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BRIEF REPORT

An Approach-Avoidance Motivational Model of Trustworthiness Judgments

Michael L. Slepian
Columbia University

Steven G. Young
City University of New York

Eddie Harmon-Jones
The University of New South Wales

Judgments of trustworthiness from faces are made rapidly, without intention, and may be supported by localized neural structures. Other work demonstrates that the left frontal cortical region is involved in approach motivation, whereas the right frontal cortical region is involved in avoidance motivation. In the current work we integrated these two streams of research to test an approach-avoidance motivational model of trustworthiness judgments. We tested whether global differences in hemispheric lateralization relate to trust judgments, which may exist due to mutual relationships with approach and avoidance motivation. The left (right) frontal cortical region has been found to relate to approach (avoidance) motivational processes, and approach (avoidance) motivation may relate to trusting (distrusting). Correspondingly, the current work finds that faces presented preferentially to the left versus right hemisphere (through manipulated visual field presentation) were trusted more often (Study 1), and trustworthy versus untrustworthy faces evoked a correlate of preferential left frontal cortical activity (right visual field bias; Study 2). These studies extend accounts that posit hemispheric specialization of approach/avoidance motivation to the domain of judging trustworthiness, thereby integrating disparate literatures on social judgment, face perception, and cortical asymmetries in approach/avoidance motivation.

Keywords: face perception, trustworthiness, approach/avoidance, laterality

Approach and avoidance are fundamental motivational tendencies in virtually all organisms (Elliot & Covington, 2001). Basic organisms reflexively approach food and avoid predators. Likewise, appetizing food evokes approach in humans, whereas frightening creatures evoke avoidance (Brunyé et al., 2013; Rinck & Becker, 2007). Aside from being instantiated by different stimuli and situations, approach and avoidance motives are further distinguished by hemispheric asymmetry (Rutherford & Lindell, 2011). In the current work, we propose approach and avoidance motivations underlie judgments of trustworthiness. To test this approach-avoidance motivational model of trust, we examine whether judgments of trustworthiness relate to lateralized attentional processes. Evidence suggests that the left frontal cortical region is involved in approach motivation, whereas the right frontal cortical region is involved in avoidance motivation (Harmon-Jones, Gable, & Peterson, 2010). Thus, given posited linked between approach and avoidance motivation and trust and distrust, respectively (Slepian, Young, Rule, Weisbuch, & Ambady, 2012), judgments of trustworthiness may relate to cortical asymmetries seen for approach and avoidance motives.

While a body of evidence has established the neuropsychological bases of fundamental approach and avoidance motivations, there have been few extensions of this framework to inter-

Michael L. Slepian, Management Division, Columbia Business School, Columbia University; Steven G. Young, Department of Psychology, Baruch College and Graduate Center, City University of New York; Eddie Harmon-Jones, School of Psychology, The University of New South Wales.

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Correspondence concerning this article should be addressed to Michael L. Slepian, Columbia Business School, Columbia University, New York, NY. E-mail: michael.slepian@columbia.edu

personal contexts. When encountering a novel individual, it is important to know whether the person can be trusted: Will they be a friend or foe, helpful or harmful, a source of security or suspicion? The importance of gleaning trustworthiness is supported by evidence showing such judgments are made rapidly (Oosterhof & Todorov, 2008), without intention (Freeman, Stolier, Ingbretsen, & Hehman, 2014), and hold a special processing status in memory (Rule, Slepian, & Ambady, 2012). Evaluations of trustworthiness are not arbitrary, but are instead influenced by a variety of facial features. For example, babyfacedness (Zebrowitz & McDonald, 1991) and facial appearances that resemble joy (Todorov, Baron, & Oosterhof, 2008) are deemed trustworthy. Trustworthiness judgments show high consensus and sometimes predict actual behavior (Slepian & Ames, 2016; Stirrat & Perrett, 2010; but see Rule, Krendl, Ivcevic, & Ambady, 2013; Todorov & Porter, 2014). We propose that trust and distrust should further be distinguished by their underlying motivations, approach and avoidance motivation. To test this hypothesis we examine how judgments of trustworthiness relate to global differences in hemispheric lateralization would relate to trust judgments due to mutual relationships with approach and avoidance motivation.

Lateralization of Approach/Avoidance Motivation

The proposal that approach/avoidance motivation is lateralized refines prior suggestions that the left and right frontal cortices are specialized for positive and negative emotions, respectively (Lang, Bradley, & Cuthbert 1990). For instance, both state and trait anger (a negative emotion) are associated with higher levels of left frontal activation (Harmon-Jones & Allen, 1998; Harmon-Jones & Sigelman, 2001). Individuals with higher approach (avoidance) motivation show greater left (right) resting prefrontal activation (Harmon-Jones & Allen, 1998; Sutton & Davidson, 1997).

