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Shaping Perceptions by Hand: The Influence of Motor Fluency on Face Judgment

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Abstract

Research has shown that individual variation in our bodies, such as differential hand dominance, can influence the way that we interact with and perceive the world (Casasanto, 2009). For example, right-handed individuals are more likely to associate their right spatial plane as more positive than their left, an effect that is switched in left-handed individuals. Here, we explored whether asking participants to use their dominant ("good") versus nondominant ("bad") hand on a motor task influenced subsequent valanced face judgment. Results demonstrate that simply asking a participant to use their right or left hand to complete a task can have a significant effect on the perceived valence of neutral faces. These findings add to the evidence that the way we physically interact with our world may have important consequences for our perceptions of social stimuli.

Keywords: embodiment; handedness; body specificity; social cognition; face judgment

Introduction

In our everyday life, we interact with physical objects in ways that both create and shape our perception of the world. Often referred to as "embodied cognition" (see Goldinger, Papesh, Barnhart, Hansen, & Hout, 2016 for review), the study of the relationship between our bodies, the environment, and thought has demonstrated remarkable interconnections between these systems. More recently, the "body specificity hypothesis" has focused on the nuanced ways that natural variation in our bodies (e.g., handedness) can influence our cognitive processes (e.g., Casasanto, 2009; 2014). In the current series of studies, we ask whether the use of one's dominant or nondominant hand on a motor task impacts later social perception.

According to the body specificity hypothesis, people implicitly associate emotional valence (positive or negative) with certain spatial planes, an association that is mediated by motor fluency (Casasanto, 2009; Casasanto, 2014). For example, right-handed individuals associate the right spatial plane with positivity or goodness, and the left spatial plane with negativity or badness. This association is reversed in left-handed individuals, who associate left with positive and right with negative (Casasanto, 2009). Such a systematic difference across right vs. left handed individuals likely results from systematically different perceptuomotor experience, involving extended interaction with the dominant side of the body. Over time, one side becomes the easiest to use, increasing motor fluency and creating an association with more positive thoughts (Oppenheimer, 2008).

While valenced associations have been found across a number of modalities (e.g., sound; McFarland & Kennison, 1989) and body parts (e.g., feet; de la Vega, Graebe, Härtner, Dudschig, & Kaup, 2015), the most common focus in the body hypothesis literature is on the connection between handedness and emotions. For example, research has shown that individuals prefer and rate objects more positively that are presented on the side aligning with their dominant hand (Casasanto, 2009), are quicker to react to positive vs. negative stimuli using their dominant hand (de la Vega, De Filippis, Lachmair, Dudschig, & Kaup, 2012), and are more likely to use their dominant hand when gesturing about ideas construed as positive (Casasanto & Jasmin, 2010). Similarly, participants rate words typed on the right side of a QWERTY keyboard as more positive than those on the left side, even if those words are not used in the English language (Jasmin & Casasanto, 2012). This suggests that, from a correlational perspective, the dominant side of the body is more strongly associated with positive conceptualizations.

The body specificity hypothesis is further supported by intervention studies, where a previously dominant or 'fluid' hand is handicapped and subsequent cognitive effects are assessed. For example, Casasanto and Chrysikou (2011) found that the right-positive association in naturally right-handed individuals flipped when participants were asked to wear a bulky ski glove over their dominant hand while completing a fine-motor task. These effects were similar to those found in stroke patients, who had previously utilized a dominant hand that they could no longer control. In fact, even imagining wearing a ski glove while completing a motor task is enough to elicit valenced reactions in line with a real handicap (de la Fuente, Casasanto, & Santiago, 2015). Therefore, both real and visualized motor experiences can have a marked effect on later perceptions.

While the previous literature has made a strong argument for a connection between handedness and general valenced appraisal, the influence of such an effect on social cognition is still generally unknown. Studies have focused primarily on how participants rate the valence of unrelated words (Jasmin & Casasanto, 2012), sort objects/pictures (e.g., Casasanto, 2009), or naturalistically gesture in accordance with their dominant versus nondominant planes (Casasanto & Jasmin, 2010). However, few studies to date have explored whether the hand we use influences the way we perceive social partners in our world, particularly in relation to the perception of emotional expression.

