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The Right Side? Under Time Pressure, Approach Motivation Leads to Right-Oriented Bias

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Abstract

Approach motivation, a focus on achieving positive outcomes, is related to relative left-hemispheric brain activation, which translates to a variety of right-oriented behavioral biases. In two studies, we found that approach-motivated individuals display a right-oriented bias, but only when they are forced to act quickly. In a task in which they had to divide lines into two equal parts, approach-motivated individuals bisected the line at a point farther to the right than avoidance-motivated individuals did, but only when they worked under high time pressure. In our analysis of all Fédération Internationale de Football Association (FIFA) World Cup penalty shoot-outs, we found that goalkeepers were two times more likely to dive to the right than to the left when their team was behind, a situation that we conjecture induces approach motivation. Because penalty takers shot toward the two sides of the goal equally often, the goalkeepers' right-oriented bias was dysfunctional, allowing more goals to be scored. Directional biases may facilitate group coordination but prove maladaptive in individual settings and interpersonal competition.

Keywords

right-oriented bias, approach, avoidance, motivation, line bisection, evolution theory, soccer, football, goalkeepers, evolutionary psychology, brain

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Approach-motivated humans and nonhumans alike display a behavioral asymmetry consisting of a right-oriented bias. When dogs observe their owners, they wag their tail toward the right (Quaranta, Siniscalchi, & Vallortigara, 2007); when toads attempt to catch prey, they are more likely to flick their tongue at prey to their right side than to their left side (Vallortigara, Rogers, Bisazza, Lippolis, & Robins, 1998); when humans kiss their romantic partners, they turn their head to the right twice as often as they turn it to the left (Güntürkün, 2003); and when approach-motivated humans quickly divide a line into two equal parts, they show a rightward bias (Friedman & Förster, 2005; Nash, McGregor, & Inzlicht, 2010).

This right-oriented bias in approach-motivated individuals is associated with left-hemispheric brain activation (Harmon-Jones, 2003; Nash et al., 2010). Evolutionary theory suggests that brain lateralization evolved because it enhanced cognitive capacity and brain efficiency: Lateralization allows each hemisphere to specialize in specific tasks that can be performed with increased precision and reduced cognitive costs (Levy, 1977). Groups of individuals presumably benefited from having the same directionality of brain lateralization because the sharing of directional behavioral tendencies increased intergroup coordination. Higher levels of coordination would increase a group's likelihood of survival (Vallortigara & Rogers, 2005) until the directional behavioral tendency became evolutionarily stable (Ghirlanda & Vallortigara, 2004). For example, African hunting dogs move together and hunt in coordinated groups to overpower large prey (Courchamp, Rasmussen, & Macdonald, 2002). These dogs exhibit an evolutionarily embedded tendency to move in synchronized ways while they close in on their prey, thereby reducing the effort required for coordinating their actions and increasing their likelihood of success.

Humans, like other animals, routinely respond to stimuli in their environment and calibrate their responses to attain positive outcomes. However, incorporating relevant situational cues into one's actions and decisions requires time and cognitive resources (Bargh & Ferguson, 2000; Schneider & Chein, 2003). For example, much guidance is needed to

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overcome the automatic tendency to think in stereotypical ways (Sassenberg & Moskowitz, 2005; Stewart & Payne, 2008). When time pressure increases and swift action is required, individuals become exceedingly likely to act on their initial automatic impulses (Gray, 2001; Tomarken & Keener, 1998). Focusing on situations in which accurate responses to stimuli are required, we predicted that the right-oriented bias under approach motivation is especially pronounced when people have to act quickly and do not have time to calibrate their behavior. We tested this hypothesis in two ways. In an experiment, we found that approach-motivated humans showed a right-oriented bias, but only when they had to act quickly. Using archival data from the Fédération Internationale de Football Association (FIFA) World Cup, we replicated this finding. We found that goalkeepers whose team was behind, and whose role in regaining their team's chance of winning the game was thus crucial, were two times more likely to dive to the right than to the left when the opposing team shot toward the goal.

Experimental Evidence

In our experiment, we manipulated the motivation of participants (approach motivation vs. avoidance motivation) and asked them to accurately divide lines into two equal parts under either high or low time pressure. We predicted that participants in the approach-motivation condition would demonstrate a relative right-oriented bias, but only under high time pressure.

