been supported by evidence that positive emotion and approach motivation are left-hemispheric lateralized, whereas negative emotions and avoidance motivation are right-hemispheric lateralized. Recent research helped specify this relationship by demonstrating that anger, a negative, approach-oriented emotion ("aggress" etymologically means "to move toward"), is associated with greater left- versus right-hemispheric activation, similar to positive emotions (Harmon-Jones, 2003). This evidence suggests that at a broad level, emotional processing in the brain fundamentally reflects approach-avoidance tendencies—perhaps even more than emotional valence.

Recently, efforts have been made to examine the link between these behavioral intentions and the perception of emotional expressions. Adams and Kleck (2003) examined this link through tests of the *shared signal hypothesis*, finding that efficient recognition of facial expressions is moderated by eye gaze, a subtle but powerful cue that can signal approach (i.e., direct gaze) versus withdrawal (i.e., averted gaze) behavior. In their initial studies, they found that expressions associated with approach (i.e., anger and joy) were identified more efficiently when paired with direct gaze. Likewise, expressions associated with avoidance (i.e., fear and sadness) were identified more efficiently when paired with averted gaze (Adams & Kleck, 2003). This hypothesis has received wide-ranging support across different stimuli and methodologies (e.g., Benton, 2010; Milders, Hietanen, Leppänen, &

Braun, 2011; N'Diaye, Sander, & Vuilleumier, 2009; Rigato, Farroni, & Johnson, 2010). Notably, however, eye-gaze direction is an indirect cue as it simply forecasts actual behavioral approach or avoidance.

In the current study, we examine the shared signal hypothesis using a more direct cue to approach-avoidance: apparent motion. Demonstrating that movement of a face toward or away from an observer fundamentally influences the recognition of facial expressions would offer stronger evidence that these action tendencies are inherent to what is signaled by the expressions. To our knowledge, only two publication have directly examined the expression-action link in perceiving facial expressions. Adams, Ambady, Macrae, and Kleck (2006) focused on the impact of expression on motion perception, finding that faces with angry expressions were more efficiently labeled as approaching than withdrawing, relative to fearful expressions. However, the authors did not find the predicted reverse effect for fear. They concluded that this might be because fear signals freezing responses before withdrawal, because freezing is an adaptive response for some animals (LeDoux, 1995), such as when being stalked by a predator that uses motion to recognize its prey. This finding, however, does not necessarily mean that fear expressions do not also signal a tendency to flee, and thus begs the question as to whether perceived movement of a face toward or away from an observer will influence the recognition of a concurrently displayed expression, something that was not examined in those initial studies.

Van Peer, Rotteveel, Spinhoven, Tollenaar, and Roelofs (2010) replicated the finding of Adams et al. (2006) that angry faces prime faster detection of approaching faces. However, when they asked participants to label the expression (rather than the motion), they found the reverse effect such that angry faces were now actually labeled more efficiently when withdrawing than approaching, a surprising finding given the known approach-oriented action tendencies associated with anger. They argued that anger is an aversive stimulus and therefore should be avoided by the participant, and hence would be associated with withdrawal-oriented behavioral intent on the part of the observer. This explanation, however, does not square with evidence that anger is an approach-related emotion (Harmon-Jones, 2003) and when viewed on others can also elicit approach-related tendencies in the perceiver (Wilkowski & Meier, 2010).

So what might explain this puzzling discrepancy? It is possible that when pitting two approach-related expressions against one another (i.e., anger and joy), the contrast in valence drives simulated evaluative responses previously found in the embodiment literature (i.e., push/withdrawal for aversive stimuli, pull/approach for rewarding stimuli), as suggested by van Peer et al. (2010). To specifically examine action tendencies signaled by the stimulus itself (rather than action tendencies elicited in the observer), a more tightly controlled experiment needs to control the confounding factor of valence, as Adams et al. (2006) did. To address this issue in the current paradigm, which is again focused on the behavioral intentions signaled by the stimulus expression, not behavioral responses of the observer, we used anger and fear expressions. These emotions are both clearly associated with survival-dependent approach (fight) and avoidance (flight) behaviors, respectively (Harmon-Jones, 2003), and control for both valence and arousal confounds as they are both negatively valenced, highly arousing expressions, hence occupying similar space in popular circumplex models of emotion (i.e., Russell, 1980; Watson & Tellegen, 1985). Therefore, anger and fear are diametrically opposed with regard to the primary dimension of interest in this study, the behavioral intentions that they signal, while controlling for other aspects of emotionality.