As may be evident, it is crucial for humans to be able to effectively detect the emotions of those around them. Emotional facial expressions provide a wealth of social information, including but not limited to communicative intentions (see Russell & Fernández-Dols, 1997) and social rejection or acceptance (de Gelder, 2009). In fact, failure to adequately identify facial emotions is often a hallmark of those with other social deficits, such as Autism spectrum disorder (e.g., Loth et al., 2018) or Borderline personality disorder (e.g., Meyer, Pilkonis, & Beevers, 2004), highlighting the adaptive importance of this ability.

Even within normative populations, emotional perception appears particularly influenced by context and priming. For example, pairing neutral face pictures with either positive or negative sentences (Wieser et al., 2014) or positive or negative backgrounds (Lee, Choi, & Cho, 2012) influences the valence reports of participants. Therefore, if handedness can influence the perceived valence of neutral words, there is reason to believe it would also influence the perceived valence of neutral faces.

Some previous research has suggested a connection between handedness and certain social judgments in-the-moment. For example, individuals are more likely to place highly vs. weakly valenced faces on the extreme ends of a continuous horizontal line (Freddi, Brouillet, Cretenet, Heurley, & Dru, 2016), with the location of these placements (left or right) corresponding to both participant handedness and stimulus valence. Similarly, right-handed individuals are faster to respond to positive socio-emotional stimuli with their right hands (Kong, 2013), tend to prefer social partners presented on their right side (Zhao et al., 2016), and are more likely to rate faces presented on their right side as positive vs. negative (Brookshire & Casasanto, 2013), the reverse of which is true for left-handed participants. Together, this body of work suggests a clear connection between handedness, locations in space (right versus left), and valenced social judgments. However, it fails to explore whether dominant vs. non-dominant hand use could later influence neutral face judgments regardless of their spatial presentation.

The current study builds upon the literature on motor fluency, handedness, and social cognition to explore the connection between dominant (vs. nondominant) hand use and face judgment. In Study 1, participants completed a timed jigsaw puzzle task using either their dominant or nondominant hand, before rating the emotional valence of facial stimuli. In Study 2, participants completed a timed domino placing task with their dominant or nondominant hand before completing the same face judgment task. Across both studies, it was hypothesized that participants who used their dominant hand would perceive the neutral face pictures as more positive compared to those who used their nondominant hand.

Study 1

Participants

Data from 46 participants between the ages of 17 and 21 years (*M* = 19.22, 11 males, 35 females) were analyzed for Study 1. Participants were recruited via introductory psychology courses at a liberal arts college. Students voluntarily signed up using the online SONA Systems software (Fidler, 2002), receiving class credits for participation. Participants were randomly assigned to one of two conditions: the *dominant hand* condition or *nondominant hand* condition. All participants consented to the study and were right-handed according to self-report.

Materials & Procedure

Each participant completed two tasks during the experiment in the following order: a puzzle completion task and a facial expression rating task.

During the puzzle task, participants were asked to complete one of two 25-piece children's jigsaw puzzles (one depicting the four seasons, one depicting various occupations, see Figure 1) while seated at a table. Each participant was randomly assigned to either the dominant (right, *N* = 22) or nondominant (left, *N* = 24) hand condition, and was instructed to complete as much of the puzzle as possible in one minute using only their assigned hand. Participants were video recorded with a handheld Canon Vixia HFR 72 video camera mounted on a tripod, and pointed at the table, recording only the participant's hands and the puzzle. After one minute, the experimenter asked the participant to stop, even if all of the puzzle pieces were not placed.

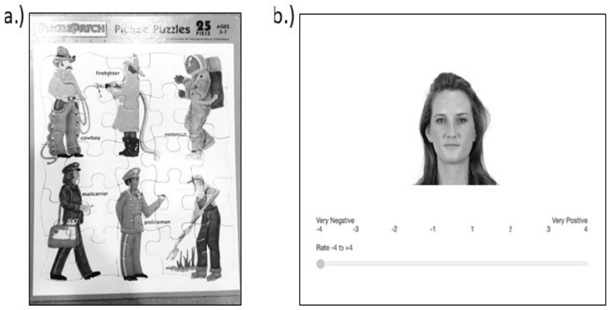

Figure 1. Stimuli from Study 1 including a) a photo of the 25-piece puzzle used in the puzzle task and b) an example of a neutral face emotion picture and associated Likert scale.