Method

Thirty-eight students (10 men, 28 women; mean age = 21.34 years, *SD* = 4.36) participated in return for €2.50. They were randomly assigned to the conditions of a 2 (motivation: approach vs. avoidance) × 2 (time pressure: high vs. low) between-subjects design. Participants were asked to look at a maze in which a cartoon mouse was depicted as either trying to find a piece of cheese at the end of the maze (approach condition) or trying to escape from an owl that was hovering over the maze (avoidance condition). They were asked to write a vivid story from the perspective of the mouse. In the approach condition, they were instructed to write about "the happiest day in the life of the mouse" by imagining the mouse getting closer to the cheese, finding it, and eventually eating it. In the avoidance condition, they were instructed to write about "the terrible death of the mouse" by imagining the mouse attempting to escape the owl and eventually being caught, killed, and eaten (Friedman & Förster, 2005).

After writing their story, participants completed a line-bisection task in which they were presented with eight 14-cm lines that appeared one at a time in different locations on a computer screen for either 4,000 ms (low-time-pressure condition) or 1,500 ms (high-time-pressure condition); the interstimulus interval was 1,000 ms. Participants were instructed to divide each line into two equal parts by clicking on it at the appropriate location and to be as accurate as possible. The line-bisection task is typically presented as a paper-and-pencil task in which, after bisecting each line, participants can directly move on to the next line, finishing the task rather quickly. The computerized version in our experiment allowed us to precisely manipulate the time frame for dividing each line. The 4,000 ms per line allotted to participants in the low-time-pressure condition gave them ample opportunity to override automatic behavioral inclinations. Therefore, we expected to replicate past findings concerning the right-oriented bias of approach-motivated individuals in the high-time-pressure, but not the low-time-pressure, condition.

A pilot test of the line-bisection task ($N = 18$) verified that participants under low time pressure took more time to bisect lines ($M = 2.19$ s, $SD = 0.66$) than did participants under high time pressure ($M = 1.12$, $SD = 0.13$), $t(16) = -4.71$, $p < .001$. To verify that participants in the two time-pressure conditions of our main experiment were similarly motivated to perform the task well, we asked participants to indicate their agreement with two statements: "It was important for me to do the line-bisection task well" and "I tried to be as accurate as possible." Responses were made on 7-point scales (1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .94$) and were averaged to form an index of motivation. As expected, participants in the low- and high-time-pressure conditions were similarly highly motivated to perform well (low time pressure: $M = 6.11$, $SD = 1.05$; high time pressure: $M = 6.11$, $SD = 0.70$), $t(16) = 0.00$, $p = 1.00$. This finding was important because our focus was on situations in which people who are motivated to respond accurately to a stimulus either do or do not have sufficient time to adjust their behavior by overriding automatic biases.

Results

Deviations from the lines' true midpoints were measured in pixels and averaged across the eight lines to create an overall bisection error index; positive values indicate a right-oriented bias (a rightward deviation from the midpoint). Greater positive deviations signify greater relative left-hemispheric activation. On average, people who read from left to right bisect lines left of their actual centers[1]; we therefore assessed participants' right-oriented bias in relative rather than absolute terms (Friedman & Förster, 2005; Nash et al., 2010). As predicted, a 2 (motivation: approach vs. avoidance) × 2 (time pressure: high vs. low) analysis of variance predicting bisection deviations revealed a significant interaction effect, $F(1, 34) = 4.136$, $p = .05$, $\eta_p^2 = .11$ (see Fig. 1). A simple-effects analysis showed that under high time pressure, approach-motivated participants made more right-oriented judgments ($M = 2.61$, $SD = 2.37$) than did avoidance-motivated participants ($M = -5.62$, $SD = 2.62$), $F(1, 37) = 5.77$, $p = .02$. No effect of motivational orientation was found in the low-time-pressure condition, $F(1, 37) = 0.35$, $p = .56$.[2]

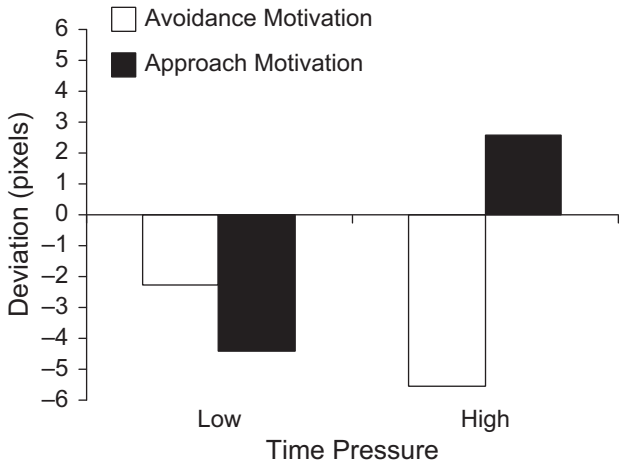

Fig. 1. Results from the line-bisection task: average deviation from the center of the line as a function of time pressure and motivation. Negative numbers indicate left-oriented deviations, and positive numbers indicate right-oriented deviations.