OVERVIEW OF STUDIES

Across two studies, we examine whether the apparent motion of a face moderates the recognition of expressions on that face. In Study 1, we used changes in size to make the faces appear to move away (i.e., by making smaller) or move toward (i.e., by making them larger) the participant. In Study 2, we used a visual illusion to create the perception that the face was moving toward or away from the participant with no actual change in the size of the stimulus.

STUDY 1

We predicted that if the perception of emotional expression is linked to perceived action tendencies associated with approach and avoidance, the recognition of such expressions would be influenced by concurrent approach-avoidance motion. To test our hypothesis, we used three types of expressive faces: pure anger expressions, pure fear expressions, and ambiguous expressions (50-50 blends of pure anger/fear). We predicted that pure expressions would be more readily recognized when coupled with a congruent action (i.e., anger approaching, fear withdrawing). Additionally, we included ambiguous faces to examine whether apparent motion can actually bias perceptions of expressions rather than simply facilitating the identification of pure expressions. As such, we expected that ambiguous threat faces would more likely be labeled as "angry" when approaching and as "fear" when withdrawing.

METHOD

Participants

Seventy-nine undergraduates received course credit for participation. No demographic information was collected.

Materials

Pure Expressions. Sixteen individuals (eight males, eight females) depicting anger and fear expressions were selected from the Montreal Set of Facial Displays of Emotion (Beaupré et al., 2000) and the Pictures of Facial Affect set (Ekman & Friesen, 1976).[1]

Ambiguous Expressions. Anger and fear expressions of the same individual were blended (50% anger, 50% fear of same individual) using a morphing algorithm

1. Stimulus set was initially included as a factor in all analyses but did not moderate any of the effects.

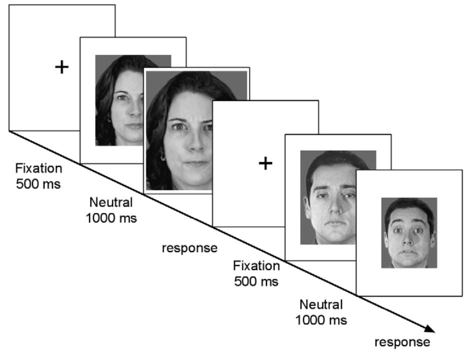

FIGURE 1. Example of the paradigm used in the current study. Each trial begins with fixation for 500 ms, followed by a neutral face that is 180 by 250 pixels for 1000 ms.Then a threat-related expression (pure anger, pure fear, or blended anger and fear) is displayed either in a larger size (235 by 325 pixels) to simulate approach or in a smaller size (135 by 185 pixels) to simulate withdrawal. The expressive face was left on the screen until participants made a response. Images in the figure come from the Montreal Set of Facial Displays of Emotion (Beaupré et al., 2000).

from Morph 2.5 software for Macintosh to create ambiguous facial expressions. The resulting photographs were inspected by an expert trained in the Facial Action Coding System (FACS; see Ekman & Friesen, 1976) to ensure that the faces resulted in facial muscle patterning that could naturally occur.

Design and Procedure. Stimulus presentations and responses were collected on PC computers using MediaLab software. Each trial began with a fixation point displayed for 500 ms. Following this trial, an 180 by 250 pixel neutral face appeared on screen for 1000 ms. This was followed by an expressive face of the same individual that was either larger (235 by 325 pixels) or smaller (135 by 185 pixels), giving the impression that the face was approaching/withdrawing from the observer, respectively (see Figure 1). When reaching their end states, the faces remained on the screen until a response was made. Participants indicated via mouse click whether an angry or fearful face was presented on each trial. Emotion labels and mouse buttons were counterbalanced across participants. Participants were encouraged to respond as quickly and as accurately as possible. There were 128 pure expression trials, with each of the 16 stimulus persons being presented twice for each expression and twice for each motion direction. Additionally, these 16 persons were used twice for each motion condition in the ambiguous face trials, resulting in 64 of these trial types and 192 trials overall. The order of presentation of these trials was random.