After the puzzle task, participants completed a face judgment task. During this phase, participants viewed a series of 20 randomly presented faces on a laptop computer, one by one (see Figure 1). The face stimuli (2.5 by 2.5 inches) were presented on a white background and were taken from the Chicago Face Database (Ma, Correll, & Wittenbrink, 2015). Individuals in the database wore grey shirts, and photos were taken from the shoulders up. Faces varied according to both race and gender. Participants viewed 8 neutral faces (4 white, 4 African American), 6 happy faces (3 white, 3 African American), and 6 unhappy faces (3 white, 3 African American). Half of the faces were female (10) and half were male (10). The happy and unhappy stimuli were used as distractors, thus necessitating fewer of these faces in the set. All stimuli and responses were presented with Qualtrics research software (Qualtrics, Provo, UT).

After viewing each picture, participants were asked to verbally rate how positive or negative the facial expression of each picture was on a scale of -4 (very negative) to +4 (very positive; adapted from Wieser et al., 2014), with positive ratings on the right. Verbal responses were recorded by an experimenter so as not require participants to use their hands when making responses, which might interfere with influence of the previous puzzle task (Casasanto & Chrysikou, 2011).

Results

Preliminary analyses found no effect of gender, age, or race on face judgment ratings (all ps > .54), so subsequent analyses were collapsed across these factors.

A 2 (condition: dominant, nondominant) by 3 (facial expression: happy, unhappy, neutral) repeated measures ANOVA with condition as a between-subjects factor was run to explore the influence of hand use on emotional face judgment. Results demonstrate a main effect of facial expression ($F(2, 43) = 585.14$, $p < .001$; partial $\eta 2 = 0.93$). As might be expected, planned contrast reveal that participants rated the happy faces as significantly more positive than the negative faces (happy: $M = 3.21$, SD=.49; unhappy: $M = -2.54$, $SD = .71$, $t(46) = 43.52$, $p < .001$), the happy faces as significantly more positive than the neutral faces (happy: $M = 3.21$, $SD = .49$; neutral: $M = -.24$, $SD = .43$, $t(46) = 41.71$, $p < .001$), and the neutral faces as significantly more positive than the unhappy faces (neutral: $M = -.24$, $SD = .43$, unhappy: $M = -2.54$, $SD = .71$; $t(46) = 24.37$, $p < .001$). There were no other main effects or interactions, suggesting condition did not have a significant effect on face judgment.

On average, participants correctly placed under one third of the potential 25-pieces in the puzzle task correctly ($M = 7.24$ pieces, $SD = 3.14$, range = 1-15), suggesting that the 1 minute time limit made this task particularly challenging regardless of which hand was used. An independent sample t-test found no significant effect of hand condition on the number of puzzle pieces correctly placed (dominant: $M = 8.09$, $SD = 3.07$; nondominant: $M = 6.46$, $SD = 3.08$, $t(46) = 1.78$, $p = .078$), though the patterns suggest that those using their dominant hand may have been at a slight advantage. There were no significant correlations between the number of puzzle pieces correctly placed and facial expression ratings within either condition (all ps > .189).

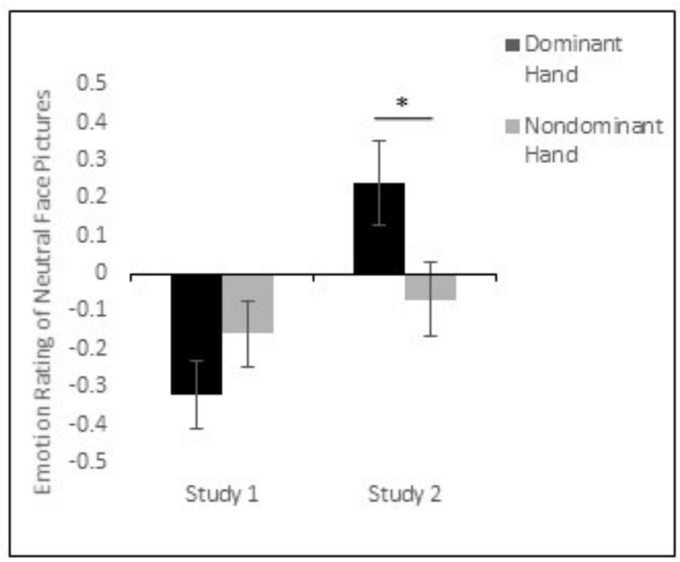

Figure 2. Emotional ratings of neutral faces based on condition (dominant, nondominant) in Studies 1 & 2. Error bars represent standard error.