Moreover, left versus right hemispheric activation promotes approach versus avoidance related thoughts, respectively (Fetterman, Ode, & Robinson, 2013). Hemispheric asymmetry in approach-avoidance minimizes competition between these systems, facilitating rapid behavioral responses to appetitive and aversive stimuli, respectively (see Davidson, 1998). Building on this work, the current research tests for links between cortical hemispheric specialization and trustworthiness judgments. We posit that faces processed preferentially with the left versus right frontal cortex will be rated as more trustworthy. Moreover, we predict this relation is bidirectional, whereby viewing trustworthy versus untrustworthy faces will increase left versus right frontal cortical activity (we employ a paradigm and target faces that rule out direct valence-based relationships).

Trustworthiness and Approach/Avoidance

As a uniquely social species, people do not *only* need to approach food and avoid predators. People also must approach others who offer rewards (e.g., affiliation) and avoid those who pose threats (e.g., violence). Given that untrustworthy conspecifics pose considerable risks (e.g., exploitation, nonreciprocation; Cosmides & Tooby, 1992), it is sensible that apparently untrustworthy faces would be linked with avoidance. Conversely, trustworthy others should be connected with approach, as they offer desirable social outcomes. These posited links (e.g., Todorov, 2008) have yet to be clearly demonstrated. One study found arm-flexion (representing approach) led participants to rate faces as more trustworthy than when engaging in arm-extension (representing avoidance; Slepian et al., 2012). Links between arm flexion and extension are far from conclusive, however, and offer multiple alternative explanations (cf. Cacioppo, Priester, & Bernston, 1993; Jones, Young, & Claypool, 2011; Laham, Kashima, Dix, Wheeler, & Levis, 2014; Seibt, Neumann, Nussinson, & Strack, 2008).

The current work aims to provide evidence that cortical asymmetries associated with approach and avoidance motivation are linked to trust judgments. Support for this notion would provide further evidence for hemispheric specialization of approach and avoidance systems, and critically present the first link between hemispheric asymmetry and trait judgments of people. By integrating distinct literatures on face perception, social judgment, approach/avoidance motivation, and cortical asymmetry, we offer new insights into the uniquely social outcomes of a cortical asymmetry in motivation processes, and a novel neuropsychological

model of trustworthiness judgments linked to these motivations.

We report how we determined sample size, all data exclusions, all manipulations, and all measures in both studies. Per visual-field study norms, we sought right-handed participants. To ensure sufficient size for left/right presentations, only participants using a desktop/laptop computer (rather than a tablet/phone) could be included. Demographics [gender, age, handedness (right/left/ambidextrous), and device (desktop/ laptop/ tablet/phone/other)] were surveyed at the end of the studies. For each experiment, we first collected 200 participants, examined eligibility (handedness/device used), and then increased sample size until 200 right-handed participants using desktops/laptops were reached. Exclusion were as follows (Study 2 in parentheses): nonright handed: 36 (31); right-handed using tablets/phones: 21 (20); nonright handed using tablets/phones: 2 (4).

Study 1

An extensive literature demonstrates the left frontal cortex is specialized for approach motivation and receives information from the right visual field (RVF) from both eyes; the right hemisphere receives information from the left visual field (LVF) from both eyes (Schall, 2004). Thus, we present faces preferentially to the right and left hemispheres via the left and right visual fields, respectively. According to our approach-avoidance motivational model of trustworthiness judgments, this should lead to differential judgments of trustworthiness, as faces projected to the left hemisphere (linked to approach) would be judged as more trustworthy than faces projected to the right hemisphere (linked to avoidance). Given the well-established mapping of approach and avoidance motives to the left and right hemisphere, respectively, this would provide evidence in favor of connections between trust judgments of faces and lateralized approach/avoidance motivational responses to those faces.

Method

Right-handed participants (N = 200; 64% women; M_{age} = 35.40 years, SD = 12.27) were presented with 20 grayscaled male faces on their monitor, displaying *neutral* expressions and controlled for distance, angle, and luminosity. These images were drawn from a larger set and pretested to be neutral in trustworthiness (Young, Slepian, & Sacco, 2015). Each face was shown twice: once aligned to the right side of the screen and once aligned to the left. These 40 presentations were randomly ordered, and participants rated each face via mouse-click (1 = *extremely untrustworthy*, 2 = *very untrustworthy*, 3 = *untrustworthy*, 4 = *trustworthy*, 5 = *very trustworthy*, 6 = *extremely trustworthy*; prerated M = 3.48, SD = 0.61). The face stayed on screen until a response was made. All trials were retained in analyses, and a mean was taken separately for faces presented to the left and right visual field. Participants were recruited via Mechanical Turk, yielding a sample more representative of the U.S. population than in-person convenience samples (Berinsky, Huber, & Lenz, 2012), with equivalent data quality (Paolacci & Chandler, 2014).