RESULTS

Pure Expressions. For pure expressions trials, accuracy of response was the dependent variable (coded as accurate = 1, inaccurate = 0). These data were submitted to a linear mixed model with the intercept, expression (2: anger = 0.5/fear = −0.5), apparent motion (2: approach = 0.5/avoidance = −0.5), and their interaction, all as fixed factors as well as random with respect to participant and the identity of the face (the face identity was repeated with both expressions). There was no main effect for apparent motion (p = .396); however, there was a nonsignificant trend toward fearful faces being identified more accurately than angry faces, β = −.04, SE = .023, F(1, 22.5) = 2.91, p = .102.[2] Critically, this trend was qualified by the predicted expression by motion interaction, approach/avoidance 0.03, SE = 0.01, F(1, 46.6) = 7.13, p = .010. Anger was identified more accurately on approaching faces than on withdrawing faces, simple β = 0.06, SE = 0.02, t = 2.34, p = .024. Conversely, withdrawing fear was not identified significantly more accurately than approaching fear, but was in the predicted direction, simple β = 0.02, SE = 0.02, t = 0.95, p = .349.

Ambiguous Faces. Labels for ambiguous faces were coded as 0 = anger and 1 = fear. Data were then submitted to a binomial generalized linear mixed model analysis with the intercept and apparent motion as fixed effects (coded as approach = −0.5, avoidance = 0.5) and random relative to (a) participant and (b) face identity of the stimulus. Critically, and consistent with our hypotheses, withdrawing faces were more likely to be labeled as fearful, whereas approaching faces were more likely to be labeled as angry, β = 4.15, SE = 0.49, z = 8.52, p < .001. This suggests that apparent motion not only facilitates processing of pure expressions, but also can bias the perception of ambiguous expressions depending on the direction of the apparent motion.

DISCUSSION

The results of Study 1 suggest that action tendencies are perceptually linked with the recognition of emotional expressions. The recognition of pure displays of anger and fear was moderated by apparent motion, such that anger was identified more accurately when approaching than when withdrawing, and fear was identified more accurately when withdrawing than when approaching, although this effect did not reach significance. Ambiguous expressions also showed a consistent pattern of effects such that when they appeared to be approaching, they were relatively more likely to be labeled as angry, whereas when appearing to withdraw, they were relatively more likely to be labeled as fearful.

One limitation of Study 1 is that apparent motion and the size of the end-state stimulus were confounded. Because we manipulated apparent motion by shrinking (to simulate dynamic withdrawal) or enlarging (to simulate dynamic approach) the face, it is possible that our effects were due to anger being perceived more readily in larger faces and fear in smaller faces. To test this possibility, Study 2 manipulated the apparent motion of the face while keeping stimulus size constant.

STUDY 2

Study 2 used a motion aftereffect visual illusion to induce the apparent motion of faces in the absence of actual changes in size. The motion aftereffect represents

2. All analyses were conducted using the "lme4" package for R. Because no degrees of freedom or significance values are given for linear mixed models by this package, we used the "MixMod" package to obtain this information using the Satterthwaite approximation. Simple slopes were obtained using an online calculator (as described in Preacher, Curran, & Bauer, 2006).

an opponent process induced by viewing sustained motion of a stimulus for a prolonged period of time. After this illusion is induced, stationary objects immediately introduced to the visual field appear to move in the opposite direction. This is often referred to as the "waterfall effect" because the same sensation can be achieved by staring at a waterfall for a prolonged period of time and then looking away from it. Neural adaptation drives this effect, whereby the neurons that code motion in a specific direction become less responsive over time (Barlow & Hill, 1963). As they remain discharged, the relative baseline for motion perception is altered, causing a stimulus to appear to be moving in the opposite direction of the initial adaptation.

Our hypotheses for Study 2 mirrored those of Study 1. We expected that pure expressions of anger would be labeled more accurately on approaching versus withdrawing faces, and vice versa for fearful faces. Likewise, we predicted that ambiguous expressions would be labeled more often as angry when the face appeared to be approaching the participant and fearful when the face appeared to be withdrawing from the participant.