Discussion

Our results showed no significant connection between hand usage (dominant vs. nondominant) and face judgment. Though participants were able to adequately distinguish and rate the facial expression present on the stimulus pictures, these ratings were not influenced by the previous motor task.

It is possible that the difficulty of the puzzle task was so high that participants were unable to reach their desired level of motor fluency even when using their dominant hand. Indeed, with only one minute to complete the task and 25 pieces to correctly place (absent a reference picture), no participants were able to finish the puzzle and often appeared distressed by this fact. These negative emotions may have been more pronounced in the dominant hand condition, where participants knew they were using their “good” hand, than in the nondominant condition, where poor performance could be more easily attributed to hand constraints.

Though a byproduct in the current study, such ‘mood priming’ has been correlated with negative biases on emotion recognition tasks in the past (Schmid & Mast, 2010). Therefore, Study 2 we changed the motor task to more directly align with the previous body specificity literature (Casasanto and Chrysikou, 2011) and to allow adequate time for participants to complete the task across conditions.

Study 2

Participants

Data from 59 participants between the ages of 18 and 21 years of age (*M* = 19.28, 25 males, 34 females) were analyzed for Study 2. All were recruited and compensated as in Study 1 and were similarly assigned to either the dominant hand condition or nondominant hand condition. All participants consented to the study and were right-handed according to self-report

Materials & Procedure

The procedure was the same as Study 1, with the following exceptions: In lieu of the puzzle task, all participants completed a domino placing motor task (adapted from Casasanto & Chrysikou, 2011) before the face judgment task.

During the domino task, participants were instructed to arrange approximately 60 dominos onto two laminated pictures according to the order and color of the dots on the stimuli. One of the laminated pictures depicted an ampersand symbol and the other depicted a star (see Figure 3). The shapes were outlined with colored dots in rainbow order (red, orange, yellow, green, blue, black), and the colors of the dominoes corresponded to the colors of the dots. The dominoes were to be placed vertically and parallel to one another. In the case that any dominoes fell over, participants were instructed to realign them before continuing (as per Casasanto & Chrysikou, 2011).

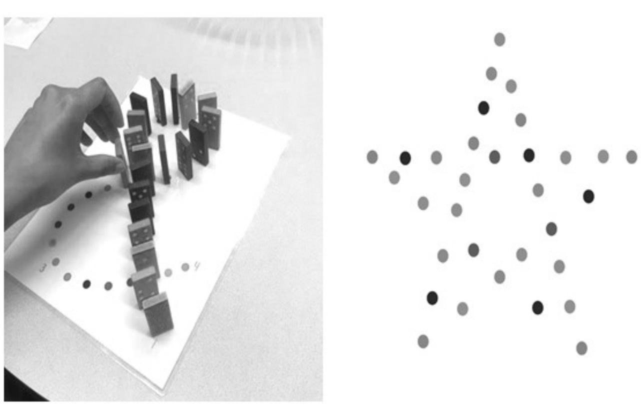

Figure 3. Action shot of participant placing dominos onto one diagram (the ampersand) next to a picture of the second diagram (a star).

As opposed to Study 1, where participants were only given 1 minute to complete a difficult motor task, Study 2 allowed participants 10 minutes to place all the dominos. This time allowed almost all participants (*N* = 57) to complete the task with time to spare, while also assuring significantly more motor priming before moving onto the second task.

After ten minutes, participants stopped the domino task and were asked to complete the face judgment task as in Study 1. Furthermore, in Study 2, the “0” was excluded on the emotional rating Likert scale in order to reduce a central tendency bias (Garland, 1991).

Results

Preliminary analyses found no effect of gender, age, or race on face emotion ratings (all *p*s > .28) so subsequent analyses were collapsed across these factors.