It is worth noting that this design precludes precise control over participants' head orientation (e.g., no chin rest), nor measures participants' saccades to the face, and requires participants to make responses with their (likely right) hand (for similar designs, see Brüne, Nadolny, Gunturkun, & Wolf, 2013; Kuhl & Kazén, 2008; Maxwell & Davidson, 2007). Each of these elements add noise to the current study. Critically, the scale was presented vertically, such that un(trustworthy) anchors were not confounded with left/right presentation.

Results and Discussion

Faces presented preferentially to the RVF (i.e., the left hemisphere) were rated as more trustworthy (M = 3.36, SD = 0.36, 95% CI [3.31, 3.41]) than faces presented preferentially to the LVF (that is, the right hemisphere; M = 3.34, SD = 0.35, 95% CI [3.29, 3.39]), $t(199)$ = 2.52, p = .01, d = .18, 95% CI [.04, .32].[1] Faces preferentially presented to left hemisphere, specialized in approach motivation, were trusted more than faces preferentially pre-

[1] In seeking (after exclusions) 200 right-handed participants using desktop/laptop computers, three additional right-handed participants using computers participated; including them does not alter statistical significance, $t(202)$ = 2.53, p = .01, d = 0.18, 95% CI = (0.04, 0.32).

sented to right hemisphere, specialized in avoidance motivation.

Study 2

Study 1 found a link between lateralization and trust judgments, which we propose is driven by mutual relationships with approach/avoidance motivation. One alternative explanation, however, is people prefer the right relative to the left. Across a variety of cultures, "right" is more often linguistically associated with "good," and "left" associated with "bad," particularly among right-handed individuals (Casasanto, 2009). This could potentially explain why faces preferentially presented to the left hemisphere were judged as more trustworthy; they were presented spatially to the right (associated with "good"). Study 2 was designed to eliminate this alternative explanation. Additionally, Study 1 did not precisely control for the visual field presentation of the stimuli, although the lack of this control would probably only introduce error variance. The Study 1 effect, while reliable, was small, likely due to the noisy design features. We thus acknowledge that the lack of control over visual field presentation in Study 1 should temper any final conclusions, that is, unless paired with a methodology that avoids a visual field manipulation, but provides converging evidence. Study 2 was designed to do just this by testing the link between trust and lateralized approach/avoidance motivations by manipulating apparent trustworthiness of presented faces and measuring visual field bias.

Visual field bias serves as a correlate of hemispheric asymmetry, presenting an efficient, unobtrusive, and subtle measure of cortical asymmetry when EEG is not feasible or available (Nash, McGregor, & Inzlicht, 2010). Indeed, visual field bias has been related to multiple outcomes associated with cortical asymmetry (Drake & Myers, 2006; Nash et al., 2010) as well as directly linked to cortical asymmetry as measured by electroencephalographic activity (Nash et al., 2010). Stimuli that evoke greater left frontal cortical activity consequently evoke a RVF-bias (Drake & Myers, 2006; Nash et al., 2010).

Method

Right-handed participants (N = 200, 57% women; M_{age} = 36.17 years, SD = 11.93), recruited on Mechanical Turk, completed a computerized line bisection task, whereby, rather than bisect lines, participants judged whether prebisected lines were bisected to the left or right (Miller, Prokosch, & Maner, 2012). Above 16 filler lines (bisected to the left or right of center) were faces neutral in trustworthiness (from Study 1). Above the 16 critical lines, bisected centrally, were trustworthy and untrustworthy faces (drawn from the same pool used in Study 1, pretested to differ in trustworthiness, but not other pertinent valence-based dimensions, e.g., attractiveness; Young et al., 2015). The 32 presentations were randomly ordered, and stimuli stayed on screen until a response was made (see Figure 1).

Indicating a centrally bisected line was bisected to the right of center (i.e., seeing the left side as longer) was coded as 0. Indicating a centrally bisected line was bisected to the left of center (i.e., seeing the right side as longer, an outcome of RVF-bias) was coded as 1. A mean was taken for the 8 centrally bisected lines presented with trustworthy faces (prerating M = 3.79, SD = 0.48), and the 8 centrally bisected lines presented with untrustworthy faces (prerating M = 2.75, SD = 0.49). Higher numbers (seeing on average the right side as longer) thereby reflect greater RVF-bias, a correlate of enhanced left frontal activation (Nash et al., 2010). At the end of the study, we asked whether participants used a measuring device to aid their judgments (4 participants who did were excluded).