METHOD

Participants

Forty-one undergraduates (20 males, 21 females, average age = 19.02, *SD* = 1.77) received course credit for their participation.

Stimuli and Materials

Ambiguous and Pure Expressions. The same stimuli used in Studies 1 and 2 were used in the current study.

Motion Adaptation. To create a motion aftereffect, a motion adaptation stimulus was retrieved from a visual illusion website (Bach, 1997; http://www.michaelbach.de/ot/mot_adapt/index.html). In this illusion, a black and white checkered spiral animation appears to cycle inward or outward to induce the perception of contraction or expansion, respectively. Viewing this stimulus for a prolonged period induces motion adaptation effects to subsequent faces that thus now appear to expand, thereby approaching the participant, or to contract, thereby withdrawing from the participant.

Design and Procedure

This study was administered on PCs using E-Prime 2.0 software with a screen resolution of 1280 by 1024 pixels. Participants were seated approximately 100 cm from the computer monitor. The study consisted of eight alternating blocks of approach and avoidance adaptation conditions. In each block, the adaptation spiral remained on the monitor for 60 s, followed by the presentation of 12 faces, centrally presented on the monitor, one by one, at a constant size of 237 by 305 pixels. Participants were instructed to, as quickly and accurately as possible, label each face presented as angry or fearful via mouse click. Each block consisted of four stimulus persons (two male and two female) expressing one of each expression (anger/fear/ambiguous), for a total of 96 trials. The order of presentation was randomized within block. There was a 30-s break between each block to allow the previous effects of the adaptation to dissipate.[3]

RESULTS

Pure Expressions. As in Study 1, for pure expressions trials, accuracy of response was the dependent variable (coded as accurate = 1, inaccurate = 0) and submitted to a linear mixed model with the intercept, expression (2: anger = 0.5/fear = −0.5), apparent motion (2: approach = 0.5/avoidance = −0.5), and their interaction, all as fixed factors as well as random with respect to participant and the identity of the face. This yielded no main effects of expression or motion (ps > .59). Crucially, the predicted expression by motion interaction was apparent, $\beta = 0.04$, $SE = 0.02$, $F(1, 113.9) = 3.75$, $p = .055$. Neither of the simple slopes, broken down by anger ($p = .121$) and fear ($p = .400$), were significant, but both were in the predicted directions. The pattern of effects matched that in Study 1, such that anger was more accurately identified on approaching faces whereas fear was identified on withdrawing faces.

Ambiguous Expressions. As in Study 1, labels applied to the ambiguous faces were coded as 0 = anger and 1 = fear and submitted to a binomial logistic regression. Contrary to Study 1, the apparent motion of the face had no impact on labels, $\beta = -0.01$, $SE = 0.13$, $z = -0.11$, $p = .915$.

DISCUSSION

Study 2 partially replicated the primary finding of Study 1 by revealing again that accuracy of identifying pure expressions was influenced by the apparent motion of the face. Recognition of anger expressions was relatively higher when faces appeared to be approaching the participant, whereas fear was relatively higher when faces appeared to withdraw from the participant. This result provides additional support for the conclusion that approach-avoidance is intertwined with the perception of anger and fear expressions, while controlling for size of stimulus.

Counter to our predictions, ambiguous expressions did not replicate the significant effects of Study 1. If the motion were providing a contextual cue by which we interpret the expression, we would expect even stronger effects under conditions of ambiguity. That we found more robust and consistent effects for pure expressions suggests that the apparent movement is not so much resolving the signal value of expression under conditions of ambiguity but rather is augmenting the signal value apparent under conditions of low ambiguity. Thus, it is possible that the visual adaptation paradigm used in Study 2 simply was not strong enough to bias the perception of ambiguous expressions, but was strong enough to resonate with

3. The parameters of the adaptation were determined through pilot tests to obtain a maximal effect across each block of faces. Also note that analyses were all first conducted with presentation order included in the model to determine whether faces presented more proximally to the motion manipulation would show the greatest results, which they did not.

the clear signal value of pure expression. Visual adaptation is a more subtle manipulation of motion than that used in Study 1, where size of stimulus augmented the illusion of motion. Additionally, it is possible that the expressions themselves affected the strength of the motion aftereffect. When the face was clearly angry or fearful, the aftereffects may have been stronger for approaching and withdrawing illusions, respectively. Thus, when the face was ambiguous, the motion aftereffect may have been weaker. Further research should examine whether the facial expressions themselves affect the strength of the motion aftereffect.