A 2 (condition: dominant, nondominant) x 3 (facial expression: happy, unhappy, neutral) repeated measures ANOVA with condition as a between-subjects factor was run to determine if there was an interaction between hand use and subsequent face judgment. As in Study 1, results demonstrate significant main effect of facial expression ($F(2, 57)$ = 1505.66, $p < .001$; partial $\eta 2$ = 0.964), but also a significant condition x facial expression interaction ($F(2, 57) = 3.01$, p = .05, partial $\eta 2$ = 0.066). There were no other significant main effects. A series of planned independent t-tests revealed that participants in the dominant condition rated neutral faces as more positive (*M* = 0.24, *SD* = 0.62) than participants in the nondominant condition (*M* = -0.07, *SD* = 0.58), $t(57) = 2.00$, $p = 0.05$, see Figure 2). There were no significant differences between ratings of happy (p = .19) or unhappy (p = .41) faces across conditions.

Discussion

In Study 2, we built upon the findings of Study 1 by creating a motor task that was more similar to previous body specificity paradigms (Casasanto & Chrysikou, 2011) while also allowing adequate time for participants to complete the task. Consistent with our hypotheses, participants who completed the domino task with their dominant (right) hand rated neutral faces more positively compared to participants who used their nondominant (left) hand on the domino task. This finding aligns with previous research demonstrating that people associate their dominant side with more positive thoughts and ideas (Casasanto, 2009; Casasanto & Chrysikou, 2011; Casasanto & Jasmin, 2010; Casasanto & Jasmin, 2012), suggesting that the use of one hand over another can have real ramifications for social stimulus perception.

General Discussion

The current set of studies was motivated by findings demonstrating that handedness can influence the perception of traditionally non-motor stimuli (e.g., Casasanto, 2009). We found that restricting a participant to use either their dominant or nondominant hand during a motor task had cascading effects, resulting in differential face judgments. Interestingly, this effect only appeared if participants were given a task that was possible to complete, and with enough time to conceivably complete it (as in Study 2). Under extreme time restraints on a more difficult task (Study 1), participants using their dominant hand did not show any positivity effects, and in fact trended towards a negativity bias.

Though not a central aim of the study, the differences in response to the motor tasks of Study 1 and Study 2 highlight the important influence that task length and difficulty can have on face judgment. In Study 1, even those in the dominant hand condition were faced with a task they could not complete in time, potentially negating any internal positive feedback they may have received from doing well on a motor paradigm. In Study 2, allowing dominant condition participants more time to experience motor fluency and a chance at completing the task resulted in a more positive evaluation of subsequent neutral face pictures. Future research could better disentangle the relative influences of priming time and task difficulty in order to create a more comprehensive picture of their respective effect on face judgment.

It is also possible that the puzzle task used in Study 1 was not motor-specific enough to create the type of motor fluency effects seen in previous research (e.g., Casasanto, 2009; 2011; 2014). Indeed, jigsaw puzzles are most commonly used to study spatial perception, and not motor abilities, in the psychological literature (e.g., Richardson & Vecchi, 2002). Furthermore, as our puzzle did not come with a map or picture to follow, participants often spent a large portion of task time simply trying to determine the structure and spatial layout of the complete picture. This may have decreased the time spent moving puzzle pieces, and also distracted them from any conscious or unconscious feelings of motor fluency. Using a task that more closely aligned with the previous research remedied this issue (Study 2), allowing for a more motor-specific (vs. spatial) task.

It is also important to mention that without a matched sample of left-handed participants, it is difficult to determine whether the current findings are due to relative body fluency, or due to the effects of using one's right hand when right-handed. Indeed, previous research has suggested that the left-hemisphere of the brain, which controls the right side of the body, might be particularly relevant for processing positively-valenced emotions (e.g., Adolphs, Jansari, & Tranel, 2001). If this is the case, it's possible that individuals using their dominant (right) hand were simply tapping underlying neural structures that support positive perceptions. However, more recent research suggests that such findings may be better interpreted as body fluency effects as opposed to hemispheric specialization for emotions (Brookshire & Casasanto, 2013). In the future, utilizing both right- and left-handed individuals will help in better disentangling the relative influence of handedness on face judgment.

Taken together, our findings underscore the influence that our bodies can have on judgments of social stimuli. These results have implications not only for future research, but also for everyday life interactions. If using one's dominant hand can alter the interpretation of social stimuli, it is worth pondering the ramifications this might have for those forced to use a certain hand due to injury, disease, or environmental constraints. Future work is necessary to explore the ecologically valid bounds of this body-specific effect, further elucidating the connections between movement and mind.

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