Archival Evidence: Goalkeepers Dive Right

Our experiment supported the hypothesis that approach-motivated individuals demonstrate a stronger right-oriented bias than avoidance-motivated individuals do, but only when they have to act quickly and cannot override their automatic behavioral tendencies. To substantiate these experimental findings, we analyzed the diving behavior of soccer goalkeepers during penalty shoot-outs. During penalty shoot-outs, goalkeepers are motivated to accurately respond to the ball being shot toward them by diving to the left, diving to the right, or standing still (the last strategy is rarely used; Bar-Eli, Azar, Ritov, Keidar-Levin, & Schein, 2007).

Goalkeepers seek clues (e.g., the movements of penalty takers' kicking leg and trunk and the position of penalty takers' hips) regarding the direction toward which the ball will be shot (Tyldesley, Bootsma, & Bomhoff, 1982; Williams & Burwitz, 1993), but the fast-moving stimulus gives goalkeepers little time to react (balls shot toward the goal reach speeds of more than 80 km/hr). However, as German goalkeeper and World Cup finalist Oliver Kahn explained,

> You can read a lot from the body language of the shooter and where he will be shooting. It is a psychological game between the goalkeeper and the taker. It has a lot to do with eye contact and body language. (quoted in "Goalkeepers Give Shoot-Out Tips," 2010, para. 4)

Indeed, goalkeepers dive in the correct direction more often than would be predicted if the direction of their diving were random (Savelsberg, Van der Kamp, Williams, & Ward, 2005). They must respond without having much time to calibrate their response (Bar-Eli et al., 2007), and such speed would increase the likelihood of their automatic behavioral tendencies taking effect (Schneider & Chein, 2003).

To test our prediction that approach-motivated goalkeepers would display a right-oriented diving bias, we analyzed data from all penalty shoot-outs in the history of the FIFA World Cup. The World Cup is the most widely viewed sporting event in the world, with revenues exceeding a billion dollars (FIFA, 2010), and winning this competition has far-reaching consequences. Tied knockout-stage matches in the World Cup are decided by penalty shoot-outs. Five players from each team alternate in shooting penalties from a distance of 11 m toward a 7.32-m × 2.44-m goal defended by the other team's goalkeeper. If the ball successfully makes it into the goal, the goal is considered scored; if the goalkeeper intercepts the ball, the goal is considered saved; if the ball misses the goal completely, it is considered off target. When the shot is saved or off target, no point is awarded to the penalty taker's team. If the score remains tied, the teams continue to take penalty shots until a winner is determined.

Because failures to score are rare (71% of World Cup shoot-out penalties have been scored), humiliating, and generally considered avoidable, penalty takers focus on not missing more than they do on scoring. Because penalty takers are avoidance motivated and have time to strategize about the penalty shot, we did not expect them to display a right-oriented bias. In contrast, because a successful defense of the goal has heroic connotations and is a relatively rare event in World Cup penalty shoot-outs (only 20% of penalty shots have been successfully saved), goalkeepers focus on the positive outcome of saving more than they do on the consequences of failing. As American goalkeeper Brad Friedel suggested, "I think of penalty kicks as no-lose situations for a goalkeeper. All the pressure is on the field player, who is supposed to score" (quoted in Benjamin, 2003, para. 1). Oliver Kahn explained: "Kickers are the ones that can lose in a penalty shoot-out; goalkeepers are the ones that can win and ultimately become the heroes" (quoted in "Goalkeepers Give Shoot-Out Tips," 2010, para. 25). This approach motivation should be even stronger for goalkeepers whose team is behind and whose role in regaining the possibility to win the game is crucial (i.e., when a penalty taker from the goalkeeper's team has missed a previous penalty; in World Cup history, this situation applies to 12% of all penalties). Because goalkeepers are focused on successfully accomplishing their task and have to respond in a split second, we hypothesized that they should display a right-oriented bias (i.e., they should dive right) when their team is behind and their approach motivation is therefore strong.

Method

We retrieved data for FIFA World Cup matches that ended in penalty shoot-outs from the FIFA Web site (FIFA, 2011). All penalties in World Cup shoot-outs (from the first, between West Germany and France in 1982, to the most recent, between Uruguay and Ghana in 2010) were coded by three independent coders for the direction of the penalty taker's shot (left, middle, or right), the direction in which the goalkeeper dove (left,

middle, or right), the score from the goalkeeper's team's perspective (behind, tied, or ahead), and the outcome of the penalty (score, save, or off-target shot). Coders agreed on 95% of the cases. Agreement concerning the remaining 5% was reached by discussion following repeated viewing of those penalties. In total, 204 penalty shots were used to settle 22 matches; 71% (144) of these penalty shots were scored, 20% (41) were saved, and 9% (19) were off target (for data for all penalty shoot-outs, see the Supplemental Material available online).