AGGREGATED RESULTS OF STUDIES 1 AND 2

To conduct direct comparisons of the effect of apparent motion on anger and fear separately across studies, we meta-analyzed the effects found in Studies 1 and 2. For pure expressions, this analysis yielded a significant effect for both anger, $Z = 2.55$, $p = .011$, such that it was more accurately labeled when perceived to be approaching, and fear, $Z = 2.52$, $p = .012$, such that it was more accurately labeled when perceived to be withdrawing. Thus, across these two studies, we have strong evidence to conclude that approach motion facilitates the identification of anger and that withdrawal motion facilitates the identification of fear.

For ambiguous expressions, we combined the effects of apparent motion on the labeling of these expressions (coding 0 as anger and fear as 1). Overall, fear labels were indeed applied more frequently to ambiguous faces when withdrawing versus approaching, $Z = 5.68$, $p < .001$. This should be interpreted with caution, however, as we outlined how the apparent motion manipulation in Study 2 may qualitatively differ from that used in Study 1.

GENERAL DISCUSSION

These studies show that anger is more accurately identified when appearing to approach an observer, whereas fear is more accurately identified when appearing to withdraw from an observer. In Study 1, we also found evidence that the apparent motion of a face can bias the labeling of ambiguous facial expressions such that they are relatively more likely to be labeled as angry if approaching and fearful if withdrawing when change in size is used to manipulate apparent motion. When the simulation of motion was more subtle, however, as with the manipulation of apparent motion aftereffects in Study 2, labels for ambiguous expressions were not influenced by the apparent motion. This suggests that approach-avoidance action is integrated as an additional source of perceptual information when identifying expressions, rather than as a contextual cue that resolves ambiguity in expression via a purely top-down influence. Future research efforts are required to further disentangle the extent to which the functional interactivity of shared signals conveyed by the face represent perceptual fusion during the early stages of processing, associative influences that guide and privilege low-level perceptual processing, or both.

The current studies offer direct evidence that coherence in behavioral approach and withdraw responses directly affect the recognition of emotional expressions, particularly easily identifiable ones. As such, these findings address the issue of whether basic action tendencies are associated with the perception of certain expressions, indicating that we inherently perceive action tendencies that are signaled by the expressions. This is much in line with Davidson and Hugdahl (1995), who stated that "approach and withdrawal are fundamental motivational dimensions that are present at any level of phylogeny where behavior itself is present" (p. 362). Thus, the current work offers evidence that these fundamental dimensions exist not only in behavioral responses associated with emotional experience but also in the perceptions of behavioral tendencies conveyed by emotional expressions as well.

These findings build upon previous work examining the influence of facial expressions on the efficiency of recognizing approach-avoidance actions (Adams et al., 2006). In two studies, Adams and colleagues found that anger expressions enhanced the ability to process apparent motion of a face with faster recognition of approach than withdraw. Although fear expressions showed converse patterns, they exerted no significant moderating effect on the recognition of either approach or avoidance. The authors concluded that anger enhances our recognition of physical approach, which is arguably an adaptive response. Fear likely lacked the same immediacy in processing because fear is also associated with a freezing response before a withdraw response.

Additionally, these findings are in accord with research on action-expression perceptual links that have been examined in body movements. For instance, motion linked to gait influences the perception of emotion (especially anger) in the walker (Atkinson, Dittrich, Gemmell, & Young, 2004; Chouchourelou, Matsuka, Harber, & Shiffrar, 2006). This is true even for point-light walkers, which is a highly degraded visual stimulus whereby the body is reduced to a limited number of points on a display.