Results and Discussion

We first examined a mean of centrally bisected lines, irrespective of whether paired with

Figure 1. Example stimulus face paired with centrally bisected line. Photo used with permission.

a trustworthy or untrustworthy face. Consistent with a right visual field bias, a one-sample *t* test against .5 demonstrated participants' tendency to judge centrally bisected lines as bisected to the left, seeing the right side as longer (left = 1, right = 0; $M = .57$, $SD = .23$, 95% CI [0.54, 0.60]), $t(195) = 4.23$, $p < .0001$, $d = 2.46$, 95% CI [2.18, 2.74]. Research demonstrates right-handed individuals tend to bisect lines to the left (Jewell & McCourt, 2000), and thus our participants demonstrate typical line-bisection behavior.

We next compared RVF-bias (judging centrally bisected lines as bisected to the left; i.e., the right appearing longer) across trustworthy and untrustworthy faces. When trustworthy faces were presented above centrally bisected lines, participants demonstrated greater RVF-bias ($M = .59$, $SD = .26$, 95% CI [.55, .62]) than when untrustworthy faces were presented with such lines ($M = .55$, $SD = .25$, 95% CI [.52, .59]), $t(195) = 2.14$, $p = .03$, $d = .15$, 95% CI [.01, .29]. These results cannot be attributed to a link between positive valence and rightward responses because we asked participants whether the line was bisected to the right/left, and thus the greater RVF-bias (seeing the right side as longer), found when viewing trustworthy faces, was linked with saying "left," not "right."

Stimuli that increase left frontal cortical activity increase RVF-bias (Drake & Myers, 2006; Nash et al., 2010). Specifically, approach-related, prefrontal EEG alpha asymmetry is associated with RVF-bias, and situational factors that promote approach motivation increase both left frontal cortical activity (as measured by EEG) and RVF-bias (as measured by line bisection; Nash et al., 2010). Likewise, here we see trustworthy (vs. untrustworthy) faces increase RVF-bias, a correlate of increased left frontal cortical activity, associated with approach motivation.

General Discussion

The current work proposed an approach-avoidance motivational model of trustworthiness judgments, predicting that judgments of trustworthiness would relate to lateralized attentional processes seen for approach/avoidance motivations. This research extends past work on hemispheric asymmetries in approach/avoidance motivation into a novel and fundamental domain of social judgment: the trustworthiness of other people. The present results offer a new integration between motivation science and social cognition and contribute to several literatures. Recent evidence reveals emotional valence and approach-avoidance are orthogonal, and approach-avoidance is lateralized unlike emotional valence (Carver & Harmon-Jones, 2009; Harmon-Jones, Harmon-Jones, & Price, 2013; Yan & Dillard, 2010). Our results support this model of frontal cortical asymmetries, and applies it to social evaluative judgments of other people.

Assessing trustworthiness occurs rapidly and without intention (Freeman et al., 2014), and is considered a fundamental component of social evaluations (Oosterhof & Todorov, 2008). While the factors that influence these judgments are often studied, such as facial features corresponding to apparent trustworthiness (Zebrowitz & McDonald, 1991), and the role of specific emotional states (e.g., fear; Young et al., 2015), our work offers a novel understanding of how trustworthiness judgments are linked to broad neuropsychological correlates of fundamental motivational states.

Future work should explore other trait judgments, which might be inversely linked to approach/avoidance (e.g., dominance/submission). Examining hemispheric asymmetries in approach/avoidance motivation as they relate to the intersection of different traits (particularly when they conflict; cf., Herring, Taylor, White, & Crites, 2011) would present new insights into impression formation, face perception, and neural and motivational bases of complex trait judgments. While the present experiments relied on a diverse sample of online participants, this entailed some sacrifice of experimental control and likely diminished our effect sizes. Reciprocally, however, this should make the current results more generalizable.

In sum, by demonstrating associations between judgments of trust with a correlate of asymmetric frontal cortical activity (line bisection) that is unrelated to valence, but linked to approach-avoidance motivations (Harmon-Jones et al., 2013; Nash et al., 2010), we present evidence for a neuropsychological basis of trust judgments founded upon basic approach and avoidance motivations. Integrating disparate literatures on social judgment, face perception,

and cortical asymmetries in approach/avoidance motivation, the current work extends accounts that posit hemispheric specialization of approach/avoidance motivation to the domain of judging trustworthiness.

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