Results

As predicted, goalkeepers were more likely to dive to the right (71%) than to the left (29%) when their team was behind, $\chi^2(1, N = 24) = 4.17$, $p = .04$, but not when their team was ahead (right: 48%; left: 51%; $\chi^2 < 1$, n.s.) or when the game was tied (right: 49%; left: 48%; $\chi^2 < 1$, n.s.; see Fig. 2). As expected, penalty takers did not show a right-oriented bias: They shot to the right and to the left to similar extents whether their team was behind, ahead, or tied (all χ^2s < 1, n.s.; see Fig. 2). Because penalty takers shot equally to the right and to the left, whereas goalkeepers dove more than twice as often to the right as to the left when their team was behind, goalkeepers were almost 3 times less likely to save the shot when their team was behind (2 of 24 shots saved; 8%) than when their team was not behind (39 of 180 shots saved; 22%). In situations in which the goalkeeper's team was behind, this tendency translated to 90% (18/20) of on-target shots being scored; in contrast, 79% of penalty shots were scored (71/90) when the game was tied, and 73% (55/75) were scored when the goalkeeper's team was ahead.

Discussion

A vast body of research has linked approach motivation to left-hemispheric brain activation (see Davidson, Jackson, & Kalin, 2000), and a wide range of right-oriented behavioral biases have been documented among animals (Vallortigara & Rogers, 2005) and, to a lesser extent, among humans (e.g., Güntürkün, 2003). Our analyses of experimental and archival data reveal that humans are subject to this right-oriented bias when quick action is required and automatic tendencies prevail over calibrated responses. Our experiment showed that when approach-motivated individuals act without time pressure, they no longer demonstrate a right-oriented bias. This finding suggests that having sufficient time to adjust behavior may reduce or even eliminate habituated behavioral biases.

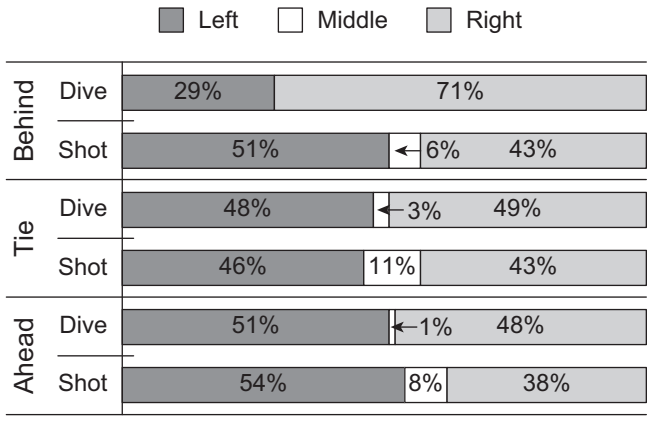

Fig. 2. Percentage of goalkeepers' dives and penalty takers' shots that were to the left, middle, and right as a function of whether the goalkeeper's team was behind, tied with, or ahead of the penalty taker's team.

Our investigation contributes to the discussion of the evolutionary development and social functions of brain lateralization. Directionality of behavioral biases presumably evolved because it facilitates synchronized group behavior. Our archival analysis shows that in situations that do not require group coordination, goalkeepers rely on their habituated rightward bias, even when this tendency is dysfunctional. Preparing for personally relevant approach-related action strengthens left-hemispheric brain activity (Harmon-Jones, Lueck, Fearn, & Harmon-Jones, 2006). People may therefore be especially prone to this directional bias in important situations that require them to act. Ironically, overriding automatic behavioral tendencies may seem most difficult when overriding such tendencies matters most, and this difficulty can benefit (and enable exploitation by) opponents, such as predators or penalty takers in soccer matches.

The prevalence of seemingly dysfunctional directional biases in individual settings suggests that the human brain may be wired for group coordination and for preparing people to cooperate rather than to compete (Dawkins, 1976; Vallortigara & Rogers, 2005). Brain asymmetries, including a right-oriented bias, may be functional for group coordination, but acting in accordance with such automatic tendencies may backfire in competitive situations in which group coordination is not needed.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

Notes

1. In countries where people read from left to right, people tend to display a leftward bias on the line-bisection task, whereas in

countries where people read from right to left, people tend to display a rightward bias (Jewell & McCourt, 2000).

2. These results were not qualified by participants' handedness (24% of participants in our sample were left-handed). Past research suggests that handedness and directionality of brain lateralization are independent factors (e.g., Hopkins & Bennett, 1994; Rogers, 2009).

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