Our findings differ from the work conducted by van Peer et al. (2010). They found that anger (compared with joy) expressions were more easily identified when appearing to withdraw versus when appearing to approach an observer. When discussing their divergent findings from those of Adams et al. (2006), van Peer et al. (2010) stated, "for the moment, we suggest that conclusions with respect to the effects of angry expressions on judgement of behavioural intent in these movement judgement studies should be drawn with caution, as long as an effect in the opposite direction is not demonstrated for emotional expressions that are predicted to signal avoidance." (p. 872). Our current findings, aggregated across studies, do reveal the converse effect for fear, now allowing for stronger conclusions about the association of certain behavioral intentions and what is signaled by expressions, in this case anger (fight/approach) and fear (flight/avoidance). As noted earlier, by examining joy, an expression that shares approach-oriented tendencies with anger, we suggest that van Peer et al. likely engaged an evaluative judgment (good/bad) consistent with findings from previous embodiment research. Additionally, recent work has shown that the choice of expressions used in an emotion recognition task influences the evaluation of expressions. When expressions cross valence (i.e., happy versus anger/sadness), evaluative judgments are favored (i.e., good judgments applied to "good" group), whereas when valence is the same (as in anger and sadness), participants show benefits for identifying stereotype-congruent pairings (i.e., more efficiently label females as sad, males as angry; Bijlstra, Holland, & Wigboldus, 2010). Thus, by using fear, which shares valence and arousal properties with anger, we were presumably able to isolate and thus directly test the approach-avoidance tendencies associated with each expression, while controlling for evaluative judgments.

Future research will be necessary to examine such methodological differences (the impact that pairing various emotions has on judgments made in response to those emotions) and the role that different expressions may play in shifting the context of judgment. In the current context, we isolated the effect of interest, namely, the behavioral intent of the expression conveyed, and in doing so now offer clearer evidence that both anger and fear expressions are associated with signaling action tendencies to approach and avoid, respectively. Additionally, future research should consider whether these effects occur at the level of perception or at the level of response. For instance, are approaching faces perceived as being more angry, or is there a bias to respond to emotional faces approaching you as angry? This may be addressed by considering *construal errors* versus *action errors* (e.g., Stokes & Payne, 2010). Construal errors are due to biases in the perception of a cue, whereas action errors occur when the stimulus is identified correctly but an incorrect response is elicited anyway. When stimulus ambiguity is high, construal errors are more likely, whereas when ambiguity is low, action errors are more likely. This would suggest from our findings that our pure expression effects were due to action errors, whereas our ambiguity effects were due to construal errors. Construal and action errors, however, are moderated by executive control (Stokes & Payne, 2010). Therefore, future research could manipulate executive functioning to directly address construal and action errors.

The idea that facial expressions signal basic approach-avoidance responses was the basis of the *shared signal hypothesis* put forth in work examining the role of eye gaze direction on emotion perception (Adams & Kleck, 2003). This research predicted that when combined, cues that share a congruent underlying signal value of approach-avoidance should facilitate the processing of that emotion, and vice versa. The findings in those studies fit with the approach-avoidance hypothesis, yet none of these studies actually directly manipulated approach-avoidance movement itself—arguably a more direct test of the hypothesis—to examine influences on anger and fear recognition as the current study does. As such, the current study is a more direct test of the shared signal hypothesis, one that is free of other influences that eye gaze direction may exert on perceptual processing (i.e., visually mediated attention; see Langton, 2010).

The influence of apparent motion on the identification of emotional expressions suggests that a "once size fits all" response to threat expressions is not adequate; rather perceptions are dependent upon the combinatorial nature of available cues. To confer a benefit on survival, a perceiver must be able to effortlessly extract basic information about the behavioral intentions of others. From this view, relevant signals, including approach and avoidance movement and facial expression, although arguably parsed in early visual processing (e.g., Haxby, Hoffman, & Gobbini, 2000), become integrated so that the combined signal value communicated by the face is the product of its functional relevance to the perceiver rather than simply to particular cues perceived in isolation. Such integration is arguably essential, allowing the behavioral intentions signaled by others to directly inform our own behavioral responses. Such a functional approach assumes that the combined processing of cues such as movement toward and away from an observer combined with facial expressions is adaptive, facilitating the recognition of intent signaled by a face in the most ecologically relevant manner.

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